Food and nutrition security in the rural plains of Nepal: Impact of the global food price crisis

A thesis submitted for the degree of Doctor of Philosophy

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Declaration

I, Nasima Akhter,

Confirm that the work presented in this thesis is my own.

Where information has been derived from other sources,

I confirm that this has been indicated in the thesis.

Nasima Akhter

August 2012

Dedication

I dedicate my thesis to all brave women who want to stand tall and live a life of aspiration to fulfil their dreams, who encourage others to achieve more in life and help to make the world a better place.

Abstract

Background: Poverty and food insecurity are often associated and may lead to malnutrition. All three remain high in Nepal and may have been aggravated by the 2008 food price crisis. Methods to measure changes in food and nutrition security and track the localised impact of changes in global food prices required further development so as to provide better guidance to policy makers.

Aim: To describe and compare measures of poverty and food security in Dhanusha District, Nepal, derived from the Household Economy Approach (HEA) and Household Surveillance Data (HSD), and assess changes in food prices and the affordability of a nutritionally adequate diet among different wealth groups in before, during, and after the 2008 food price crisis.

Methods: HEA baseline data collected in 2006 was used to describe livelihoods, food insecurity, and food prices in Dhanusha. Principal Component Analysis was used to generate asset indices from HEA and HSD data and examine their correlations. Additional surveys collected food prices in 2008 and 2009, and data on income levels in 2005 and 2008. Inflation in food prices was estimated using Dhanusha food and beverage index, calculated for 2005, 2008 and 2009 (Sep-Oct). Linear programming was used to estimate the minimum cost of a nutritionally adequate diet in 2005 and 2008 (Sep-Oct).

Results: HEA and HSD asset indices were weakly associated. HEA data provided detailed descriptions of the livelihoods of the wealth groups, but underestimated food insecurity. Annual inflation in food prices was much higher (18.8%) in 2009 than average inflation between 2005 and 2008 (9.5%). The nutritionally adequate diet was unaffordable to poorer households in both 2005 and 2008. The situation did not deteriorate much due to increasing levels of household income that accompanied the rise in food prices.

Conclusions: Application of the HEA method is demanding on skill and such skills may not be readily transferable. Poorer households are vulnerable to increased food insecurity and malnutrition due to continued increases in food prices after 2008.

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Abbreviations and acronyms

AED	Academy for Educational Development
CBS	Central Bureau of Statistics, Government of Nepal
CR	Community Representatives
CRD	Community Representatives' Interview Data
CIHD	Centre for International Health and Development, UCL, London
CoD	Cost of Diet tool, Save the Children UK
FANTA	Food and Nutrition Technical Assistance Project
FAO	Food and Agriculture Organisation
HEA	Household Economy Approach
HDDS	Household Dietary Diversity Score
HFIAS	Household Food Insecurity Access Scale
HSD	Household Surveillance Data
IFPRI	International Food Policy Research Institute
IQR	Inter-quartile range
Kcal	Kilocalorie
PCA	Principal Component Analysis
PRA	Participatory Rural Appraisal
MDG	Millennium Development Goal(s)
MoHP	Ministry of Health and Population, Government of Nepal
MoF	Ministry of Finance, Government of Nepal
NLSS	Nepal Living Standard Survey
Oct	October
ODI	Overseas Development Institute
Sep	September
VDC	Village Development Committee
WFP	World Food Programme
WHO	World Health Organization
WGR	Wealth Group Representatives

Chapter 1. Introduction and objectives

1.1 Introduction

Food insecurity is strongly associated with poverty, and often challenges progress in improving health, nutrition, and overall development in low-income countries. The World Food Summit (WFS) 1996 declared food security as a status when

> "all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (Food and Agriculture Organization 1996).

However, it is also a difficult concept to measure and the search for simple but reliable tools is ongoing (Webb et al. 2006). Many approaches to its measurement have been developed and there are disagreements about which methods measure this concept best (Wolfe and Frongillo 2001).

Approaches for determining food security through quantitative methods using structured questionnaire are common. Various quantitative measures have been employed in different parts of the world to assess food security. Some examples are the United States Household Food Security Survey Module used by United States Department of Agriculture (Melgar-Quinonez et al. 2006), the Rasch model used in Bangladesh Food Insecurity Measurement and Validation Study (Coates et al. 2006 a), and different assessment tools developed by the Academy for Educational Development's (AED) Food and Nutrition Technical Assistance Project (FANTA). Moving beyond traditional measures of per capita income and caloric adequacy based food security assessments, attempts were made to understand cultural differences and communality in experience of food security (Coates et al. 2006b). Coates et al. (2006b) emphasized that in order to make a standard way of understanding people's experience of food security, collecting data about experience based measures of food security is important. The FANTA has led recent developments in the design of questionnaire-based tools, such as Household Food Insecurity Access Scale (HFIAS) and Household Dietary Diversity Scale (HDDS), used in quantitative surveys to assess food insecurity and measure its severity (Swindale and Bilinsky 2006 a, b). These tools have been tested for validity and for correlations with nutritional status (Hoddinott and Yohannes 2002). However since the meaning of food varies in different contexts, and understanding the local context of food insecurity is important, qualitative approaches have also been used in different settings alongside quantitative approaches for assessing food insecurity (Coates et al. 2006b).

The 'Household Economy Approach' (HEA) provides an analysis framework that uses participatory methods to assess food insecurity status along with a description of the livelihoods of a community (Seaman et al. 2000a; Holzmann et al. 2008). Unlike household surveys, it collects descriptions of wealth groups by interviewing groups from the community. Interviews of community representatives are done to gather a description of wealth groups, quantify what proportion of the community each group comprises, and identify wealth group representatives. A detailed description and quantitative estimation of the economy of a population are then generated through disaggregated interviews of wealth group representatives (ibid). HEA explores how people meet their food needs by collecting data on livelihoods, crises and coping mechanisms, income, expenditure, and food consumption patterns, together with commodity prices from local markets (Seaman et al. 2000a). This approach applies participatory data collection, and has been used in varied contexts to generate a description of livelihoods and to quantify income, expenditure, and food consumption of the population. Besides describing livelihoods of a population, another important contribution of HEA is to predict the effect of shocks on households and assess their ability to respond to them. The method has been used as a predictive method, as it defines a normal economy of a population, and then assesses how different shocks may impact the economy. HEA is best known for its use in emergency settings (in disaster preparedness, relief and recovery purposes). However, it has also been used to assist poverty reduction and social protection programs (designing safety nets, identifying constraints to health and education programs), as well as for monitoring purposes (Holzmann et al. 2008). Because this method provides the details of livelihoods within a community and uses participatory approaches, it can be used to guide policy and planning of appropriate poverty reduction interventions.

HEA is a powerful technique that uses rapid rural appraisal (RRA) and participatory rural appraisal (PRA) methods, and relies on specialized skills to generate descriptive and quantitative findings (Seaman et al. 2000a). Robert Chambers (1994), pioneer of participatory approaches, mentioned that PRA included various approaches, and can be defined as a

"family of approaches and methods to enable rural people to share, enhance, and analyze their knowledge of life and conditions, to plan and to act."

In his later publication, Chambers (1995) emphasized the need to shift the paradigm of professionals' realities, which he described as universal, reductionist, standardized and stable, against the poor peoples' realities which are local, complex, diverse and dynamic. He criticised that although researchers and stakeholders such as the World Bank and economists need measurable and comparable indicators and often use income and consumption poverty, such applications do not put poor people first, or allow them to analyze their situation and prioritize their needs. Later, the World Bank adopted participatory approach in their poverty assessments, and used in a number of countries (Narayan-Parker et al. 2000, in Laderchi et al. 2003). Laderchi et al. (2003) examined the use of PRA in defining poverty, and highlighted that this approach presents the perspective of the poor against the conventional approach of imposing external standards. However, they also cautioned that although communities are not homogenous and proper representation is important in PRA, this could be difficult as some groups tend to be systematically excluded. Additionally, the small sample used in participatory appraisals, even when used in large-scale assessments, makes the use of significance tests complicated (Laderchi et al. 2003).

Mayoux and Chambers (2005) argued that even though some consider PRA as a fashionable add on to conventional standard quantitative techniques, it is capable of generating more accurate quantitative estimates when properly implemented. They referred to the issue that training, experience, and understanding of the issues involved, rather than the educational level of people using the approach are the key to generating proper description and quantification of the problem studied. In an earlier work, Chambers (2003) reported some examples of generating numbers using PRA methods, such as one study in Bangladesh (Chambers 2003) quantified the amount of faecal extract produced in a year for a sanitation project in Bangladesh. Alongside other examples, he documented the use of proportional piling to generate the percentage of wealth groups in India (Mukherjee 2002) and to reflect use of different coping strategies after drought in Malawi, Zambia and Zimbabwe (Eldridge 1995, 1998, 2001, in

Chambers 2003). Since HEA uses PRA methods to generate description and quantitative estimation of food insecurity and economy of a population along with other secondary data, understanding the strengths and weaknesses in applying PRA as part of the HEA is important.

Since access to food, a basic determinant of food security (FAO/FIVIMS 2008), is determined largely by supply, demand, and the resulting market prices, the HEA assessment includes a local market price data collection component. Food markets for some commodities are now regional and global, and affected by commodity and derivative trading (Pace et al. 2008). Conversely, some populations still rely on household level production, bartering and the functioning of local markets which may be insulated, to a lesser or greater extent, from national, regional, and global price movements. The food security status of a country is influenced by many factors including its position in the global market, whether it is predominantly an importing or exporting country and how price of the different commodities needed by its population are changed. Within a country, the food security status of a household is influenced by the availability of foods in the local markets, accessibility to the markets, and consumer behaviour such as whether the household is a supplier or as a buyer, price of the food items and the affordability to the household to buy those.

The recent global food price crisis in 2008 caused a sharp increase in food insecurity around the world (FAO 2009). FAO estimated that worldwide, 1.02 billion people were undernourished in 2009. Consequently, making food accessible to people suffering most from hunger has become a struggle for a number of countries in Africa and Asia that already had a high burden of undernutrition and needed more sustained effort to reach the Millennium Development Goal (MDG) 1 (FAO 2011; Shafique et al. 2007). In 2000, world leaders set 8 Millennium Development Goals (MDG); and the MDG 1 was set to:

"Eradicate extreme poverty and hunger by the year 2015 (UNDP 2011). The target 1 of this goal aims to halve the proportion of people whose income is less than one dollar a day. The target 2 is set to halve the proportion of people who suffer from hunger and uses the prevalence of underweight among under-five children (ibid)**"**.

Even though estimates of the number of under-nourished people were not yet available from FAO in 2011 due to methodological developments in progress, it was pointed out that import dependant small countries were greatly affected by the current food and economic crises (FAO 2011). Low-income countries and poorer wealth groups within a country, especially landless people, are considered to be the worst affected.

In Nepal, the prevalence of under-five under-nutrition is high (10.9% wasting: low weight for height; 40.5% stunting: low height for age, in 2011) (Ministry of Health and population (MOHP) [Nepal], New Era, and Macro International Inc. 2007; Ministry of Health and population (MOHP) [Nepal], New Era, & Macro International Inc. 2011). The food security situation is quite challenging in Nepal as the country is constrained by its low agricultural productivity; high susceptibility to natural disasters; dependency upon food imports from neighbouring countries; and existing widespread food insecurity and under-nutrition (Govt. of Nepal et al. 2008). Understanding the scale and impact of the price rises on poorer wealth groups in Nepal is important to ensure availability of information to guide strategic and policy decisions. Such information is needed to plan short-term and long-term measures to address food insecurity and under-nutrition in this country.

1.2 Aim

Within the scope of my research, I aim to describe the wealth groups in Dhanusha district in the rural plains of Nepal and measure the magnitude of prevailing food insecurity among the groups using the Household Economy Approach (HEA); and compare the findings with questionnaire-based Household Surveillance Data (HSD). In addition, I aim to use HEA data to describe income, expenditure and food consumption patterns of the households in the district, disaggregated by the wealth groups. Furthermore, I aim to use market prices (2005, 2008, and 2009) and income data (2005, 2008) collected over 2006 and 2008 to assess change in food prices and income levels. These data will be used for an estimation of the minimum cost of a nutritionally adequate diet for this population to model the impact of the global food price rises.

1.2.1 Main hypothesis of the study

The main hypothesis for my PhD research is 'food prices increased significantly in 2008 and reduced the ability of all wealth groups to afford a nutritionally adequate diet'. Statistical tests to assess whether the null hypothesis of non-significant price increases and no impact on affordability is true are included in the relevant chapters of the thesis.

1.2.2 Specific research questions of the study

The specific questions investigated within my PhD research are listed below:

1. What was the baseline food security and livelihood situation in Dhanusha in 2005-6, as described by the HEA and HSD?

2. How does the description of poverty status of Dhanusha obtained from HEA community representatives' data compare with that derived from the household surveillance data (HSD)?

3. How did food prices in Dhanusha change during the 2008 global food price crisis, in comparison to pre- crisis (2005) period?

4. How did food prices change in Dhanusha between 2008 and 2009, following the 2008 peak in global food prices?

5. How did income levels of the wealth groups in Dhanusha change between 2005 and 2008?

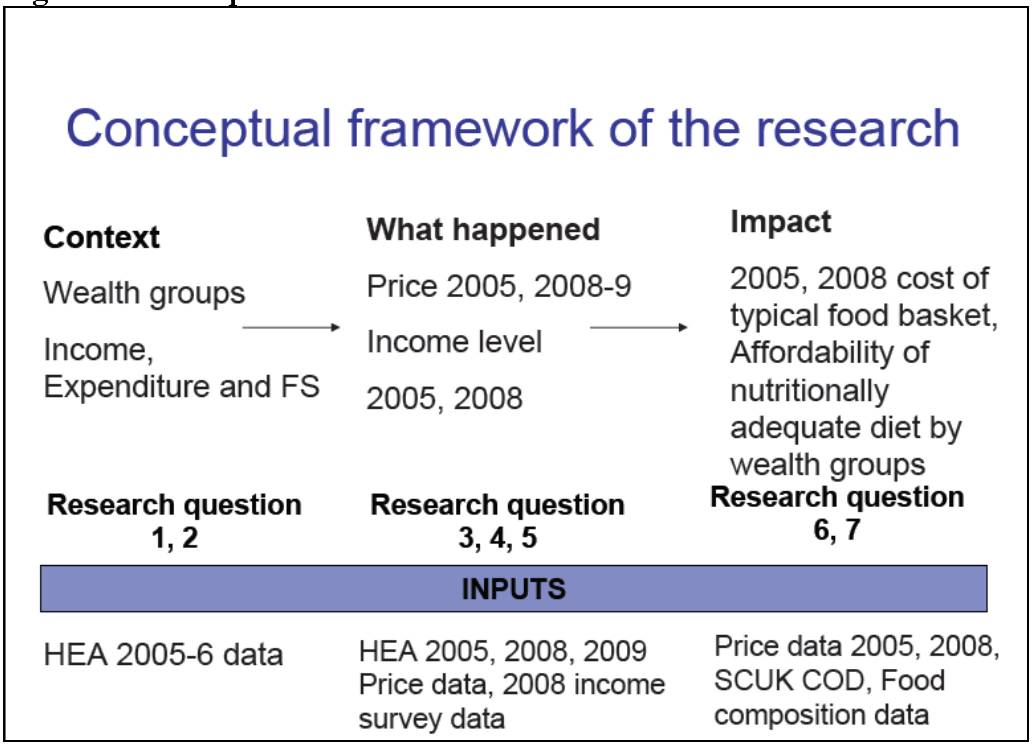
6. How did the cost of a daily typical food basket and a nutritionally adequate diet change among wealth groups in Dhanusha during the 2008 food price crisis, in comparison to the pre-crisis (2005) period?

7. How did the affordability of a nutritionally optimised diet by different wealth groups in Dhanusha change during the food price crisis, in comparison to pre-crisis (2005) period?

1.3 Conceptual framework of the research

The **Figure 1.1** shows the conceptual framework of the research and how different components of the thesis contributed to a coherent picture. The first part includes research questions 1 and 2, which uses HEA data to typify the wealth groups and their livelihood patterns, present a local description of poverty in Dhanusha, and then compares the HEA findings to the Household Surveillance Data (HSD). The second part then shows the changes in food prices and income levels before and during the 2008 food price crisis. In the final part, I use the price and income data from Dhanusha, which allow theoretical assessment of the impact of the crisis by estimating cost and affordability of a typical food basket and a nutritionally adequate diet by the different wealth groups in Dhanusha.

Figure 1.1 Conceptual framework of the research



1.4 Scope of the thesis

In this research, I attempt to present a holistic picture of the food security and livelihood situation in Dhanusha, Nepal. I start by describing the local definitions of poverty described by community representatives in Dhanusha, which depict food security status, namely patterns of income, expenditure, and food consumption gathered by interviewing different wealth group representatives. Next, I assess food prices and income levels of wealth groups in Dhanusha before, during and following the global food price crisis of 2008. Using these data, I also assess the cost of a typical and a nutritionally adequate daily food basket. I then assess the affordability of a nutritionally adequate diet for the wealth groups. My research compares asset based local definitions of poverty with poverty assessed through asset scores derived from indicators used in conventional household survey methods. The household surveillance questionnaire encompassed household demographics, socio-economic indicators, and details on newborn and maternal health issues and was the main surveillance tool of a cluster randomized controlled trial (RCT). This was implemented to assess the impact of community mobilization through women's groups on neonatal mortality in Dhanusha from 2006 to 2011 (Shrestha et al. 2011). The HEA study was part of the baseline formative research for this cluster RCT conducted to provide supplementary information to understand the food security and livelihood context of people living in the district. Standard indicators of poverty, such as consumption or income data were not available from the surveillance data. Researchers have argued about which indicators can measure poverty well, but generally expenditure, income, or consumption expenditure are considered as standard indicators to measure poverty (Bavier 2008). This study compares the HEA-based asset index with the HSD-based asset index, but does not compare those estimations to standard indicators such as income or expenditure.

This research focused on food security and nutrition, rather than attempting to deal with detailed economic analysis. I investigated the food security situation and livelihood options to understand the scope and limitations to improve food security and nutrition in this population. I used Save the Children, UK's 'Cost of Diet (CoD)' linear programming tool and estimated the cost of a nutritionally adequate diet based on the food consumption pattern of wealth groups in Dhanusha in 2005-6 (Save the Children UK 2011b). Although, the food price crisis may have altered their food consumption pattern, I have not collected data on actual consumption pattern in 2008, which may or may not be different from 2005-6. I calculated Dhanusha food price index to assess change in purchasing power, as is conventionally done by creating Laspeyres type consumer price index focusing on change in cost of a fixed basket of food and non-food items and not considering substitution (Braithwait 1980). However, the estimation of cost of a nutritionally adequate diet selects lowest cost nutritionally optimised diet in different period and permits food substitutions (Balintfy, Neter and Wasserman 1970). The estimation of cost of a nutritionally adequate diet, for this research is therefore based on available foods and the consumption pattern in a normal year. 2005-6 was identified as a reference normal year by respondents during HEA data collection.

This research includes a range of themes, such as strengths and weaknesses of HEA and household surveys in food security and poverty assessments, quantification of estimates using participatory approaches in the HEA, the 2008 food price crisis, economic developments in Nepal, food consumption and activity patterns of the rural Nepalese population, cost of nutritionally adequate diet, and affordability of it. Each of these is a vast area on its own. I therefore tried to keep the literature review and discussions limited to studies that are very relevant to my study; focusing on changes in food prices in Nepal during the global food price crisis in 2008 and assessment of its nutritional impact. In many cases, alongside peer reviewed articles, I have used a number of reports, conference proceedings, and government reports and documents available online. Since most research findings in this area come from development organisations rather than academic institutions, I included important grey literature documents that were good sources of information relevant to my study. I believe both peer reviewed articles and findings in reports and conference proceedings contributed significantly to my research.

1.5 Role of the investigator

I enrolled for a PhD in 2007, and had the opportunity to utilise HEA data already collected by the Mother and Infant Research Activities (MIRA) team in Dhanusha, Nepal in 2006 with the training and guidance of my supervisor Naomi Saville. The data were entered by MIRA staff, and I had access to the datasets in June 2008. The HEA data were available as entered in MS Excel using spreadsheets adapted from those that had been used by the Food Security Analysis Unit (FSAU) in Somaliland, which is now known as Food Security and Nutrition Analysis Unit (FSNAU 2011; personal communication, 2008). I compiled the data entered in one FSAU spreadsheet per VDC into one Excel worksheet (separated by types of data), and cleaned the data as necessary. I then transferred the data to Statistical Package for the Social Sciences (SPSS

Inc.) version 16.0 for analysis. Later in 2008, I designed a structured questionnaire to collect data on food price and changes in cash-income levels. The price data collection questionnaire was used again for a 2009 market survey as a follow up to the 2008 survey. The 2008, 2009 price and income change (2008 only) surveys were implemented by MIRA Dhanusha team, again with the training and guidance of Naomi Saville, who is Technical Advisor to MIRA Dhanusha.

Although my thesis largely exploited HEA data, I also had the scope to use data from the prospective surveillance system in Dhanusha that had been established for a randomised controlled trial (RCT) on the impact of community interventions on reducing neonatal mortality (Shrestha et al. 2011). The MIRA team collected the data, prepared the database, entered and cleaned the data. I had access to cleaned surveillance data of the RCT in September 2010, which I then used to compare and validate HEA findings.

Based on the HEA data collected in Dhanusha in 2006, I generated a list of foods consumed by rural Nepalese population in the area. My supervisor, Naomi Saville added food groups, scientific names and helped standardisation of the Nepalese, Maithili and English names of the food items to make the list more complete. I then used this main list as the basis for a Nepal-specific food composition database, adding caloric values for the items using a range of relevant food composition databases. Further to that, nutrient values of selected nutrients were included for a sub-set of food items used for estimation of a nutritionally adequate diet. This sub-set excluded food items which did not have adequate price data. I utilised this sub-set data for the Save the Children 'Cost of Diet (CoD)' (Perry 2009) spreadsheet to assess the cost and affordability of a nutritionally adequate diet by wealth groups in Dhanusha. Although I had access to a previous version of the CoD software, it was under ongoing development. I therefore, finally used the updated Save the Children CoD tool, which was made available to me in October 2011.

I lived in Nepal during 2008, and worked with the MIRA central Kathmandu office and Dhanusha field team to gain an overall understanding of the data collected and the life and livelihoods of the rural Nepalese population. Because of the insurgency and security concerns before the 2008 general election, I could not spend much time in the

Dhanusha district. However, the time spent in Nepal was a useful experience that helped me to understand the context of the study and interpret my research findings.

1.6 Potential contribution of this research

This research presents local descriptions of wealth groups and poverty, and assesses food security and the impact of food price rises on different wealth groups in the rural plains of Nepal. A description of wealth groups will be useful for designing context specific poverty alleviation and pro-poor health interventions. Such descriptions could be used for targeting interventions to a group or for monitoring impact of health and nutrition programs in different wealth groups.

To my knowledge, very few studies have compared estimates generated using a participatory approach with quantitative survey findings (Temu et al. 2000), especially in the area of poverty and food security. The comparison of assessment of poverty by HEA with that of household surveillance data enabled me to assess whether a quick participatory method of wealth breakdown by community members themselves is comparable to that generated through a household survey using a structured questionnaire. Along with the findings on the comparability of community-generated estimates, the ease and difficulties of collecting reliable data are discussed. This research discusses how user-friendly the HEA is, and describes its strengths and weaknesses. This knowledge would be beneficial for those conducting training on HEA, and those who will be implementing the approach in future. These findings will also complement the ongoing discussion on application of qualitative and quantitative techniques, and using participatory approach in quantification and description of prevailing situation (Mayoux and Chambers 2005).

Data on trends in price, and estimated adequate diet costs could guide social safety net programmes, and market regulation policies. Whilst recent price rises of food and non-food commodities have affected people on a larger scale in different parts of the world, not all estimates of impact have been calculated using baseline data collected before the global food crisis happened (World Food Programme and Nepal Development Research Institute 2008). This study also collected data on food prices in Dhanusha in 2009, as a follow up after the 2008 global food price crisis to assess local trend in price.

The estimate of impact together with understanding of how people meet their food and non-food needs can provide insight for poverty reduction strategies for developing countries, and specifically in this case for Nepal.

This study is unique in that it uses before, during and post- global food crisis price data, and uses the SCUK 'Cost of Diet' tool to estimate the cost of a nutritionally adequate diet based on a large number of locally available foods in Nepal. Hobbs (2009) investigated the impact of food price crisis, economic and climate change crisis in Nepal. The report showed that the high food price in 2008 negatively impacted households in Nepal, irrespective of their wealth status. The welfare status of all households declined due to the food price crisis and associated lack of purchasing power (ibid). Therefore, information on price changes in Dhanusha and how these affect affordability of nutritionally adequate diet by the different wealth groups will be useful for planning short and long-term measures to minimize adverse effect of the price hikes. Rigorous evaluation of this kind, communicated to donors and policy makers, will assist governments, donor agencies, and other institutions that plan, implement and evaluate programs to choose the most appropriate and cost effective means of addressing food security, understanding livelihoods, and improving nutrition.

1.7 Thesis structure

I present this thesis as a compilation of nine chapters, each one adding its own contribution towards the conclusion.

In Chapter 2, I provide background information and a brief literature review on relevant topics to my research.

In Chapter 3, I share an overview of data utilised for this research, a brief description of data used and the outcome variables used to answer my research questions.

In Chapter 4, I present the findings of HEA in terms of estimating food security situation in Dhanusha in comparison to findings of HSD, along with HEA annual estimation of income, expenditure and caloric intake by the wealth groups.

In Chapter 5, I provide the description of poverty in Dhanusha using participatory HEA method in comparison to that of quantitative household surveillance data.

In Chapter 6, I assess change in food prices between 2005, 2008, and 2009 (September-October period); and estimate food price inflation in Dhanusha over the period.

In Chapter 7, I estimate the income levels of the wealth groups in Dhanusha in 2005 and 2008. I consider the 2005 data as a base period and assess change in income over the period.

In Chapter 8, I use the price data from previous chapters to estimate the cost of a typical daily food basket and nutritionally adequate diet in 2005, and 2008; and investigate affordability of the nutritionally adequate diet by wealth groups in Dhanusha.

In Chapter 9, I summarise the overall research findings and draw conclusions.

In appendices, I include questionnaires, detailed result tables, and other relevant materials, which are not in the main thesis to impede the flow and because of space limitations.

Chapter 2. Background

2.1 Overview of Nepal

Nepal is situated near the Himalayas and is in between China to its north and India to its south, east and west. It shares an open border with India and has an area of 147,181 sq. km with a population size of 27 millions (Ministry of Health and Population (MOHP) [Nepal], New Era, & and ICF International, 2012). Nepal is also a ethnically diverse country where 100 ethnic groups resides and speaks 92 languages (Central Bureau of Statistics 2006). Depending on topographical variation, Nepal is divided into Hills, Mountains and Plains (*Terai*). The Hills occupy the largest part (42%), followed by Mountains (35%), and *Terai* (23%). Although *Terai* is the smallest part, it has the highest (50.1%) percentage of population living there, and is the most densely populated part of Nepal (Government of Nepal 2011). *Terai* covers the southern part of Nepal and is generally more productive than other regions.

The climatic condition in Nepal ranges from tropical to sub-tropical condition. The *Terai* and Hills have tropical to subtropical climates, and the Mountain part has a cold climate (Ministry of Home Affairs 2009). Nepal is prone to natural disasters and 64 out of the 75 districts are prone to disasters of some kind, whereas 49 are prone to floods and/or landslides. Earthquake, flood and drought are common along the different parts of the country. Because of disasters taking place frequently in Nepal, sometimes disaster like floods are almost considered 'normal' (Ministry of Home Affairs 2009). Agriculture is the mainstay of the economy contributing nearly one third of the gross development product (GDP) of Nepal (CBS 2008). Rainfall in the country very widely between different administrative and ecological regions in terms of frequency, intensity, and duration (ibid).

Administratively, Nepal consists of 75 rural districts and 58 municipalities. Each district has several smaller units, called village development committees (VDC). The total area of Nepal is currently divided in to five different development regions: Eastern, Central, Western, Mid-Western, Far-Western (CBS 2006). According to recent 2011 census report, Central development region has the highest population (36.5%) (Government of Nepal 2011). Some basic health and nutrition data of the country is shown in **Table 2.1**.

Table 2.1 Basic demographic, health and nutrition data on Nepal

Indicators	Nepal statistics
Area (sq km)	147,181
Population (millions)	26.6
Land ownership, National (%)	67.6
Land ownership, Rural (%)	71.3
Religion (%)	
Hindu	85.1
Buddhist	8.6
Muslim	3.6
Other	2.6
Maternal Mortality Ratio (per 100,000 live births)	281
Under five Mortality Ratio (per 1000 live births)	54
Low birth weight (%)	12.4
Stunting (%)	40.5
Underweight (%)	28.8
Wasting (%)	10.9
Anaemia in children (%)	46.2
Anaemia in women (%)	35.0

(Source: Nepal Demographic and Health Survey 2011; Nepal National Population Census 2011)

Nepal has a total population approaching 27 millions in 2011(Government of Nepal, National Planning Commission 2011). The majority of the Nepalese population live in rural (83%) areas. Because of the ecological differences and difficult condition of living in other areas, *Terai* remained the most populated area. The average family size decreased from 5.44 in 2001 to 4.7 in 2011. Nepal has shown significant improvement in terms of reduction in maternal mortality ratio (MMR) from 539 in 1996 to 281 deaths per 100,000 births (Ministry of Health and Population (MoHP) [Nepal], New Era, & Macro International Inc. (2007). However, malnutrition and especially micronutrient deficiency was still high in 2011(Ministry of Health and Population (MOHP) [Nepal], New Era, & and ICF International, 2012). Women also lagged behind in terms of enrolment in education. In 2011, 20% of the male population who are above five years had never attended school, whereas it was 41.0% among female population of the same age group (ibid).

2.2 Political developments in Nepal

Nepal experienced civil war for a decade between 1996 and 2006, which ended by signing of the Peace Accord between the Maoist and other political parties in Nepal (Do and Iyer 2010). The monarchy in Nepal cease power in 1990, and a multiple democracy was established (UNDP 2009). Thereafter, the first parliamentary election was held in 1991, followed by later elections in 1994 and 1999.

Figure 2.1 shows the political developments in Nepal during 1990-2009, which indicates that the country has gone through long period of conflict and un-settled political situation in the past.

Figure 2.1 Chronology of events in Nepal (1990-2009). Reproduced from UNDP 2009, p-14

BOX 1.1 A chronology of key events leading to the current state of Nepali polity

1990	The multi-party system was revived and a new 1990 constitution of Nepal was prepared.
1996 13 Feb	The Communist Party of Nepal (Maoist) launched the People's War.
2001 1 Jun	King Birendra, Queen Aishwarya and other close relatives were killed.
2001 Nov	A state of emergency was declared after more than 100 people were killed in four days of conflict.
2005 1 Feb	King Gyanendra dismissed Prime Minister Deuba and his government, declared a state of emergency, and assumed direct power, citing the need to defeat Maoist rebels.
2005 Nov	The Maoist rebels and seven political party alliance agreed on a programme aimed at restoring democracy.
2006 24 Apr	King Gyanendra agreed to reinstate parliament following a 19-day Janandolan (people's movement or uprising) with violent strikes and protests against direct royal rule. GP Koirala was appointed Prime Minister.
2006 21 Nov	The government and Maoists signed the Comprehensive Peace Accord, declaring a formal end to a 10-year rebel insurgency, and transforming the Nepali state.
2007 Jan	Maoist leaders were elected to parliament under the terms of the Interim Constitution of 2007. Violent ethnic protests demanding regional autonomy erupted in the southeast part of Nepal.
2007 Apr	Former Maoist rebels joined the interim government, thereby moving into the political mainstream.
2007 May	Election for a Constituent Assembly was postponed to November 2007 and again shifted to 10 April 2008.
2007 Oct	United Nations Secretary-General Ban Ki-moon urged Nepal's parties to resolve their differences to save the peace process.
2008 28 Feb	The Nepal Government and the United Democratic Madhesi Front signed an eight-point agreement, which brought to an end a 16-day long general strike in the Tarai.
2008 10 Apr	A Constituent Assembly election was held throughout the country.
2008 28 May	The first meeting of the Constituent Assembly was held; it formally abolished the monarchy and proclaimed Nepal a republic as stated in the Interim Constitution of 2007.
2008 15 Aug	A Government under Maoist leadership was formed.
2008 Dec	14 Committees, including 10 thematic, 3 process and 1 constitutional committee, were formed, and the drafting of a new constitution began.
2009 Apr	All the committees collected information and views of people administering a questionnaire in their field visits.

Source: Adapted from BBC News (http://news.bbc.co.uk/2/hi/south_asia/country_profiles/1166516.stm)

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The political and economic power in Nepal is linked with the Hindu caste system. Although caste system is mainly practiced among Hindus, it also existed among people from other religion in Nepal (DFID and World Bank 2006). The caste system puts people into four categories, where *Brahmans* (Priests) are at the top, followed by *Khsatriya* (King and warriors), *Vaisya* (traders and businessman), and *Sudra* (peasants and labourers). Those who do not belong to caste system are the 'untouchable' or Dalits, and faces deprivation. Even though democracy was introduced in 1990, the Dalits, Muslims, Madhesis (people living in plains), women were marginalised (DFID and World Bank 2006).

The insurgency, known as 'People's War' officially started on 13 February 1996, with the Maoist attack on a police post in a rural area of Nepal (Do and Lyer 2010). In 2001, a tragic event occur when the Prince killed himself, his father King Birendra, and other immediate family members. Consequently, King Gayendra, brother of the dead king took over the power and declared a more aggressive stance against the Maoist rebel. However, the insurgency continued and by 2003, the Maoist had control of several districts in Nepal. As the insurgence become more intense, King Gayendra decided to take direct control of power in February 2005 dismissing the then Prime Minister. Despite his effort, Maoist had extended their activities and took control of most rural districts by September 2005. In November 2005, they gained more strength by forming a alliance with seven major political parties. Finally, King Gayendra was forced to give up power in April 2006. The civil war formally ended in November 2006, when the Comprehensive Peace Accord was signed between the government and the Maoist. This led to the process of holding a constituent assembly election in April 2008. The Maoist won the majority of seats enabling them to form a democratic government. Formation of the democratic government is expected to facilitate better development in Nepal that has been undermined by long period of conflict (ibid).

2.3 Poverty and food security in Nepal and its regions

In Nepal, a national income poverty line is estimated using cost of basic needs approach, which calculates the amount of money required to satisfy minimum food and non-food needs (CBS 2005; MoF 2008). A food poverty line is estimated based on amount of money needed to meet the per capita minimum energy (Kcal) requirements. Another measure of poverty, Purchasing Power Parity (PPP) is also calculated in Nepal which draws the poverty line allowing international comparison. Income level of Rs.

7,696 was set as minimum cost of basic need, and was used by NLSS 2003/04 to define the population living below poverty line. According to the NLSS 2003/04, 30.8% of the Nepalese population lived with an income below the national poverty line. Nepal had declined its national poverty level to 25.4% in 2008/09. Based on the poverty line set by the World Bank as those earning below one dollar in day, 24.1% of Nepalese population were poor in 2008/09 (MoF 2011). Although, the World Bank has updated its poverty line from one dollar to $1.25 dollar a day in 2005, but it has not yet been incorporated in Nepal. Decline in poverty in Nepal is associated with remittance income, urbanisation, increased wage among agricultural labours, and more people being becoming economically active (ibid). Nevertheless, a comparison of inequality over 1992/93 to 2003/04 revealed that income gap has widened in Nepal, and richer people has gained better in terms of improving income levels over the period.

Although the incidence of poverty in Nepal declined steadily from 1995/96 to 2010/11, there are considerable differences between rural and urban areas, between ecological or administrative zones. (**Figure 2.2 - Figure 2.4**) (CBS 2011). The decrease in poverty was evident in all parts of Nepal, although remained quite high in 2010/11. The highest poverty was prevalent among people living in the Mountains and in the Far-western region. Based on the national poverty line, nearly one quarter of the population in *Terai* was still poor in 2010/11 (CBS 2011) (**Figure 2.3**).

Figure 2.2 Percentage of population below national poverty line in rural and urban Nepal in 1995/96, 2003/04 and 2010/2011. (CBS 2011)

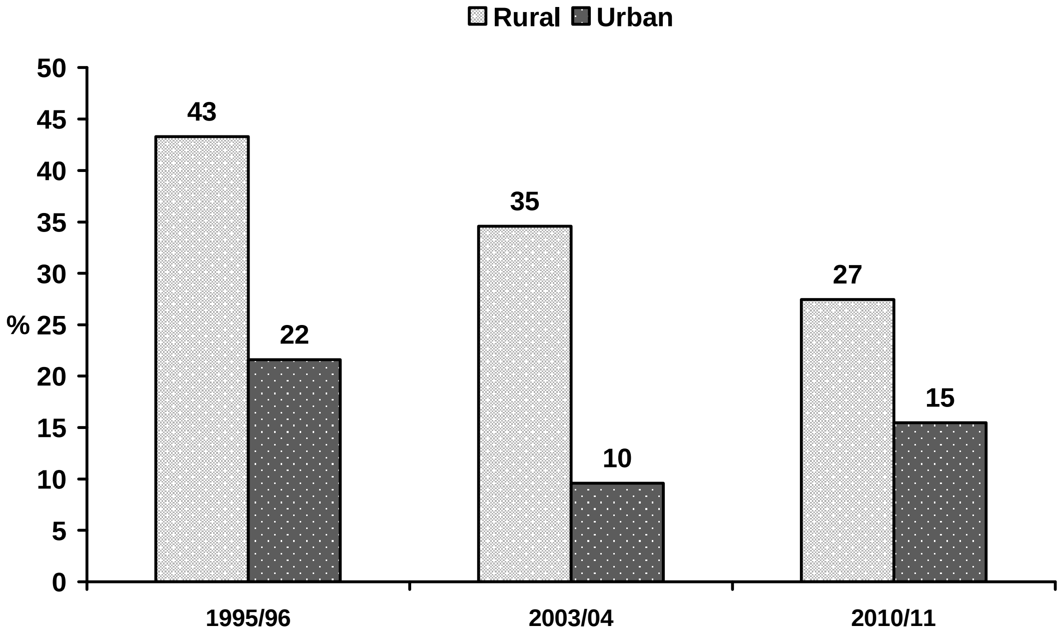


Figure 2.3 Percentage of population below national poverty line in Mountain, Hill and *Terai* in Nepal in 1995/96, 2003/04 and 2010/2011. (CBS 2011)

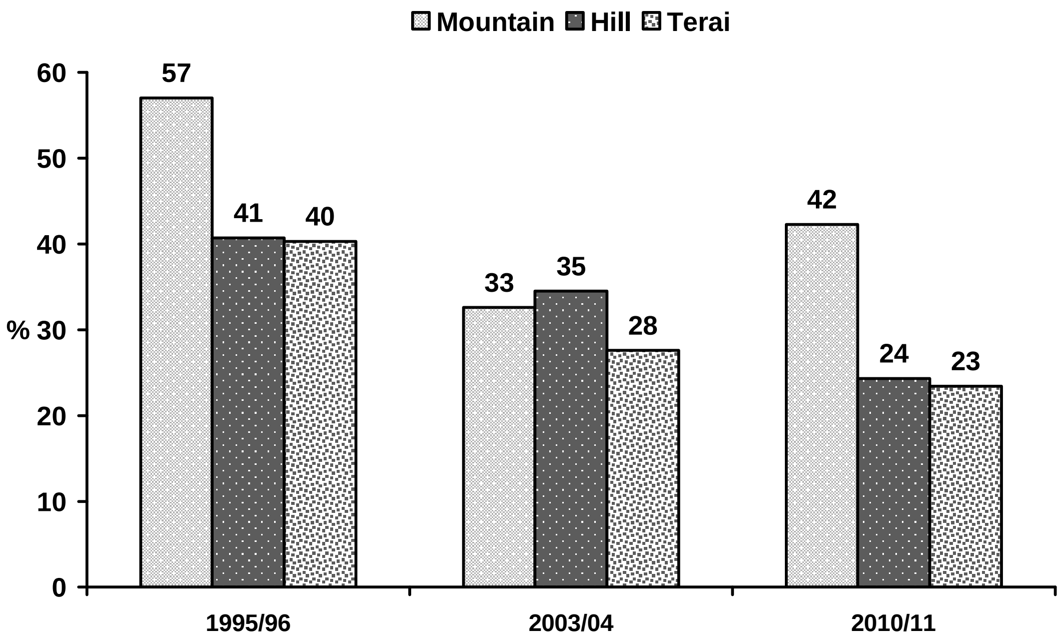
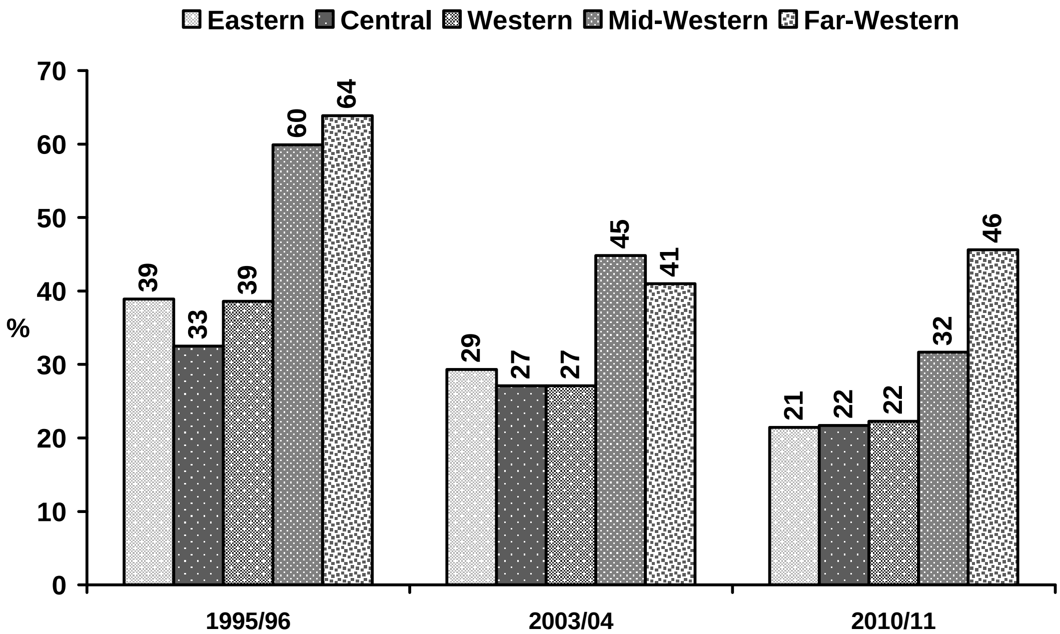


Figure 2.4 Percentage of population below national poverty line in administrative regions in Nepal in 1995/96, 2003/04 and 2010/2011. (CBS 2011)



Since food security and poverty are closely linked, the Nepal Demographic and Health Survey (DHS) added a food security assessment tool to the recent 2011 survey (Ministry of Health and Population (MOHP) [Nepal], New Era, & and ICF International, 2012). To achieve MDG 1, Nepal aims to reduce its population living below a minimum level of dietary energy intake to 25 percent by 2015. To monitor country progress in doing so, they adopted the 'Household Food Insecurity Access Scale (HFIAS)', an indicator reflecting access to food, to measure food security. Overall, 51% of the households were food insecure. The percentage household food insecure was much higher in rural (54%), compared to that in urban areas (33%). Food insecurity also varied widely between ecological regions (47.9%, 52.8%, and 59.5% in *Terai*, Hill, and Mountain respectively). Furthermore, it also showed evidence of stark inequality among households from different socioeconomic status (Food insecure in Poorest quintile: 81.9%; Wealthiest quintile: 18.1%)

2.4 Nutritional status of children and mothers in Nepal and its regions

Prevalence of stunting (height-for-age), underweight (weight-for-age), and wasting (weight-for-height) remains quite high in Nepal, compared to other countries in South Asia (IFPRI 2010). The reference population used for estimation of malnutrition in 2006 and 2011 are not the same, and therefore estimates in the two periods are not comparable. However, large disparities existed between rural and urban malnutrition rate in both years (**Figure 2.5**). In 2011, at least 10% more children were stunted and underweight in rural areas compared to that of urban areas.

Disparities were also evident by both ecological (**Figure 2.6**) and by administrative regions (**Figure 2.7**). Overall, the prevalence of malnutrition was highest among children living in Mountainous region. Interestingly, wasting prevalence did not vary by ecological regions in Nepal in 2011. In terms of administrative regions, Mid-Western and Far-Western regions have the highest prevalence of malnutrition. Nevertheless, *Terai* region also had reasonably high prevalence of malnutrition in both 2006 and 2011. Prevalence of anemia was also quite high in Nepal and did not show much decline between 2006 and 2011. Micronutrient deficiency, in terms of anemia among children and women was highest in *Terai*, and considerably higher than other region, for both 2006 and 2011.

Figure 2.5 Nutritional status among under-five children in rural and urban Nepal in 2006 and 2011 (MoHP, New Era and ICF International Inc. 2012)

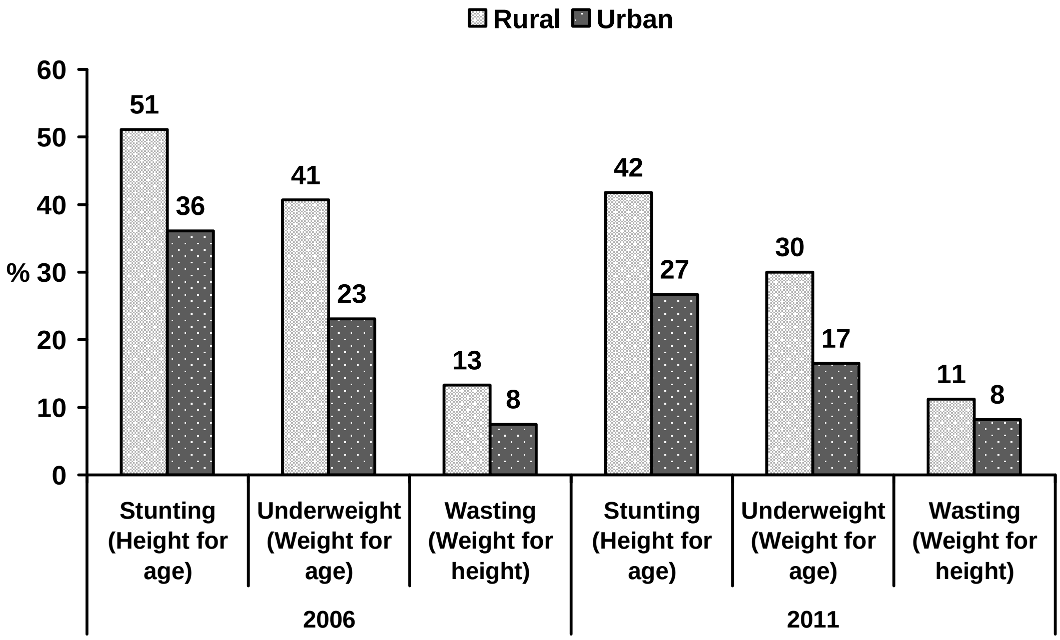


Figure 2.6 Nutritional status of under-five children in ecological regions in Nepal in 2006, and 2011 (MoHP, New Era and ICF International Inc. 2012)

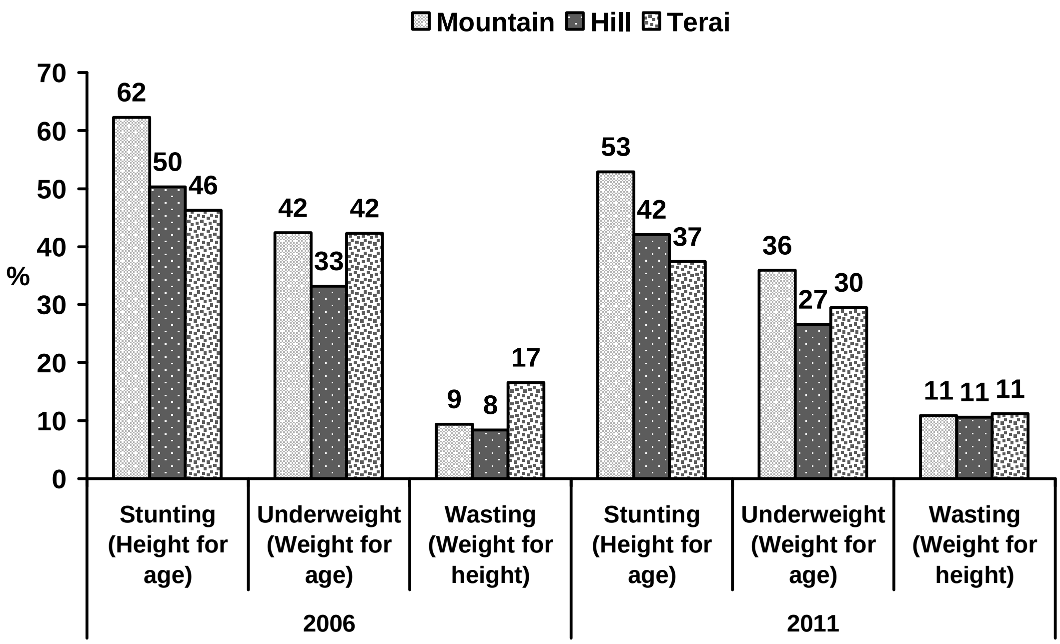


Figure 2.7 Nutritional status of under-five children in administrative regions in Nepal in 2006, and 2011 (MoHP, New Era and ICF International Inc. 2012)

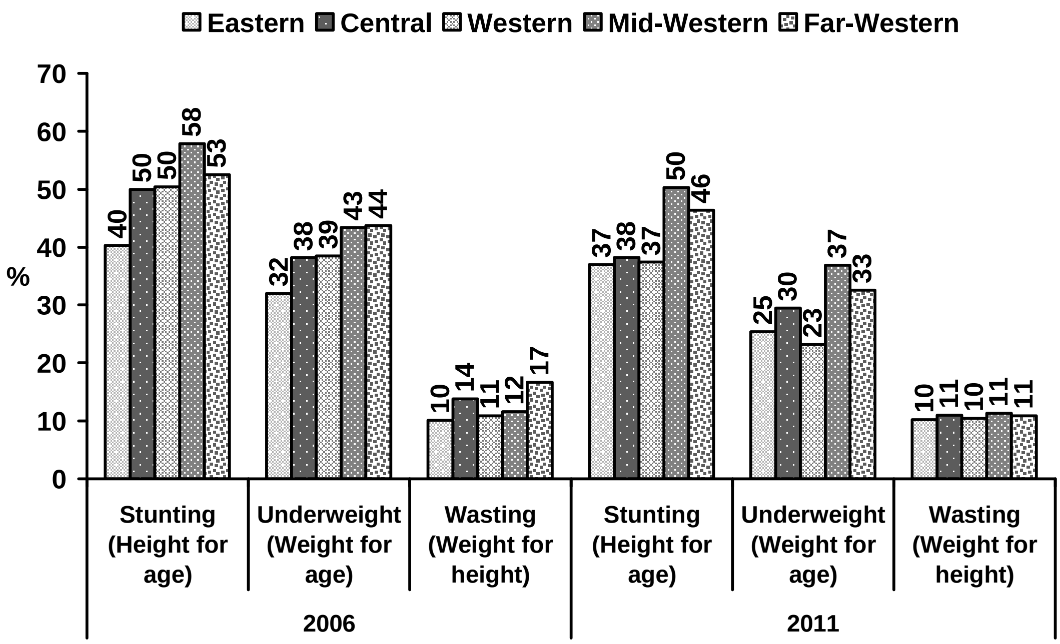
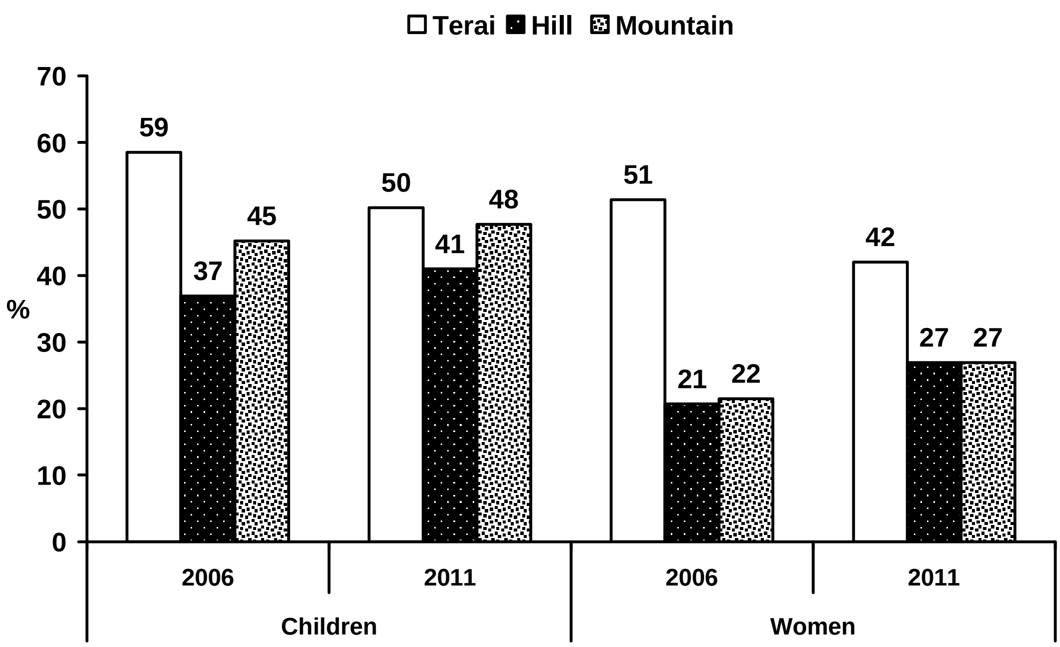


Figure 2.8 Prevalence of anemia among under-five and women in Terai, Hill, and Mountain in Nepal in 2006, and 2011 (MoHP, New Era and ICF International Inc. 2012)



2.5 Economic concepts and terminologies

2.5.1 Demand and its determinants

The demand for a commodity specifies the amount of it that a consumer will buy at a given price in a given time. In economic terms, demand should include the want to buy something as well as the ability to buy the product (Ahuja and Chand 2008; Samuelson and Nordhaus 2006). Although it can be also be a virtual market, market is a place that allows exchange of goods and services between seller and buyer. In a market system, each product has a set price, which is the value of an item in terms of money (Samuelson and Nordhaus 2006). Price acts as a modifier of decision of customer and producer. The law of demand expresses the association between price of an item and quantity of it demanded. It states that other things remaining constant, if price of an item increases buyers tend to decrease the quantity of it purchased. Income effect and substitution effect are the reasons behind the decline in quantity demanded. The substitution effect occurs when the price of an item increases and cheaper alternatives are available. In this situation people tend to substitute the increased price item with others. The income effect of price increase occurs when the price of an item increases and the real income lessens, meaning that a person can buy a smaller quantity of the item with the same amount spent earlier. Whereas nominal income denotes to the actual amount of monetary income, real income denotes nominal income adjusted for the effect of price change over time. Therefore at a static income level, people who experience increase in price tend to cut back on their expenditure and buy less (ibid).

Although, generally the law of demand remains valid there are some exceptions (Ahuja and Chand 2008). Some consumers have increased demand when price increases for an item that has prestige value. For example, when the price of diamonds goes up, consumers may buy more of it due to the associated high prestige value and satisfaction level. Another exception occurs at the other extreme, i.e. some other goods although not hugely expensive, may have increased demand with increase in price. Such goods are called 'Giffin goods', after the name of an economist, Sir Robert Giffin who first observed the phenomenon. He observed that despite an increase in the price of bread, the low paid British workers bought more bread. When prices of bread went up, the workers had to spend larger amount of their budget on it as it generally constitute a large part of their diet. In this situation, as price of other food items also increased they even had to substitute bread for comparatively higher value foods such as for meat (Ahuja and Chand 2008).

Several factors may influence the demand of a product including level of income, the size of the population, the price and availability of related goods, taste and preferences of the consumers, change in propensity to consume, consumer expectation about future prices, and income inequality in the region or country (Ahuja and Chand 2008; Samuelson and Nordhaus 2006). Income is the most important determinant of demand, because households will have greater purchasing power with greater income. The price of related goods may also influence demand, when substitutes are at lower price people may shift to buy the substitutes instead of the goods they would usually buy. The tendency of people to buy or save more also affects consumer behaviour. Therefore, increase in propensity to consume or propensity to save can dictate demand of goods in the market. Income inequality in a society also controls demand. In a society with large income inequality people generally have low propensity to consume. On the other hand, in a society where income distribution is more equal, people tend to have higher propensity to consume. The prediction about future prices also influences demand of an item. When people expect that the price of an item will rise, then at present they demand a larger quantity of it (Pace, Seal and Costello 2008).

2.5.2 Elasticity of demand

The measure of elasticity of demand can be useful in terms of targeting households, deciding on food items for food aid, and guiding government policies regarding subsidies to improve consumption behaviour among households (Andreyeva, Long and Brownell 2010). The concept of elasticity explains the change in demand of a product in response to changes in price, income or other relevant factors. In formal terms, elasticity measures the percentage change in demand of a variable in response to 1 percent change of another variable (Ahuja and Chand 2008). Quantity of goods demanded can vary in response to change in price of the goods in question, income or price of related goods. Price elasticity, income elasticity and cross elasticity are three concepts of elasticity measure, which relate to the percentage change in quantity demanded in response to change in price, income and price of substitutes or complementary goods respectively (Muhammad et al. 2011). In mathematical terms, the elasticity of demand is expressed as:

$$eP \text{ (Price elasticity)} = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price}}$$

$$eI \text{ (Income elasticity)} = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in income}}$$

$$eCP \text{ (Cross price elasticity)} = \frac{\text{Percentage change in quantity demanded for item i}}{\text{Percentage change in price for item j}}$$

The elastic or inelastic demand is a comparative measure, which can be elastic (e.g. eP >1), inelastic (e.g. eP <1), or unitary (e.g. eP =1) (Ahuja and Chand 2008). If demand for an item is elastic, it means that demand for the goods is more responsive to change in price than other goods. Unitary elasticity of demand occurs when the quantity demanded changes due to the change in price such that the total expenditure remains same. Elastic price elasticity means that a change in price resulted in an increase in the total expenditure for the goods. The price elasticity of demand for food can be estimated for a single item or for food groups (Cranfield and Haq 2010). Economists often use 'demand system' analysis, which is a mathematical modelling developed based on the concept of elasticity, to predict change in consumption in relation to price and income among different populations (Andreyeva, Long and Brownell 2010; Cranfield and Haq 2010; Matthew, Richard and Kelvin 2010). This analysis provides useful information and helps in identifying vehicles for intervention. For example, despite price rises of a food item for which demand is inelastic, people may still buy a similar amount of it and spend a larger share of budget on it. Conversely, a rise in the price of a food item that has elastic demand may result in people easily shifting to buy cheaper alternatives or reducing the quantity demanded.

2.5.3 Inflation and consumer price index

Inflation is defined as 'a steady and sustained rise in prices' (Friedman 1963, p-1). It is an important economic indicator, which assesses the growth of price. Although different organisations have different choices of indicator to suit their needs, the consumer price index (CPI) is a commonly used indicator to measure inflation, used by government statistical offices in many countries (United Nations 2009). Because expenditure patterns vary for individuals and households, calculation of price indices are done based upon the cost of a basket of goods for a typical household. Thus average expenditure on the basket of goods including food and non-food items are measured over a period to measure change in price. The three types of price indices calculated are:

1. Laspeyres index,
2. Paasche Index, and
3. Fisher Index (United Kingdom Office for National Statistics 2007).

Laspeyres Index: The Laspeyres index measures cost of a fixed basket of goods over a given period. Keeping the items in the basket constant, it calculates the cost of the fixed basket in a later period and assesses the change in price of that (Ruiz-Castillo, Ley and Izquierdo 2002). Prices of goods included in the basket are weighted according to their share of total expenditure, so that items that households spend more money on are given more weight and vice versa. However, the items and amounts consumed are based on a base year and remain static for the later years. By measuring the amount of money needed to buy a fixed basket of goods, this index measures the purchasing power of the currency, i.e. whether people need to spend more or less money to buy the same items. The reference period of the food basket to which prices of later periods are compared is known as 'base period'. The list of items and weights are estimated based on household budget surveys. The items in the basket are weighted based on the proportion of expenditure on various items in it. The formula for calculating Laspeyres index is:

$$P_L = \frac{\sum \text{Price of items in current period X Quantity of items bought in base period}}{\sum \text{Price of items in base period X Quantity of items bought in base period}}$$

Paasche Index: Paasche Index measures change in price for goods included in the *current* shopping basket of consumers instead of price of goods included in the previous period. The recent period is considered as the weight reference period, whereas the base period acts as a price reference period. For this index, goods are weighted based on the amount bought in the latest period. The formula used for calculation of Paasche index is:

$$Pp = \frac{\sum \text{Price of items in current period X Quantity of items bought in current period}}{\sum \text{Price of items in base period X Quantity of items bought in current period}}$$

Fisher Index: This index uses price and quantities in both recent and base period. This index takes account of the substitution effect, which is not considered in both Laspeyres and Paasche index. This is calculated as the geometric mean of the Laspeyres and Paasche indices, using the formula as follow:

$$P_F = (Pp \text{ X } P_L)^{0.5}$$

2.5.4 Nepal Consumer Price index

In Nepal, the Consumer Price Index (CPI) is calculated using Laspeyres price index. It measures change in prices of a fixed basket including food and non-food goods, which is determined by the Household Budget Surveys (HBS) done at national level (Central Bank of Nepal 2007). The CPI is calculated by the Nepal Rastra Bank who generates the National urban CPI, CPI for Kathmandu (the capital city), Hills, and *Terai* (Plains). The weights of items are calculated separately for these areas based on expenditure patterns obtained from the HBS surveys. Nepal has conducted four HSBs in 1972/73, 1983/83, 1995/96, and 2005/06. The CPI calculations during 2005-2009 are based on 1995/96 HBS. The 2005/06 survey findings were used for the CPI estimation in 2010. To calculate CPI, price data were collected from 21 urban market centres in total from Kathmandu, *Terai*, and Hills. The basket for Kathmandu, Hills, and *Terai* contains 301, 284, and 267 items respectively, for which price data were collected on regular interval. Out of the total item list, the basket for Kathmandu, *Terai*, and Hills contains 102, 88, and 100 food items, respectively. The CPI includes a food and beverages index and a non-food and services index. **Table 2.2** shows the weights of items included in the National and *Terai* Price indices, used in 2005-2009 CPI calculation, where 1995/96 is used as a base period (Central Bank of Nepal 2006).

Table 2.2 Weights of items included in the Nepal Urban Consumer Price Index

		National Index [a]	*Terai* index
	All items	100.00	100.00
	Food and Beverages	**53.20**	**54.98**
1	Grains and Cereal products	18.00	19.76
	Rice and Rice Products	14.16	13.42
2	Pulses	2.73	3.35
3	Vegetables, fruits and nuts	7.89	7.63
4	Spices	1.85	2.06
5	Meat, fish and eggs	5.21	5.02
6	Milk and milk products	4.05	3.98
7	Edible oil and ghee	3.07	3.23
8	Sugar and related products	1.21	1.09
9	Beverages	2.28	2.00
10	Restaurant meals	6.91	6.86
	Non-food and services	**46.80**	**45.02**
1	Cloth, clothing and sewing services	8.92	9.16
2	Footwear	2.20	1.78
3	Housing	14.87	14.80
	Fuel, light and water	5.92	6.91
4	Transport and communication	4.03	4.16
5	Medical and personal care	8.03	8.04
6	Education, reading and recreation	7.09	5.54
7	Tobacco and related products	1.66	1.54

[a] **Base period = 1995/96**

2.6 Livelihoods in food security assessment

Food security assessments in the early days were more focused on sufficient availability of food at national level, but analyses later shifted towards assessing food security at local, household and individual levels, as well as understanding livelihoods. Since the mid-1990s, analysis of livelihoods has increasingly become integral to the analysis of poverty and food security and the findings are used to design context-specific interventions to reduce poverty and prevent famine (Devereux et al. 2004). Income or production-based poverty measurements alone were inadequate, as availability on its own does not ensure the well-being of households. In 1981, Sen introduced the idea that although there could be enough food available, famines occur due to people lacking access to enough food (Sen 1981). He clarified that each person's 'entitlement' to a commodity bundle including food, determines whether people can access food (ibid). Sen emphasized on focusing on what opportunities people may have to improve their conditions rather than focusing on a fixed set of assets and skills (Alkire 2007; Frediani 2008). Moving beyond income focus, Sen suggested a holistic approach that lists capabilities to enable people to access food or to improve their overall well-being. However, the capabilities should be context specific to suit variable needs of people living under different circumstances (ibid).

Analysis of livelihoods includes the dimension of understanding the context, the way of living, and opportunities that exists to support livelihoods and improve food security and nutrition of households living in an area. This offers an understanding of variability in livelihoods that exist at the sub-national level, which are important to address to improve food insecurity of a population (Hussein 2002). Although in simple terms, people may understand livelihood as the way people earn their living, several researchers have used broad definitions of livelihoods. Chambers and Conway (1992, p. 7-8) has defined livelihood as

> "the capabilities (including both material and social assets) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, while not undermining the resource base."

A FAO (FAO 2003, page 8) guideline on livelihood defined it as,

"livelihood means all the different elements that contribute to, or affect, their ability to ensure a living for themselves and their households. This includes:

the assets that the household owns or is able to gain access to – human, natural, social, financial and physical;

the activities that allow the household to use those assets to satisfy basic needs;

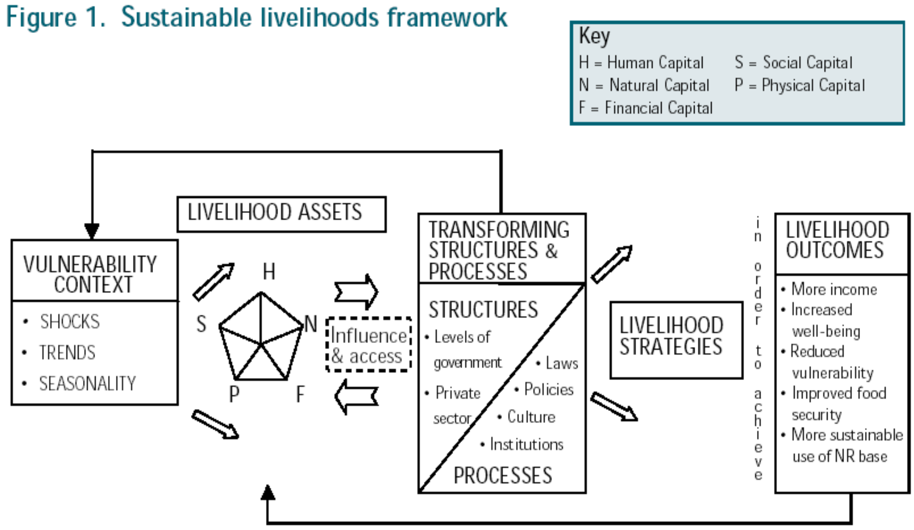
the different factors that the household itself may not be able to control directly, like the seasons, natural disasters or economic trends, that affect its vulnerability; and

policies, institutions and processes that may help them, or make it more difficult for them, to achieve an adequate livelihood**"**.

Livelihood analysis helps in understanding the vulnerability context, such as seasonal changes, trends including that of change in environmental conditions, government policies, as well as exposure to shocks, such as natural disasters or war (Devereux et al. 2004). Households react to different vulnerability contexts and use different coping mechanisms to maintain their livelihoods and well-being. Livelihood approaches are complex and varied depending on the specific context that people live in (ibid). Livelihood analysis helps to identify livelihood interventions that are important to the local people, holistic and recognise the importance of factors that influence their lives, incorporate change over time, and are sustainable. In a sustainable livelihoods approach, the emphasis is that households should be able to cope with shocks and maintain their livelihoods over time.

Several institutes have designed livelihood frameworks and the main elements of the frameworks included livelihood resources, which simply mean what people have; livelihood strategies, i.e. what sort of activities they are engaged in; and livelihood outcomes that reflects what they expect to achieve as an outcome of the livelihood strategies they utilise (Schafer 2002). This enables the researcher to understand their way of living, what assets they have access to, and priorities set by them. **Figure 2.9** shows the sustainability livelihood framework of the Department for International Development (DFID), United Kingdom (ibid).

Figure 2.9 Sustainable livelihoods framework of DFID (Schafer 2002)



The DFID sustainable livelihoods framework includes the dimension of access and its link to process and structures (Schafer 2002). It shows that people utilise the asset base they have access to achieve livelihood outcomes including increase in income, increase in food security and reducing vulnerability among others. The sustainable livelihoods framework emphasizes identifying people's own priorities and having a supportive policy that enables them to reach those objectives (ibid). Ashley and Carney (1999, p-6) documented DFID's experience in using sustainable livelihood framework. They clarified that poverty is a multidimensional issue that has many facets beyond income. They defined sustainable livelihood as follows:

"Sustainable livelihoods is a way of thinking about the objectives, scope and priorities for development, in order to enhance progress in poverty elimination."

They advocated that sustainable livelihood approach should be people-centred (i.e. that focuses on people's own goals), holistic, dynamic (i.e. understands the complexity of livelihoods and identify opportunities and threats), build on people's strengths rather than needs, and should contain the macro-micro links (i.e. can link with policies). Holistic sustainable livelihood analysis can provide great insight for policy or programme design that can expedite poverty reduction.

Households use different resources including skills and knowledge, and all that they use for a livelihood outcome are considered livelihood assets (FAO 2003). Five types of livelihood assets, included in the DFID framework, are important to operate livelihood analysis in an area. Examples included under each type are shown as follows:

- **Natural capital (N):** agricultural land, livestock, forests, water, soil quality, rain;
- **Physical capital (P):** livestock, land, shelter, tools, water supply, health facilities, road infrastructure, communication networks;
- **Financial capital (F):** cash, income, credit/debt, savings, and other economic assets, including basic infrastructure and production equipment and technologies;
- **Human capital (H):** knowledge, skills gained through experiences, education, good health and capability to work;
- **Social capital (S):** networks, social relations, affiliations, associations;

A growing number of organisations have included the concept of sustainable livelihoods in their programmes and analysis to improve lives and well-being of households in an area. DFID, Cooperative for Assistance and Relief (CARE), Oxford Committee for Famine Relief (Oxfam) and the United Nations Development Programme (UNDP), Save the Children are some of the organisations who have incorporated livelihood analysis in various contexts.

2.7 Food Security

The World Food Summit (WFS) 1996 declared food security as a status when people have a consistent access to enough, safe and nutritious food which is not only adequate in meeting dietary energy requirement, but also allows people to have their preferred food. The summit also recognised that poverty is a major contributor to food insecurity (FAO 1996). Later in 2001, FAO included the social dimension to the food security definition as-

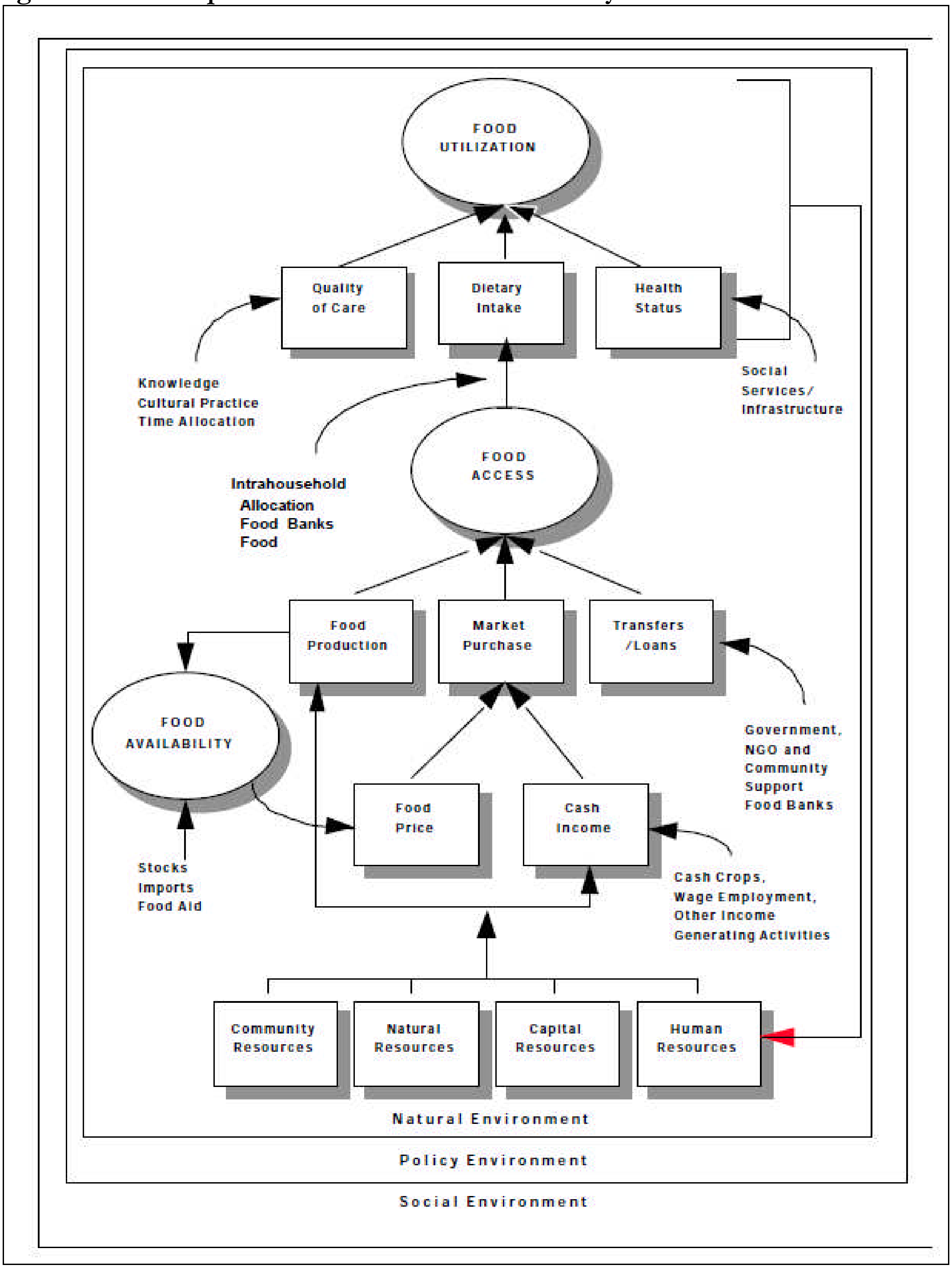
"A situation that exists when all people, at all times, have physical, *social* and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life**"** (FAO 2002).

Food availability, food access, and food utilization are the core elements of food security, that are linked with households' asset endowments, livelihood strategies, and political, social, institutional, and economic environment (World Food Programme 2009a). Various frameworks for understanding the root causes of food security and malnutrition has been devised (such as by UNICEF, WFP/ODAN, and others). The conceptual framework of food security from the Food and Nutrition Technical Assistance (FANTA) Project, Academy for Educational Development shown below depicts the linkages between the components of food security (Riely et al. 1999). It also describes the components as follows:-

> "**Food availability** reflects a condition when sufficient quantities of food are consistently available to all individuals within a country. Such food can be supplied through household production, other domestic output, commercial imports, or food assistance.
>
> **Food access** is ensured when households and all individuals within them have adequate resources to obtain appropriate foods for a nutritious diet. Access depends on income available to the household, on the distribution of income within the household, and on the price of food.
>
> **Food utilization** is the proper biological use of food, requiring a diet providing sufficient energy and essential nutrients, potable water, and adequate sanitation. Effective food utilization depends in large measure on knowledge within the household of food storage and processing techniques, basic principles of nutrition and proper child care, and illness management."

Although food availability is a major component of food security, Sen argues that lack of entitlement, the ability of individual or households to command food through the legal means available in the society, rather than availability can be more responsible for starvation or deprived access to food (Sen 1981). Per Pinstrup-Andersen argued that at an individual level, nutritional status is the outcome of food security; and policies need to enable households to have sufficient foods for all members, as well as ensure a clean and safe environment that allows proper utilization of food to meet micro and macro nutrients demands (Pinstrup-Andersen 2009).

Figure 2.10 Conceptual Framework of Food Security



Source: Riely 1999

2.8 Measurements of food security

Food insecurity is a difficult concept to measure and the search for simple but reliable tools is ongoing (Webb et al. 2006). While food security has three dimensions, Coates et al. mentioned that currently there is a shift from measuring access to food by households towards measuring availability and utilization (Coates et al. 2006a). The access component of food security includes the demand side, economic, social, cultural and political aspects. Nevertheless, access to food at the household level does not ensure that all household members are food secure. Adult and children may react differently to a food shortage faced by a household (Renzaho and Miller 2010). Because it is a multidimensional concept, measuring access to food as an estimate of food security is a difficult process (Barrett 2010). The measure of access to food may inform policies related to poverty reduction, stabilising food price or enhancing social protection among populations in a country. Overall, food security assessments are useful to assess the prevailing situation, to set target groups for an intervention, and to monitor progress or evaluate impact of a food security intervention.

Approaches of determining food security through quantitative methods using structured questionnaires are common. Various quantitative and qualitative measures have been used by institutes and researchers around the world. Because of the varied research focus of different organisations, the measurement techniques used by them also varied. FAO assess food security at a global level, while other organisations such as USAID, WFP have used tools, which are suitable for household level assessment. Because household level assessment cannot capture differences in energy intake among individuals, individual level dietary intake or assessment of nutritional status are also used to assess food security situation. In order to monitor and evaluate impact of food security interventions, the United States Agency for International Development (USAID) also needed tools. They have assigned the Food and Nutrition Technical Assistance Project (FANTA) to develop standard and easily applicable tools to assess food security. The FANTA developed quantitative questionnaire-based tools to assess food insecurity and measure its severity, so these can be used around the world with modifications, when necessary to be applicable in an area (Swindale and Bilinsky 2006 a,b). The section below presents some literature review on food security assessment with a focus on household level assessment.

2.8.1 Macro level food security assessment

FAO assesses food security in more than 100 countries and generates global level data on food security. It uses '**Prevalence of Undernourishment** (PoU)' as an indicator of chronic food insecurity, which measures the extent of deprivation of food for the last one year. Since 1960, FAO routinely produces the publication 'The State of Food Insecurity (SOFI)' to make this estimate widely available (FAO 2012; Haen, Klasen, and Qaim 2011). These data allow comparison of food security estimates in different regions, and assessment of trends at global or national level (FAO 2012).

The PoU estimate uses data on food availability in a country, and compares that with the requirements of energy (kcal) estimated at population level. Three parameters, Mean Dietary Energy Supply (MDES), Coefficient of variation (CV), and Mean Dietary Energy requirement (MDER) of the population are used to estimate undernourishment. Food Balance Sheet (FBS) estimates dietary energy supply by measuring food availability at a national level. The MEDR is an estimation of energy requirement that will balance energy expenditure required for light physical activity level. The estimation of CV generally relies on distribution of the energy intake available from national level dietary intake surveys (Haen, Klasen, and Qaim 2011; FAO 2013).

FAO estimate of undernourishment is a chronic measure, which cannot assess short-term effect of inability to access food due to emergency or other crises. The three parameters used in estimation are subject to criticism about their level of accuracy and precision. Furthermore, the estimate of undernourishment is calculated for per capita dietary energy availability and not intake. On a national level, FBS may underestimate or overestimate supply (Haen, Klasen, and Qaim 2011). The measure of CV is influenced by the distribution of food-secure population in the total population. The MEDR is estimated based on population level aggregated estimate of energy requirements and assumes sedentary activity level, which is a simplistic assumption and does not reflect requirements based on actual habitual energy intake.

To improve the food security assessment, FAO has now identified additional indicators to incorporate that will capture various dimensions of food insecurity. The food price index, share of food expenditure by the poor, prevalence of food inadequacy (energy requirement calculated based on moderate physical activity), domestic food price volatility are among the listed indicators (FAO 2013).

2.8.2 Micro level food security assessment (Household level)

Consumption surveys: Household consumption surveys are usually done at national level to estimate prevalence of food security (Haen, Klasen, and Qaim 2011). Compared to the FAO estimates of energy availability, these national surveys provide better estimates of energy intake at household level. Data are collected on all foods consumed by household members for a previous period. The recall period for household level data may include 7 days, 14 days, or 30 days period, whereas it usually involves 24-hour recall period for individual level intake estimation. After assessment of quantity of all food consumed by the household members, those are converted to energy (kcal) intake using available food composition tables. The households with inadequate energy intake of its members (based on Recommended Dietary Intake) are considered food insecure.

Moving beyond assessment of inadequate energy intake, consumption survey data can also assess dietary diversity and nutrient deficiency in a population (Szponar et al. 2001; Labadarios et al. 2005). Whereas FAO estimate of undernourishment uses population level aggregated data on proportion of individuals in specific age-sex categories, household consumption data uses actual demographic data of households. Data can be used for regional or socio-economic disaggregation, and thus can be useful for targeting and policy decisions (Haen, Klasen, and Qaim 2011).

Although estimates of food security using food consumption has several advantages over the FAO method, these surveys require specialised skill, are time consuming and expensive. Because consumption surveys generally are expensive and time-consuming, surveys are not frequent enough to cover seasonal variation in consumption. Also, precise estimation of energy from food eaten outside home is difficult, which is more of a problem for areas where household members frequently eat outside. Furthermore, since the method relies on recall of food consumption, maintaining data quality can be an issue especially when a longer recall period is used (Carletto, Zezza, and Benarjee 2012). Food intake data collected by weighted record (weigh foods consumed by individual household members) can provide more reliable estimate of energy intake, but are very expensive and time consuming to do on a large scale (Sudo et al. 2006).

Household expenditure on food: How much households spend on food out of the total expenditure can indicate their food security status. Data from household expenditure survey data in South Africa were used to derive two measures of diet quantity that assessed food security (Rose and Charlton 2002). The first indicator was named **food poverty**, which estimated whether household expenditure on food was less than the amount of money needed to meet nutritional requirements of its members. The average cost of a basic diet was derived by estimating amount of money needed for individuals in various age and sex categories. The amount was then weighted by distribution of population in the respective group. The second indicator, **low energy availability**, assessed whether the total energy provided by the monthly household food supply (obtained from food purchase and consumption of own production) was less than the amount of energy needed to meet requirements of its members. The energy requirements of household members were set based on low-moderate physical activity. The study used both indicators to assess the prevalence of food insecurity in South Africa and examine factors associated (rural/urban, income level of households, household size, characteristics of household head) with it. They found the indicators suitable for targeting of various types of intervention.

Smith and Wiesmann (2007) also used household expenditure data from 16 nationally representative surveys in South Asia and South Africa (data collected between 1996 and 2001) to develop food insecurity indicators concerning both diet quantity and quality. The survey used these indicators to compare the extent and severity of food insecurity in the two regions. The diet quantity indicators included **household daily food energy availability per capita,** percentage of population food energy deficient, percentage of population severely food energy deficient. Daily energy availability at household level was assessed by converting expenditure on food items or amounts of food acquired to energy. Per capita daily energy availability was then assessed dividing that by number of household members. Finally, it was assessed whether the available energy was below the amount required to meet need of basic metabolic rate and light physical activity of household members in different age-sex categories.

Measures of dietary intake: Dietary diversity is a measure of diet quality, which is also an indicator of food security among household and individuals. This is a simple count of food or food groups consumed over a reference period ranging from 1 to 15 days (Hoddinott and Yohannes 2002; Ruel 2003; Carletto, Zezza, and Banerjee 2012; Kennedy, Ballard, and Dop 2010). Analysis of data from 10 countries ((India, the Philippines, Mozambique, Mexico, Bangladesh, Egypt, Mali, Malawi, Ghana, and Kenya) found that dietary diversity (using household level food groups) and per capita availability of dietary energy was positively associated (Hoddinott and Yohannes 2002). In a linear regression, a 1.0 percentage increase in dietary diversity was associated with a 1.0 percentage increase in per capita consumption, which were 0.5 and a 1.4 percentage increase for household per capita daily caloric availability from staples and from non-staples, respectively. These associations remained same irrespective of rural/urban areas, and across seasons. Hoddinott and Yohannes (2002) advocated using dietary diversity for a number of reasons: **a**. the variety of diet itself is an outcome of food security; **b**. it is associated with improved micronutrient status, and child anthropometric status; **c.** it is suitable to apply for assessment of food security among households; and d. training enumerators for data collection is straightforward, and data collection requires very short time (about 10 minutes).

For comparative analysis of food security across regions, Smith and Weismann (2007) used household level dietary diversity (measure of diet quality). It was a sum of up to seven food groups from which households have acquired food from within a reference period. Low dietary diversity meant acquiring food from less than four food groups out of the seven food groups (cereals, roots and tubers; pulses and legumes; dairy products; meats, fish and seafood, and eggs; oils and fats; fruits; vegetables). A study in Bangladesh also found that dietary diversity was associated with per capita food and total expenditure (Thorne-Lyman 2010).

Surveys that collected data on dietary diversity used varied numbers of food groups, and the FANTA proposed using a standardised household level measure known as **Household Dietary Diversity Score (HDDS).** The HDDS involves a 24-hour recall of 12 food groups consumed by the household. This is simple un-weighted count of food groups consumed by the household. This tells how varied or limited the household diet is at one point in time reflecting economic access to food and energy sufficiency of the diet (Swindale and Bilinsky 2006b). Dietary diversity was associated with nutrient intake and adequacy in developing countries (Ruel 2002). Ruel (2003) commented that dietary diversity was found to be consistently associated with indicators of household food consumption and food availability, and it can be a promising tool for food security assessment, especially in resource poor setting. The validity of the HDDS has been assessed in 11 countries, which showed that the indicator was in good agreement with nutritional status of children, an outcome of food security (Arimond and Ruel 2004). However, no universal cut-off in terms of number of food groups consumed is available for defining food secure populations across different settings is available.

Food consumption score (FCS) is a commonly used indicator used by WFP for assessment of food security among different population (WFP 2009). This indicator can be a proxy for dietary diversity, energy intake, and micronutrient deficiency. FCS collects data from households using a quantitative structured questionnaire and asks them about consumption of various food groups over a seven-day period. This indicator uses both food diversity and frequency of intake data, and a weighting system is used to calculate the score (**Table 2.3**). Data collection for FCS can be relatively simple and quick to administer. IFPRI examined the validity of using FCS for grouping households by their food security status in Burundi, Haiti and Sri Lanka. They observed that the FCS was significantly correlated with per capita dietary energy intake (Wiesmann et al. 2009). They also found that the energy intake that corresponded to the FCS cut off of 'poor' was less than 2100 kcal/capita/day. The study suggested that using twelve food groups instead of eight groups might improve validity (ibid).

A multi-country assessment examined correlation between HDDS (24 hour recall) and FCS (7 day recall), and observed high correlations (r= 0.73 in Burkina Faso, 0.65 in Lao PDR, and 0.53 in northern Uganda) (Kennedy et al. 2010). In this study, consumption of <=3 food groups by households was considered food insecure from HDDS data, whereas <=35 was considered food insecure from FCS data. Agreement between the classifications of food security using these two indicators was moderate to high, as measured by kappa coefficient.

Data collection for FCS takes a little more time compared with HDDS, but also provides more detail data on consumption (Kennedy et al. 2010). Both methods are good indicators to provide population level data and to monitor impact of a program. Consistent data collection using any suitable indicator can provide trend data. Although FCS is a simple and promising tool, like HDDS, this tool is inadequate to describe intra-household food distribution. The study concluded that FCS and HDDS are not interchangeable, and need-based decisions should be taken in selecting appropriate indicators for a study. Further research is needed to determine suitable cut-offs for both measures (Kennedy et al. 2010; Ruel 2003).

Table 2.3 Food groups and weights used to construct Food Consumption Score and Household Dietary Diversity Score (Kennedy et al. 2010)

Food Consumption Score (FCS)	Weight	Household Dietary Diversity Score (HDDS)	Weight
Cereals, tubers and root crops	2	Cereals	1
		White toots and tubers	1
Meat and fish	4	Meat	1
		Fish	1
		Eggs	1
Milk	4	Milk and dairy	1
Oil/ fats	0.5	Oils and fat	1
Fruits	1	Fruits	1
Vegetables	1	Vegetables	1
Pulses	3	Pulses, legumes and nuts	1
Sugar	0.5	Sweets	1
Condiments	0	Spices, condiments & beverages	1

A recent IFPRI publication on improving the measures of food security opined that dietary diversity should be considered as an important indicator (which they referred as class indicator), as this is the only indicator that has potential in terms of meeting a number of criteria (e.g. cross-country, within country, temporal, impact of shocks, seasonality, nutrition, macro-micro nutrients) that are chosen to compare usefulness of food security indicators (Haedey and Ecker 2012).

Experience-based tools: The experience-based measures of food security are built on the idea that food security is a managed process and reactions to it can be predicted and quantified (Carletto, Zezza, and Banerjee 2012). The US Department of Agriculture (USDA) developed the **Household Food Security Survey Module** (**US HFSSM**), which combines a set of questions on experience of food insecurity. The responses to the questions can be used to create a categorical or continuous scale of food insecurity. A study in three developing countries (Bolivia, Burkina Faso, and the Philippines) observed that food secure households defined using USFSSM had significantly higher total food expenditure and expenditure on animal source foods (Melgar-Quinonez et al. 2006).

The US HFSSM and similar tools (modified or adapted in local context) have been used in studies in a number of countries. When used in a new area, the initial stage usually involves a qualitative validation study so that it can be modified in terms of translation, clarity and understanding of the same concept. The tool was used in Venezuela (Lorenzana and Mercado 2002), Iran (Rafiei et al. 2009), Peru (Vargas et al. 2009), Iran (Mohammadzadeh et al. 2010), and Jordan (Bawadi et al. 2012). In Indonesia, a 9-item adapted USHFSSM tool was used, which showed that the resulting food insecurity measure was associated with prevalence of anaemia among children and under-five mortality in rural households were associated (Campbell et al 2009; Campbell et al. 2011). In Colombia, this tool was adapted as Colombia Household Food Security Survey (Hackett 2008). The USFSSM was found to be reliable, internally consistent, and valid tool in a number of settings (Vargas et al. 2009; Lorenzana and Mercado 2002; Melgar-Quinonez et al. 2006).

The **Household Food Insecurity Access Scale (HFAIS)** was developed by FANTA as a standardised tool that combines 9-questions on experience of food insecurity. It was developed to provide a user friendly, simple tool for food security assessment in developing countries. It encompasses three domains of food insecurity experience: worry/ anxiety about food supply, insufficient food quality, and insufficient food quantity. Coates and colleagues (2006a) emphasized that in order to make a standard way of understanding people's experience of food security, collecting data about experience-based measures of food security is important. Frongillo (2003) developed a questionnaire and tested its suitability to describe the experience of food insecurity in rural areas in Bangladesh. Later, Saha et al. (2009) used this scale to examine the association of household food security with the growth of infants and young children. The indicator categorises households into four levels of food insecurity status: food secure, mildly, moderately, and severely food insecure. It was validated in Burkina Faso, Bangladesh, Tanzania, Ethiopia (Frongillo and Nanama 2006; Swindale & Bilinsky 2006a; Coates, Swindale and Bilinsky 2007; Knueppel 2009; Regassa and Stoecker 2011). The strengths of this method is that it is simple, can be administered by non-specialist, and easy to analyse and interpret which may save time for identifying target group and deliver food security intervention among them (Knueppel 2009).

Frongillo and Nanama (2006) used HFIAS in Burkina Faso, and concluded that the indicator was sensitive to seasonal change in food availability and access, and suitable for differentiating households based on food security status and for measuring change over time. Although it was strongly associated with dietary intake, the association with nutritional status (anthropometry) was weak. Knueppel and colleagues (2009) found that the HFIAS as internally consistent (Cronbach's alpha =0.90) tool, which was consistently and significantly associated with indicators of socio-economic status. It produced reliable and valid results in the context of Tanzania. The study also observed that the whereas insufficient food quality and insufficient food intake domain of the HFIAS scale was identified as a strong predictor of food insecurity, the anxiety/worry factor was not considered as such as strong predictor. This could be due to the fact that food insecurity was widely prevalent and may have become a day-to-day reality (Knueppel et al. 2009).

The Nepal DHS recently added HFIAS as a measure food security in the country (Ministry of Health and Population (MOHP) [Nepal], New Era, & and ICF International, 2012). Household surveys in Nepal and Bangladesh have also included the indicator to assess national, regional or local level food insecurity (Osei et al. 2010; Helen Keller International, Bangladesh 2011). HFIAS is simple to use and can be used for geographical targeting and has become increasingly a popular choice. However, it emphasizes primarily on access to food and does not examine dietary diversity or coping mechanisms used, except the coping mechanisms of reducing number of meals, reducing meal sizes and going without food for a day or for a day and night (Carletto, Zezza, and Banerjee 2012). Some argue that it may lack validity to use across countries, and that the statistical validity of such a subjective measure is not yet conclusively established (Headey and Erick 2012).

Coping mechanisms: The **Coping Strategy Index (CSI**) is locally adaptable context specific indicator, which incorporates households coping behaviours related to food security. The idea behind the indicator is that food security is predictable, and therefore it is a managed process. Households can initiate reaction when they expect to be unable to access food. WFP and CARE commonly use this indicator to assess the food security situation in different countries. The CSI examines the level of food insecurity by using data on how a household tends to cope in response to a shock (WFP 2009; Maxwell, Caldwell, and Langworthy 2008)).

This is a quick and simple alternative to dietary recall data, expressed as a numeric score. The score is a count of household coping behaviours, which are weighted according to severity. The total score can be used as a continuous scale or can be converted to a categorical one. This scale can be used as a monitoring and evaluation tool to assess change in situation over a period of time. However, the indicator may not be used cross-country since it is usually adapted for specific location based on coping behaviour available to the population and how those relate to them.

Hadley (2007) developed a 7-item locally appropriate CSI based on ethnographic research in Tanzania, which was suitable to monitor seasonal change. The responses identified for inclusion in the scale were: (1) consuming less preferred foods (e.g. sorghum instead of maize, maize instead of rice); (2) borrowing money from relatives; (3) borrowing money from friends; (4) selling labour for food or money to buy food; (5) gathering wild edible plants; (6) reducing the amount of food cooked; and (7) sitting the entire day without food. Weights were applied to the items based on experience of the ethnographic study rather than respondent's ranking suggested by Maxwell (1999). Households were divided into three categories based on their total score as low, medium and high food secure. The study found that the CSI was internally consistent, which had a high reliability score (Cronbach's alpha = 0.79).

Maxwell et al. (2008) assessed the suitability of using CSI as a universal tool, which will allow for comparative analysis. They found that there is a core set of behaviours that are experienced across different contexts in similar scale and severity. They suggested focusing on five behaviours: eating less-preferred foods, borrowing food or money, limiting portion size, reducing number of meals, or favouring some members of the household whilst excluding others. The proposed reduced CSI, can be used along side the original CSI which will generate context specific and comparable results.

Other household level indictors: Becquey et al. (2012) developed a Mean Adequacy ratio (MAR) indicator for assessment of food security in urban Burkina Faso. Food security was assessed by using 24-hour recall for 2 non-consecutive days that provided detailed account of the quantity of all food consumed by household members, which was used to derive a Mean Adequacy Ratio for a household. It is a composite indicator that estimates whether a household can adequately meet household members' requirements of energy and 11 micronutrients. Requirements of energy and recommended nutrient intake for their age and sex are based on light physical activity. The study assessed seasonal variation of MAR, and found that MAR was low in the lean season compared to the post-harvest season. However, it did not change much among those who had higher expenditure on food.

Another simple measure of household food insecurity developed by the FANTA is **Months of Inadequate Household Food Provisioning (MIHFP**), which measures adequacy of food to a household on a month-by-month basis (Bilinsky and Swindlae 2007). If a respondent replies that their household experienced any months of food inadequacy in the last 12 months, they are then asked to say in which months they experienced in adequacy. The number of months of inadequacy is a crude measure of food insecurity but population-wide it provides clear seasonal patterns of food insecurity / timing of the lean seasons.

In Sri Lanka, a multidimensional indicator of food security, **Household Food Security Index (HFSI)** was developed that included dimension of (i) accessibility, (ii) availability (iii) utilisation. Seven indicators i.e. economic (ECO), social (SOC), dietary (DIET), nutrition (NUT), water and sanitation (WAS), perception on food consumption (PFC) and coping strategies (COP) (Malkanthi 2011) were combined for this calculation.

Results showed that with per capita household income, haemoglobin status and underweight among children, household's perception of food consumption and coping strategy score were associated with the HFSI.

2.8.3 Micro level food security assessment (Individual level)

Collecting individual level data for food security assessment is important, as availability at the household may not ensure acquisition and equal distribution among all household members. Anthropometric data collected by household surveys can assess individual level food security. **Stunting, wasting, and underweight** among children are commonly used indicators, which are calculated using height and weight data and then comparing their Z-score to a population with normative growth. Another anthropometric measurement, **Mid Upper Arm Circumference** (MUAC) is also used in food insecurity assessments to guide food aid decisions (IPC 2008). The advantage of having nutritional data is that it provides a direct measure of both chronic and acute deprivation, and it allows universal comparison, and disaggregation by geographical regions or by groups within a region (Haen, Klasen, and Qaim 2011). However, the drawback is that nutritional status is not only influenced by food availability or intake, it is also influenced by utilization, which may be affected by non-food factors (e.g. health/ absorptive capacity for ingested food, hygienic conditions and care practices) (Maxwell, Caldwell, and Langworthy 2008).

The FANTA also developed **Individual Dietary Diversity Score (IDDS),** an indicator of food security, which can examine the inequality in intra-household food distribution. Data are collected about consumption from food groups by individuals in the last 24-hour (FANTA 2006). The number of food groups included in dietary diversity score for children and women is different than that is included in HDDS. The dietary diversity score for children includes eight food groups (Swindale and Bilinsky 2006b).

2.8.4 Measuring food security in relation to food price crisis

Davilla (2010) utilised data collected in 2006 and 2008 among households in different socio-economic groups in Mexico and used 'percentage expenditure on maize (main cereal) as an indicator to estimate the impact of food price rises on food security. He observed that the situation remained unchanged among richer households, whereas expenditure on maize increased significantly among rural and urban poorer households.

Using panel data from Ethiopia collected during 2005/6 and 2008 among rural, urban and peri-urban households, Hadley (2011) assessed change in food security using an experience-based six-item scale similar to the HFIAS. The tool was internally consistent (Chronbach's alpha >0.70 for both years). They found that food security declined in all areas, whereas it was most prominent in rural areas (33.0%). Food security did not change much among households who were wealthier in 2005. The study concluded that rural households are the worst affected, and also poorer households, irrespective of being in rural or urban areas, were more affected. Rural households did not benefit from food sale due to small sales and because one third of the households did not sell any foods.

Korale-Gedra and colleagues (2012) assessed impact of food price inflation on individual and national level energy intake in Sri Lanka using a modelling technique called Stone-Geary utility function. The study estimated that between 2007 and 2009, increase in undernourished population (proportion of population not meeting required calorie intake) would be only 1.7% when adjustment are made for increase in food prices (54.8%) and non-food items (25.9%), together with increase in income (57.0%). The increase in proportion of population undernourished was estimated to be much higher when income effect was not considered.

Another study in Burkina Faso assessed the effect of the food price crisis on household food security between 2007 and 2008 (Martin-Prevel 2012). The study collected data using the HFIAS and Individual DDS as indicators of food security, and observed that mean IDDS decreased from 5.7 ± 1.7 to 5.2 ± 1.5 in 2008. Overall monthly household food expenditure increased by 18% and prevalence of food insecurity measured by HFIAS increased from 67% to 78% over the period.

2.8.5 Micro level food security assessment (household level, livelihood based)

Household economy approach (Livelihood based assessment): In contrast to the FANTA or WFP household survey tools, the **Household Economy Approach** (HEA) developed by Save the Children UK in early 1990, uses participatory tools and a semi-structured questionnaire to assess food security status of a population. First a mixed group of community representatives provides information about the wealth breakdown and general livelihood situation (historical, seasonal and reference information). Then group of representatives from each wealth group separately take part in a detailed semi-structured interview where they generalize about 'households like their own' to generate quantitative estimates of annual food sources, income sources and expenditure, as well as assets owned and coping strategies adopted in shocks. HEA is an analytical framework that provides an overall detailed description of livelihoods and inter-dependency between wealth groups, enabling analysis of what each group is vulnerable towards (FEG Consulting and Save the Children UK 2008).

This method uses a livelihoods-based framework to inform how households meet their food and non-food needs, and has been used in countries in Asia and Africa (Food Economy Group 2009).

"This method is based on the principle that an understanding of how people make ends meet is essential for assessing how livelihoods will be affected by wider economic or ecological change and for planning interventions that will support, rather than undermine, their existing survival strategies.

At the heart of HEA is an analysis of

1) How people in different social and economic circumstances get the food and cash they need;

2) Their assets, the opportunities open to them and the constraints they face;

3) The options open to them at times of crisis**"** (Holzmann et al. 2008).

Along with data on livelihoods options, HEA studies collect data on market price to understand the context that the households live in. Such price estimates provide an opportunity to assess the impact of the global food price crisis on a population. The strength of the HEA is that it uses the community itself to describe livelihoods allowing estimation of food security with a detailed description of the context. Such estimates may be less comparable across countries compared with quantitative methods using household surveys.

Originally, the Household Economy Approach (HEA) was designed to meet the needs of understanding how people access food and income. This approach was initiated in early 1990 as a collaborative approach of Save the Children with Global Information and Early Warning System of the Food and Agriculture Organization (FAO) of the United Nations. The approach collects data about how households access food and income in a normal year. The normal year is generally known as baseline, which can then be used to assess impact of shocks, such as natural disasters, price changes, or change in policies, on households. Sometimes, the recent past twelve months are considered as baseline, or reference year (Holzamann et al. 2008: p 6). The 2008 Save the Children and FEG publication defined baseline as below:

> **"**… the baseline…. presents a picture of the 'normal' household economy: household assets; the strategies employed to derive food and income and the relationships between households and with the wider economy; and how households use that income to meet their basic needs, for investments or for social obligations.**"**

The HEA baseline assessment has three elements: livelihood zoning, a wealth breakdown and an analysis of livelihood strategies of the wealth groups in the area studied (Holzmann et al. 2008: p 9). The first step in HEA baseline data collection is **livelihood zoning**, which divides people according to how they access food (such as differences in production system), and the marketing network they use. Generally, livelihood zones resemble agro-ecological zones (Seaman et al. 2006: p-3).

The second step of HEA baseline assessment is known as **wealth breakdown**, disaggregating households by their wealth status based on definitions given by the community. This involves characterising typical households in a livelihood zone to three or more wealth groups. At this stage, local definitions are used to define poor or better-off households, and the percentages of people falling in each wealth group are estimated by the community (Holzmann et al 2008; Seaman et al. 2000a). According to Food and Economy Consulting Group (FEG website 2009), "A wealth breakdown is a process of dividing a population within one livelihood zone into groups that share the same range of options for obtaining food and cash income, similar levels of income and similar expenditure requirements."

This process helps understanding

"who has what, how people will be affected by different shocks, and which people will be able to take advantage of new opportunities" (FEG website 2009).

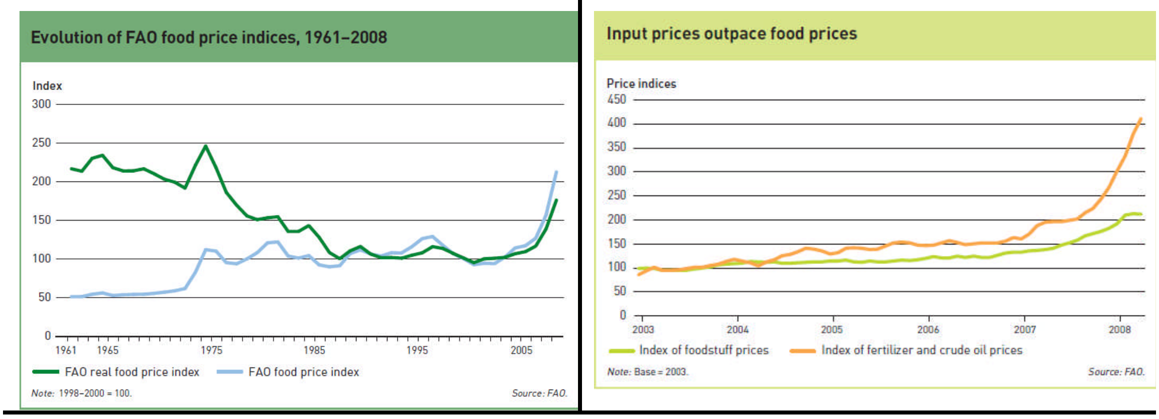
Applying this wealth breakdown process, a group of mixed wealth group representatives are interviewed to group people using local definitions of wealth and to quantify their assets (ibid). Stephen and Downing (2001) suggested that in terms of targeting vulnerable households, small units such as districts works better than national level. They also cited the paper of Hoddinott (1999), which showed there is a large effect in improving food security when resource utilisation are targeted to fewer small units, such as districts, village or households. The description of the various wealth groups in a community, and their livelihoods can therefore be useful for targeting interventions, and for planning poverty reduction programmes.

The next step, **analysis of livelihood strategies**, includes exploring in detail the pattern of access to food and cash, and also pattern of expenditure. This is done by conducting separate focus group interviews with the different wealth group members. During this interview, WG members provide detailed information on food consumption, income, expenditure, reflecting that of a typical household, similar to the wealth status of that they belong to. Focus group discussion-style interviews, using semi-structured questionnaires are conducted with wealth group members to make quantitative estimates of access to food, income from various sources and expenditure.

2.9 Global food price crisis – a threat to food security and nutrition

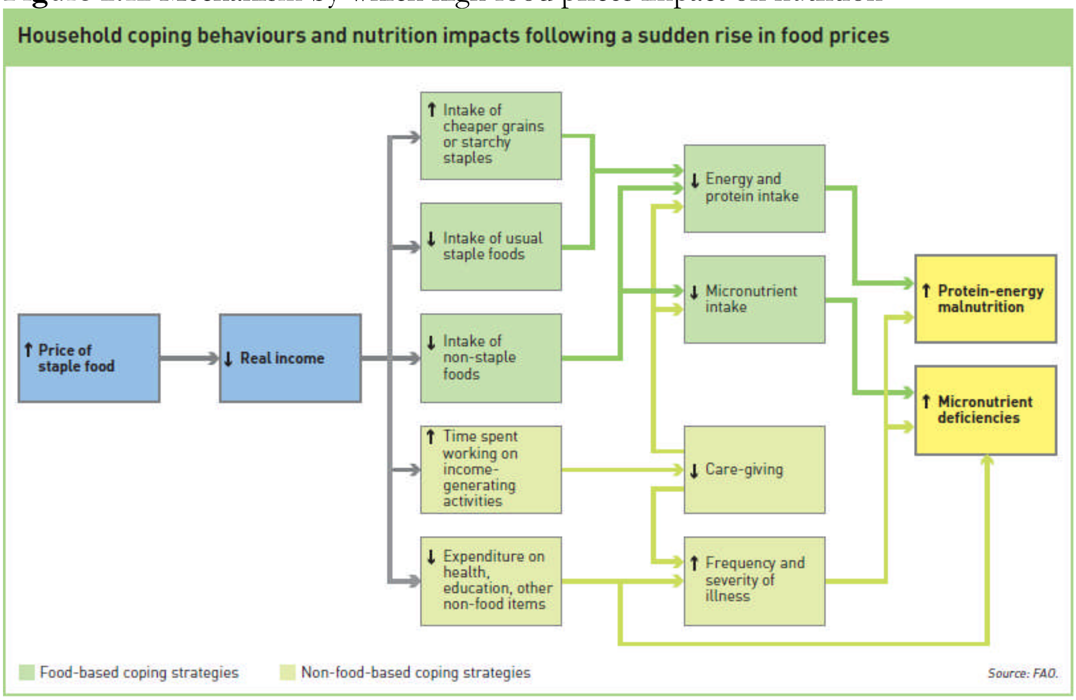
The food prices around the world have been on rise since 2002, and a sharp increase was evident in 2006 which reached an alarming stage around mid 2008 (FAO 2008). Compared to 2002, levels of real food prices in the world were 64 percent higher in mid 2008, and such change was earlier observed in the early 1970s during the first international oil crisis (FAO 2008). **Figure 2.11** shows FAO estimates of change in food price between 2002 and 2008.

Figure 2.11 FAO estimate showing trend in food price (1961-2008)



The 2008 food price crisis raised concerns that hunger and poverty will increase sharply, halting the reduction in malnutrition around the world. Although the proportion of undernourished people declined between 1990 and 2006, the decline was at a slower pace than needed to meet the first Millennium Development Goal (MDG) (FAO 2009b). The following **Figure 2.12** (FAO 2008) describes the mechanism by which high food prices impact upon nutrition of a population.

Figure 2.12 Mechanism by which high food prices impact on nutrition



FAO 2008

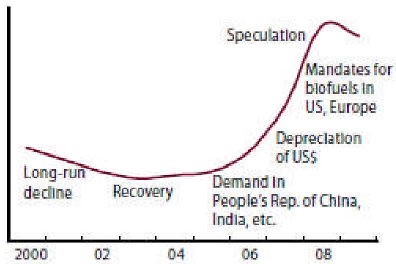
Timmer from the Asian Development Bank has investigated the causes of high food prices and summarised the factors (**Figure 2.13**). He also shared the layers of causation of price rise since 2000 (Timmer 2008). Rising living standards, depreciation of the dollar against other important currencies, increased frequency of natural disasters, slowed down cereal production worldwide, topsoil erosion, high production costs because of raised price of oil and energy, under-investment in agricultural sector, and increased demand of cereals due to the use of crops in bio-fuel production all together were responsible for the spike in price of foods around the world (Ramalingam, Proudlock, and Mitchell 2008).

Figure 2.13 Factors related to increase in food prices (Timmer 2008)

2.3.1 External drivers of food prices

	Supply	Demand
Low variance	Seed technology	Population growth
	Irrigation	Income growth
	Total harvested area	Dietary changes and tastes
	Climate change	Meat and livestock economy
	Knowledge and management skills	
High variance	Weather	Exchange rates
	Diseases	Speculation
	Crop-specific harvested area	Biofuels (but predictable from mandates; not predictable from oil prices)
	Fuel costs	Panic or hoarding
	Fertilizer costs	Government trade and inventory policies

2.3.7 Factors contributing to food price formation since 2000



Source: Based on Timmer (2008a).

Pace et al. (2008) have argued that supply and demand factors by themselves were not responsible for the striking peaks in food prices. The paper showed that speculative purchase of food-commodity derivatives creating inflationary pressure to cause particular prices to increase above their real value, and artificially increasing demand could be responsible for such an increase (Pace, Seal, and Costello 2008).

The global food price crisis has affected large parts of the world. The key affected areas are Asia, sub-Saharan Africa and Central America (Benson et al. 2008). Benson et al. pointed out that the global food price crisis effect varies at country levels, and levels within countries (household level, and individual level). Thus, assessment of impact of food price crisis in each country needs to account for such specific contextual factors.

2.10 Measuring food security and the impact of the food price crisis in Nepal

The global food price crisis attracted a lot of media attention and attempts have been made to measure impacts on different countries. The World Food Programme (WFP) launched food security assessments at household level for those countries that were more vulnerable to increased food and fuel price (e.g. Madagascar, Gambia, Zimbabwe). The WFP assessment of food price changes in Nepal showed that between 2007 and 2008, average real price increase was 44% for rice and 28% for wheat. Average expenditure on food was 59% of total household expenditure, whereas for the poorest 20% of the population it was 73% (Sanogo 2009). However, this estimate compared data for 2007 and 2008, and a sharp increase in food price was already evident in 2006 (FAO 2008).

According to the Nepal DHS 2011, about 41% of the children under-five were stunted and nearly half were anaemic; also one third of the adult women were anaemic(Ministry of Health and Population (MOHP) [Nepal], New Era, & Macro International Inc. 2012). In 2006, nearly a quarter of the women had a low BMI (World Health Organization 1995; (Ministry of Health and Population (MOHP) [Nepal], New Era, & Macro International Inc. 2007). The findings reflected a critical food insecurity situation in Nepal (Ministry of Health and Population (MOHP) [Nepal], New Era, & Macro International Inc. 2007). Although, the recent DHS 2011 observed improvement in maternal nutrition (18% with BMI <18.5 kg/m^2), micronutrient deficiency among women and children is still highly prevalent, and *Terai* had the highest percentage of anemic women and children (ibid).

Given that Nepal is a country that faces low productivity and is highly dependent on food import to meet its demand for food, impact of recent price hikes is likely to be large in this country (Govt of Nepal et al. 2008). WFP and Nepal Development Research Institute carried out a market and price impact assessment in Nepal that utilized primary data collected during April/May 2008, recall of price six months prior to that, and secondary data on price available from other sources (World Food Program and Nepal Development Research Institute 2008). This study showed that over the six-month period, there was an overall increase in prices as follows: rice -19%, oil 26%, and wheat 5%. The increase in wheat price was less dramatic than that of rice. This study investigated reasons behind the price rise and assessed food expenditure of households in different wealth groups. WFP has also set up a market watch system to collect data from local markets in Nepal, and data were available from December 2006. The system generated data from different areas in Nepal (WFP 2009b). WFP conducted a comprehensive food security and vulnerability analysis in 2005, and assessed the vulnerability to food insecurity for people living in different parts of Nepal (WFP 2005). However, none of these studies estimated how much a nutritionally adequate diet that uses locally available foods in rural Nepal would cost and whether households in Nepal can afford such a diet under the current price conditions.

2.11 Cost of Diet tool

Save the Children UK has developed a 'Cost of Diet (CoD)' (Perry 2009) tool that uses linear programming to calculate the minimum amount of money a family will have to spend to meet their nutritional requirements using locally available foods. In both Bangladesh and Tanzania, CoD studies were implemented in areas where data was already collected using HEA assessment (Perry 2009). This software can be operated using Solver function in MsExcel. This tool has been used in Myanmar, Bangladesh, Ethiopia, Tanzania, Kenya, Democratic Republic of Congo by Save the Children to estimate minimum cost of a nutritionally adequate diet (Save the Children UK 2007; Hilton 2008; Save the Children UK 2009a,b; Save the Children UK [online] ; Save the Children UK 2010). The detail planning of a nutritionally adequate diet for households in Dhanusha, plains of Nepal, is described in Chapter 8. Based on the concept that nutrient content and cost of food are linearly associated, the *objective function* of the program is set to minimise the cost of diet.

With a set of constraints that are set to meet the nutritional requirements (for energy and nutrients), and respect the dietary pattern of the target group, the CoD tool uses a mathematical modelling to minimise the cost of a nutritionally adequate diet. It uses the constraints, food composition database, list of locally available food items and thier prices to generate the *decision variables,* the grams of food selected (Hilton 2008). The tool is generally used to estimate cost of household diet, but also allows estimating cost of the diet of an individual. Several types of constraints are included in the programme, such as:

a. Energy equality constraints

b. Nutritional constraints
c. Food group constraints
d. Food item and portion size constraints

The suggested diet (i.e. gms of food items) for the household by the CoD should fulfil the requirements of energy, and the nutritional content should also be adequate to fulfil requirements of all household members. Food group constraints specify the minimum and maximum frequency household members can consume from each specific group over a one week period. Similarly, constraints specifying the limits of intake (minimum, maximum) as well as portion size are set so that dietary pattern is more realistic. Based on availability of food items in an area and their nutritional quality, the tool may find a feasible solution or an unfeasible solution. The feasible solution will be able to generate the decision variables, which indicates that a minimum cost diet can be planned with the food items respecting the dietary pattern of the community that can meet the nutritional requirements of the household members.

Chapter 3. Overview of data and methods

3.1 Study design and settings

This PhD research assesses the change in food price due to the food price crisis in 2008 and its impact on affordability of a nutritionally adequate diet by the different wealth groups in Dhanusha district of Nepal. The research undertakes an exploratory study using the Household Economy Approach (HEA), prospective surveillance of households where a woman had recently delivered, and market price and income surveys conducted in the district between 2006 and 2009. This research compares asset indices derived from HEA and household surveillance data (HSD); describes food insecurity and livelihood patterns; compares local market food prices before, during and after the 2008 global food price crises and the changes in income; and assesses the overall impact of the price rise on the affordability of a nutritionally adequate diet by the wealth groups in Dhanusha.

Dhanusha district is one of 75 districts in Nepal, and is situated in the central development region. According to ecological zone, this district is part of the plains (*Terai*) of Nepal. It is adjacent to Bihar state, India on its south border, and the rest of the district is surrounded by districts of Siraha, Sindhuli and Mahottari within Nepal. It covers an area of 1180 Sq. Km and has an altitude varying from 61m to 610m. In 2001, the district had a population 671,364, (fifth most populous district in Nepal) and the population density has remained quite high (CBS 2006). On average, households have 5.72 members and 0.889 hectares of land (ibid). In total, about one third of its households are landless or cultivating marginal farms (<0.5 ha farm size) (UNDP and Govt. of Nepal 2001). The majority of the population in this area are Hindus (88.7%) of varied caste, followed by Muslims (8.7%). Based on the human development index (HDI) which is a combined measure including a long and healthy life, access to education, and a decent standard of living (UNDP 2009), Dhanusha ranks 43 out of 75 districts within Nepal. The HDI of the district was 0.449, whereas the national average was 0.471 (UNDP 2004). Dhanusha is also one of the poorest performing districts in terms of net enrolment at primary schools (Government of Nepal and United Nations Country team of Nepal 2010). Almost half (49.0%) of its adult population are literate but literacy rates are much lower for women (35.9%) than men (69.9%) (UNDP 2009).

Maithili is the most common language in this area spoken by 90% of the population (Sharma et al. 2010). According to WFP, 26.9% of the households in Dhanusha are poor (measured by per capita expenditure below the poverty line), and 32% did not meet their caloric requirements. This district has high prevalence of under-nutrition; 53% of the under-five children were stunted, 55% were underweight, and 17% were wasted, in 2006 (CBS/WFP/WB 2006).

The map (**Figure 3.1**) shows the location of Dhanusha district within Nepal, along with the administrative regions shown as dark lined boundaries, and district boundaries within the regions shown as lighter boundaries.

Figure 3.1 Map of regions in Nepal, and administrative units showing Dhanusha district within Central region of Nepal

3.2 Ethical approval

A cluster randomised controlled trial assessed the impact of community interventions in Dhanusha, Nepal on perinatal mortality and maternal and infant nutrition. The ethics committee of the Institute of Child Health and Great Ormond Street Hospital for Children NHS Trust approved the research to be conducted in Nepal. The Nepal Health and Research Council also approved the trial in 2004. The trial collected range of data during 2005-2011, and the approval covered all the data utilised by this thesis.

3.3 Description of data sets and variables

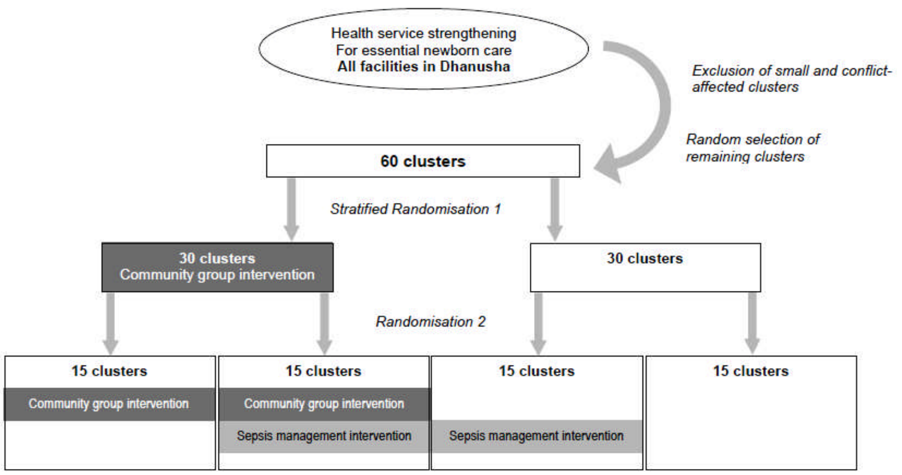
This research included data collected in Dhanusha from the following sources:

- Household Surveillance Data (HSD) of the Dhanusha randomized controlled trial
- Household Economy Approach (HEA) study
- Market price surveys conducted in 2008 and 2009
- Dhanusha Income level study in 2008

3.3.1 Household Surveillance Data of the Dhanusha randomised controlled trial

A cluster randomized controlled trial (RCT) was set up in Dhanusha to evaluate the impact of community based interventions on neonatal mortality. The two interventions under test were: 1) community mobilisation through participatory women's groups, and 2) training of community health volunteers on the detection and management of neonatal sepsis. This study used a factorial design. In Dhanusha district, 60 village development committee (VDC) clusters (geopolitical units), with an average population size of 8000, were selected randomly. Thirty clusters were then allocated to the women's group interventions and 30 clusters (VDC) were considered as control. The next step was to randomly allocate a sepsis management health volunteer component to 15 VDCs in both the women's group intervention and control clusters (Shrestha et al. 2011). **Figure 3.2** shows the design of the RCT, implemented in Dhanusha.

Figure 3.2 Study design of the randomised controlled trial in Dhanusha (reprinted from Shrestha et al. 2011)



For the purposes of monitoring RCT outcomes a prospective surveillance system was employed in the area to collect quantitative data at the household level in the 60 study clusters in Dhanusha between September 2006 and May 2011. Two periods of formative research were undertaken in preparation for this trial: 1) a formative research phase in which mapping, census, a survey of female community health volunteers and a study of livelihoods using the HEA was conducted; 2) a prospective baseline surveillance period in which the trial surveillance questionnaire was piloted and pre-intervention data collected on trial primary and secondary outcomes. The formative baseline data collection using HEA took place from March to June 2006 and the HSD of the prospective baseline were collection from mid-September 2006 to mid-April 2007. Thereafter, interventions were allowed a run-in period from mid-April 2007 to mid-April 2008 (Nepali calendar year 2064). Full-scale intervention implementation ran from 13 April 2008 and continued till 13 April 2011 (Nepali calendar years 2065 to 2067 inclusive).

The vital surveillance system of the RCT recorded live- and still-births and child and female deaths in the study 60 VDCs. After identifying birth and death events, HSD questionnaires were conducted in households where the event occurred. During the prospective baseline period all households where a birth or neonatal death occurred were interviewed, but from the run-in year (mid-April 2007) onwards data were collected from up to 10 randomly selected households per cluster per month where a child had been born. Most interviews took place within 4-6 weeks after delivery except during periods when insurgency made data collection impossible.

Surveillance interviews were conducted with recently delivered women about their pregnancy, birth and postpartum periods as well as socioeconomic and food security-related information about the household where they spent the majority of the pregnancy. Data collected from September 2006 to April 2007 formed a prospective baseline of the RCT. The baseline HSD was used to compare HEA findings in assessing food security in Dhanusha. A structured questionnaire, typed in Nepali script, was used to collect data on demographics, socio-economic status, livelihoods, food security, maternal and newborn care including health and nutrition related behaviours of mothers and newborn. Questionnaires were delivered in Nepali or Maithili language depending on the mother-tongue of the respondent. All reproductive aged women who delivered within the study VDCs were eligible to participate in the data collection (Shrestha et al. 2011), but households where no births or deaths occurred were not interviewed. I have used modules on socio-economic status, livelihoods, and food security of this questionnaire and analysed the prospective baseline HSD to compare with the findings of the Household Economy Approach study for my PhD research.

3.3.2 Household Economy Approach (HEA) study in Dhanusha

To help planning and preparation of the RCT of community-based interventions for reducing neonatal mortality rate in Dhanusha, the HEA study was conducted as formative research. One of the community interventions under test in the RCT was a participatory women's group intervention, which involved women discussing maternal and newborn health problems and nutritional issues affecting their health. In order for this intervention to be appropriate to the local context and to understand the food security constraints upon a nutrition-focused intervention, this study on livelihoods and food security was undertaken. This enabled design of the nutritional intervention component of the RCT to be informed by knowledge of locally available nutritious foods, livelihood options and practices, and constraints and opportunities of the local people.

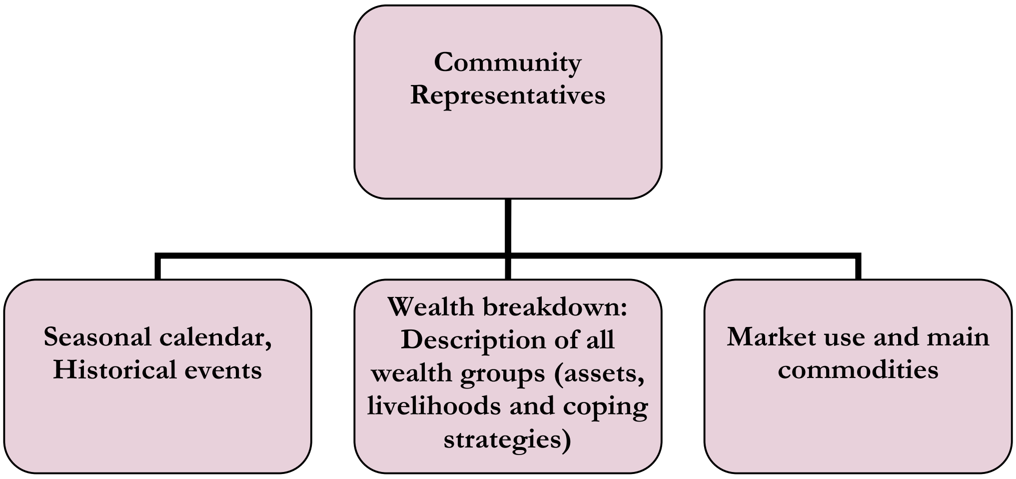
HEA data were collected from each of the 60 study clusters (VDC) that were randomly selected for the RCT and included in the prospective surveillance system. Detailed information on the study clusters, their population and number of interviews conducted are listed in **annex 3.1**. The formative work and the entire RCT was implemented by the Nepalese NGO MIRA (chapter 1), in partnership with the UCL Centre for International Health and Development (CIHD) (Mother an Infant Research Activities 2009). The field team of MIRA Dhanusha collected all data, with training and support from Dr Naomi Saville, technical advisor to the project from UCL CIHD.

The HEA study included data from interviews of community representatives (CR) of mixed wealth groups and wealth group representatives (WGR) representing their own wealth group; and market price data collected from vendors in the local markets. Data were collected between 5 March and 29 June 2006. Details of data collected from each type of interviews are briefly presented in the following section.

3.3.2.1 HEA Community representatives' interview data (HEA CRD)

The community representatives' (CR) interviews function as an initial community entry process to get to know who lives there and how their livelihoods operate. The CR interviews were done in each of the 60 study clusters to quantify the proportion of the population belonging in each of the different wealth groups in a VDC and to generate a description of those wealth groups, specific to each of the study areas. Key informants from the CR interview also nominated wealth group representatives (WGR) for interview. **Figure 3.3** shows an overview of data collected from community representatives' interviews. The interviews collected data on seasonal patterns of livelihood activities, distribution and description of the wealth groups, information about access to markets, and terms of trade for the main food commodities in Dhanusha.

Figure 3.3 Overview of data collected by community representatives' interview



In each VDC, the community representatives' interview collected the following information:

- Seasonal calendar

  Seasonal activities, cropping cycles, work schedules, labour migration, market prices of staple crops, livestock and vegetables, availability of major foods, and timing of major disease epidemics and festivals were recorded for each Nepalese calendar month for each cluster (VDC).

- Historical events

Data were collected on perception about good or bad year in recent past, and reasons why the years were considered as such. The past years are ranked on a scale of 1 to 5 with 1 being the 'Very bad' and 5 as 'Very good'.

- Wealth breakdown

One CR interview per VDC provided a description of up to 4 wealth groups (Very Poor, Poor, Medium, Better-off) (**Figure 3.3**). In each VDC, CR reported the perceived proportions of populations of the VDC falling into the different wealth groups, and described assets (consumer goods, livestock numbers and types, landholding sizes), livelihoods, and crisis coping strategies of the various wealth groups in the area.

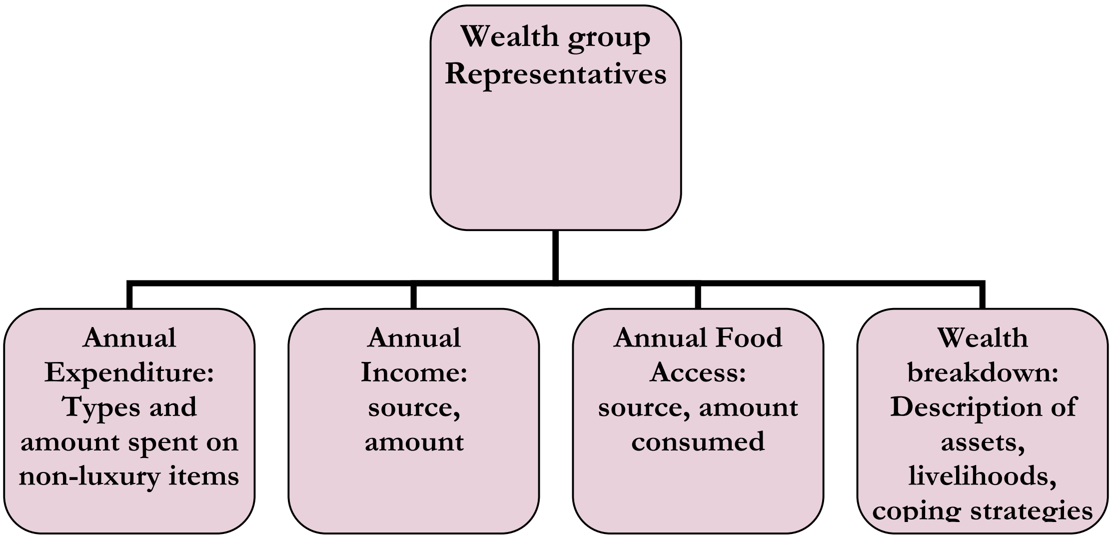
- Market use data (commodity, price, location)

Information regarding the terms of trade for the three most important crops grown in each VDC was collected, along with data on which markets they were sold, price per unit, and yields for normal, good and bad year.

3.3.2.2 HEA Wealth group representatives' interview

In each VDC, 3-4 separate semi-structured interviews were conducted with WGR representing their own wealth group. During each interview of WGR, three to five members of a specific wealth group, including men and women were interviewed. The WGR interviews were conducted to identify sources of income, food, and expenditure categories and to make quantitative estimates of these for a 'typical household' in their wealth group. The WGR interview also included wealth breakdown data that provides a description of their own wealth group in terms of assets, landholdings and livestock holdings, livelihood activities and coping strategies employed during 'shocks' (**Figure 3.4**). All these estimates were collected considering 2005-6, the most recent Nepali year, as the reference year. This data helped to triangulate the information collected from the CR for that cluster, and to check that people who fit into the wealth group as described by the CR were interviewed.

Figure 3.4 Overview of data collected by wealth group representatives' interview



- **Annual income of a typical household**

Annual income of a typical household within each wealth group was estimated by asking the WGR to provide examples of typical income sources for households like their own, separated into the following categories:

1. Staple crop sales
2. Pulse crop sales
3. Oil, root and spice crop sales
4. Vegetable crop sales
5. Green leaf crop sales
6. Fruit crop sales
7. Dairy product sales
8. Livestock/poultry product sales
9. Farmed fish sales
10. Wild fish/shell fish sales
11. Wild vegetable/fruit sales
12. Daily waged labour
13. Regular job
14. Trade
15. Self employment
16. Remittances
17. Gifts
18. Income

- **Annual expenditure of a typical household**

Wealth group representatives estimated annual expenditure for households like their own under the following categories:

1. Staple purchase
2. Non-staple purchase
3. Social costs including health, education, taxes, and other costs
4. Inputs (e.g. seed, fertiliser, labour)
5. HH inputs (e.g. soap, gas, electricity)
6. Alcohol, tobacco, pan
7. Gifts
8. Other

- **Annual food consumption of a typical household**

In each wealth group interview, representatives of that wealth group provided descriptions of the annual amounts of food consumed by the typical household from various sources. By discussing how a typical household meets their needs from production, purchase, labour exchange or gift, the annual amounts accessed were estimated for individual food items and amount consumed, sold or used for other purposes recorded. The resulting total kilograms estimated for each individual food enabled calculation of caloric intake per person per day for each wealth group. Subcategories of food sources provided in the semi-structured questionnaire as follows:

1. Staple production
2. Pulse production
3. Cash crop production
4. Oil crop production
5. Root crop production
6. Spice production
7. Vegetable production
8. Green leaf production
9. Fruit production
10. Other food production
11. Dairy production
12. Livestock/ Poultry production
13. Farmed fish production
14. Wild meat
15. Wild fish/shell
16. Wild vegetables
17. Wild fruits

18. Staple purchase
19. Non-staple food purchase
20. Labour exchange
21. Gifts

- **Wealth breakdown data** (assets, livelihoods and coping mechanisms)

Representatives of each wealth group (WGR) also generated a description of households similar to their own. Wealth breakdown data collection included descriptions of assets such as consumer goods and agricultural tools, livestock, land holdings, livelihood activities, coping strategies and basic demographic data such as number of household members. This description also included their perception about what proportion of the population of the VDC their wealth group comprised.

3.3.2.3 HEA Market price data

Local market price data from HEA study included collection of price data for foods, and some basic non-food items commonly available in the markets that the households in the study clusters had access to. The interviewers listed items available in the local markets using Nepali, or Maithili names, and collected prices of those for the current period; for the Nepali seasons over the last one year: winter (December 2005 - January 2006), spring /summer (March 2006 - May 2006), monsoon (mid June to early September 2005); and during the Dashain festival period. Dashain is the most important Hindu religious festival celebrated in Nepal, usually taking place in September-October each year. The items included in the HEA price survey were later coded, and were used to develop a structured questionnaire used in the 2008 and 2009 market price surveys.

3.3.3 Market price survey 2008 and 2009

A structured questionnaire with codes assigned to the food items commonly available (based on the HEA 2006 market price survey) in Dhanusha was used to collect data from the markets sampled in the 2006 HEA survey. In 2008 and 2009 data were only collected for the festival period (September-October), when prices tend to peak. In these questionnaires, suggested units were provided for each food type to encourage data collectors to collect comparable data across the different VDC market places. In the case that the food was not available in the specified unit, the interviewer could record a new unit and report the price per that unit as necessary.

3.3.4 Dhanusha Income level study in 2008

Data were collected in 2008 using key informant interviews with purposively sampled informants involved with different employment or income earning activities to report on their current income levels and recall the same for 2005. Interviews were conducted in Dhanusha between 27 October 2008 and 27 November 2008. Data were collected on cash-income categories commonly reported in the HEA wealth group interviews including daily waged labour, seasonal migratory labour, overseas remittance earning, and government employments. Details of the data collection and income categories are reported in chapter 7.

3.4 Research questions and outcome variables

This section shows the specific research questions posed and outcome variables to answer those.

- ***Baseline food security and livelihoods situation in Dhanusha***

1. What was the baseline food security and livelihood situation in Dhanusha, as described by the Household Economy Approach (HEA) and the household surveillance data?

Outcome indicators

- Description of seasonal activity patterns, main commodities in Dhanusha, livelihood options of the wealth groups, derived from HEA data;
- Annual per capita expenditure and % expenditure by the types of expenditure among wealth groups in Dhanusha in 2005-6, derived from HEA data;
- Source of income among typical households in the different wealth groups in Dhanusha in 2005-6, derived from HEA data;

- Percentage of households that met minimum energy requirement (>=2100 kcal/per capita/day), and median per capita per day kcal intake by wealth groups in Dhanusha in 2005-6, derived from HEA data;
- Sources of food consumed by the wealth groups and % of kcal contribution by the different food groups among the wealth groups in Dhanusha in 2005-6, estimates using HEA data;
- Percentage of household that are food insecure (using HDDS and HFIAS) in Dhanusha in 2006-7 by wealth groups, estimated from household surveillance data.

➢ ***Comparison between description of wealth groups by HEA and household surveillance data***

2. How does the description of poverty status of Dhanusha obtained from HEA CR interviews compare with that derived from the household surveillance data (HSD)?

Outcome indicators

- Range and distribution of the PCA-based asset indices derived from HEA community representatives' data (CRD) and household surveillance data (HSD);
- Correlation coefficients and the significance of association between PCA-based VDC level asset indices derived from HEA CRD and HSD.

➢ ***Change in food prices and income of wealth groups***

3. How did food prices in Dhanusha change during the 2008 global food price crisis, in comparison to pre- crisis (2005) period?

4. How did food prices change in Dhanusha between 2008 and 2009, following the 2008 peak in global food prices?

5. How did income levels of the wealth groups in Dhanusha change between 2005 and 2008?

Outcome indicators

- o Average prices of food commodities in local markets in Dhanusha in 2005 and 2008 (September - October for both periods)
- o Percentage change in prices of food groups and overall food price inflation rate between 2005, 2008 and 2009 (Sep-Oct period)
- o Average price of a standardised list of common food items in Dhanusha between 2005 and 2009
- o Inflation in Dhanusha food and beverage price index in comparison to Nepal national level food price index and *Terai* food and beverage price index between 2005 and 2009
- o Average cash-income levels in Dhanusha in 2005, 2008 by sources and percentage changes in income level of the sources between 2005 and 2008;
- o Average percentage change in cash-income by wealth groups in Dhanusha, between 2005 and 2008;
- o Total income levels of the wealth groups in Dhanusha in 2005 and 2008.

➢ ***Cost of a nutritionally adequate diet and its affordability by wealth groups***

6. How did the cost of a typical diet, and a nutritionally adequate diet change among wealth groups in Dhanusha during the 2008 food price crisis, in comparison to pre- crisis (2005) period?

7. How did the affordability of a nutritionally optimised diet by different wealth groups in Dhanusha change during the food price crisis, in comparison to pre-crisis (2005) period?

Outcome indicators

- o Cost of a typical diet for household in different wealth groups in Dhanusha in 2005 and 2008;
- o Cost of a nutritionally adequate diet for households in Dhanusha, in 2005 and 2008;
- o Estimated proportion of income on food needed by various wealth groups to afford a nutritionally adequate diet in 2005 (pre-crisis), and 2008 (post crisis).

3.5 Data management

HEA data were available as individual MS Excel files (Microsoft Office, version 2003), which were then combined to prepare a single data sheet per information category (income; expenditure; food consumption; livelihoods, assets and coping strategies; price of commodities). Coding was applied for descriptive data to facilitate analysis, where necessary. These subsets of datasheets were converted to SPSS datasets. Analyses of data were done using SPSS 16.0 (SPSS Inc.). Details of data processing and analyses are discussed in the relevant chapter.

Surveillance data were entered into a relational database in Microsoft Access, extracted and recoded using STATA by the MIRA team, which I then exported to SPSS for analysis.

3.6 Estimation of sample size and data analysis

My research has three main components: **1)** Description of the wealth groups in Dhanusha and their livelihoods (context); **2)** Estimation of changes in food prices in the district during and after the global food price crisis in 2008 (situation analysis); **3)** Assessment of the impact of the food price rise on affordability of food for each of the wealth groups (impact assessment) (see Chapter 1 - Conceptual framework).

3.6.1 Description of the wealth groups in Dhanusha and their livelihoods

Findings from the semi-quantitative participatory HEA study were used to describe the contextual background of people living in Dhanusha. The HSD, collected in the same study clusters was compared with the HEA findings. Sample size estimation was not done for the comparison for two main reasons. Firstly, HEA does not use a statistical sampling technique and employs purposive data collection based on perceptions of community representatives rather than conventional survey sampling (Holzmann et al. 2008; Seaman et al. 2000a). Therefore, for comparability purposes HEA data were collected from the same 60 VDCs included in the RCT, so that units of data collection for the HSD and HEA are same. Secondly, sampling for the RCT was powered for detection of differences in mortality rates and other health and nutrition-related outcomes (Shrestha et al. 2011) and hence samples are very large (>35,000 surveillance households data collected over 4.5 years Sept 2006 to May 2011). The large numbers of households included in the surveillance system (combining intervention and control households) were considered comparable to HEA data collected in the area. We focused especially upon the prospective baseline data of the RCT, which were collected close to a period HEA 'baseline' data were collected.

The large sample size of the RCT prospective baseline was considered to adequately represent life and livelihoods in Dhanusha, comparable to what was derived from the HEA study. Within each comparable VDC, the data collection units for surveillance were households in which a woman had recently delivered, whereas HEA data described a typical household in each wealth group. In rural Nepal, many people live in extended families in which sons and their wives live with more elderly parents (McPherson 2006). Therefore even though the RCT only included households where a woman delivered recently and was not a cross-sectional study sampling all types of households, it is likely to represent a reasonable overall picture of Dhanusha. I have used the surveillance data, excluding households that may have been visited more than once due to more than one birth in the same household to avoid bias. Also, since women were asked to provide information on the socioeconomic status of the household where she spent most of her pregnancy regardless of where she delivered or spent her postpartum period, interviews where a woman provided socio-economic data for an area outside the 60 study clusters were excluded. Both the HEA study and the HSD were collected in 60 study clusters in Dhanusha, which were used to describe the overall food security livelihood situation, and price change in the district. The findings of both surveys were used to describe the status in Dhanusha as a whole, and not at a further disaggregated level of VDC (study clusters). Therefore, data from both studies were considered adequate to describe the livelihood, food security and price status of the district.

3.6.2 Estimation of change in food price in Dhanusha following the global food price crisis in 2008

The main hypothesis of my research is 'food price increased significantly in 2008 and reduced the ability of wealth groups to afford a nutritionally adequate diet'. The combined results of HEA market price study 2006 (recall of 2005 prices), and 2008, 2009 market price data collection allow me to test whether the food prices in Dhanusha increased significantly during the 2008 global food price crisis, in comparison to before crisis period (2005). I also compared the 2008 and 2009 Dhanusha food prices to assess how food prices in Dhanusha changed following the 2008 global food price crisis.

Testing of the hypothesis of a significant increase in price was done in several ways:
Comparing price of individual food items in 2005 vs. 2008;
Comparing overall food price in 2005 (pre-crisis) and 2008 (during crisis);
Comparing overall food price in 2008 and 2009.

Independent - Samples T-test was used for all these comparisons; and $P < 0.05$ was considered significant.

3.6.3 Assessment of the impact of food price rise on affordability of a nutritionally adequate diet by wealth groups

The second part of the main hypothesis of my research focuses on the impact of food price rises in 2008 on affordability of a nutritionally adequate diet by different wealth groups in Dhanusha. The SCUK CoD tool was used for estimating the cost of a nutritionally adequate diet in 2005 and 2008. The percentage of total income needed to afford such a diet was used to assess whether the wealth groups in Dhanusha are likely to afford a nutritionally adequate diet.

Chapter 4. The food security and livelihood status of wealth groups in Dhanusha in 2005-6

4.1 Chapter summary

This chapter describes the food security status and livelihood strategies in Dhanusha based on data collected using the Household Economy Approach (HEA) data and the Household Surveillance Data (HSD). This chapter also discusses the strengths and weaknesses of HEA, based on the experience gained in application of the method in Dhanusha and analysis of the data to generate a description of livelihoods and food security.

4.2 Research questions

The research question addressed in this chapter was:

- What was the baseline food security and livelihood situation in Dhanusha in 2005-6, as described by the Household Economy Approach (HEA) and household surveillance data (HSD)?

The **outcome indicators** used to answer the question are:

- **HEA findings**: Description of seasonal activity patterns, main food commodities in Dhanusha, livelihood options of the wealth groups;
- Annual per capita expenditure, and expenditure pattern (types of expenditure);
- Source of income among typical households in the different wealth groups in Dhanusha;
- Percentage of households that met the minimum energy requirement (>=2100 kcal/per capita/day), and median per capita per day kcal intake by wealth group;
- Sources of food consumed by the wealth groups and % of kcal contributed by different food groups among the wealth groups in Dhanusha.
- **HSD findings**: Percentage of households in different wealth groups that were food insecure (using household dietary diversity score and household food-insecurity assessment scale) in Dhanusha.

4.3 Introduction

Assessment of food security is important to plan programmes and policies to improve food security and the nutritional status of people around the world. In 1996, world leaders gathered at the world food summit and declared that access to food is a human right and that the high level of food insecurity in the developing world is unacceptable (FAO 2009b). In September 2000, eight Millennium Development Goals (MDGs) were endorsed by leaders from 189 countries as a commitment to decrease poverty and hunger and improve quality of life around the world (UNDP 2011). MDG 1 aims to halve the number of hungry people by 2015 (ibid). The FAO food balance sheet is widely used to generate estimates of hungry people, but it only measures food availability at national and sub-national level, and not access by households or individuals (Hadley and Maes 2009; FAO 2012). Food availability at the country or regional level does not necessarily ensure access to food by all. The definition of food security mentions that people need to have adequate access and utilisation of food to become food secure. Amartya Sen, in his entitlement theory explaining the cause of famine, refers to the fact that inability to access food leads to food deprivation, even though food may be available in the country or region (Sen 1981). Therefore, the dimension of measuring access to food is important in measurements of food security.

Even though measuring access to food is necessary for the estimation of the numbers of food insecure people around the world, measuring access to food is not always easy. Food consumption at household level can be measured by food consumption surveys and access to food at the individual level can be measured by dietary recall or weighed intake methods to estimate dietary energy intake. Not only are these measures demanding in terms of skills but they are also expensive to use on a large population. Household dietary diversity is also used as a proxy of dietary energy intake among households, although the preferences for indicators vary across organisations. The household dietary diversity score (HDDS) and household food insecurity access scale (HFIAS) have been developed by the Food and Nutrition Technical Assistance Project (FANTA) as simple tools for the assessment of food security at the household level (Swindale and Bilinsky 2006a; Swindale and Bilinsky 2006b). The FAO uses HDDS that requires recall of food intake in the last 24 hours, whereas WFP uses food consumption score (FCS) that uses consumption of food items in the last week (Kennedy et al. 2010). The validity of the HDDS has been assessed in 11 countries which showed that the indicator was in good agreement with nutritional status of children, an outcome of food security (Arimond and Ruel 2004). Also, FCS was found to be highly correlated with HDDS (Kennedy et al. 2010). The HFIAS indicator is used in national level food security monitoring systems that collect household level data (Helen Keller International Bangladesh 2011). Another common indicator used by WFP to examine the level of food insecurity is the coping strategy index that collects data about how a household tends to cope in response to a shock (WFP 2009).

In a number of emergency and non-emergency settings, nutritional status is often used as a proxy indicator to indicate the prevailing food security situation in an area or a population (Doocy et al. 2011; Young et al. 2004; Cogill 2003). Pinstrup-Andersen (2009) suggested that assessment of food security should be complemented by individual nutritional status so that household behaviour can be understood and proper policies and programmes can be designed. Anthropometric measurement such as Mid Upper Arm Circumference (MUAC) and weight for height (wasting) are often used to assess food insecurity level and guide food aid decisions (IPC 2008). While there is a lot of variation in the way food security is assessed and an obvious need for simple and reliable measurements, appropriate policy intervention requires contextual data along with estimates of prevalence of food insecurity. Thus, livelihood analyses are becoming increasingly common in food security analysis to assess of food security status and to identify appropriate interventions.

Jaspars (2006) recommended that livelihood analysis should be integral to identification of appropriate interventions to improve food security, as it provides a thorough understanding of household assets, strategies, their problems and own priorities using a participatory approach. Ellis (1999) defined livelihood as

> "the activities, the assets (natural, physical, human, financial and social capital), and the access that jointly determine the living gained by an individual or household".

The household economy approach (HEA) provides a framework of livelihood analysis using participatory methods. It divides the population into wealth groups based on their economic status and provides descriptions of their livelihoods, coping strategies, patterns of income, expenditure and food consumption. The strength of HEA is that it quantifies the food deficit of wealth groups in the area, as well as their sources of income, expenditure, and food consumption (Jaspars and Shoham 2002). The main idea of this concept is to describe a typical household in the different wealth groups, and then describe and quantify how they obtain income and food, and what they spend money on in a normal year (Boudreau 1998). This approach uses a context specific benchmark known as a 'normal year' as a period of normal level of household food consumption, and then compares changes in livelihood strategies in response to a shock (Seaman 2000b). The important feature of HEA is that it provides details of the context, and explains the relationship between poverty and vulnerability (ibid). This allows not only assessment of food security status of the population, but also understanding the potential for, and constraints upon, improving food security in a particular setting (Hemrich 2005). Nepal is a diverse country in terms of its geography, topology, ethnicity and languages spoken (UNDP 2009). Also, there is variability in terms of food production (CBS 2006) and nutritional status in the different ecological and administrative areas within Nepal (Ministry of Health and Population (MoHP) [Nepal], New Era, & Macro International Inc. 2007). The application of HEA in Dhanusha, therefore, can provide important local information on characteristics of the population and details about livelihoods strategies used by them, which is crucial for designing policies and plans to improve food security and nutrition in the area.

The assessment of food security using participatory approaches of HEA has the advantage that a detailed understanding of household functioning is obtained and realistic options to improve food security can be identified. Although participatory methods often provide qualitative descriptions, they can also provide quantitative estimates (see Chapter 1) when implemented well (Mayoux and Chambers 2005; Chambers 2003; Mukherjee 2002). HEA uses participatory methods for description and quantification, and the validity of findings are checked during data collection through triangulation to assess whether descriptions match with one another in logical sense as well as in quantity. For each wealth group interview, income levels should balance with expenditure levels, and other results should also make sense logically (Seaman et al. 2000a; Holzmann et al. 2008). Because of its explanatory power, pooled analysis of HEA data from 49 locations in South Africa was used to examine determinants of food security, which showed that poverty, environmental factors, low access to land, property and markets, lack of employment and poor infrastructure were associated with food insecurity (Misselhorn 2005). Although HEA provides great insight about the ways people meet their food needs, applying this can be challenging as it is very demanding on skills and generally requires experienced practitioners (Hoddinott 1999;

LeJeune and Holt 2003; Marsland 2004; Holzmann 2008). To become a successful 'household economist', one has to fully understand the concept and key data needs and be a thorough field worker, able to implement the method well so that the data makes sense (in terms of logic and quantification) (Holzmann et al. 2008). However, as with other methods, careful examination of validity and reliability of the HEA findings is important. This chapter describes the wealth groups in Dhanusha using HEA, discusses their livelihood options, and documents the experiences of using this method in a non-emergency diverse economy setting.

4.4 Methods

4.4.1 Data sources

HEA baseline data and the HSD from the prospective baseline were analysed to answer the research questions in this chapter. A usual HEA baseline assessment includes three major components: livelihood zoning, wealth breakdown, and analysis of livelihood strategies. Analysis of livelihood strategies includes the sources of income, quantification of expenditure patterns and sources of food by the wealth groups in Dhanusha. In each of the study clusters included in the RCT, the HEA used participatory tools and semi-structured questionnaires to collect data on livelihoods, income, expenditure, food consumption, and local market prices, along with other relevant data. An overview of the data collection is shown in Chapter 3. HEA data collection included interviewing large mixed groups of community representatives with up to 30 participants at a time during certain mapping exercises (CR), and homogenous small groups of Wealth Group Representatives (WGR) comprising 3-6 persons per group in each of the 60 study clusters. Both prospective surveillance and the HEA study were implemented by MIRA, a local partner organisation of the UCL CIHD in Nepal; and MIRA staff working at the Dhanusha site collected the data.

4.4.2 *Selection of HEA Community Representatives*

The HEA data were collected in each Village Development Committee (VDC) through interviewing Community Representatives (CR) and Wealth Group Representatives (WGR). In Nepal, VDCs are the lower administrative units of the Ministry of Local

Development in rural areas. The term VDC refers to a geopolitical area. Each VDC has a VDC committee, which consists of elected positions including **a.** VDC Chairperson and Vice-Chairperson, **b.** nine Ward Chairmen representing their wards, and **c.** two members including at least one woman. In each VDC, a VDC secretary appointed by the government provides administrative support and coordinates activities of the committee. The VDC works as an independent body of local authority to discuss issues of concern at a village level. For the HEA study in each of the 60 VDCs, MIRA assigned a VDC Interviewer (VDCI) who is a local resident with good understanding of local circumstances and key people in the area. The VDCI was responsible for organising the logistics of the HEA data collection in a VDC and, where needed assisting in selection of informants.

A two-member team of MIRA field coordinators (the supervisory cadre to VDCIs) conducted CR interview in each VDC, which was supported by the VDCI. The VDCI and the field coordinators selected key informants to participate to CR interview. They explained the purpose of the CR interview to the one or two lead key informants and requested support from him/her to identify other key informants. Where available, the purpose of interview was explained to the VDC secretary and he was requested to identify key informants. Because of the Maoist insurgency at that time, VDC secretary was not always available. The key informants included members of health workers from government health facilities, local teachers in government or private schools, government line office workers, NGO, CBO and youth club representatives, VDC committee members (where available), and any other residents who were expected to have good knowledge about life and livelihoods of people living in the area. Aside from these invited key informants, any member of the community who wanted to take part was welcome to come and join in the discussions. The CR interviews were deliberately held in open communal spaces so that anyone would feel free to come and join in. The interviewers attempted to include representatives of mixed wealth groups and women in each of the CR interview. Although women seemed to have better knowledge of certain aspects of livelihoods, sometimes they were not available due to other engagements, not being allowed to participate, or due to men dominating the discussions.

In most cases, the CR interviews were done with quite large groups of villagers (at least 10-15 but often more during the initial resource mapping, historical timeline and seasonal calendar exercises). In each VDC, VDCI tried to mobilise various type of participants including those s/he knew to be from poorer households or marginalised groups and encouraged them to stay for the whole interview.

Participatory Rural Appraisal methods were utilised to collect data, which were then recorded on a semi-structured data collection forms (Annex 4.3). Generally one FC facilitated the discussion, while the other FC and VDCI filled in the forms or helped to record the maps and charts on large sheets of newsprint. Where informants were comfortable drawing on the newsprint we encouraged them to record the maps and charts for themselves. Any difference in opinion arising during the interview was resolved through further probing until the group agreed to a common consensus. The length of CR interviews ranged between one and half hour to three hours maximum.

4.4.3 Selection of HEA Wealth Group Representatives

People of homogenous wealth status representing their own wealth group participated to the WGR interviews. The participants were generally nominated by CR interview key informants who had emerged as the most reliable and well informed during CR interviews. At the end of the CR interviews, the participants were requested to provide names of representatives of different wealth groups who were believed to have sufficient knowledge to give detail accounts of livelihoods of individual wealth groups. The VDCI (assigned in a VDC) kept records of these names and invited these people for separate WGR interviews with the help of the key informant as necessary. In certain cases, key informants were not able to provide names because of living in a different part of the VDC from the poorest people. In these cases, they provided the name of the hamlet (tole) in which the wealth group resided. Then the VDCI went to that tole to identify participants and ask their permission before starting the interview. In each VDC, because the VDCI her/him-self was a member of the community s/he was able to identify people who would be representative of a wealth group based on the criteria provided by the participants of CR interview. Similar to the CR interviews, these interviewers were conducted by two-member team of MIRA field coordinators. The length of WGR interviews ranged between 1.5 to 3 hours maximum. Wealth groups with a lot of agricultural production and diverse livelihood sources took a long time to interview whereas groups who were not farming and tended to earn cash took less time.

4.4.4 HEA components utilised

HEA data consisted of the following basic components: i) community representative (CR) interviews; ii) wealth group representative (WGR) interviews; iii) market price data. In this chapter, findings of HEA CR and WGR interviews are reported.

4.4.4.1 Community Representative (CR) interviews

In each of the study clusters in Dhanusha district, CR interviews generated a seasonal calendar of production and activities and a historical timeline, described the main commodities in local agricultural markets, and wealth breakdown of the population. The wealth breakdown provided data on % of households in the different wealth groups and defined characteristics of households in each wealth group.

The data generated by CR interviews were as follows:

- Historical timeline
- Seasonal calendar for description of weather patterns, cropping cycles, terms of trade, food prices availability of vegetables, and related activities
- Market use and main commodity prices
- Assets, livelihood options, coping mechanisms for households in different wealth groups; and proportion of the cluster (VDC) population that fell into each wealth group

4.4.4.2 Wealth group representatives (WGR) interviews

A total of 210 wealth group representatives (WGR) interviews were done in the study clusters. The WGR respondents provided descriptions of livelihood strategies of a 'typical' household in their wealth group. They described annual income, expenditure and food consumption patterns and made quantitative estimates of the annual kg of food consumed, income and expenditure in households like their own. Data on assets, livelihood options and coping mechanisms were also collected to triangulate information given by the CRs. The data collected from the HEA WGR interviews for a typical household in the respondents' group were as follows:

- Annual estimated expenditure,
- Annual estimated income,
- Annual estimated food consumption,
- Assets and livelihood sources, coping mechanisms

4.4.5 HSD components utilised

The RCT surveillance system collected a range of information regarding socio-economic status, dietary practices, nutrition-related behaviour of mothers, breastfeeding, antenatal and perinatal care practices and care seeking for mothers and babies, and food security situation in the study clusters. In this chapter, I use food security data collected using the Household Dietary Diversity Score (HDDS) and the Household Food Insecurity Access Scale (HFIAS). To estimate the HDDS, a responsible adult member of the household (in approximately 90% of cases this was the woman who had recently delivered) was asked to recall whether any member of the household had consumed foods from the different food groups (cereals; roots and tubers; vegetables; fruits; meat; eggs; fish/shell fish; pulses and nuts; dairy; oils and fats; sugar/honey; others such as spices and beverages) in the last 24 hours. The HDDS module of the questionnaire is included in the **annex 4.1**.

HFIAS data collection involved asking 9 questions about the household members' experiences of food insecurity over the last 30 days. This includes questions about whether household had enough food, were able to eat preferred food, and whether they reduced dietary quantity or quality. The HFIAS module used in the surveillance questionnaire are included in **annex 4.2**.

4.4.6 Data management and statistical analysis

Both CR and WGR interviews for each VDC were recorded using the HEA semi-structured questionnaires (on paper), which were then entered as one excel sheet for each category of data (e.g. CR assets data; WGR income data; WGR expenditure data;

WGR food consumption data). All these data were then converted to SPSS, where VDCs were set as row and respective summary data for different indicators (e.g. assets, income, expenditure, food consumption) were set as variables in the column. The process is described in the following section.

4.4.6.1 Processing of HEA CR data

Each interview of CR from mixed wealth groups generated description of 3-4 wealth groups and also data on % of the wealth groups in each VDC. To estimate the overall percentage of population comprised by the different wealth groups, the data on quantification of wealth groups in each VDC were averaged. The distribution of the data was approximately normal; therefore, the mean of the CR representatives perceived percentage of households in each wealth group according to CR interviews was used as a measure of the percentage of Very poor, Poor, Middle, and Better-off households in Dhanusha. Data for each study cluster was entered into a separate MS Excel file, which was then combined for all VDC by data type, and transferred to SPSS version 16 (SPSS Inc.) for analysis. Wealth breakdown data that included ownership of assets, livelihood options and coping mechanisms for the wealth groups were collected in a way that only positive cases were recorded 1, and otherwise were left blank. During analysis, the blank cells (i.e. for cases where the wealth group did not own the asset or did not use a particular livelihood option) were coded to zero because only positive responses had been entered as one and negative responses were left blank. This enabled percentage estimates to be done. Data analysis were done to reflect characteristics of wealth groups in terms of ownership of assets, livelihoods and coping mechanisms practiced by the Very poor, Poor, Middle, and Better-off wealth groups.

Market data from the CR interviews included responses on what were the three most important food commodities in that VDC (cluster) and which 2 markets were mostly used for trading these commodities. This information helped identifying the main food items available in the area and the market accessed for food production in the area. In addition, terms of trade for these commodities in a good, bad and normal year were also collected.

Figure 4.1 Community Representatives' (CR) Interview in Dhanusha, using the Household Economy Approach (HEA) in 2006

Figure 4.2 Wealth Group Representatives' (WGR) interview on livelihood strategies for the reference year, using the HEA in Dhanusha in 2006

4.4.6.2 Processing of HEA WGR data

In each of the study clusters, wealth group interviews were conducted to collect data on annual income, expenditure and food consumption for the Very poor, Poor, Middle, and Better-off wealth groups. One wealth group interview with three to five respondents per interview for each wealth group in each VDC provided the details of the sources and amounts of income, expenditure, and food consumption for a typical household in that wealth group. Data were collected using pre-determined sub-categories as shown in **Table 4.1**. All data collected were recorded using a semi-structured interviewing template adapted from that used by FSAU in Somalia in 2003 (FSNAU 2005; Hemrich 2005). The questionnaire used for collection of income, expenditure, and food consumption data by interviewing WGR is shown in **Annex 4.4.**

Table 4.1 Summary of HEA data categories collected by interviewing Wealth Group Representatives (WGR) in Dhanusha in 2006

Categories used for collecting Household Economy Approach data on expenditure, income and food consumption pattern in Dhanusha		
Types of expenditure	**Sources of income**	**Sources of food**
Staple purchase Non-staple purchase Agricultural inputs Household inputs Health Education Water Social cost Alcohol/ tobacco/betel leaves Gifts Other	Staple sale Pulse sale Oil, root, spice sale Leafy vegetable sale Vegetable sale Fruit sale Dairy product sale Livestock/poultry sale Farmed fish sale Wild fish/shell-fish sales Wild vegetable/fruit sale Farmed fish sale Wild fish/shell sale Wild vegetable/fruit sale Daily waged labour Regular job Trade Self employment Remittances Gifts	Staple production Pulse production Oil crop production Root crop production Spice production Cash crop production Green leaf production Vegetable production Fruit production Other food production Dairy production Livestock/poultry production Farmed fish production Wild meat Wild fish/shell fish Wild vegetables Wild fruits Staple purchased Non-staple purchase Labour exchange Gifts

Data on annual income, expenditure and food consumption were collected from each of the 210 interviews done among the WGR. Each interview consisted of annual expenditure, income and access to food, saved as separate worksheets in a single Excel file. All interviews were then combined and 3 separate excel files for expenditure, income, food consumption data were created adding all interviews. **Annex 4.5** includes the income data entry format in Ms Excel as an example. Coding was applied for descriptive data to facilitate analysis, where necessary. Preliminary checks and editing were done in Excel and then data were transferred to SPSS for further checks and analysis.

For each wealth group interview, the HEA collects annual non-luxury income and expenditure data, and ideally it is collected in a way that income is balanced with expenditure (Seaman et al. 2000a; Bush 2002; FEG Consulting and Save the Children 2008). In Dhanusha, HEA income data were recorded as earnings (pay rate or salary, profits for trades) per unit, number of units and total income earned per category. As shown in the **Table 4.1**, data on income sources were collected under pre-determined categories including food-derived and cash-income. The data collection form included in the **Annex 4.4** shows that data collectors were supposed to include specific types of income under each category. For example, if teaching was a typical source of income for a wealth group, then data collectors would include this under regular job and record no of months earning per year, salary per month and total money earned annually. However, due to the diversity of income sources in Dhanusha this was not a straightforward task. Because there were a large number of possible sources of income within one wealth group data collectors were encouraged to list out income sources which are typical of the wealth group. The typical income sources may combine several types of income categories and the proportion of income coming from different sources are usually varied for different households in the wealth group. For example, in one VDC the Middle wealth group may have different sources of cash-income: one household may have one person earning from a small shop and another person working overseas; another household may solely depend on one person teaching in a primary school, and another household may have earned from one person working on different types of self-employment over the year and another household member earning from regular job. The interviewers asked the wealth group for a breakdown of months of earning and income per month for each category. The difficult part was to use their judgement when multiple types of incomes were typical and they needed to average for that wealth group. The recording of such information in the form also turned to be difficult. This led to inconsistency between interviewing groups and between the start of the study and later on. Because of both intra and inter-observer variability between interviews it was not possible to detect any systematic bias in the data which could have been adjusted for during analysis, making quantitative estimates of annual income very difficult. As a result of this, quantification of income sources is not presented in this thesis and data were only analysed to assess which sources were utilised by the different wealth groups, rather than to provide estimates of actual income.

Data were available for the amount spent on different items included under the sub-categories for a total of 210 wealth groups in the 60 study clusters. Because we asked about a standard list of foods and non-luxury goods and no averaging was required, and that there is less diversity in ways people spend on food and non-luxury goods than in ways of earning money, these quantitative estimates of expenditure were much less variable between interviewing groups than the quantitative income estimates. Total annual expenditure for each of the wealth groups was estimated by adding up the amount of money spent under each of the categories of expenditure of a typical household in the wealth group. In this chapter, expenditure data are reported as median per capita annual expenditure for the different wealth groups. Data were also added up by expenditure categories, so that contribution of each category to the total expenditure (% expenditure by type) could be estimated. In summary, the expenditure data for the wealth groups were analysed to generate two outputs: **1.** Median total annual household and per capita expenditure, and **2.** Percentage of total expenditure spent on different expenditure categories.

To estimate the annual intake of food for each wealth group interviewed, names of foods, units (number of days per month, year or week) and amount of food per unit were recorded. The total amount consumed per item was then calculated by multiplying the amount per unit by the number of units. Interviewers recorded all these information in the given semi-structured questionnaire. One food item could have multiple sources, for example, a typical household in the Very poor wealth group may access rice from production and purchase or in the Poor wealth group they may access rice from labour exchange and purchase. In such cases, the specific item was recorded under both sources. As a first step in cleaning the data, a standard list of all food item was generated so all synonyms of one specific item is given one name and a list of food codes was developed. This code list was also used for the market price data. For some food items, such as jute leaves, amounts were recorded as pieces or bundles, which were converted to kg or litre using data collectors' notes on their approximate weights. In cases when items are recorded as pieces/bundles (such as bottle gourd, eggs) and weights were not indicated weights were estimated using data from a food consumption study in Bangladesh (Helen Keller International Bangladesh, 2009).

The next step was to estimate caloric value per item and add that to the database so that kcal contribution for the amount of each item accessed could be estimated. Three main food consumption databases were used following an algorithm (**Annex 4.6**) to estimate kcal/100g of foods consumed by the people in Dhanusha (USDA 2009; FAO 1972; Darnton-Hill 1988). The food items listed also included some mixed foods, such as small meals and large meals paid in exchange for labour. The typical food content of big and small meals was estimated in consultation with the MIRA local team who had good insight into the socio-economic structure and food practices in Dhanusha. The kcal estimates of these items were calculated based on approximate weight of the items included in the meals (**Annex 4.7**). The annual food intake data was then used to estimate three key findings for each of the wealth group: **1)** Annual kcal access (percentage of 2100 kcal and median amount kcal per day), **2)** Access to food disaggregated by sources, and **3)** Contribution of food groups to total food access.

4.4.6.3 Processing of HSD data

The Household Dietary Diversity Score (HDDS) was estimated among households in Dhanusha by adding up food groups consumed by the household members in the last 24 hours. The following set of 12 food groups were used to calculate the HDDS:

A. Cereals	B. Root and tubers	C. Vegetables
D. Fruits	E. Meats, poultry	F. Eggs
G. Fish / shell fish	H. Pulses/legumes/nuts	I. Milk and milk products
J. Oil/fats	K. Sugar/honey	L. Miscellaneous (spices, tea/coffee)

For each of these group, responses were coded as 'consumed in the last 24 hours' = 1, and 'not consumed in the last 24 hours' =0. Therefore, adding up the scores of each of the 12 food groups, the HDDS per household can range from 0 to 12. In summary, HDDS is the total number of food groups consumed by members of the household, calculated as:

HDDS = Sum (A+B+C+D+E+F+G+H+I+J+K+L)

The FANTA guideline suggests that if income data are available the average HDDS of the richest 33 percent of households can be used as a target.(Swindale and Bilinsky 2006b). For Dhanusha, households were divided into three groups using the asset-based index score (see Chapter 5: HSD Independent variables PCA-based index); the average HDDS of the households in the upper tercile (HDDS =4) of asset index was then considered a cut off. A HDDS was available for each household, and using the cut off of acceptable HDDS (4) households were considered food secure (HDDS >=4), or food insecure (HDDS <4). Next, percentages of households with HDDS>=4 were calculated for each of the wealth groups.

The HFIAS and HDDS (Swindale and Bilinsky 2006a; Swindale and Bilinsky 2006b), both are tools developed by the Food and Nutrition Technical Assistance Project (FANTA) of the Academy for Educational Development (AED). The HFIAS is made up of nine questions and covers the following 3 domains of food insecurity experience: anxiety about food supply, insufficient food quality and insufficient food quantity. The 9 types of experience related to these domains are presented in **Table 4.2**. Using this module, respondents were asked if household members have experienced the conditions and the frequency of such experience in the preceding 30 days. For each of the 9 experiences, the frequency of that experience was coded as 0 = No, 1=Rarely (once or twice in the past four weeks), 2=Sometimes (three to ten times in the past four weeks), 3=Often (more than ten times in the past four weeks).

All these responses were then summed up to estimate Household food insecurity access prevalence (HFIAP) as shown in the matrix included in the FANTA indicator guide (**Table 4.3**) (Coates, Swindale and Bilinsky 2007). The HFIAP indicator categorises households into four levels of food insecurity status: food secure, mild, moderate, and severe food insecure households.

Unlike using conventional quartile or quintiles, the analysis of HSD for HDDS and HFIAP used surveillance data disaggregated as Very poor, Poor, Middle, and Better-off. As mentioned above, using the asset index described in the next chapter (see Chapter 5: HSD Independent variable PCA-based index), households were divided into the wealth groups according to the mean estimates of percentages falling into each wealth group derived from HEA CR interviews. The mean HDDS, percentage households considered food insecure (HDDS based), and percentage of households falling into the four levels of food insecurity (HFIAS) for the wealth groups were then estimated.

Table 4.2 FANTA Household Food Insecurity Access Scale (HFIAS) questions

Questions included in the HFIAS module in the surveillance questionnaire	
Q1	Worry about food
Q2	Unable to eat preferred foods
Q3	Eat just a few kinds of foods
Q4	Eat foods they really do not want eat
Q5	Eat a smaller meal
Q6	Eat fewer meals in a day
Q7	No food of any kind in the household
Q8	Go to sleep hungry
Q9	Go a whole day and night without eating

Table 4.3 Household Food insecurity access prevalence (HFIAP) categories (Reprinted from FANTA HFIAS indicator guide) (Coates, Swindale and Bilinsky 2007a)

Question		Frequency		
		Rarely	Sometimes	Often
Q1	Worry about food			
Q2	Unable to eat preferred foods			
Q3	Eat just a few kinds of foods			
Q4	Eat foods they really do not want eat			
Q5	Eat a smaller meal			
Q6	Eat fewer meals in a day			
Q7	No food of any kind in the household			
Q8	Go to sleep hungry			
Q9	Go a whole day and night without eating			

Food secure
Mildly food insecure
Moderately food insecure
Severely food insecure

4.4.7 Indicators of livelihoods and food security

4.4.7.1 Analysis of livelihood strategies

The analysis included information on characteristics of households in the different wealth groups such as: livelihood options and coping mechanisms of a typical household in each wealth group; sources of food and income; and expenditure patterns for each wealth group; and food availability in the market and main commodities traded in the area.

4.4.7.2 Food security indicators

To assess the food security status of people living in Dhanusha between 2005 and 2007, both HEA and HSD data were collected from the same study clusters. Two FANTA indicators (HFIAS and HDDS) were used for the HSD data analysis (Coates, Swindale and Bilinsky 2007; Swindale A and Bilinsky 2006b) and a caloric sufficiency indicator was used from the HEA data. The indicators used were:

1. Household Food Insecurity Assessment Scale (HFIAS),
2. Household Dietary Diversity Score (HDDS)
3. Caloric sufficiency indicator: A household consuming >=2100 kcal/ per capita/day was considered to be food secure (Holzmann et al. 2008: p78; IPC Global Partners 2008)

The HFIAS was used to generate four categories of food security status to determine prevalence, and HDDS used a score of 4 as a target value to assess food security in this population. For HEA, per capita intake of 2100 kcal per day was considered as the minimum food energy need and food security of the population was assessed using this cut-off (Holzman et al. 2008).

4.5 Results

4.5.1 CR interview

4.5.1.1 Livelihood zoning

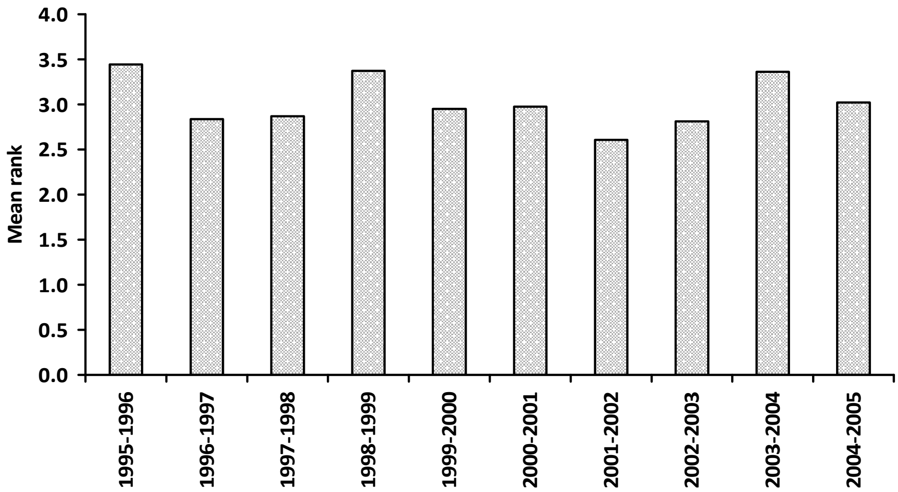
The starting point of HEA interview is livelihood zoning based on production practices and market characteristics in the area. In this study, the whole Dhanusha district was considered as one food economy zone as food economy in this area is predominantly agriculture based and the markets are quite homogenous. The main crop produced in the area was rice, wheat and pulses, except that a few VDCs also cultivated sugarcane as a main crop. However, because all VDCs were predominantly agriculture based no separate zoning was used, and CR and WGR interviews were conducted in each of the 60 study VDC.

4.5.1.2 Reference year and historical timeline

The reference year was considered to be the Nepalese year 2062 coinciding with English dates 15 April 2005 - 14 April 2006. This was the year preceding the study.

Figure 4.3 shows the historical timeline, reflecting the average ranking of how good or bad a year was in the last ten years, particularly in terms of agricultural production. In each VDC, the respondents ranked each year on a 5 point scale (1 = Very bad, 5= Very good). Mean ranking was then derived by averaging the ranks assigned to all VDCs for a particular year. Flood, drought, problems with insect pests attacking crops, diseases among animals or humans were reasons associated with a year being bad in Dhanusha over the last decade. Description within the data revealed that flooding affected 13 VDCs in 2003-2004 and only a few VDCs in 2004-2005. It shows that not all VDCs were exposed to the same shock at the same time. The year 2004-2005 was considered the mostly normal year with flooding in some of the VDCs.

Figure 4.3 Mean ranking by Community representatives of how good or bad the previous ten Nepalese calendar years (1995-96 - 2004-05) were, in terms of agricultural production in particular, in Dhanusha district (1 = Very bad, 5 = Very good)



4.5.1.3 Seasonal calendar and main commodities in the market

The seasonal calendar (**Figure 4.4**) shows that Nepali year starts in the middle of April with the very hot weather, followed by the monsoon with frequent rain and occasional flooding between the months of June/July and mid September. The cooler weather runs from mid-November to mid-February. Cultivation of paddy, the staple food in the area, begins with preparing land and seed beds between May and July with irrigation and transplanting of seedlings taking place between June and August. **Figure 4.4** shows the weather pattern, migratory work period, and cultivation of main crops. **Figure 4.5** presents the seasonal pattern of activities related to vegetable cultivation in Dhanusha. Both the figures showed that agriculture is a key activity in the area and cultivation of pulses, oilseeds, or vegetables takes place right round the year. Seasonal migration is quite common in Dhanusha, as members of household spent nearly half of the year away from home doing migratory labour. **Figure 4.6** shows that paddy, wheat, sugarcane, pulses and potatoes were the dominating food commodities traded in the markets in Dhanusha district.

Figure 4.4 Seasonal patterns or weather, migratory labour and activity in relation of cultivation of main crops in Dhanusha[a]

	Apr/May	May/Jun	Jun/Jul	Jul/Aug	Aug/Sep	Sep/Oct	Oct/Nov	Nov/Dec	Dec/Jan	Jan/Feb	Feb/Mar	Mar/ Apr
SEASONAL ACTIVITY	**Baisakh**	**Jyestha**	**Asad**	**Shrawan**	**Bhadau**	**Asoj**	**Kaartik**	**Mangsir**	**Push**	**Magh**	**Phagun**	**Chait**
Weather patterns	very hot, drought	very hot	hot, rain	hot , heavy rain, flood	hot, heavy rain, flood	getting cooler	getting cooler	cold	very cold, fog	very cold, fog	getting hotter	hot, drought
Migratory Labour	go to Delhi, Punjab, Assam	go to Delhi, Punjab, Assam	go to Delhi, Punjab, Assam	go to Delhi, Punjab, Assam	go to Delhi, Punjab, Assam		Return home				go to Delhi, Punjab, Assam	go to Delhi, Punjab, Assam
Plains Rice		ploughing, sowing, planting	sowing, planting	planting	weeding, fertilizer, irrigation	weeding, fertilizer, irrigation	weeding, cutting	cutting, threshing, storing	threshing, storing			
Wheat	cutting, threshing, storing					ploughing, sowing	ploughing, sowing	sowing, irrigation, fertilizer	irrigation, fertilizer			cutting, threshing
Red lentil (musuro)						sowing	sowing	irrigation	irrigation	irrigation	pulling up, storing	pulling up, storing
Horse gram					sowing	sowing			pulling up			
Yellow split pea	cutting, threshing, storing	sowing, planting	sowing, planting									cutting, storing
Potato						prepare field, planting	planting	planting, fertilizer	fertilizer, insecticide, irrigation	fertilizer, insecticide, irrigation, pulling up	pulling up	pulling up
Sugar cane							planting	planting			cutting	cutting
Maize	picking	picking	sowing	irrigation, fertilizer	irrigation, fertilizer	picking	picking			sowing	sowing, weeding, fertilizer	
Mustard (oil seed)						sowing	sowing	irrigation, fertilizer	irrigation, fertilizer		pulling up, threshing, storing	pulling up, threshing, storing
Flax seed	pulling up, threshing					sowing	sowing	sowing			pulling up, threshing, storing	pulling up, threshing, storing

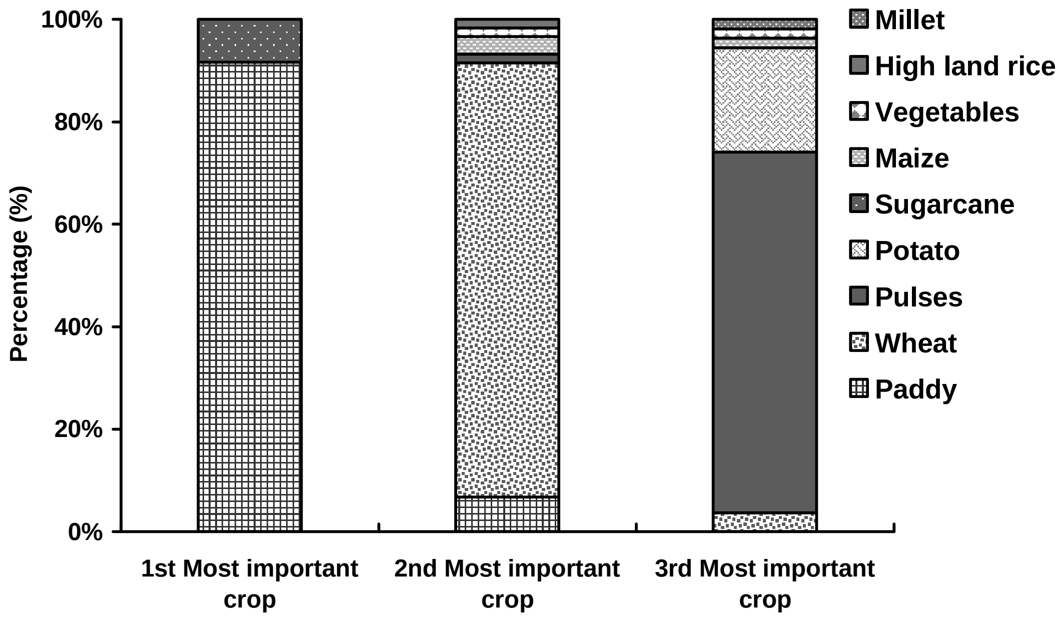
[a] Different colour used in the table are for illustrative purpose, for easy identification of separate activities

Figure 4.5 Seasonal activity in relation of cultivation of vegetables in Dhansha[a]

SEASONAL ACTIVITY	Apr/May Baisakh	May/Jun Jyestha	Jun/Jul Asad	Jul/Aug Shrawan	Aug/Sep Bhadau	Sep/Oct Asoj	Oct/Nov Kaartik	Nov/Dec Mangsir	Dec/Jan Push	Jan/Feb Magh	Feb/Mar Phagun	Mar/ Apr Chait
Okra	Picking	picking									planting	
Bottle gourd	Picking	picking	picking, planting	planting	picking	picking	picking	picking	sowing	sowing , planting	irrigation , fertilizer	ready to eat
Chillies	sowing, planting, picking		ready	ready		sowing, planting			planting		ready	ready
Pumpkin		planting	planting	ready to eat	ready to eat	ready to eat	sowing, planting	planting	weeding, irrigation	weeding, irrigation	ready to eat	ready to eat
Bitter gourd	sowing, picking	picking	picking	picking				sowing	sowing	weeding, irrigation	picking	picking
Beans				planting	planting			picking	picking	picking	picking	
Sponge gourd	sowing, picking	sowing		picking	picking	picking			sowing	sowing, planting		
Onion	pulling up, storing					prepare field, sowing	sowing, planting	sowing, planting, weeding	planting, weeding	weeding irrigation	weeding, pulling up	pulling up, storing
Garlic						sowing	sowing		pulling up	pulling up		
Jute leaves	Picking									sowing	sowing	picking
Black mustard							sowing	picking	picking	picking	picking	
Aubergine	Picking	picking	picking			sowing, planting	irrigation fertilizer, picking	irrigation fertilizer, picking	picking	picking	picking, planting	
Cauliflower / Cabbage					sowing / planting	sowing / planting	sowing / planting, picking	planting, picking	picking	picking	picking	picking

[a] Different colour used in the table are for illustrative purpose, for easy identification of separate activities

Figure 4.6 The three most important crops cultivated in Dhanusha District, reported by Community representatives' in 2006



4.5.1.4 Wealth breakdown

The next step in HEA interview was wealth breakdown where the community representatives (CR) described the distribution of wealth groups in each VDC and gave a description of the different wealth groups. According to the perceptions of community representatives, nearly a quarter of the households living in Dhanusha were Very Poor, and only 9% of the households were Better-off. Both Poor and Middle wealth groups were about one third of the households in Dhanusha (**Figure 4.7**).

Figure 4.8 shows that households in the Very Poor and Poor wealth groups in Dhanusha were mostly landless, who relied heavily on daily-waged labour activities and seasonal migration as livelihood options. Typically, the Middle and Better-off wealth groups were farming households; earned from regular job, business, and remittances from overseas. The average amount of land owned by Better-off was nearly double what the Middle wealth group owned.

Figure 4.7 Percentage of wealth groups in Dhanusha, reported by the Community Representatives

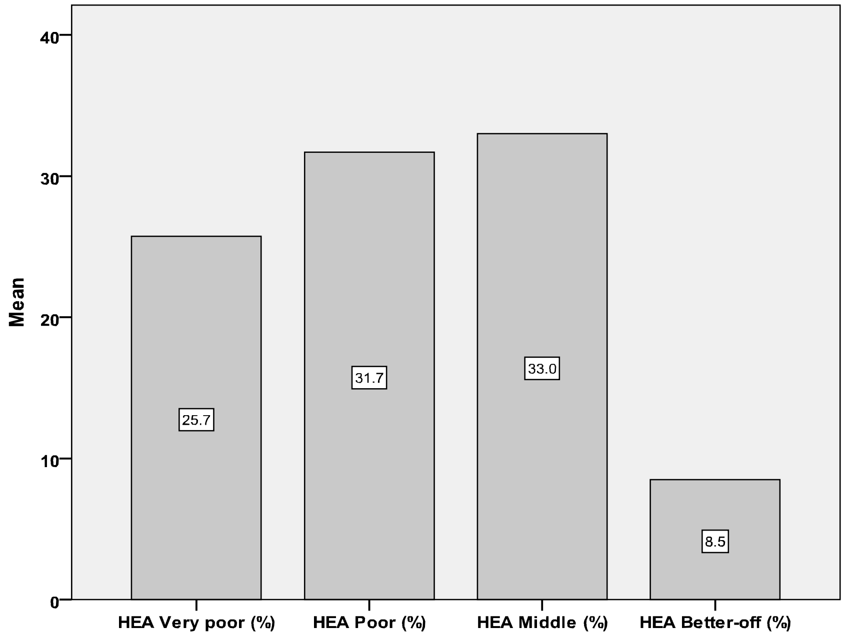


Figure 4.8 Description of wealth groups from Household Economy Approach (Community Representative Interview) data, collected in 2006 in Dhanusha.

Very Poor	Poor	Middle	Better-off
Household size (median, range): 6 members, 4-10 members.	Household size (median, range): 6 members, 4-12 members.	Household size (median, range): 6 members, 3-9 members.	Household size (median, range): 6 members, 4-12 members.
Land owned (mean, range): 0.03 bigha, 0-0.5 bigha.	Land owned (mean, range): 0.41 bigha, 0-1.5 bigha).	Land owned (mean, range): 2.12 bigha, (0-5.5 bigha); Cultivate with tractor	Land owned (mean, range): 5.11 bigha, (0-15.0 bigha); Cultivate with tractor
Occupation Daily waged labour Seasonal migration Self employed / petty trade	**Occupation** Daily waged labour Seasonal migration Self employed /petty trade; Some regular job, remittance	**Occupation** Farming household Self employed / small business Regular job Earn remittances	**Occupation** Farming household Self employed / med-large business Regular job Earn remittances

Table 4.4 shows the coping mechanisms used by the different wealth groups when faced with a 'shock'. Flood, drought, disease of human and animal, bad harvests are generally considered as shock in the area. Whereas poorer wealth groups had to reduce quantity and quality of diet, or take up more employment than usual, selling land or other assets were common strategies used by Middle or Better-off wealth groups. Another point to note is that formal loans from banks were less available to poorer household and they had to rely on lending money from wealthier households that often lend money with much higher rates of interest than banks.

Table 4.4 Coping mechanisms used by the wealth groups in Dhanusha, gathered from CR interviews, data collected in 2006.

Coping mechanism	Very poor	Poor	Middle	Better-off
Eating stored grain	X	XX	XXX	XXX
Seasonal migration to Delhi	XX	XX	-	-
Seasonal migration to Punjab	XXX	XX	-	-
Taking more paid work	XXXX	XXX	XX	-
Reduce number of meal	XXXX	XXX	X	-
Reduce quality of meal	XXXX	XXXX	XXX	X
Sell land	-	XXXX	XXXX	X XX
Sell livestock	XX	XXXX	XXXX	X XX
Sell other assets	X	XX	XXX	XX
Sell stored grain	-	XX	XXX	XXX
Loans from Bank	X	XX	XXX	XX
Loans from money lender	XXX	XXX	X	-

Coping strategies are grouped as used by very few = x, some = xx, common = xxx, almost all = xxxx

4.5.2 WGR interviews describing livelihood strategies

The WGR described an account of livelihoods of typical households in the wealth groups in Dhanusha in the preceding one year, April 2005 – April 2006. **Figure 4.9** shows the sources of income for the different wealth groups. The figure reflects that earning from food sales was a common source of income among the all wealth groups although it was more frequent among the wealthier households, whereas sale of livestock was more frequent among the poorer wealth groups. The descriptive data showed that among the poorer households sale of livestock involved selling mostly baby goats, which they earned due to taking care of adult goats owned by the wealthier households. Income from staple sales was most frequent among the Better-off households, whereas earning from selling dairy foods, pulses, vegetables or fruits were most frequent among the households in the Middle wealth group. The Very Poor households hardly earned through fruit sale, whereas earning from selling wild fishes were only done by poorer wealth groups (Very Poor, Poor). In terms of non-food income sources, poorer wealth groups were more reliant on daily waged labour or seasonal migratory labour activities to India. A regular job was not a typical source of income among the Very Poor, whereas the Middle and Better-off households were the ones more involved in regular job and remittance earning from overseas locations such as Arab countries or Malaysia. Employment types within regular jobs varied by wealth group. Members of households in the Poor wealth group were employed as support staff, junior administrative clerk, primary school teacher etc., whereas the Better-off households commonly worked as senior level government officers, school teachers, or doctors.

Figure 4.9 Income sources by the wealth groups in Dhanusha in 2005-6, data collected from interview of Wealth group Representatives in 2006

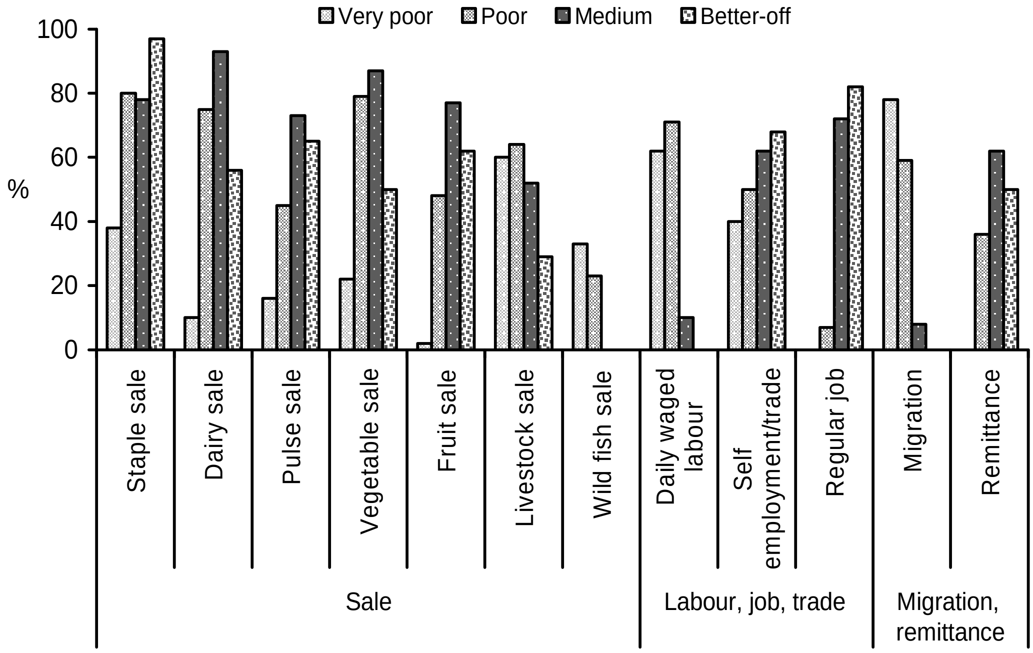


Table 4.5 shows the median household and per capita annual expenditure among the wealth groups in Dhanusha, compiled from the description given by the WGR. The per capita annual expenditure for the Very Poor households was 6429 NRs, and it was nearly four times higher among the Better-off household (24224 NRs).

Figure 4.10 presents the expenditure pattern of the wealth groups. Clearly, there are marked differences between the wealth groups in the percentage expenditure on food, especially on staple food. Food expenditure as a percentage of the total expenditure decreased with increase in wealth and was more than double among the Very poor households, compared to Better off (Very Poor: 58%; Poor: 45%; Middle: 32%; Better-off: 24%). The Very Poor households spent the highest percentage of their total expenditure on staples, whereas it was nominal for Middle and Better off households (Very Poor: 30%; Poor: 17%; Middle: 4%; Better-off: 2%). Although absolute amount of money spent varied a lot between wealth groups, the percentage of total expenditure spent on non-staple purchase was similar for all wealth groups (Very Poor: 28%; Poor: 28%; Middle: 28%; Better-off: 21%). Social cost included gift, donations, wedding or festival related cost and was higher among the wealthier households. Of the total expenditure, expenditure on agricultural inputs (such as seeds, tools, fertilisers) and on education varied largely between wealth groups showing a clear gradient, the wealthier the households the higher was the percentage expenditure on these categories. Conversely, the percentage of expenditure on health was highest among the poorest households and the percentage declined with increase in wealth.

Figure 4.11 shows the average food intake among the wealth groups in Dhanusha in 2005-6, indicated by the percentage of minimum energy requirement (2100 kcal per capita per day). The results illustrate that the reported intake of all wealth groups collected by the HEA study was well above the minimum energy requirements. Also, the average per capita food consumption (% intake of 2100 kcal) among wealth groups increased as the wealth status of households increased. **Figure 4.12** shows that the median annual per capita intake by the households in the Very Poor, Poor, Middle, and Better-off wealth groups were 3300kcal, 3617kcal, 3526kcal, and 4139 kcal, respectively.

Table 4.5 Annual household and per capita expenditure of the wealth groups in Dhanusha in 2005-6, reported by WGR, data collected in 2006

Wealth group	Indicator	Median	Mean	95% confidence intervals		Standard deviation
				Lower limit	Upper limit	
Very Poor	Annual household expenditure	37876	42941	37450	48433	21073
Poor		50952	60687	52516	68857	30509
Middle		86790	108829	86432	131226	86700
Better-off		148889	171182	141674	200691	83219
Very Poor	Annual per capita expenditure	6429	7443	6382	8504	4072
Poor		8027	9705	8223	11187	5533
Middle		15168	19665	15663	23666	15489
Better-off		24225	28901	23278	34525	15859

Figure 4.10 Percentage of total expenditure on different items by the wealth groups in Dhanusha, data collected from interview of Wealth Group Representatives in 2006

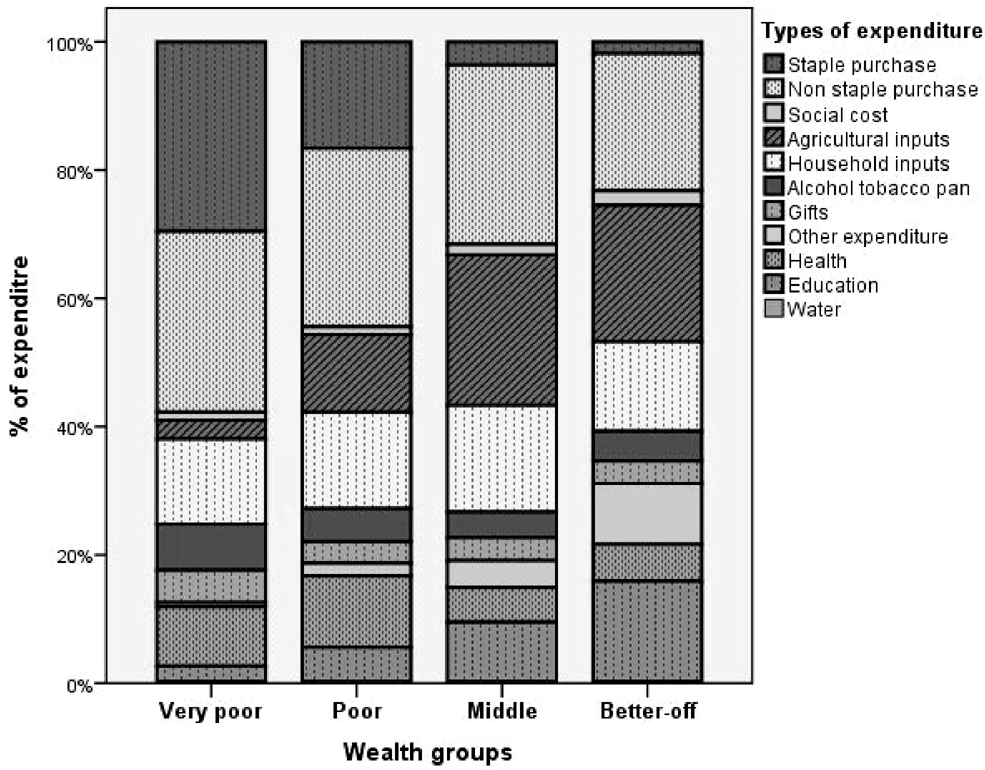


Figure 4.11 Percentage of minimum food requirements (2100 kcal per person per day) met by the wealth groups in Dhanusha in 2005-6 (Error bars show confidence intervals of the mean)

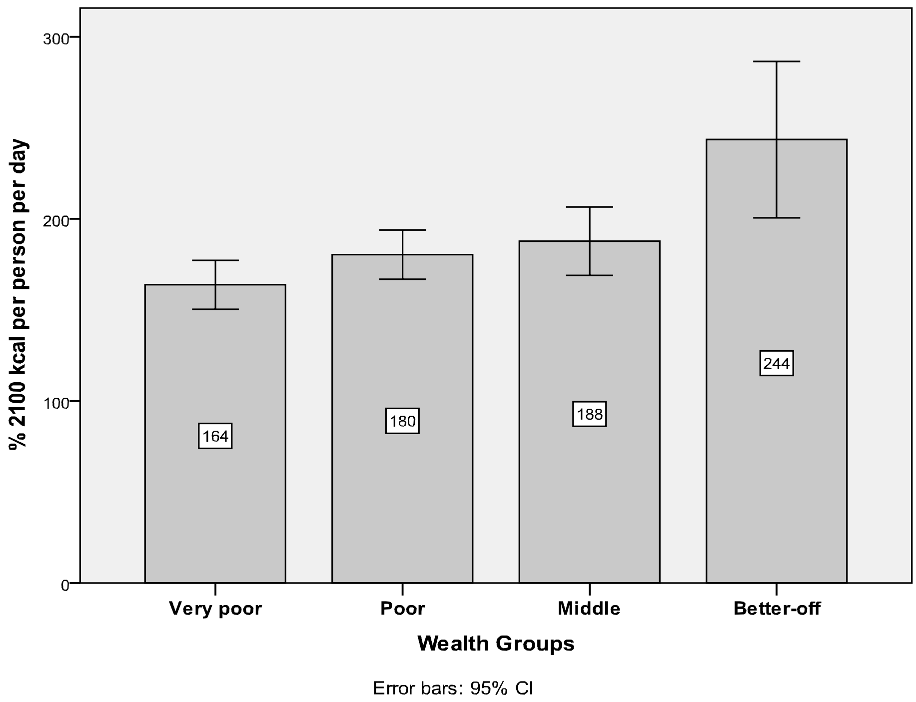


Figure 4.12 Per capita daily dietary energy intake (median kcal) for the wealth groups in Dhanusha in 2005-6, collected by Wealth Group Representatives interviews in 2006. (Upper edge of the box plot shows 75% percentile and lower edge indicates 25% percentile).

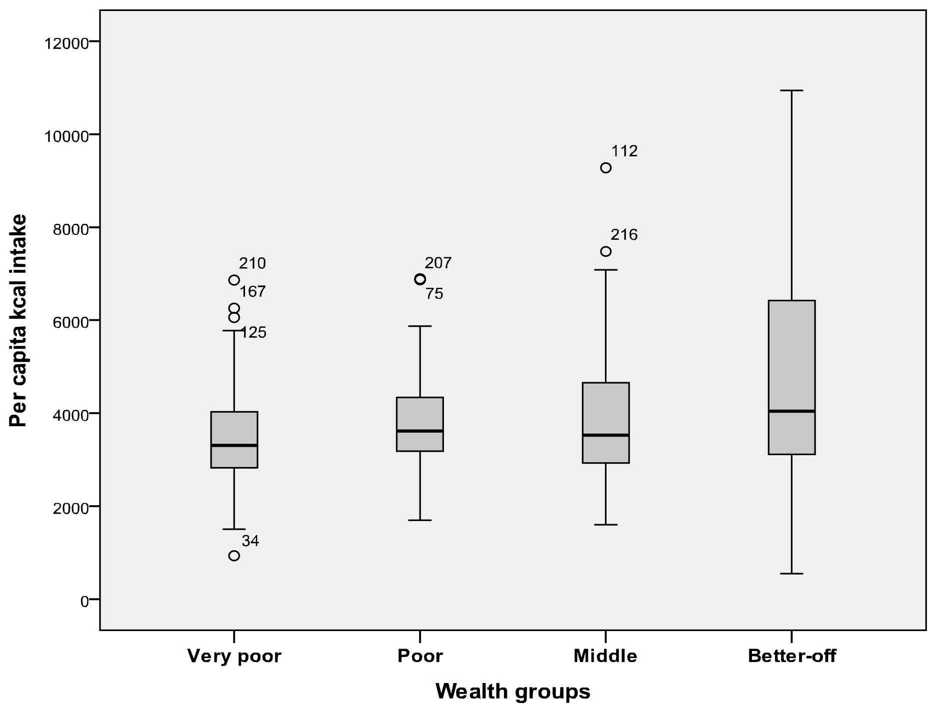


Figure 4.13 shows the sources of annual food consumption by the different wealth groups in 2005-06 in Dhanusha. This figure clearly shows that among the poorer households, staple purchase and foods received in exchange for labour were dominant sources, whereas the Better-off households were reliant on staple production from their own land. Overall, the contribution of total annual kcal intake from staple production was <20% for the Very poor, in contrast to more than half among the Better-off households. The contribution to the annual food intake of pulses, dairy production was very limited among the poorer households (Very Poor and Poor), compared to Middle or Better-off households. The percentage of energy contributed by purchased non-staple which included vegetables, pulses, meat, sugar, oils etc were similar among the poorer households. Contribution of kcal from non-staple among the Middle and Better-off households was almost double the amount contributed in the diet of poorer households. Whereas purchased vegetables were included as non-staple, vegetable production accounted for a limited amount of energy in the total diet of all wealth groups.

Figure 4.14 shows the percentage of annual per capita kcal intake contributed by the food groups among the different wealth groups. For all wealth groups, cereals contributed to the bulk of energy, ranging from >80% for the Very Poor and about 40% among the Better-off households. The % of energy provided by oil and oilseeds, pulses, and vegetables increased with wealth. The intake of meat, fish, eggs were very limited among all wealth groups, as percentage of kcal from this group was negligible for all. Contribution of kcal from fruits, dairy and sugar was negligible among the diets of poorer households, whereas dairy is a significant energy source for the Better-off. Similarly, the percentage of caloric intake contributed by sugars and fruits was also much higher among Middle and Better-off households than poorer households.

Figure 4.13 Sources of annual food consumption by the wealth groups in Dhanusha in 2005-6, data collected by interview of Wealth Group Representatives in 2006

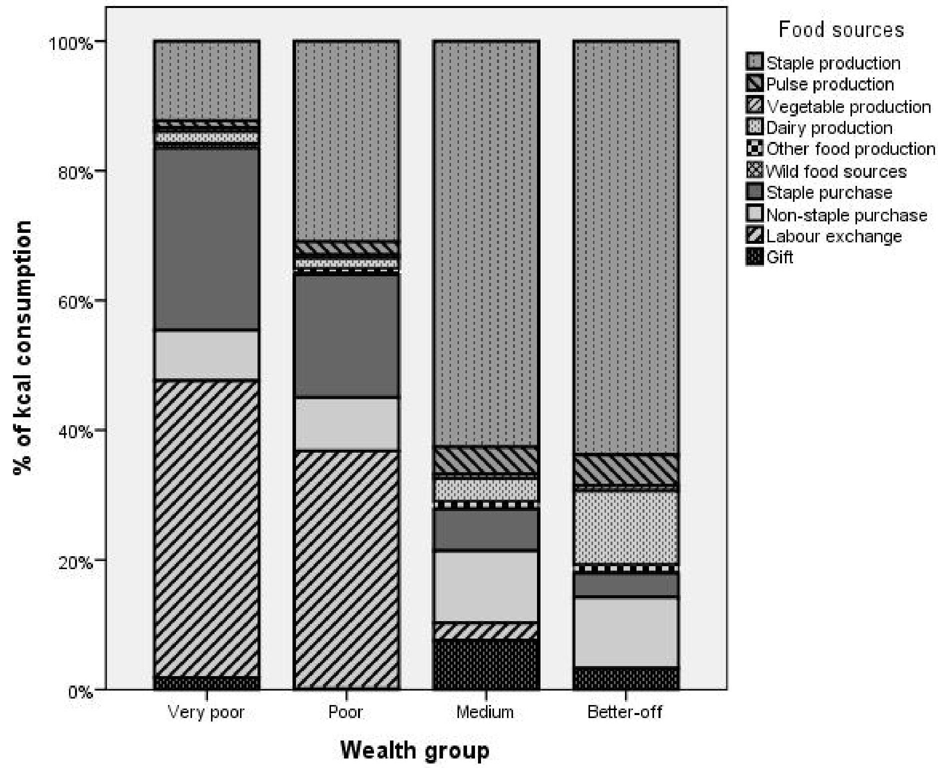
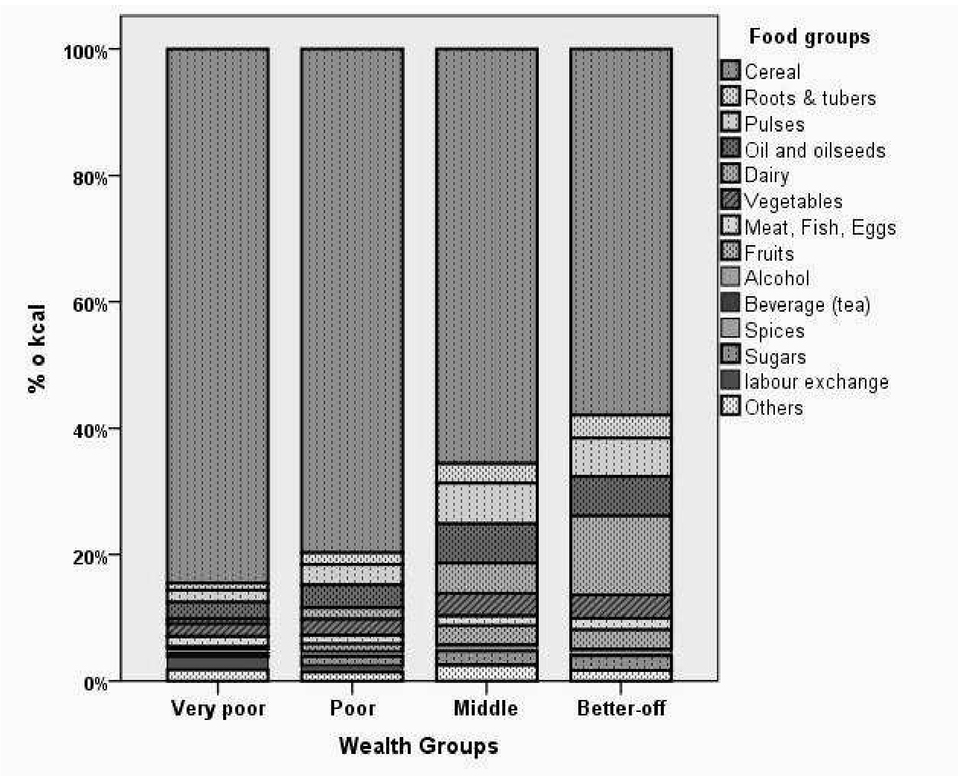


Figure 4.14 Percentage of annual per capita kcal access in 2005-6 contributed by the food groups among the different wealth groups, data collected using HEA in 2006



4.5.3 Household Food security status, HFIAS and HDDS of Surveillance data

Figure 4.15 shows the food security status of households in the different wealth groups in Dhanusha during September 2006 - April 2007, based on 4 food security categorisations derived from the household food insecurity access scale (HFIAS), and the percentage of food secure households were 17.8%, 34.2%, 47.7%, and 67.0% among the Very Poor, Poor, Middle, and Better-off. On the other hand, the percentage of households who were severely food insecure was 32.4%, 13.3%, 4.5%, and 3.0% among the Very Poor, Poor, Middle and Better-off. Overall, 41.0% of households in Dhanusha were food secure; 14.3% were mild food-insecure, 30.9% were moderately food-insecure, and 13.8% of the households were severely food.

Figure 4.16 presents mean HDDS of households in the different wealth groups, which ranged from 3.6±1.5 (mean, SD) in the Very Poor households to 4.7±1.6 (mean, SD) in the Better-off households. Overall, mean HDDS among households in Dhanusha was 4.0 (SD 1.6), which was the same as the median (HDDS = 4). When all households were grouped according to HDDS terciles, one third of the households at the bottom end had a HDDS of <=3, the second tercile had households with HDDS >3 and <5, and households at the top end of HDDS scored >=5. **Appendix 4.8** shows the distribution of HDDS among HEA-based wealth groups in Dhanusha. **Figure 4.17** shows that when the >=4 cut-off of HDDS is used as food security indicator, 61.2%, 51.1%, 44.0%, 32.9% of the households in the Very Poor, Poor, Middle, and Better-off were food insecure respectively. Overall, 40.9% of the households in Dhanusha were food insecure based on HDDS cut-off (<4).

Figure 4.15 Percentages of households in each of four food security categories in different wealth groups in Dhanusha, using household surveillance data in September 2006- April 2007

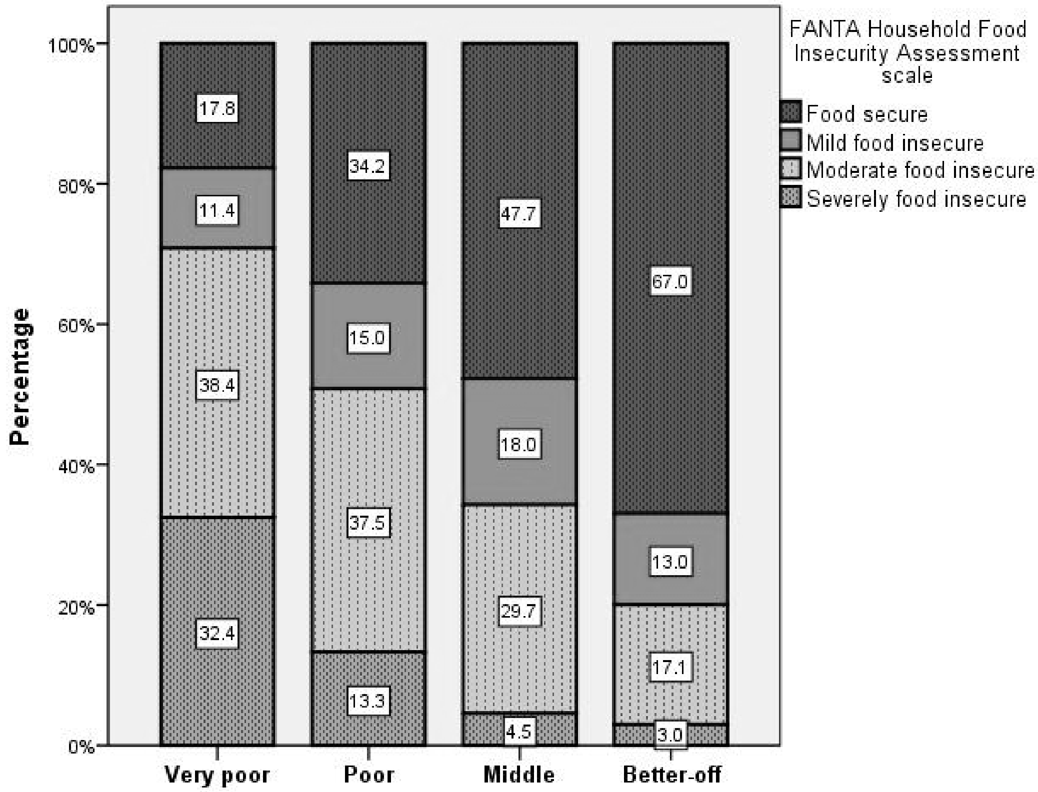


Figure 4.16 Mean Household Dietary Diversity Score (HDDS) among households in the different wealth groups in Dhanusha, data collected in September 2006 - April 2007 by the prospective surveillance system

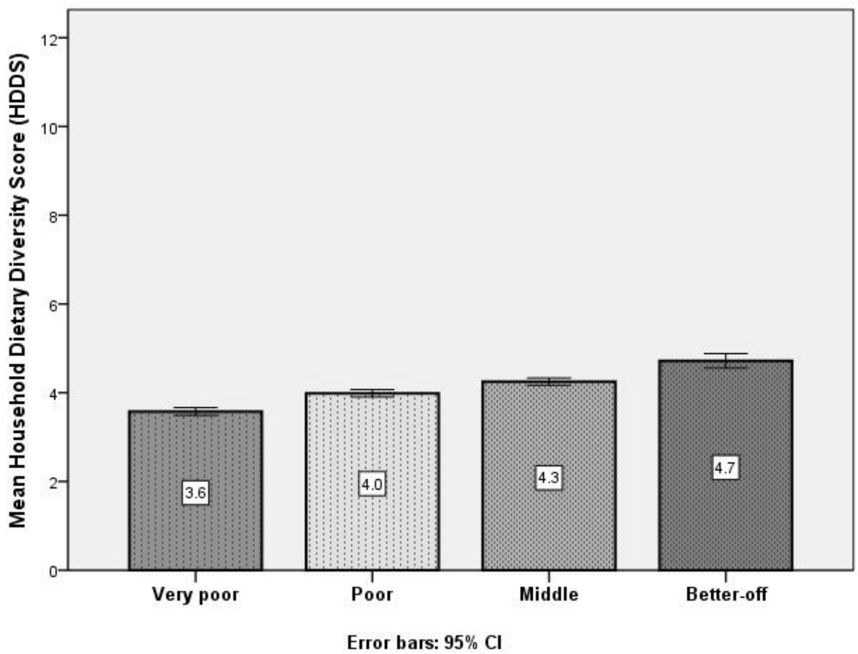
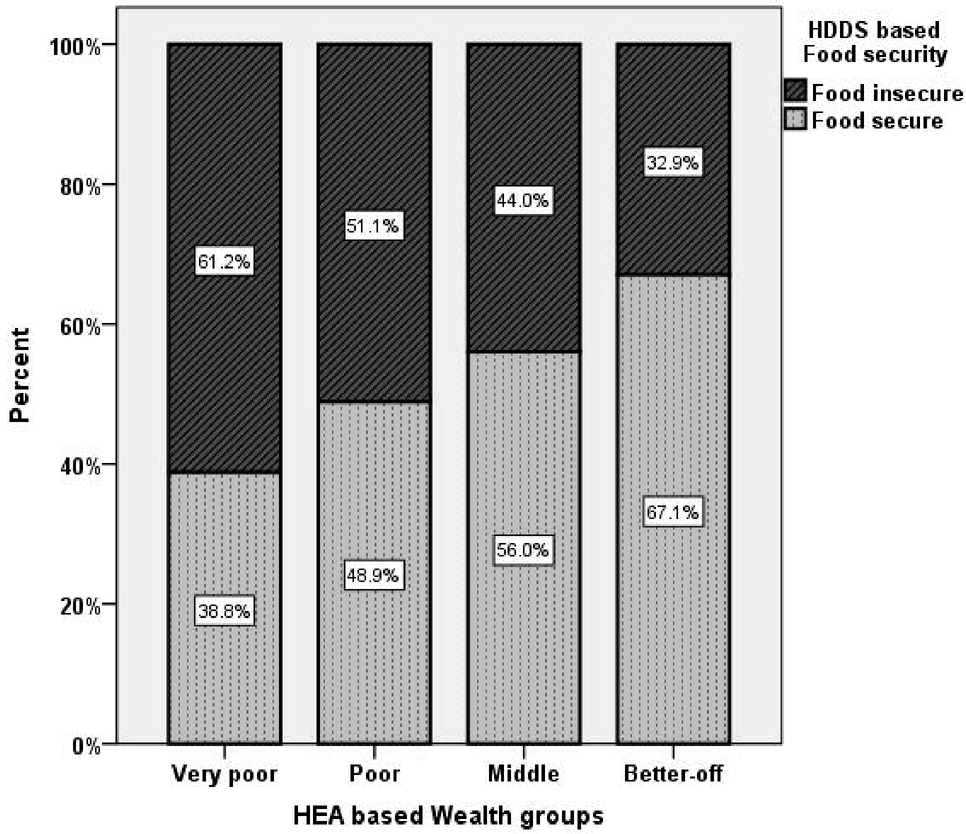


Figure 4.17 Percentage of food secure households in the different wealth groups in Dhanusha in September 2006 - April 2007, data collected by the prospective surveillance system



4.6 Discussions

4.6.1 HEA description of livelihoods of Dhanusha

This chapter describes the food security and livelihoods of the wealth groups in Dhanusha, where agriculture dominates most people's livelihoods (Dillon A, Sharma M and Zhang X 2011; Central Bureau of Statistics 2011). In HEA, a livelihood zone is defined as an area in which people share the same pattern of livelihoods (FEG Consulting and Save the Children 2008). Broadly, Dhanusha district falls within one livelihood zone based on a system of rice production in the monsoon and wheat and pulses in the winter / dry season (ibid). In Dhanusha, nearly half of its land (46%) is irrigated and the rest is rain-fed (Ministry of Home Affairs 2009). Because agriculture is the predominant livelihood of people in Dhanusha, weather conditions and natural disasters greatly influence agricultural productivity of the area (Regmi 2007). Depending on adequate rain-fall and irrigation facilities, three (spring, summer and late summer) paddy crops are possible in the *Terai* (plains) of Nepal whereas in the Hills only two crop cycles (summer and spring) are possible (FAO/ WFP 2007).

Based on the responses of the mixed wealth group representatives that were obtained from the CR interviews, the perceived percentages of households in the Very Poor, Poor, Middle and Better-off wealth groups were 26%, 32%, 33%, and 9%. The Nepal Living Standard Survey (NLSS) 2003/04 (Central Bureau of Statistics 2004) collected nationally representative household survey data and created income quintiles using national level data. It then checked what percentages of households in the different administrative region belonged to each quintile, so an assessment of poverty status of the areas can be made (ibid). East *Terai* area was the closest match to Dhanusha, for which data were available in the living standard survey 2003/04. According to their statistics, 25.9%, 25.3%, 21.0%, 18.4%, and 9.4% of the households in the rural East *Terai* belonged to the first (poorest) to fifth (richest) quintiles. The estimates for percentages of households in the highest and lowest income quintiles (lowest = 26%, highest = 9%) of the NLSS 2003/04 (CBS 2004) are consistent with the perceived percentages reported by the CR. In the HEA study, wealth groups are based on the economic conditions of the households in the area studied but respondents are not required to make equal sized groups (Boudreau 1999). This is different to usual household survey data, where the households are grouped into five equal sized wealth quintiles during analysis. Generally, the NLSS 2003/04 (ibid) findings were also similar when expenditure quintiles were used (Poorest 26.7%, Richest: 8.8%). Unlike the survey using quintiles, the HEA divided households into four groups and therefore the % of other groups were not comparable.

The median annual per capita expenditure (NRs) for the wealth groups in Dhanusha, derived from HEA data for 2005-6 was 6429, 8027, 15168, 24225 NRs for Very poor, Poor, Middle and Better-off households respectively. According to the NLSS 2003/04, total expenditure among Nepalese households from poorest to wealthiest quintiles were 4913, 7373, 10073, 14657, and 42236 NRs respectively (CBS 2004). The two surveys are not comparable as the NLSS estimates were combined for rural and urban areas and were made several years earlier, whereas the HEA study only recorded expenditure in rural areas of Dhanusha, in the plains of Nepal.

HEA data on annual food consumption pattern showed that diets of Nepalese households were predominantly comprised of rice, pulses, and vegetables. Similar findings were reported by studies assessing food intake in plains of Nepal (Hirai et al. 1994, Ohno et al. 1997). Contribution of meat, fish, eggs were minimal for any wealth group reflecting that consumption of these foods is limited in Nepal. Hirai et al. (1994) observed that dairy products were the sole animal source food consumed in many Nepalese households. In Dhanusha, poorer households had very limited access to meat, fish and eggs or dairy; however, consumption of dairy products was quite common among wealthier households.

4.6.2 Validation of HEA findings

HEA results were found to be internally consistent in terms of findings reported by CR agreeing with that of WGR. Wealth group descriptions, provided by CR showed that Middle and Better-off households were farming households, owning large land holdings that are cultivated using tractors. This was consistent with findings of WGR that selling staples and earning from other food sales were most frequent among Middle and Better-off households. Also, expenditure pattern results show that the % expenditure on agricultural inputs was highest among in the Better-off households. Again, in agreement with the HEA WGR description of income sources, the results of food consumption sources showed that own production was dominant sources for higher wealth groups. Thus, results from CR and WGR interviews provided rich descriptions of the wealth groups, and income sources, expenditure and food consumption patterns were in general agreement with each other.

There were, however, some quite severe difficulties with the data as well. Despite efforts to clean and standardise data collected on annual income of the typical households in the different wealth groups, quantitative estimates of amounts of income earned in total and by income source were extremely difficult to use due to inconsistency in data collected. Income sources in the non-emergency setting of Dhanusha were diverse and getting a reasonable generalisation of income for a 'hypothetical typical household' was complicated. Although interviewing groups were encouraged to gather several types of income estimate and take an average, some groups did this in a different way from others. Examining the data in depth suggests that data collectors were confused about when it would be necessary to average several income sources and when it would be necessary to sum the totals for each income source. In some interviews, they have mentioned several sources and only recorded an average of those; and in other interviews, they have summed individual amounts from different possible sources. Therefore, data could not be combined across different interviews in a wealth group to average them, because of large variability in data collection approaches between interviews. As the estimates in this case did not yield meaningful results, quantitative income data were discarded. Similar difficulties have occurred while applying HEA in other non-emergency settings, such as one study reported that instead of using the income data derived from wealth group interviews, they collected actual income data of three households in each wealth group and averaged them to show the possible combinations (Jaspars and Shoham 2002). Another study also reported that the analysis of income data done in 2006 was found to be incorrect and was later revised in 2009 (Save the Children UK 2009b).

Although sources of food consumption patterns and the relative importance of different foods in the diet seems logical and consistent with others' findings on the diet in the Nepal plains, the annual average per capita per day intake of >=3300 kcal for even the Very Poor households is unrealistic. These figures seem to be an unrealistic reflection of actual kilocalorie access in a population where child stunting and low maternal BMI is high (CBS 2011). To check the validity of these results, I compared the findings with relevant results specific to Dhanusha and other parts of Nepal. The FAO regional estimate showed that per capita dietary energy intake (based on Dietary Energy Supply calculated using national level Food Balance Sheet data) for Nepal during 2005-2007 was 2350 kcal (FAO 2010). The study by Ohono et al. (1997) on food consumption in a district in Terai of Nepal (using 24 hour dietary recall data) found their per capita daily kcal intake was 2340 ± 526 for males, and 1930 ± 457 for females. This is much lower than estimates obtained from analysing Dhanusha HEA data. Other studies in Nepal showed similar Kcal consumption, for example, Hirai et al. (1994): male 2010 kcal, female 1835 kcal (using 24 hour dietary recall data); Sudo et al. (2006): 2083 for male and 1701 for female per capita per day intake (energy intake estimated using a 19 item food frequency questionnaire). Using data from NLSS 2003/04 (household level annual consumption expenditure and daily energy intake), the WFP has estimated that 32% of households in Dhanusha were food insecure (per capita intake <2703 kcal) based on per capita dietary intake parameter (CBS/WFP/WB 2006). Clearly, the per capita per day kcal intake of 3300 kcal - 4139 kcal for very poor to Better-off households cannot be a true reflection of actual dietary energy intake, especially as obesity is not a highly prevalent problem. When disaggregated by food groups, the caloric contribution of cereals was unrealistic for all wealth groups (**Figure 4.18**) even before inclusion of food paid as labour exchange. Average per capita rice intake was much higher in the poorer households (Very Poor: 719g; Poor: 539g) compared to Middle (273g) or Better-off (586g) households (**Figure 4.19**). This finding was in agreement with **Figure 4.14**, which showed consumption of cereal was higher for poorer households. The other point to note is that this amount of cereal did not include the amount of food coming from labour exchange for poorer households. Therefore, the absolute amount (g) per day per capita intake of rice, derived from HEA would be much higher than the national level estimate of 469g per capita per day cereal intake in Nepal in 2005-7 (FAO 2010). However, the pattern of intake showing that percentage of total energy coming from cereal was much higher in poorer households fits with the fact that diet in the poorer households are less diverse (**Figure 4.16**) and predominantly cereal based (Torlesse, Kiess and Bloem 2003).

The problem of PRA and HEA overestimation is reported in several other studies (Richards et al. 1999; Jaspars and Shoham 2002). Because food consumption in Dhanusha includes a diverse range of items, in order to check the validity of their findings, data collectors would have needed to estimate kcal contribution from about 200 food items, which would have been a very time consuming task. Also, data collectors did not have complete information about kcal content of each food item during data collection. Therefore checking of dietary kcal intake by a wealth group immediately after each interview was not possible. This may have contributed to inaccurate estimation of food consumption among households in Dhanusha.

This inaccuracy in the Kcal consumption estimation is further proved by preliminary results from an endline anthropometric survey of 3300 children aged 11 to 35 months and their mothers in Dhanusha. This found that 41% of the women in the area were thin (Body Mass Index <18.5kg/m2); 46% of children were stunted, 39% underweight, and 15% wasted (Naomi Saville 2012, personal communication).

Figure 4.18 Median caloric contribution by different food groups among households in different wealth groups in 2005-6, data collected by HEA in 2006

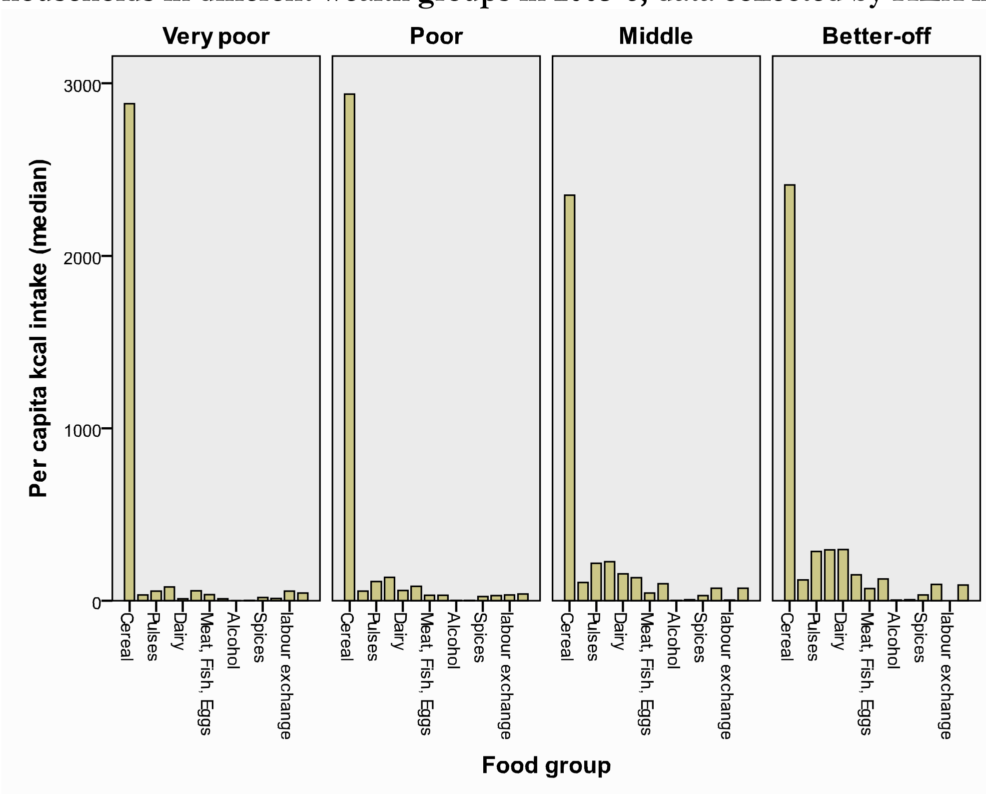
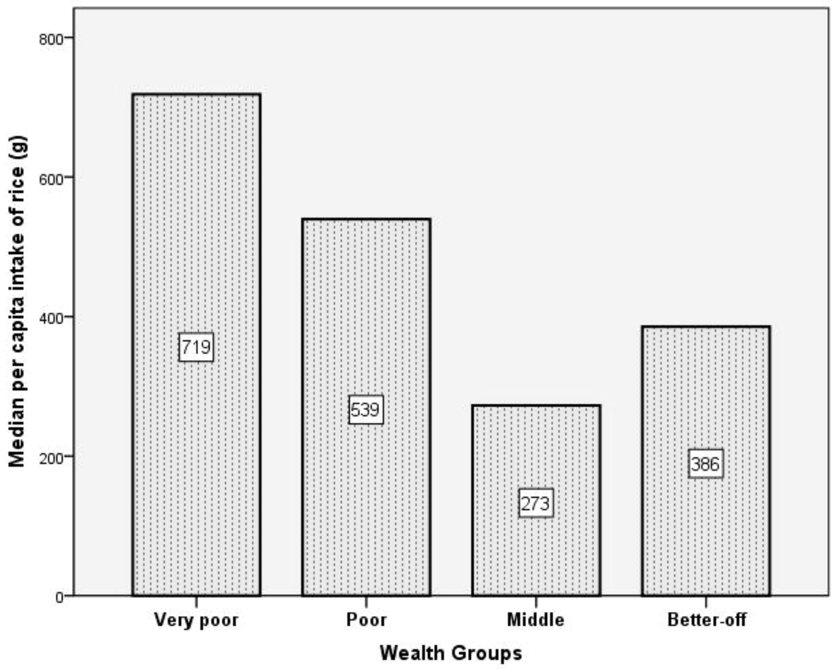


Figure 4.19 Per capita per day rice intake among wealth groups in Dhanusha in 2005-6, data collected by HEA in 2006



The prospective surveillance system collected data in the same study clusters as the HEA study. Analysis of data collected in a period soon after the end of the HEA study, using the household food insecurity assessment scale (HFIAS) food security indicator, found that 59% of the households in Dhanusha were food insecure. Also 32% of the Very Poor households were severely food insecure. This finding was consistent with another study that used a modified version of the HFIAS in one district in Far-western region of Nepal and found 69.2% of the households were food insecure (Helen Keller International Nepal 2010). Similar findings were available for Udaypur district of Nepal in 2007, where 72% of the households using conventional farming system were food insecure (Nepal and Rajbhandari 2007).

Similarly the household dietary diversity score (HDDS) revealed that overall 40.9% of the households in Dhanusha were food insecure, according to the cut-off of households having consumption from less than four food groups in a day. Using this indicator even 32.9% of the Better-off households had a low dietary diversity (<4 food groups).

4.6.3 Challenges in applying HEA

Overall, HEA provided a detailed analytical framework of livelihoods and food security of typical households in the different wealth groups in Dhanusha, their income sources, expenditure and food consumption patterns. This enabled vulnerability assessment to be made and enabled exploration of potential to improve food and nutrition. The downside of this method is that it demands a lot of technical skill and experience to be properly implemented and to yield meaningful results. The experiences of the HEA study in Dhanusha also showed that the technical skills in judging how to make generalised quantitative estimates from wealth group representatives' responses are not readily transferable. This concern was also present among several partners of vulnerability assessment committees in South Africa and in several countries they preferred to use household surveys instead of HEA (Marsland 2004). Marsland (2004), in his documentation of evidence for developing food security and vulnerability information systems expressed that the data collection involves very skilled practitioners and such skills are not easily transferable, and also mentions that data collection could be problematic due to applying recall method to collect data (ibid). In application of the HEA in Dhanusha, annual estimates of income, expenditure and food consumption showed that the method can generate good description of livelihoods but accurate quantification is not easy. The team of 12-14 data collectors who were trained to collect HEA data in Dhanusha in the 60 study VDCs had variable amounts of experience in quantitative studies but no prior experience in HEA application. Collecting data in 60 study clusters by these inexperienced data collectors not only added time, but also introduced lots of variability.

Although HEA data collection requires highly skilled practitioners, accuracy of data may vary depending on the type of data collected. Generally, collecting expenditure data is easier as the expenditure of households can be easily defined within several categories. Price data, collected from vendors also generated good estimates (see Chapter 6), as the estimates were provided by vendors. It is expected that since vendors deal with numbers on day- to-day basis, they have good mathematical knowledge and the variability in such data is therefore limited. On the other hand, collecting food consumption data is quite difficult even when household survey methods are used. Collecting HEA food consumption data on an annual basis, using recall of wealth group respondent is quite challenging and can therefore yield incorrect estimates. Also the fact that data collectors did not come from a nutritional background and did not have enough information (e.g. kcal value of food items) have also contributed to the over-estimates.

To get the benefit of HEA by applying it properly, it requires the focus of an accountant, the view point of anthropologist, as well as the understanding of a nutritionist (Bush 2002). While application of HEA using PRA has its strength of providing detail description of livelihoods, the quantification of income and food sources is not easy. In my personal experience, I have seen that training a data collection team to use a structured questionnaire (with coded responses) to collect expenditure data for up to a month is relatively much easier, and less challenging than training a team to conduct an open ended or semi-structured interview. To avoid these problems, anthropometric data as a proxy of food security status is preferred by many researchers (Bush 2002). Although anthropometric data needs to be accurate and precise, quality of such data can be ensured through extensive training and checking of inter-observer technical error of measurement. HEA, although apparently simple, uses participatory approach and semi-structured interview techniques which means that the quality of the data is very dependent on data collectors' skills in probing to validate and make sense of information provided by respondents. Also the knowledge and understanding of data collectors about what would be realistic figures for food consumption or income can influence data quality. Developing these skills can be very difficult for researchers especially who were previously only experienced quantitative research with pre-coded questionnaires.

Looking back on our experience of applying the HEA in Dhanusha, it is apparent that HEA data provides rich contextual details about the livelihoods of people living in the area. However, because this method is technically demanding, it is often applied by expats who are experienced in applying it and thus it may become expensive (Marsland 2004; Jaspars and Shoham 2002). The experience of applying it in Dhanusha shows that data quality varied depending on the type of data collected, the skills of the data collectors, and the range of food and income sources available. Applying HEA techniques in non-emergency settings requires a thorough understanding of the method, highly trained data collectors, secondary data (such as kcal/ food item, national level estimates) to crosscheck findings as well as personal skills to match one component of data with another component so that it all make sense and can be useful to understand, and quantify the food security status of the people living in the area.

4.6.4 Implications of the findings

The research in this chapter concludes that the HEA is a suitable method to provide a rich description of livelihoods, which is important in considering options to improve food security in an area. However, it is not suitable to assess the prevalence of food security in a non-emergency setting.

The HEA has recently adopted a household interview approach to collect detailed information on income, expenditure and food consumption among the different wealth groups (HEA 2013). This approach may make the data collection easier and improve quality of data collected. Yet, the recall period of the last one-year is still broad and may lower the quality and credibility of such data, especially annual data on food consumption practice.

Future research needs to assess the accuracy and cost-effectiveness of estimating food insecurity in non-emergency settings by applying the revised HEA (using household interview rather than group interview), in comparison to other experience-based food security measures (such as HFIAS) or objective dietary intake based measures (e.g. HDDS or FCS).

Chapter 5. Comparing description of poverty in Dhanusha from the Household Economy Approach and the Household Surveillance Data

5.1 Chapter summary

This chapter outlines how the Household Economy Approach (HEA) describes poverty status in Dhanusha in comparison to the Household Surveillance Data (HSD). Principal Component Analysis (PCA) was used to generate asset indices from both HEA and HSD as a proxy indicator for poverty (Vyas and Kumaranayke 2006; Gwatkin et al. 2007; Howe, Hargreaves, and Huttly 2008). For HEA, asset indices were derived using the local descriptions of wealth groups given by the community representatives' (CR). The surveillance data is taken as the 'gold standard' for assessing poverty status and HEA CR indices were compared with indices derived from HSD.

5.2 Research questions

The specific research question that this chapter aims to answer is:

- How does the description of poverty status of Dhanusha obtained from HEA CR interviews compare with that derived from the household surveillance data (HSD)?

The **outcome indicators** used are:

- o Correlation coefficients and the significance of association between PCA-based VDC level asset indices derived from the HEA CR interviews and the HSD.

5.3 Introduction

Poverty is a determinant of health, nutritional status and well-being of people living in an area, and therefore researchers and programme managers often use different indicators to group people according to their wealth status and thereby allocate resources to them as needed. Traditionally, economists have used income or consumption expenditure as a standard indicator that can easily distinguish between households of different living standards (Hargreaves et al. 2007; Central Bureau of Statistics 2004). However, as households often earn from multiple sources paid in cash and/or kind, which may vary seasonally (Howe, Hargreaves and Huttly 2008), income data are difficult to collect, especially in developing countries (Sahn and Stifel 2003; Montgomery et al., in Vyas and Kumaranayke 2006). Milanovic (2002) examined income data generated by nationally representative household surveys in 91 countries and reported that income tends to be underreported by 30-40% compared to expenditure level. Often, in resource-poor settings households tend to hide income expecting that the survey is being conducted to screen beneficiaries for a service. Under-reporting of income was also evident for richer countries where property income, contributing a large portion to their total income, was underreported (Milanovic 2002). Thus, such data often lack reliability (Houweling, Knust and Makenbach 2003). Similarly, collecting and summarising expenditure data is also not easy as it is time-consuming, costly, and requires expert skill. Although collecting expenditure data may appear simpler than income data, the drawback is that it is more likely to indicate current rather than long-term wealth status (Filmer and Pritchett 2001). Researchers have also used food consumption data to disaggregate households, which requires specialised skill, training of interviewers and is therefore quite expensive and time consuming. In addition, for any of these measures, household members may have difficulty remembering detailed accounts over a certain period, and this recall bias may affect data quality. In contrast, collecting data on asset ownership is quite straightforward and easier for interviewers and household members may find it easy to respond (Prakongsai 2006).

Even though collecting data about asset ownership has advantages of simplicity and accuracy, the challenge remains about how to sum up the information to estimate socio-economic status. Several approaches, which have used asset data to describe socio-economic status, have applied equal weights to assets, using weights based on consensus of experts, applying weights based on price of items, and used statistical techniques to weight assets included in the indices (Falkingham and Namazie 2001). Weighting asset variables equally may appear simple, but is quite arbitrary as two assets may not have equal importance and thus the indices may not be useful. Weighting by price does not also solve the problem as price of an item may change over time and vary by quality. This process involves difficult judgement issues, which are subject to errors. The Principal Component Analysis (PCA) uses a statistical technique to assign weight to some correlated variables and extracts components that explain the variability in the dataset. PCA assigns weights to the variables in the model based on the correlation matrix between them (Howe, Hargreaves, and Huttly 2008), and assigns higher weights for more unequally distributed variables (Vyas and Kumaranayake 2006).

Howe et al. (Howe, Hargreaves and Huttly 2008) explained that

> **"**PCA is a 'data reduction' procedure. It involves replacing a set of correlated variables with a set of uncorrelated 'principal components' which represent unobserved characteristics of the population**"**.

In other words, it is a multivariate technique that uses a number of variables included in the model to reduce dimensions (Vyas and Kumaranayake 2006). The reduced dimensions, known as 'principal components', are created from linear combinations derived from the original variables (Howe, Hargreaves and Huttly 2008). PCA generates several components and among those the first component explains the largest variability. The first component, derived from PCA is considered as a proxy of socio-economic status, and is commonly used as an adequate measure of socio-economic status (Houweling, Knust and Makenbach 2003; O'Donell et al. 2008). This first component, derived from PCA is therefore used to disaggregate the population into wealth groups.

The use of a PCA-based asset index derived from household survey data to disaggregate people by wealth status is becoming increasingly common. Mckenzie (Mckenzie 2005) examined the suitability of using such an index as an indicator of living standard and found it as a good proxy of wealth, which can also measure inequality. The PCA-based asset index was found to be consistent with assessment of income and expenditure (Rutstein 1999, in Johnson and Bradley 2008). The application of PCA to data from India, Indonesia, Nepal and Pakistan by Filmer and Prechitt (2001) worked well. They have found the index an internally and externally coherent and stable measure (Filmer and Pritchett 2001), and recommended use of a PCA-based asset index as a proxy for wealth in a community. The World Bank has also used it in more than 50 countries in relation to mortality, nutrition, access to health services and health related behaviours (Gwatkin et al. 2007). Often asset indices are used to group people equally into quintiles or quartiles and health outcomes are described disaggregated for these groups (Ministry of Health and Population (MoHP) [Nepal], New Era, & Macro International Inc. 2007; Central Bureau of Statistics 2004).

In recent years, a multidimensional poverty index, used in 104 countries, has been suggested (Alkire and Santos 2010) as an indicator of poverty in developing countries. This is a composite index, and includes indicators of health (mortality, nutrition); education (years of schooling, child enrolment); and standard of living (electricity, drinking water, sanitation, flooring, cooking fuel, ownership of selected assets). However, not all of the indicators to be included were available from the HEA CRD or the HSD. Therefore comparing the HEA CRD to the HSD using the multidimensional poverty index was beyond the scope of this study.

The HEA is an alternative method used for defining wealth groups and their food security and livelihood status. This method is different to household surveys collecting data from individual household, as it interview groups of people who describe the wealth groups and describe food security status of wealth groups. At the first stage of HEA interview in a community, mixed wealth group representatives generate the descriptions of wealth groups. In HEA terminology, the representatives of mixed wealth groups are community representatives' (CR) who describes which assets different wealth groups typically own. Thus, the CR generates a list of assets for each wealth group, which can assist classifying individual household into wealth groups as needed. This approach is a generally less expensive data collection technique than household surveys, because it relies on a small number of group interviews as opposed to population proportional sampling of households. The validity of this method of defining wealth groups as a measure of describing poverty, in comparison to a standard household survey is not yet been explored. Hence, this research may provide a better understanding of the suitability of using HEA to describe wealth groups in different settings.

5.4 Methods

5.4.1 Data sources

In this chapter, I used the HEA CRD and the HSD to compare poverty status of Village Development Committees (VDCs: geopolitical population units) in Dhanusha district. Using the two datasets, asset indices were generated from independent variables and matched variables PCA, which is described more in the later part of this chapter.

- **HEA community representatives' interview data (CRD)**: Wealth breakdown data were collected in 60 study VDCs between March and June 2006 on ownership of household assets, landholdings, livestock, and livelihood. Out of total study VDCs, six VDCs had missing data about percentage of households belonged to the different wealth groups. Therefore, analysis in this chapter included data from 54 VDCs, excluding the six VDCs (Lagma Gathaguthi, Basaya, Sakuwa Mahendranagar, Dhalkewar, Ramdaiya, Shantipur). In each VDC, one CR interview generated descriptions of the wealth groups in the VDC. The CR generally divided the community into 3-4 wealth groups. In total, wealth breakdown data of 202 wealth groups were available from focus group interviews among mixed groups of men and women in 54 VDCs. Data were collected by trained interviewers who used a semi-structured questionnaire (**see Annex 4.3**) as a guide. The questionnaire had pre-listed items already identified in consultation with the local field team who had good knowledge of the asset distribution in Dhanusha. Using the list, the interviewers asked the participants to estimate what assets belonged to the different wealth groups within a VDC. They also recorded ownership of assets or livelihood options not listed in the questionnaire but mentioned by the respondents during interview. The interviewers also asked the CR to share with them what percentage of households belonged to the different wealth groups. Usually this is done by 'pile sorting' and then interviewers record the perceived proportion of households in the different wealth group as the CR described.

- **Household Surveillance Data (HSD)**: To compare the findings of HEA CRD with the HSD, a subset of HSD collected between 18 September 2006 - 15 April 2007 in the 54 study VDCs matched to HEA CRD in Dhanusha were used. The HSD comes from the prospective surveillance system in Dhanusha (See - Chapter

3), and were collected from households where a child had been born within the last 3 months (usually 4-6 weeks after delivery). A structured pre-coded questionnaire was used to collect data on ownership of assets, livestock, and livelihood options. Any other assets not listed were included as open questions (**see Annex 5.1**).

Data excluded from the HSD for the purposes of this analysis were i) cases where a woman gave birth to the newborn outside the study area and therefore provided description of an area outside the study clusters, and ii) the whole VDCs which were excluded in the CRD analysis. After exclusions, surveillance data were available from 4,121 households in the 54 matched VDCs for **independent variables PCA** and from 2,498 households for **matched variables PCA**.

5.4.2 Selection of variables for creating PCA-based asset indices

Before proceeding with the PCA, the **first step** was to screen both the HEA CR data and the HSD to select variables and to check their frequency. For binary variables to be included in the PCA model, a minimum of 5% households should own the item. For a categorical variable, each of the categories was expected to have at least 5% frequency.

The **second step** was to check whether the indicators to be included in creating asset indices were likely to be good predictors of socio-economic status and their consistency of direction. For this, candidate indicators (which are likely to reflect socio-economic status of Dhanusha) from both the HEA CRD and the HSD were selected and their directions were checked. Indicators were primarily selected based on experiences of the MIRA-UCL partnership, work of others (Rutstein 2004; Johnson and Bradley 2008); Ministry of Health and population (MOHP) [Nepal], New Era, & Macro International Inc. 2007), and my own knowledge of the data sets and socio-economic status in the area. Then frequencies of the candidate variables were checked against land ownership (recoded to ordinal variable) as a well-known indicator of poverty for both datasets. Variables selected for inclusion in PCA were the ones that had higher frequencies for higher ordered categories of the established indicator (**Table 5.1 and 5.2**). The idea was that a higher ordered category of the well-known poverty indicator would have higher frequency amongst the variables included in the PCA (e.g. among households with no land, % ownership of TV will be low; and among households with large land % ownership of TV will be high). The variable 'daily waged labour' was recoded as non-daily waged labour so that its percentages would increase with higher category of wealth indicator. This helped the direction of all variables to be consistent (Hargreaves et al. 2007). **Table 5.1** shows the percentage of indicators chosen for the independent variables PCA-based asset index generated from HEA CRD, and **Table 5.2** shows that of the HSD by categories of well-known poverty indicator.

The **third step** involved checking the strength of associations and directions between variables using a correlation matrix. Since all the variables were included to measure dimensions of poverty, they are required to have positive and good correlations with each other. A correlation matrix was created using all candidate variables of PCA, and then variables that did not correlate well with most of the variables were excluded for the analysis. Also, at this stage if a pair of variables showed very high correlation ($r > 0.8$), one of the paired variables was excluded from the analysis to avoid multicollinearity and redundancy (Balen 2010, Field 2005). A pair of variables with very high correlation indicates that both of them reflect the same dimension of poverty and therefore are interchangeable. Overall, most variables in the two datasets correlated well and were suitable to include in PCAs, although the correlations between variables from CR data were generally higher than in the household surveillance data. The significance value of correlation of a variable with most other variables was set to be <0.05.

In this chapter, I focused on examining the correlations of PCA-based asset indices of the two datasets using variables that best predict the wealth status within each data set. Therefore, initially I selected variables for inclusion in PCAs of both HEA CRD and HSD based on the relations of variables within each dataset. Thus selection of PCA variables for each data set was independent, and based on correlations with other variables within the dataset. These PCAs are mentioned as **HEA independent variables PCA** and **HSD independent variables PCA** in the later part of the chapter. The correlations of independent variables PCAs of the two data sets are shown in **Table 5.3** and **Table 5.4**.

The indicators, which appeared to be good indicators to include in the **HEA independent variables PCA** showing variability and passing the test of directionality, were the followings:

- Assets owned by wealth groups: motorbike, oxcart, colour TV, black and while TV, radio cassette player, CD player, land ownership in bigha (one bigha is approximately 0.68 hectare);
- Ownership of agricultural tools: irrigation pump, grass chopper, thresher;
- Livelihood options: involved in business, have regular job, agricultural labour
- Ownership of livestock: Number of buffaloes, number of cow /oxen.

During screening stage of the PCA of the HEA CR data, variables that were excluded were ownership of rickshaw (1%) due to insufficient variability; and ownership of goat, cycle, tractor, hand pump due to lack of consistent relationship with landownership.

The indicators which were acceptable in terms of variability and showing consistent relationship with well known indicators of poverty (land ownership and reading skill), and were selected to be included in **HSD independent variables PCA** were the followings:

a. Assets owned by households: motorbike, oxcart, colour TV, black and while, TV, radio, sewing machine, land ownership in bigha;
b. Housing characteristics: number of rooms, wall materials, roof materials, improved toilet, electricity;
c. Reading skill of women in household,
d. Livelihood option: own production is main source of food.

Among HSD variables, the indicators on water source and ownership of tractor were excluded from independent variables PCA due to lack of consistent relationship with reliable poverty indicator (landownership). The variable 'Black & white TV' showed negative correlation with another variable (Colour TV) but showed good correlation with all other variables and therefore was included in the PCA model. Ownership of a thresher was excluded as only 1.2% had owned this item. Although motorcycles and irrigation pumps (3.0%, 3.4%) were owned by <5%, these were included as the HSD frequency of 3% (total household 4,121) included reasonable number of households.

Ownership of livestock and livelihood options (business, day labour) were not available for the total data collection period of the HSD and were therefore not included in these HSD independent variables PCA.

Following similar processes described in earlier section of this chapter, PCAs were repeated to generate asset indices from the two datasets using a set of variables that were comparable between them. Therefore, the PCAs including comparable variables from the data sets are mentioned as **HEA matched variables PCA** and **HSD matched variables PCA** in the later part of this chapter. The matched variables PCAs were done to assess whether the nature of association between matched variables PCA-based indices of the HEA and the HSD data were different from the association between independent variables PCA-based indices of the two datasets. This was done to understand whether the choice of indicators for independent variables PCAs have influenced the nature of associations of asset indices of the two datasets. To allow inclusion of more comparable variables in the matched variables PCA, HSD variables that were comparable (e.g. ownership of livestock) but may not be available for the whole period were also included in the list of variables for matched variables PCAs from the both datasets. The variable 'motorbike' was available in both datasets, but was not included in the matched variables PCA due to low frequency in the subset of HSD used in this PCA. Some other adjustments were done to enable inclusion of more of the comparable variables in the PCAs. For example, daily waged labour in the HSD was considered comparable to agricultural labour in HEA dataset. The three variables about involvement in small, medium, and large trade in the surveillance data were also combined to create one variable comparable to the variable 'involved in businesses' in the HEA CRD. After careful considerations, 12 variables which fulfilled the inclusion criteria for matched variables PCA were available in both datasets.

Table 5.1 Percentage of interviews reported owning assets that are included in Independent variables PCA of HEA CRD, by land ownership categories (a well-known poverty indicator) (n =202)

Indicators	No land (%)	< 1 bigha (%)	>=1 bigha (%)	Total (%)
Have radio	80.0	93.8	95.4	91.1
Have black & white TV	16.0	26.2	74.7	44.6
Have colour TV	4.6	6.0	50.6	24.8
Have motorbike	10.0	13.1	54.0	26.7
Have oxcart	10.0	16.9	75.9	40.6
Have cassette player	16.0	47.7	75.9	52.0
Have CD player	14.0	23.1	67.8	40.1
Have grass chopper	4.0	4.6	24.1	12.9
Have thresher	6.0	6.2	59.8	29.2
Have irrigation pump	7.7	8.0	66.7	33.2
Have regular job	18.0	32.3	82.8	50.5
Agricultural labourer	62.0	49.2	1.1	31.7
Involved in businesses	30.0	46.2	67.8	51.5
Have buffaloes: None	86.0	63.1	18.4	49.5
1	14.0	27.7	57.5	37.1
2	0.0	9.2	24.1	13.4
Have cow/oxen: None	60.0	24.6	18.4	30.7
1	24.0	49.2	9.2	25.7
2	12.0	15.4	36.8	23.8
3-5	4.0	10.8	35.6	19.8

Distribution of landownership in HEA CRD: No land = 24.8%; <1 bigha= 32.2%; >=1 bigha = 43.1 respectively.

Table 5.2 Percentage of households owned assets (indicators) that are included in Independent variables PCA of the HSD, by land ownership categories (a well-known poverty indicator) (n = 4,121)

Indicators	No land (%)	<1 bigha (%)	>=1 bigha (%)	Total (%)
# of rooms: <=1	24.9	12.9	2.6	11.5
2	38.1	30.4	12.8	26.2
3	21.5	25.7	19.6	23.4
4	9.1	18.5	24.0	19.1
5 or more	6.4	12.5	41.2	19.9
Wall materials: Plank of wood/Thatched	10.9	13.7	12.4	12.8
Mud and brick/stone/metal sheet	83.6	74.8	64.1	73.0
Cement and brick	5.6	11.6	23.6	14.3
Roof materials: Thatched roof	54.1	24.4	5.6	22.4
Tile roof	12.4	19.3	16.2	18.1
Traditional tiles	31.0	47.1	58.3	48.1
Cement	2.5	9.1	19.9	11.4
Improved toilet	5.9	8.7	28.0	13.8
Reading skills: Cannot read	91.2	83.9	58.0	77.6
Reads with difficulty	3.8	6.2	9.7	6.9
Reads easily	5.0	9.9	32.4	15.5
Main food source is own production	2.5	59.5	97.0	63.9
Have electricity	24.3	42.7	54.4	44.0
Have radio	34.2	53.2	75.2	57.3
Have black & white TV	4.3	10.2	20.3	12.4
Have colour TV	3.6	10.9	25.3	14.1
Have oxcart	0.2	2.6	23.3	8.1
Have motorcycle	0.2	1.0	8.7	3.0
Have irrigation pump	0.2	0.8	10.7	3.4
Have sewing machine	1.6	4.3	9.3	5.3

Distribution of landownership in household surveillance data: No land = 9.7%, <1 bigha =63.2 %, >=1 bigha = 27.1%.

Table 5.3 Pearson correlations between selected variables included in independent variables PCA of HEA data

Pearson Correlation	Regular job	Agricultural labour	Business	Motor bike	Oxcart	Cassette player	CD player	Colour TV	Grass chopper	Radio	Thresher	Irrigation pump	Black & white TV	Land ownership	Own buffaloes	Own Cow/ Oxen
Regular job	1															
Agricultural labour	.411	1														
Business	.366	.318	1													
Motorbike	.419	.411	.206	1												
Oxcart	.496	.476	.298	.571	1											
Cassette player	.337	.389	.316	.357	.512	1										
CD player	.467	.405	.269	.464	.558	.524	1									
Colour TV	.407	.391	.212	.509	.530	.459	.444	1								
Grass chopper	.262	.262	.196	.302	.254	.251	.319	.259	1							
Radio	.142	.123	.218	.150	.259	.221	.150	.139	.120	1						
Thresher	.462	.414	.297	.571	.578	.334	.474	.439	.436	.201	1					
Irrigation pump	.445	.412	.158	.525	.660	.340	.518	.473	.357	.220	.704	1				
Black & white TV	.469	.439	.352	.471	.658	.543	.588	.432	.280	.280	.454	.469	1			
Land ownership	.568	.576	.307	.495	.612	.467	.490	.493	.282	.180	.559	.590	.527	1		
Own buffaloes	.349	.375	.191	.325	.552	.364	.319	.245	.134	.135	.391	.361	.388	.544	1	
Own Cow/ Oxen	.390	.335	.349	.367	.547	.444	.424	.379	.313	.170	.400	.380	.499	.479	.473	1

Table 5.4 Pearson correlations between selected variables included in independent variables PCA of Household Surveillance Data

Pearson Correlation	Reading skill	Land ownership	# of rooms	Own production is main source of food	Wall material	Roof material	Improved toilet	Have electricity	Have radio	Have black & white TV	Have colour TV	Have ox cart	Have motor cycle	Have Irrigation pump	Have sewing machine
Reading skill	1														
Land ownership	.331	1													
# of rooms	.224	.441	1												
Own production is main source of food	.219	.577	.361	1											
Wall material	.156	.136	.177	.105	1										
Roof material	.228	.374	.370	.359	.331	1									
Improved toilet	.337	.280	.264	.156	.283	.245	1								
Have electricity	.163	.176	.231	.147	.227	.202	.191	1							
Have radio	.177	.275	.313	.264	.096	.230	.173	.193	1						
Have black & white TV	.183	.174	.212	.121	.090	.143	.178	.191	.197	1					
Have colour TV	.179	.247	.253	.183	.208	.206	.282	.370	.187	-.057	1				
Have ox cart	.144	.367	.244	.195	.044	.156	.112	.050	.129	.103	.099	1			
Have motorcycle	.225	.223	.159	.116	.124	.136	.253	.085	.094	.129	.172	.098	1		
Have irrigation pump	.098	.260	.174	.134	.063	.118	.128	.028	.095	.073	.099	.261	.097	1	
Have sewing machine	.146	.122	.147	.096	.117	.120	.179	.119	.121	.083	.183	.051	.100	.074	1

Table 5.5 shows the variables included for the PCA-based asset indices of the two data sets, for both independent variables PCA and matched variables PCA models. In all cases, variables with binary and ordinal coding were included in PCA models, and no dummy variables were created for ordinal variables. The conventional approach described by Vyas and Kumaranayake (2006), and Filmer and Pritchett (2001) suggest converting ordinal variables into binary dummy variables before inclusion in PCA. However, Kolenikov and Angeles (2009) examined the use of binary dummy variables in comparison to use of original ordinal variables and concluded that PCA on ordinal data yielded more accurate results which explained higher variance in the data set. They have therefore recommended using ordinal variables without converting them into dummy variables to have better results (ibid). PCA uses assumption of linear associations between variables. Using binary dummy variables in places of ordinal categorical variables violates this assumption, and therefore difficulties of using binary dummy variables as PCA-variables were also reported by others (Howe, Hargreaves, and Huttly 2008).

Table 5.5 Variables included in PCA-based asset indices of HEA community representatives' data and Household surveillance data (HSD) in Dhanusha

Indicators	HEA Independent variables PCA (n = 202)	HSD Independent variables PCA (n = 4121)	Matched variables PCA (HEA data and HSD)	Variable type
Have oxcart	Yes	Yes	Yes	Binary
Have colour TV	Yes	Yes	Yes	Binary
Have motorbike	Yes	Yes	-	Binary
Have cassette player	Yes	NA†	NA	Binary
Have CD player	Yes	NA	NA	Binary
Have grass chopper	Yes	NA	NA	Binary
Have radio	Yes	Yes	Yes	Binary
Have black & white TV	Yes	Yes	Yes	Binary
Have thresher	Yes	-	Yes	Binary
Have irrigation pump	Yes	Yes	Yes	Binary
Have buffaloes	Yes	-	Yes	Ordinal
Have cow/oxen	Yes	-	Yes	Ordinal
Land ownership (bigha)	Yes	Yes	Yes	Ordinal
Agricultural labourer	Yes	-	Yes	Binary
Have regular job	Yes	Yes	Yes	Binary
Involved in business	Yes	-	Yes	Binary
Wall materials	NA	Yes	NA	Ordinal
Roof materials	NA	Yes	NA	Ordinal
# of rooms	NA	Yes	NA	Ordinal
Type of toilet	NA	Yes	NA	Ordinal
Have electricity	NA	Yes	NA	Binary
Sewing machine	NA	Yes	NA	Binary
Can read	NA	Yes	NA	Ordinal
Own production is main source of food	NA	Yes	NA	Ordinal

† Not applicable

5.4.3 Conducting Principal component analysis (PCA) to create asset indices

After selecting variables for inclusions in the models, PCAs were conducted on the HEA CRD and the HSD. The data collection unit for HEA data was wealth group, but the pre-existing wealth groups were ignored for PCA. While creating the PCA-based indices, each of the wealth group included in the HEA CRD was considered as a case. The criteria checked and steps followed to finalise PCA models (both independent variables and matched variables PCA) on both the HEA CRD and the HSD are described in the following section.

Checklists for PCA:

PCAs were done using factorial analysis procedures in SPSS (Field 2005) to generate the asset indices when conditions for a satisfactory PCA were met. The following conditions were checked:

1. **Determinant:** The determinant statistics of the correlation matrix, indicating whether singularity or multicollinearity is a problem, should be >0.00001 to be acceptable (Field 2005).

2. **Kaiser-Meyer-Olkin and Bartlett's test**: Adequacy of sample size was assessed by the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, for which values between 0.8 and 0.9 are considered good, and values above 0.9 are considered excellent (Field 2005). The Bartlett's test of sphericity is a measure of factorability, which tests the null hypothesis that the correlation matrix is an identity matrix. In an identity matrix, all variables are completely independent to one another (Field 2005). The significance value <0.05 here indicates that the correlation matrix was not an identity matrix and relationship between variables were factorable.

3. **Variability, residuals and reliability:** Several PCAs were run for both datasets (HEA CRD and HSD), and the final PCAs (independent variables and matched variables) were chosen as the ones which explained the highest variability (Kolenikov 2004), had acceptable level of residuals, and generated a reliable scale. Residuals measure the difference between the observed correlation and the correlation of the model (Field 2005), and assess the fit of a model. Field

(2005) suggested that a model with <=50% residuals with a value <0.05 are indicative of a good model. The smaller the percentage of residuals, the better is the model. For both independent variables PCA and matched variables PCA, the Chronbach's alpha, a measure of scale reliability, for final PCA chosen needed to have a value of 0.7 or higher to be acceptable (Field 2005).

5.4.4 Conversion of HEA CRD wealth group level asset index to VDC level asset Index

The HEA CRD provided description of a typical household in different wealth groups and the proportion of households in the different wealth groups in a VDC. However, in order to compare the results of the HEA description of poverty with that of the HSD, I needed to have both indices to be able to assess poverty status of comparable units, such as of VDCs rather than wealth group or household level poverty status. For this purpose, the HEA CRD and HSD asset indices were both adjusted to reflect VDC-level index.

The process of converting HEA CRD wealth group level asset index to a VDC-level index required two indicators in each VDC: **1.** Asset index score of each wealth group, **2.** Percentage of households in each wealth group. The process begins with multiplication of the asset index score of each wealth group by the percentage of households in the respective wealth group. Next, the mean of the weighted asset index of the 3-4 wealth groups per VDC generated a weighted average asset index for each VDC.

In summary, the HEA VDC level asset index = mean (a1b1, a2b2, a3b3, a4b4),

Where,

a1 = Proportion of households in the Very Poor wealth group,

a2 = Proportion of households in the Poor wealth group,

a3 = Proportion of households in the Middle wealth group,

a4 = Proportion of households in the Better-off wealth group,

b1 = asset index score for Very Poor wealth group,

b2 = asset index score for Poor wealth group,

b3= asset index score for Middle wealth group,

b4 = asset index score for Better-off wealth group.

5.4.5 Conversion of household level asset index of the HSD to VDC level asset index

Using the surveillance data, VDC level asset index were created by averaging household level index scores per VDC. The distributions of household level asset indices (independent variables and matched variables) were apparently normal, so mean of household level index score generated VDC level asset index.

In summary, the HSD VDC level asset index was created as:

HSD VDC level asset index = Sum (C_1, C_2, C_3…..C_n)/ n households in a VDC,

Where,

$C_{1…n}$ = PCA-based asset index score per household (1 to nth household) in a VDC,

n = number of households per VDC

5.4.6 Merging HEA CR and HDS indices into a comparable dataset

Finally, a comparable dataset was prepared by merging the HEA and the HSD VDC level indices. For each dataset, both independent variables and matched variables PCAs indices were available in the merged data. This comparable data allowed assessment of association between the indices of the two datasets. Pearson's correlation coefficient test was used to estimate associations between the indices and $P<0.05$ of the test was considered significant.

5.5 Results

5.5.1 Characteristics of CR and HH data wealth indices

Table 5.6 shows the characteristics of the PCAs using selected indicators from PCA analysis of the HEA CR data and the HSD. Determinant estimates from PCAs of both data sets were >0.0001. Satisfactory KMO (>0.8) statistics shows that there were enough cases to perform a PCA for both HEA and the surveillance data. In addition, the Bartlett's tests for both datasets were highly significant, meaning that the relations between the variables in each dataset were factorable.

Table 5.6 Characteristics of wealth indices of HEA CR data and HSD

Indicators	Data sources			
	HEA CRD		HSD	
	Independent variables PCA (n = 202)	Matched variables PCA (n = 202)	Independent variables PCA (n = 4121)	Matched variables PCA (n = 2498)
Determinant	0.001	0.005	0.081	0.218
KMO measure of sampling adequacy	0.925	0.902	0.824	0.766
Significance of Bartlett's test (*P* value)	<0.001	<0.001	<0.001	<0.001
Variability explained (%)	44.1	45.9	25.0	24.0
Residuals with value >0.05 (%)	46.0	60.0	55.0	68.0
Cronbach's Alpha	0.89	0.84	0.75	0.70
Total variables (ordinal, binary)	16 (3, 13)	12	15 (5, 10)	12

The models that generated PCA-based asset indices using independent variables from HEA CRD and from HSD both had good fit, reflected by the amount of residuals. Residuals with a value >0.05 (difference between observed correlation and correlation of the model) was <=50% (a guideline suggested by Field 2005) for the PCA on HEA data, and was slightly above 50% for the PCA on surveillance data. However, the matched variables PCAs of both datasets had higher residuals (HEA community representatives' data: 60%; Surveillance data: 68%). The Cronbach's alpha, indicator of scale reliability and reproducibility (Bhuiya 2007) indicated that the criteria for a satisfactory PCA were met for all the indices generated, and therefore the indices generated were acceptable.

Figures 5.1 - **5.8** show the distribution of indices at wealth group level and VDC level, generated from independent variables and matched variables PCAs of the HEA community representatives' data and the household surveillance data. The asset indices generated from both datasets had roughly normal distribution with slightly positive skewness (**Figure 5.1 - 5.8**).

Figure 5.1 Distribution of independent variables PCA-based asset index (wealth group level) of HEA community representatives' data in Dhanusha, unweighted data

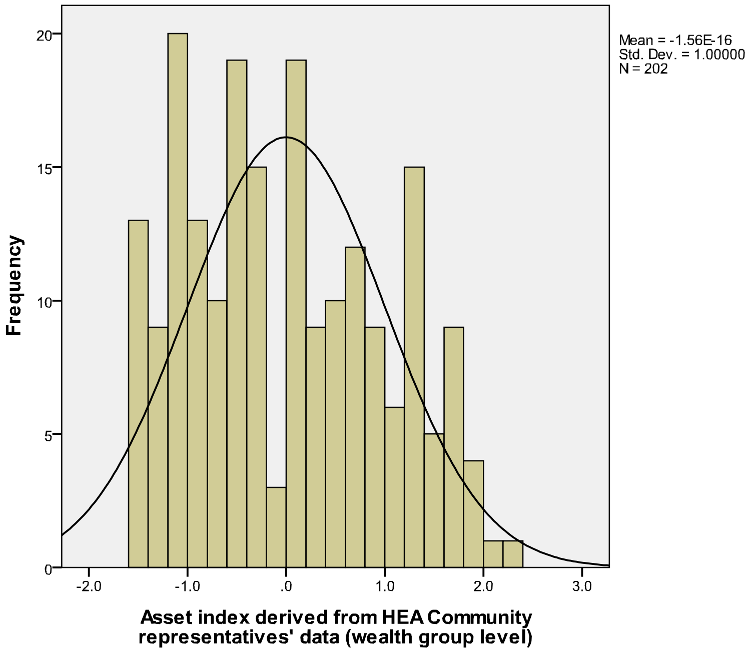


Figure 5.2 Distribution of independent variables PCA-based asset index (VDC level) of HEA community representatives' data in Dhanusha (average asset scores weighted by proportion of each wealth group in that VDC)

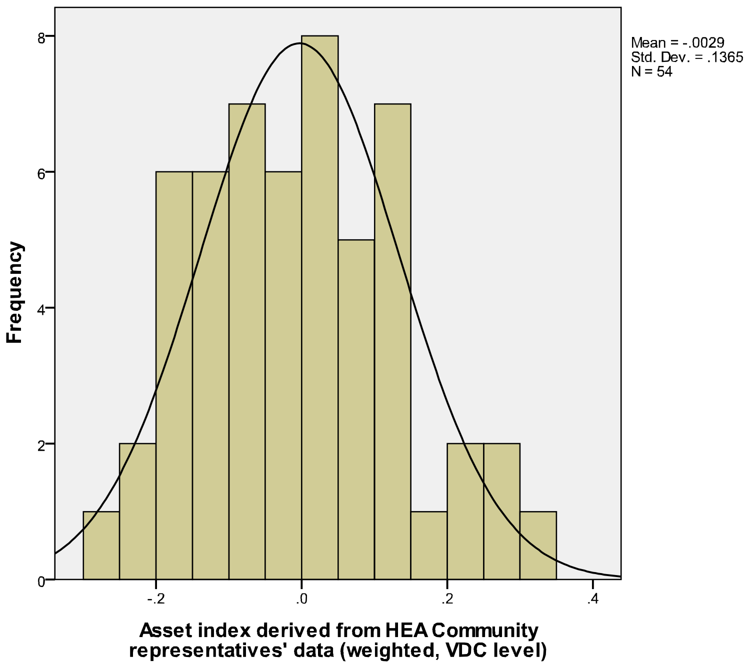


Figure 5.3 Distribution of matched variables PCA-based asset index (wealth group level) of HEA community representatives' data in Dhanusha

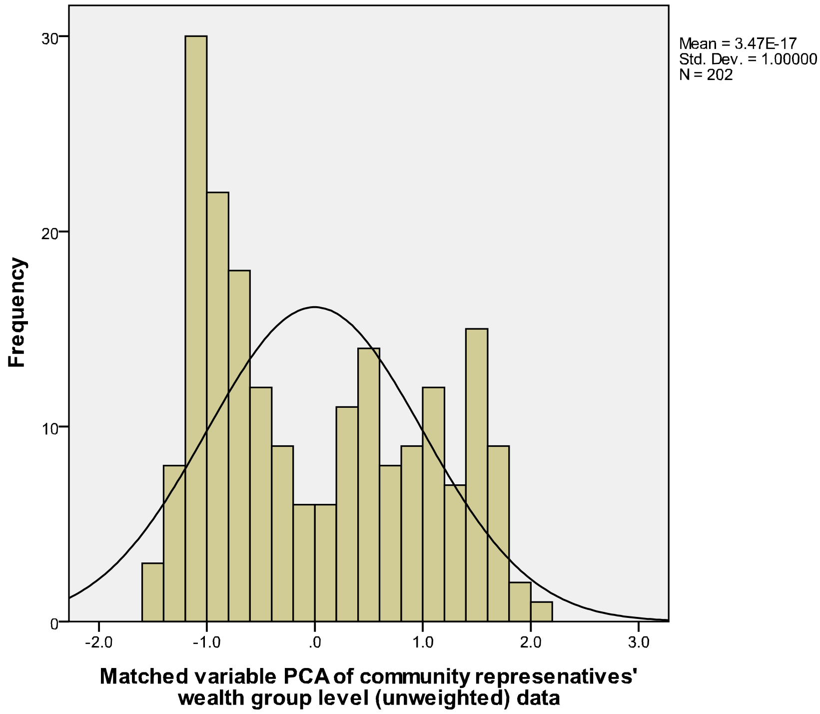


Figure 5.4 Distribution of matched variables PCA-based asset index (VDC level) of HEA community representatives' data in Dhanusha

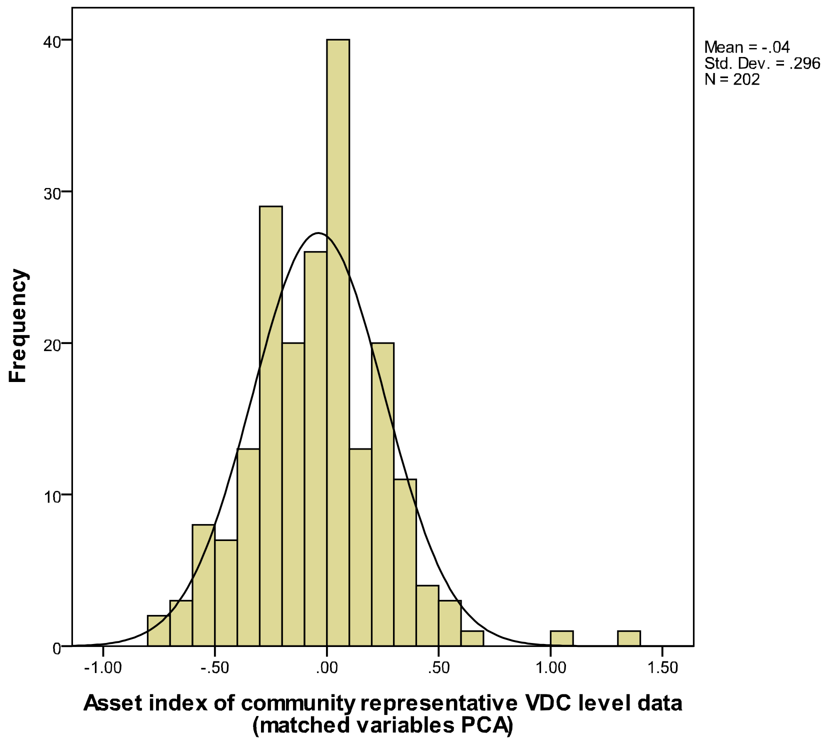


Figure 5.5 Distribution of independent variables PCA-based asset index (household level) of household surveillance data collected in Dhanusha

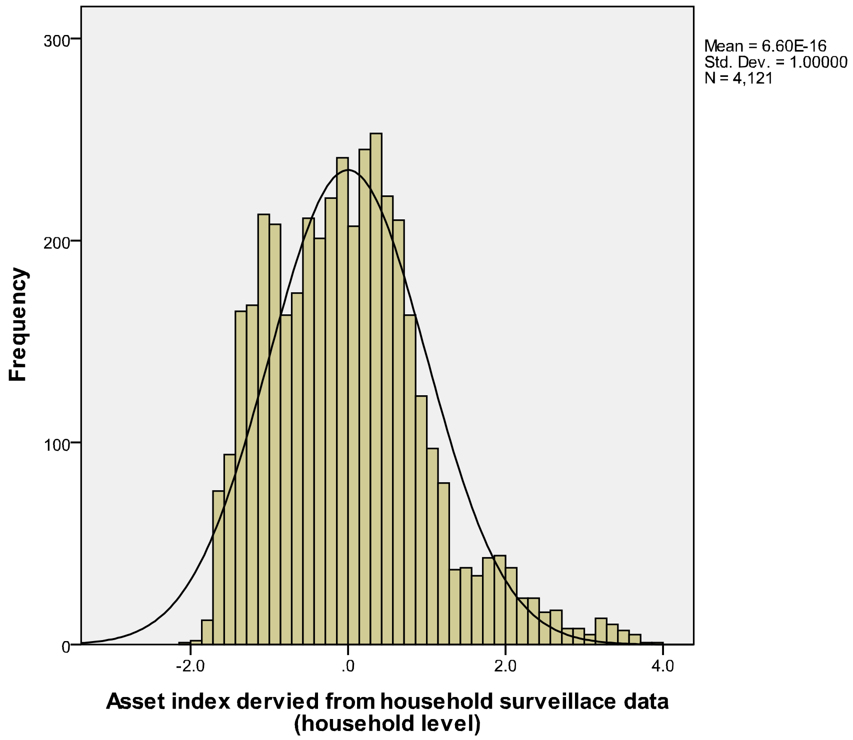


Figure 5.6 Distribution of independent variables PCA-based asset index (VDC level), household surveillance data collected in Dhanusha, averaged by VDC

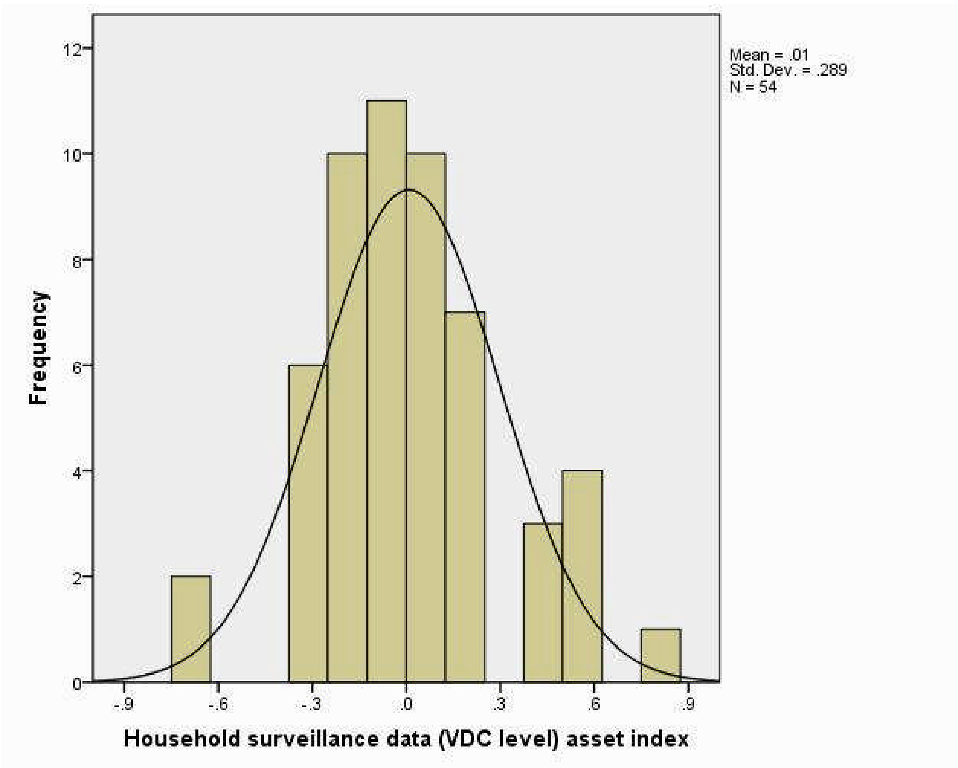


Figure 5.7 Distribution of matched variables PCA-based asset index (household level) of household surveillance data in Dhanusha

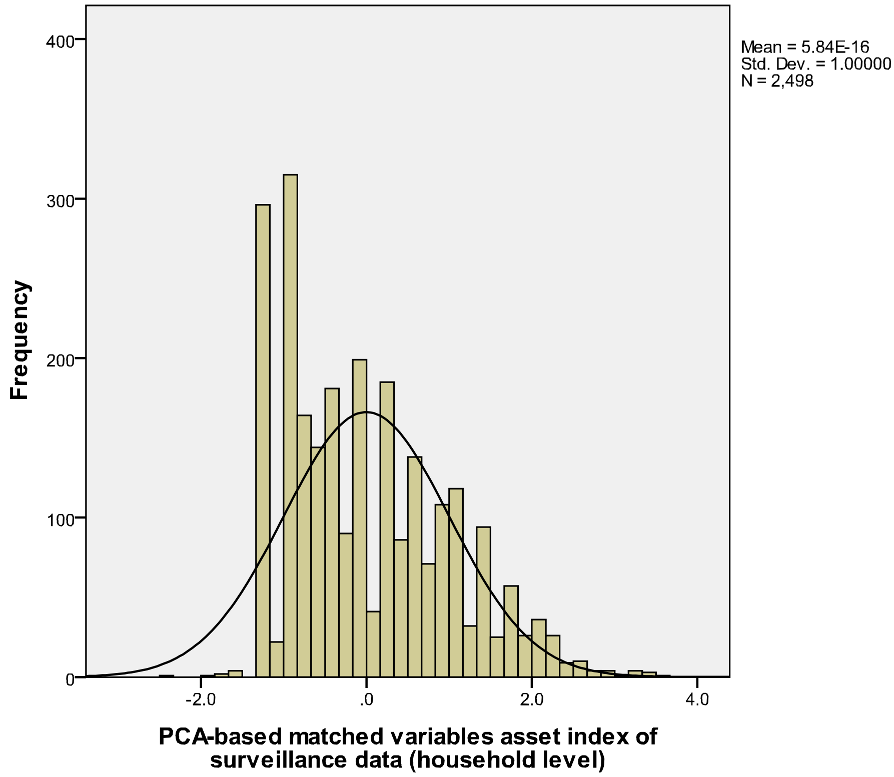
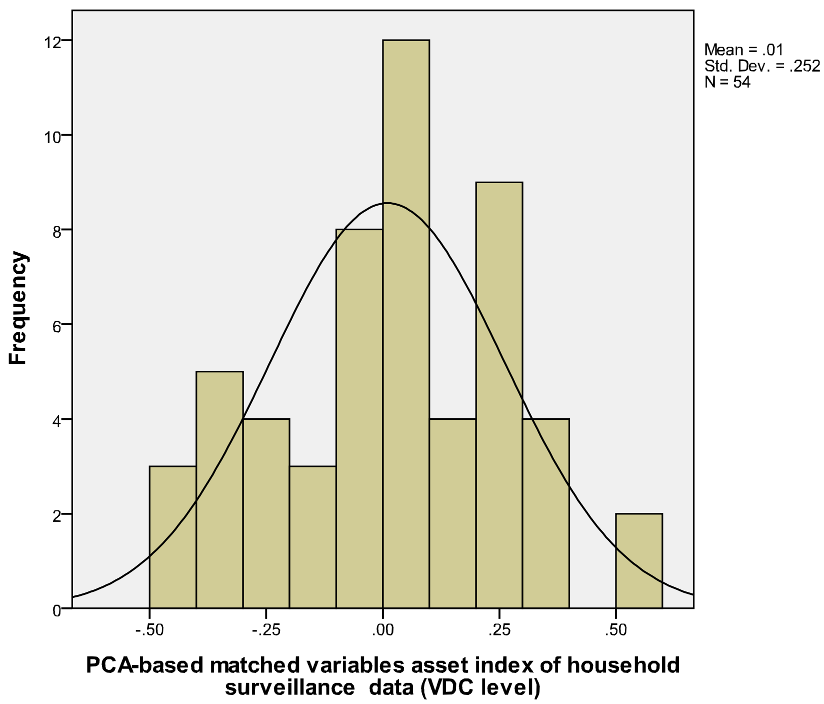


Figure 5.8 Distribution of matched variables PCA-based asset index (VDC level) of household surveillance data, collected in Dhanusha, , averaged by VDC



5.5.2 Indicators used in description given by different respondents

Table 5.7 presents the variables used in independent variables PCAs on HEA community representatives' data, and household surveillance data and their component scores, represented by factor loadings. Among the three high ranked variables (those that PCA assigned a high weight) in the independent variables PCAs, land ownership was common for both datasets, but others were not the same for the two data sets (Oxcart, black and white TV in the HEA community representatives' data; number of rooms, roof materials in the surveillance data). In general, indicators of housing characteristics were ranked high in the PCA of household surveillance data, whereas these variables were not available in the data of HEA community representatives.

Table 5.8 presents the variables used in matched variables PCAs on HEA community representatives' data, and household surveillance data and factor loadings of each variable. For both the HEA and the surveillance data, factor loadings for a specific indicator were similar between the independent variables PCA and the matched variables PCA within each dataset.

Table 5.7 Factor loadings for independent variables Principal component analysis (PCA) of HEA community representatives' data (CRD), and household surveillance data (HSD) in Dhanusha

Indicators	HEA CR (n = 202)	HSD (n = 4121)	Variable type
Have oxcart	0.835	0.402	Binary
Land ownership	0.795	0.728	Ordinal
Have black & white TV	0.757	0.346	Binary
Have thresher	0.746	-	Binary
Have irrigation pump	0.745	0.328	Binary
Have CD player	0.720	-	Binary
Have motorbike	0.696	0.380	Binary
Have regular job	0.673	-	Binary
Have cow/oxen	0.663	-	Ordinal
Have colour TV	0.660	0.491	Binary
Have cassette player	0.654	-	Binary
Agricultural labourer	0.647	-	Binary
Have buffaloes	0.592	-	Ordinal
Have grass chopper	0.458	-	Binary
Involved in business	0.452	-	Binary
Have radio	0.307	0.486	Binary
# of rooms	-	0.660	Ordinal
Roof materials	-	0.607	Ordinal
Main food source is own production	-	0.599	Binary
Type of toilet	-	0.554	Ordinal
Can read	-	0.524	Ordinal
Have electricity	-	0.443	Binary
Wall materials	-	0.408	Binary
Sewing machine	-	0.311	Binary

Table 5.8 Factor loadings for matched variables Principal component analysis (PCA) of HEA CRD, and HSD in Dhanusha

Indicators	HEA CRD (n = 202)	HSD (n = 2498)	Variable type
Land ownership	0.788	0.796	Ordinal
Have oxcart	0.845	0.611	Binary
Have black & white TV	0.749	0.291	Binary
Have thresher	0.756	0.368	Binary
Have irrigation pump	0.755	0.506	Binary
Have regular job	0.691	0.274	Binary
Have cow/oxen	0.665	0.667	Ordinal
Have colour TV	0.653	0.332	Binary
Have radio	0.316	0.441	Binary
Agricultural labourer	0.658	0.645	Binary
Have buffaloes	0.616	0.285	Ordinal
Involved in business	0.461	0.225	Binary

5.5.3 Association between asset indices generated by the HEA and the surveillance data

F**igure 5.9** and **Figure 5.10** present the scatterplots of independent variables PCA-based asset indices and matched variables PCA-based indices respectively, as generated from the HEA and the surveillance data. Both figures show VDC level asset index scores from HEA CRD against the index score of the HSD from 54 matched VDCs. The straight lines in the figures show the line of equality. With perfect correlation each data point would appear on this line. The broken lines show the correlation pattern between the indices of the two datasets. Figure 5.9 reflects that the correlation between the two indices generated by independent variables PCAs was inverse and weak ($r = -0.292$, $P = 0.032$). Similar pattern of inverse correlation was evident for the matched variable PCA scores of the two data sets, although the association was barely significant ($r = -0.231$, $P = 0.046$).

Figure 5.9 Scatter plot of independent variables asset indices of HEA Community representative's data and household surveillance data in Dhanusha district, Nepal (both indices shown for VDC level)(n =54)

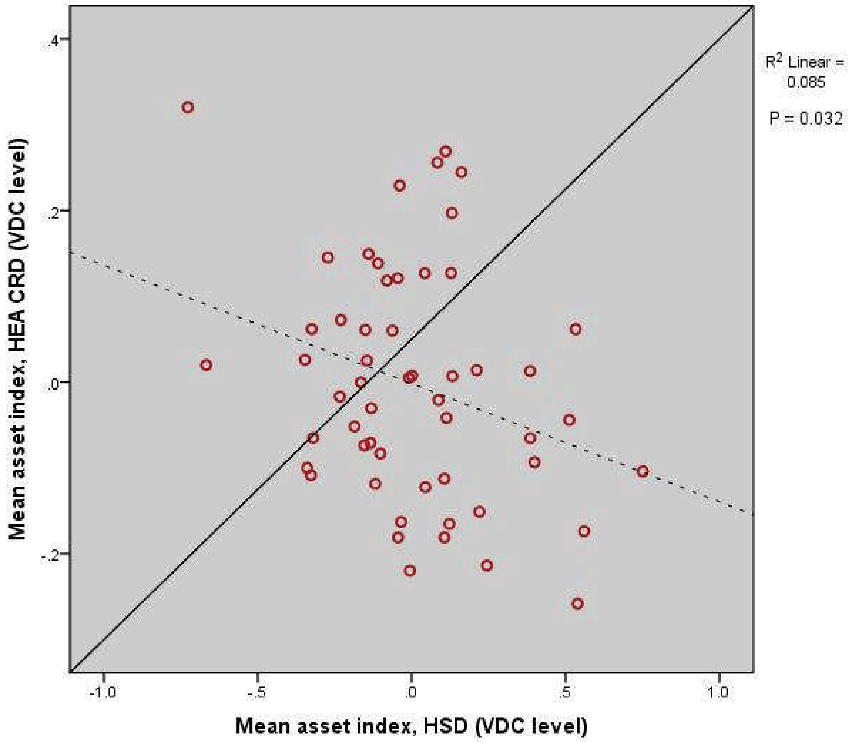
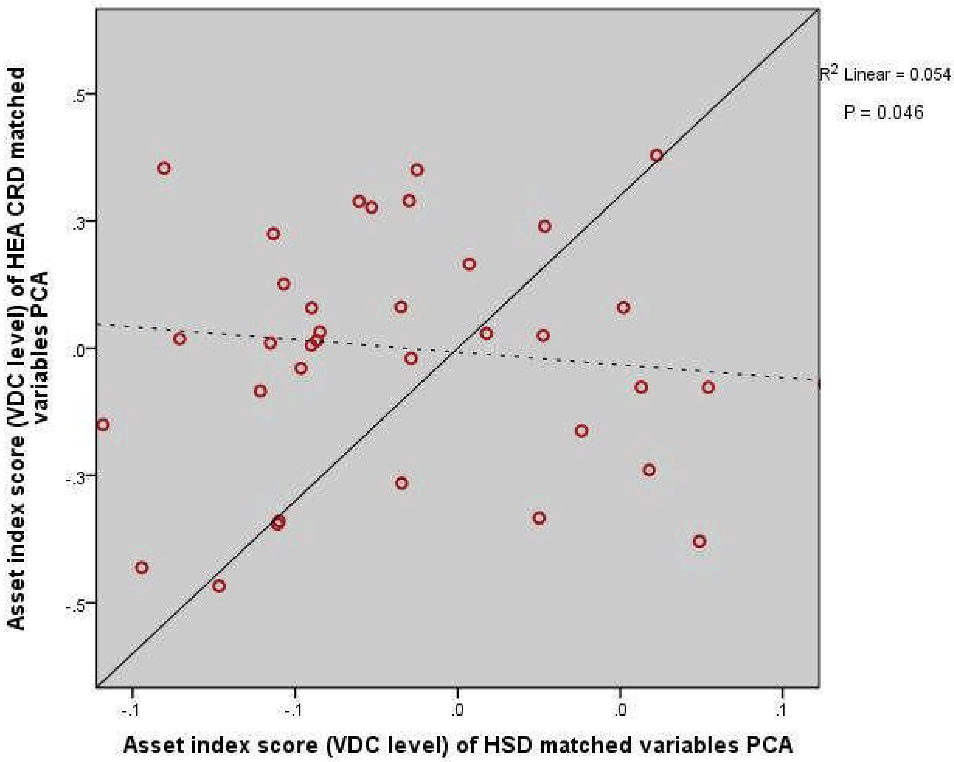


Figure 5.10 Scatter plot of matched variables asset indices of HEA Community representative's data and household surveillance data in Dhanusha district, Nepal (both indices shown for VDC level) (n =54)



5.6 Discussion

This chapter focused on assessing how well the asset indices created using the HEA description of wealth groups correlated with the indices from the HSD. The discussion includes the characteristics of the PCAs conducted and the indices generated, and associations between indices derived from independent variables PCAs and matched variables PCAs of the two datasets.

5.6.1 PCAs and their characteristics

The PCAs conducted on both the HEA and the surveillance data had adequate cases, as the KMO statistics for sampling adequacy reflected (Field 2005). Hare et al. (1998) suggested that the sample size for PCA should be >=100 and minimum observations should be at least five times the variables included in the analysis. For both independent variables PCA (16 variables) and matched variables PCA (12 variables), the HEA CRD used 202 wealth group interview cases. For the HSD, the independent variables PCA (15 variables) and matched variables PCA (12 variables) used 4121 and 2498 household interviews respectively. Therefore, both the HEA and the household surveillance data sample sizes were reassuringly adequate to conduct PCA on these datasets. The PCAs conducted on both the datasets were also internally consistent as the indices had high reliability scores (all Cronbach's alpha >=0.7). The Cronbach's alpha statistics, measure of reliability of PCA-based asset indices, was not available for all of the studies using PCAs, but my findings were consistent with the study of Bhuyia et al. (2007) in Bangladesh (0.80); and with Skordis-Worall et al. (2011) in India (0.81), and Balen et al. (2010) in China (0.67).

The two important determinants of performance of PCA are proportion of variance explained and number of variables used (Kolenikov and Angelse 2009). The percentage of variability in the dataset explained by PCA-based asset indices of CRD were 44%, 46% respectively for independent variables and matched variables PCA, and was 24% and 25% respectively for indices generated from the household surveillance data. The variability explained by PCAs of the HEA community representatives' data was higher than what was found in other studies using household level data in Bangladesh (15%) (Arifeen et al. 2008), in Brazil (11%) and Ethiopia (16%) (Vyas and Kumaranayake

2006), in South Africa (23%) (Hargreaves et al. 2007), and in 10 other countries (12% - 35%) (Houweling, Knust and Makenbach 2003). The higher variability explained by HEA PCA may partially be accounted for by the fact that the indices derived from generalised descriptions of the wealth groups were collected from group interviews. In total, 54 group interviews generated descriptions of the 202 wealth groups, and therefore the variability in the descriptions may include less variability than the variability in description gathered by the surveillance data interviewing larger samples of individual households (>= 2498 households) describing their wealth status. The PCAs done using the HEA data variables were therefore able to explain more variability. Although the variability explained by the surveillance data asset indices was lower than indices derived from the HEA data, it still explained higher variability than what most of the other studies had found (Arifeen et al. 2008; Vyas and Kumaranayake 2006; Hargreaves et al. 2007).

The asset indices (Figure 5.1-5.8), derived from both HEA CRD and HSD were apparently normally distributed with a slight positive skewness. This is usual for a developing country like Nepal because the majority of people in the country are poor and only a small percentage of people are at the richest end of the spectrum. The positive skewness also confirms that many households in Dhanusha had a low asset index score. This is not surprising, as other studies have also reported income inequalities in Nepal (Wagle 2010, UNDP 2009). This finding is consistent with findings of Rutestein (Rutestein 2004a), who reported similar distribution patterns of asset index in India, Kenya, and Nepal (skewness =0.972, 1.96, 2.28 respectively). Rutestein had used the national level data to generate asset index in Nepal, and therefore it is likely that his index from Nepal data had a higher skewness compared to only slight positive skewness (<1.0) for the indices in Dhanusha. Nepal is a diverse country in terms of its ecological zones and their poverty status within the country (UNDP 2009). Thus, national level data contains a wider spread of economically diverse households compared to that in a district like Dhanusha, which is relatively homogeneous. Kolenikov and Angeles (2004) shared their experience that a skewed but not heavy tailed distribution (containing few extreme cases that make it highly skewed) did not affect the performance of the PCA.

The associations between indicators and their suitability to be included in the PCA within each dataset were examined separately to generate both independent and matched variables indices from the two datasets. In terms of independent variables PCA models, the indices from the two data sets included seven of the same variables (i.e. around half the variables were matched). The reason behind including different variables for each PCA was partly that the variables suitable to perform PCA within a dataset were sometimes not available in the other datasets. For example, 'ownership of CD player' and 'ownership of Cassette player' variables were suitable for inclusion in PCA of the HEA CRD, but were not available in the household surveillance data. Similarly, some of the variables included in independent variables PCA of the surveillance data (number of rooms, wall materials, roof materials, type of toilet, reading skills) were not available in the HEA data. The association between variables varied by the datasets and guided the decision of whether or not to include them in a PCA.

The independent variables PCA models from both data sets assigned similar factor loadings (weight) to the variable 'ownership of land' compared to that of other variables. This indicator is a commonly used indicator of poverty, associated with food security and malnutrition in Nepal (Maharjan and Joshi 2011) and other settings (Deolalikar 2005). This indicator had the highest factor loading for the asset index generated from the surveillance data, and had the second highest factor loading for the index of HEA data (both independent variables PCA). Assigning high factor loadings to the 'ownership of land' by both PCAs validates that both PCA models were a good proxy of wealth status in Dhanusha. However, some variables used by PCA models of both the datasets had quite different factor loadings assigned by the two datasets (e.g. oxcart: 0.835, 0.403; and irrigation pump: 0.745, 0.328 for the HEA CR and the household surveillance data respectively). The weight assigned to a particular variable is relative for a specific data set (in relation to correlation of all variables included in the PCA). The independent variables PCAs included some of the variables specific for the each dataset in addition to having indicator common for both datasets. This will have influenced the different factor loadings of the variables common for the two datasets. Prakongsai (2006) also had similar findings of PCA assigning different weight to the same variable when data from a different period was used.

Comparison of factor loadings of the matched variables PCAs from the two datasets revealed that 'ownership of land' also had high factor loading in these models, consistent with what has been observed for independent variables PCA models. Out of the total 12 variables included in matched PCAs, in total three variables (land-ownership, ownership of cow/oxen, agricultural day labour) had similar factor loadings assigned by indices of both HEA community representative data and household surveillance data. This indicates that the ownership of assets and internal structure of wealth indicators within each dataset based on the reporting of HEA community representatives and individual households in Dhanusha were somewhat different.

Kebede (Kebede 2009) explained the issue of including different variables in participatory wealth ranking compared with the household data. In participatory wealth ranking, each household is assigned a particular rank based on assets owned by the households. Kebede also explained that the visibility of resources varies, e.g. ownership of livestock has higher visibility compared to visibility of income. Because the visibility of assets and society assigned values to different items varies, participatory wealth ranking may choose different indicators than those used in household surveys. Therefore, the indicators that a community consider important and mentions in wealth ranking may not always be included in the standard household surveys (ibid). In general, researchers chose well-established standard indicators in household survey/surveillance which allow compatibility; and such decisions are based on previous work of others and knowledge of researchers. In Dhanusha, a list of common assets was included in both HEA semi-structured questionnaire and in the household surveillance questionnaire, which was developed in discussion with MIRA staff (Janakpur office), but the factor loading for those indicators was not similar for the two datasets. The Dhanusha HSD questionnaire was designed in light of the Nepal DHS questionnaire, and indicators appropriate for the context were included in this HSD. Even though a common list was included in both surveys, community representatives described asset ownership of wealth groups based on their perceptions, whereas for the household surveillance the respondents reported their actual ownership of assets.

5.6.2 Comparing the asset indices of the HEA community representatives' data and the household surveillance data

The main objective of this study was to assess comparability of HEA wealth grouping with standard household survey wealth grouping, using correlation between asset indices derived from the two methods. The HEA CRD were collected by interviewing mixed community representatives in groups, and the HSD were collected by interviewing individual household representatives. Comparison of both independent variables and matched variables PCA-based asset indices of the two datasets showed a weak and inverse correlation. The association between the indices derived from independent variables PCAs was significant (P = 0.032), whereas the association between the indices generated using matched variables of the two datasets was barely significant (P = 0.046). The independent variables PCAs were considered to include the best predictors of the wealth status of each data set, and both independent variables and matched variables PCAs showed weak inverse association and the difference between P values of the two correlations was not large.

Several studies have examined the association of asset index with expenditure data, but to my knowledge, no studies have examined the association of poverty status described by household survey with HEA findings. Using a participatory approach, HEA generates a description of a typical household of a wealth group involving community members, while others have used the participatory wealth ranking (PWR) which is used to assign rank to individual households in an area through group interview. Hargreaves et al. (2007) collected data on asset ownership using household survey and also used PWR technique in the same setting of a South African province. From the PWR exercise, they had three datasets with independent observations on wealth ranking of the same households. They compared the ranking of individual households using random effect two-way ANOVA and found high level of agreement between these three observations made by different group of participants. However, this was done to rank individual households and within method difference was assessed. Ranking of individual households could be easy for a well-informed community, and size of the community may also affect such findings.

Hargreaves et al. (2007) also applied the PCA technique on the household survey data collected in the study area and compared findings of the two methods (comparing

PCA- based asset index and PWR) using Spearman correlation. They have commented that the correlation between the two indices (PWR and PCA) was weak ($r=0.31$), but significant ($P<0.001$). The households included in this study were also grouped into three categories using tertile based cut-offs of both the average of the three participatory rankings and the PCA based ranking of households. When they measured agreement between categories of the two indices using Kappa statistics, they found limited agreement between the two methods. This limited agreement between the original scale of PCA and PWR of the households and also between categorical variables created out of the two scales (PCA and PWR categories) is consistent with my findings in Dhanusha comparing the two methods. However, I found inverse association between indices of the HEA and the surveillance data. Hargreaves et al. (2007) explained that inaccurate data collection for both PWR and survey data used for the PCAs, and the fact that different data collection methods were used for PWR and PCA could be related to this low agreement. I could not examine agreement of categorical variables created using household level indices for both methods, as it was beyond the scope of my research due to not having individual household level data from both methods.

Bergeron et al. (1998) conducted a study on group informant's rating of food security of households and examined the agreements between the food security classifications of the households. They found low inter-rater agreement between the categorisation, and commented that rating intermittently food secure households was more difficult than rating of food secure or insecure households. The authors explained that the variation could be because of differential understanding and information available to the groups, selection of informants, and variability in training of staff involved in the study.

Balen et al. (2010) utilised household survey data to create asset indices using PCA and principle axis factoring (PAF) method, and compared correlation between the two indices. PCA and PAF are very similar techniques; both generate asset- based indices (ibid). The correlation between the two indices was therefore very high and significant ($r = 0.99$, $P<0.001$). Although the correlation between indices using two similar statistical methods based on the same indicators was high, the correlation of the PCA and PAF based indices with household per capita income (a different indicator) were low but significant (r = 0.27, 0.26 respectively, both $P<0.001$) (ibid). This therefore is consistent with my own and Hargreaves et al.'s (2007) findings that using data collected by very different methods may lead to weak associations.

The PCA-based asset indices of the HEA community representatives' data and the household surveillance data from Dhanusha were inversely associated for both the independent variables and the matched variable PCA-based indices. To investigate this, I compared the original data of the two datasets on different indicators, and compared those with published national data (DHS 2006). **Figure 5.11** combines some of the data presented in Table 5.1 and 5.2, and shows a comparison of ownership of different assets reported by the HEA data and the surveillance data. For both the datasets, the ownership of assets is shown against the standard indicator of landownership categories: among those who owned no land, owned <1 bigha, and >= 1 bigha of land. In comparison to the findings of the surveillance data, the ownership of assets (%) reported by the HEA community representatives' data was generally higher, especially among those who owned >=1 bigha of land. Thus, Figure 5.11 reflects a systematic pattern of overestimation reported by the HEA group interviews in comparison to that of the surveillance data, especially in the wealthier wealth groups.

Figure 5.12 shows a comparison of asset ownership for HEA CRD, HSD and rural national estimate. To compare the estimates from the HEA and the HSD with national level data, data were available on ownership of assets for rural areas only, but not at a level disaggregated by ownership of land. The national estimates of rural households owning assets were taken from the Nepal Demographic and Health surveillance that collected data in 2003/04. The HEA percentages of ownership of the different assets were generated taking an average of estimates of all the 202 wealth groups. This comparison shows that national level estimates were more in agreement with the surveillance data findings, and HEA data reported much higher ownership of these indicators. This partially explains why there was an inverse and very weak association between the indices of the two datasets.

Figure 5.11 Ownership of assets reported by the HEA and the surveillance data in Dhanusha, both by land-ownership categories

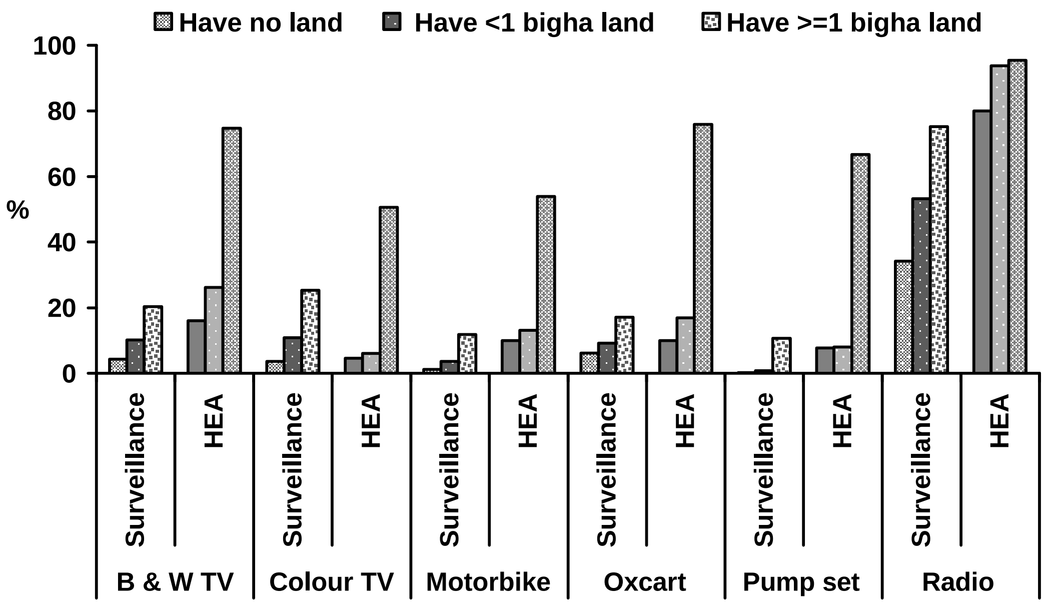
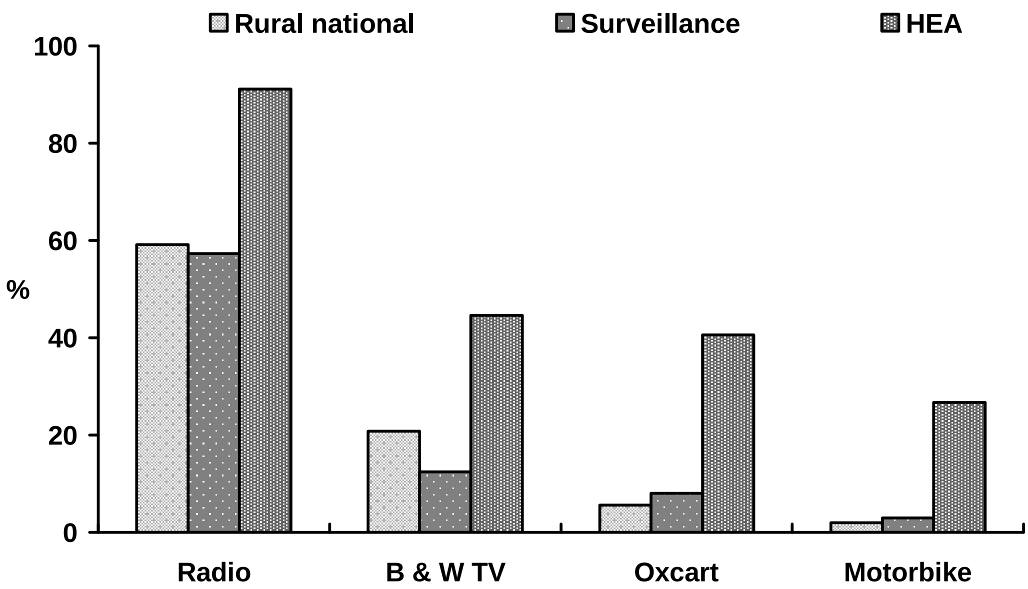


Figure 5.12 Percentages of households owning assets, estimates from the national level rural data, household surveillance data and HEA data in Dhanusha ǂ



ǂ The national level data on ownership of TV was available for any TV, not separated by black and white or colour TV.

Several factors such as to what extent the areas chosen for HEA were representative of Dhanusha and of the wealth groups in the district, and skills of the interviewers may have influenced HEA and HSD estimates of poverty. These factors could have contributed to the weak correlation between the indices of the two datasets. The asset indices for the two data sources were both used to describe overall poverty status in Dhanusha, and how well both datasets represented Dhanusha may influence that. The data generated by the surveillance system in Dhanusha was used as a standard to compare with the HEA findings, for which data were available from 54 VDCs out of 103 VDCs in the district. I have used the prospective baseline period HSD. During the prospective baseline, a vital surveillance system identified all recently delivered women in the area for interviewing. This means our sample did not include households where there had not been a delivery and this might have made the estimates less representative of the general population. Nevertheless, we assumed that birth rates did not vary between the VDCs, so the number of households interviewed would be proportional to the size of the VDCs. Usually, household surveys require a large sample for precise estimate at lower administrative levels, such as villages (SCUK 2008b). Since the HSD findings assessed poverty status of Dhanusha district as a whole, the sample of 4121 or 2498 households was considered to adequate to represent overall status of households in the area.

HEA applies a purposive sampling approach to collect data from CR, which can gather good contextual information when experienced users have used it with a specific research question in mind (SCUK 2008a, b). In Dhanusha, 54 VDC data were analysed and 6 VDCs were excluded due to missing data. Dhanusha is more or less homogenous and VDCs were located in a geographically similar plains area. Therefore, the six excluded VDCs may not be distinctive from the other remaining VDCs. Excluding the matched VDCs from both surveys helped to keep the datasets as comparable as possible and meant that data were still available for more than half (54/103 VDCs) of Dhanusha district.

The comparison of data from the two methods is valid even though the data come from somewhat different periods. HEA baselines are generally conducted to learn about the 'normal year', which depicts the picture of usual livelihoods and characteristics of population in the area. Therefore, baseline picture remains valid for longer period unless some important or unusual event has occurred in the area so that it would change livelihood patterns (SCUK 2008b). The recommendation is that HEA baseline data (comprehensive data about the wealth groups and their livelihoods) are collected every few years (e.g. every 5 years), as the typical livelihood pattern is not expected to change rapidly unless there was a major crisis (Holzmann et al. 2008).

Both the HEA and the HSD required that they represent all wealth groups well, so that the asset indices generated can be a good proxy of wealth status of households in the area. The surveillance system employed an incentivised vital surveillance system to identify households for data collection where a baby was born. Because enumerators were paid for identifying such households for inclusion in data collection, the surveillance is unlikely to have missed a particular wealth group and no systematic lack of coverage of a particular wealth group is expected. HEA data, on the other hand, were collected from groups of community representatives, and it is possible that respondents may have been biased towards some particular group, or had low representation of very poor (and also the least poor) wealth groups (Stephen and Downing 2001).

Due to the insurgency in 2006 during the HEA data collection, there was a low representation of wealthier households in Dhanusha at that time. Maoists were targeting the Better-off at that time and consequently many members of this wealth group had moved out to live in cities or in India. This means that in some VDCs interviewers were only able to interview representatives from the poorer wealth groups. Therefore, at the initial stage of data collection communities divided households into three wealth groups in some VDCs rather than dividing them into four wealth groups in all VDCs. Later, data collectors encouraged them to divide households in the area into four wealth groups. Nevertheless, when the households were divided into four groups, there may have been low representation of the wealthiest households in the group. This may also lead to overestimation of ownership of assets of the Better off by respondents who did not belong to the group.

The comparison of indices generated by the two methods here is based on one household-level study with one HEA study only, and such findings may be influenced by quality of data collected by either of the method. HEA CRD were collected at the formative research stage prior to the beginning of the large-scale randomised controlled trial (RCT). The household data used in this study were collected as part of a 7-month prospective baseline of the RCT that took place after the HEA data collection. Therefore, the interviewers who collected the HEA data, being new employees, had a limited amount of experience in field data collection. The application of HEA was new to all the field team in Dhanusha, and the skills of enumerators, their training, and difficulty in understanding and implementing the method may have affected data quality (Fimer and Pritchett 2001). The HEA method, although comparatively quicker than household surveys, requires high calibre field staff needing to have good mathematical ability, logical understanding, and able to triangulate findings of the different components. Because of the special skills required and the difficultly in implementing this method, especially in early days of development of this method, Save the Children UK also used a phase by phase approach while teaching this technique to others (Lejeune and Holt 2003). In Burundi, a food security team supported WFP to learn the technique and decided to implement a simpler HEA in 1997 before applying the complete HEA in 1998 (ibid).

The team in Dhanusha had several weeks of training and conducted piloting in two non-study VDCs prior to starting the data collection for the HEA study described here, so most of the interviewers had a reasonable understanding of the approach. At the beginning the teams were closely supervised by senior staff and in particular Dr Naomi Saville, who was experienced in using the method in Africa. After the first week or two of the study however, a major political revolution occurred in which the King was overthrown. At this time, due to security concerns, it was not possible for Dr Saville to continue field level supervision and this may have compromised quality.

Specialised methods, such as the HEA often rely on expatriate staff to apply the technique to collect data and to interpret the results (Laderchi, Saith and Stewart 2003). Such studies could be expensive when units of data collection are large (SCUK 2008b). A study in Zimbabwe compared findings of PRA with a household survey in the same areas and criticised the amount of time needed by researchers and the community for a PRA exercise (similar to ours). When they compared time spent on the survey with time spent on the PRA, the requirements of time was 240% more for the PRA (Richards, Davies and Cavendish 1999). Save the Children UK suggested that cost can me minimised through collecting fewer high quality data.

Overall, the comparison of poverty status of Dhanusha using asset indices generated from the HEA CR interviews and the prospective HSD showed weak association. **Figure 5.11** reflected that HEA estimates on percentage of household owning different assets were much higher than HSD findings. **Figure 5.12** further showed that the HSD estimates of ownership of assets were more or less in good agreement with the national data; but HEA data estimates were consistently much higher than the national data for the listed assets. The HEA data seemed to have overestimated the assets owned by the different wealth groups, particularly for the Better-off wealth groups. The weak association was consistent between both independent variables and matched variables PCAs of the two methods, which indicates that the choice of indicators did not have much influence on the nature of association between the indices of the two methods. The different methods used for the data collection and the variability within method may have attributed to the weak association between indices generated by the participatory HEA and conventional household interviews in Dhanusha. Meta-analysis using pooled data of similar studies in number of settings could be useful to provide more information on the nature of association or establish how HEA and household surveillance describe poverty status of an area.

5.6.3 Implications of the findings

Principal Component Analysis (PCA) is a statistical tool that uses asset data, and assigns weights to correlated assets to generate a poverty index. The PCA-based asset index is a one-dimensional measure of poverty, which is often used to rank poverty status of areas. The usefulness of this measure requires that asset data collected among the different wealth groups are well quantified to accurately reflect the distribution of asset ownership between the wealth groups. The HEA collects asset data by interviewing mixed group of wealth representatives. To ensure that HEA provides reliable asset data for all wealth groups, all wealth groups should be adequately represented in an interview. Furthermore, the interviewers should also have the experience and skills to probe well and quantify asset ownership. Alternatively, HEA data can be used to generate simple descriptions of which assets are usually owned by different wealth groups rather than quantifying assets. Caution should also be taken about household survey data, so that it includes a sample of households that adequately represent different socio-economic groups in an area.

The PCA technique can also be used to identify indicators which are more unequally distributed among wealth groups and hence are good indicator of socio-economic status. The indicators to which PCA assigns higher factor loadings (weights) are expected to be highly associated with poverty. Future research needs to examine the usefulness of PCA suggested indicators for targeting of poverty reduction interventions.

Chapter 6. Food prices in Dhanusha before, during, and after the 2008 food price crisis

6.1 Chapter summary

This chapter presents the results on 2005, 2008, and 2009 local market prices of food items commonly available in Dhanusha, food price inflation in Dhanusha over the period (between 2005, 2008 and 2009), and discusses the change in food prices during and after the global food price crisis in 2008 in comparison to pre-crisis (2005) period.

6.2 Research question

This section addresses the following specific research questions:

- How did food prices in Dhanusha change during the 2008 global food price crisis, in comparison to pre-crisis (2005) period?
- How did food prices in Dhanusha change between 2008 and 2009, following the 2008 peak in global food prices?

The **outcome indicators presented are:**

- Average prices of food commodities in local markets in Dhanusha in 2005 and 2008 (Sep-Oct for both periods)
- Percentage change in prices of food groups and annual food price inflation rate between 2005, 2008 and 2009 (Sep-Oct period)
- Average price of a standardised list of common food items in Dhanusha between 2005 and 2009
- Inflation in Dhanusha food price index in comparison to Nepal national level food price index and Terai food price index between 2005 and 2009

6.3 Introduction

World prices of food commodities increased by 130 percentage points from January 2002 to June 2008 (Lustig 2009), causing in a massive food price crisis around the world in 2008 (Ramalingam, Proudlock, and Mitchell 2008). The number of people with food insecurity has increased largely due to this crisis (USAID 2009). Sub-Saharan Africa, Asia, and Central America were the hardest hit and needed assistance to tackle this problem (IFPRI/CGIAR 2008). In 2009, the Food and Agricultural Organization (FAO) reported that due to chronic food insecurity and raised prices, food emergencies were persistently prevalent in 31 countries that included 20 African countries (USAID 2009). The World Bank expressed its concern that an estimated 2 billion people are negatively affected by this crisis (Darnton-Hill and Cogill 2010) which will slow down economic progress in low-income countries (Overseas Development Institute 2008a). Ivanic and Martin (2008) analysed data from nine low-income countries and a rough estimate showed that between January and April 2008 poverty (as defined by having an income of less than US 1 $/day) increased by 4.5%. Such an increase in low-income countries would make 105 million more people to fall into poverty. Considering the average rate of poverty reduction in these countries, the impact is equivalent to a halt in the progress of poverty reduction for almost seven years (ibid).

Even though the food price crisis is likely to have significantly increased poverty, food insecurity and malnutrition, the impact may vary according to country depending on its economic status, import dependency, government policies, and between the different population groups within each country **(**Benson et al. 2008). Whether an international price affects the domestic price depends on the country's dependency upon food imports, ability to increase export, and scope of government to change its tax policy or introduce subsidies (IFPRI 2007). As the food price crisis struck, Nepal, being a developing country had to struggle to meet the country's need due to its high import dependency (Sanogo and Amadou 2010). During the crisis when international prices were high, neighbouring India banned cereal export and competition among countries to import food was also high (Sanogo and Amadou 2010; ODI 2008b). WFP identified Nepal as one of the 30 countries most vulnerable to high food and fuel prices (Sanogo 2009).

The impact of the food price crisis does not only vary by country, but also at the household level depending on the location of the household (Ruel et al. 2010), characteristics of household as a net seller or net buyer, consumption pattern of the locality, and available income opportunities (ODI 2008b). Poor people, especially landless or marginal farming people with unstable income sources often struggle to meet their needs with their limited earnings. High food prices are therefore likely to affect a major proportion of the population in developing countries (Brinkman et al. 2010). Within a household, limited resources may trigger inequitable and unequal distribution of food, and worsen the status of those who already are at increased risk of malnutrition (Block et al. 2004). Poor wealth groups in a community with access to limited resources are therefore more vulnerable to food insecurity when food price or other crises occur. In Nepal, adolescent girls and women receive less favourable share of micronutrient rich foods such as animal source foods compared to adult male and children (Gittelsohn et al. 1997a; Gittelsohn and Vastine 2003). Thus the food price rise may make the intra-household food distribution more unequal and increase risk of malnutrition among the vulnerable groups.

Assessing the impact of the food price crisis and planning short and long term responses to it requires understanding of the local context, such as food consumption patterns of a community and how these differ by wealth group, and detailed analysis of change in prices of the food commodities that are consumed by these different groups. Understanding household economic behaviour, such as use of product substitution as prices change, is also important. Thus, for local and international program and policy makers, market prices and contextual data are important to ascertain the food security status of a community (IFPRI 2008b). Demand for food varies by country and even between regions of a country. Studies have shown that price rises of foods and purchasing power influences the responsiveness of demand for cereal and other food groups (IFPRI 2007; Muhammad et al. 2011). Low-income countries generally spend a large portion of their income on food. The price elasticity of demand of an item, i.e. percentage change in demand in response to 1% increase in price may vary depending on wealth status of households, available substitutes, and % household income spent on that (Andreyeva et al. 2010). The elasticity of demand of a product is also influenced by the characteristics of it, whether it is a luxury or non-luxury item, or may even vary by food groups depending on taste, choice among the different wealth groups in a population (Samuleson and Nordhaus 2008). Households react differently to increase in prices of different food groups. However, several discussions around the 2008 food price crisis were centred on the price of cereals only or on a limited variety of foods (FAO GIEWS 2011). Ivanic and Martin (2008) extended this discussion and showed that the effect of a price hike could be different in relation to poverty due to differential changes in the price of different food groups. Thus data on cereal prices alone may not give the complete picture of how access is restricted due to the differential increases in the price of different food commodities and products. In Chapter 4, I reported food access by the different wealth groups in Dhanusha. In this chapter, I aim to assess and interpret changes in prices for food items commonly consumed in Dhanusha.

6.4 Methods

6.4.1 Local market price data collection

In 2006, the HEA study included a price data collection component and prices of food items available in local markets in Dhanusha district were collected during 7 March- 29 June 2006. This study collected current price, and retrospective price data for the Nepali seasons over the preceding one year: winter (December 2005 - January 2006); spring /summer (March 2006 - May 2006); monsoon (mid June to early September 2005); and 'Dashain / Tihar and Chhat' festivals (late September to October 2005).

Based on the experience of processing and analyzing HEA local market price data collected in 2006, a structured questionnaire was developed in consultation with MIRA (Mother and Infant Research Activities) local researchers in Nepal which was used to collect data on food items from local markets in Dhanusha in 2008 and 2009. The 2008, 2009 price survey questionnaire included food items that were frequently reported in the HEA 2006 price data, and also included some open questions so prices of other items commonly available in the markets can be included. The 2008 and 2009 market price surveys were conducted in the same market locations as was done in the 2006 survey. For each of the surveys, data were collected from retail vendors in the most accessible market in each of the study VDCs. Generally, data collectors recorded one price per item from each market.

For comparability purposes, this study used price data from all three surveys for the largest Nepalese festival '*Dashain*' period when prices tend to peak (WFP/ MoAC/ FNCCI 2009). The analysis in this chapter used data from the three surveys from the following periods

- 2006: prices recalled by traders for 2005 September – October period;
- 2008: current market prices from traders (17 September – 12 October 2008);

- 2009: current market prices from traders (13 September – 10 October 2009)

From the 60 VDCs included in the RCT (surveillance system), data were collected from the most accessible markets for each of the VDC. The HEA 2006 price data were therefore available from 53 VDCs, as some markets were commonly used by more than one VDC; the same 53 VDCs were included in the price survey in 2008; one market location per VDC. However, data for the 2009 survey was limited to 48 VDCs out of the 53 VDCs included in previous surveys because certain markets had closed down in the interim period.

6.4.2 Data entry, editing, and processing

Since the 2006 price data collection of HEA study used a semi-structured questionnaire to record food name and local units by which items were sold in the VDC markets, it had more variability in data compared to later price surveys. Thus, the first step was to list all food names and units recorded in the HEA price data and standardise those. The 2006 price data had one food item recorded in different names (Maithili, Nepali, or English). For each food item, food price per unit was recorded, but the unit used for one particular item was variable, such as kg, bundle, or pieces. To start with, all synonyms of one item were grouped together and a list of food codes was prepared that assigned one code to each unique item for which data were available. Similarly, codes for units were developed so that price data could be compared over the whole sample and possible changes in price of a specific item could be tracked. Data were available as entered in Microsoft Excel, which was reorganised in Excel and then imported to SPSS to clean and analyse. Because the price data collection in 2006 used semi-structured questionnaire and was more variable than later surveys, it needed more adjustment and cleaning before analysis.

The majority of the food items had one price per market location for data collected in 2006, and therefore one price was assigned per item in one market location. There were six VDCs where data were collected from two markets. In the rest of the VDCs, data were collected from the market most accessible to the VDC residents only. In cases when a VDC had more than one price recorded for a particular item (such as a price range instead of one value or had data from more than one market in the same

VDC), an average of those prices was taken. In 2006, since variable units for one specific item were recorded, units of one item were converted to most frequently recorded unit. From 2008 onwards, market price surveys used a pre-coded questionnaire and only one price per item in a market location was allowed.

The 2006, 2008, and 2009 data were processed and analyzed to assess price changes that took place over the period. The recalled 2005 data was used to describe the price scenario before the global food price crisis; the 2008 data described price during global food price crisis, and the 2009 data described the situation in Dhanusha following the 2008 peak in global food price.

6.4.3 Outlier detection and removal

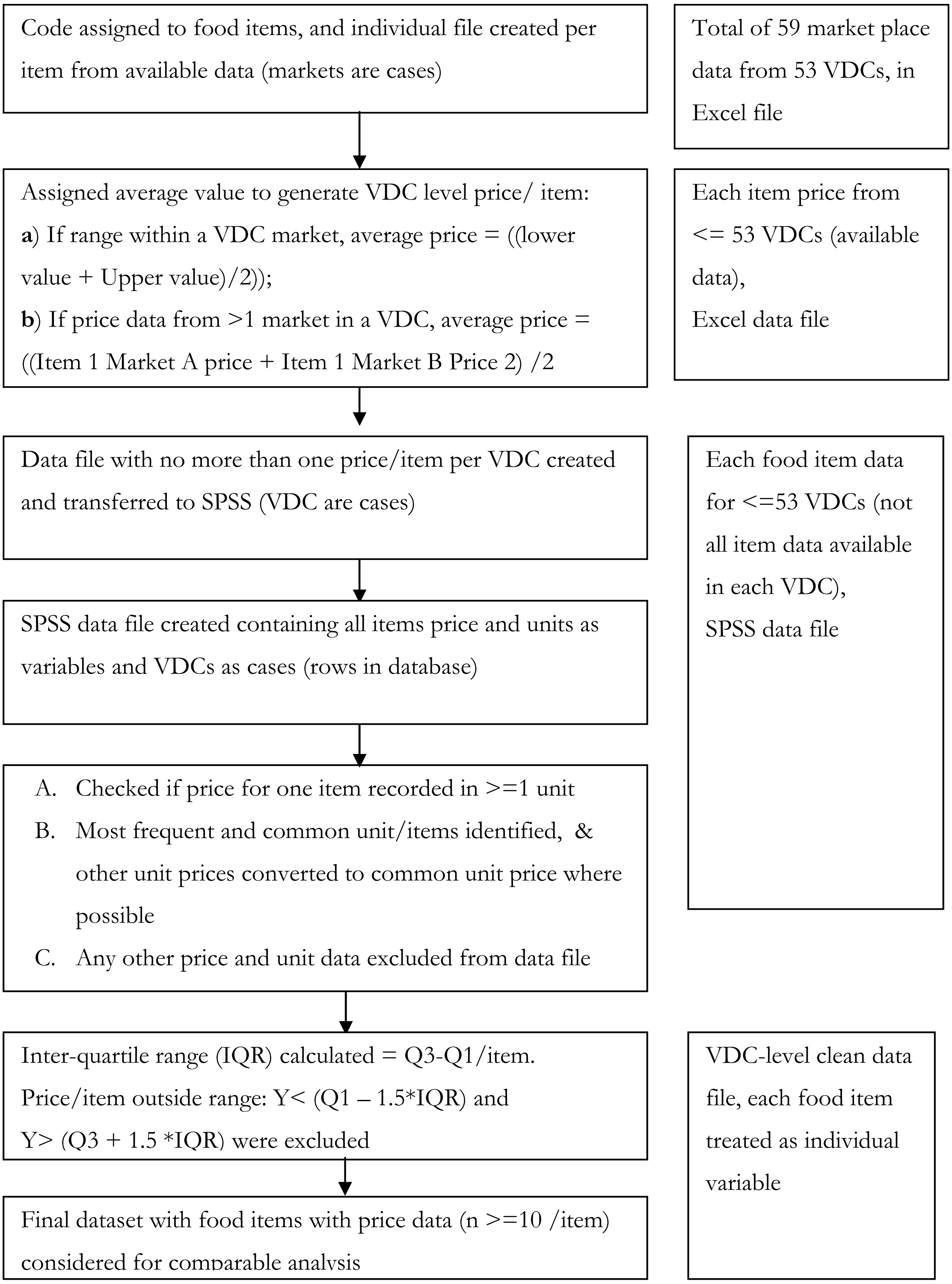
To allow comparison, an average price per item per data collection period was created after removing the outliers. Since the local market price data tended to be non-normally distributed in most cases, this study used the Tukey algorithm to detect outliers which does not require a distribution assumption. The first step was to arrange the data in ascending order to detect the 25th percentile (Q1) as lower limit and 75th percentile as upper limit (Q3) values of individual items. This then allowed the determination of the inter-quartile range of price (IQR = 75th percentile – 25th percentile). Finally, any value outside the boundary of 'Y< (Q1-1.5 *IQR) or Y> (Q3+ 1.5*IQR) were treated as outliers and were excluded from the data (Hoaglin 1983; Zhou et al. 2006). Some other surveys have used less stringent cut-off, such as the Office of National Statistics, UK has used cut-off of 2.5 instead of 1.5 (UK Office for National Statistics 2007).

In summary, the exclusion criteria used were: Y< (Q1 – 1.5*IQR) and Y> (Q3 + 1.5 *IQR), where
Q1 = Lower (25^{th}) quartile
Q3 = Upper (75^{th}) Quartile
Inter Quartile Range (IQR) = Q3 (75^{th} percentile) – Q1 (25^{th} percentile)

Final dataset had price data for unified unit of one specific item for the 2005, 2008, 2009 period merged to one file, which was used for statistical analyses to compare price changes over the period.

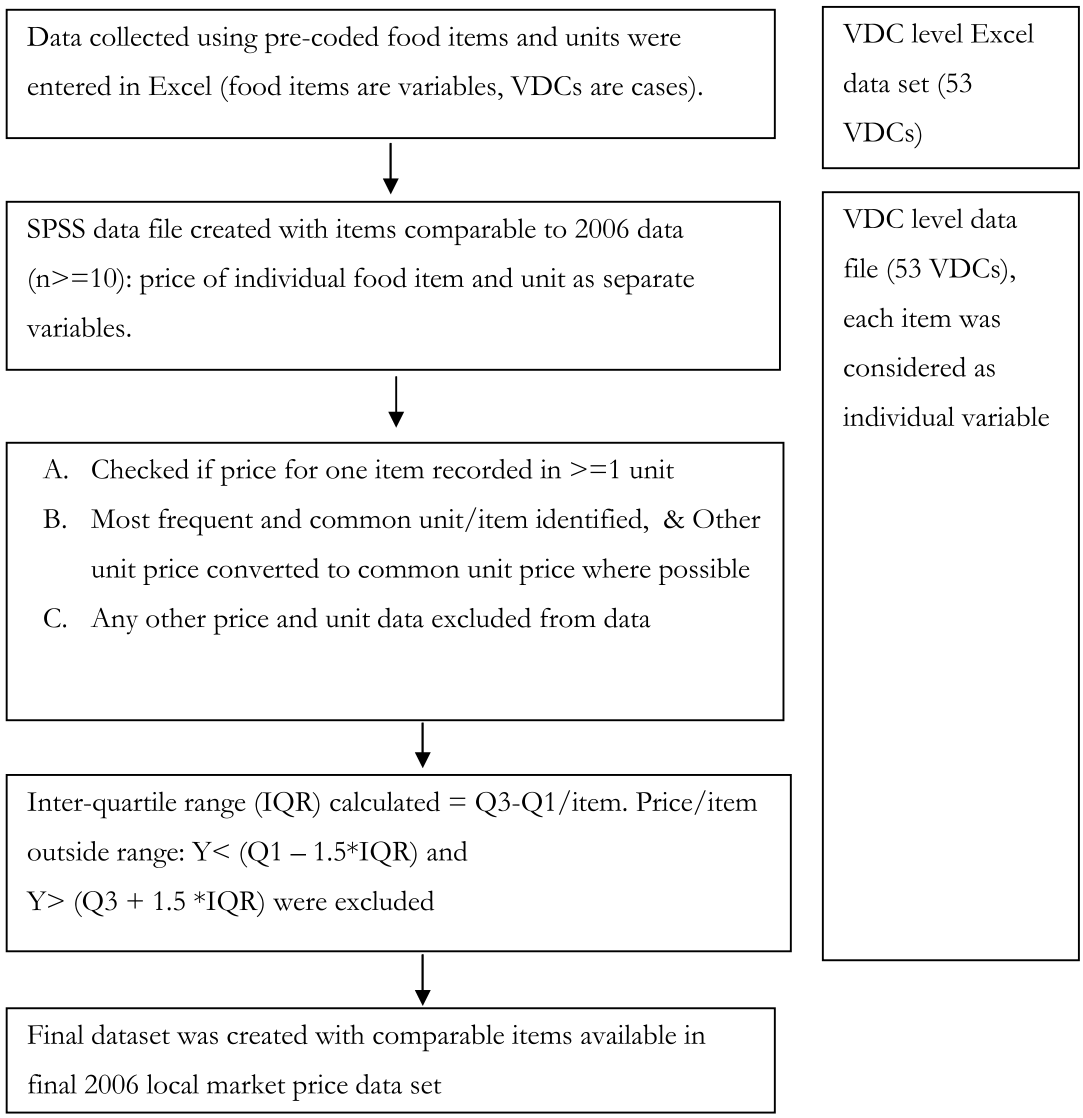
The overall steps involved in processing and cleaning of 2006, 2008, and 2009 data to prepare comparable dataset for 2006, and 2008-2009 are explained in the flow charts (**Figure 6.1, Figure 6.2**). The steps in the left hand side of the flow chart show the process and the right hand side boxes show the level and type of data.

Figure 6.1 Flow chart showing steps in processing of 2006 price data



The processing of 2008 and 2009 price data is shown in the **Figure 6.2**. Similar to the flow chart above, the left hand side show the process and the right hand side boxes show the level and type of data.

Figure 6.2 Flow chart showing steps in processing of 2008 and 2009* price data



*2009 data were available for 48 VDCs

6.4.4 Statistical analysis

To test whether price of a commodity or overall yearly price was significantly different in 2008 compared to 2005 and in 2009, an independent sample T-test was performed. Any P value <0.05 was considered to be significant. Mean and confidence intervals were calculated for price of each item, for each time point. Confidence intervals were not available for 3 items (2005: Chicken farm eggs, n = 29; 2008: Apple, n = 26; Sugar, n = 31) that had no variability in price. Percentage changes in food prices by food groups between 2005 and 2008 were estimated as: 2008 average price/2005 average price*100-100. Similar method was followed to assess change between 2005 and 2009, as well as changes between 2008 and 2009.

6.4.4.1 Estimating Dhanusha overall food price

To compare overall prices for 2005, 2008, 2009 Sep – Oct periods, an overall price was created averaging 65 item prices in 48 market places which were available in the three datasets for the same 48 VDCs. For comparability purposes, items that did not have adequate data for all three years were dropped from calculation of the overall mean price (e.g. for 2009, cinnamon, yellow split pea whole n=3, black lentil n=1, soyabean chunk n=1, mungri fish = no data, buffalo ghee n=6, cow ghee n=5, local beans =9). Since the price of a specific item was not always available from each study VDC, item-wise missing data for any VDC was replaced by mean of available data.

6.4.4.2 Construction of Dhanusha Food and beverage price index

On national level, the Nepal urban consumer price index (CPI) is constructed by Nepal Rastra Bank (NRB) which includes Food and beverages price index and Non-food and service index (Central Bank of Nepal 2012). Price data on food and non-food items are collected from urban market places in the three regions - Kathmandu, Terai and Hills; and weights are applied to different items based on national level expenditure data derived from the household budget survey 1995/96. The CPI is constructed for three regions, which is then weighted to come up with a national level index. The CPI basket in Terai includes prices of a total of 267 items, of which 88 items were food items. The Dhanusha food price index was constructed using average prices of 65 food items in the district and applying weights to food group for the NRB Terai food price index (Central Bank of Nepal 2012). Since the detailed list of food items included in the NRB Terai food price index was not available, food items included in Dhanusha food price index was compared with the published list of essential commodities in Terai markets. Out of 30 food items mentioned in the list, prices of only two of those items were not available from Dhanusha data (Central bank of Nepal 2008). Dhanusha food price index used prices of 65 food items for which data were available from the local markets within the district for 2005, 2008 and 2009.

The NRB food price index in Terai, included food items from ten sub-groups, and had a total weight of 54.98 (**Table 6.1**). The weights of food groups in the NRB food price index was used as a guide to create Dhanusha food price index. Price data on nuts, alcoholic beverage, and restaurant meals were not available from Dhanusha, and therefore the total weights of Dhanusha food price index was calculated subtracting weights of those items. **Table 6.1** shows the weights from national data and estimated weights for Dhanusha food price index. Like many other countries, CPI calculation in Nepal uses Laspeyres price index formula, which estimates change in price of a fixed item basket of consumer goods and services, and do not consider substitution of items (Braithwait 1980; Central Bank of Nepal 2012; IMF 2011; Yuan and Li 2010). In other words, the CPI assesses how much a household would need to spend for the fixed basket compared to expenditure in earlier period reflecting the change in purchasing power. The first step therefore includes assessing percentage change in prices of food groups, and then weighting that by Household Budget Survey weights, i.e. depending on average proportion of expenditure Nepali households spent on each those food groups. In summary, the index was calculated as: Dhanusha Food Price Index = ∑ wt 95/96 * (Pi / P i-1) *100, where Pi= Current price, Pi-1 = Base period price (2005 prices). In Namibia, Levine (2012) constructed CPI using similar process to estimate how households in the country would be affected due to the 2008 global food price rise.

The Dhanusha food price index used Sep-Oct 2005 as a base period and point-to-point inflation rate estimated for 2008 and 2009 Sep-Oct periods, such as: (2008 Dhanusha food price index/ 2005 Dhanusha food price index)*100-100. Similar procedure was used for estimating point-to-point inflation rate in Dhanusha in 2009.

Table 6.1 Calculation of Dhanusha food price index weights

#	Index/ Food groups	Urban Terai	Dhanusha[a]	
		Weights	Weights	Weights [b]
#	**Overall Index**	**100.00**	**100.00**	-
	Food & Beverages Index	**54.98**	**46.73**	**100.00**
1	Grains and Cereal Products	**19.76**	**19.76**	**42.29**
1.1	Rice and Rice Products	15.42	15.42	33.00
1.2	Wheat and Wheat Flour	3.30	3.30	7.06
1.3	Other Grains & Cereal products	1.04	1.04	2.23
2	Pulses	**3.35**	**3.35**	**7.17**
3	Vegetables and Fruits	**7.63**	**7.58**	**16.22**
3.1	All Vegetables	6.04	6.04	12.93
3.1.1	Vegetables without leafy green	4.98	4.98	10.66
3.1.2	Leafy green vegetables	1.06	1.06	2.28
3.2	Fruits and Nuts	1.60	1.54	3.30
3.2.1	Fruits	1.54	1.54	3.29
3.2.2	Nuts	0.05	-	-
4	Spices	**2.06**	**2.06**	**4.41**
5	Meat, Fish and Eggs	**5.02**	**5.02**	**10.74**
6	Milk and Milk Products	**3.98**	**3.98**	**8.52**
7	Oil and Ghee	**3.23**	**3.23**	**6.91**
8	Sugar and related products	**1.09**	**1.09**	**2.33**
9	Beverages	**2.00**	**0.66**	**1.41**
9.1	Non alcoholic beverages	0.66	0.66	1.41
9.2	Alcoholic beverages	1.34	-	-
10	Restaurant meals	**6.86**	-	-

[a] Total weight excluding nuts, alcoholic beverages, and restaurant meals
[b] Weights estimated considering the total weight of Food price and beverage index as 100.

6.5 Results

Local market price data for a comparable period (September-October) in 2005, 2008, and 2009 were collected in Dhanusha to estimate the average price of various food items within different food groups. The primary focus of the study was to estimate food prices before (using data from 2005) and during the 2008 food price crisis. Food prices during 2009 are shown as a follow up to 2008 data to assess how prices continued to change in Dhanusha over the period. Detailed data on exact prices of all items and their variability is presented in **Annex 6.1 and Annex 6.2**.

6.5.1 Pre- and post- crisis cereal prices

Figure 6.3 compares mean per kg prices of varieties of rice and **Figure 6.4** compares mean prices of non-rice cereals during September-October. Prices of all varieties of rice increased significantly (all $P<0.001$) between 2005 and 2008 (Figure 6.3). In 2008, the mean price of parboiled rice (coarse) increased by 14%, whereas the mean price of Basmati rice (finest grain) increased even more dramatically by 34%. **Figure 6.4** shows that in 2008, prices of wheat flour (whole-wheat and fine-white) and flattened rice increased significantly; and the price of beaten rice had the largest increase (34%) among all the cereals.

Figure 6.3 Mean prices of varieties of rice (per kg) in Dhanusha, 2005 and 2008 (market samples: 2005, 2008 =11, 42; 42, 46; 18, 47). Error bars represent 95% confidence intervals.

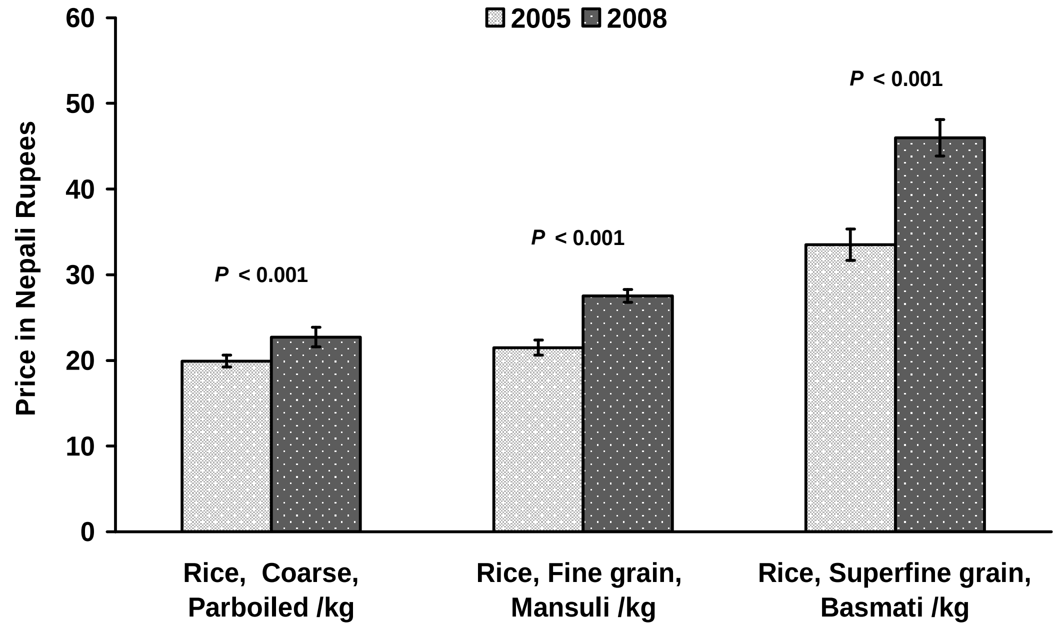
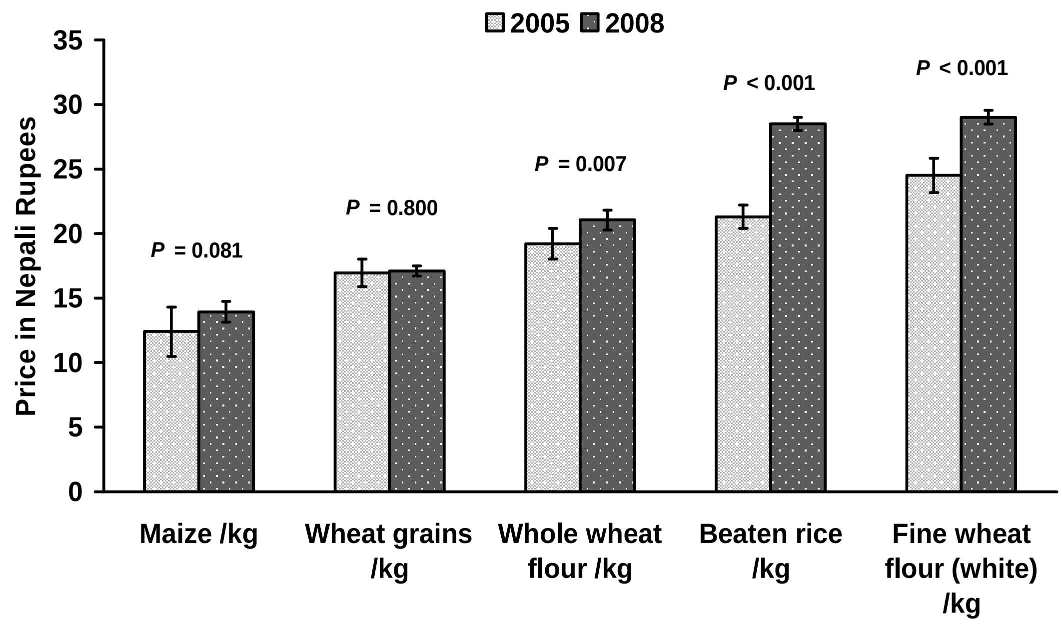


Figure 6.4 Mean prices of other cereals (per kg) in Dhanusha, 2005 and 2008 (market samples: 2005, 2008 = 10, 37; 31, 49; 35, 51; 25, 49; 14, 47). Error bars represent 95% confidence intervals.



6.5.2 Pre- and post- crisis pulses prices

Mean prices per kg of varieties of pulses consumed in 2005 and 2008 is presented in **Figure 6.5 and Figure 6.6**. In 2008, mean prices of all varieties of pulses were significantly higher than 2005 prices (all P<0.001), be it the lowest priced *Khesari* (or grass pea) lentil or the highest priced yellow split pea lentil. In 2008, the mean price increase for the different varieties of pulses ranged from 16% (*Kheshari* yellow lentil) to 67% (red lentil). Following red lentil, the mean price per kg of soyabean chunks (44 NRs to 67 NRs/kg) and horse gram (32 NRs to 48 NRs/kg) were the next that showed the largest increases.

Figure 6.5 Mean prices per kg of pulses in Dhanusha in Sept-Oct in 2005 and 2008 (market samples: 2005, 2008 = 44, 42; 10, 49; 42, 46; 28, 46; 41, 41; 39, 42). Error bars represent 95% confidence intervals. (Pulses that are sold as whole instead of split are mentioned in label).

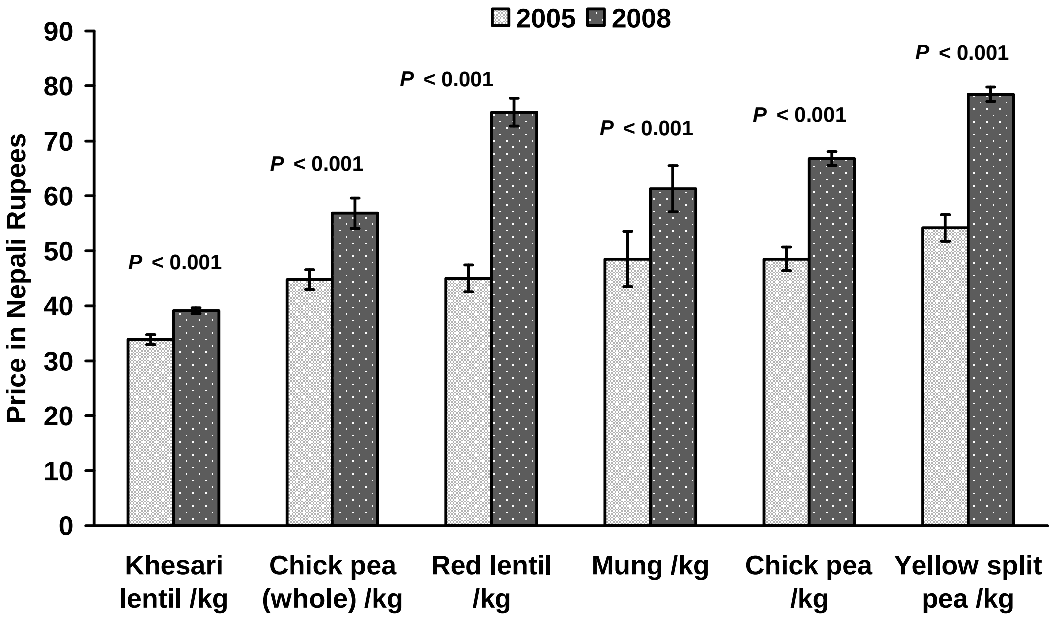
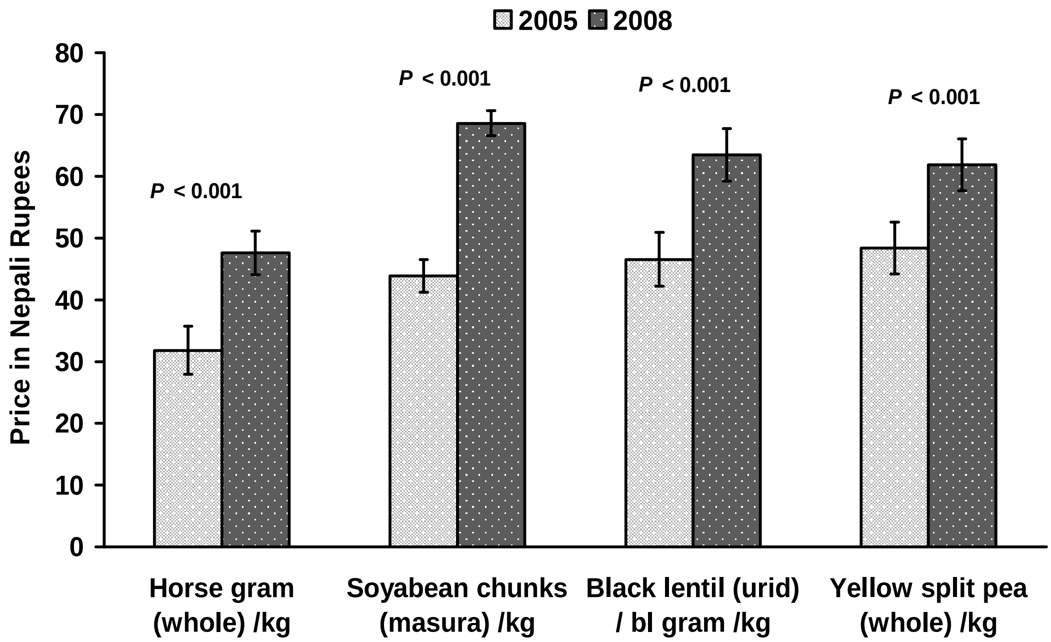


Figure 6.6 Mean prices per kg of pulses in Dhanusha in 2005 and 2008 (market samples: 2005, 2008= 18, 33; 11, 46; 23, 37; 10, 44). Error bars represent 95% confidence intervals. (Pulses that are sold as whole instead of split are mentioned in label).



6.5.3 Pre- and post- crisis prices of fish, meat, poultry, eggs

Figure 6.7 compares the mean per kg prices of the varieties of fishes available in local markets in Dhanusha. In 2008, no matter whether it was a small fish (small fish, Gaincha), medium (Mungri), or big fish (Silver Carp, Common carp, Big head, Rahu), prices of all of them increased significantly (all P <0.001). The price increase ranged from 30% (Mungri) to Silver carp (67%). Prices of poultry and goat meat in 2005 and 2008 are presented in **Figure 6.8,** which also showed similar increase (ranging between 29 to 47%). Mean prices of eggs (per four eggs) of local and hybrid hen in 2005 and 2008 are presented in **Figure 6.9**. Price of eggs of hybrid farm chickens increased significantly in 2008 from the 2005 level, but remained lower than eggs of local chicken in both periods. The mean price of eggs of local chicken did not change significantly over the period, and had a wide confidence interval in 2005 due to large variation in prices (market sample =10 only).

Figure 6.7 Mean prices per kg of fish in Dhanusha in 2005 and 2008 (both September-October) (market samples: 2005, 2008= 12, 50; 34, 52; 23, 49; 11, 49; 13, 49; 27, 51; 13, 44). Error bars represent 95% confidence intervals.

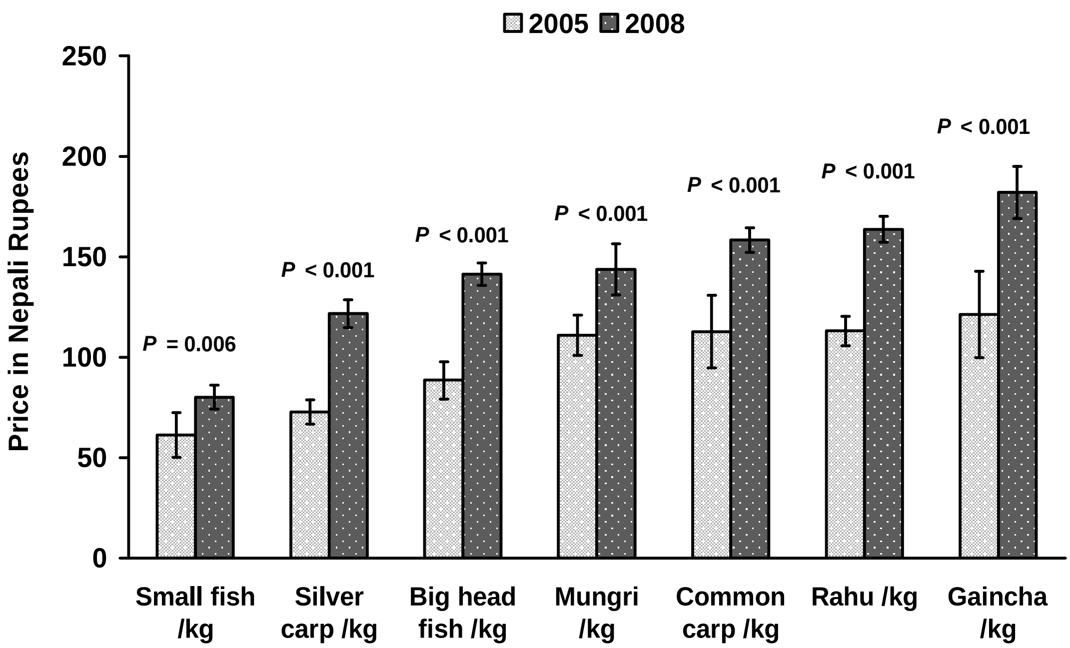


Figure 6.8 Mean prices per kg of poultry and other meats in Dhanusha in 2005 and 2008 (market samples: 2005, 2008 = 15, 32; 44, 48; 17, 39; 46, 34). Error bars represent 95% confidence intervals.

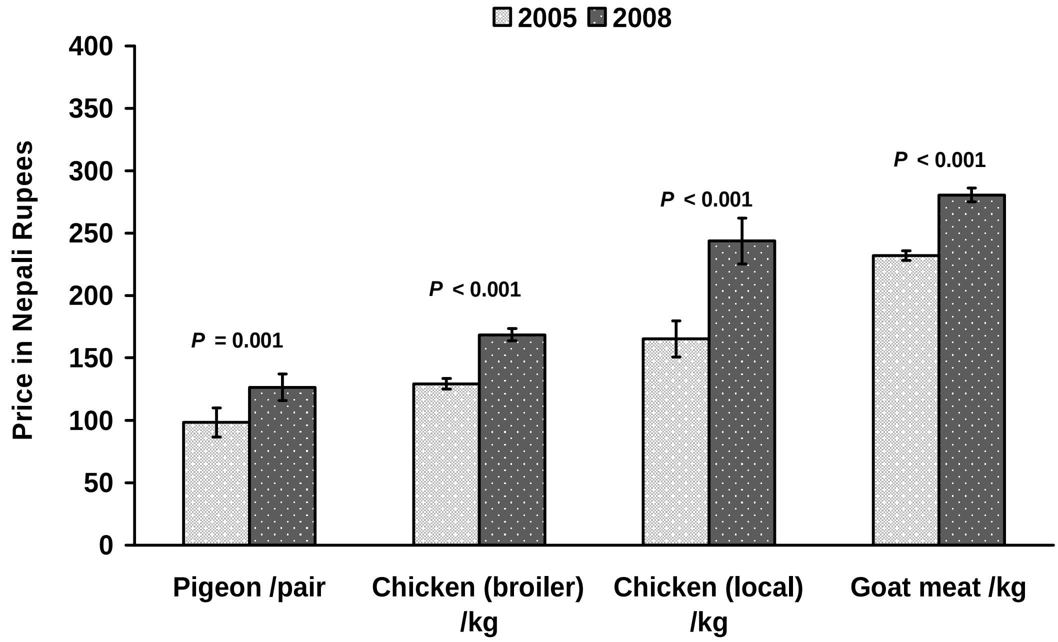
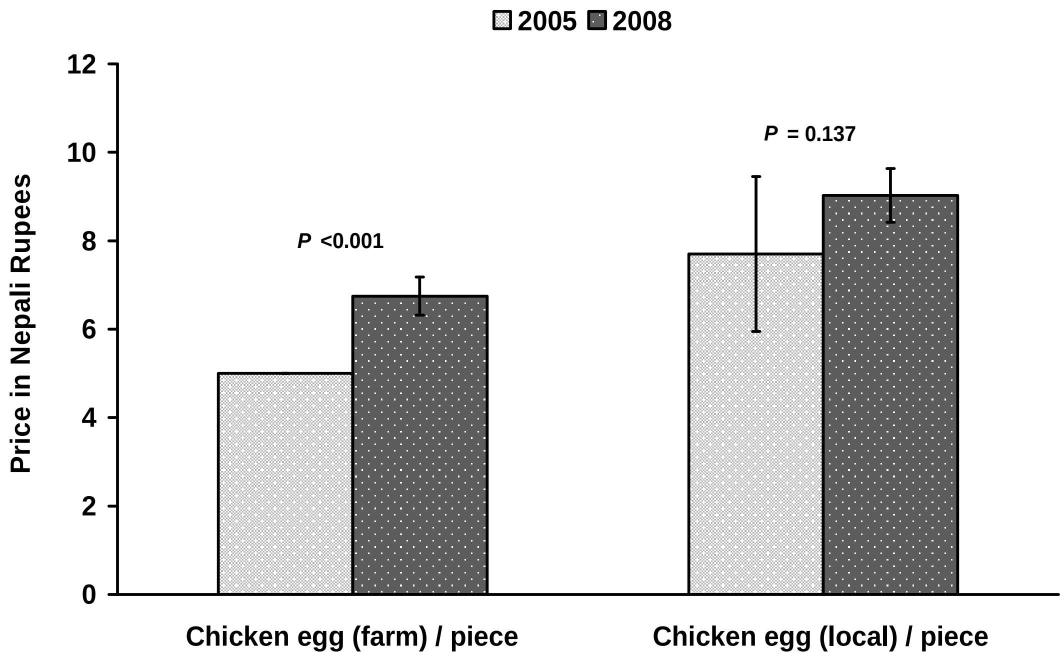


Figure 6.9 Mean prices of eggs in Dhanusha in 2005 and 2008 (market samples: 2005, 2008 = 29, 48; 10, 39)*. Error bars represent 95% confidence intervals.

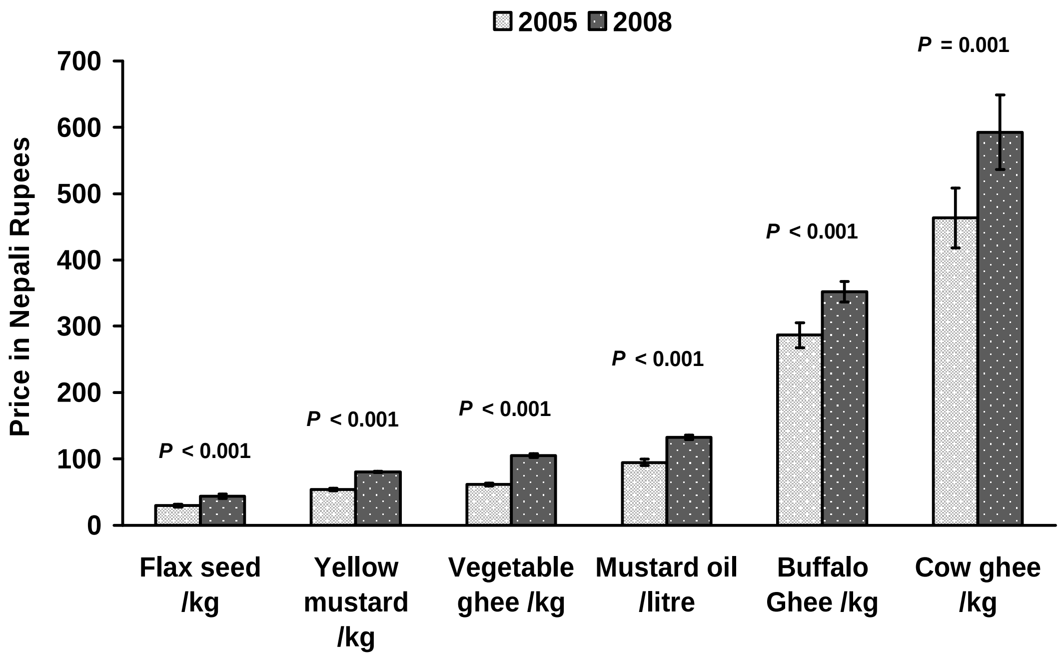


*Price of chicken farm eggs (n = 29) did not vary between markets in 2005, so no confidence intervals are shown.

6.5.4 Pre- and post- crisis prices of oil and oilseeds

Figure 6.10 shows average prices of oil and oilseeds in Dhanusha in 2005 and 2008. Between 2005 and 2008, mean prices of all items in this group increased significantly ($P \leq 0.001$). The highest increase was evident for vegetable ghee (71%), and the minimum increase was 23% for the price of ghee made from buffalo milk.

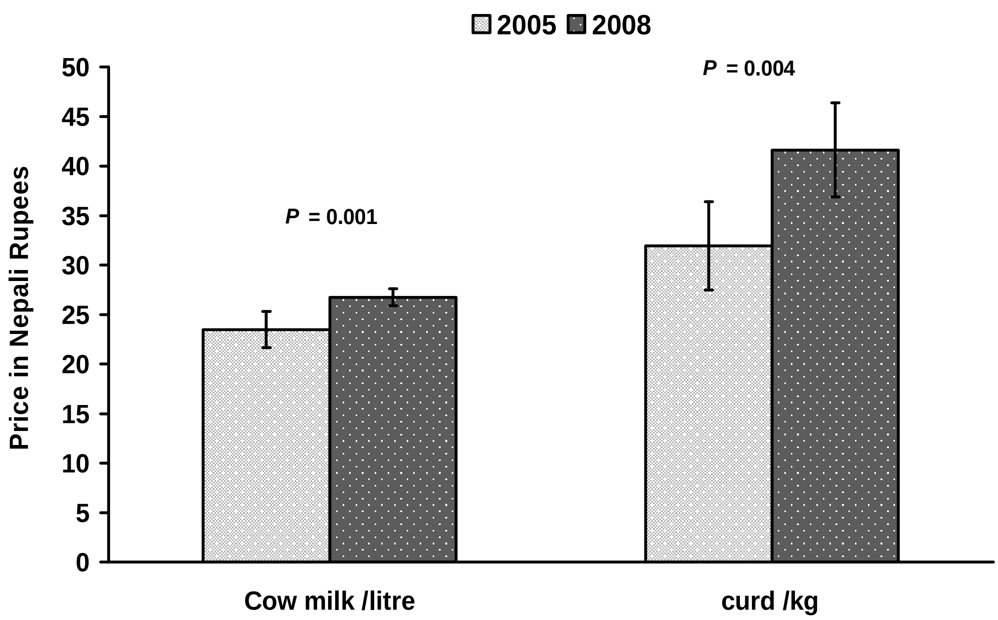
Figure 6.10 Mean prices of oil and oilseeds in local markets in Dhanusha in 2005 and 2008 (market samples: 2005, 2008 = 25, 41; 44, 33; 14, 46; 18, 52; 17, 51; 15, 51). Error bars represent 95% confidence intervals.



6.5.5 Pre- and post- crisis prices of milk and milk products

Figure 6.11 shows the average prices of dairy products in the 2005 and 2008 Sept-Oct periods. In 2008, the price of both items in this group increased significantly, whereas the increase in price of curd was larger than the price of cow milk (14%: from 23.5 to 26.7 NRs).

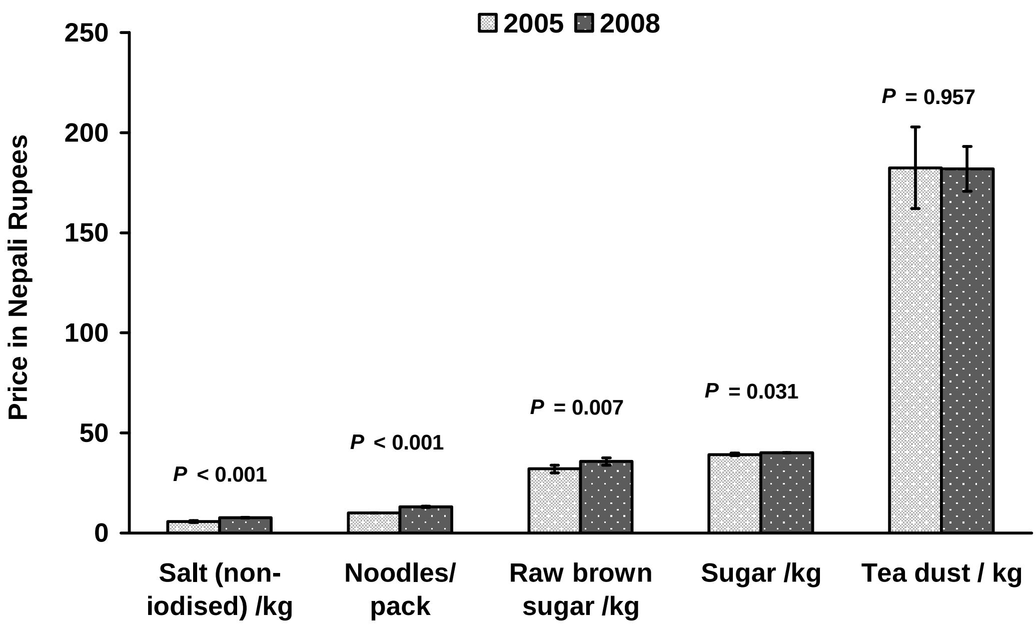
Figure 6.11 Mean prices of Dairy products in local markets in Dhanusha in 2005 and 2008 (Sept-Oct) (market samples: 2005, 2008= 17, 53; 39, 51). Error bars represent 95% confidence intervals.



6.5.6 Pre- and post- crisis prices of salt, processed foods, sugars, and spices

Figure 6.12 shows that the average per kg price of salt, per pack noodles, and the two varieties of sugars increased significantly in 2008 but price of tea-dust remained unchanged. The mean price of salt had small variability between markets for both 2005 and 2008, while the sugar price did not vary at all in 2008. **Figure 6.13 - 6.14** presents the mean prices of a range of spices available in the local markets in 2005 and 2008. On average, prices of all spices shown in both figures were significantly higher in 2008, except for cinnamon leaves. In 2008, the most stark increase was observed for price of whole coriander (NRs 55.8 to 123.5 in 2005 and 2008 respectively= 121% increase), followed by the increase in the price of coriander powder (95%), black pepper (69%), fenugreek and turmeric powder (56%), cumin (54%), chilli powder (53%).

Figure 6.12 Mean prices of salt, noodles, sugars† and tea dust in local markets in Dhanusha in 2005 and 2008 (market samples: 2005, 2008= 10, 42; 11, 52; 20, 41; 30, 31; 12, 43). Error bars represent 95% confidence intervals.



† Confidence intervals were not shown for the price of noodles (snacks) in 2005, and of sugar in 2008 (n = 31), as the prices did not vary between markets.

Figure 6.13 Mean prices of spices in local markets in Dhanusha in 2005 and 2008 (market samples: 2005, 2008 = 22, 11; 23, 49; 12, 35; 46, 49; 33, 49; 13, 52). Error bars represent 95% confidence intervals.

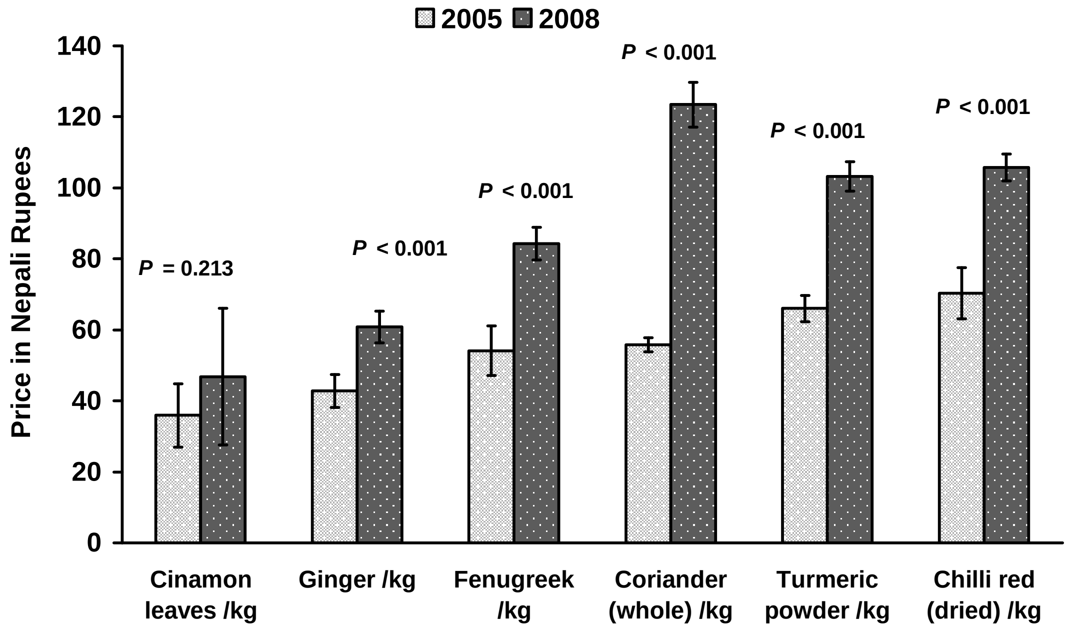
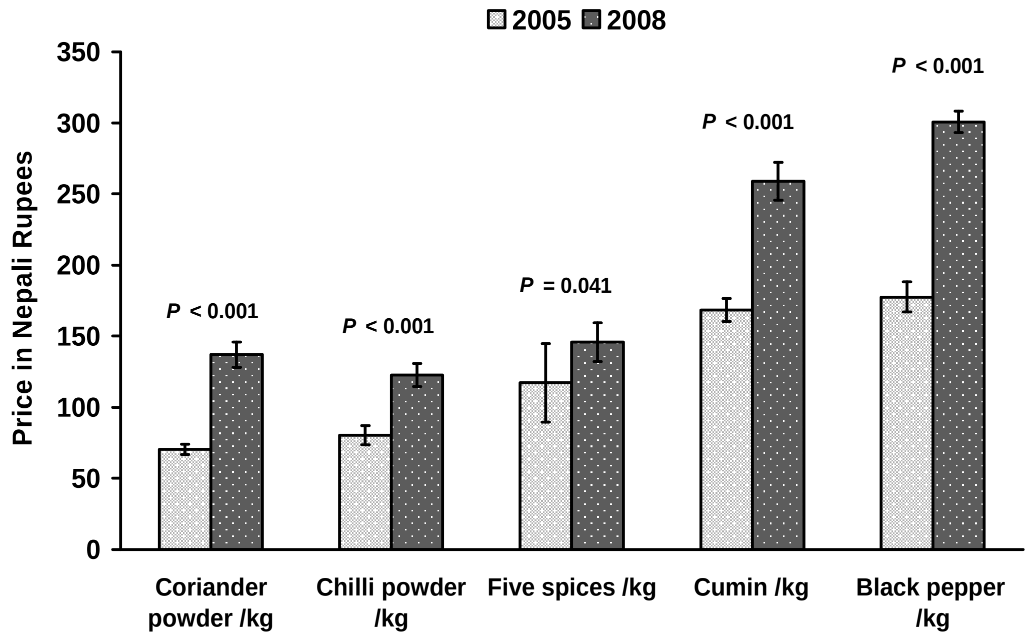


Figure 6.14 Mean prices of spices in Dhanusha in 2005 and 2008 (market samples: 2005, 2008 = 24, 52; 22, 52; 32, 49; 33, 52; 27, 37). Error bars represent 95% confidence intervals.



6.5.7 Pre- and post- crisis prices of roots and tubers, and vegetables

Figure 6.15 - 6.18 presents mean prices of different vegetables available in the local markets in 2005 and 2008. Among the varieties of green leafy and yellow vegetables presented in **Figure 6.15**, mean prices of red amaranth, tomatoes, and drumstick increased significantly over the period. The increase in mean prices of tomatoes (130%) and drumsticks (66%) was very large, compared to other vegetables prices. **Figure 6.16** shows the mean prices of condiment vegetables in Dhanusha. Only the price of Green chillies showed a large and significant increase (mean price in 2005 and 2008 was 25.8 NRs and 57.0 NRs respectively). **Figure 6.17- 6.18** shows that prices of vegetables were more variable than other food groups; some items prices increased significantly (cabbage, bottle gourd, local beans), some did not change, and some prices (potatoes, Okra) decreased significantly.

Figure 6.15 Mean prices of green leafy and yellow vegetables Dhanusha in 2005, and 2008 (market samples: 2005, 2008 =27, 43; 41, 49; 13, 15; 26, 23; 14, 26). Error bars represent 95% confidence interval.

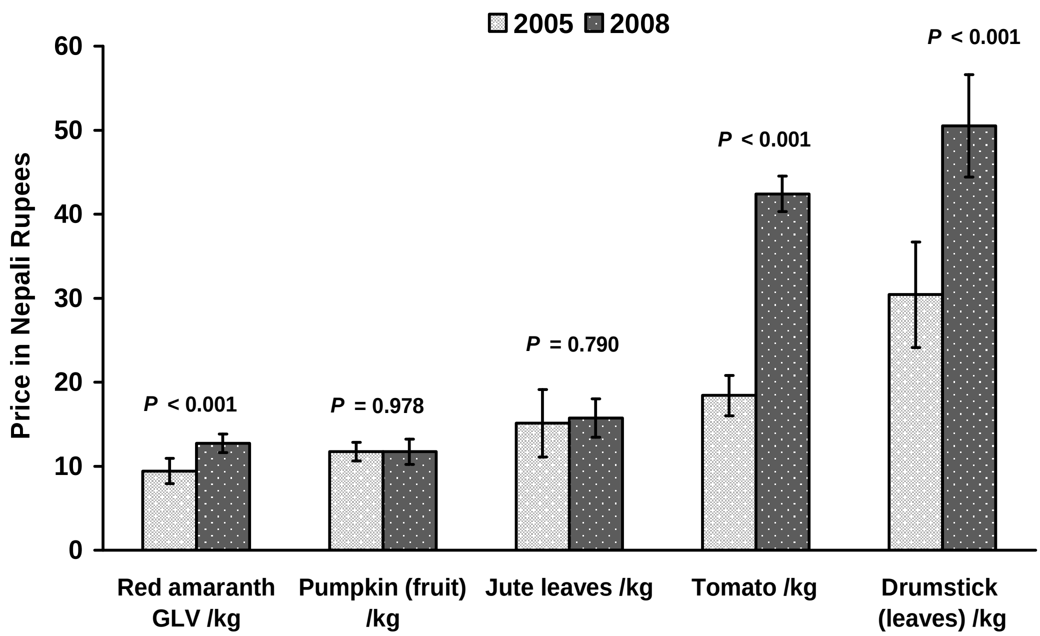


Figure 6.16 Mean prices of condiment vegetables in Dhanusha in 2005 and 2008 (market samples: 2005, 2008= 45, 50; 22, 50; 38, 49). Error bars represent 95% confidence intervals.

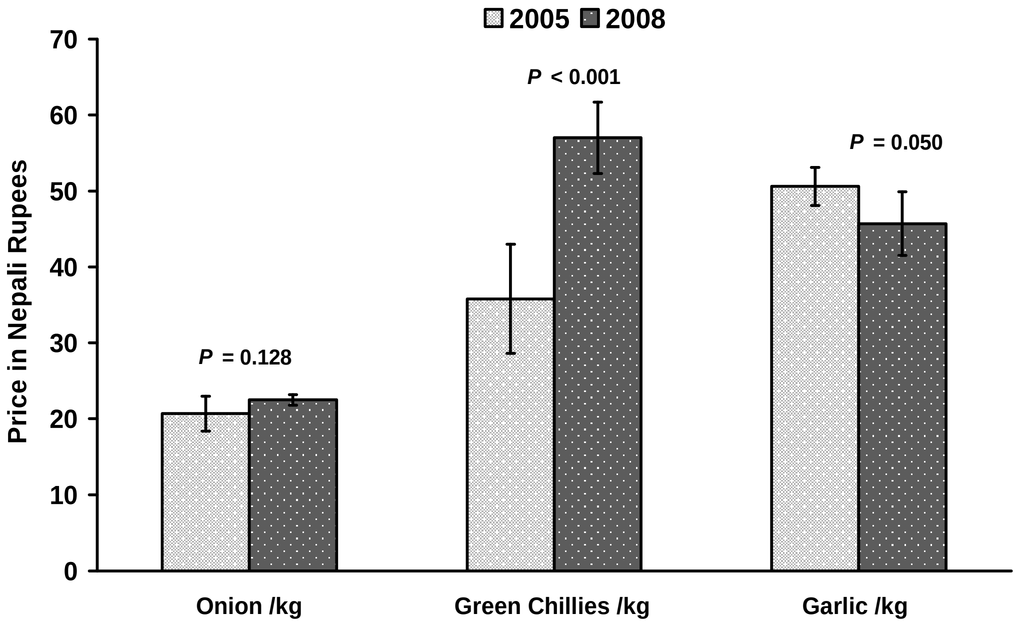


Figure 6.17 Mean prices of roots (potatoes) and vegetables in Dhanusha in 2005 and 2008 (market samples: 2005, 2008: = 17, 31; 14, 49; 15, 35; 18, 48; 36, 51). Error bars represent 95% confidence intervals.

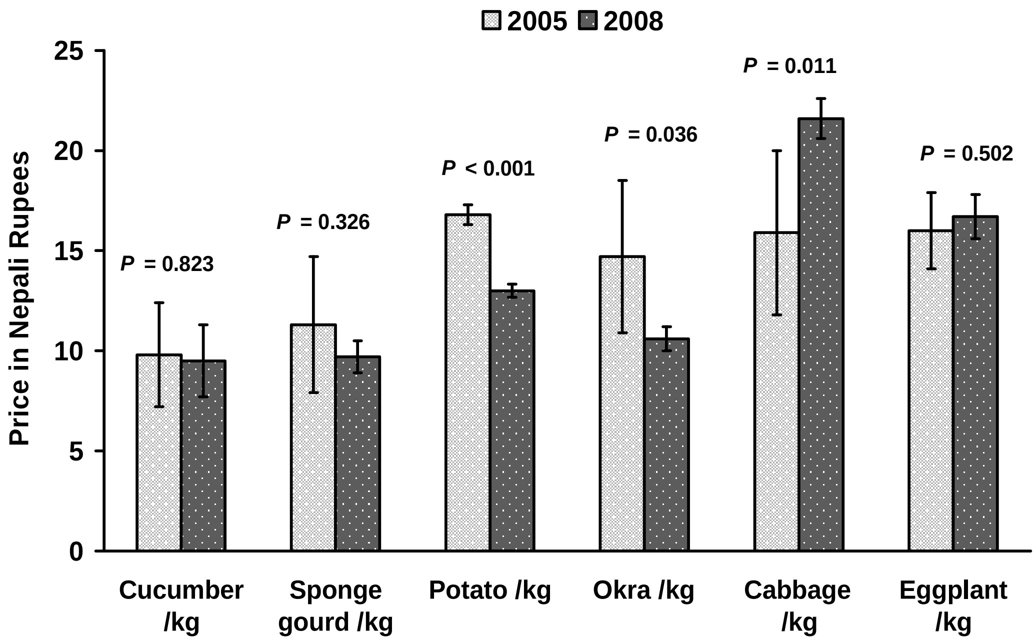
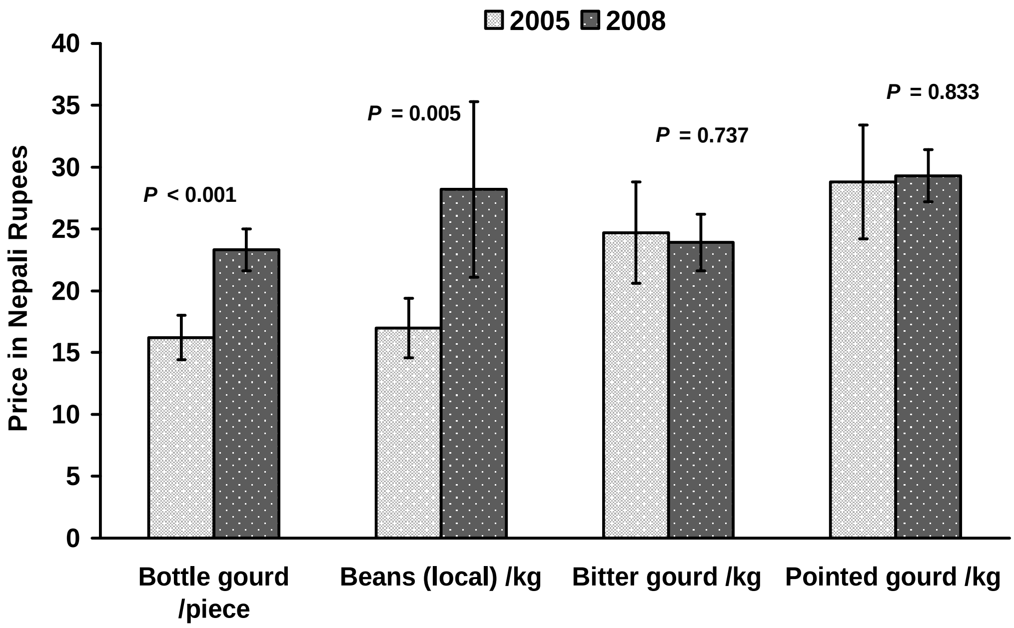


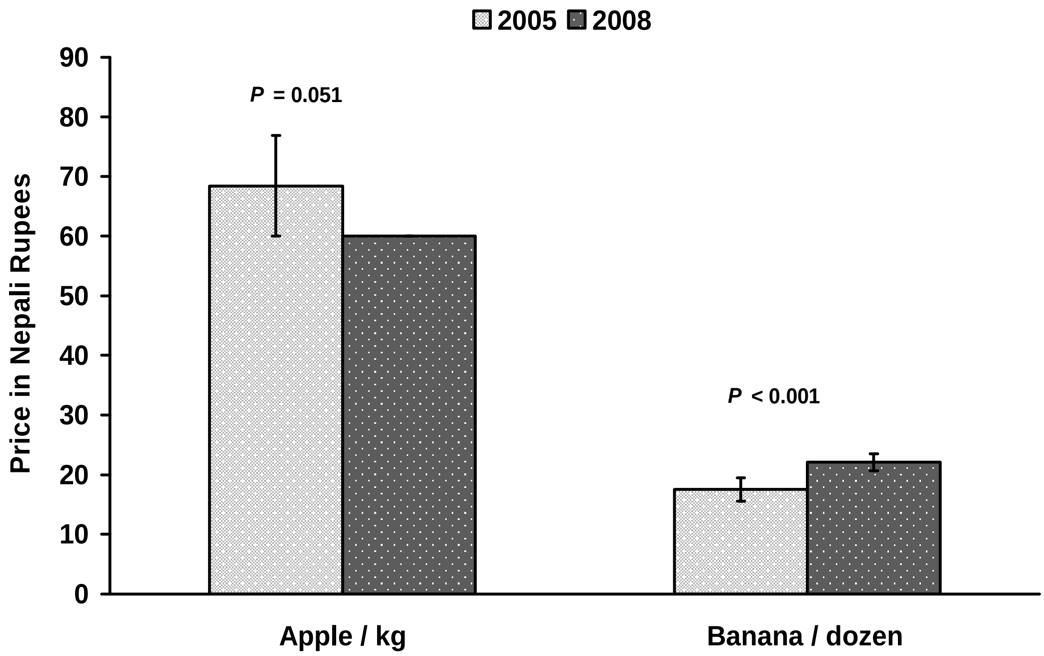
Figure 6.18 Mean prices of vegetables in Dhanusha in 2005 and 2008 (market samples: 2005, 2008: = 26, 47; 25, 15; 34, 46; 31, 51). Error bars represent 95% confidence intervals.



6.5.8 Pre- and post- crisis fruit prices

Figure 6.19 shows the average price of apples (per kg) and bananas (per dozen) in 2005 and 2008. In 2008, the mean price of apples showed a decline, but the mean price of bananas (per dozen) increased significantly (NRs 17.5 vs. 22.1).

Figure 6.19 Mean prices of fruits†† in Dhanusha in 2005 and 2008 (market samples: 2005 and 2008 = 22, 26; 40, 43). Error bars represent 95% confidence intervals.

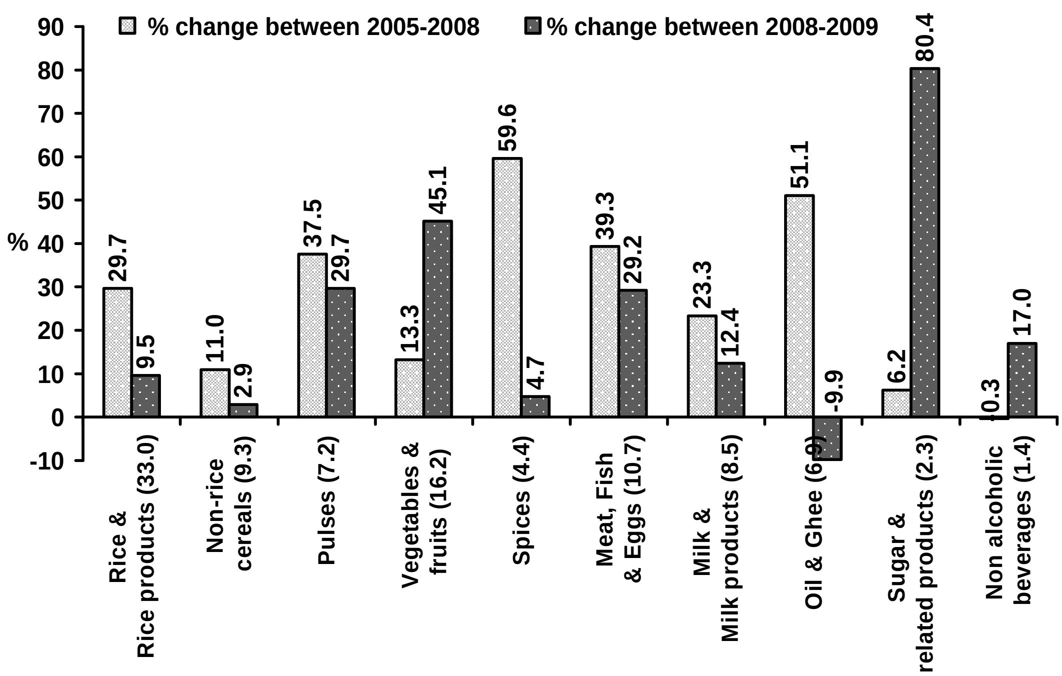


†† Confidence intervals were not shown for the price of apple in 2008 (n=26), as the price did not vary between markets.

6.5.9 Overall percentage change in food prices, between 2005 and 2008, and between 2008 and 2009

Figure 6.20 shows the overall percentage change in food prices for food groups including the change in price of cereal sub-groups, between 2005 and 2008 and between 2008 and 2009. In 2008, prices of spices and oils showed the largest increase. Prices of pulses and meat, fish, eggs also showed an increase of over 30%, compared to 2005 levels. Cereal price increased by 21.6% between 2005 and 2008, and increased further by 6.9% in 2009. In 2009, compared to the 2008 level prices of sugar showed largest increase, about 80%. Prices of vegetables and fruits also increased largely. Generally, in 2009 the overall prices of all food groups showed further increase compared to 2008 level, except for oil and oilseeds which showed a decline in price.

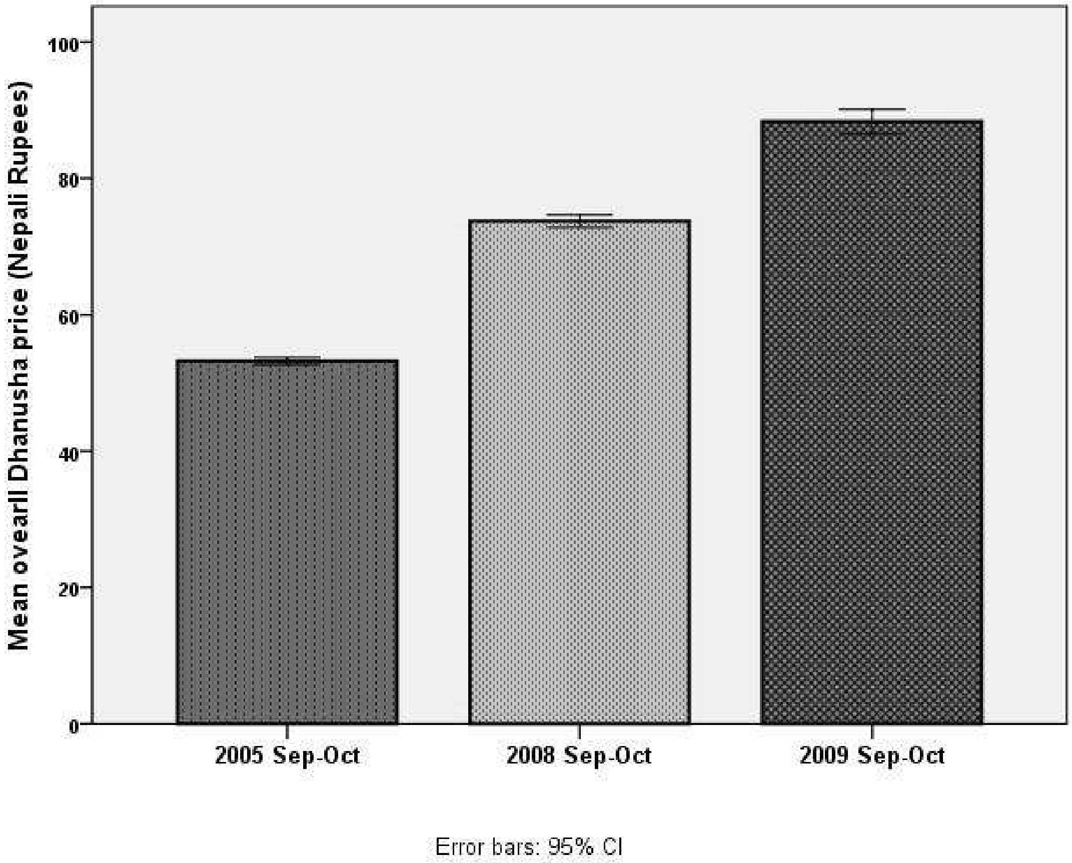
Figure 6.20 Percentages change in overall prices of food groups in Dhanusha between 2005 and 2008, 2008 and 2009.



6.5.10 Comparison of overall food prices in Dhanusha between 2005 and 2009

The result showed that the un-weighted overall food price in Dhanusha (average of 65 item prices from 48 VDC markets) for 2008 was significantly ($P < 0.001$) higher than 2005 (**Figure 6.21**) price. Furthermore, the 2009 overall food price in Dhanusha was significantly higher ($P < 0.001$) than the 2008 overall food price.

Figure 6.21 Un-weighted overall prices of food commodities (65 items) in Dhanusha district between 2005 and 2009. Error bars represent 95% confidence intervals.



6.5.11 Dhanusha food prices inflation

Figure 6.22 shows inflation in food prices in Dhanusha between 2005 and 2009. Point-to-point inflation was 28.5% in 2008 compared to 2005 prices, whereas there was an additional increase of 18.8% in 2009. **Figure 6.23** shows that the increase was steady over the period, but much steeper between 2007 and 2009 compared to the earlier period. Compared to the inflation in food prices in Nepal and Terai (plains within Nepal), it was about 5% less in Dhanusha between 2005 and 2008, but slightly higher in 2009 (**Figure 6.24**).

Figure 6.22 Inflation in Dhanusha food prices, between 2005 and 2009

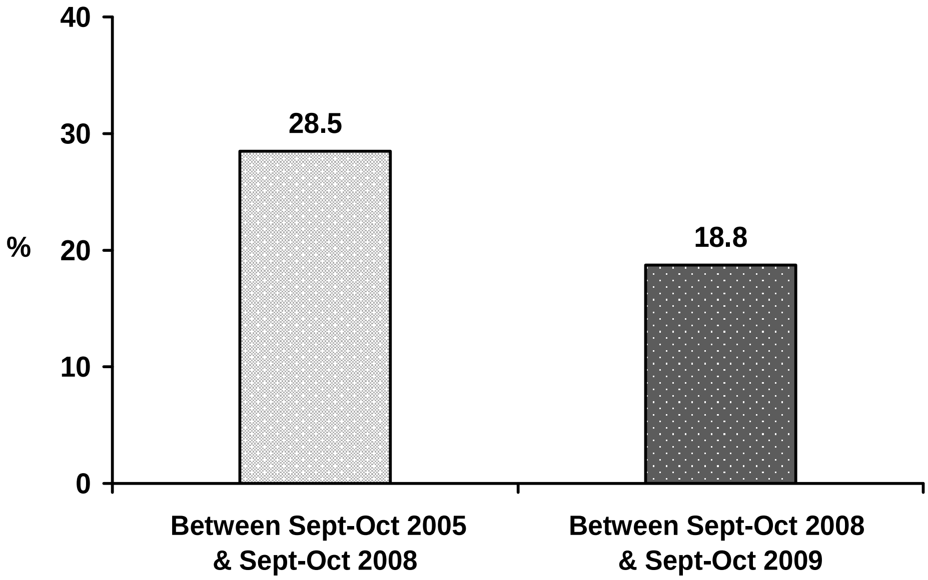


Figure 6.23 Food price inflation in Nepal, Terai and Dhanusha between 2005 and 2009 (2005 considered as base year)

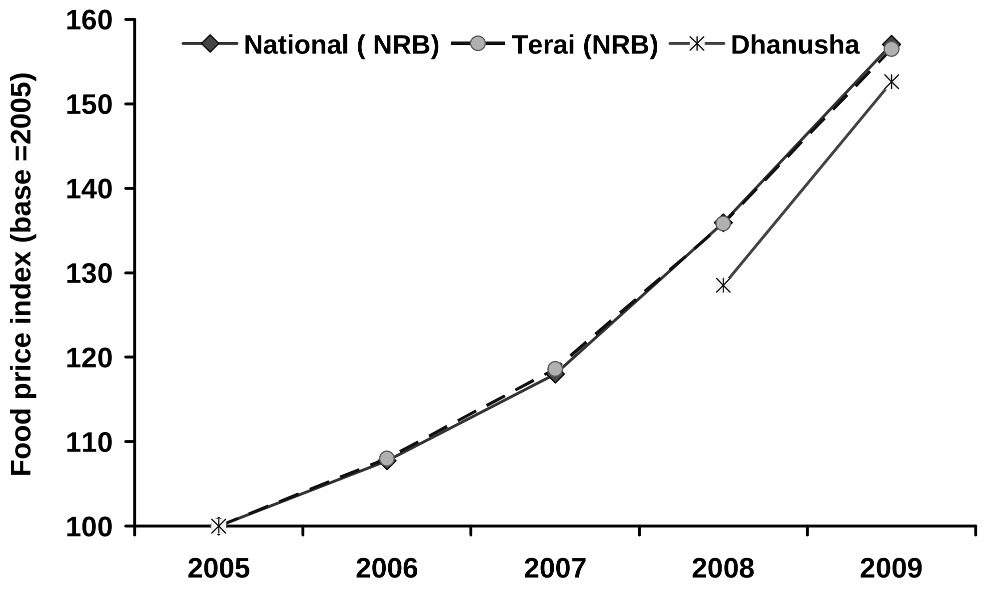
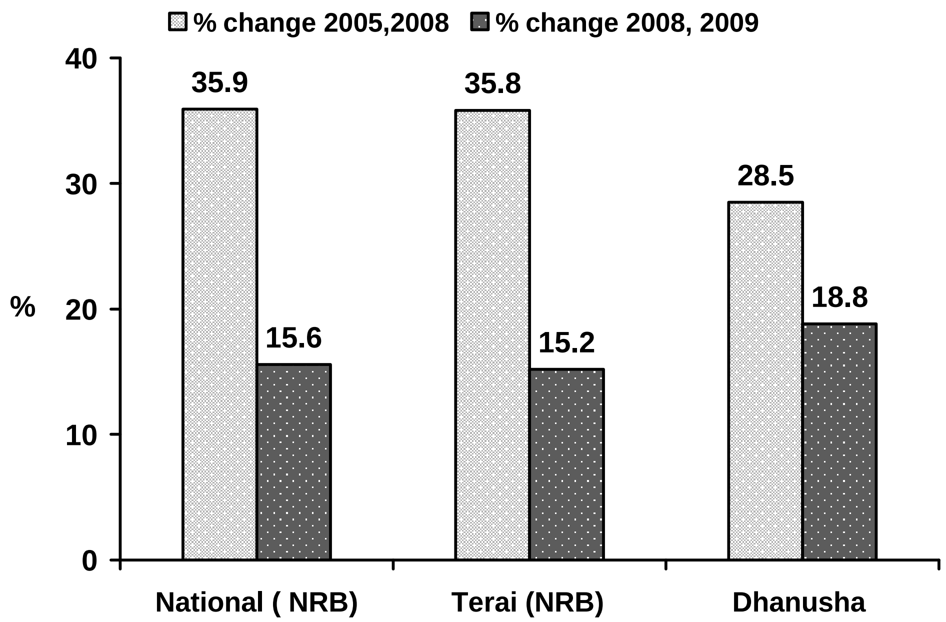


Figure 6.24 Food price inflation in Nepal, Terai (plains of Nepal), Dhanusha between 2005 and 2008, and between 2008 and 2009



6.6 Discussion

6.6.1 Comparison of prices of food items in Dhanusha before (2005) and during (2008) the food price crisis

This chapter estimated food prices in Dhanusha in Sept-Oct of 2005, 2008, and 2009 to assess change in food prices after the 2008 food price crisis. The overall findings showed that food prices increased significantly for most items within the different food groups between 2005 and 2008 (Sept-Oct). Brinkman et al. (2010) estimated that following the food price crisis the overall worldwide cost of a food basket increased by 36%. Their analysis of Nepal data showed that food prices were inversely associated with diversity and frequency of consumption. The consequence of increased prices in rural Nepal included worsened food consumption score, increase in debt, lowering of quality of diets, sale of assets, and taking children out of school.

Within Nepal, production practices as well as food prices often vary between the different regions of the country (WFP 2006). A comparison of rice prices between 2004 and 2007 showed that the prices in mountain markets were consistently higher compared to the markets in the plains; also prices varied between Mid-Western and Eastern region Terai markets (FAO/ WFP 2007). Dhanusha, adjacent to India at one of its border, lies in the Terai (plains) region. Cereal markets in bordering areas of Nepal (Terai and Hills) are integrated with India and influenced by formal and informal trades between the two countries (WFP 2006). Thus the price in Indian markets often determines the price of cereals in neighbouring areas of Nepal (FAO/WFP 2007). The study by Pan et al. (2009) also reconfirms the regional variation in food consumption, and influence of food prices in India specifically on prices in Dhanusha. The Dhanusha price estimates are therefore compared with prices of food items in a border market using data from the Central Bank of Nepal (Central Bank of Nepal 2008; Central Bank of Nepal 2011). The closest match to our Sept-Oct 2005 and 2008 Dhanusha data were from mid-August 2005 and mid-June 2008 Central Bank data. The comparisons of price estimates are shown in **Table 6.2**.

Table 6.2 Food prices in Dhanusha in 2005, 2008; and in the border market as reported by the Central Bank of Nepal

		Central Bank Nepal, Mid-Aug 2005	Dhanusha Sept-Oct 2005	Central Bank Nepal, Mid-Jun 2008	Dhanusha Sept-Oct 2008
Food grains					
	Maize	10.1	12.4	11.8	13.9
	Rice, fine, Basmati	37.4	33.5	51.9	46.0
	Rice, Mansuli	23.8	21.5	33.3	27.5
	Rice Coarse	19.7	19.9	25.3	22.7
	Beaten Rice	24.2	21.3	30.7	28.5
	Wheat Flour, whole	16.8	19.2	26.5	21.1
	Wheat Flour, fine	19.3	24.5	27.8	29.0
Pulses					
	Black Gram	44.8	46.5	62.8	63.5
	Yellow Split pea	51.7	54.2	71.3	78.5
	Mung	53.1	48.5	79.1	61.3
	Red lentil	43.8	45	70.5	75.2
	Chick Pea	35.6	44.8	54.8	56.9
Vegetables					
	White Potato	14.0	16.8	10.5	13.0
	Tomato	32.7	18.4	25.3	42.4
	Cabbage	20.8	15.9	9.9	21.6
Fruits					
	Banana (Dozen)	20.7	17.5	26.3	22.1
	Apple (Chocolate)	75.0	68.4	105.6	60
Spices					
	Salt	9.0	5.7	11.3	7.6
	Turmeric	71.0	66.0	89.0	103.2
	Garlic	46.7	50.6	47.0	45.7
	Ginger	68.3	42.8	63.3	60.8
	Cumin seed	165.0	168.4	233.7	258.9
	Dry Chilli	65.7	70.3	117.3	105.7
	Coriander	51.0	55.8	114.0	123.5
Oil & Ghee					
	Vegetable Ghee (Litre)	49.8	61.5	101.9	105.2
	Mustard Oil (Litre)	95.4	94.7	137.9	132.7
Milk & Milk Products					
	Dairy Milk (Litre)	23.0	23.5	27.5	26.7
Meat, Fish, Egg					
	Mutton	215.0	232.1	266.7	280.7
	Chicken	122.1	129.3	179.2	168.5
	Fish (Rahu)	95.8	113.1	123.8	163.6
	Egg (piece)	4.5	5.0	5.7	6.8

Although the areas and time of data collection are not exactly the same, the Dhanusha and the *Terai* food prices are in good agreement with each other for most of the items. The prices which had a large difference (>=10 NRs) were tomatoes, ginger, mutton, rahu fish, vegetable ghee (oils) in 2005; and mung lentil, tomatoes, apples, cumin, dry chilli, mutton, and rahu fish in 2008. The average price of specific food item in Dhanusha was generated by combining prices of the items sold in different varieties or qualities available in the markets, whereas the Central Bank data recorded price of specified variety (e.g. apples). Therefore *Terai* prices of items which are available in variable size and quality in the local markets may be less comparable to the Dhanusha prices. Food items, such as apples, bottle gourds were sold in variable sizes/units in markets and price data were collected as price/piece or units other than kg or litre. The 2005 data contained more variable units for one item than later surveys. All prices were converted to price per kg or litre for comparability by applying known weight to the units, where possible. The converted per kg or litre price could be less accurate than price data originally collected per kg or litre. Later surveys used pre-coded structured questionnaires and data collectors were encouraged to collect price data for standard units (kg/litre) where possible, so fewer conversions were required. It is also possible that some prices fluctuated a lot within a short period of time and therefore the fact that prices were not matched for exact periods could have contributed to the difference. In total, comparable prices were available for 31 food items and all others showed good agreement with Dhanusha prices; and similar increases in price were also observed in this study.

Strengths of this study are that the price data collection in Dhanusha included items available in local markets and used an extensive list of items commonly consumed by the households in the locality. Food price data were available for pre and post global food crisis, which can be interpreted with the information available on food consumption, expenditure pattern of households and change in income levels within the period. The semi-structured questionnaire used in 2006 HEA data collection was useful to develop a structured questionnaire used in the 2008 and 2009 price surveys. Later, the 2008 and 2009 surveys used one price per item in a market, so the data collection systems were slightly different in 2006 compared with 2008 and 2009.

6.6.2 Prices of cereals in Dhanusha before (2005), during (2008), and after (2009) the global food price crisis

Economists analysed the relationship between price and food consumption, and observed that change in price initiate variable response in demand for the different food groups (Cranfield and Haq 2010). In 2008, all cereals in Dhanusha were significantly higher priced than in 2005, except for prices of maize and wheat (higher but not significantly different). Cereals comprise the bulk of the energy in the total diet, especially in the low-income countries (ODI 2008b). The change in demand (i.e. reduced purchase or consumption) in response to change in food prices and income is much less for cereals, compared to larger decline in consumption of other food groups (Cranfield and Haq 2010; Muhammad et al. 2011). This means that poor people in Dhanusha are less likely to reduce intake of cereals in response to price increase (Ivanic & Martin 2008). A comparison of food consumption pattern in 144 countries, including Nepal, showed that the low-income countries spend larger amount of an additional income on cereal foods (Muhammad et al. 2011). In Nepal, the expenditure of an additional unit of income on food was largest for cereals (16.7%) followed by fruits and vegetables (15.3%) than meat (14.5%), fish (4.9%) or dairy (8.1%) (ibid). Rice, being the main staple in Nepal, accounts for about 67% of the total cereal consumption (World Bank 2010), and contributed to 51.4% and 57.6% of energy, respectively, for men and women (Hirai et al. 1994). In Cambodia, a 10% increase in the price of rice, the staple food, was estimated to increase national poverty by 0.5 percentage points, for both rural and urban areas (Ivanic and Martin 2008). Therefore, the impact of overall 30% increase in rice price and 11% increase in non-cereal prices in Dhanusha between 2005 and 2008 could be large on poor landless households in Dhanusha who rely on purchasing foods. Thus even a small increase in cereal price can influence affordability and quality of the total diet. In Dhanusha, which was the fifth most densely populated district in Nepal (CBS 2006), such an increase in rice price may increase poverty. Furthermore, rice prices in Dhanusha increased by 10% between 2008 and 2009.

The magnitude of cereal price rise in Nepal was lower than in the international market where rice price showed an increase of 60% between 2005 and 2008 (Overseas Development Institute 2008b). The WFP and NDRI (2008) assessment indicated that a good paddy and wheat harvest in 2008 and informal trading from India could have contributed to that. Several studies have also mentioned that the price of cereals in the plains of Nepal is integrated with change in prices in India (WFP market update 2006; Pan et al. 2009; FAO/WFP 2007), and the flow of rice through the border (formal and informal trade) may have played a stabilizing role on the price of rice in Nepal. In the plains of Nepal, approximately one third of the supply of traders comes from India (WFP and NDRI 2008). Brinkman et al. (2010) estimated that rice price increases in Nepal in 2008 over the last year would increase the cost of a food basket by 19%, which is categorised as a very high increase. This impact, however, did not consider income or substitution effect, i.e. whether income of households have changed or they have altered food practice by substituting with a cheaper variety of food items.

When cereal price increases, households have less money available to buy other foods, so their intake of non-grain foods is constrained, resulting in lowered dietary diversity. Torlesse et al. (2003) investigated this issue among rural Bangladeshi households during 1992-2000 and observed that rice prices had a significant positive association with the prevalence of underweight among under-five children. However, over the period, per capita consumption of rice was not associated with rice price. Consistent with findings of Cranfield and Haq (2010), Torlesse et al. (2003) also highlighted that the amount of cereal intake did not change much over the period, and commented that when the price of rice remains low households are able to spend more on micronutrient rich non-cereal. In Indonesia, a similar phenomenon was seen after the economic crisis of 1997, when diminished purchasing capacity made people less able to buy micronutrient rich non-cereal foods and increased micronutrient deficiency among mothers and children was visible (Block et al. 2004).

6.6.3 Prices of non-cereal food groups in Dhanusha before (2005), during (2008), and after (2009) the global food price crisis (2008)

Along with cereal prices, other food prices also influence the prevalence of poverty in a country (Ivanic and Martin 2008). Inevitably, the 2008 food price crisis will have impacted on malnutrition by reducing the quality and the quantity of food consumed, putting more households at risk of malnutrition (Brinkman et al. 2010). The study by Thorne-Lyman et al. (2010) also showed that increased expenditure on non-grain was associated with increased dietary diversity and therefore increased access to micronutrients by households. Pulses, an excellent source of protein, are consumed very frequently in Nepal. Based on findings of the surveillance system in Dhanusha, nearly 60% of the households consumed pulses in the last 24 hours. In 2008, prices of all varieties of pulses increased significantly, which is likely to reduce protein intake in this population.

Compared to 2005 prices, prices of animal foods in Dhanusha increased significantly in 2008, with the exception of eggs from local chicken which are not widely available. The price of eggs from local chickens was much higher in 2008 (rising from 7.7 to 9.9 NRs), but was not significantly different. Findings of the Dhanusha household surveillance showed that the wealthier households had higher consumption of animal source foods, but generally consumption of animal source foods were limited. Hirai et al. (1994) reported that milk and dairy products were the main animal source food in the plains of Nepal. In Dhanusha, the price of curd remained similar but the price of cow milk increased significantly between 2005 and 2008. The rise in prices of animal origin foods is therefore likely to limit protein and micronutrient intake of many households in Dhanusha, as reducing the quantity and quality of diet in response to crisis was common among the households in the poorer wealth groups (see Chapter 4).

Oil and oilseeds are condensed sources of energy in the diet in Nepal. In Dhanusha, oil and oilseeds prices showed large and significant increase in 2008, compared to 2005 prices. Hirai et al. (1994) reported that in rural plains of Nepal fats are consumed in low quantities compared to cereals, pulses and vegetables, and they contributed to around 20% of the total energy intake. Mustard oil is a commonly consumed food item for all wealth groups, and its price increased by 40%. Even though this item is used in small quantity in cooking of Nepalese diet, the household will have to pay more on top of quite high price paid in 2005 (94.7 NRs/litre). A further increase (40%) in price to 132.7/litre by September 2008 would make it even less affordable for the poorer wealth group.

Similar increases were also evident for salt and sugar prices in Dhanusha. In terms of spices, all prices increased significantly, except for cinnamon leaves. The HEA food consumption data in Dhanusha found that turmeric, cumin, and coriander were the items most frequently consumed and prices for these items showed larger increases than others in this group.

The price of fruits and vegetables in Dhanusha were more variable in 2008 and some of the items showed a decline in price. Price of vegetables rich in vitamin A (Tomato, Drumstick leaves) increased significantly, and the price of only one vegetable, Okra, declined significantly in 2008. Vegetables sold in the markets were generally produced in the local area or other areas of Nepal and variability in production in relation to local weather conditions and demand could be one of the reasons for price fluctuation in this food group.

The overall increase in prices of food items in the different food groups in Dhanusha between 2008 and 2009 suggests that on top of the impact of the 2008 food price crisis, the price continued to increase in Dhanusha in 2009. The percentage change in prices for oil (-6.5%), and pulses (30%) in Dhanusha was similar to that reported in Market Watch bulletin 18 in Sept 2009 (WFP/ MoAC/ FNCCI 2009).

6.6.4 Change in overall food prices between 2005 and 2009

The study collected one price per item in a VDC market and generally collected data from one market per VDC to generate a district level overall food price. This was done to minimise resource use and to have an overall price estimate for Dhanusha district. To compare price over period, data were analysed from 48 matched VDCs for 2005, 2008 and 2009. Price of a detailed list of 65 food items available in Dhanusha was combined to estimate overall food price and assess food price increases between 2005 and 2009. The overall price data from Dhanusha was used to assess changes in price in the district as a whole and not to assess variability in prices within the district. Data collection (recall data for 2005) excluded some VDCs in 2006 data collection (7 VDC excluded: VDC #18 Suga Madhukarai, 21 Banniniya, 24 Bagchauda, 29 Dhalkebar, 30 Jhojhikataiya, 37 Naktajhij, 40 Aurahi) due to security concern as there was insurgency at that time. To allow comparable data collection, the 2008 price study included the same 53 VDCs, using which item-wise comparison of food prices between 2005 and 2008 are made. In 2009, data collection was done in 48 VDCs because certain markets had stopped running in the smaller VDCs, having merged with the larger ones, so matched VDCs were chosen for comparing overall prices in Dhanusha in Sept - Oct 2005, 2008 and 2009.

The FAO world food price index shows a rapid increase between 2005 and 2008 (117 in 2005 to 200 in 2008), which then declined in 2009 (200 to 157) (FAO 2012). The increase in food prices varied by country, as well as by food items consumed by people in different parts of the world. The Dhanusha price index showed that between 2005 and 2008 inflation was 28.5%, whereas it increased further by 18.8% within one year. Compared to the increase in last three year, the increase in food prices in Dhanusha in 2009 was larger. For a comparable period of Sep-Oct, the Nepal national urban food and beverage price index showed a annual point-to-point inflation of 7.8%, 9.5%, 15.2%, and 15.6% in 2006, 2007, 2008, 2009 respectively (Central Bank of Nepal 2009). Although prices in Nepal sometimes vary by region, a similar trend was observed for the Terai (plains of Nepal) food and beverage price index. The annual point-to-point inflation rate for the Terai food and beverage index was 8.0%, 9.8%, 14.5%, and 15.2% in 2006, 2007, 2008, and 2009 respectively. On top of the overall inflation of 35.8% between Sep-Oct 2005 and Sep-Oct 2008, the inflation of 15.2% was quite large. A similar trend was observed in Dhanusha food prices.

The phenomenon of change in food prices was different in Nepal compared with the international food price index, as when the world food price was declining in 2009 the Nepal food prices continued to rise (WFP 2010; MOAC, WFP, and FAO 2009). This shows the importance of assessing trends in individual countries or geographic regions. WFP assessment of food security in Nepal predicted that due to low production in 2009 and continued rise in fuel prices, such an increase will continue till mid 2010 (ibid). Another WFP report on Nepal described that 3.4 million people are highly to severely food insecure due to the 2008 food price crisis and the further increase of prices due to winter drought in 2008-09 affecting Nepal (Hobbs 2009). In comparison to 2008, the 2009 winter harvest declined by 10% in the Terai (plains) of Nepal causing a 10% decrease in production and caused a further decline in food availability. Dhanusha, although part of the food surplus areas in Nepal, was considered as one of the marginal deficit area in 2009 in terms of food insufficiency (ibid).

In most settings, the 2008 food price crisis is considered to act as a catalyst in the rise in poverty, food insecurity, and malnutrition, especially in low-income countries (Ivanic and Martin 2008; Davilla 2010; Webb 2010). The large increase in food prices in Dhanusha in 2009 has come on top of the increase in food prices in 2008 due to global food price crisis. Such an increase is likely to affect many poor households in Dhanusha who spent a large amount of expenditure on food. The livelihood patterns of wealth groups (see – Chapter 4) reflected that poorer wealth groups in Dhanusha were engaged in less stable sources of income, compared to Middle or Better-off wealth groups; and that most of them were landless or have minimal landholdings, only sufficient for their home. The Very poor and Poor households had spent a large proportion of expenditure on food (58%, 45% respectively) before the crisis, which reflects their higher vulnerability to food insecurity (IDS 2009). The increased food price may result in households having to spend larger proportions of their total budget on food and to lower the quality of their diet, as the findings in Chapter 4 also showed that poorer households in Dhanusha reduce their quantity and quality of food in response to a crisis, such as the food price crisis. The WFP and NDRI report (2008) suggests that since the extreme poor and poor in rural Nepal have limited land access and spend the majority of their income buying food, they are the most vulnerable to the food price crisis. The report estimated that using a food price vulnerability index, about 9.7 million of the rural population of Nepal would be significant losers, with an additional 9.5 million as marginal losers (83.4%) (WFP and NDRI 2008). The next chapter (Chapter 7) will assess how household incomes in Dhanusha changed between 2005 and 2008. In Chapter 8, price and food consumption data will be used to assess the cost of a nutritionally adequate diet for a typical household in Dhanusha and show how affordability for the different wealth groups may have been affected.

6.6.5 Implications of the findings

Food price volatility, with varied patterns across countries and within countries, has become a threat to food security around the world. Monitoring of local food prices at regular interval can assess trends and guide food insecurity interventions. Although cereals contribute to the bulk of dietary energy intake and a major portion of the food expenditure in developing countries, data collection should include prices of cereals and non-cereal items that are commonly consumed by local people. This will allow an understanding of the overall impact of a food price crisis on a population. Increase in cereal prices alone may imply that households have less money available to buy other non-cereal nutritious food. However, marked increase in price of both cereals and non-cereals may put the households at even greater risk of malnutrition.

A localised food price index that weight data by contribution of food groups in the usual diet can be a useful tool to measure inflation over time. Therefore, local level surveillance of food prices of key food items within different food groups is a good way of predicting the potential impact of food price change on people's purchasing power and food and nutrition security.

Chapter 7. Comparison of income levels among wealth groups in Dhanusha in 2005 and 2008

7.1 Chapter summary

This chapter presents the 2005 and 2008 income levels of the different wealth groups in Dhanusha. Data on income levels of the wealth groups were available for 2005, but not for 2008. Therefore, data collected on changes in cash-income categories used by the different wealth groups and changes in food-derived incomes between the two periods are used for estimating the 2008 income levels of wealth groups.

7.2 Research questions

This chapter answers the following specific research question:

- How did income levels of the wealth groups in Dhanusha change between 2005 and 2008?

The **outcome variables** used to answer the research questions were

  - Average cash-income levels in Dhanusha in 2005 and 2008 by sources and percentage changes in income from these sources between 2005 and 2008;
  - Average percentage change in cash-income of wealth groups in Dhanusha, between 2005 and 2008;
  - Total income levels of the wealth groups in Dhanusha in 2005 and 2008.

7.3 Introduction

Availability and access to food are essential components of food security, and inadequate access to food limits food security. Poverty, purchasing power, and income are important factors that can influence the level of access to food (Maharjan 2011; Sen 1981). Food availability at a country level alone does not necessarily ensure access to food for all. At a household level, households that do not produce sufficient food for the family have to rely on buying food from the market. Whether households can access food in the market depends on their income levels, and purchasing power, especially when food prices rise and households' real income decline. Globally, there are

2.5 billion people who spend <$2 per day and have to spend the majority of their income on food. These are the worst affected by food and economic crisis, but the impact is not the same in populations in different parts of the world. South Asia faced more challenges in 2008, as it was already one of the regions with highest number of hungry (undernourished) population (Naylor and Falcon 2010).

In terms of improving food security in the South Asian Association of Regional Cooperation (SAARC) countries, Nepal warrants more attention because of its prevailing poverty situation and persistent lowest human development index (UNDP 2009). One third of the Nepalese population are still poor, as defined by the population with earnings below the national poverty level (defined by earning needed for the cost of basic needs including food and non-food expenses) (CBS 2004). In terms of the international poverty line, 24.1%, and 65.8% of Nepalese population lived below $1/day and $2/day in 2003/04 (CBS 2005), indicating that low per capita income in the country was a major problem (UNDP 2009). Furthermore, the economic, social and political development in Nepal has been low for the last few decades (Devkota 2007). Nepal is predominantly a country (Pyakuryal K and Suvedi M 2000), where agriculture is the main subsistence activity for nearly 90 per cent of the total population (Devkota 2007). The country relies heavily on external donor supports, which accounted for two-third of its annual budget in recent years. Agriculture had been a poor performing sector with stagnant production for many years (Devkota 2007). The country has been a net food importing country since 1990 (Bohle and Adhikari 1998; Dahal 2010). Food security did not receive much attention in government policy and plans, until the Tenth Plan (2002-2007) was prepared. The Tenth Plan is also known as the poverty reduction strategy paper (PRSP) for Nepal. It included plans to address food insecurity by improving agricultural production, productivity, and decreasing poverty (Nepal Planning Commission 2006). Later, the country aimed at food sovereignty of the people in the recent Three Year Interim Plan (2007-2010) (Nepal Planning Commission 2007). In 2003/04, the average size of agricultural land in Nepal was 0.8 hectares, whereas the area of agricultural land varied between 10.0% and 52.6% between mountains, and plain region of Nepal (CBS 2004). Due to the topographical variation, and low land availability and productivity compared to other Asian countries, achieving food sovereignty for the country is not easy (Dahal 2010).

In Nepal, the prevalence of poverty (% below national poverty line) declined from 42% to 31% between 1995/96 and 2003/04 (UNDP 2009; CBS 2004), but it varied between rural and urban areas, ecological zones, and among different groups. There was considerable inequality between poverty levels in rural and urban areas (34.6% vs. 9.6%, respectively). In 2006, 27.6% of Terai (plain) households were poor and 37.4% did not have sufficient caloric intake (CBS/WFP/WB 2006). The UNDP (2009) Nepal human development report showed that agricultural wage labourers had the highest rate of poverty in 2003/04; however, the decline of poverty was not the same among groups benefiting from different types of income sources. The Terai region covers 14 per cent of the total land area of Nepal, has 64 per cent of total agricultural land (CBS 2008), and is generally the most productive area of Nepal (Pyakuryal et al. 2009). Within the region, productivity may also vary between districts. In 2008/09, Dhanusha district had a grain production deficit (Dahal 2010). However, this does not imply that all households in that area were food insecure.

Wagle (2010) examined income inequality in Nepal using nationally representative data from the Nepal Living Standard Survey 1996 and 2004, and commented that income sources are a useful means of marking inequality in income. He described household income (Wagle 2010, p.576) as follows:

"Household income includes rental, employment, agricultural and business earnings as well as remittance received and the consumption of items that are home grown, produced or received in kind."

His findings reflected that income inequality was very high in Nepal in 2004 and did not change much over the period 1995-2004. He also pointed out that the distribution of income in 2003/2004 was skewed to the right. When the population were divided into income quintiles, the bottom 20% accounted for only 5.3% of national income, whereas the top 20% accounted for 53.4% (CBS 2004). This reflected that even though overall national income increased in 2004, it was largely shared by the wealthier households (ibid). Inequality worsened in 2010/2011, as the contribution of the bottom 20% households decreased slightly (5.3% to 4.1%) whereas increased among the top quintile (53.4% to 56.2%) (CBS 2011). Given the existing high economic inequality and that about one third of the rural population rely on buying foods to meet their need (Govt. of Nepal et al. 2008), rural households in Nepal are likely to be at increased risk of food insecurity after the food price crisis in 2008.

Rising prices and food insecurity generally imposes the biggest challenge to the poor wealth groups in a setting. In a situation when cash income remains unchanged, price increases result in falls in real income, meaning the actual amount of goods and services that can be bought by a unit of money reduces, i.e. purchasing power diminishes. The resultant effect causes households with lower income to have lower consumption, or to substitute cheaper, less preferred items (Samuelson and Nordhaus 2008). In a community where income inequalities are large, this may affect many households. Ruel et al. (2010) argued that in any continent, the poorest will be hardest hit, regardless of them being rural or urban poor. The extent of the impact will depend on the nature of the problem in a particular area and coping strategies available to them (Ruel et al. 2010). Naylor and Falcon (2010) suggested that the impact would go beyond the poor people to reach the middle class as the value of their assets lessens as a crisis advances. Information about change in income in relation to change in food prices among different wealth groups is essential to the understanding of impact of price rises on food security. Therefore, this chapter aims to assess how income of wealth groups engaged in different income categories have changed between 2005 and 2008, so that along with the magnitude of food price rise, information about relevant factors influencing the food security situation in Dhuanusha, plains of Nepal is available.

7.4 Methods

7.4.1 Data sources

A list of cash income sources commonly reported in the HEA wealth group interviews was prepared, and data were collected on income levels of the sources in 2008 and in 2005. Key informant interviews purposively sampling persons involved in different income sources were conducted between 27 October 2008 and 27 November 2008 in Dhanusha. Three questionnaires were used:

1. A questionnaire was designed for key informants from each of 60 VDCs to ascertain the *common forms of labour* such as agricultural labour, migratory labour and remittance. For each income source a key informant involved in that income opportunity was sought where possible (i.e. In each VDC a number of key informants answered about their respective income sources).

2. A second questionnaire was administered to collect data on *income sources*. For administrative purposes, the data collection area (60 VDCs) was sub-divided into 6 unit offices of the local NGO MIRA (each had 8-12 VDCs depending on VDC size), and interviewers in each of the unit covered a maximum of two study cites. The allocation was done based on geographical locations within Dhanusha so that data comes from different parts of the district and covers the possible spatial differences in income level of its residents. Where possible, data were collected from a key informant directly involved in the type of income for which data were collected.
3. One key informant interview was conducted to collect relevant data about a range of *government office pay scales*, in each of the following offices: District Development Committee (DDC) office, District Public Health Office (DPHO) and District Education Office (DEO). As government pay rates are standardised across Dhanusha district and nationally, from each of these offices only one estimate was taken for a specific job.

Details of the type of data collected from the key informants are shown in **Table 7.1**. It is important to note that data were collected on level of income from cash-income sources only. Data on income through selling their agricultural production were not included. During each interview, data on current income levels (2008), recall of 2005 cash-incomes, and type of informant of each income source were recorded. Respondent categories (except for government jobs) included a person directly involved in the work, somebody in the family of a person involved in the work, someone in the same occupational caste, a community leader etc. Data on pay of the government employees were collected from a senior officer in the respective office. Due to variability in cash-income sources, data were collected on daily pay rates for day labourers; monthly profits for those involved in self-employment/trades; annual incomes from seasonal migratory labours and remittances from overseas; and monthly salaries for government employees.

Table 7.1 Cash-income sources by data collection sites

Every VDC	12 purposively selected VDC	Government Offices
Daily waged labour	**Daily waged labour**	**District Development Committee**
- Agricultural labour **Migratory labour to** - Janakpur - Kathmandu - India - Other places	- Digging irrigation canals - Road repair - House making - Thatching roof - Rickshaw driving - Borehole digging - Construction labour - Carpenter - Skilled factory labour - Unskilled factory labour - Wedding band play	- Support staff - Junior Administrative clerk - Middle-rank Administrative clerk - Agricultural Officer - Senior level Officer
Remittances from	**Self-employment/ trade**	**District Public Health Office**
- Arab - Malaysia - Other	- Small tea shop - Small snack shop - Small restaurant /hotel - Small vegetable stall - Mobile vegetable stall - Medium vegetable stall - Small grocery shop - Small alcohol shop - Medium grocery shop - Small medicine shop - Medium medicine shop - Small tailoring shop - Small cloth shop - Livestock middle man - Large cloth shop - Large wholesale shop	- Maternal and Child Health Worker / Village Health Worker - Auxiliary Nurse Midwife / Auxiliary Health Worker / Community Medical Assistant - Health Assistant / Staff nurse - BA Nurse - Doctor **District Education Office** - Primary school teacher - Lower secondary school teacher - Secondary school teacher - Campus lecturer

7.4.2 Data analysis

This chapter utilised both data collected on changes in cash-income between 2005 and 2008, as well as the detailed HEA data on what types of income earning activities were utilised by the different wealth groups (see Chapter 4). Analyses in this chapter were done to generate the indicators mentioned in **Table 7.2**:

Table 7.2 Analysis performed and income indicators generated for wealth groups in 2008

Type of data	Indicators generated
1. HEA WGR income data (Chapter 4)	a. Percentage of total income contributed by food-derived income and cash-income, disaggregated by wealth group b. Percentage of total cash-income contributed by sub-categories, disaggregated by wealth group
2. Income survey 2008	**2.** Percentage change in cash-income between 2005 and 2008, disaggregated by its sub-categories

Since the total income of wealth groups was comprised of a)food-derived income and b) cash-income, analyses were done to estimate the proportion of income from these two sources. **Table 7.3** shows the sub-categories included under food-derived income and cash-income categories.

Table 7.3 Types of income included under food-derived income and cash-income categories

Categories	**Food-derived income**	**Cash-income**
Sub-categories	Sale of staples	Daily waged labour
	Sale of dairy products	Migratory labour
	Sale of vegetables	Self-employment/ remittance
	Sale of pulses	Regular job
	Sale of fruits	Remittance
	Sale of wild-fish	
	Sale of livestock	

7.4.2.1 Percentage of total income contributed by food-derived income and cash-income, disaggregated by wealth group

The HEA generally divides income into two main categories: food-derived income and cash-income. **Food-derived income** may come from selling own production and that received from shared cropping, or selling own or shared animals or animal products. The **cash-income** component of the total income in Dhanusha was defined as income earned as cash in the form of salaries, wages, remittances, or profits from self-employment/trade. At first, detailed wealth group income interviews data (chapter 4) were used to estimate the proportion of income contributed by food and cash-income categories, disaggregated by wealth groups. The frequency of interviews reporting categories of food-derived income and cash-income were converted to a percentage contribution to the total income. This was done separately for each wealth group, for example:

Percentage of total income contributed by food-derived income among the Very poor =

$$\frac{\text{Number of income interviews among the Very Poor that reported utilising food-derived income}}{\text{Total number of income interviews among the Very Poor (\# interviews reporting food-derived income + cash-income)}} \times 100$$

7.4.2.2 Percentage of total cash-income contributed by sub-categories, disaggregated by wealth group

The next step was to estimate the percentage of total-cash income contributed by the sub-categories included within it, so that this data could be used to predict 2008 cash-income according to their relative importance. Cash-income sources were summed up for each sub-category (e.g. daily waged labour, seasonal migration, remittance earning, self-employment/ trade, regular job). A separate calculation was done for each wealth group.

For example, the percentage of total cash-income contributed by daily waged labour among the Poor wealth group was estimated using the following formula:

Percentage of total cash-income contributed by daily waged labour among the Poor =

$$\frac{\text{Income interviews among the Poor that reported income from daily waged labour}}{\text{Total income interviews among the Very poor that reported utilising cash-income categories}} \times 100$$

7.4.2.3 Percentage change in cash-income between 2005 and 2008, disaggregated by its sub-categories

The 2008 income study collected data on 2005 and 2008 income levels for common sources of cash-income included within each of the sub-categories (e.g. daily waged labour, regular job, remittance). Using the 2008 income study data, median cash-income levels in 2005 and 2008 were estimated for different cash-income sources, except for government job salaries. For government job salaries, the minimum and maximum pay for each source was collected (e.g. minimum and maximum salaries of primary school teachers). The mean was then used to reflect government pay for different occupations.

For each cash-income source that was not a government job, the percentage change was estimated using the median income level in 2005 and 2008. The formula used to calculate change in a cash-income source was: (2008 income level/2005 income level) X 100-100.

The overall percentage change in a cash-income sub-category was estimated by averaging the percentage change in all available income sources within that category. For example:

% change in daily waged labour income = Average (percentage changes in commonly utilised daily waged income sources).

Analyses of the 2008 income study also included calculating mean and 95% confidence intervals for data on the availability of seasonal migratory labour work (months) in 2005 and 2008. Independent Sample T tests were performed to examine differences in the availability of seasonal migratory labour in 2005 and 2008, separately for each of the different places they went to (e.g. India, Kathmandu). P value of <0.05 was considered to be significant.

7.4.2.4 Estimating the 2008 income data for wealth groups

The next step was to use the data generated to predict the income levels of wealth groups in 2008. The HEA study generated detailed data about the type of income earning activities that wealth groups were engaged in, but it was not possible to estimate the average level of income obtained from them (See Chapter 4). However, the HEA method is designed to estimate income so that it will be the same as the expenditure level, while the focus of either income or expenditure data collection remains on how different categories contributed to the total amount (Holzmann et al. 2008). Therefore, average expenditure levels for wealth groups in Dhanusha were used as a proxy of their income levels. The next step was to predict 2008 income levels of wealth groups using the available data. Firstly, expenditure levels in 2005 (proxy of income), were divided into cash-income and food-derived income, and each component was adjusted to reflect 2008 income levels.

> **2005 cash-income** = (2005 total income X percentage of total income contributed by cash-income);
>
> **2005 food-derived income** = (2005 total income X percentage of total income that were food derived)

To reflect 2008 income levels, the change in cash-income of wealth groups was adjusted by the relative contribution of sub-categories within it, whereas food-derived income levels were adjusted to allow for the estimate of food price inflation in Dhanusha (Chapter 6). It was assumed that the contribution of cash-income and food-derived income for all wealth groups remained static over the period. For each wealth group, the 2008 cash-income and food-derived income were predicted using the following formulas:

a. 2008 cash-income = (2005 cash-income) + [(2005 cash-income X change in cash-income) for each sub-categories];

b. 2008 food-derived income = (2005 total income X proportion of income that was food derived) + [(2005 total income X proportion of income that was food derived) X food price inflation between the period]

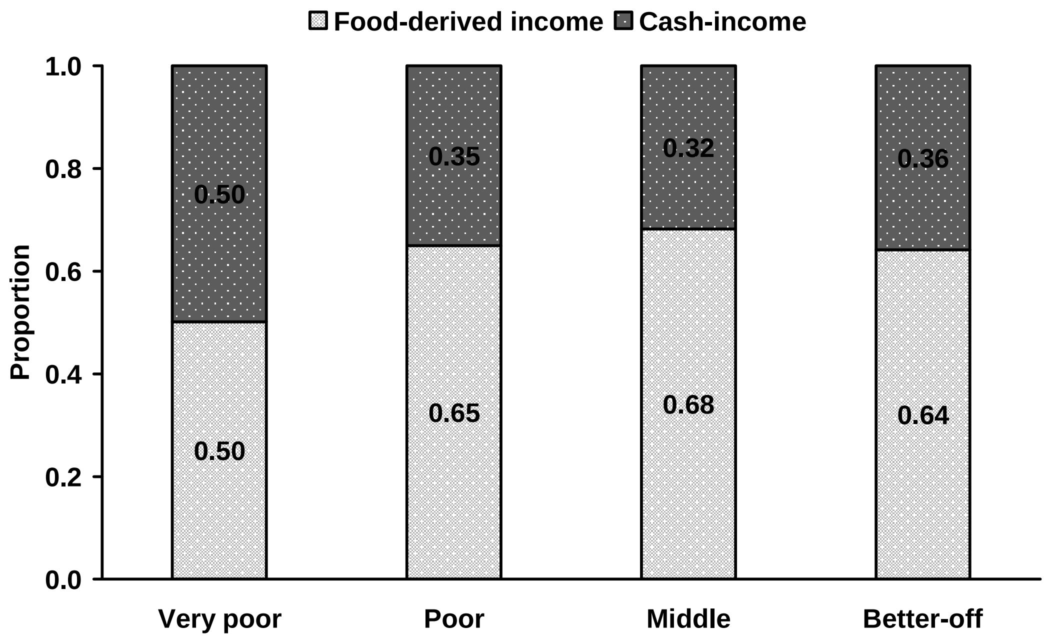
Save the Children UK practitioner's guidelines about using the Cost of Diet programme suggested that in a case when recent income data has not been collected, previously collected income data can be updated using the national food price inflation rate (Save the Children UK 2011b). Save the Children has used this approach in Bangladesh, Ethiopia, Mayanmar and Tanzania (Save the Children 2009). The guidelines suggested using national level inflation data assuming that inflation at local level would be similar, but also cautioned to check that this assumption was correct for a specific area (Save the Children UK 2011b). For estimation of Dhanusha income in 2008, I used data collected on the change in cash-income to adjust the proportion of total income contributed by cash-income, and used the estimated food price inflation (see Chapter 6) to adjust the food-derived income. The total income of a wealth group in 2008 in Dhanusha was therefore generated by adding up the overall adjusted contribution of food-derived and cash-income sources.

7.5 Results

7.5.1 Proportion of food-derived and cash-income of wealth groups

Figure 7.1 shows the relative contribution of food-derived income and cash-income to the total income of wealth groups in Dhanusha in 2005. Nearly half of the total income of the Very poor households was contributed by cash-income, whereas it was about one third among other wealth groups.

Figure 7.1 Proportion of food-derived and cash-income by the wealth groups in Dhanusha (based on HEA data income data collected in 2006)



7.5.2 Income profile of the wealth groups

Table 7.4 shows the utilisation of daily labour, seasonal migration and remittance by the wealth groups in Dhanusha as cash-income sources. Overall, daily waged labour as a source of income was commonly used by the poorer wealth groups (Very poor, Poor). Within the daily labour wage category, the Middle wealth group only reported using 'House making' and 'Carpentry' as their income sources. Seasonal migratory labour to different parts of Nepal or outside Nepal, was utilised by the Very poor, Poor and Middle wealth groups as income source. However, all wealth groups other than the Very poor reported remittance earning as their source of income.

Table 7.5 presents the different income sources within self-employment/trade category utilised by the different wealth groups in Dhanusha. Poorer wealth groups reported earning from sources such as 'small tea shop', 'mobile vegetable stall', or basket vegetable stall' which generally did not require high start up costs. The Middle wealth group were involved in somewhat larger businesses, such as 'small tailoring/cloth shop', 'medium grocery shop'. On the other hand, the wealthiest households were engaged with larger businesses, and reported earning from 'large medicine shop', 'large cloth shop'. **Table 7.6** shows that government employment, a regular source of income, was more used by the Middle and Better-off wealth groups. None of the interviews among the Very poor wealth group reported earning from government jobs. The Better-off households included senior level government employees such as 'Agricultural Officer', 'Senior Officer' and various levels of teachers within their income sources.

Table 7.7 presents the sources of food-income that wealth groups in Dhanusha utilised. It is apparent that households of any wealth groups sold agricultural outputs (staples, dairy, pulses, vegetables, and fruits) as a source of food-income. Similarly, all wealth groups sold livestock each year to earn income. The only exception was selling of wild fish, which was done by poorer households only.

Table 7.4 Daily waged labour and seasonal migratory labour as cash-income sources of wealth groups in Dhanusha, based on HEA data income data collected in 2006

Cash-income sources	Wealth groups			
	Very poor	Poor	Middle	Better-off
Daily waged labour				
Digging irrigation canals	x	x	-	-
Agricultural labour	x	x	-	-
Road repair	x	x	-	-
House making	x	x	x	-
Thatching roof	x	x	-	-
Borehole repair	x	x	-	-
Construction labour	x	x	-	-
Unskilled factory labour	x	x	-	-
Skilled factory labour	x	x	-	-
Wedding band	x	x	-	-
Rickshaw driving	x	x	-	-
Carpenter	x	x	x	-
Seasonal migratory labour to				
Janakpur/ Kathmandu	x	x	x	-
India/ Other places	x	x	x	-
Overseas remittance earnings from				
Arab/ Malaysia/	-	x	x	x
Other places	-	x	x	x

Table 7.5 Self employment and trading as cash-income sources of wealth groups in Dhanusha, based on HEA data income data collected in 2006

Cash-income sources	Wealth groups			
Self-employment /trade	**Very poor**	**Poor**	**Middle**	**Better-off**
Small snack shop	x	x	-	-
Small tea shop	x	-	-	-
Mobile vegetable stall	x	-	-	-
Small vegetable stall	x	-	-	-
Medium vegetable stall	x	-	-	-
Small grocery shop	x	x	-	-
Small tailoring shop	-	x	x	-
Small local pub	-	x	x	-
Small restaurant	-	x	x	-
Home brewing alcohol	-	-	x	-
Livestock middle men	-	-	x	-
Medium grocery shop	-	-	x	x
Small cloth shop	-	-	x	x
Small Medicine shop	-	-	-	x
Medium Medicine shop	-	-	-	x
Large cloth shop	-	-	-	x
Large wholesale shop	-	-	-	x

Table 7.6 Government employment as cash-income sources of wealth groups in Dhanusha, based on HEA data income data collected in 2006

Cash-income sources	Wealth groups			
Government employments	Very poor	Poor	Middle	Better- off
Support staff	-	x	x	-
Junior Administrative Clerk	-	x	x	-
Middle-rank Administrative Clerk	-	-	x	-
Senior level Officer	-	-	x	x
Primary School Teacher	-	x	x	x
Lower Secondary School Teacher	-	-	x	x
Secondary School Teacher	-	-	x	x
Campus Lecturer	-	-	x	x
Maternal and Child Health Worker	-	x	x	-
Village Health Worker	-	x	x	-
Auxiliary Nurse Midwife /Health Worker	-	x	x	x
Community Medical Assistant	-	x	x	x
Health Assistant / Staff Nurse	-	-	x	x
Doctor	-	-	x	x

Table 7.7 Food-derived income sources among wealth groups in Dhanusha, based on HEA data income data collected in 2006

Food-derived income sources	Wealth groups			
	Very poor	Poor	Middle	Better-off
Selling staples	x	x	x	x
Selling pulses	x	x	x	x
Selling vegetables	x	x	x	x
Selling fruits	x	x	x	x
Selling dairy and dairy products	x	x	x	x
Selling wild fish	x	x	-	-
Selling livestock	x	x	x	x

7.5.3 Change in cash-income by sources and wealth groups

The daily pay rates for agricultural and non-agricultural daily labourers in Dhanusha and changes in pay are shown in **Table 7.8**. Between 2005 and 2008, median pay rates from all types of daily labour increased. The increase in daily pay ranged from 25% - 67%, except for those who earn by playing in a wedding band increasing greatly (140%). The increase in playing in a wedding band was followed by the increase in the pay of repairing borehole (67%). Similar increase was evident for the pay of house making (66%), and road repair (63%). Increase in pay was lowest among the agricultural labour, similar for both men and women (25%). The pay of rickshaw driving also showed similar increase (26%). However, comparison of the absolute amount that daily labourers earned per day in 2008 showed that the agricultural labourers remained the lowest paid (100 Nepali Rupees/ day).

Table 7.9 shows the median annual income by a household member in Dhanusha, earning from short-term migratory labour activities and overseas remittances. Similar to the increase in income of daily labourers in Dhanusha, an increase was evident for people having short-spells of work in different migratory labour locations (7- 42%). Percentage increase in income from India was comparatively lower (19%) than increase in income from migratory labour within Nepal (33% - 42%). For seasonal migratory work, household members in Dhanusha also went to locations other than those commonly used (several locations), but on average the earning did not show much increase (7%). Although variable increase in earnings from seasonal migratory labour was evident, availability of migratory labour (number of months work was available/year) remained similar (**Figure 7.2**) for both periods (all $P > 0.05$). The availability of migratory labour in places other than Janakpur, Kathmandu, and India included more than one place and therefore a significance test to compare availability in the two periods was not performed for this source. The absolute amount (Nepali Rupees) earned through remittances from working in Arab countries, Malaysia and other countries was much higher than that earned from seasonal migratory labour in both 2005 and 2008. However, in 2008 the average annual remittances earned by working in Arab countries also remained same, but remittances earning through working in Malaysia increased by 11% from 2005 level.

Table 7.8 Daily pay rates for different types of labourers in Dhanusha in 2005 and 2008

Daily pay income sources	2005 median daily pay in Nepali Rupees/ kg (25th – 75th percentile)	2008 median daily pay in Nepali Rupees/ kg (25th - 75th percentile)	Change (%)	n*	Respondents involved in the work (%)
Agricultural labour men (cash)	80 (60 - 100)	100 (100 - 150)	25	60	73
Agricultural labour women (cash)	80 (60 - 100)	100 (100 - 144)	25	60	73
Road repair	100 (50 - 100)	163 (119 - 200)	63	10	80
Digging irrigation canals	100 (100 – 125)	150 (120 - 175)	50	11	91
House making	113 (93 - 169)	188 (122 - 250)	66	12	75
Thatching roof	150 (100 – 200)	200 (158 - 300)	33	6	67
Unskilled factory labour	90 (76 - 138)	125 (106 - 181)	39	5	60
Borehole repair	113 (100 – 158)	189 (150 - 238)	67	8	75
Skilled factory labour	150 (113 – 188)	200 (75 - 250)	33	5	100
Rickshaw driving	149 (95 - 194)	188 (133 - 350)	26	11	82
Carpenter	200 (181- 200)	300 (256 - 338)	50	12	83
Construction labour	200 (150 – 250)	300 (250 - 350)	50	11	55
Wedding band	278 (167 – 625)	667 (422 - 958)	140	11	82

*n denotes number of interviews

Table 7.9 Yearly income of one person in Dhanusha earning from seasonal migratory labour and overseas remittance in 2005 and 2008

Income sources	2005 median income in Nepali Rupees (25th -75th percentile)	2008 median income in Nepali Rupees (25th , 75th percentile)	Change (%)	n*	Respondents involved in the work (%)
Yearly income from seasonal migrations to:					
Janakpur	22,500 (18,000 - 30,000)	32,000 (27,000 - 48,000)	42	55	63
Kathmandu	33,750 (18,000 - 48,000)	45,000 (35,750 - 60,000)	33	54	65
Seasonal migration to India	26,000 (20,000 - 35,750)	31,000 (25,250 - 50,000)	19	56	67
Seasonal migration to Other places	30,000 (14,000 - 55,000)	32,046 (23,750 - 71,250)	7	24	70
Yearly income from remittances from:					
Arab countries	125,000 (100,000 - 150000)	125,000 (100,000 - 150,000)	0	57	71
Malaysia	112,500 (100000 - 150000)	125,000 (110,000 - 150,000)	11	59	71
Other places	215,000 (150000 - 400000)	205,000 (165,000 - 300,000)	5	39	71

*n denotes number of interviews

Figure 7.2 Number of months income earned from short-term migratory labour from places outside Dhanusha in 2005 and 2008 (n: Janakpur = 55, Kathmandu = 54, India = 55, Others = 24)

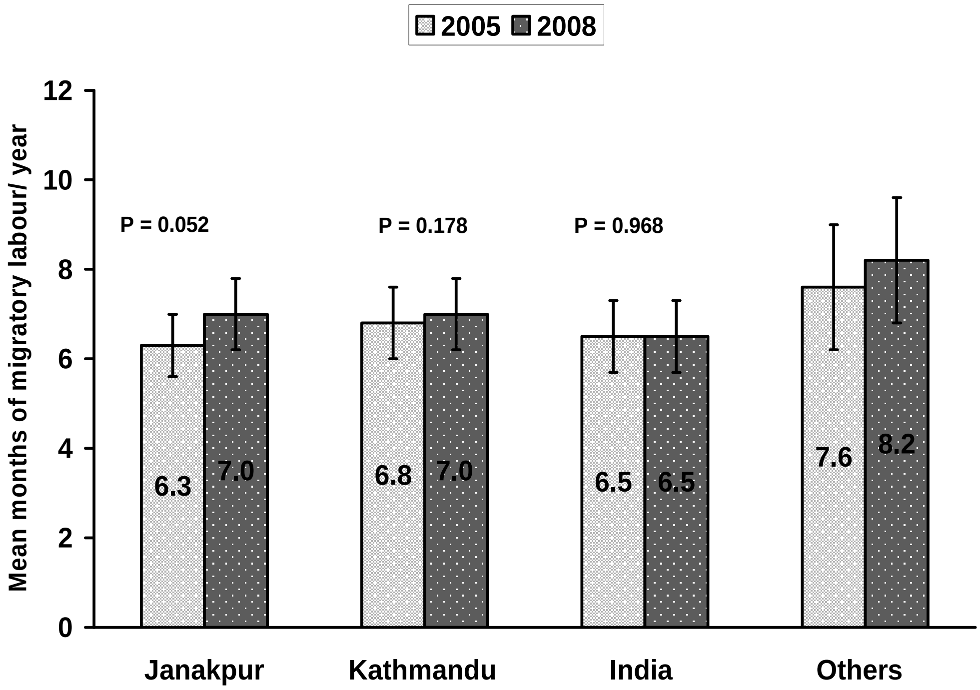


Table 7.10 shows profits from the different self-employments and trading in Dhanusha in 2005 and 2008. The profit from small, medium, and large businesses varied largely within one source, but did not show a clear pattern of change. In 2008, on average profits increased for all income sources included in this category. The increase between 2005 and 2008 ranged from a minimum of 6% from a 'small medicine shop' to a maximum of 90% from a 'small vegetable stall'. Within this category, profits earned from a 'small snack shop', 'large cloth shop', or a 'large wholesale shop' (50%, 47%, 47% respectively) were the ones that showed comparatively larger increase.

Table 7.11 shows the average monthly salary of different government jobs in Nepal in 2005 and 2008. The increase in salaries of government employees ranged from 14% to 69%. Salaries of 'Doctors' and 'Campus Lecturers' were some of those who were highest paid in 2005. Both these positions had the lowest increase in monthly salary in 2008 (both increased by 14%). It seemed that the increase was lower among the employees who already had a comparatively high salary than others in 2005.

Table 7.10 Monthly incomes from self-employment/trades in Dhanusha, in 2005 and 2008

Self-employment/ Trade	2005 median monthly profit in Nepali Rupees(25th-75th percentile)	2008 median monthly profit in Nepali Rupees(25th-75th percentile)	Change (%)	n*	Respondents involved in the work (%)
Small snack shop	1,000 (1,000 - 1,500)	1,500 (800 - 2,000)	50	10	44
Small tea shop	1,500 (975 - 2,313)	2,000 (1,000 - 3,250)	33	11	40
Mobile vegetable stall	1,425 (400 - 1,875)	1,825 (1,125 - 3,000)	28	8	50
Small vegetable stall	1,450 (788 - 2,250)	2,750 (788 - 3,813)	90	10	73
Small grocery shop	3,000 (1,500 - 4,000)	4,000 (1,750 - 5,000)	33	8	17
Medium vegetable stall	3,500 (1,775 - 4,750)	4,500 (2375 - 6,250)	29	12	56
Small cloth shop	3,250 (2,250 - 5,750)	4,000 (2,938 - 7,250)	23	8	40
Small tailoring shop	4,000 (2,900 - 5,250)	5,000 (4,000 - 7,250)	25	9	60
Small local pub	4000 (3,063 - 5,750)	5,000 (3,250 - 7,250)	25	9	50
Small medicine shop	4,250 (3,125 - 6,500)	4,500 (3125 - 5,000)	6	11	27
Small restaurant	4,750 (4,000 - 7,000)	5,750 (5,000 - 9,000)	21	8	50
Medium grocery shop	4,750 (3,375 - 6,125)	6,000 (4,875 - 8,125)	26	12	56
Medium medicine shop	6,000 (3,500 - 7,125)	7,750 (3,813 - 8,750)	29	10	25
Livestock middle men	6,250 (4,750 - 9,250)	7,000 (5,750 - 10,625)	12	6	86
Home brewing alcohol	7,000 (4,375 - 9,625)	8,000 (6,625 - 11,250)	14	7	43
Large cloth shop	8,500 (5,500 - 13,750)	12,500 (7,500 - 22,500)	47	4	38
Large wholesale shop	12,750 (8000 - 19375)	18,750 (11,250 - 28,125)	47	6	50

*n denotes number of interviews

Table 7.11 Average monthly salaries of government jobs in Dhanusha, in 2005, 2008

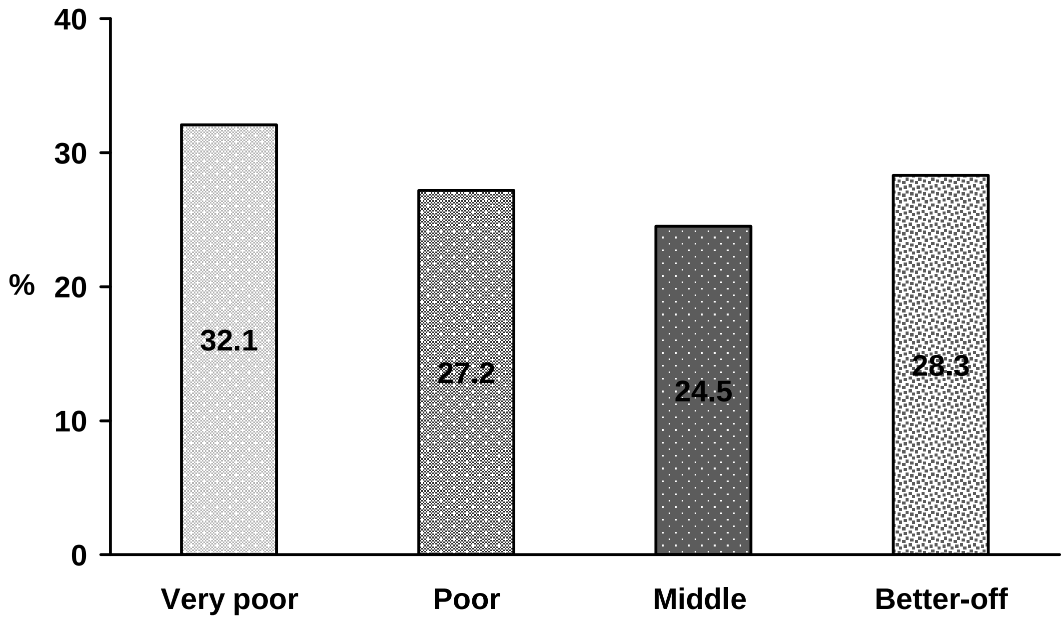
Government job	2005 mean monthly salary in Nepali Rupees	2008 mean monthly salary in Nepali Rupees	Change (%)	Data collected from
Administrative and other jobs				
Support staff	4536	7016	55	District Development Committee
Junior Administrative Clerk	4537	7704	67	
Middle-rank Administrative Clerk	5672	8640	52	
Agricultural Officer	6356	9750	53	
Senior level Officer	9632	12481	30	
Health workers				
Maternal and Child Health Worker / Village Health Worker	5920	7920	34	District Public Health Office
Auxiliary Nurse Midwife / Auxiliary Health Worker / Community Medical Assistant	8865	10865	23	
Health Assistant / Staff Nurse	9845	11845	20	
Doctor	14100	16100	14	
Teachers				
Primary School Teacher	4900	8280	69	District Education Office
Lower Secondary School Teacher	6280	9885	57	
Secondary School Teacher	9000	13450	49	
Campus Lecturer	14510	16510	14	

Figure 7.3 shows the contribution of different income categories to the total cash-income of the wealth groups. Daily waged labour and seasonal migratory labour were dominant income sources for the Very poor and Poor wealth groups, accounting for more than half of the total income (77.7%, 57.3% respectively). On the other hand, remittance earnings, and self-employment/ trade were prominent sources of cash-income for the Middle and Better off wealth groups. Combining these two categories, it accounted for 62.6% and 85.1% of their total cash-income respectively.

Figure 7.3 Proportion of different income categories contributing to the total cash-income of wealth groups in Dhanusha (based on HEA data income data collected in 2006)

Figure 7.4 presents the average weight adjusted change in cash-income among the wealth groups in Dhanusha. The weighted overall change shows that income of all wealth groups increased between 2005 and 2008. The increase in cash-income was highest among the Very poor (32.1%), followed by increase amongst the Better off (28.3%).

Figure 7.4 Percentage increase in cash-income of wealth groups in Dhanusha between 2005 and 2008



7.5.4 Predicted income levels of wealth groups in 2008

Figure 7.5 shows the total income levels of wealth groups in Dhanusha in 2005 and predicted income levels of them in 2008. Between 2005 and 2008, average annual income of the Very poor increased from 37,876 Nepali Rupees to 48,894 Nepali Rupees; the overall income of Better-off increased from 148,889 Nepali Rupees to 188,921 Nepali Rupees. On a whole, the total income increased was largest among the Very poor (30.3%) (**Figure 7.6**); a similar increase was also evident among other wealth groups (Poor: 28.0%; Middle: 27.2%; Better-off: 28.4%).

Figure 7.5 Annual estimated income levels of wealth groups in Dhanusha in 2005 and 2008

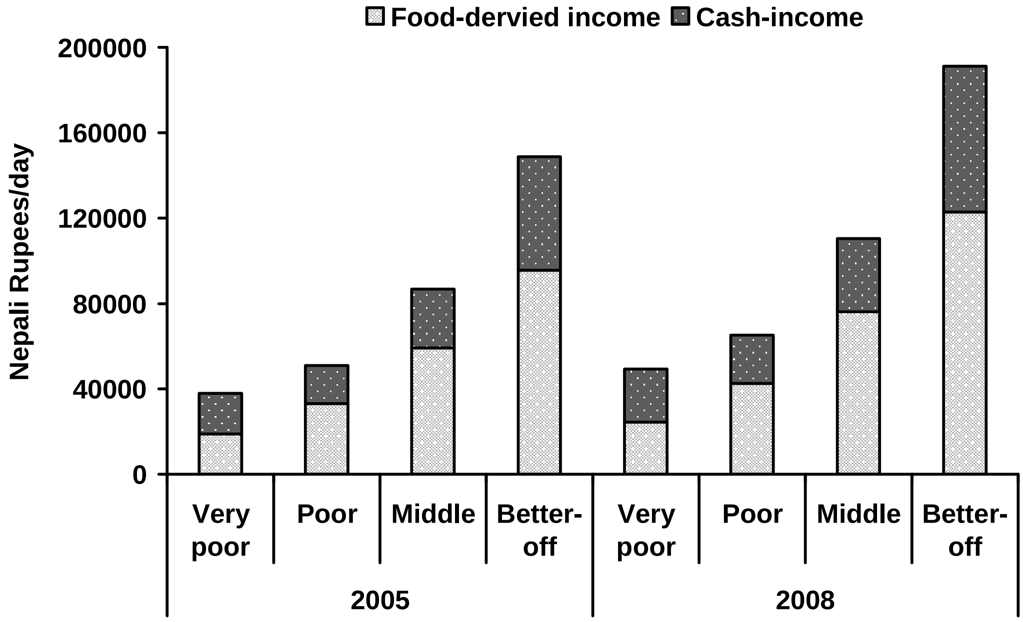
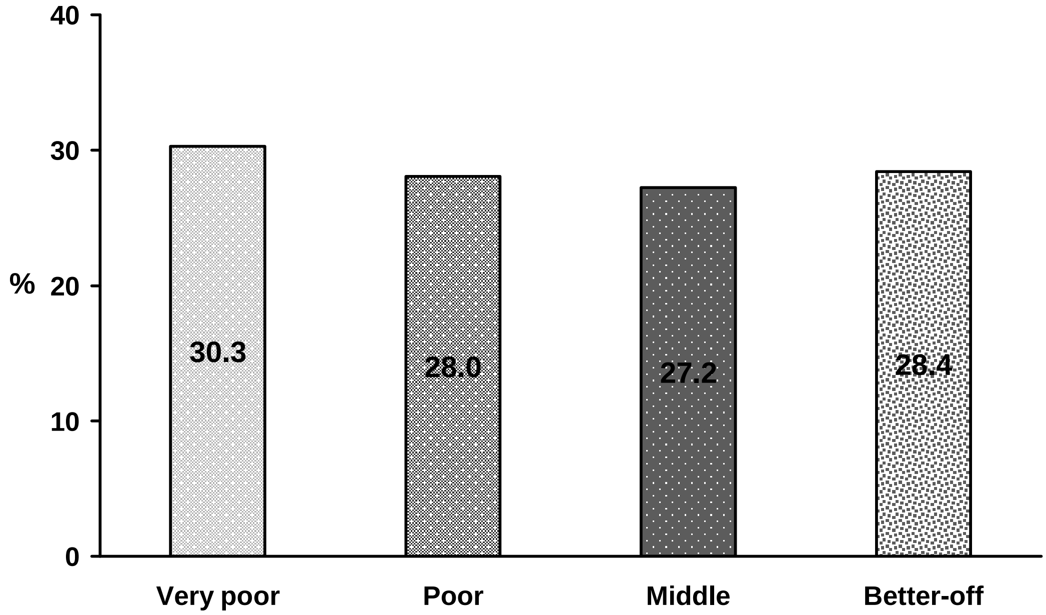


Figure 7.6 Percentage change in total income levels of the wealth groups between 2005 and 2008



7.6 Discussion

7.6.1 Change in income levels by sources of income

The income profiles of the wealth groups in Dhanusha showed that in terms of cash-income sources households in the Very poor wealth group were engaged largely in various daily labour and seasonal migratory labour activities. The Poor were slightly better off, and were also engaged in some self-employment/ trade activities and remittance income together with earning from daily labour activities. The Middle group was the most diverse income group, and their income sources included all categories (daily waged labour, seasonal migration, remittance, self-employment/trade, regular job). In terms of daily waged labour activities, Middle wealth group were only involved in income sources, which require specialised skill such as 'House making' and 'Carpentry'. The Better-off households were involved in more stable income sources, such as remittance and senior level government jobs. All wealth groups earned by selling various food items, although the amount of different items sold by a wealth group and amount earned from that would vary largely between wealth groups. The amount of land owned was much larger for households (see chapter 4) in the Middle (mean land: 2.12 bigha) and Better-off (5.11 bigha) wealth group, compared to that of the poorer households (Very poor: 0.03 bigha; Poor: 0.41 bigha). Because of the large land ownership in wealthier households, their agricultural production is also much higher.

Between 2005 and 2008, the overall increase in daily waged labour ranged from 25% - 140% combining agricultural and non-agricultural wages. The earning by playing in a wedding band increase was much higher than other sources. This is a group activity and earnings were shared among all band members, and this type of earning could also be variable depending on the type of contract. The second highest increase in pay was evident among those who earned by repairing boreholes. A large number of people in rural Nepal are engaged in agricultural activities. The labour force survey 2008 stated that the income source for 70% of the employed population was subsistence agriculture in rural Nepal (CBS 2009; Shrestha 2009). It was followed by 10.3% engaged in elementary occupations, 7.3% in craft and other trades, 5% in service work, and the rest including professional jobs and others (ibid). Shrestha (2009) also reported that nearly half (47%) of the people engaged in work were underemployed. Annually, 300,000 new unskilled labourers enter the job market, which reflects the dominance and potential for employment of rural unskilled labour. The low proportion of service work is also indicative that economic activities of households in Nepal are mainly around agriculture. Between 1995/96 and 2003/04 (an 8 year period), Campbell et al. (2010) observed that increase in agricultural wages (25%) and non-agricultural wages (24%) was lower compared to quite high (67%) increase in wages of skilled non-agricultural labour, as was also observed in Dhanusha. Compared to their findings, percent increase in agricultural wage (25%) observed in Dhanusha in a shorter period (3 years) was slightly higher. The comparatively stable political situation following the peace agreement with the Maoists in 2006 could have contributed to better economic growth for the country during this period. Although the income showed an increase (25%) in 2008, pay of agricultural wage labourers (absolute amount) were at the bottom end of the low paid labourers in both periods (pay of men in 2005, 2008: 80, 100 Nepali Rupees). Except for those engaged in rickshaw driving, increase in daily pay from other sources was at least 8% higher.

The increase in income from self-employment/trade was quite variable, which indicated that specific factors associated with a particular type of self-employment/trade could be responsible for one being more profitable than the others are. However, we only collected a small sample for each type, which may not be enough to establish a pattern of change for each source.

Short and long-term migration and remittance income play a key role in driving the economy of Nepal and contributed to 20% of the decline in poverty in Nepal between 1995 and 2004 (Lokshin, Bontch-Osmolovski, and Glinskaya 2010; MOF 2008; Nepal Planning Commission 2006; Kohler et al. 2009). In Dhanusha, average yearly per capita short-term migratory income increased by 7- 42% between 2005 and 2008. In Nepal, mainly male members of households (Lokshin and Glinskaya 2009) migrate to places within-country and to neighbouring India. Migration to India mostly took place on a seasonal basis (Seddon, Adhikari and Gurung 2002). Because of the open border and short distance, most migrant workers go to India to work in agriculture, industry, and construction sectors (Pyakuryal K and Suvedi M 2000; Acharaya 2007). Although seasonal migration to India is common among rural Nepalese households, the increase in earning was comparatively less than that from places within Nepal (ICIMOD 2011).

In terms of absolute amount, income from migratory labour in Kathmandu, the city of Nepal, was highest in both 2005 and 2008.

Nepal has a long history of earning remittances from the Diaspora in overseas countries (Seddon, Adhikari and Gurung 2002). Because of the high level of income earning opportunities abroad in the face of existing poverty, lack of income opportunities, and long standing political instability in-country, many households in Nepal consider remittance as a good way to considerably improve living conditions. On a national level, 23% of the households were receiving remittances from abroad in 2008; and per capita remittance earned was 4,042 Nepali Rupees (NRs) (Campbell, Slany and Khare 2010). Even though the percentage of households having remittance from overseas countries may seem low, Seddon et al. (2002) investigated this issue using other relevant data and concluded that the national estimates is likely to be under-reported (e.g. in the Nepal living standard survey). They also showed that the value of remittance income was much higher than short-term work within Nepal and in India (ibid). In Dhanusha, no increase in overall remittance earnings between 2006 and 2008 was reported, but the level of earnings was still high, similar to the earnings from large businesses in Dhanusha. The Nepal living standard survey 2003/04 showed that about 15% of the households in Terai had remittance earning from Malaysia and Arab countries (CBS 2004). The Nepal Labour Force Study (NLFS) 2008 reported that in Central Terai (the administrative region in which Dhanusha falls) 20.0% of households had remittance earnings from abroad and the average number of remittance earners in a household was 1.18 (CBS 2009). At the end of 2008, remittance remained similar and no negative impact of global food price crisis was observed by that time (ibid).

In Dhanusha, data were collected separately for per capita income from short-term migration work within Nepal and to India, and income earned by household members from longer-term remittance earning from Malaysia, Arab and other countries. Generally, income tends to be much higher from countries outside of South Asia and because migration to India is usually short term and involves household members returning with cash and in-kind goods, rather than sending remittances. The Nepal labour force study considered both the sources as remittances. Also the average remittance earning were calculated including remittance earnings of absent household members and also contribution of non-household members. Since there were methodological differences, income levels of the two studies were not comparable.

The Nepali national salary and wage index comprises of two components: **1.** a salary index with a weight of 27% (includes Civil service 2.8%; Public enterprise 1.1%, Bank and Financial institutions 0.6%; Army and Police 4.0%; Education 10.6%; Private organisation 7.9%); and **2.** a wage index having a weight of 73.0% (includes Agricultural labour 39.5%; industrial labourers 25.2%, construction labourers 8.3) (MoF 2008). The weight of Civil service (<3%) in the national data indicates that government employees form a lower proportion of the Dhanusha population. The salary of government employees in Dhanusha increased for each category and % increases were generally larger for low paid employees (Junior Adminstrative Clerk: 67%, Support staff: 55%) than higher rank officials (Campus lecturer, Doctor: 14%, Health Assistant/ Staff Nurse: 20%). In September 2008, the government introduced a salary increase for all employees including a differential increase for some low paid employees in an attempt to deal with the existing inequality (MoF 2009). This explains the large increase of salaries of government employees, with a maximum increase of 69% in salary of primary school teachers.

The limitations of this study are that data were not collected from a representative sample of households, and recall data were used to estimate income in 2005. Interviews were conducted among key informants to estimate current income (2008) and recall income in 2005. Key-informants were generally people directly involved in the work, or family members of a person engaged in the specific category of income. Even though household data were not collected, key-informants were chosen based on their knowledge about a specific income type. Richards et al. (1999) compared the use of survey data and Participatory Rural Appraisal (PRA) methods in collecting detailed income data in rural Zimbabwe. They commented that even though survey data were comparable with previous available income estimate and PRA methods overestimated income data, survey data lacked clarification about some income categories which may have included errors in the estimate. They suggested that key informants could be a valuable source of income data along with survey data, as it would allow flexibility and collection of reliable information with clarity about income types and amount (ibid). Even though the income level data presented in this chapter were not collected using a statistically representative sample the findings give a good indication of changes in income that took place between 2005 and 2008.

7.6.2 Change in income in relation to change in food prices

In Dhanusha, the overall food price inflation was 28.5% (see Chapter 6) and increase in total income levels for the wealth groups was slightly higher among the Very Poor (30.3%), compared to the Poor (28.0%), Middle (27.2%,) and Better-off (28.4%) households. The overall findings may indicate that the effect of the food price increases could be buffered by increases in income. Given that price increase was variable within and between food groups and so was the increase in income from the different categories, an understanding of how the income rise affected purchasing power of the population is needed to have better insight into the overall impact. In chapter 8, the cost of a typical food basket of the wealth groups was estimated for 2005 and 2008. For the typical food basket, substitution was not allowed so cost of a fixed basket of food items in the two periods will indicate the change in purchasing power.

The other point worth noting is that on a national level, the consumer price index including food and non-food prices increased by 13.4% from 2005/06 to 2007/8 and the non-food and services component of the index showed an increase of 8.1%. The component including basic commodities such as energy, fuel, and water also showed a fairly high increase (8.3%) in this period. Since the overall cost of living has increased (including food and non-food expenditure), many households may face greater challenges in meeting food needs and affording a nutritionally adequate diet. With the food price rises due to the 2008 food price crises, many households would need to spend a larger percentage of their income on food. Chapter 8 will therefore assess the cost of a typical food basket and a nutritionally adequate diet in 2005 and 2008, and will examine how affordability of such diet by the different wealth groups may have changed following the 2008 global food price crisis.

7.6.3 Implications of the findings

To understand the effect of a food price crisis on a population, data on changes in food prices should be accompanied by changes in their income levels. National level data on income may mask difference between sub-national or socio-economic groups. Where resource (money, time) limitations do not allow collection of such data from a representative sample of households, key informants can provide valuable information about income opportunities available for the different wealth groups, and how that may have changed over a period. Income data are thus an essential component of analysis of how increases in food prices may have affected affordability of foods among different wealth groups. The assessment of changes in food price on its own can only provide an incomplete assessment of its impact. Data on changes in food prices, seasonal availability of income options and the level of income among different wealth groups are useful in analysis of vulnerability and need for social assistance in an area.

Chapter 8. Affordability of a nutritionally adequate diet among wealth groups in Dhanusha in 2005 and 2008

8.1 Chapter summary

This chapter presents estimations of the cost of a typical food basket fulfilling energy requirements and a nutritionally adequate diet (fulfilling energy and nutrient requirements) in 2005 and 2008 for households in Dhanusha, and assesses the affordability of these diets by wealth groups in both periods.

8.2 Research questions

The research questions addressed in this chapter are:

- How did the cost of a typical food basket and a nutritionally adequate diet change among wealth groups in Dhanusha during the 2008 food price crisis, in comparison to the pre-crisis (2005) period?
- How did the affordability of a nutritionally adequate diet by different wealth groups in Dhanusha change during the food price crisis, in comparison to pre-crisis (2005) period?

The **outcome indicators** used to answer the research questions are:

- Planned daily food basket fulfilling the energy requirements of a typical household in the different wealth groups in Dhanusha
- Percentage of requirements of selected macro and micronutrients met by the typical food basket of the wealth groups in Dhanusha
- Cost of typical household food baskets of the wealth groups in Dhanusha during Sep - Oct period 2005, 2008
- Cost of a nutritionally adequate diet for a typical household in Dhanusha during Sep - Oct period 2005, 2008
- Comparison of the cost of a nutritionally adequate diet in 2005 and 2008 compared to income levels of the wealth groups in Dhanusha

8.3 Introduction

Access to adequate quantity and quality food is essential to ensure food and nutrition security in a population. Availability and affordability of food are important determinants of access to food. Several researchers have shown the association of dietary quality and socio-economic status (Darmon and Drewnowski 2008). In developed countries, obesity is a nutritional disorder associated with lack of access to high quality expensive diets among poorer households (Drewnowski and Darmon 2005; French 2003). In developing countries, widespread under-nutrition among the poorer households is a bigger concern, whereas over-nutrition and the double burden of malnutrition is slowly becoming a rising problem (Oddo et al. 2012; Shafique et al. 2007). Although a linear association has been observed between socio-economic status and dietary quality, the causal pathway is not always clear. The limited budget of poorer households may restrict their food choice and lead to low intake of nutritious foods (Bowman 2007). Bowman (2007) investigated the effect of income on food choices among an elderly population, and found that poverty was inversely correlated with food or nutrition security. Monsivais et al. (2010a) examined the variability of quality of diet among households of the different socio-economic background and found that the differential amount of money spent explained the variable quality. Darmon et al. (2002) observed similar findings. They found that introducing a cost constraints in diet planning among French adults and making it stronger resulted in generating a diet low in vitamin C and β–carotene compared to that of the average population. Mhurchun (2010) mentioned that food cost is the most important determinant of food purchasing decisions and suggested that regulation of food price could be an important component of public health nutrition strategies.

The 2008 food price crisis has increased the susceptibility of vulnerable households to increased malnutrition. According to the World Bank, globally food price increase caused an addition of 44 million became undernourished people and 100 million people fell into poverty (Save the Children UK 2009b). Monsivias et al. (2010b) examined the trend in food prices, disaggregated by their nutritional quality over the period of 2004 to 2008 in an area in the United States. They observed that inflation was higher among higher quality food items. Over the period of 4 years, the increase was larger for the top quintiles of nutrient dense foods (29.2%) compared to that of the lowest quintile

(16.2%). Although the food price crisis affected many populations around the world, due to many factors including variability in the magnitude of price rises, consumption patterns, and preferences of food items, the effects were not same. In Ghana, the national level impact of the 2008 global food price crisis was moderate, but differences among regions and income groups existed due to varied consumption patterns within the country (Cudjoe et al. 2010). Poorer households in urban areas who had to buy most of their food and those living in northern region who spend a large proportion of their income on food were the worst effected. The varied consumption practices and income levels by region explained the differential effects of food price rises in the country (ibid).

Estimating the cost of a localised food basket is important to measure inflation and assess change in purchasing power of people. Poorer households generally rely on buying foods to meet their requirements. If food prices rise, the risk of food insecurity and malnutrition among the poorer households increase due to loss of purchasing power and higher quality food becoming unaffordable to them. The cost of a typical food basket of a country or region is important to assess the impact of price changes on purchasing power. This food basket is generally determined using national level household budget surveys that assess per capita intake of food items, and determine a list of commonly consumed items to include in the basket. The consumer price index, a measure of inflation, contains both a food and non-food index; and the decision whether a household can afford to buy a diet that meets their requirements are influenced by changes in both indices. However, a typical food basket constructed at national or regional level may only meet energy requirements but not ensure nutrition security. Therefore, planning and estimation of cost of a nutritious diet for more local areas with different food and livelihood patterns is important to understand the nutritional impact of a crisis.

Estimation of the cost of a nutritionally adequate diet using linear programming is useful in assessing the nutritional impact of a food price rise among households from different socio-economic status in an area. The use of mathematical modelling to select items for nutritious diet has long been practiced. Stigler modelled such a diet from 77 food items using linear programming in 1945 (Stigler 1945). Since then, many others have used it for varied purposes (Taj 1990; Soden and Fletcher 1992; Briend, Ferguson and Darmon 2001; Darmon, Ferguson and Briend 2002; Ferguson et al. 2004; Darmon, Ferguson and Briend 2006; Rambeloson, Darmon and Ferguson 2007; Malliot et al. 2008; Seljak 2009; Malliot, Darmon and Drewnowski 2010). Researchers have used linear programming as a tool to plan a nutritionally adequate diet for individuals or groups and estimate the cost of it. In a number of countries, linear programming was used to estimate the cost of diet for children, men and women (Darmon, Ferguson and Briend 2002; Darmon, Ferguson and Briend 2006), but it was used less frequently to plan diets for the whole household (Save the Children 2009a; Save the Children 2009b). Linear programming was incorporated to a diet analysis program 'NutriSurvey', which allows planning of a nutritionally adequate diet for children (NutriSurvey 2012; Briend et al. 2003). Save the Children UK has developed a 'Cost of Diet' tool that can plan such a diet for individual or households. Using data about local food and consumption patterns, the programme can identify foods with good nutritional quality at a minimum cost, and assess the affordability of such a diet by households from different socio-economic groups. Malliot et al. (2010) highlighted the necessity of a diet being socially and culturally acceptable and realistic, as well as being affordable. They used linear programming to estimate the minimum cost diet for French adults and commented that although the programme could suggest a diet that emphasized cost minimization, such a diet may not be socially and culturally acceptable. However, they also experienced that the more rigid consumptionbased constraints were added, the higher was the cost (ibid). In this chapter, I used the SCUK Cost of Diet software that uses linear programming to estimate the minimum cost of a nutritionally adequate diet. The CoD estimation for Dhanusha households attempted to meet nutritional requirements using commonly consumed foods, which are locally available. The program also used consumption constraints based on the social and cultural practices of people in the area. This allowed me to estimate the change in the cost of an adequate diet due to the food price crisis in 2008 and assess whether households in Nepal can afford it.

8.4 Methods

The cost of a typical daily food basket and a nutritionally adequate diet in the period before the global food price crisis (2005) and during the crisis (2008) for households in Dhanusha was assessed. Because the dietary habits varied by wealth groups (Chapter 5), the estimation of a typical food basket varied by wealth groups. However, the estimation of an adequate diet yielded a suggested diet plan to fulfil the requirements of a hypothetical household in Dhanusha and therefore did not vary by wealth group, as the nutritional requirements were assumed not to vary between wealth groups.

The planning of both a typical and nutritionally adequate diet involved estimation of household composition, estimation of energy and nutrient requirements of household members, and selection of food items to satisfy kcal or nutrient requirements of the members. All these estimations relied on analysis of primary data available for this research, and published work of other researchers. The essential part of the planning was to estimate household composition: including family size, and age and sex profile of the household members.

8.4.1 Household composition and demographics

a. Family size

As a **first** step, the family size was estimated based on findings of the HEA WGR data, which showed that on average households in Dhanusha had six members. The data also showed that the size of family did not vary by wealth groups (Median household size: 6 for all wealth groups).

b. Age and sex profile of the household members

The **second** step was to hypothesize the age and sex profile of the family members of a typical household in Dhanusha, which was done using national level data from the Nepal Demographic and Health Survey (DHS) 2006. The Nepal DHS 2006 presented the distribution of the overall population for the different age categories (Ministry of Health and Population (MOHP) [Nepal], New Era, & Macro International Inc. 2007). The demographic data were grouped into the broad categories: preschool children <5 years, school age and adolescents of 5-19 years, adults aged 20-44 years, and adult aged

45 or more years. Using the DHS percentages of population in the different age categories, estimation of the number of people in the different age categories in a typical family in Dhanusha household was done. The number of people expected to be in the different age categories were estimated using the formula below:

$$\frac{\text{\% of population in the age group (DHS 2006 data) X Family size of typical household}}{100}$$

Table 8.1 shows estimated composition of a typical household in Dhanusha. Using the above mentioned formula, it appeared that a typical household of six members in Dhanusha would have the following age group of people: 1 children aged <5 years, 2 young and adolescent aged 5-19 years, 2 adults between 20 and 44 years, 1 adult aged 45 or above years.

Table 8.1 Estimated number of people from different age categories in a typical household in Dhanusha (predicted using Nepal DHS 2006 data)

	Nepal DHS 2006			Typical Dhanusha family
Age group	**Male (%)**	**Female (%)**	**Overall (%)**	**Number/ group†**
< 5 years	14.9	12.2	13.5	1 (0.8)
5 -19 years	40.3	37.1	38.6	2 (2.3)
20 – 44 years	26.3	33.3	30.1	2 (1.8)
>= 45 years	17.4	17.8	17.8	1 (1.1)
Total	100.0	100.0	100.0	6 (6.0)

† Exact value shown in parenthesis

The **third** step was to decide on the sex of the household members within the different age categories. Since data were not always available on how the proportion of males and females contributed to the different age categories, the assumption of specific sex distribution within the age categories was based on anecdotal evidence, personal understanding, or published findings where available. Within the age category of <5 years old, it was expected that the household will have a boy of 2-3 years old as the DHS data showed proportion of boys was higher than girls in this category (Ministry of Health and Population (MOHP) [Nepal], New Era, & Macro International Inc. 2007).

Within the age group 5 -19 years, the household was expected to have a boy of 5-6 years old and an adolescent girl of 13-14 years.

Among the adults aged 20 – 44 years, the household was expected to have one male of 37 years and one female of 28 years, as was the reported average age of respondents in Itahari, a nearby district where a food consumption survey was done (Hirai et al. 1994). Recent work by Vaidya et al. (2008) in Dhanusha reported similar age (mean, SD: 24± 3.4 years) of mothers. Because females have slightly higher life expectancy than men, it was anticipated that within the age group of 45 or more years, a female is more likely to be present in a typical household (Macro International 2007). The Nepal DHS 2006 supported this assumption as it reported that sex ratio (male per 100 female) is 87 in rural Nepal (Ministry of Health and Population (MOHP) [Nepal], New Era, & Macro International Inc. 2007).

Overall, the hypothetical household was expected to have 2 boys and 1 girl children and 1 adult male and 2 adult female, as shown in the **Table 8.2**.

Table 8.2 Age and sex of members of a typical household in Dhanusha

Age group (years)	Age (years)	Sex	Number
<5	2- 3	Boy	1
5-19	5-6	Boy	1
5-19	13-14	Girl	1
20-44	28	Female	1
20-44	37	Male	1
>=45	45-50	Female	1

8.4.2 Physical Activity and energy requirements of the household members

After deciding on the age and sex of household members, their physical activity level (PAL) was estimated. Using FAO (2004) data on the habitual activity level of children and adolescents, PAL and the corresponding energy requirements of Dhanusha household members in this age group were estimated. For adult members, the PAL for moderate activity level ranged from 1.70 to 1.99 (ibid). Data on estimated PAL in the area or region is scarce. Panter-Brick (1996) assessed that PALs in dry and wet season among Tamang men living in hilly areas of Nepal was 1.8 and 2.22. She also reported that the PAL among farmers in India and Tamil Nadu was 1.98 and 1.56 (ibid). Dhanusha is predominantly an agrarian society where men are engaged in agriculture related activities, and women spend reasonable amount of time on unpaid household and food production related tasks (CBS 2009; CBS 2011). Therefore, the activity level of both adult men and women aged 20-44 years were expected to correspond to a PAL at the higher end within the range (1.70-1.99) of PAL for moderate activity; and a PAL of 1.9 was selected (CBS 2009; Sudo et al. 2006; FAO 2004**)**. The senior women in the household aged >=45 years was expected to have a sedentary life, and a PAL of 1.6 was considered reasonable for her. Weights of adults in the households were estimated using data from Sudo et al.'s (2006) study in similar setting in plains of Nepal. The estimated weight and PAL enabled estimation of energy requirements of adults in the households shown in the **table 8.3**, following FAO/WHO guidelines (FAO 2004).

The energy requirement for each household member was compared to that of the adult male by dividing the energy requirement of the adult male by that of each of the others to come up with the adult equivalent units. The adult equivalent energy requirement of all members of the household, including that of the adult male, added up to 4.32 units (Table 8.3). The total energy expenditure of the household was estimated to be 11,875 kcal, whereas the per capita energy requirement was estimated to be 1,979 kcal per person per day.

Table 8.3 Estimated energy expenditure and anthropometric data for reference members in the household

Age (years)	**Sex**	**Weight**	**PAL**	**Activity level**	**Kcal/ day**	**Proportion**†
2-3	M	-	1.45	Moderate	1125	0.41
5-6	M	-	1.55	Moderate	1475	0.54
13-14	F	-	1.75	Moderate	2375	0.86
28	F	43.4 ± 6.3	1.90	Moderate	2200	0.80
37	M	52.5 ± 6.3	1.90	Moderate	2570	1.00
45 -50	F	43.0 ±8.2	1.60	Sedentary	1950	0.71
Total					11875	4.32
Per capita kcal requirement/day					1979	

†**Adult equivalent**

8.4.3 Assumptions used for planning of the typical food basket

After making an estimation of the energy requirements of the household members, planning of a typical food basket of each of the wealth groups for one day was completed by following several steps. The planning of the typical food basket for a household used some basic assumptions:

- The **first** assumption was that the requirements of the energy intake did not vary among households in the different wealth groups in Dhanusha. This assumption was made as not enough data were available on whether body size or PAL varied in rural Nepal according to the wealth status of the households. The Nepal DHS 2006 data showed that body mass index (BMI) among women in the 1st (Poorest) to 5th (Wealthiest) quintiles were 20.0, 19.8, 20.1, 20.6, 22.3 kg/m^2 respectively. This data reflects that BMI did not vary much among the wealth groups, except being somewhat higher among women in the wealthiest households (Ministry of Health and Population (MoHP) [Nepal], New Era, & Macro International Inc. (2007). However, data on physical activity level of men and women belonging to the different wealth status were not available from this source. Generally, it is expected that members of a wealthier household would be heavier in weight compared to the poorer households. Conversely, it is also anticipated that the activity level would be lower for wealthier households and comparatively higher for poorer household, which would balance out the need of energy among the different wealth groups. Considering these factors, I assumed that for maintaining active and healthy life adjustable to their body size, all wealth groups required the same level of energy intake.

- The **second** assumption was that the all wealth groups had equal numbers of family members, which was apparent for the results of HEA data. It was also assumed that the household composition did not vary by wealth group.

- The **third** assumption was that the kcal contribution from non-cereals in the typical food baskets of Dhanusha would be increased by 10% over a period between 1987 (data collection period of Hirai et al. 1994) to 2005. It was assumed because a trend of decline in percentage of kcal contributed by cereals to the total diet in developing countries and specifically in Nepal was evident (FAO 2010; WHO 2003). Based on findings of Hirai et al (1994), it was also assumed that out of the total kcal contributed by cereals, 90% will come from rice and the remaining kcal will be contributed by wheat in a form commonly consumed by the particular wealth group.

- Finally, although there was evidence of variation in intra-household distribution of foods, especially for consumption of protein and micronutrient rich foods in Nepali households no adjustment in the typical food basket of the household was made (Gittlesohn and Vastine 2003; Sudo et al. 2006). Therefore, the cost of the household diet was estimated by multiplying the cost of an adult male by 4.32 adult equivalents.

In summary, the steps followed to estimate cost of the typical food basket for households in different wealth groups are as follow:

1. Defined the size and demographic characteristics of a typical household.
2. Estimated the typical diet of an adult male based on previous published work on consumption pattern in the plains of Nepal and HEA food consumption data.
3. Estimated total cost of the household food basket by multiplying the cost of a daily food basket for an adult by 4.32 adult equivalents.

8.4.4 Selecting food items in a typical food basket of adult male and deciding on amounts consumed

Background information used in the selection of food items to be included in a typical food basket for an adult male in the different wealth groups in Dhanusha, and deciding on amounts consumed were the following:

1. **Published data on food consumption patterns in Nepal:** Published research on food consumption pattern in plains in Nepal guided assumptions on food consumption patterns in Dhanusha. Hirai et al (1994) collected food consumption data using 24-hour recall method in plains in Nepal and presented

data on amount of food consumed from the different food groups. These data contained information on mean amount consumed from different food groups and kcal contributed by the food groups. However, data were not available for consumption variability among different wealth groups.

2. **Household Surveillance Data (HSD) on 24-hr dietary recall**: Using the HSD of the RCT in Dhanusha, data on the frequency of consumption of food groups by households were collected (chapter 5). The asset indices generated from the HSD (see chapter 4) were grouped as wealth groups using HEA-based proportions of wealth groups (see chapter 5). Then, the percentage consumption of food groups (e.g. cereals, roots and tubers, milk and milk products) were separated by wealth groups (**Table 8.4A**). For example, these data informed us that the consumption of pulses and nuts among the Very Poor, Poor, Middle, and Better-off were 42.3%, 59.6%, 65.1%, 70.4% respectively.

3. **HEA food consumption data**: HEA food consumption data estimated annual food consumption of typical households in different wealth groups in Dhanusha by interviews of WGR (see chapter 3, 5). For each wealth group, interviewers recorded name of food items and amounts consumed in the preceding year. The analysis of HEA data generated the frequencies of consumption of each item, separately for each wealth group. This data helped identifying food items commonly consumed by the different wealth groups in Dhanusha.

Using the three main elements above, a typical food basket for the wealth groups in Dhanusha was selected. The flowchart in the following page explains the steps followed in planning of a typical food basket and estimating the cost of such diet for the various wealth groups in Dhanusha.

8.4.5 Steps in planning of a typical food basket of adult male and estimation of cost of household food basket

Part A. Estimating consumption of non-cereal foods by wealth groups

A1. Selection of non-cereal food groups for the food basket:

Foods commonly consumed by a wealth group were considered eligible for inclusion in the food basket. Therefore, if HSD data found that <5% of households in a wealth group consumed food from a particular food group, consumption of foods from that group was considered negligible and not included in their typical daily food basket (**Table 8.4A**).

↓

A2. Deciding on the quantity of non-cereal food items

- Based on consumption of food items from a food group among different wealth groups, a ratio was calculated. This was done separately for each of the 12 food groups (**Table 8.4B**). The Very poor wealth group was considered as a reference group. For example, ratio of dairy consumption among the Poor households was estimated as such: % of Poor households consumed dairy/ % of Very Poor households consumed dairy. Depending on whether or not consumption frequency was higher or lower than that of the very poor, ratio of other wealth groups was calculated to be higher or lower than 1.

- Estimation of amount consumed from different food groups by an adult male was done using average intake of adult male reported by Hirai et al. (1994), which would be equal to average of ratios of the wealth groups (Table 8.4B). The reference intake of the Very poor was estimated as such: Overall ratio of wealth groups/average intake amount reported by Hirai et al (1994). For other wealth groups, amount of intake of Very poor was multiplied by the respective ratio of a food group to estimate amount of intake. The same process was applied for each food group.

- The estimated amount to be consumed from each food group by a wealth group was multiplied by 1.1 to adjust for the trend of decline in contribution of cereal kcal to the total kcal, over the period (FAO 2010).

After deciding on amount of food to be consumed from the different food groups, the next step was to select food items within the food group that the different wealth groups are likely to consume. This was done using frequency of consumption of food items by the wealth groups from the HEA food consumption data.

A3. Selection of food items within non-cereal food groups: Within each food group, the one food item that was most frequently consumed by a wealth group, (based of HEA annual consumption data) and also had price data available was then chosen to be included in the food basket. If the food item with the highest frequency did not have price data, then the item with next highest frequency with price data available was chosen.

Table 8.4 Household Surveillance baseline data on food consumption pattern by wealth groups and estimate ratio of consumption

	A. Percentage household consumption					B. Ratio of household consumption				
Food groups	Very poor	Poor	Middle	Better off	P value	Very poor	Poor	Middle	Better off	Overall
Cereals	98.3	98.5	98.9	98.7	0.655	1	1.0	1.0	1.0	1.0
Roots & tubers	73.6	79.7	82.2	83.9	<.001	1	1.1	1.1	1.1	1.1
Vegetables: coloured	29.8	32.9	35.3	37.9	.009	1	1.1	1.2	1.3	1.1
Vegetables: Other	52.7	58.3	62.7	70.1	<.001	1	1.1	1.2	1.3	1.2
Pulses & nuts	42.3	59.6	65.1	70.4	<.001	1	1.4	1.5	1.7	1.4
Oil/ fats	38.3	43.1	41.9	41.8	0.100	1	1.1	1.1	1.1	1.1
Others (tea/coffee, spices)	33.0	36.9	39.9	42.4	<.001	1	1.1	1.2	1.3	1.2
Dairy	10.5	29.2	45.3	59.8	<.001	1	2.8	4.3	5.7	3.5
Fish (all)	7.3	7.7	6.0	5.8	0.340	1	1.1	0.8	0.8	0.9
Meat (all)	2.2	4.2	3.9	7.1	<.001	1	1.9	1.8	3.2	2.0
Sugar/ honey	0.8	2.9	4.8	7.1	<.001	1	3.4	5.6	8.4	4.6
Fruit (all)	0.9	1.9	3.6	5.8	<.001	1	2.0	3.9	6.2	3.3
Eggs	0.2	0.7	0.7	1.0	0.175	-	-	-	-	-

Part B. Estimating consumption of cereal foods by adult male in wealth groups

After deciding on food items and amounts typically consumed by an adult male in each of the different wealth groups, the next step was to decide on type and amount of cereals consumed.

B1. Kcal from non-cereal food groups and from cereals:

At this stage, total amount of kcal contribution from non-cereal foods was calculated. For a wealth group, the total kcal that has to be filled in by the cereals was then determined by subtracting the kcal of non-cereal items from the daily kcal need (total daily estimated kcal requirements –estimated daily non cereal kcal intake).

↓

B2. Estimating proportion of intake from rice and wheat:

For each wealth group, cereals contributed the remaining balance of energy (kcal).

↓

B3. Deciding on the amount of kcal from rice, wheat:

The total kcal to be contributed by cereals was divided into amounts of rice and wheat using the proportion of kcal contributed by rice (0.9) and wheat (0.1) (Hirai et al. 1994). The amount of kcal required from rice divided by per gram kcal provided the amount of rice required. The same process was applied in deciding amount of wheat needed. The type of rice and wheat commonly consumed by the different wealth group was selected for inclusion in their food basket.

Part C. Estimating cost of typical food basket by wealth groups in 2005 and 2008

Having completed the estimation of daily amount of foods to be consumed from all food groups by an adult male in the wealth groups, the next step was to estimate the total cost of the items included in the food basket.

C1. Estimating the cost of a typical food basket for adult male in 2005:
Total cost of cereals and non-cereal food items included in the food basket of an adult male was determined by multiplying 2005 Sep-Oct price per unit of each item by the total amount consumed. Thus, the cost of a typical daily food basket for an adult was estimated summing up cost of all the items included in the plan.

↓

C2. Estimating the cost of a typical food basket for adult male in 2008:
A similar process to that of C1 was used to estimate cost of typical daily food basket in 2008, where items consumed remained same but the amount of each item consumed is multiplied by the price/unit for respective period. The same process was repeated for each wealth groups, which allowed estimating daily cost of a food basket for an adult male in the different wealth groups in Dhanusha in 2008.

↓

C3. Estimating cost of typical food basket for household in 2005 and 2008:
For each wealth group, the estimated total cost of a typical daily food basket for an adult male per day in 2005 and 2008 Sep - Oct period was multiplied by the factor 4.32 (adult kcal equivalent) to generate the cost of a household food basket.

8.4.6 Estimating cost of a nutritionally adequate diet using the SCUK Cost of Diet programme

The cost of a nutritionally adequate diet was estimated using the Save the Children UK (SCUK) Cost of Diet (CoD) programme, which uses linear programming. In linear programming, a mathematic programming is done that optimises the diet keeping the cost minimum and respecting the constraints set to reflect food consumption in the area and to meet nutritional demands of individual or household members. Here, the objective function was to calculate minimum cost of a nutritionally adequate diet for a typical household in Dhanusha. Constraints of nutrient requirements and food consumption were set to come up with the decision variables 'gms of food intake/item', which altogether meets nutritional requirements of the household members.

The household profile remained the same as was used for estimation of the typical food basket (Save the Children UK 2011a; Save the Children UK 2011b). The programme used an optimisation process to generate a cheapest cost diet for the household that met the requirements for the energy and nutrient needs of the households. This was done by selecting foods locally available while respecting constraints, including the dietary pattern of suggested food group frequency, food item frequency, portion size based on the usual intake in the area.

The CoD program uses in-built requirements for energy, macro and micronutrients specific for age, sex, and physiological condition of each household member. The target of energy requirements of the household members were the same as what was set for the typical food basket following the guidelines of the joint FAO/WHO/UNU Expert Consultation in 2001 (FAO 2004). The requirement of fats was set as 30% of the energy requirements. Regarding the requirement of micronutrients (Thiamine, Riboflavin, Niacin, vitamin B2, B6, B12, Pantothenic acid, Folic acid, Vitamin C, Iron, Zinc) for household members, the programme uses requirements for individuals recommended by the FAO/WHO guidelines on vitamin and mineral requirements in human nutrition (FAO 2004). For vitamin A, Iron, vitamin C, Calcium and Niacin, upper limits of requirements set by the guideline were used (ibid; Save the Children 2011b).

8.4.7 Inputs needed by the CoD programme for estimation of a minimum cost diet

In terms of estimation of cost of a nutritionally adequate diet for households in Dhanusha, the CoD programme required some input so that the programme can check whether a feasible solution exists that meet the nutritional requirements of household members with set constraints. The feasible solution selects grams of food items as a decision variable. The program used the Solver function in Ms-Excel to solve the problem of calculating a minimum cost of a nutritionally adequate diet, specific to a location. To enable the calculation of a minimum cost nutritionally adequate diet, the following information was inputted to the programme (**Figure 8.1**).

Figure 8.1 shows the elements required for the CoD programme to estimate a nutritionally adequate diet.

Figure 8.1 Data needed to plan a nutritionally adequate diet for a typical household in Dhanusha

Input used in the Cost of Diet programme (A- F)

A. Price/ g of each item	**B**. Food composition database of local items (Kcal and Nutrient values)	**C**. Constraints 1. Food group: min-max/week 2. Item frequency: min-max /week
D. No. of family members 6-23 months	**E**. No. of family members >= 24 months (age, sex, activity level)	**F**. Portion size of food items for 12-23 months child

A. List of food items and their price: A list of food items and price/unit, for each period (2005, 2008 Sep-Oct) was provided, from which the grams of items required were selected for a least cost nutritionally adequate diet**.**

B. Food composition database of local food items: A food composition database was prepared for foods commonly consumed by households in

Dhanusha which also had price data available from >=10 markets. The databases consulted in preparation of Dhanusha food composition table were USDA National Nutrient database (USDA 2009), East Asia Food Composition database (FAO 1972), and the Bangladeshi food composition tables (HKI and WFP 1988).

C. **Food group constraints:** The minimum and maximum frequency of intake in a week from a particular food group, as well as for each food item was set. This was set according to published findings (Sudo et al. 2006, Hirai et al. 1994; Gittelsohn and Vastine 2003; Helen Keller International, Nepal 2010), anecdotal evidences or personal judgement based on the best understanding of the usual intake reflected in the dietary recall data or from other sources.

D. **Profile of household members <24 months:** Total number of children in the reference household aged 6-8 months, 9-11 months and 12-23 months were provided. Since children age 0-5 months are expected to be exclusively breastfed, this information was not required.

E. **Profile of household members >=24 months:** Age, sex, physiological status and activity level of each household member (same as used for the planning of typical food basket) in this group were inputted to the program so that nutritional requirements were matched to the needs of the individual household members.

F. **Portion constraints:** Amount of food usually consumed by a 12-23 months old child in the area during each meal was specified. This was done based on suggested amount mentioned in the CoD manual (Save the Children UK 2011b), where possible. The programme scaled up or down the amount set for each item based upon the adult equivalent of kcal intake (Table 8.3) to generate portion size of specific food for a meal for other household members who were not aged 12-23 months. After adjustment of portion size for age, the per meal portion of rice was further adjusted to reflect usual intake. The median amount of rice consumed by male and female (Sudo et al. 2006) in a similar setting in Nepal was used to reflect usual intake of rice among adult male and female with moderate activity. For the elderly female in the household with sedentary activity, the 25th percentile of intake of rice among females was used to reflect the usual intake (ibid).

8.4.8 Constraints used by the Cost of Diet (CoD) programme

The following constraints were provided to the CoD software while it attempted to generate a minimal cost, nutritionally adequate diet:

- The chosen diet must fulfil the requirements of energy of all household members in the family.

- The chosen diet must provide the nutritional requirements of all household members. In other words, the total amount of food selected for consumption by household members should provide the sum of the individual member's macro and micronutrient requirements.

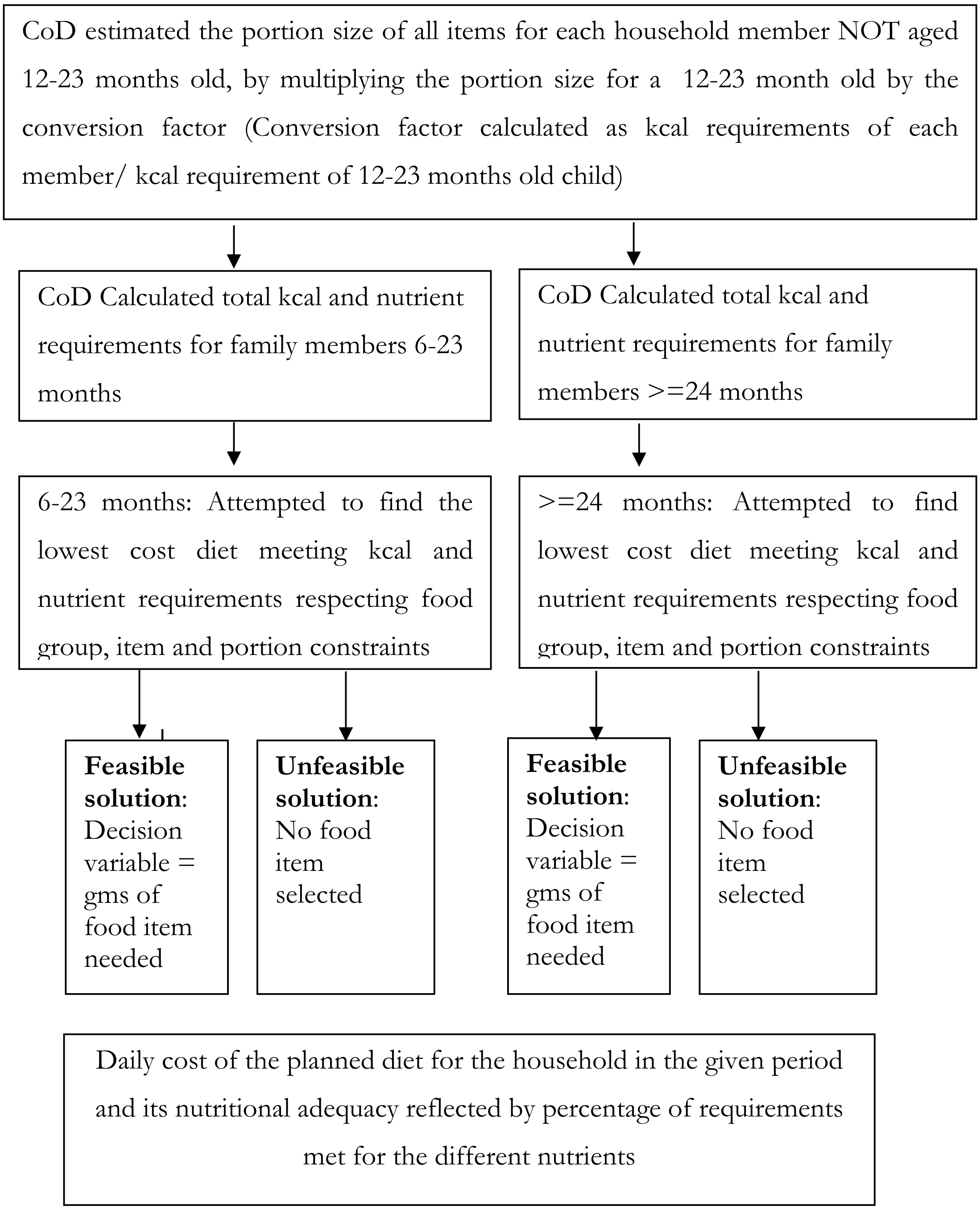
- The selection of food items within a food group and the amount of each individual item to be consumed by the household must fall within the limits set for food groups, food items and portion size. The range for number of times a food item can be included in the diet plan in a week ranged from 0 to 21. The minimum and maximum portions/week food from one particual food groups that can be included in the plan is shown in **Table 8.5** (SCUK CoD 2013).

Table 8.5 The limits set for food groups to included in the modelled nutritionally adequate diet

Food group	Minimum # of portions/ week	Maximum # of portions /week
Cereals	14	100
Pulses	3	100
Fruit	0	100
Vegetables	3	100
Dairy	0	100
Meat, Poultry, Fish, Eggs	1	100
Roots and Tubers	5	100
Fats	3	100
Manufactured	0	100
Beverages	0	100
Condiment Vegetables	0	100
Sugars	0	100
Snacks	0	100
Breast Milk	0	0

8.4.9 *Steps followed by the CoD programme*

After inputting the necessary information about the household members (age, sex, and activity level) and the foods available locally and their prices, the CoD programme was ran so that it would attempt to find whether it is possible to plan a diet that meet requirements of household members with listed items in given prices, nutritive values and constraints set. The steps followed by the CoD to come up with a nutritionally adequate diet for the target groups.



8.5 Results

8.5.1 Typical food basket of Dhanusha wealth groups

Table 8.6 shows the food items and amount included within the typical food basket of an adult male in the different wealth groups in Dhanusha. **Table 8.7** presents the typical daily food basket of households from different wealth groups in Dhanusha in 2005 and 2008.**The f**ood basket for a typical day among households in all wealth groups included rice, wheat, potatoes, vegetables, pulses, dairy, and oil, although the specific variety consumed was different among the wealth groups. The typical diet of the Better-off households was the most diverse including meat, sugar and fruit, which were absent in the food basket of others.

Figure 8.2 shows that for the typical food basket of the wealth groups in Dhanusha, cereals contributed nearly three quarters of the total kcal requirements among the Very Poor households, whereas it was slightly over half of its energy requirements among the Better off households. **Figure 8.3** indicates that the typical food basket of all wealth groups was deficient in meeting several of the nutrient requirements of its members, namely for vitamin A, fats, vitamin B12, calcium, iron and zinc. The usual food basket of the Very poor could also not provide adequate vitamin B2 and vitamin B6, which other wealth groups were able to meet. **Figure 8.4** reflects that the cost of typical food baskets of all wealth groups increased in 2008 (19%- 26%) with the increase being the largest among the Middle wealth group.

Table 8.6 Food items included in the typical daily food baskets of an adult male among wealth groups in Dhanusha

	Very poor		Poor		Middle		Better-off	
Food groups	**Item**	**Amount (g/l)**	**Item**	**Amount (g/l)**	**Item**	**Amount (g/l)**	**Item**	**Amount (g/l)**
Cereals	Rice, parboiled	540	Rice, parboiled	495	Rice, fine grain	481	Rice, fine grain	394
	Whole wheat flour	64	Whole wheat flour	59	Whole wheat flour	56	Wheat flour, fine	43
Roots/ tubers	Potato	135	Potato	146	Potato	151	Potato	154
Coloured vegetables	Red amaranth	80	Red amaranth	88	Red amaranth	95	Red amaranth	102
Other vegetables	Aubergine	65	Aubergine	72	Aubergine	77	Pointed gourd	86
Pulses	Kheshari lentil	24	Red lentil	34	Red lentil	37	Yellow split pea	40
Oil	Mustard oil	26	Mustard oil	29	Mustard oil	28	Mustard oil	28
Dairy	Cow Milk	83	Cow Milk	231	Cow Milk	360	Cow Milk	474
Others	Yellow mustard	14	Yellow mustard	16	Yellow mustard	17	Yellow mustard	18
Fish	Small fish	14	Small fish	15	Fish, Silver carp	12	Fish, Silver carp	12
Meat	-	-	-	-	-	-	Chicken, broiler	18
Sugar	-	-	-	-	-	-	Sugar	50
Fruit	-	-	-	-	-	-	Apple	21

Table 8.7 Food items included in the typical daily food baskets of households from different wealth groups in Dhanusha

	Very poor		Poor		Middle		Better-off	
Food groups	Item	Amount (g/l)	Item	Amount (g/l)	Item	Amount (g/l)	Item	Amount (g/l)
Cereals	Rice, parboiled	2331	Rice, parboiled	2138	Rice, fine grain	2076	Rice, fine grain	1703
	Whole wheat flour	278	Whole wheat flour	255	Whole wheat flour	244	Wheat flour, fine	188
Roots/ tubers	Potato	582	Potato	631	Potato	651	Potato	664
Coloured vegetables	Red amaranth	346	Red amaranth	382	Red amaranth	409	Red amaranth	440
Other vegetables	Aubergine	279	Aubergine	309	Aubergine	333	Pointed gourd	372
Pulses	Kheshari lentil	105	Red lentil	148	Red lentil	162	Yellow split pea	175
Oil	Mustard oil	112	Mustard oil	124	Mustard oil	121	Mustard oil	120
Dairy	Cow Milk	359	Cow Milk	999	Cow Milk	1553	Cow Milk	2049
Others	Yellow mustard	62	Yellow mustard	69	Yellow mustard	75	Yellow mustard	79
Fish	Small fish	62	Small fish	65	Fish, Silver carp	51	Fish, Silver carp	49
Meat	-	-	-	-	-	-	Chicken, broiler	77
Sugar	-	-	-	-	-	-	Sugar	216
Fruit	-	-	-	-	-	-	Apple	90

Figure 8.2 Percentage of energy (kcal) requirements contributed by the cereals in the typical food basket, disaggregated by households in different wealth groups in Dhanusha

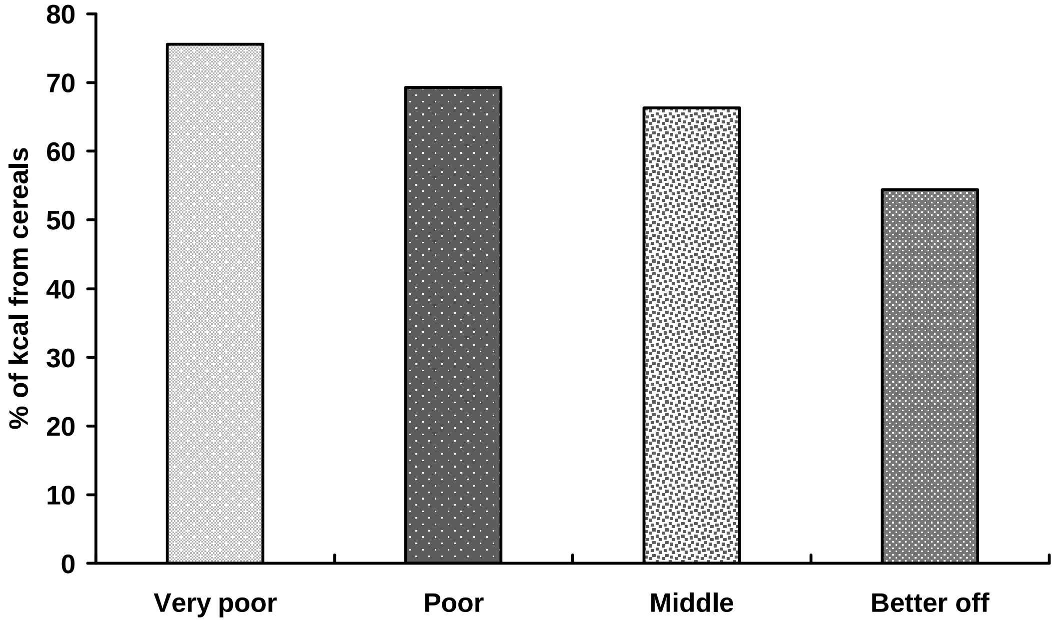


Figure 8.3 Percentage of household nutritional requirements met by the typical daily food basket, disaggregated by wealth groups in Dhanusha

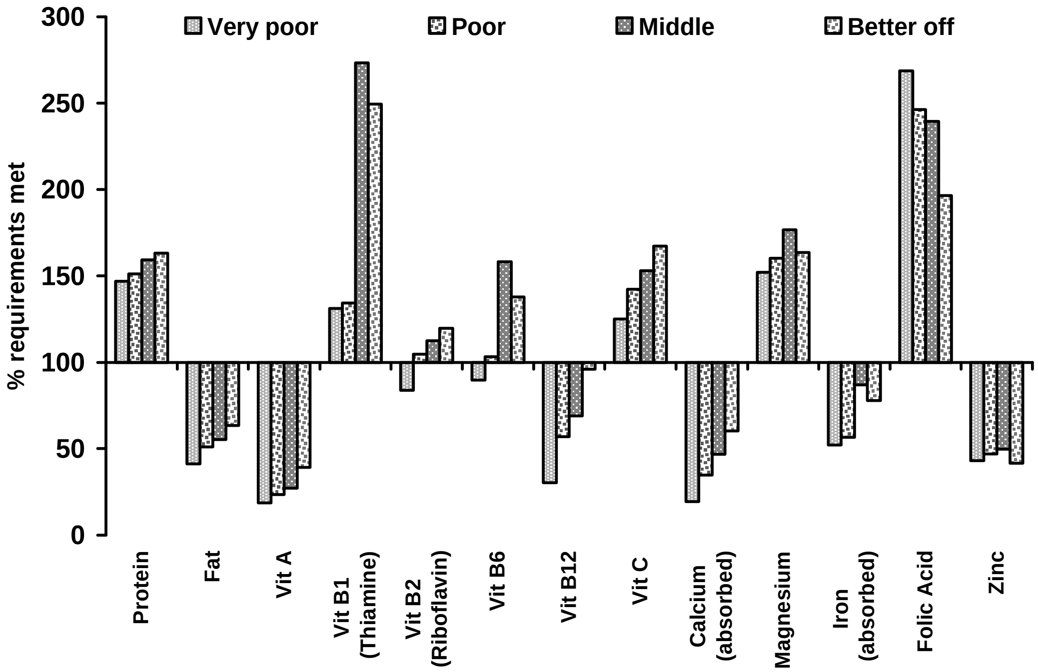
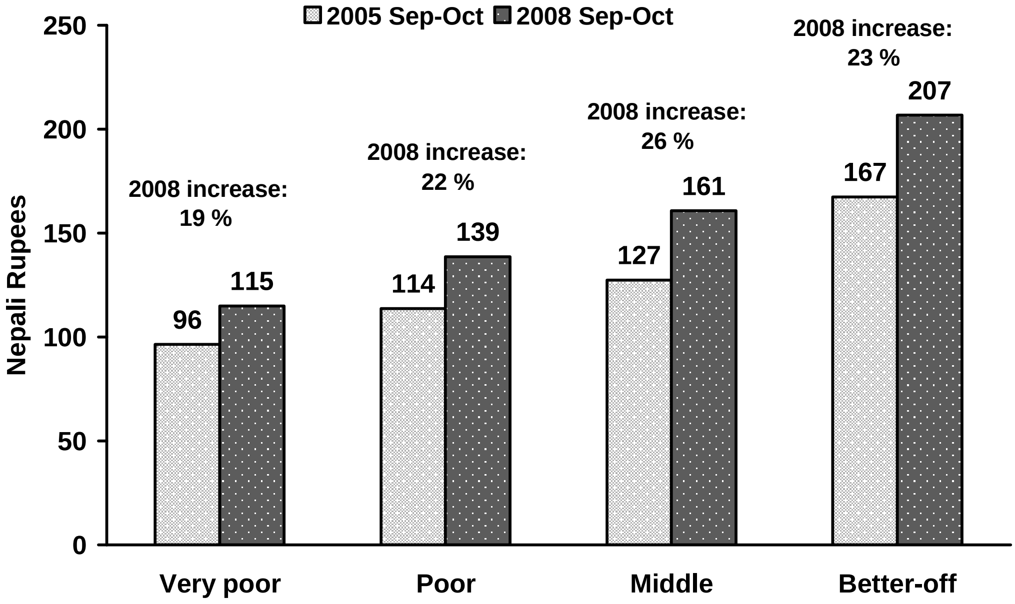


Figure 8.4 Cost of a typical daily food basket of wealth groups in 2005, 2008



8.5.2 Cost of a nutritionally adequate diet for households in Dhanusha

Table 8.8 shows the selection of food items included in the minimum cost nutritionally adequate diet by the CoD for a typical household in Dhanusha in 2005 and 2008. The selection of items did not vary much between the periods, but amount of food was adjusted to meet requirements of the household members. The cost of the nutritionally adequate diet increased by 22% in 2008, compared to that of 2005 **(Figure 8.5)**. However, neither the Very Poor or Poor households were able to afford the adequate diet in 2005 or in 2008 **(Figure 8.6)**. **Figure 8.7** shows that the poorer households needed to spend more than their total income on food to afford the nutritionally adequate diet, whereas the Better-off households required spending only one-third of their income on food. **Figure 8.8** presents a comparison of cost of the typical diet and the optimised diet among households in Dhanusha in 2005 and 2008. It is apparent that the cost of a nutritionally adequate diet was higher among Very Poor -Middle wealth groups, but Better-off households tend to spend slightly much money on typical food basket than was required for the adequate diet.

Table 8.8 Minimum cost of a nutritionally adequate daily diet in typical households in Dhanusha in 2005 and 2008

2005			2008		
Food Item	**Quantity (g)**	**Cost (NRs)**	**Food Item**	**Quantity (g)**	**Cost (NRs)**
Rice, Parboiled	1456	29.0	Rice, Parboiled	1607	36.5
Rice, fine grain (Mansuli)	353	7.6	Rice, fine grain (Mansuli)	202	5.6
Cow Milk	1621	38.1	Cow Milk	1695	45.2
Fish, Rahu	267	30.2	Fish, Rahu	277	45.3
Mustard oil	46	4.4	Mustard oil	46	6.2
Horse gram	139	4.4	Horse gram	139	6.6
Potato	387	4.6	Potato	387	5.0
Cumin	5	0.9	Cumin	6	1.5
Chilli powder	33	2.6	Chilli powder	33	4.0
GLV[†], Amaranth	975	9.2	GLV, Jute leaves	827	13.0
GLV, Jute leaves	319	4.8	Garlic	65	3.0
Garlic	65	3.3	Vegetable Ghee	244	25.6
Vegetable Ghee	246	15.1	-	-	-

[†] Green leafy vegetables

Figure 8.5 Cost of the minimum cost nutritionally adequate diet for households in Dhanusha in 2005 and 2008

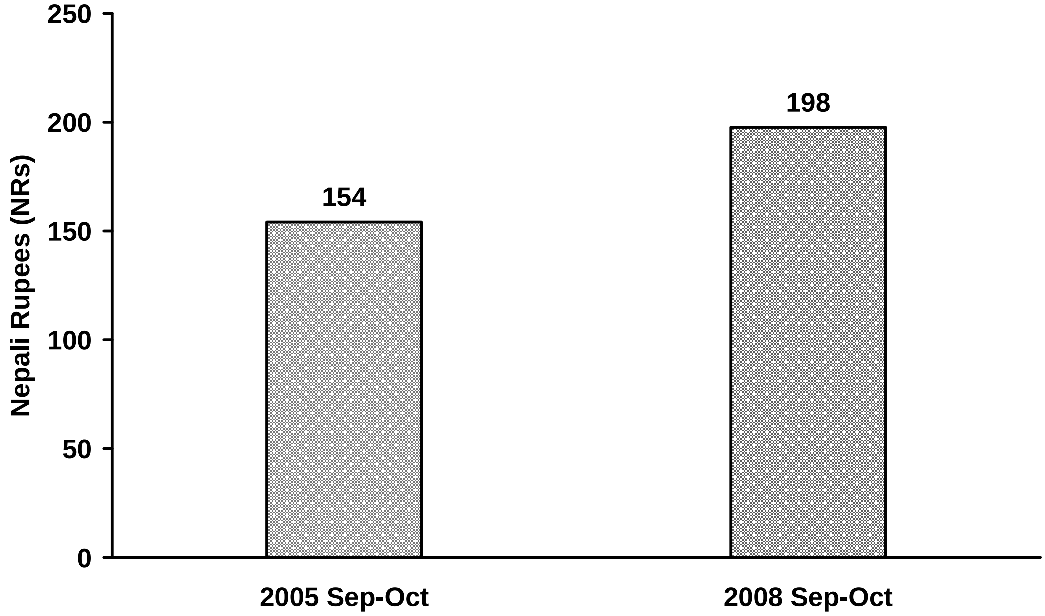


Figure 8.6 Affordability of a nutritionally adequate diet among wealth groups in Dhanusha in 2005 and 2008

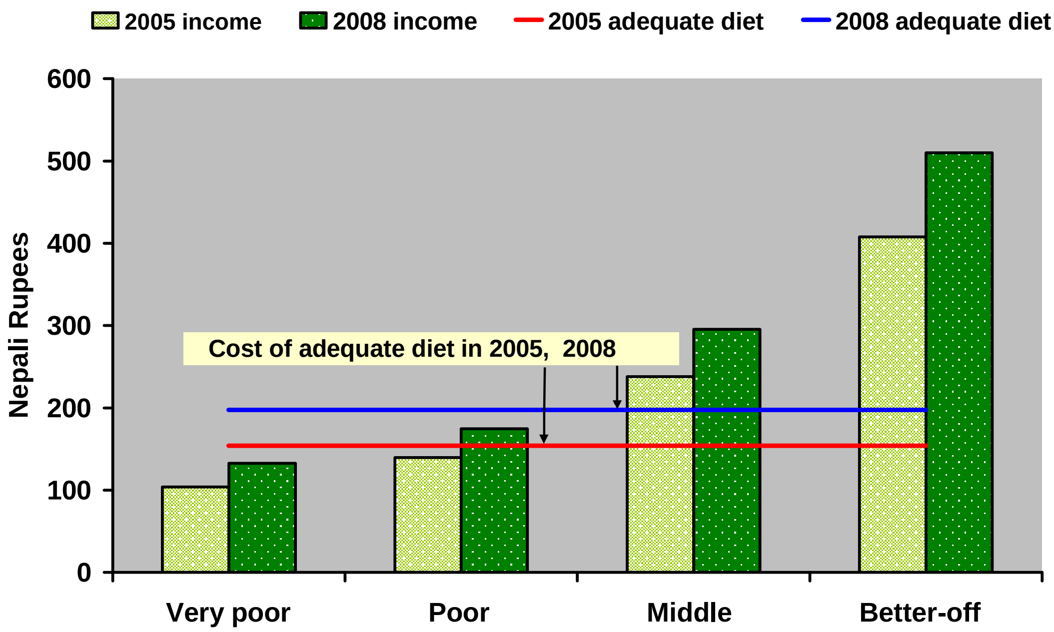
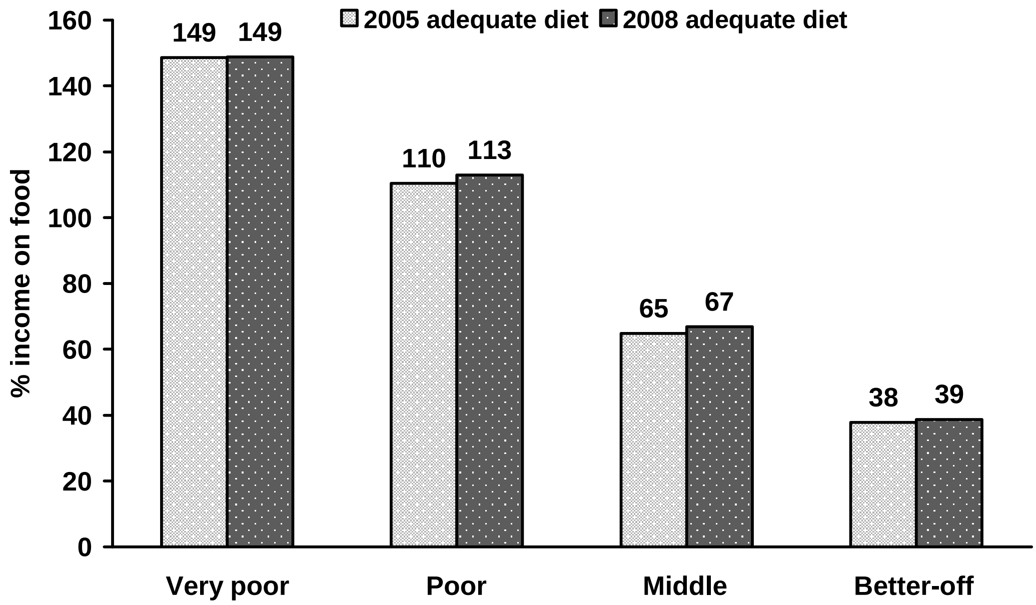


Figure 8.7 Percent of income needed to afford a nutritionally adequate diet for households in Dhanusha in 2005 and 2008



8.6 Discussion

The findings in this chapter showed that the cost of a typical food basket varied by wealth group and increased by 19% - 26% in 2008, and the cost of a nutritionally adequate diet increased by 28%. The cost of the nutritionally adequate diet for a Dhanusha household, optimised using linear programming, was \$2.1 (1 NRS = 0.0137 USD) in 2005, and was \$2.6 (1 NRS = 0.0132 USD) in 2008 (Oanda 2012). This was somewhat higher that the estimated cost of a minimum cost nutritionally adequate diet planned in 2005-6 for households in Ethiopia (\$1.27), Myanmar (\$1.15), Tanzania (\$0.72), and Bangladesh (\$0.91), respectively (Save the Children UK 2009a). This shows the importance of estimating the cost of local diets, which are influenced by many factors that control prices in the area. Nepal, being a land- locked country heavily reliant on import of foods, may need to spend more on food than other countries. Due to the food price crisis in 2008, households in the different wealth groups were required to spend a larger share of their budget on food to buy the same food basket. Although the CoD allows food substitution over time by selecting the minimum cost nutritionally adequate diet, selection of food items remained almost the same for both 2005 and 2008. The only difference was that instead of selecting two green leafy vegetables (GLV) in 2005, CoD selected one GLV item in 2008. However, the amount included for different item varied for the two periods. The selection of food items for the adequate diet in both 2005 and 2008 being very similar indicated that while maintaining the dietary pattern in Dhanusha there was not much scope for substitution. Furthermore, the CoD programme estimated the cost of a minimum cost adequate diet and therefore it could be possible that different set of foods may fulfil the nutritional requirements with higher cost.

The planned typical food basket reconfirmed the association of dietary pattern with widespread micronutrient deficiencies of several nutrients in rural Nepali households (Brown, Worth and Shah 1968; Christian et al. 1998; Shankar et al. 1996; Gittelsohn et al. 1997b). Deficiencies of vitamin A, calcium, vitamin B6, B12, iron, and zinc were common among typical food basket of all households, irrespective of wealth groups. Although the requirements of vitamin B1 and B6 was met by typical diets of other wealth groups, these nutrients were deficient in the typical food basket of the Very poor. Consumption of food varied between regions in Nepal (Ohno et al. 2004; Ohno et al. 2007). However, researchers have shown that diets among households in the plain were predominantly cereal based where cereals provided bulk of the energy, and consumption of animal foods was very low (Hirai et al. 1994; Ohno et al. 2007; Sudo et al. 2006). The deficiencies of several micronutrients in typical diets of households in the *Terai* (plains) is explained by the fact that generally their food basket include large amount of rice, accompanied by thin pulses soup, potatoes, vegetables, and milk being the sole animal origin food (Ohno et al. 1997; Sudo et al. 2006; Parajuli, Umezaki and Watanabe 2012). Most of the studies reported average intake of macro and micronutrient intake, but only few studies assessed adequacy of micronutrient intake from the household diet (Gittlesohn 1991; Gittlesohn, Thapa and Landman 1997a; Parajuli, Umezaki and Watanabe 2012). Parajui et al. (2012) assessed food intake by weighted intake method in a district in central Terai (same region to Dhanusah) in 2006 and observed that the diet of men and women were deficient in vitamin A, iron, riboflavin. This was consistent to our findings, although only the very poor household's diet was deficient in riboflavin in Dhanusha. Consistent to our findings of iron deficient diets of households from all socio-economic groups, the Nepal DHS 2006 also showed that 48% of the children aged 6-59 months and 36% of the women aged 15-49 were anaemic (Ministry of Health and Population (MOHP) [Nepal], New Era, & Macro International Inc. 2007).

The cost of both the typical food basket and the nutritionally adequate diet increased in 2008. On average, the usual expenditure on food out of total household was 61%, 57%, 55% and 45% among the Very Poor, Poor, Middle and Better-off households in Dhanusha in 2005-6 (Chapter 5). Data were not collected in the area to examine expenditure pattern in 2008. The cost of the planned typical food basket for Dhanusha households could be somewhat higher than actual expenditure, because the plan was devised to estimate cost of a diet that met energy requirements of household members. Data were not available on actual energy intake (kcal) levels in Dhanusha, but the actual intake could be below the required level. Parajuli and colleagues (2012) assessed dietary intake in the plains of Nepal in 2006 and found energy intake varied for two ethnic groups (Mushar male: 86.4% kcal of RDA, Tharu male: 99.1%; Mushar female: 76.6%, Tharu female: 87.3%). However, dietary intake of energy was below the recommended level for all groups. The planning of the food basket for Dhanusha did not also account for intra-household distribution of food. Although discriminatory food distribution was evident for women and girl children in the household, their intake for the typical food basket was estimated in relation to the adult male. The amount of intake by an adult male was scaled up or down using adult equivalent units of recommended energy level of them (Gittlesohn and Vastine 2003; Sudo et al. 2006). In reality, it is unlikely that all food items will be proportionately distributed to women and girl children and therefore the actual cost would be somewhat less than the cost of the planned food basket. Another factor influencing the cost of the typical food basket was limited consumption of some items for economic and cultural reasons. The estimated intake of each food items by an adult male was multiplied by the adult equivalents to estimate amount consumed by the household. Yet, some items, such as oil, spices, milk and sugar may not be consumed as such. Rather, because these items are comparatively expensive the consumptions of such items were more likely to be constrained by purchasing power of households.

Although the cost of both the typical food basket and the nutritionally adequate diet increased in 2008, households were required to spend a larger share of budget in both 2005 and 2008 for the adequate diet compared to that for a typical food basket. For the nutritionally adequate diet, the percentage of income spent on food would be 149%, 110%, 65%, and 38% in 2005 among households from the Very poor, Poor, Middle, and Better-off respectively. Such a diet was unaffordable for Very Poor and Poor households in both 2005 and 2008. The percentage expenditure on food needed in 2008 by the different wealth groups in Dhanusha was quite similar to that of 2005, which indicates that the poorer household required additional assistance to enable them afford a nutritionally adequate diet even before the 2008 food price crisis. Save the Children UK (2009a) also reported similar findings of un-affordability of a nutritious diet by the poorer households in rural Bangladesh and in Ethiopia in the 2005-6 period. The study also reported that the poorer wealth groups in Myanmar and Tanzania could barely afford the nutritious diet during 2005 and 2006 (ibid). Temple et al. (2011) studied the availability of food and their costs in Western Cape in 2008 and 2009, and modelled the cost of healthier dietary plans compared to a typical South African menu. They found that although healthier foods were available in the area, they were more expensive. When price per unit of energy intake was compared, the six healthier options modelled appeared to be 30% -110% higher in price. On average, a household of five members would be required to spend an extra amount of US$ 140 per month. The comparison of income levels and additional cost of a healthier diet showed that the households in third, fifth, and seventh deciles needed to spend 98%, 57%, and 30% of their total income (ibid). Although, households from the different wealth groups in Dhanusha needed to spend higher proportion of their income compared to South African population to afford a nutritionally adequate diet, a similar gradient in percentage of income needed by socio-economic status was observed. Hopgood et al. (2010) estimated the cost of a nutritious diet among New Zealand children of 3-14 years of age and found that although many households do not receive child tax benefit, a family with one child receiving child tax credit would be required to spend 20-59% of the amount received to buy the foods included in the nutritious diet plan. Many households may not afford spending this much after meeting other essential needs of clothes, medical and school expenses.

The findings that there was no major change in affordability of the adequate diet in 2005 and in 2008 indicates that the effect of the food price crisis may have been buffered by a similar increase in income among the wealth groups. One significant point is that this cost only included the food cost, whereas households in the different wealth groups spend roughly 10-15% of the expenditure on household inputs, which includes essential commodities such as fuel, firewood, soaps that are needed as basic expenses. Adding these costs to the amount of money needed for an adequate diet, the poorer households are far below affording a nutritious diet. Another point is that, the increase in government salary only took place in September 2008, soon before the data collection period (see Chapter 7) whereas the food price continued to rise and reached its peak in middle of 2008. Therefore, the impact of increased food price on malnutrition can not be ignored. The increase in income was evident for non-government employments or other sources, but it is considered that the rises in the government salaries have pushed other employers to raise pay. Remittances have also played an important role in Nepal economy. In Dhanusha, although households from other wealth groups had remittance earning, HEA data suggested this was not utilised by the Very Poor households. A recent report examined the trend on remittance income flow in Nepal and observed that although the overall yearly data showed a increasing trend in remittance flow in Nepal, the monthly breakdown of data showed a fall in remittances between July and August 2008 which then recovered again in March 2009 (ICIMOD 2011). Although rural Nepali households used earning from seasonal migration to India, the remittance earning from countries such as Malaysia and Qatar were much higher (Chapter 7). Nepal is one of the few countries who did not experience a long-term negative flow of remittance earning due to food and financial crisis for longer period, as Malaysia and Qatar recovered comparatively earlier from these crises compared to other European countries (ICIMOD 2011). After the 2008 food price crisis and economic crisis in 2009, more households may have sought earning opportunities abroad due to lack of economic opportunities within the country.

The calculation of the estimated cost of typical or nutritionally adequate diets did not take into account that many households produce some food for themselves in rural areas. Households reliant on consumption of their own production spend less on purchased food, but are nevertheless affected by affordability of those foods. In Dhanusha according to HEA data, the percentages of total consumption contributed by household food production were 3%, 9%, 31% and 47% among the Very poor, Poor, Middle and Better-off, respectively. The reliance of poorer Dhanusha households on purchased food signals their vulnerability to price rises and their risk of food insecurity and malnutrition. Without targeted assistance, the continued increases in food prices in 2009 may deepen the poverty of many more households. Besides, women and children in poorer households may suffer more, as was observed in Indonesia following an economic crisis (Block et al 2004). On top of the inequitable food distribution within households, mothers may often sacrifice their intake in time of a crisis to buffer the intake of their children. Although this may cover for energy intake among children, both women and children suffer the consequence of micronutrient deficiencies (ibid). The overall assessment of food security or poverty may not always reveal such a worsening of poverty, as although categorisation of households may not change they may still suffer from deepened poverty or food-insecurity. Hence, nutritional assessments together with other rapid assessments of food security are important to assess the impact of a crisis and for target of resources.

The research found that households needed to spend larger amounts of money on an adequate diet compared to the cost of the typical food basket for all wealth groups, with exception of the Better-off households. Even though Better-off households were spending more money, their typical food basket was deficient in fat and several micronutrients. This indicates that although poorer household's earnings were too low to be able to afford a nutritionally adequate diet, it was not the case among wealthier households. Therefore, targeted social safety net programme and nutritional behaviour change communication may be required for households from different socio-economic groups.

Chapter 9. Conclusions

This PhD research generated descriptions of livelihoods, poverty and food security derived from the participatory Household Economy Approach (HEA), estimated changes in food prices before, during and after the 2008 global food price crisis, and assessed affordability of a nutritionally adequate diet among Dhanusha wealth groups before and during the global food price crisis. The livelihoods and poverty of wealth groups provided contextual data, price data described the situation, and the impact of food price rises on the affordability of a nutritionally adequate diet among the different wealth groups was then assessed. Descriptions of poverty and food security generated from HEA were also compared with findings from household surveillance data (HSD) collected in the same study sites. The conclusions, based on my research, are therefore summarised within three main components:

1. Descriptions of wealth groups, their livelihoods and food security,

2. Change in food prices before, during and after the global food price crisis,

3. Affordability of a nutritionally adequate diet among wealth groups in Dhanusha.

9.1 Descriptions of wealth groups, their livelihoods and food security

HEA and HSD were used to describe characteristics of the wealth groups in Dhanusha, their livelihood and food security status. HEA uses semi-structured interviews with mixed wealth group representatives to get an overview of wealth groups. Pairs of data collectors then interview each wealth group separately to collect detailed information about and quantify estimates of, annual income, expenditure, and food consumption for a typical household in that group.

The findings showed that HEA provided rich details of the characteristics of the wealth groups, their livelihood options, and expenditure patterns. HEA data were internally consistent in terms of descriptions of livelihoods, telling who does what, how much they spent under different budget headings, what foods were commonly consumed in the area, and how the wealth groups were linked with each other. However, the HEA data collected in Dhanusha failed to generate reliable quantitative estimates of asset ownership, income, or food consumption. Estimates of the percentage of household owning different assets were much higher in comparison to the national estimates, or estimates derived from HSD. Similar overestimation was evident for food consumption data, resulting in average caloric intake among all wealth groups being much higher than 2100 kcal. This per capita per day intake cut off was used to define households as food insecure. In addition, due to the diversity of income options for a wealth group, typifying income sources by wealth groups was difficult. Data collected were inconsistent, and both inter- and intra-observer variability was present. Therefore, income data could not be summarised to generate a reliable quantitative estimate of per capita annual household income for any wealth group.

Drawing upon my experiences of analysing the HEA data, discussing with people involved with the study in Dhanusha, and learning about HEA-related experiences of others, it is apparent that, although it may appear simple to use participatory tools such as focus group interviews of this kind, such a method requires strong technical skills and experience. This research backed up others' observations that conducting an HEA study requires specific skills and experiences and the skills required may not be readily transferrable (Jaspers and Shoham 2002; Lejune and Holt 2003; Marsland 2004; Shoham 2005). The experience in applying HEA in Dhanusha suggests that the incorrect quantitative estimates could be associated with the design of the semi-structured questionnaire used, the high diversity of livelihood options and foods consumed, the number of study sites (workload of interviewers), length of recall period, supervision of data collection, and the ease of understanding and adopting of methods by first time HEA data collectors. Shoham (2005) has also reported that 'baseline' data collection for HEA is quite difficult and very demanding on skills and time. Marsland (2004) reported that sometimes organisations were reluctant to use HEA because the skills of applying HEA are not always readily transferable.

Given that HEA is able to provide rich contextual details necessary to identify links between poverty, food insecurity, and localised factors associated with vulnerability to food insecurity, certain careful steps or modification of the method might make data collection easier and make HEA findings more credible. Concluding remarks on some of the factors associated with quality of HEA data are discussed in the following section.

- **Dealing with diverse income sources**:

Collecting HEA data on income in non-emergency settings and poor areas, where income sources are usually diverse and people tend to gather income from a combination of sources at different time in a year can be difficult. A difficult area is that several of the concepts used in HEA, such as 'typical household' or 'wealth group', are not comparable with other methods. In Dhanusha, it was not possible to typify or limit income sources by wealth groups within the sub-categories set. In reality, there were many combinations, and data collectors struggled to establish a common pattern. In light of the wide variety of income sources, it is not sure whether it would have been a manageable task for skilled and experienced HEA practitioners, but it was difficult for newly trained data collectors in Dhanusha. This shows that developing skills on how to generalise are not easy, and also raises the question of how appropriate it is to try to make a generalisation of this kind.

In recent years, HEA practitioners have introduced a derivative of HEA, known as the Individual Household Model (IHM) that collects data from individual households rather than interviewing groups (Seaman and Petty 2004). This is done in addition to the usual HEA to collect income data, which is analysed using specially designed software. This method allows modelling of income data and detecting errors early enough to revisit households where needed. The IHM model collects a random sample of households in an area, which is similar to standard household surveys or living standard surveys and therefore produces comparable estimates (ibid). Promotion of use of IHM as a core element in HEA replacing the income data collection using group interviews among different wealth groups may improve the quality of income data and is more likely to produce a reliable estimate.

Instead of trying to establish one common pattern of income sources per wealth group, considering income data as qualitative in nature and including several combinations of income sources as example of livelihoods within each wealth group may increase validity of estimates in a non-emergency setting. Another point is that the HEA could only collect details of expenditure data to quantify expenditure estimate per group, in addition to collecting data on income pattern among wealth groups using proportionate piling, rather than generating quantitative estimates of both. Thus, HEA methods can be used to collect descriptive data on income and to understanding how different categories of income contribute to the total income of a wealth group.

- **Design of the questionnaire**:

As shown in **Annex 4.3** the data collection in the Dhanusha HEA used independent questionnaires, one individual form for each of income, expenditure, and food consumption in a study area. The format used in Dhanusha was similar to what had been used by FSAU in Somaliland (Naomi Saville, personal communication). The focus of HEA is on how people meet their needs rather than on exactly what foods they consume to meet their kilocalorie (kcal) needs. The HEA practitioners' guide mentioned (Food Economy Group 2011, chapter 3, p-36):

> "Not 'what' but 'how'. HEA is concerned with the economic question of how people obtain access to food rather than the nutritional question of exactly what people consume".

A combination of 'what' and 'how' both are needed as it may not be enough to group one food item separately under sub-categories of food consumption only. Whereas data collectors using HEA are expected to triangulate findings, they may find it difficult if estimates of income, expenditure and food consumption are done separately. A typical household may produce rice, and consume and sell part of it. Therefore, it comes under both consumption and income sources. The form that is included in recent version of the practitioners' guidelines includes the linkages between expenditure and food consumption (appendix 9.1) (Food Economy Group 2011). SCUK needs to promote using this newer version of data collection forms to make the data collection easier and more usable.

- **Food consumption data and estimating the food deficit**:

HEA attempts to estimate annual food intake of a typical households in each of the different wealth groups and estimate the deficit in meeting the minimum energy (kcal) requirements. Collecting HEA food consumption data by interviewing groups of people in a non-emergency setting, where people have access to a very wide range of food items seems to lead to erroneous estimates. HEA was developed primarily for emergency targeting of food assistance, and therefore food or income sources in those areas tended to be limited. In a complex and diverse agricultural society with wage earning, trade, and public and private sector employment opportunities, it becomes difficult for data collectors to disentangle the different potential source of foods and quantifying them properly may be difficult. The whole process is quite laborious, requires at least good mathematical skills and preferably knowledge of the kcal content of different food items; otherwise it may well generate incorrect estimates.

To some extent, this is also related to the design of the data collection form. The design of the HEA semi-structured questionnaire used for food consumption data focuses on broad categories of consumption such as food purchased, produced, or paid as labour exchange. Therefore, it becomes difficult for data collectors to sum up an one item that is included in each of these categories. We found that seeking a very detailed breakdown of each and every food item from each of the possible source lead to overestimation of food consumption. For example, if varying amounts of rice come from several of the sub-categories, such as from purchase, labour exchange, and as gift, the data collector may not add the amount of each item up to check if the estimate is believable. It may also not seem to be feasible to keep running totals of the amounts of kcal coming from different food sources where the list of items consumed is diverse, but perhaps this could be built in for the important staple foods. A change in design of the questionnaire where data collectors can see sources of one item side by side and add them up to see if the estimate is reasonable might improve data quality. This would make the data collection easier, but would still allow disaggregation at the analysis stage.

Using the FANTA HDDS or HFIAS to assess food security could be much simpler and easier for both data collectors and household members, and may produce results that are more ‘accurate’ in terms of assessing food insecurity among households in different wealth groups or to identify target areas with high levels of food insecurity. Food security and nutritional status are often related, and anthropometric indicators can be used as a proxy indicator (Koch 2011). Nutritional indicators however indicate food utilisation as well as access so are not a direct measure of food security. Measures such as Mid Upper Arm Circumference

(MUAC) have the benefit of simplicity and there are ways of ensuring data quality when a good training includes quality checks of measurements by data collectors and only those able to measure reliably are included in data collection team. A similar approach of screening data collectors who develop the best understanding of the method could also be applied in training for people learning how to apply the HEA.

- **Political unstable situation**:

The HEA practitioners guidelines suggests that data collectors make a rough estimate of findings soon after the data is collected and cross check one data collectors' finding with another, so that it all makes sense (FEG 2011). In this study, this was not possible because of the very un-settled political situation at the time of data collection and insecurity in the field site. Data collection teams checked their work themselves, but there were inconsistencies within a team and especially across teams in standardising income data. In Dhanusha, supervision of data collection by an experienced HEA practitioner was not possible for the whole period due to the in-secure situation. Onset of a mass uprising throughout Nepal at the time of the study (April 2006) affected supervision of data collection as the technical advisor was evacuated. This meant there was a lack of skilled personnel available for cross-checking of results at field level, and no scope to validate results quickly. Due to the diverse food consumption pattern, the kilocalorie estimates of range of food items consumed could not be completed at the time of data collection, or even shortly after completion of the study. Reducing data collection in terms of number of sites or even limiting the type of data to be collected in such a situation may help maintain the quality (i.e. fewer higher quality HEA baseline studies rather than one per VDC are likely to have yielded more robust data quality).

- **Number of study sites**:

Guidelines on HEA data collection need to provide a better indication of the number of areas to collect data from, as many studies so far did not report very clearly how many areas data were collected from, or number of areas to be included in sampling. Whereas a previous HEA manual (Seaman et al. 2000a) did not include a clear guidance about number of areas to collect data from, the recent HEA practitioners guides suggest to collect a minimum of 8 villages within one livelihood zone, and to conduct a minimum of 10 interviews per wealth group (FEG 2011). In Dhanusha, data collected from 60 study sites generated 60 Community representatives' (CR) interview and 210 wealth group representatives' (WGR) interviews. This not only added a large workload for data collectors, but is also likely to have affected data quality. The financial implication of collecting more data than needed is not negligible when time for data collection, participant's time, entry, editing, and time on analysing the data are all added up. The most recent HEA handbook states that it is more important to collect good quality data than collecting many interviews, which are not of good quality (Holzman et al. 2008).

- **Recall period**:

  HEA data on income, expenditure and food consumption, collected from wealth group representatives are all collected with a one year recall period, which may add errors to the data. Limiting the quantitative data collection for a recall period of one month with additional qualitative data on lean periods or change in consumption and income levels may be more useful.

In summary, HEA data collection in Dhanusha demonstrated that HEA in non-emergency settings is able to provide rich details of the livelihoods that influence food security of a population, but collecting food data and quantification of kcal intake to determine food deficit is difficult. In such settings, HEA can be used to generate contextual data on livelihoods along with expenditure and/or nutritional indicators so that estimates are valid and reliable. Modification of HEA data collection tools, using individual household level estimates of income, and capacity building of local staff to use and adapt HEA could be more cost effective and could generate useful contextual information.

9.2 Changes in food prices before, during and after the global food price crisis

The price data collected from market vendors seemed to generate reliable estimates and the inflation rate measured using these data were comparable with national level estimate. This suggests that the quality of HEA data seemed to have been influenced by skills needed, variability in the type of data collected and between different respondent groups. The local market price data showed that food prices increased by 28.5% between 2005 and 2008, and increased further by 18.8% in 2009. Within this period, a similar increase of income of the wealth groups was evident. In 2008, the Government of Nepal introduced a salary increase in Nepal that may have obliged others to increase rates of pay, especially for the most poorly paid. Data on Dhanusha income levels were not available for 2009, and it is unlikely that there was a similar increase in 2009 as well, especially as local sources suggest that no such increase was evident in 2009. The world food price started to fall in 2009, but the Dhanusha food price continued to rise. Poor harvest, high fuel prices, banning of food import from India, and transport problems were associated with this increase. Most people in Nepal rely on agriculture, but land productivity is limited. This indicates that improving agricultural productivity is important and the country needs to give more attention and allocate resources to this sector.

9.3 Affordability of a nutritionally adequate diet among wealth groups in Dhanusha

The cost estimate of a typical diet among wealth groups in Dhanusha showed that the diet of all wealth groups were generally low in several micronutrients. The cost of a nutritionally adequate diet showed that the Very Poor and Poor wealth groups were unable to afford a nutritionally adequate diet in both 2005 and 2008. Although the negative impact of the food price crisis seems to have been buffered by a similar level of increase in income of the different wealth groups, the overarching finding is that poverty, in terms of disposable income, limits food security and causes under-nutrition in Dhanusha. In 2009, when the global food prices showed decline, food prices continued to rise in Nepal. Given that prevalence of malnutrition is high and researchers have shown evidence of widespread micronutrient deficiencies among Nepali population (Gittelsohn, Thapa and Landman 1997; CBS 2011), the situation is alarming. Programmes need to focus on safety net measures, targeted food security interventions that are suitable for an area where the life of people is dominated by agriculture. HEA data showed that the poorer households have almost no land or limited land (mean land size 0.03 and 0.41 bigha for Very Poor and Poor respectively), are engaged in unstable employment such as daily waged labour. At times of crisis, such as a continued price rise, the poorer households may have limited access to loans from formal institutes such as from banks, and they have to take loans from money-lender with high interest. Furthermore, they may reduce the number and quality of meals, and take up seasonal low paid migration work as a coping mechanism. These households need special assistance such as inclusion in income generating opportunities, and a safety net programmes to sustain their livelihoods and avoid a deterioration of the food security situation. The typical diets of wealthier households were also likely to be low in micronutrients, even though the cost of diet was much higher than other wealth groups. This indicates that targeted food security interventions and promotion of better nutrition via behaviour change communication may be needed for the whole Dhanusha population if an adequate nutritional status is to be achieved.

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Annex 3.1 VDC name, demographic data and number of interviews conducted

VDC #	VDC name	Total households	Total population	# Community Representative interview	# Wealth group interview	# Very poor interview	# Poor interview	# Middle interview	# Better-off interview
1	Mukhiyapatti	983	3,154	1	3	0	1	1	1
2	Tulsiyahi Jabdi	964	2,827	1	3	1	0	1	1
3	Tulsiyahi Nikas	723	2,350	1	3	1	1	1	0
4	Bahedabela	1,073	3,137	1	3	1	1	1	0
5	Phulgama	1,902	5,327	1	4	1	1	1	1
6	Ghodghas	955	2,782	1	4	1	1	1	1
7	Devdiyaha	1,084	3,166	1	3	1	1	1	0
8	Lagma Gathaguthi	822	2,565	1	3	1	1	1	0
9	Bahuarba	792	2,492	1	3	1	1	1	0
10	Devpura rupaitha	1,310	3,853	1	4	1	1	1	1
11	Basaiya	1,028	3,236	1	4	1	1	1	1
12	Bindhi	957	2,877	1	4	1	1	1	1
13	Lohana	1,028	3,153	1	4	1	1	1	1
14	Nuwakhor Prasahi	724	1,906	1	4	1	1	1	1
15	Sakuwa Mahendranagar	2,833	7,450	1	4	1	1	1	1
16	Digambarpur	1,668	4,736	1	4	1	1	1	1
17	Mansingpatti	713	2,142	1	3	1	1	1	0
18	Suga Madhukarai	883	2,787	1	3	1	1	1	0
19	Dhanusha Dham	1,520	4,400	1	3	1	1	1	0
20	Jhattiyai	982	2,847	1	3	1	1	1	0
21	Banniniya	652	1,916	1	4	1	1	1	1
22	Tarapatti Sirsiya	1,352	3,955	1	2	1	0	1	0
23	Thera Kachuri	1,006	3,116	1	4	1	1	1	1
24	Bagchauda	997	2,977	1	3	1	1	1	0
25	Paudeswar	1,048	3,102	1	4	1	1	1	1
26	Bhuchakrapur	868	2,441	1	3	1	1	1	0
27	Bateswor	1,021	2,656	1	3	1	1	1	0
28	Kanakpatti	877	2,313	1	3	1	1	1	0
29	Dhalkewar	1,779	5,205	1	4	1	1	1	1
30	Jhojhikatiya	685	2,188	1	4	1	1	1	1

VDC no	VDC name	Total households	Total population	# Community Representative interview	# Wealth group interview	# Very poor interview	# Poor interview	# Middle interview	# Better-off interview
31	Hariharpur	1,511	4,179	1	4	1	1	1	1
32	Dhanauji	1,222	3,592	1	4	1	1	1	1
33	Ramdaiya	1,114	3,062	1	3	1	1	1	0
34	Sapahi	1,388	4,136	1	4	1	1	1	1
35	Sinurjoda	1,496	4,331	1	4	1	1	1	1
36	Shantipur	899	2,296	1	4	1	1	1	1
37	Naktajhij	1,283	3,659	1	4	1	1	1	1
38	Mithileswar Mauwahi	636	1,840	1	3	1	1	1	0
39	Bhutahi Paterwa	864	2,379	1	3	1	1	1	0
40	Aurahi	883	2,670	1	3	1	1	1	0
41	Barmajhiya	1,078	2,912	1	3	1	1	1	0
42	Bharatpur	2,846	8,095	1	4	1	1	1	1
43	Deuri Parbaha	804	2,307	1	3	1	1	1	0
44	Yagyabhumi	2,898	7,560	1	4	1	1	1	1
45	Dhanusha Govindapur	1,568	4,400	1	3	1	1	1	0
46	Kajara Ramaul	860	2,515	1	4	1	1	1	1
47	Sabaila	1,545	4,241	1	4	1	1	1	1
48	Makhnaha	1,157	3,263	1	4	1	1	1	1
49	Mithileswar Nikas	1,112	3,150	1	3	1	1	1	0
50	Sonigama	1,136	3,331	1	3	1	1	1	0
51	Chakkar	924	2,800	1	4	1	1	1	1
52	Chora Koyalpur	783	2,341	1	4	1	1	1	1
53	Goth Koyalpur	685	1,920	1	4	1	1	1	1
54	Hathipur Hadwada	682	2,052	1	4	1	1	1	1
55	Giddha	898	2,544	1	3	1	1	1	0
56	Ekrahi	825	2,412	1	3	0	1	1	1
57	Thadi Jhija	1,225	3,572	1	3	1	1	1	0
58	Khajuri Channa	1,070	2,970	1	4	1	1	1	1
59	Pra Khe Mahuwa	759	2,272	1	3	1	1	1	0
60	Maachi Jhitkoiya	1,692	4,916	1	4	1	1	1	1
	Total	69,072	198,773	60	210	58	58	60	34

Annex 4.1 Household Dietary Diversity Score module in the surveillance questionnaire

In the last 24 hours which of the following foods did you or your family eat (i.e. foods that were eaten at home or made at home)?

☐ Cereals e.g. rice, wheat, maize, millet,

☐ Root tubers e.g. potatoes, yams, sweet potatoes,

☐ Vegetables : ☐ *yellow colour like pumpkin & carrots* ☐ *green leaves*

☐ Fruits : ☐ *yellow like mango and papaya*

☐ Meat: ☐ *goat* ☐*chicken* ☐ *duck* ☐ *buffalo* ☐ *pig* ☐ *mouse / rat* ☐ *cow / bull*

☐ Eggs

☐ Fish / shell fish: ☐ *small fish +bones* ☐ *large fish no bones* ☐ *snails or crabs*

☐ Pulses & nuts

☐ Dairy

☐ Oil / fats

☐ Sugar / honey

☐ Other e.g. spices, tea, coffee,

Annex 4.2 Household Food insecurity assessment scale module in the surveillance questionnaire

I am now going to ask you 10 questions about food and food access in the house where you stay. Please answer about the last 30 days only and please answer for yourself and your household. By 'resources' we mean money or food.

Q34. Did you worry that your household would not have enough food? O Yes I worried O No I did not worry ***(If no go to question 35)***
Q34.1. If you worried that you would not have enough food how often? O Rarely (very little) O Sometimes O Often
Q35. Were you or any household member not able to eat the kinds of food you preferred because of lack of resources? O Yes we were not able to eat O No ***(If no go to question 36)***
Q35.1 If you were not able to eat foods you preferred how often? O Rarely (very little) O Sometimes O Often
Q36. Did you or any household members just eat a few kinds of food day after day because of lack of resources? O Yes O No(***If no go to question no 37)***
Q36.1 If yes how often? O Rarely (very little) O Sometimes O Often
Q37. Did you or any household member eat food that you did not want to eat because of a lack of resources to obtain other types of food? O Yes O No (***If no go to question no 38.)***
Q37.1 If yes how often? O Rarely (very little) O Sometimes O Often
Q38. Did you or any household member eat a smaller meal then you felt you needed because there was not enough food? O Yes O No (***If no go to question no 39)***
Q38.1 If yes how often? O Rarely (very little) O Sometimes O Often
Q39. Did you or any other household member eat fewer meals because there was not enough food? O Yes O No (***If no go to question no 40.)***
Q39.1 If yes how often? O Rarely (very little) O Sometimes O Often
Q40. Was there ever no food at all in your household because there were no resources to get more? O Yes O No (***If no go to question no 41.)***
Q40.1 If yes how often? O Rarely (very little) O Sometimes O Often
Q41. Did you or any household member go to sleep hungry because there was not enough food? O Yes O No (***If no go to question no 42.)***
Q41.1 If yes how often? O Rarely (very little) O Sometimes O Often
Q42. Did you or any household member go a whole day without eating because there was not enough food? O Yes O No (***If no go to question no 43.)***
Q42.1 If yes how often? O Rarely (very little) O Sometimes O Often

Annex 4.3 HEA Community Representatives’ Interview form

गा.वि.स. का वरिष्ठ नागरीक, नेता तथा प्रतिनिधिहरु (VDC Leaders & representatives) सँगको अन्तर्वार्ता

VDC Representatives Interview Summary Form
गा.वि.स. का वरिष्ठ नागरीक, नेता तथा प्रतिनिधिहरुसँगको अन्तर्वार्ता

अन्तरवार्ता नं (सुपरभाईजरले भर्ने) **INTERVIEW NO.**	

अन्तरवर्ताकार नं.हरु ☐☐ र ☐☐ गा.वि.स. नं. ☐☐ गा.वि.स.को नाम ☐

भाग १ : संपति विवरण वांडफांडको सारंश WEALTH BREAKDOWN

आर्थिक स्तर	अति निम्न स्तर वा अति गरिब	निम्न स्तर वा गरिव	मध्यम स्तर	उच्च स्तर वा धनी
Local Name of Groups समुहको स्थानिये नाम				
% Household in village गांउको घरधुरी प्रतिशत				
No. of wives श्रीमतीको संख्या				
Family size परिवार संख्या				
# Persons living away घर वाहिर बस्ने परिवारको सदस्यहरुको संख्या				
# extra persons in HH घरमा बाहिरबाट आएर बसिरहेको थप संख्या				
HH size minus persons away & including extra persons हाल परिवारको संख्या जसमा बाहिरबाट थपिएको संख्या जोड्ने तर बाहिर गएको संख्या भए घटाउने				
ASSETS सम्पति				
COWS / OXEN: गाई । गोरु # owned: **total** (आफ्नो जम्मा)				
Male/Female गाइ वा गोरु	गाइ | गोरु	गाइ | गोरु	गाइ | गोरु	गाइ | गोरु
# Milking Cows दुध दिने गाइ				
# Oxen for plough / cart गाडा तान्ने वा जोत्ने गोरु)				
# Borrowed Cows पोसिया वा अधियाको रुपमा अरुको पालेको				
Sustainable off-take of cattle* मुख्य झुण्ड वा संख्यामा कमि नआउने गरी खपत गर्न वा बेच्न मिल्ने गाइ वा गोरुको संख्या				
BUFFALO: भैंसी र रागां # owned: **total** आफ्नो जम्मा				
Male/Female भैंसी वा रांगा	भैंसी | रांगा	भैंसी | रांगा	भैंसी | रांगा	भैंसी | रांगा
# Milking females दुध दिने भैंसी				
# Oxen for plough / cart गाडा तान्ने वा जोत्ने रांगा				
# Borrowed Buffalo पोसिया वा अंधियाको रुपमा अरुको पालेको				

Interview summary form – VDC leaders and representatives 1

गा.वि.स. का वरिष्ठ नागरीक, नेता तथा प्रतिनिधिहरु (VDC Leaders & representatives) सँगको अन्तर्वार्ता

आर्थिक स्तर	अति निम्न स्तर वा अति गरिब		निम्न स्तर वा गरिब		मध्यम स्तर		उच्च स्तर वा धनी	
Sustainable off-take of buff's* मुख्य झुण्ड वा संख्यामा कमि नआउने गरी खपत गर्न वा बेच्न मिल्ने भैंसी वा रांगाको संख्या								
GOATS: बाखा / बोका / खसी # Own Goats आफ्नो बाखा	बाखा	बोका वा खसी	बाखा	बोका वा खसी	बाखा	बोका वा खसी	बाखा	बोका वा खसी
# Borrowed Goats पोसिया वा अंधियाको रुपमा अरुको पालेको बाखा								
# Milking Female Goats दुध दिने बाखा								
Sustainable off-take of goats* मुख्य झुण्ड वा संख्यामा कमि नआउने गरी खपत गर्न वा बेच्न मिल्ने बाखाको संख्या								
SHEEP: भेडा # Own Sheep आफ्नो भेंडा								
# Borrowed Sheep पोसिया वा अंधियाको रुपमा अरुको पालेको भेंडा								
# Milking Female Sheep दुध दिने भेडा								
Sustainable off-take of sheep* मुख्य झुण्ड वा संख्यामा कमि नआउने गरी खपत गर्न वा बेच्न मिल्ने भेंडाको संख्या								
Other livestock and poultry (please specify) अन्य कुनै पनि पशु वा पंक्षी जे छ सबै लेख्ने								
FARMING: खेतिपाती								
Own Landholding size आफ्नो जग्गा								
Sharecropping landholding size बटैया वा अंधियाको रुपमा रहेको अरुको जग्गा								
Area cultivated खेति गरेको जग्गा								
Cultivation method खेति गर्ने तरिका जस्तै, गोरु वा ट्याक्टरको प्रयोग								
WATER Access: पानीको पहुंच Human मानिसको लागि								
Animal पशुको लागि								

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आर्थिक स्तर	अति निम्न स्तर वा अति गरिव	निम्न स्तर वा गरिव	मध्यम स्तर	उच्च स्तर वा धनी
OTHER ASSETS: अन्य सम्पतिहरु				
Cycle साइकल				
Rickshaw रिक्सा				
Motorbike मोटरसाइकल				
Ox cart वयल/टायर गाडा				
Electric lighting विजुली				
Radio रेडियो				
B&W TV टेलिभिजन (कालोसेतो)				
Colour TV टेलिभिजन (रंगिन)				
Cassette player क्यासेट प्लेयर				
CD सी डी				
Pump set पम्पसेट				
Thresher थ्रेसर				
Tractor ट्याक्टर				
Mechanical Grassa घांस काट्ने मेसिन				
Other vehicles अन्य सवारी साधन				
Other अन्य सम्पति (उल्लेख गर्नुहोस्)				
MAIN LIVELIHOOD ACTIVITIES जिबिकोपार्जनका मुख्य मुख्य कृयाकलापहरु list in the boxes प्रत्यक आर्थीक समुहको जिविकाको मुख्य कृयाकलापहरु वा मुख्य पेशा वा आम्दानीको मुख्य श्रोतहरु भर्नुहोस				
Farming खेतिपाति				
Livestock पशुपालन				
Daily waged labour (specify) ज्यालादारीकाम (उल्लेखगर्नुहोस)				
Regular job (specify) जागीर (उल्लेख गर्नुहोस)				
Business / Trade (Specify) व्यापार (उल्लेखगर्नुहोस)				

आर्थिक स्तर	अति निम्न स्तर वा अति गरिब	निम्न स्तर वा गरिब	मध्यम स्तर	उच्च स्तर वा धनी
Self employment (specify) सोरोजगार (उल्लेख गर्नुहोस)				
Other (specify) अन्य (उल्लेखगर्नुहोस)				
Coping Strategies विषम परिस्थिति वा आपतकालमा बांच्ने वा जीविका गर्ने रणनिति वा वैकल्पिक उपाय				
Loans (specify from where) ऋण लिने (उल्लेख गर्नुहोस काहां बाट)				
Selling land जग्गा जमिन बेच्ने				
Selling livestock गाई बस्तु बेच्ने				
Selling stored grains अन्नपात बेच्ने				
Selling other assets अन्य सम्पतिहरु बेच्ने				
Using cash saving जम्मा भएको पैसा खर्च गर्ने				
Go elsewhere to work (specify where) अन्त काम गर्न जाने (उल्लेख गर्नुहोस काहां जान)				
Eating stored grains जम्मा गरेको खानेकुराहरु खाने				
Reducing number of meals खानको छाक घटाएर				
Reducing food quality खानेकुराको गुणस्तर घटाएर				
Taking on more work paid work पैसा पाउने काम धेरै गरेर				
Receiving gifts दान तथा उपहारहरु लिएर				
More Self employment activities (specify what) आफै सो रोजगार भएर (उल्लेख गर्नुहोस)				
Other (specify) अन्य (उल्लेख गर्नुहोस)				

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अन्तरवर्ताकार नं.हरु र गा.वि.स. नं. गा.वि.स.को नाम:

ऐतिहासिक समय रेखा

Historical Timeline : ranking of years to ascertain a 'Normal' or 'Baseline Year'

वर्ष Season मौसम→	Ranking (1-5 beans; 5=v.good; 1=v.bad)		Comments (बाली उत्पादन, मुल्य, मुख्य घटनाक्रम, बाली, पशु वा मानिसमा लाग्ने रोग, आपतकालको रणनीति) Crop yields, prices, major events, any diseases of crops, livestock diseases or people's disease epidemics, coping strategies).
2062			
2061			
2060			
2059			
2058			
2057			
2056			
2055			
2054			
2053			

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अन्तरवर्ताकार नं.हरु _____ र _____ गा.वि.स. नं. _______ गा.वि.स.को नाम: ___________________________

Local Market information (स्थानिय बजारको जानकारी)

	Name of market for key commodities (मुख्य उत्पादन)		
Rank Markets	**Commodity 1:** उत्पादानको नाम	**Commodity 2:** उत्पादानको नाम	**Commodity 3:** उत्पादानको नाम
Name: (1): मुख्य बजार			
Name: (2): दोस्रो बजार			

Reference information for different types of years (थप जानकारी)

	Bad year, e.g. ________ नराम्रो वर्ष	**Normal year, e.g. ______** सामान्य वर्ष	**Good year, e.g. ______** राम्रो वर्ष
Price/मुल्य [………………………………]			
Price/मुल्य [………………………………]			
Crop yield 1 उत्पादन १ ____________			
Crop yield 2 उत्पादन २ ____________			

Daily Milk Yields*/ दैनिक दुध उत्पादन	Normal Year / सामान्य वर्ष	Current Year / हालको वर्ष
# Months of milk from cows per cycle एक वेतमा दुध दिने अवधि	_________ महिना	_________ महिना
Daily milk yields दैनिक गाइको दुध उत्पादन (Local Cow)	Wet season: वर्षा याम ________ litres Dry season: हिउंदयाम _________ litres	Wet season: वर्षा याम _____ litres Dry season: हिउंदयाम ______ litres
Daily milk yields दैनिक विकासे गाइको दुध उत्पादन (Hybrid Cow)	Wet season: वर्षा याम ________ litres Dry season: हिउंदयाम _________ litres	Wet season: वर्षा याम _____ litres Dry season: हिउंदयाम ______ litres
# times cows reproduce in 5 years? ५ वर्ष भित्रमा गाइ कतिपटक ब्याउंछ?		
# Months of milk from Buffalo per cycle भैंसीको एक वेतमा दुध दिने अवधि	_________ महिना	_________ महिना
Daily milk yields दैनिक भैंसीको दुध उत्पादन (Buffalo)	Wet season: वर्षा याम ________ litres Dry season: हिउंदयाम _________ litres	Wet season: वर्षा याम _____ litres Dry season: हिउंदयाम ______ litres
# times buffaloes reproduce in 5 years? ५ वर्षभित्रमा भैंसी कतिपटक ब्याउंछ?		

** Make sure you are discussing the same period of time*

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अन्तरवर्ताकार नं.हरु ____ र ____ गा.वि.स. नं. ______ गा.वि.स.को नाम. ________________________

मौसमी पात्रो SEASONAL CALENDAR (state who in the household is doing the activities): baseline year

Season → Name of Month →	Baisakh	Jyestha	Asad	Shrawan	Bhadau	Asoj	Kaartik	Mangsir	Push	Magh	Phagun	Chait
Normal rains & other weather patterns (वर्षा र सामान्य मौसम)												
Main Farming activities (कृषिखेति सम्बन्धी मुख्य काम जस्तै मुख्य बालीको बीउ रोप्ने, गोडमेल गर्ने, बाली भित्राउने												
Minor farming activities कृषिखेति सम्बन्धी अन्य काम जस्तै तरकारी वा फलफुलको बीउ रोप्ने, गोडमेल गर्ने, बाली भित्राउने)												

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Season → Name of Month →	Baisakh	Jyestha	Asad	Shrawan	Bhadau	Asoj	Kaartik	Mangsir	Push	Magh	Phagun	Chait
Vegetables के के तरकरीहरु पउने र कहिले												
Purchase estimation. (qty/mth, price)												
खरिद गरिने वस्तुहरु												
Cereal अन्न												
Other foods अन्य												
Livestock sales: बिक्रि हुने पशु (qty/m, price)												
Animal:												
Animal:												
Work load (hours / day) कामको चाप												
Grass / Fodder: (qty/mth, price) घाँसपात												
Fuel wood / Fuel dung: दाउरा वा गोबर गुँइठा (qty/m+price)												
Activity:												

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Season → / Name of Month →	Baisakh	Jyestha	Asad	Shrawan	Bhadau	Asoj	Kaartik	Mangsir	Push	Magh	Phagun	Chait
Paid Labour: (qty/m+price) ज्यालादारी काम **Type:** **Type:**												
Migration for work कामको लागि बाहिर जाने												
Gifts/Remittance उपहार तथा वैदेशिक रोजगारीबाट आउने रकम												

Annex 4.4 HEA Wealth Group Representatives' interview form

Wealth Group Interview Summary Form
बिभीन्न आर्थीक समुहाको अन्तावार्ता फारम

अन्तरवार्ता नं (सुपरभाईजरले भर्ने) **INTERVIEW NO.**	

यो फारम अति गरीब, गरीब, मध्यम वर्ग तथा उच्च बर्ग बाट प्रतिनिधीत्व गर्ने समुहमा तथा महिला स्वास्थ्य स्वयं सेविकाहरु संग केस स्टडी गर्दा प्रयोग गर्नु पर्दछ । अन्तरवार्ता लिईरहेको समुहको मात्र सम्पति विवरण वांडफांड बारे सुचना भर्नुहोला साथै अन्तरवार्ताके कममा सम्पुर्ण फारम भर्ने कोसीस नगर्नुहोला र आवश्यक सुचनाहरु संभनुपर्ने हुन्छ । जब मुख्य अन्तरवार्ताकारले कुरा गरीराखेको बेला अवलोकन गर्ने अर्को साथिले सुचनाहरु भर्नुपर्ने हुन्छ तर फारमको मुख्य मुख्य भागहरु अन्तरवर्ताको अन्त्यमा भर्ने पर्ने हुन्छ ।

छलफल गरेको वर्ष : ______ आर्थीक स्तर समुह: ______ अन्तरवर्ताकार नं. ______

गा.वि.स. नं. ______ गा.वि.स.को नाम: ______ वडा नं: ______ गाउं: ______

भाग १ : संपति विवरण वांडफांडको सारंश WEALTH BREAKDOWN

आर्थिक स्तर	अति निम्न स्तर वा अति गरिब		निम्न स्तर वा गरिब		मध्यम स्तर		उच्च स्तर वा धनी	
Local Name of Groups समुहको स्थानिये नाम								
% Household in village गांउको घरधुरी प्रतिशत								
No. of wives श्रीमतीको संख्या								
Family size परिवार संख्या								
# Persons living away घर वाहिर बस्ने परिवारको सदस्यहरुको संख्या								
# extra persons in HH घरमा बाहिरबाट आएर बसिरहेको थप संख्या								
HH size minus persons away & including extra persons हाल परिवारको संख्या जसमा बाहिरबाट थपिएको संख्या जोड्ने तर बाहिर गएको संख्या भए घटाउने								
ASSETS सम्पति								
COWS / OXEN: गाई । गोरु # owned: **total** (आफ्नो जम्मा)								
Male/Female गाइ वा गोरु	गाइ	गोरु	गाइ	गोरु	गाइ	गोरु	गाइ	गोरु
# Milking Cows दुध दिने गाइ								
# Oxen for plough / cart गाडा तान्ने वा जोत्ने गोरु)								
# Borrowed Cows पोसिया वा अधियाको रुपमा अरुको पालेको								
Sustainable off-take of cattle* मुख्य भुण्ड वा संख्यामा कमि नआउने गरी खपत गर्न वा बेच्न मिल्ने गाइ वा गोरुको संख्या								
BUFFALO: भैंसी र रागां # owned: **total** आफ्नो जम्मा								
Male/Female भैंसी वा रांगा	भैंसी	रांगा	भैंसी	रांगा	भैंसी	रांगा	भैंसी	रांगा

आर्थिक स्तर	अति निम्न स्तर वा अति गरिब		निम्न स्तर वा गरिब		मध्यम स्तर		उच्च स्तर वा धनी	
# Milking females दुध दिने भैंसी								
# Oxen for plough / cart गाडा तान्ने वा जोत्ने रांगा								
# Borrowed Buffalo पोसिया वा अधियाको रुपमा अरुको पालेको								
Sustainable off-take of buff's* मुख्य भुण्ड वा संख्यामा कमि नआउने गरी खपत गर्न वा बेच्न मिल्ने भैंसी वा रांगाको संख्या								
GOATS: बाखा / बोका / खसी # Own Goats आफ्नो बाखा	बाखा	बोका वा खसी	बाखा	बोका वा खसी	बाखा	बोका वा खसी	बाखा	बोका वा खसी
# Borrowed Goats पोसिया वा अधियाको रुपमा अरुको पालेको बाखा								
# *Milking Female Goats* दुध दिने बाखा								
Sustainable off-take of goats* मुख्य भुण्ड वा संख्यामा कमि नआउने गरी खपत गर्न वा बेच्न मिल्ने बाखाको संख्या								
SHEEP: # Own Sheep आफ्नो भेंडा								
# Borrowed Sheep पोसिया वा अधियाको रुपमा अरुको पालेको भेंडा								
# *Milking Sheep* दुध दिने भेडा								
Sustainable off-take of sheep* मुख्य भुण्ड वा संख्यामा कमि नआउने गरी खपत गर्न वा बेच्न मिल्ने भेंडाको संख्या								
Other livestock and poultry (please specify) अन्य कुनै पनि पशु वा पंक्षी जे छ सबै लेख्ने								
FARMING: खेतिपाती								
Own Landholding size आफ्नो जग्गा								
Sharecropping landholding size बटैया वा अधियाको रुपमा रहेको अरुको जग्गा								
Area cultivated खेति गरेको जग्गा								
Cultivation method खेति गर्ने तरिका जस्तै, गोरु वा ट्याक्टरको प्रयोग								
WATER Access: पानीको पहुंच Human मानिसको लागि								
Animal पशुको लागि								

आर्थिक स्तर	अति निम्न स्तर वा अति गरिब	निम्न स्तर वा गरिब	मध्यम स्तर	उच्च स्तर वा धनी
OTHER ASSETS: अन्य सम्पतिहरु				
Cycle साइकल				
Rickshaw रिक्सा				
Motorbike मोटरसाइकल				
Ox cart वयल/टायर गाडा				
Electric lighting बिजुली				
Radio रेडियो				
B&W TV टेलिभिजन (कालोसेतो)				
Colour TV टेलिभिजन (रंगिन)				
Cassette player क्यासेट प्लेयर				
CD सी डी				
Pump set पम्पसेट				
Thresher थ्रेसर				
Tractor टयाक्टर				
Mechanical Grassa घांस काट्ने मेसिन				
Other vehicles अन्य सवारी साधन				
Other अन्य सम्पति (उल्लेख गर्नुहोस्)				
MAIN LIVELIHOOD ACTIVITIES जिबिकोपार्जनका मुख्य मुख्य कृयाकलापहरु list in the boxes प्रत्यक आर्थीक समुहको जिविकाको मुख्य कृयाकलापहरु वा मुख्य पेशा वा आम्दानीको मुख्य श्रोतहरु भर्नुहोस				
Farming खेतिपाति				
Livestock पशुपालन				
Daily waged labour (specify) ज्यालादारीकाम (उल्लेखगर्नुहोस)				
Regular job (specify) जागीर (उल्लेख गर्नुहोस)				
Business / Trade (Specify) व्यापार (उल्लेखगर्नुहोस)				
Self employment (specify) सोरोजगार (उल्लेख गर्नुहोस)				
Other (specify) अन्य (उल्लेखगर्नुहोस)				

आर्थिक स्तर	अति निम्न स्तर वा अति गरिब	निम्न स्तर वा गरिब	मध्यम स्तर	उच्च स्तर वा धनी
Coping Strategies विषम परिस्थिति वा आपतकालमा बांच्ने वा जीविका गर्ने रणनिति वा वैकल्पिक उपाय				
Loans (specify from where) ऋण लिने (उल्लेख गर्नुहोस काहां बाट)				
Selling land जग्गा जमिन बेच्ने				
Selling livestock गाई वस्तु बेच्ने				
Selling stored grains अन्नपात बेच्ने				
Selling other assets अन्य सम्पतिहरु बेच्ने				
Using cash saving जम्मा भएको पैसा खर्च गर्ने				
Go elsewhere to work (specify where) अन्त काम गर्न जाने (उल्लेख गर्नुहोस काहां जान)				
Eating stored grains जम्मा गरेको खानेकुराहरु खाने				
Reducing number of meals खानको छाक घटाएर				
Reducing food quality खानेकुराको गुणस्तर घटाएर				
Taking on more work paid work पैसा पाउने काम धेरै गरेर				
Receiving gifts दान तथा उपहारहरु लिएर				
More Self employment activities (specify what) आफै सो रोजगार भएर (उल्लेख गर्नुहोस)				
Other (specify) अन्य (उल्लेख गर्नुहोस)				

PART 2: MILK PRODUCTION
भाग २ : दुध उत्पादन

1. COW milk गाईको दुध: *Yearly Milk Production वार्षीक दुध उत्पादन :*

____# दुध दिने गाईको संख्या x _____ लि. / दिन x _____ दिन ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा = ____लि production in wet or productive season

____ # दुध दिने गाईको संख्या x ____ लि. / दिन x ____ दिन / कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) = ____लि production in dry or non-productive seasons

= वार्षीक दुध उत्पादन = _______ लि. प्रति वर्ष Total production per year

a) **DAILY** Wet season production ब्याएको बेलामा दैनिक उत्पादन : ______ लि. प्रति दिन

➔ _____ लि./ दिन x _____ दिन हरु = _____ ℓ ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा जम्मा शुद्ध (छाली नकटाएको) दुध आफ्नो परिवारले खाएको total whole milk consumed wet season

➔ _____ लि./ दिन x _____ दिन हरु = ______ ℓ ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा जम्मा बिक्रीहुने (छाली नकटाएको) दुध total whole milk sold wet season

➔ _____ लि./ दिन x ____ दिन हरु = ______ ℓ ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा जम्मा बिक्रीहुने (छाली नकटाएको) दहि total whole curd sold wet season

➔ _____ लि./ दिन x _____ दिन हरु = _______ ℓ total milk skimmed छाली नकाटिकन घिउ बनाउन प्रयोग गरीने जम्मा दुध makes _____ ℓ छाली काटेको दुध ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा skimmed milk wet season

➔ ____ लि./ दिन x _____ दिनहरु = _____ ℓ ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा जम्मा (छाली कटाएको) दुध आफ्नो परिवारले खाएको total skimmed milk consumed wet season

➔ ____ लि./ दिन x _____ दिनहरु = ______ ℓ ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा जम्मा बिक्रीहुने (छाली कटाएको) दुध total skimmed milk sold wet season

➔ ____ लि./ दिन x _____ दिनहरु = ______ ℓ ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा जम्मा बिक्रीहुने (छाली कटाएको) दही total skimmed curd sold wet season

Cows Ghee production in wet season: ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा गाईको घिउ उत्पादन

➔ _____ ग्राम छाली निकाल्ने / दिन x ______ दिनहरु = _______ के. जि ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा गाईको घिउ उत्पादन गर्न प्रयोग गरीने दुधको छाली total cream production for ghee in wet / productive season

➔ _______ के जि छाली बाट _______ के जि ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा घिउ उत्पादन Total ghee production in wet season

➔ ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा घिउको आफ्नो परिवारले खाएको: _____ के जि ghee consumed wet season

➔ ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा घिउको बिक्री: _____ के जि ghee sold wet season

➔ ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा उपहार स्वरुप दिईने घिउ : _____ के जि ghee given as gift wet season

b) कम दुध उत्पादन (सुख्खा वा थाक्ने बेलामा) सीजनमा दैनिक दुध उत्पादन: ______ ली । प्रति दिन DAILY Dry season production

➔ _____ लि./दिन x _____ दिन हरु = _____ ℓ कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) जम्मा शुद्ध (छाली नकटाएको) दुध आफ्नो परिवारले खाएको total whole milk consumed dry season

➔ _____ लि./दिन x _____ दिन हरु = ______ ℓ कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) जम्मा बिक्रीहुने (छाली नकटाएको) दुध total whole milk sold dry season

➔ _____ लि./दिन x ____ दिन हरु = ______ ℓ कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) जम्मा बिक्रीहुने (छाली नकटाएको) दहि total whole curd sold

➔ _____ लि./दिन x _____ दिन हरु = _______ ℓ total milk skimmed कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) छाली नकाटिकन घिउ बनाउन प्रयोग गरीने जम्मा दुध

makes _____ ℓ skimmed milk छाली काटेको दुध

➔ ____ लि./दिन x _____ दिनहरु = _____ ℓ कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) जम्मा (छाली कटाएको) दुध आफ्नो परिवारले खाएको total skimmed milk consumed

➔ ____ लि./दिन x _____ दिनहरु = ______ ℓ कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) जम्मा विकीहुने (छाली कटाएको) दुध total skimmed milk sold

➔ ____ लि./दिन x _____ दिनहरु = ______ ℓ कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) जम्मा विकीहुने (छाली कटाएको) दही total skimmed curd sold

Cows Ghee production in dry (less productive) season:

कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) गाईको घिउ उत्पादन:

➔ _____ ग्राम छाली निकाल्ने / दिन x ______ दिनहरु = _______ के. जि कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) गाईको घिउ उत्पादन गर्न प्रयोग गरीने दुधको छाली total cream production for ghee in dry / non-productive season

➔ _______ के जि छाली बाट _______ के जि कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) घिउ उत्पादन

➔ कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) घिउ आफ्नो परिवारले खाएको : _____ के जि ghee consumed dry season

➔ कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) घिउको बिक्री: _____ के जि ghee sold dry season

➔ कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) उपहार स्वरुप दिईने घिउ : _____ के जि ghee given as gift dry season

*COW GHEE PRODUCTION REFERENCE INFORMATION -गाईको घिउ उत्पादन गर्न चाहीने आवश्यक सुचनाहरु)

गाईको घिउ उत्पादन: घिउ उत्पादन गर्न चाहीने दुधको परीमाण Cow's Ghee production: conversion ratio of milk to ghee:

गाईको दुध **Cow milk :** _______ ली. गाईको दुध ℓ cow milk ➔ _____ के. जि घिउ kgs ghee

_______ ग्रा. दुधको छाली g cow cream ➔ _____ के. जि घिउ kg ghee

अर्को तरीकाले घिउ उत्पादन गर्दा सोधिने प्रश्नहरु: प्रत्यक बेतमा कति जति घिउ उत्पादन हुन्छ ________ के जि

(Alternative ghee production question: how much ghee do you get from each reproductive cycle)

2. BUFFALO milk **भैंसीको दुध:** *Yearly Milk Production वार्षीक दुध उत्पादन :*

____# दुध दिने भैसीको संख्या x _____ लि. / दिन x _____ दिन ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा = ____लि production in wet or productive season

____ # दुध दिने भैसीको संख्या x ____ लि. / दिन x ____ दिन / कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) = ____लि production in dry or non-productive seasons

= वार्षीक भैसीको दुध उत्पादन = _______ लि. प्रति वर्ष Total production per year

b) ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा दैनिक उत्पादन : _____ लि./ दिन **DAILY** Wet season production

➔ _____ लि./ दिन x _____ दिन हरु = _____ ℓ ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा जम्मा शुद्ध (छाली नकटाएको) दुध आफ्नो परिवारले खाएको total whole milk consumed wet season

➔ _____ लि./ दिन x _____ दिन हरु = ______ ℓ ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा जम्मा बिक्रीहुने (छाली नकटाएको) दुध total whole milk sold wet season

➔ _____ लि./ दिन x ____ दिन हरु = ______ ℓ ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा जम्मा बिक्रीहुने (छाली नकटाएको) दहि total whole curd sold wet season

➔ _____ लि./ दिन x _____ दिन हरु = _______ ℓ total milk skimmed छाली नकाटिकन घिउ बनाउन प्रयोग गरीने जम्मा दुध makes _____ ℓ skimmed milk छाली काटेको दुध ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा

➔ ____ लि./ दिन x _____ दिनहरु = _____ ℓ ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा जम्मा (छाली कटाएको) दुध आफ्नो परिवारले खाएको total skimmed milk consumed wet season

➔ ____ लि./ दिन x _____ दिनहरु = ______ ℓ ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा जम्मा बिक्रीहुने (छाली कटाएको) दुध total skimmed milk sold wet season

➔ ____ लि./ दिन x _____ दिनहरु = ______ ℓ ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा जम्मा बिक्रीहुने (छाली कटाएको) दही total skimmed curd sold wet season

BUFFALO Ghee production in wet season: ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा भैंसीको घिउ उत्पादन

➔ _____ ग्राम छाली निकाल्ने / दिन x ______ दिनहरु = _______ के. जि ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा भैसीको घिउ उत्पादन गर्न प्रयोग गरीने दुधको छाली total cream production for ghee in wet / productive season

➔ _______ के जि छाली बाट _______ के जि ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा घिउ उत्पादन Total ghee production in wet season

➔ ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा घिउको आफ्नो परिवारले खाएको : _______ के जि ghee consumed wet season

➔ ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा घिउको बिक्री: _______ के जि ghee sold wet season

➔ ब्याएको बेलामा वा बढि दुध उत्पादन हुने सिजनमा उपहार स्वरुप दिईने घिउ : _______ के जि ghee given as gift wet season

b) कम दुध उत्पादन (सुख्खा वा थाक्ने बेलामा) सीजनमा दैनिक भैंसीको दुध उत्पादन: ______ ली । प्रति दिन

DAILY buaffalo milk production in dry / less productive seaon

→ _____ लि./दिन x _____ दिन हरु = _____ ℓ कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) जम्मा शुद्ध (छाली नकटाएको) दुध आफनो परिवारले खाएको total whole milk consumed dry season

→ _____ लि./दिन x _____ दिन हरु = ______ ℓ कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) जम्मा बिक्रीहुने (छाली नकटाएको) दुध total whole milk sold dry season

→ _____ लि./दिन x ____ दिन हरु = ______ ℓ कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) जम्मा बिक्रीहुने (छाली नकटाएको) दहि total whole curd sold dry season

→ _____ लि./दिन x _____ दिन हरु = _______ ℓ total milk skimmed कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) छाली नकाटिकन घिउ बनाउन प्रयोग गरीने जम्मा दुध

makes _____ ℓ skimmed milk छाली काटेको दुध

→ ____ लि./दिन x _____ दिनहरु = _____ ℓ कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) जम्मा (छाली कटाएको) दुध आफनो परिवारले खाएको total skimmed milk consumed dry season

→ ____ लि./दिन x _____ दिनहरु = ______ ℓ कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) जम्मा बिक्रीहुने (छाली कटाएको) दुध total skimmed milk sold dry season

→ ____ लि./दिन x _____ दिनहरु = ______ ℓ कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) जम्मा बिक्रीहुने (छाली कटाएको) दही total skimmed curd sold dry season

Buffalo Ghee production in dry (less productive) season: कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) भैसीको घिउ उत्पादन

→ _____ ग्राम छाली निकाल्ने / दिन x ______ दिनहरु = _______ के. जि कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) भैसीको घिउ उत्पादन गर्न प्रयोग गरीने दुधको छाली total cream production for ghee in dry (less productive) season

→ _______ के जि छाली बाट _______ के जि कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) भैसीको घिउ उत्पादन Total ghee production in wet season

- → कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) घिउ आफनो परिवारले खाएको : _____ के जि ghee consumed dry seaon
- → कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) घिउको बिक्री: _____ के जि ghee sold dry season
- → कम दुध उत्पादन सीजनमा (सुख्खा वा थाक्ने बेलामा) उपहार स्वरुप दिईने घिउ : _____ के जि ghee given as gift dry season

*BUFFALO GHEE PRODUCTION REFERENCE INFORMATION -गाईको घिउ उत्पादन गर्न चाहीने आवश्यक सुचनाहरु)

भैसीको घिउ उत्पादन: घिउ उत्पादन गर्न चाहीने दुधको परीमाण (Buffalo Ghee production: conversion ratio of milk to ghee):

भैसीको दुध **Buffalo** milk : _______ ली. भैसीको दुध ℓ buffalo milk → _____ के. जि घिउ kgs ghee

_______ ग्रा. दुधको छाली g buffalo cream → _____ के. जि घिउ kg ghee

अर्को तरीकाले घिउ उत्पादन गर्दा सोधिने प्रश्नहरु: प्रत्यक बेतमा कति जति घिउ उत्पादन हुन्छ ________ के जि

(Alternative ghee production question: how much ghee do you get from each reproductive cycle)

PART 3: FOOD SOURCES भाग ३ : खाद्य स्रोत

खानेकुरा **Food**	जम्मा आफ्ना र बटैयाको उत्पादन (बिस्तृत रुपमा) र अन्य प्रयोग उल्लेख गर्नुहोस **Total production (give detail & specify uses)**	के.जि. बिक्री Kgs sold	के.जि. अन्य प्रयोग Kgs other use	के.जि. खपत Kgs consumed
OWN PRODUCTION आफ्नो उत्पादन				
मुख्य खाद्य बस्तु **STAPLE CROPS** (उपयूक्तमा चिन्ह लगाउनुहोस) : धान__ गहुं __ कोदो __ मकै __ आलु __ जौ __				
धान चामल Rice				
गहु Wheat				
आलु Potatoes				
दलहन वाली **PULSES** (उपयूक्तमा चिन्ह लगाउनुहोस) मुसुरो __ रहर __ खेसरी __ मुगं __ चना __ मटर __ मास __ भकुला / रहरिया __ कुथी / गहत __ भटमास __ अन्य __				
मुसुरो				
रहर				
नगदे वाली **CASH CROPS** (उपयूक्तमा चिन्ह लगाउनुहोस) उखु __सुर्ति__पटुवा/ जुट__साव__बदाम -मम्फली)__अन्य __				

खानेकुरा **Food**	जम्मा आफ्ना र बटैयाको उत्पादन (बिस्तृत रुपमा) र अन्य प्रयोग उल्लेख गर्नुहोस **Total production (give detail & specify uses)**	के.जि. बिक्री Kgs sold	के.जि. अन्य प्रयोग Kgs other use	के.जि. खपत Kgs consumed
तेल वाली **OIL CROPS** – (उपयक्तमा चिन्ह लगाउनुहोस) तोरी __ आलस वा तिसि __ तिल __ सरस्यू __ सुर्यमुखी __ फीलीगें __ अन्दी __ अन्य __				
ROOT CROPS (उपयूक्तमा चिन्ह लगाउनुहोस) केसार __सखरखन्ड / अलुवा __ मुला __ गाजर __ खमरुहा / तरुल __ प्याज __ लसुन __ पिनालु __ रातो पिनालु / अरुवा __ ओल __ अन्य __				
मसला **SPICES** (उपयूक्तमा चिन्ह लगाउनुहोस) अदुवा__ बेसार __ खुर्सानी__ धनिया__ जिरा__सोंप__ जुवानो__ मेथि__ अन्य__				

खानेकुरा **Food**	जम्मा आफ्ना र बटैयाको उत्पादन (विस्तृत रुपमा) र अन्य प्रयोग उल्लेख गर्नुहोस **Total production (give detail & specify uses)**	के.जि. बिक्री Kgs sold	के.जि. अन्य प्रयोग Kgs other use	के.जि. खपत Kgs consumed
तरकारी **VEGETABLES:** (उपयुक्तमा चिन्ह लगाउनुहोस) सीमी / सीम __ भान्टा/ वैगन__ काउली__ बन्दगोपी __ घिरौंला __ लौका / सजभन्न __ परवर __ करेला__ सजभन्न __ भिन्डी / रमभिम्नी __ जिमनी__ अमरा __ पिडार __ ईमली__ सजकुम्हा / कुभिन्डो __ सोहजन / मुन्गा __ अन्य __				
साग **SAG** (उपयुक्तमा चिन्ह लगाउनुहोस) रायो__ बेथु / बेथुवा __ ठडिया __ पालक__ चम्सुर __ मेथि__ फर्सिको मुन्टा__ खेसारी __ तोरी__ कर्कलो__ अन्य साग सब्जी__				

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<tr><th>खानेकुरा
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Total production (give detail & specify uses)</th><th>के.जि. बिक्री
Kgs sold</th><th>के.जि. अन्य प्रयोग Kgs other use</th><th>के.जि. खपत
Kgs consumed</th></tr>
<tr><td colspan="5">फलफुल FRUITS (चिन्ह लगाउनुहोस) कटहर __ आंप __ खरभुजा / तरबुज __ लिची __ केरा__ मेवा __ सरीफा__ सिताफल__ अंगुर __ नरीवल__ भुईकटहर / अनारेस __ अनार __ अंगुर __ अमला / रिखिया __ फुइट / किम्वु __ कागती__ निवुवा __ भोगटे __ अम्वा / अम्धुर / लताम __ अन्य फलफुल __</td></tr>
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<tr><td colspan="5">अन्य उत्पादन गरीएका वाली नाली OTHER CROPS PRODUCED: सुपारी__ ताडी__ अन्य__</td></tr>
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<tr><td colspan="5">दुधजन्य पदार्थहरु DAIRY PRODUCTS:(चिन्ह लगाउनुहोस) गाईको दुध / दही __ भैंसीको दुध / दही __ गाईको घिउ __ भैंसीको घिउ __ बाखाको दुध __ अन्य__</td></tr>
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खानेकुरा **Food**	जम्मा आफ्ना र बटैयाको उत्पादन (बिस्तृत रुपमा) र अन्य प्रयोग उल्लेख गर्नुहोस **Total production (give detail & specify uses)**	के.जि. बिक्री Kgs sold	के.जि. अन्य प्रयोग Kgs other use	के.जि. खपत Kgs consumed
पशुजन्य तथा कुखुरा पालन बाट उत्पादान **LIVESTOCK / POULTRY PRODUCTS:** (उपयूक्तमा चिन्ह लगाउनुहोस) कुखुराको अण्डा __ हांसको अण्डा__ खसीको मासु __ भेंडाको मासु __ भैसीको मास __ हांसको मासु __ कुखुराको मासु__सुंगुरको मासु __ परेवाको मासु__ अन्य पशुहरु तथा कुखुरा बाट उत्पादन __				
माछा पालन **FARMED FISH:** (उपयूक्तमा चिन्ह लगाउनुहोस) रौहु __ कमन काप__ सिल्भर काप __ ग्रास काप __ Big head / बिभ्फट __ मुग्रीं__ नैनी__ बुआरी __ भ्फीगें माछा__ जल कपुर__ अन्य पालीएका माछाहरु__				
Other अन्य				
आफुले पालेको मौरीबाट प्राप्त मह				

खानेकुरा **Food**	जम्मा आफ्ना र बटैयाको उत्पादन (बिस्तृत रुपमा) र अन्य प्रयोग उल्लेख गर्नुहोस **Total production (give detail & specify uses)**	के.जि. बिक्री Kgs sold	के.जि. अन्य प्रयोग Kgs other use	के.जि. खपत Kgs consumed
जंगलबाट उत्पादन हुने खानेकुरा **WILD FOODS**				
जंगली मासु **WILD MEAT:** (उपयुक्तमा चिन्ह लगाउनुहोस) भंगेरा__ मुसा __ अन्य __				
जंगली माछा **WILD FISH / SHELL FISH:** (उपयुक्तमा चिन्ह लगाउनुहोस) पोठिया__ हिलेमाछा __ झींगे माछा __ गैचा__ बागी__ तेंग्रा__ छाही__ सिगें __ देब्रा __ बोटे/ चेंगा __ मारा__ अन्य जंगली माछा__ घोंगी __ डोका __ कोकोरा __ कचुवा__ बाम / अनैह __ अन्य__				
जंगली तरकरी **WILD VEGETABLES** (उपयुक्तमा चिन्ह लगाउनुहोस) कर्मी__ कर्कलो__ बडहर __ खमरुहा / तरुल __ अन्य __				

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खानेकुरा **Food**	जम्मा आफ्ना र बटैयाको उत्पादन (बिस्तृत रुपमा) र अन्य प्रयोग उल्लेख गर्नुहोस **Total production (give detail & specify uses)**	के.जि. बिकी Kgs sold	के.जि. अन्य प्रयोग Kgs other use	के.जि. खपत Kgs consumed
जंगली फलफुल **WILD FRUITS** (उपयुक्तमा चिन्ह लगाउनुहोस) वेल__ वयर __ कदम __ फुइट / किम्बु __ खजुर __ सिंगारा__ जामुन__ वडहर __ अन्य जंगली फलफुल __				
जंगली मौरीको मह Honey from wild bees				

खाद्य पदार्थको किनबेच FOOD PURCHASE

PURCHASED FOODS (उपयुक्तमा चिन्ह लगाउनुहोस र सवै प्रकारका किनीएका बस्तुहरुलाई तल लिस्टमा लेख्नुहोला) : धान__ चमल__ गहुं __ गहुंको पिठो___ मैदा__ अन्य अन्न__ दाल__ चना__ अन्य दालहरु __ तेल __ आलु__ तरकारी __साग __ फलफुल __ हल्दी__ खुर्सानी__ जिरा__ धनिया __ मेथी__ अन्य मसला__ दुध __ दही __ घिउ__ अण्डा __ हांसको अण्डा__ खसीको मासु __ भेंडाको मासु __ भैंसीको मासु __ हांसको मासु __ कुखुराको मासु __ संगुरको मासु __ परेवाको मासु __ माछा __ चिनि__ मिठा __ बिस्कुट __ चाउचाउ __ चियापत्ती__ नुन__ अन्य__

खाद्य पदाथ Food	विस्तृत जानकारी Detail	के.जी. खपत Kgs consumed

खाद्य पदार्थको किनबेच **FOOD PURCHASE**		
खाद्य पदाथ Food	विस्तृत जानकारी Detail	के.जी. खपत Kgs consumed

खाद्य पदाथ Food	विस्तृत जानकारी Detail	के.जी. खपत Kgs consumed

काम को प्रकृति (पैसाको सट्टामा खाद्यान्नहरु दिईने कामहरु)
LABOUR EXCHANGE (types of labour paid in FOOD not cash)

FOOD EATEN AT WORKPLACE काम गर्ने स्थानमा दिईने वा खाईने खानाहरु: प्रत्यक काम गर्ने स्थान र प्रत्यक व्यक्तीको रेकर्ड तलको टेवलमा भर्ने For each work place and each worker record in the table below as appropriate:

पकाएको खाना पाइने कामको प्रकारहरु Type of work paid in cooked food eaten at workplace	प्रति घर बात कति जनाले पाउंछन Persons /HH	एक महिनमा कति दीन No. days / mth	एक वर्षमा कति महीना No. mths / yr	एक दिनमा खाजा कति पटक No. sm meals /day	एक दिनमा मुख्य खना कति पटक No. main meals / dy	प्रति वर्ष खाईने जम्मा खाजा Total small meals / yr	प्रति वर्ष खाईने जम्मा मुख्य खाना Total main meals / yr

घर परीवारलाई लगीने खानेकुराहरु (साधारणतया सुख्खा खानेकुरा) **FOOD TAKEN HOME TO FAMILY** (usually dry foods): छोरा मन्छे, छोरी मन्छे र भिन्दा भिन्दे रेटमा कामगर्ने मानीसहरुको भिन्दा भिन्दे हिसाव किताव राख्नुपर्ने हुन्छ Make separate calculations for men and women or anyone working at different rates of pay.

घर लगीने नपकाएको खानेकुराहरु लिएवापत गरीने कामको प्रकारहरु Type of work paid in dry food (taken home) (प्राप्त हुने प्रत्येक खानेकुराहरुलाई भिन्दा भिन्दै लाईनमा लेख्नुहोला)	प्राप्त हुने खानेकुराहरु Type of food received	प्रति दिन प्राप्त हुने के. जि Kg of food received /day	प्रति घर बात कति जनाले पाउंछन No. person / HH	एक महिनमा कति दीन No. days / mth	एक वर्षमा कति महीना No. mths / yr	प्रति वर्ष पाईने खानेकुराहरु के जि मा Kg of food received/ yr

उपहार GIFTS

उपहार स्वरुप पाईने खानेकुराहरु Type of food received as gift बुन्नी वा बइन सिस्टम जस्तै धान अथवा गहुं भित्राउने बेलामा १६ बोफ को १ बोफ दिईन्छ (प्रत्येक खानेकुराहरुलाई भिन्दै लाईनबाट सुरुगर्नुहोस)	कस्ले दिन्छ ? From whom?	एक पटकमा कति के. जि. सम्म पाईन्छ Kg food / time	कति जनाले पाउंछन No. people receiving food	एक वर्षमा कति पटक पाईनछ No. times / yr	प्रति वर्ष जम्मा कति हुन्छ Tot. Kg food received / yr

अन्य श्रोतहरु OTHER FOOD SOURCES

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PART 4: INCOME SOURCES कमाईका श्रोतहरु

प्रकार **Category / Activity**	बिस्त्रीत विवरण **Details**	कति के. जि. बेचिन्छ **# Units sold**	कति रुपैयां उठछ **Price/ unit**	जम्मा उठने रुपैयां **Tot income**
आफनो उत्पादन **OWN PRODUCTION** बिक्री गरीने बालीहरु जस्तै धान गहुं, अन्न, दाल, तरकारी फलफुल आदी				
धान				
मुसुरो				
गहुं				
सालाखाला बालीनाली बाट हुने कमई ***Sub-Total Crop Sales***				
पशुजन्य उत्पादनको बिक्री **Animal Product Sales** मासु घिउ, दुध, पालेको माछा				

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प्रकार **Category / Activity**	बिस्त्रीत विवरण **Details**	कति के. जि. बेचिन्छ **# Units sold**	कति रुपैयां उठछ **Price/ unit**	जम्मा उठने रुपैयां **Tot income**
सालाखाला मासुजन्य उत्पादनबाट हुने कमई Sub-Total Animal Product Sales				
अन्य जस्तै आफ्नो मौरीको मह Other e.g. honey				
सालाखाला अन्य उत्पादनबाट हुने कमई ***Sub-Total Other Sales***				
आफ्नोउत्पादनबाट हुने जम्मा कमई ***TOTAL OWN PRODUCTION SALES***				

सिकार अथवा जंगली खानेकुरा **'HUNTED' / WILD FOODS** जंगली खानेकुरा जस्तै माछा, मह, फलफुल, जनावर आदी

प्रकार **Category / Activity**	बिस्त्रीत विवरण **Details**	कति के. जि. बेचिन्छ **# Units sold**	कति रुपैयां उठछ **Price/ unit**	जम्मा उठने रुपैयां **Tot income**
सिकार अथवा जंगली उत्पादनबाट हुने जम्मा कमई ***TOTAL HUNTED OR WILD FOOD SALES***				

काम गरेर हुने कमाई जस्तै दैनिक ज्यालादारी वा जागीर **CASH INCOME FROM LABOUR** – e.g. work for money as daily wage, job, etc.						
कामको प्रकार TYPE OF WORK	विस्त्रीत विवरण DETAILS	प्रति घर बात कति जनाले काम गर्ने Persons /HH	एक महिनमा कति दीन No. days / mth	एक वर्षमा कति महीना No. mths / yr	मसीक रुपमा कि ज्यालादारी Monthly or daily wage	काम गरेर हुने कमाई Income from labour
काम गरे वापत हुने जम्मा कमई ***TOTAL INCOME FROM LABOUR***						

व्यापार जस्तै खरीदगरेर बेचिने सामानहरु (सामान बेचेर हुने नाफा मात्र) **TRADE** – e.g. sale of items bought from others (record only the PROFIT not selling price)				
प्रकार **Category / Activity**	विस्त्रीत विवरण **Details**	बिक्री भएको संख्या **#** **Units sold**	नफा **Profit/ unit**	जम्मा कमाई **Tot income**
व्यापार बाट हुने जम्मा कमई ***TOTAL INCOME FROM TRADE***				

स्वरोजगारका कृयाकलापहरु जस्तै घरमा बनाईएका सामानहरु गुन्द्री, रक्सी आदी **SELF-EMPLOYMENT ACTIVITIES** – e.g. sale of items made at home like pots, mats, alcohol, hiring out cart				
प्रकार **Category / Activity**	विस्त्रीत विवरण **Details**	बिक्री भएको संख्या **# Units sold**	दर **Price/ unit**	जम्मा कमाई **Tot income**
स्वोरोजगार बाट हुने जम्मा कमाई **TOTAL SELF-EMPLOYMENT INCOME**				

अन्य **OTHER**		
बाहीर बाट पठाईने पेसा **REMITTANCES**	Details: विस्त्रीत विवरण	
उपहार **GIFTS**	Details: विस्त्रीत विवरण	
सबै कृयाकलाप बाट हुने जम्मा कमाई **GRAND TOTAL INCOME**		

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PART 5: EXPENDITURE खर्च

प्रकार **Category /item**	वार्षीक खर्च विस्त्रीत विवरण **Annual expenditure (detail)**	जम्मा खर्च के. जि, लीटर आदी **Total units**	प्रति के.जि वा लि वा यूनिट को मुल्य **Price/unit**	जम्म खर्च **Total spending**
मुख्य खाद्य बस्तु **STAPLE FOOD** धान__ चमल__ गहुं __ गहुंको पिठो__ मैदा__ आलु__ अन्य__				
मुख्य खाद्य बस्तुहरुको खर्च **TOTAL STAPLE FOOD EXPENDITURE**				
अन्य खाद्य बस्तु **NON-STAPLE FOOD** दाल__ चना__ अन्य दालहरु __ तेल __ तरकारी __ साग __ फलफुल __ मसला __ चिनि__ मिठा __ बिस्कुट __ चाउचाउ __ चियापत्ती__ दुध __ दही __ घिउ__ मासु __ माछा__ अण्डा __ घोंगी __ कोकोरा __ कचुवा__ बाम __ नुन __ अन्य__ (सवै प्रकारका किनीएका बस्तुहरुलाई तल लेख्नुहोला)				

प्रकार **Category /item**	वार्षीक खर्च विस्त्रीत विवरण **Annual expenditure (detail)**	जम्मा खर्च के. जि, लीटर आदी **Total units**	प्रति के.जि वा लि वा यूनिट को मुल्य **Price/unit**	जम्म खर्च **Total spending**

प्रकार **Category /item**	वार्षीक खर्च विस्त्रीत विवरण **Annual expenditure (detail)**	जम्मा खर्च के. जि, लीटर आदी **Total units**	प्रति के.जि वा लि वा यूनिट को मुल्य **Price/unit**	जम्म खर्च **Total spending**
अन्य खाद्य वस्तुको जम्मा खर्च **TOTAL NON-STAPLE FOOD EXPENDITURE**				

प्रकार **Category /item**	वार्षीक खर्च विस्त्रीत विवरण **Annual expenditure (detail)**	जम्मा खर्च के. जि, लीटर आदी **Total units**	प्रति के.जि वा लि वा यूनिट को मुल्य **Price/unit**	जम्म खर्च **Total spending**
सामाजिक **SOCIAL** स्वास्थ्य ___ शिक्षा ___ पानी ___ सामाजिक कार्यको पैसा ___ कर ___				
स्वास्थ्य Health				
शिक्षा स्कूल फीस किताव Education				
पानी Water				
सामाजिक कार्यको पैसा Social				
कर Taxes				
जम्मा सामाजिक खर्च **TOTAL SOCIAL**				
लगानीहरु **INPUTS** विउ ___ मल खाद्य ___ किटनासक औषधि ___ गाईवस्तुको औषधि ___ ट्रेक्टर ___ थ्रेसर ___ पम्प सेट ___ सिचाइं ___ औजारहरु ___ कामदारको खर्च ___ दाना गाईवस्तुको लागी ___ घांसपात ___ अन्य ___				
विउ				
मल खाद्य				
किटनासक औषधि				
गाईवस्तुको औषधि				
ट्रेक्टर				
थ्रेसर				
पम्प सेट सिचाइं				
औजारहरु				
कामदारको खर्च				
दाना				

प्रकार **Category /item**	वार्षीक खर्च विस्त्रीत विवरण **Annual expenditure (detail)**	जम्मा खर्च के. जि, लीटर आदी **Total units**	प्रति के.जि वा लि वा यूनिट को मुल्य **Price/unit**	जम्म खर्च **Total spending**
घांसपात				
जम्मा लगानी **TOTAL INPUTS**				
अत्यावश्यक घरेलु सरसामान **HOUSEHOLD ITEMS** मट्टीतेल ___ सलै___ ग्यास___ नुहाउने सावन ___ लुगा धुने सावन ___ सर्फ___ दउरा ___ विजुलिको विल ___ टेलीफोन ___ लुगा र कपडा ___ दाना गाईवस्तुको लागी ___ घांसपात ___ लुगा र कपडा ___ अन्य ___				
मट्टीतेल				
सले				
ग्यास				
नुहाउने सावन				
लुगा धुने सावन				
सर्फ				
दउरा				
विजुलिको विल				
टेलीफोन				
लुगा र कपडा				
घरेलुसरसामानको जम्मा खर्च **TOTAL HOUSEHOLD ITEMS**				
उपहार GIFTS				
अन्य OTHER				
सम्पुर्ण खर्च **GRAND TOTAL**				

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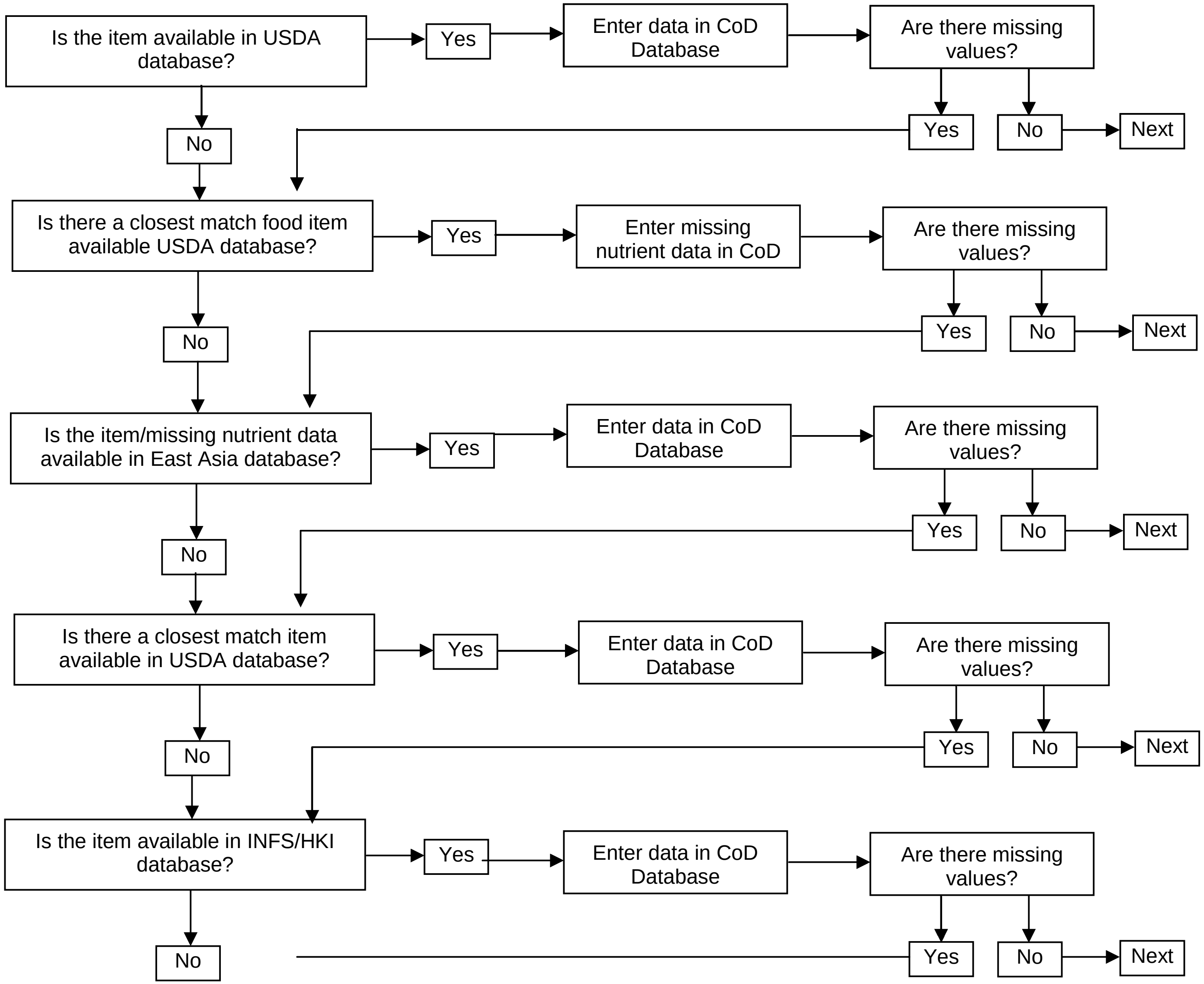
Annex 4.5 HEA Wealth group income interview data entry format

Zone:	Mukhiyapatti					
Year:	2006					
Wealth Group:	'Poor'					
HH size:	7					
Cost of a minimum Food basket		Average price/kg =			Annual food needs (kg)	
STAPLE CROP SALES						
Product	Explanation	Unit	# sold	Price	Value	% of Total
Rice	Adhiya 210 kg rice cutting 450 kg = 760	Kg	660.0	7	4,620	12%
Wheat	Wheat cutting 16 bhogha 5 kg * 30 days	Kg	150.0	12	1,800	5%
	TOTAL STAPLE CROP SALES				6,420	17%
PULSE CROP SALES						
Product	Explanation	Unit	# sold	Price	Value	% of Total
	TOTAL PULSE CROP SALES				0	0%
OIL, ROOT & SPICE CROP SALES						
Product	Explanation	Unit	# sold	Price	Value	% of Total
	TOTAL OIL, ROOT & SPICE CROP SALES				0	0%
VEGETABLE CROP SALES						
Product	Explanation	Unit	# sold	Price	Value	% of Total
Lauka	30 pcs	Pcs	30.0	10	300	1%
	TOTAL VEGETABLE CROP SALES				300	1%
GREEN LEAF (SAG) CROP SALES						
Product	Explanation	Unit	# sold	Price	Value	% of Total
	TOTAL GREEN LEAF (SAG) CROP SALES				0	0%
FRUIT CROP SALES						
Product	Explanation	Unit	# sold	Price	Value	% of Total
	TOTAL FRUIT CROP SALES				0	0%
DAIRY PRODUCT SALES						
Product	Explanation	Unit	# sold	Price	Value	% of Total
	TOTAL DAIRY PRODUCT SALES				0	0%
LIVESTOCK / POULTRY PRODUCT SALES						
Product	Explanation	Unit	# sold	Price	Value	% of Total
	TOTAL LIVESTOCK / POULTRY PRODUCT SALES				0	0%
FARMED FISH SALES						

Product	Explanation	Unit	# sold	Price	Value	% of Total
				TOTAL FARMED FISH SALES	0	0%
WILD FISH / SHELL FISH SALES						
Product	Explanation	Unit	# sold	Price	Value	% of Total
Fish	Only in monsoon	Kg	50.0	50	2,500	7%
				TOTAL WILD FISH / SHELL FISH SALES	2,500	7%
WILD VEGETABLE / FRUIT SALES						
Product	Explanation	Unit	# sold	Price	Value	% of Total
				TOTAL WILD VEGETABLE / FRUIT SALES	0	0%
DAILY-WAGED LABOUR						
Product	Explanation	Unit	# sold	Price	Value	% of Total
Labour work in India	2 person working 3 months	Rs	4,800.0	3	14,400	38%
Labour work in farm	2 person working .05 days* in 1 months 10 days * Rs 20	Rs	400.0	1	400	1%
				TOTAL DAILY-WAGED LABOUR	14,800	39%
REGULAR JOB						
Product	Explanation	Unit	# sold	Price	Value	% of Total
				TOTAL REGULAR JOB	0	0%
TRADE						
Product	Explanation	Unit	# sold	Price	Value	% of Total
Contraband	2300* 6 months	Rs	13,800.0	1	13,800	36%
				TOTAL TRADE	13,800	36%
SELF-EMPLOYMENT						
Product	Explanation	Unit	# sold	Price	Value	% of Total
				TOTAL SELF-EMPLOYMENT	0	0%
REMITTANCES						
Activity	Explanation	Unit	Number	Price	Value	% of Total
				TOTAL REMITTANCES	0	0%
GIFTS						
Activity	Explanation	Unit	# sold	Price	Value	% of Total
				TOTAL GIFTS	0	0%
				BASELINE ACCESS	**37,820**	**100%**

Annex 4.6 Algorithm of Dhanusha Food composition table preparation



Annex 4.7 List of food items, food code and energy content per 100gram

Group	Name	Foodcode	Kcal/100g
Cereals	Flour wheat white	1202	360
Cereals	Maize	1124	349
Cereals	Millet flour	1208	354
Cereals	Millet kodo	1401	341
Cereals	Paddy unspecified	1207	341
Cereals	Puffed rice	1108	354
Cereals	Rice Beaten	1109	346
Cereals	Rice unpsecified	1209	358
Cereals	Semolina	1204	360
Cereals	Wheat	1201	340
Cereals	White bread	1205	266
Cereals	Whole wheat flour	1203	339
Fish	Big head eaten filleted	7204	115
Fish	Common carp fish	7202	127
Fish	Crabs	7501	92
Fish	Derba/Pothiyaa (bones eaten)	7303	94
Fish	Fish Israeli	7106	113
Fish	Fish large	7104	113
Fish	Fish unspecified	7109	104
Fish	Gaincha /Latta (bones eaten)	7302	100
Fish	Garai /Chenga fish (small fish)	7304	94
Fish	Katla filleted	7505	111
Fish	Mungri Singhi fish	7206	95
Fish	Prawn/ shrimp	7105	87
Fish	Rahu fish eaten filleted	7201	97
Fish	Silver carp fish	7203	115
Fish	Small fish bones eaten	7301	94
Fish	Snails big	7402	90
Fish	Snails small	7401	90
Fish	Tengra fish	7108	144
Fruit	Apple	4208	52
Fruits	Badhar	4219	83
Fruits	Bael fruit/Bengal quince	4202	87
Fruits	Banana ripe	4214	100

Fruits	Bhogate	4201	39
Fruits	Coconut	4206	354
Fruits	Custard apple fruit	4216	101
Fruits	Dates	1323	234
Fruits	Fruit unspecified	4224	83
Fruits	Grapes	4212	57
Fruits	Guava	4209	68
Fruits	Indian Gooseberry (Amla)	4220	19
Fruits	Indian plum Chinese date	4221	46
Fruits	Jackfruit	4203	94
Fruits	Jambu/ rose apple	4210	25
Fruits	Kusum fruit	4223	83
Fruits	Lemon big	3508	30
Fruits	Lime	4205	30
Fruits	Litchi	4207	66
Fruits	Mango	4105	65
Fruits	Melon Foot	4218	34
Fruits	Orange small/ Satsuma	4103	53
Fruits	Orange sweet	4104	47
Fruits	Papaya	4102	39
Fruits	Pear	4225	42
Fruits	Pineapple	4101	50
Fruits	Pomegranate	4213	83
Fruits	Raisin	1317	296
Fruits	Small Custard apple	4215	101
Fruits	Water melon	4204	30
Fruits	Wild date palm	4222	324
Meat	Buffalo	5401	86
Meat	Chicken egg unspecified	6105	143
Meat	Chicken local	5201	302
Meat	Chicken unspecified	5802	213
Meat	Duck	5301	404
Meat	Duck egg	6201	181
Meat	Goat	5101	109
Meat	Mice	5803	131
Meat	Pig meat	5501	376
Meat	Pigeon	5801	294
Milk	Buffalo milk	9101	97
Milk	Cow milk	9102	67
Milk	Curd- cow/ buffalo yogurt	9104	343
Milk	Curd of Buffalo milk	9404	343.3

Milk	Milk unspecified	9403	82
Milk	Mixed cow/buffalo milk	9103	82
Oil and oilseeds	Black mustard seed	3514	541
Oil and oilseeds	Cow ghee	9302	884
Oil and oilseeds	Flax seed	1016	534
Oil and oilseeds	Flax seed oil	1014	884
Oil and oilseeds	Ghee Buffalo	9301	884
Oil and oilseeds	Ghee unspecified	9303	884
Oil and oilseeds	Ghee Vegetable	1015	900
Oil and oilseeds	Oil Khari	9304	884
Oil and oilseeds	Oil mustard	1011	884
Oil and oilseeds	Oil Sunflower	1013	884
Oil and oilseeds	Sesame seed	1017	573
Oil and oilseeds	Yellow mustard	1221	508
Others	Betel nut, supadi	1229	394
Others	Boiled sweet chocolate	1324	387
Others	Dalmut	1316	393
Others	Jilebi (fried sugar wheat flour snack)	1311	393
Others	Large meal	3333	289
Others	Local alcohol Rakshi	1242	17
Others	Noodles small	1302	527
Others	Palm wine	1241	17
Others	Pan	1228	44
Others	Papadam	1331	371
Others	Small meal	3332	177
Others	Tea leaves	1233	293
Pulses and nuts	Black lentil urid black gram dal	8113	344
Pulses and nuts	Broad bean dried	8112	341
Pulses and nuts	Chick pea dal	8103	364
Pulses and nuts	Chick pea flour	8122	364
Pulses and nuts	Chick peas whole	8104	364
Pulses and nuts	Dal unspecified	8124	347
Pulses and nuts	Dried peas whole	8105	315
Pulses and nuts	Horse gram dal	8107	354
Pulses and nuts	Horse gram whole	8106	354
Pulses and nuts	Kheshari yellow lentil	8116	345
Pulses and nuts	Mung dal	8110	348
Pulses and nuts	Red kidney bean	8115	333
Pulses and nuts	Red lentil	8108	353

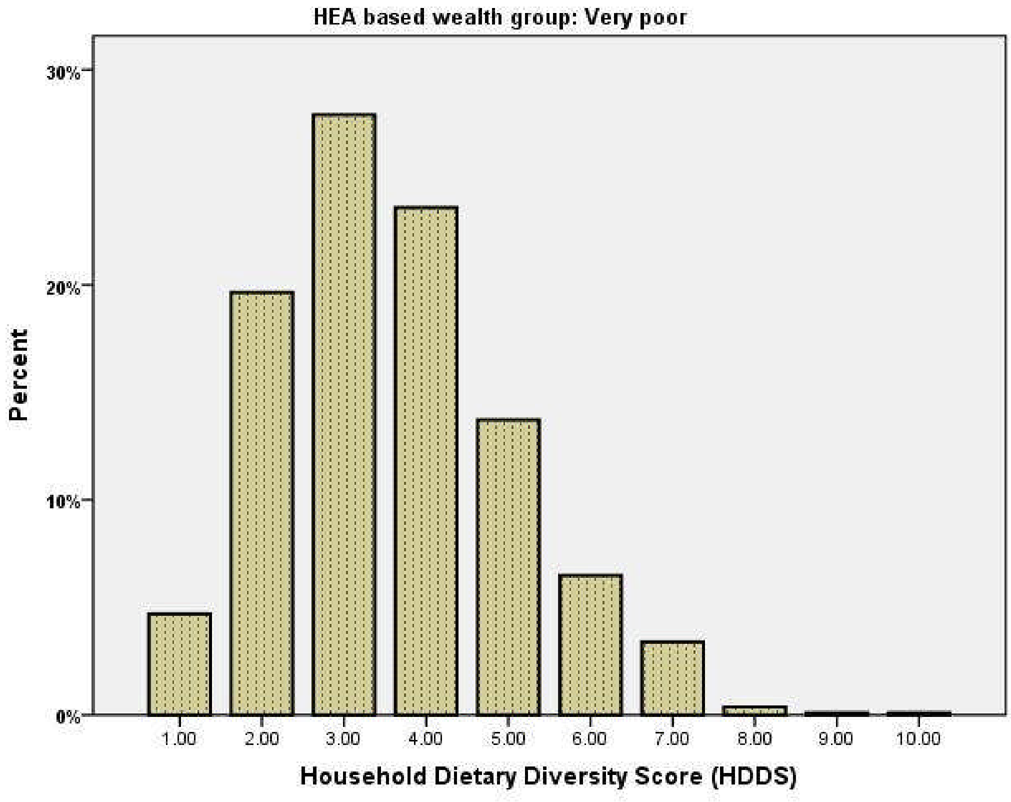
Pulses and nuts	Red lentil whole	8109	353
Pulses and nuts	Soyabean chunks masura	8114	312
Pulses and nuts	Soyabean dal	8117	400
Pulses and nuts	Yellow split pea dal	8118	343
Pulses and nuts	Yellow split pea whole	8102	343
Pulses and nuts	Peanuts	8101	567
Roots and tubers	Elephants foot Ol	2204	81
Roots and tubers	Potato	2101	77
Roots and tubers	Sweet potato	2203	86
Roots and tubers	Sweet Turnip	3501	18
Roots and tubers	Taro Coco yam	2201	112
Snacks	Biscuit unspecified	1329	450
Spices	Ajwain	1253	337
Spices	Black cardamom	1256	311
Spices	Black pepper	1216	255
Spices	Chilli powder	1223	314
Spices	Chilli red dried	1224	324
Spices	Chilli unspecified	1252	324
Spices	Cinamon leaves	1212	313
Spices	Clove	1255	323
Spices	Coriander powder	1222	298
Spices	Coriander seeds	1213	298
Spices	Cumin	1214	375
Spices	Fenugreek	1217	323
Spices	Five spices	1211	332
Spices	*Garam masala* (spices)	1226	325
Spices	Ginger	1218	80
Spices	Iodised salt	1219	0
Spices	Meat masala	1227	325
Spices	Rock salt/ non-iodised salt	1220	0
Spices	Turmeric powder	1225	354
Spices	Turmeric whole	1215	46
Sugars	Crystalized sugar	1330	387
Sugars	Sugar	1112	387
Sugars	Sugar cane	1113	67
Sugars	Sugar raw brown	1111	398
Vegetables	Amaranth leaves GLV	3201	23
Vegetables	Aubergine	3607	24
Vegetables	Beans	3402	336
Vegetables	Bitter gourd	3303	17
Vegetables	Black Mustard leaves	3515	22

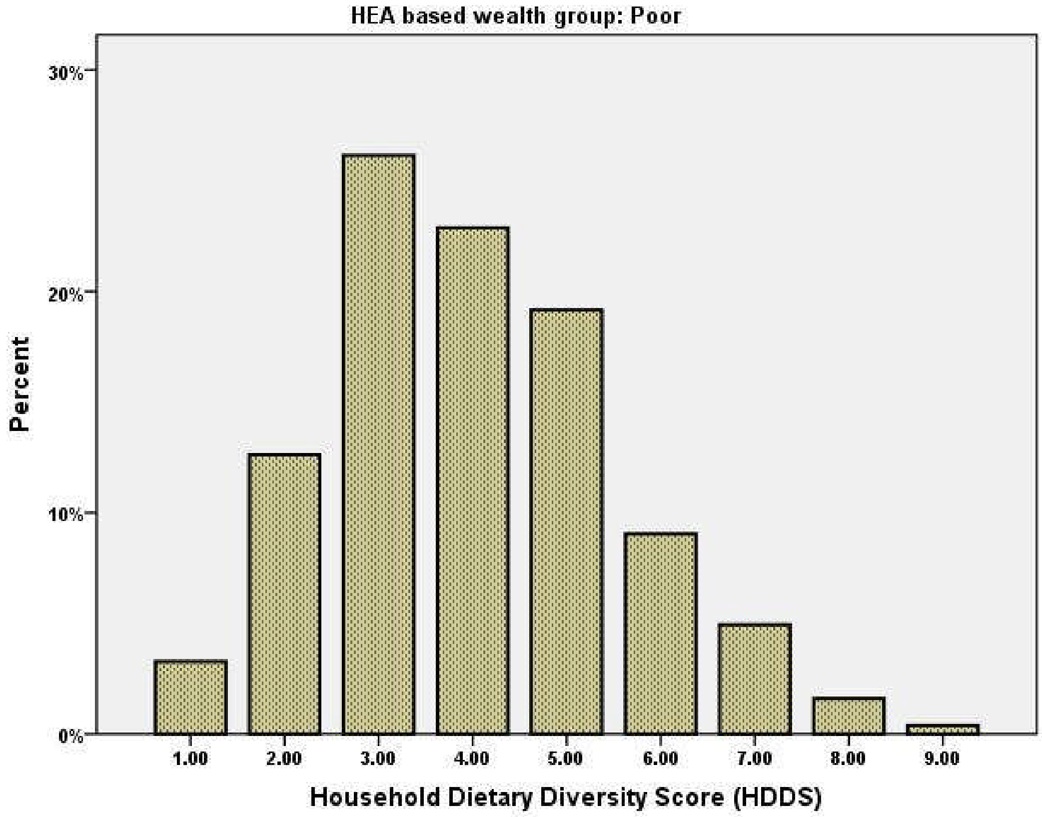
Vegetables	Bottle gourd	3302	16
Vegetables	Broad bean	3404	72
Vegetables	Broad leaf mustard GLV	3202	22
Vegetables	Butter bean	3407	334
Vegetables	Cabbage	3604	25
Vegetables	Carrot	3505	41
Vegetables	Cauliflower	3603	25
Vegetables	Coriander leaves	3205	23
Vegetables	Cucumber	3301	12
Vegetables	Drumstick	3606	72
Vegetables	Fenugreek leaves	3207	49
Vegetables	Garden cress	3408	32
Vegetables	Garlic	3504	149
Vegetables	Green chillies	3608	40
Vegetables	Jackfruit unspecified	3506	53
Vegetables	Jute leaves GLV	3204	34
Vegetables	Khesari yellow lentil Grass pea leaves	3208	55
Vegetables	Ladys finger	3601	31
Vegetables	Lambs quarter Goosefoot veg	3203	43
Vegetables	Mator simi	3509	81
Vegetables	Onion	3503	40
Vegetables	Pea green	3403	81
Vegetables	Pea leaves	3409	29
Vegetables	Pidar fruit eaten as a vegetable	3609	69
Vegetables	Pointed gourd	3307	31
Vegetables	Pumpkin shoots	3210	19
Vegetables	Pumpkin winter squash yellow	3101	34
Vegetables	Radish	3502	18
Vegetables	Radish leaves	3410	24
Vegetables	Small sponge gourd	3306	19
Vegetables	Spinach palak saag GLV	3206	23
Vegetables	Sponge gourd	3305	19
Vegetables	Sunrauchi Leafy vegetables	3411	23
Vegetables	Taro leaf Arum leaf	3209	11
Vegetables	Tomato	3605	18
Vegetables	Unripe jackfruit	3602	53
Vegetables	White gourd	3308	12
Vegetables	Yard long bean	3405	47

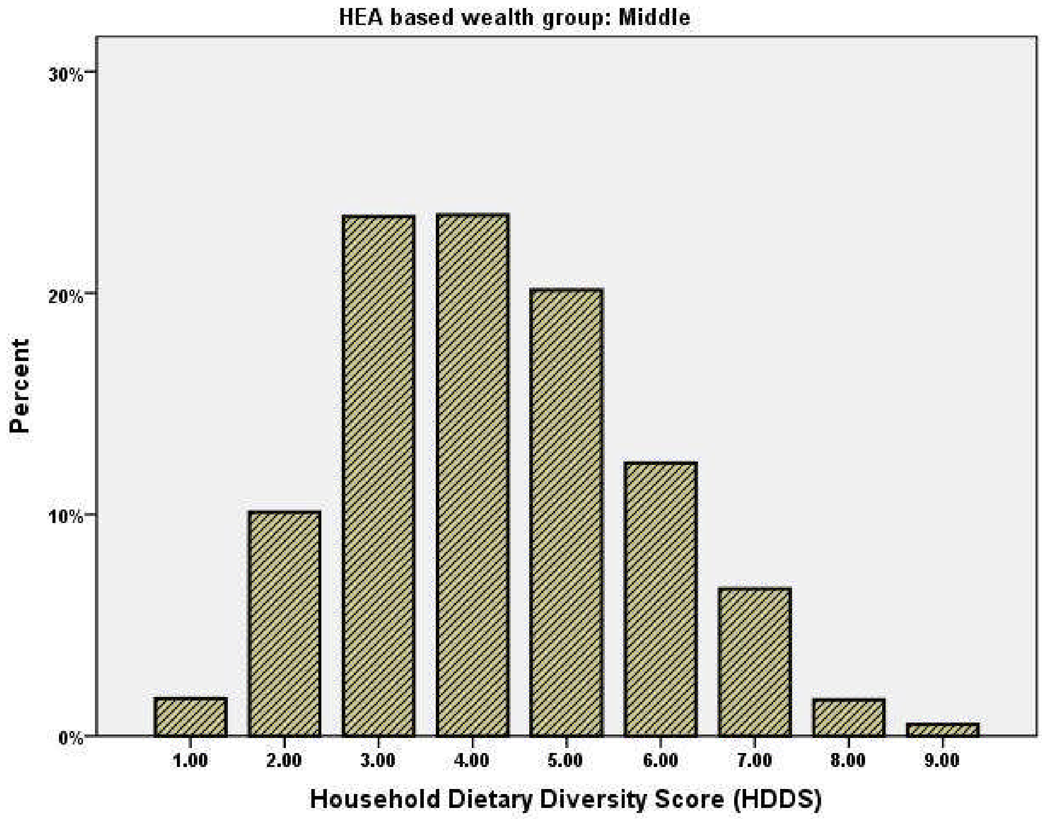
Annex 4.8 Distribution of HDDS in surveillance data, by HEA-based wealth groups

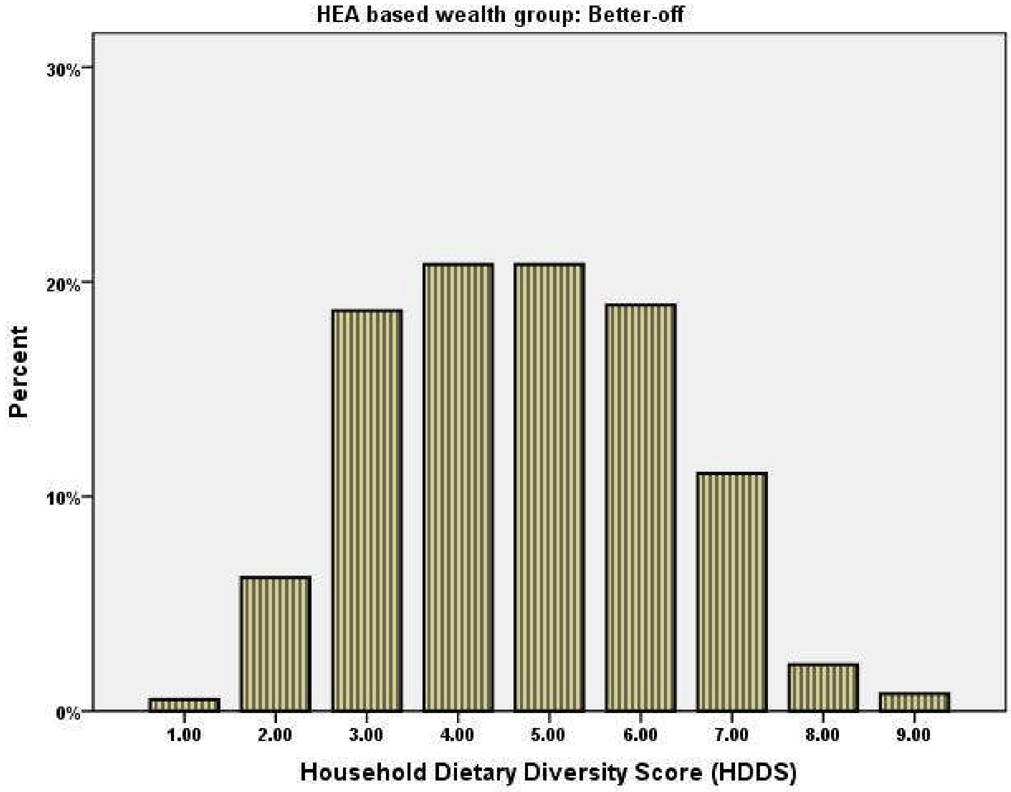
HEA-based wealth group	Mean, SD	N	Median	Minimum	Maximum	Skewness
Very poor	3.6 (1.5)	1064	3.0	1.0	9.0	0.57
Poor	4.0 (1.6)	1316	4.0	1.0	9.0	0.44
Middle	4.3 (1.6)	1356	4.0	1.0	9.0	0.36
Better-off	4.7 (1.6)	370	5.0	1.0	9.0	0.15
Total	4.0 (1.6)	4106	4.0	1.0	9.0	0.42

Figures in Annex 4.8: Distribution of Household dietary diversity Score, disaggregated by HEA-based Wealth groups




HEA based wealth group: Poor
Percent
30%
20%
10%
0%
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
Household Dietary Diversity Score (HDDS)


HEA based wealth group: Middle
Percent
30%
20%
10%
0%
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
Household Dietary Diversity Score (HDDS)


HEA based wealth group: Better-off
30%
20%
10%
0%
Percent
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
Household Dietary Diversity Score (HDDS)

Annex 5.1 Module on household assets and livelihoods in the questionnaire for the prospective households surveillance data in Dhanusha

<u>Assets and livelihoods</u>

NOTE: please answer all these questions in reference to the home where you spent MOST of the pregnancy. By household we mean a family or group eating from the same cooking pot or fireplace.

1. What is the house made of?

Walls: ☐ Cement and bricks ☐ Mud and bricks ☐ Mud and Stone

☐ Mud and woven stems or bamboo (tat) ☐ Metal sheets

☐ Grass / Straw Thatch ☐ Planks of wood ☐ Other

Roof: ☐ Cement ☐ Traditional tiles (Khapadaa) ☐ Tiles

☐ Metal sheets ☐ Grass / straw thatch ☐ Other

2. How many rooms are there in total in your house? _____ _____ rooms

3. What things do you have in your house?

☐ Electricity ☐ Radio ☐ Black & white TV ☐ Colour TV

☐ Bicycle ☐ Ox cart ☐ Rickshaw (own) ☐ Motorcycle

☐ Tractor ☐ Bus / truck / jeep / car / tempo ☐ Thresher

☐ Pump set ☐ Telephone ☐ Sewing machine ☐ Battery set

☐ Solar set ☐ Mobile phone ☐ Camera

☐ Other _______________

4. What is the main drinking water source for your household?

☐ Piped drinking water in your residence ☐ Public water tap

☐ Own (private) well ☐ Public well ☐ Neighbours well

☐ Own (private) hand pump in courtyard (***If private water source go to question 5)***

☐ Neighbours hand pump ☐ Public hand pump

☐ River / stream/ canal / pond

☐ Deep bore hole (requires no pumping) ☐ Traditional public well

5. What kind of toilet do your family members use?

☐ Flush toilet ☐ Pan toilet ☐ Bushes / stream / open areas

□ Pit toilet □ Other toilet

Education

6. Can you read this sentence?

□ Reads easily □ Reads with difficulty □ Can not read

Livelihoods

NOTE: please answer all these questions in reference to the home where you spent MOST of the pregnancy

7. Does the household where you stayed most during pregnancy have its own land?

□ Yes own □ Yes sharecropped land □ No ***(If no please go to question 8)***

If yes, how much of your own land do you have in total?

__ __ Bigha __ __ Katta __ __ Dhur

__ __ Ropani __ __ Anna __ __ Dam

8. Does your household keep any livestock or poultry?

□ Yes □ No ***(If no go to question 9)***

If yes what types of livestock and poultry do you have and how many? *(Tick boxes and write numbers)*

□ Own Cows __	□ own cows milking? ____
□ Borrowed cows __	□ borrowed cows milking? ___
□ Own buffalo __	□ own Buffaloes milking? ____
□ Borrowed buffalo __	□ borrowed buff' milking? __
□ Oxen for ploughing / cart ____	□ Calves ___
□ Ranga (male buffalo) ____	□ Buffalo calves ___
□ Own goats ____	□ Borrowed goats ____
□ Sheep ___	□ Pigs ____
□ Chickens ____	□ Ducks ____
□ Pigeons ____	□ Other (specify) ________________

No. ___

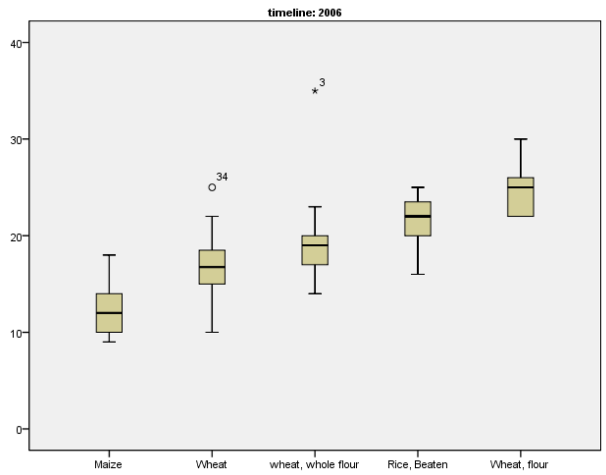
9. What is your family's main source of staple food?

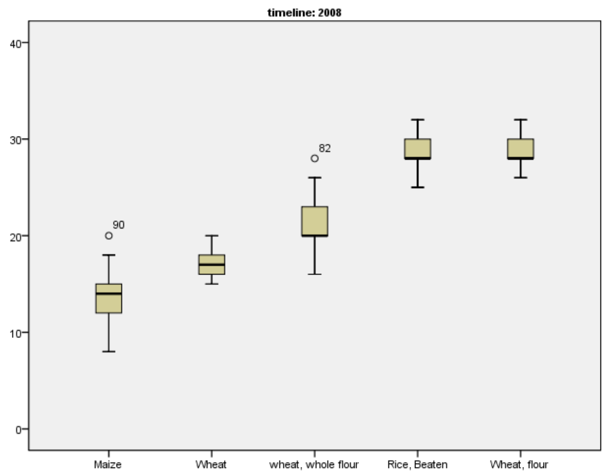
- ☐ Own production
- ☐ Share-cropping (bataiya)
- ☐ Use of land in place of interest on loan (Sodh barna / bandaki)
- ☐ Labour exchange (bain / bunni)
- ☐ Purchase of food
- ☐ Gifts from daughter-in-law's home (maiti)

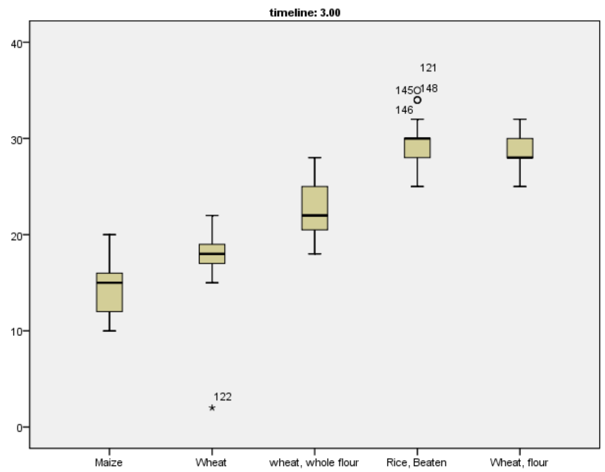
10. What are you or your family's sources of income?

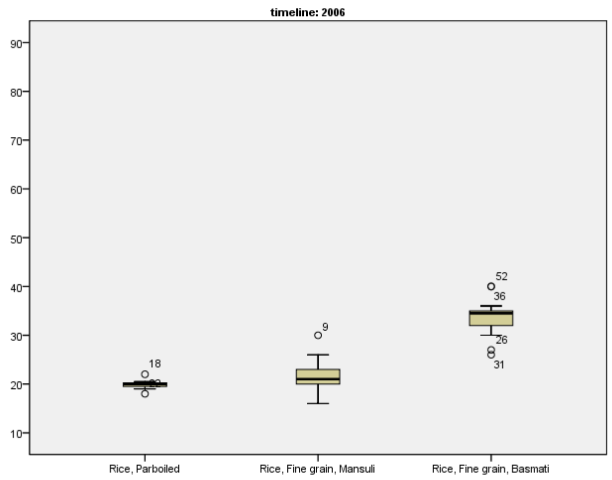
- ☐ Daily paid labour
- ☐ Regular job
- ☐ Selling own crop production (cereal, vegetables, fruits, etc)
- ☐ Selling milk, yoghurt or ghee from own cattle
- ☐ Selling own livestock, meat or fish
- ☐ Small scale trade (tela, small market stall, very small shop)
- ☐ Medium scale trade (small grocery, medicine shop, small rice mill, etc)
- ☐ Large scale trade (large shop in main bazaar, big grain store or mill, factory, etc)
- ☐ Self-employment (making things for sale e.g. bamboo baskets, fans, tailoring, etc.)

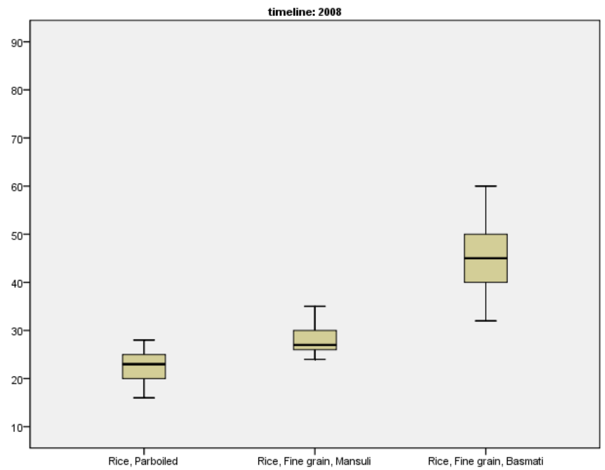
Annex 6.1 Food prices and their variability in 2005, 2008 and 2009

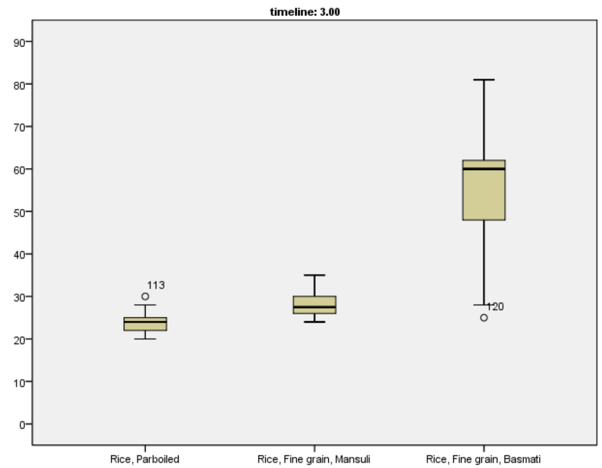


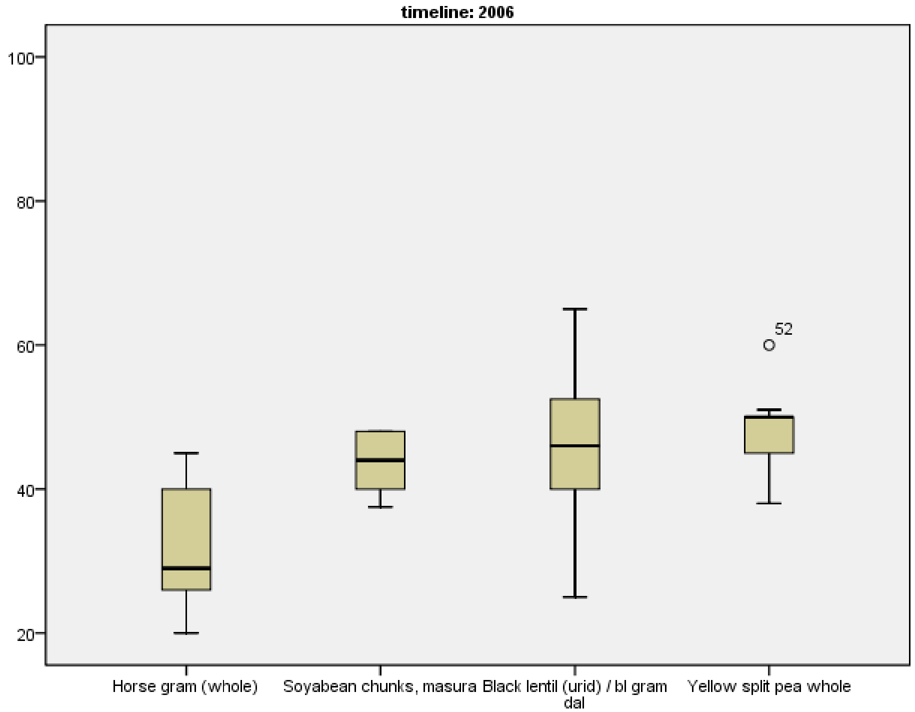




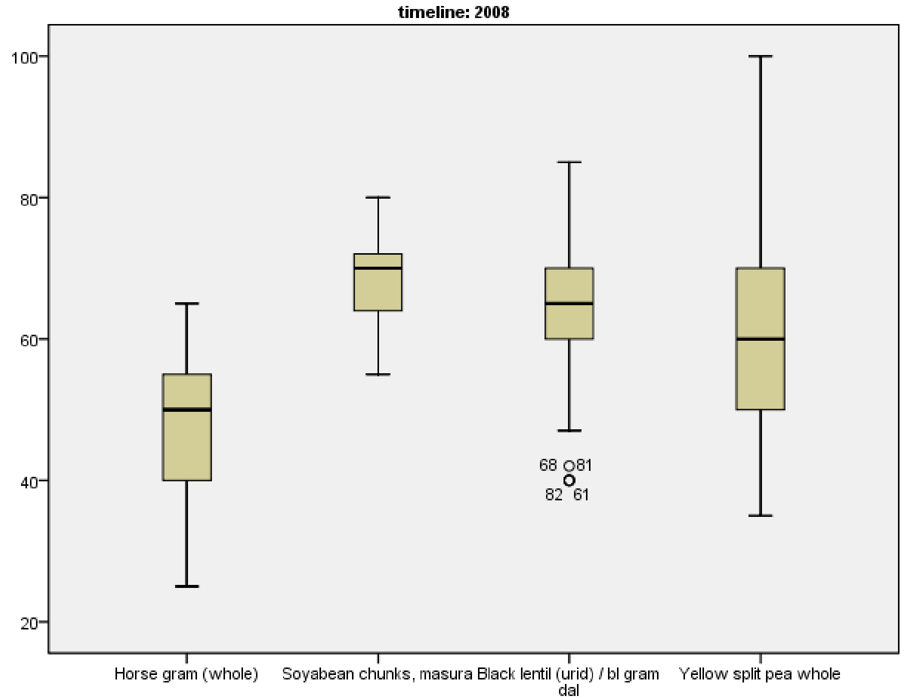




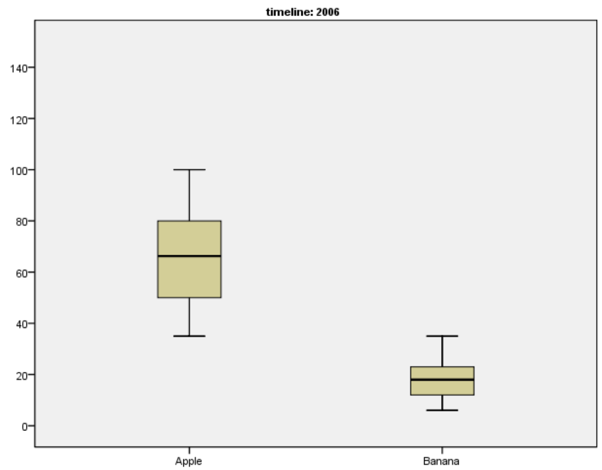


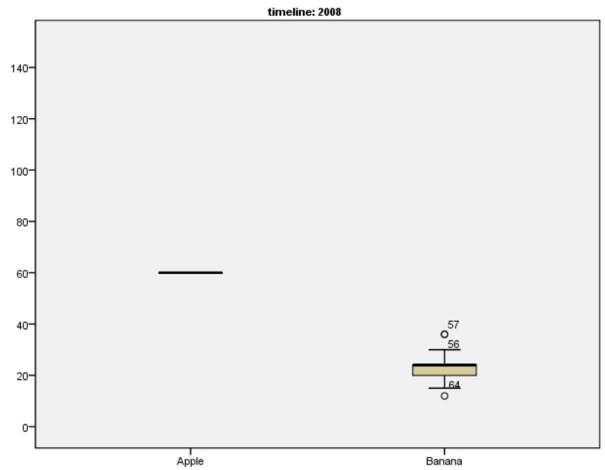


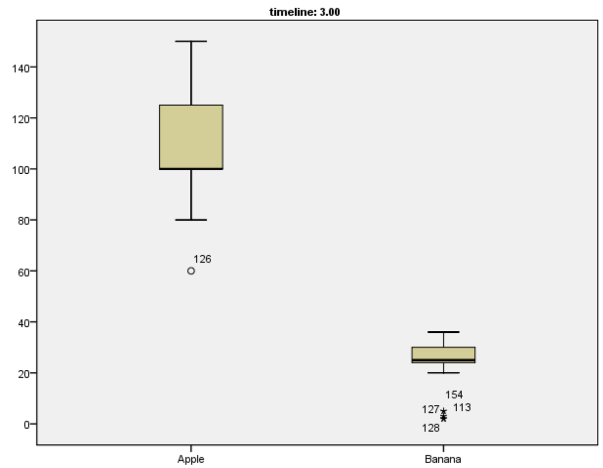
timeline: 2006
100
80
60
40
20
52
Horse gram (whole)
Soyabean chunks, masura
Black lentil (urid) / bl gram dal
Yellow split pea whole

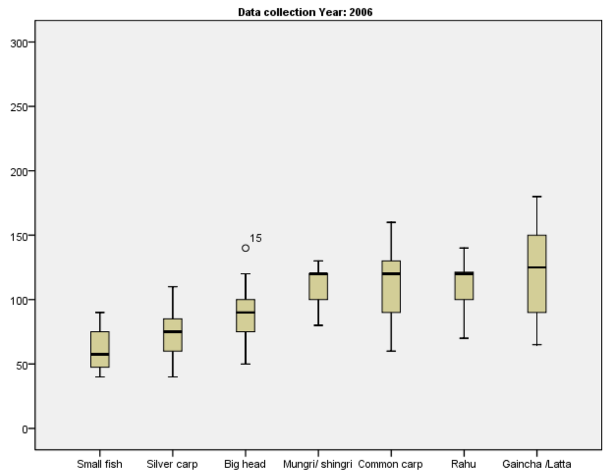


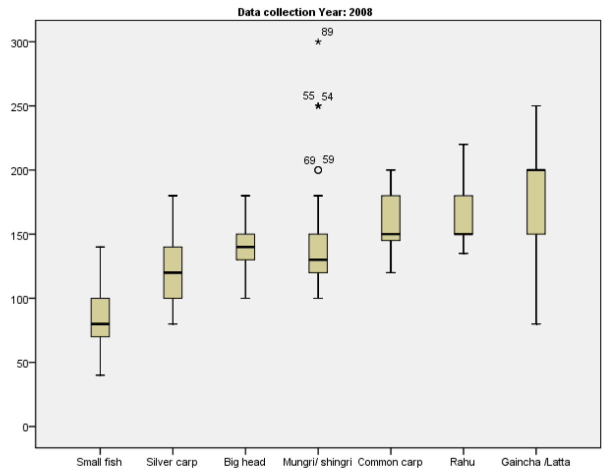
timeline: 2008
100
80
60
40
20
68
81
82
61
Horse gram (whole)
Soyabean chunks, masura
Black lentil (urid) / bl gram dal
Yellow split pea whole

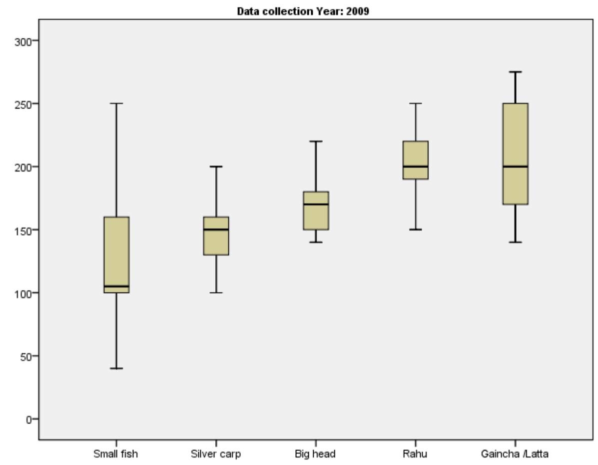

timeline: 2006
140
120
100
80
60
40
20
0
Apple
Banana

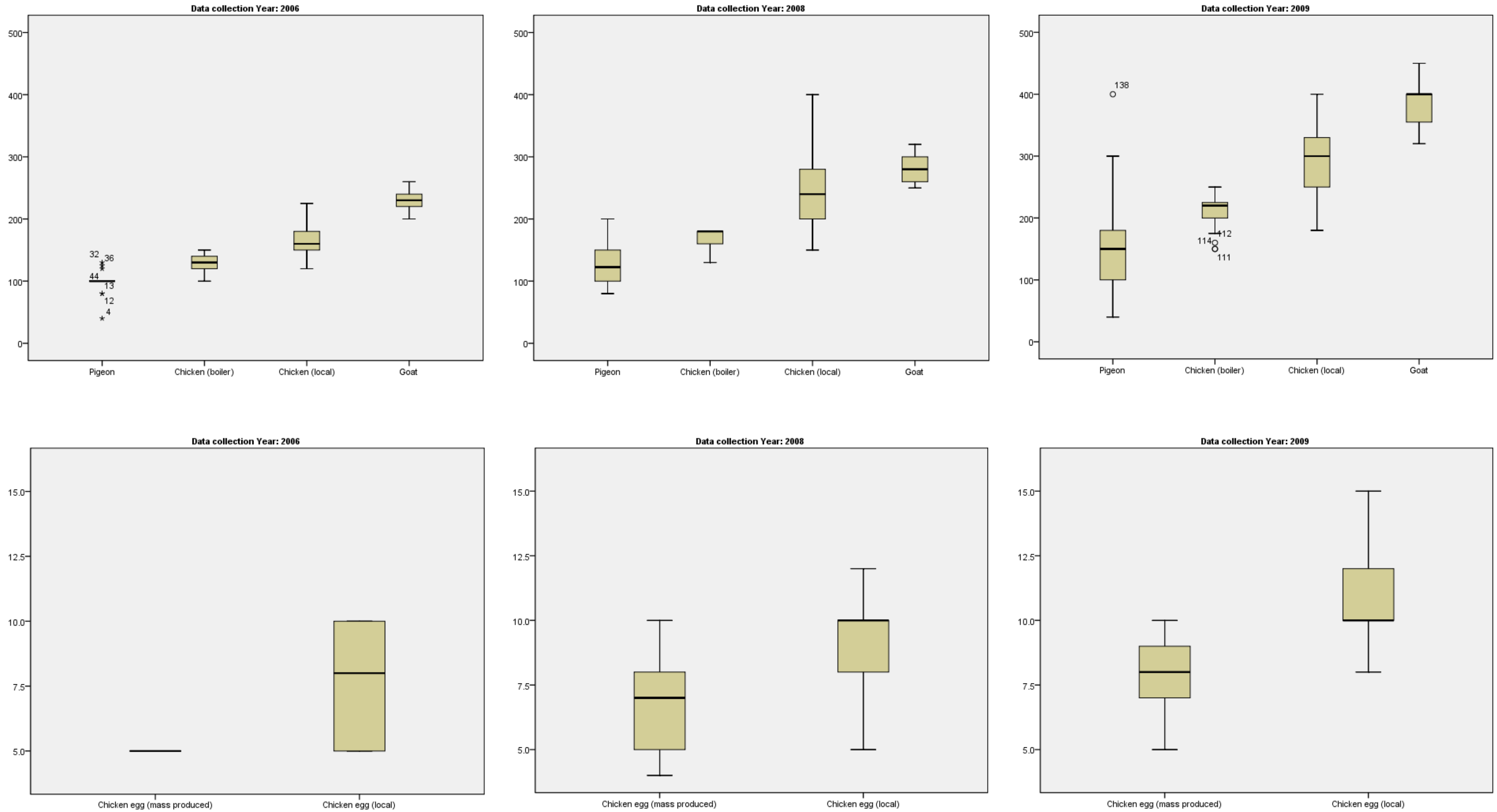

timeline: 2008
140
120
100
80
60
40
20
0
57
56
64
Apple
Banana

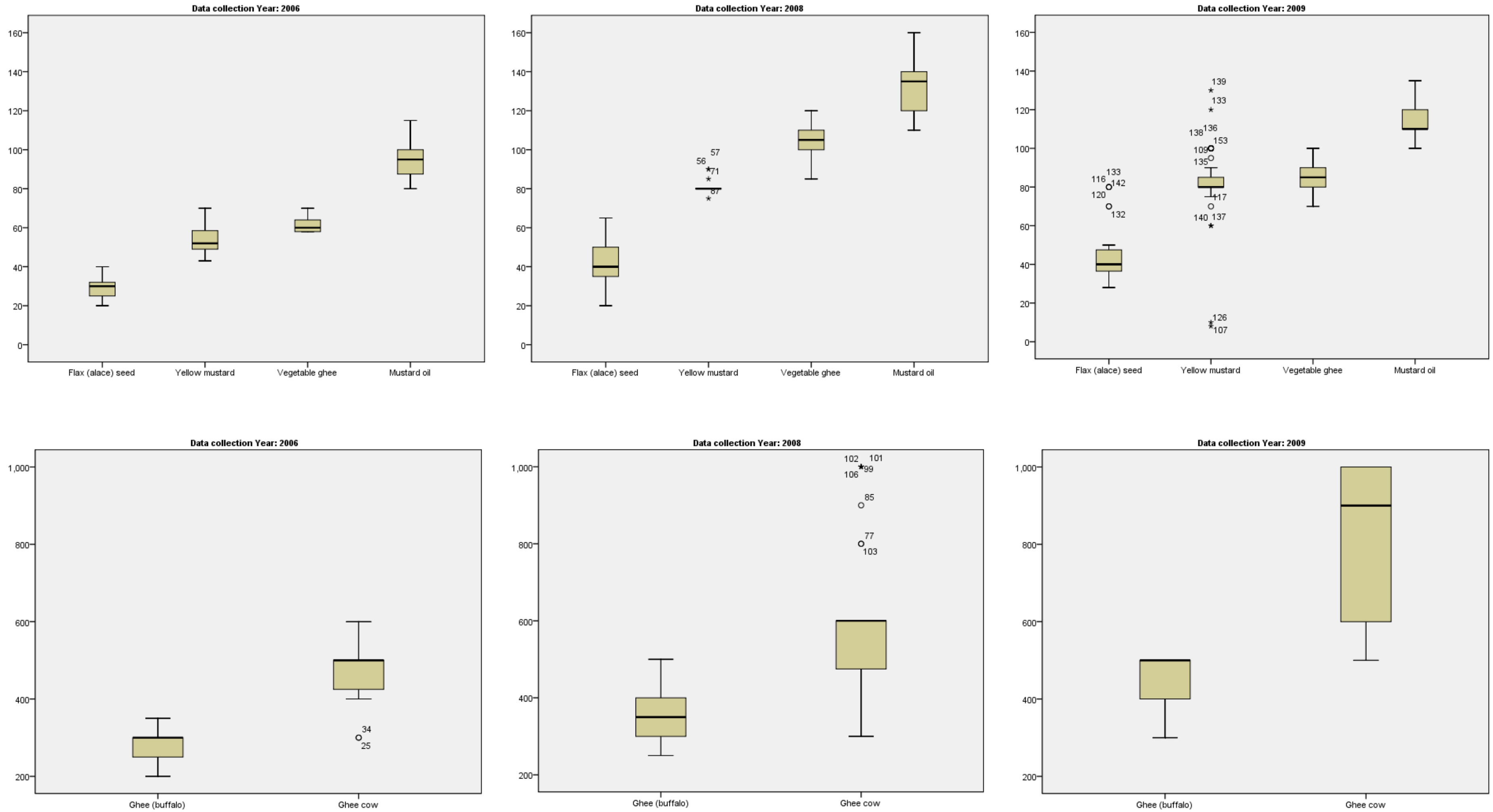

timeline: 3.00
140
120
100
80
60
40
20
0
126
154
127
113
128
Apple
Banana

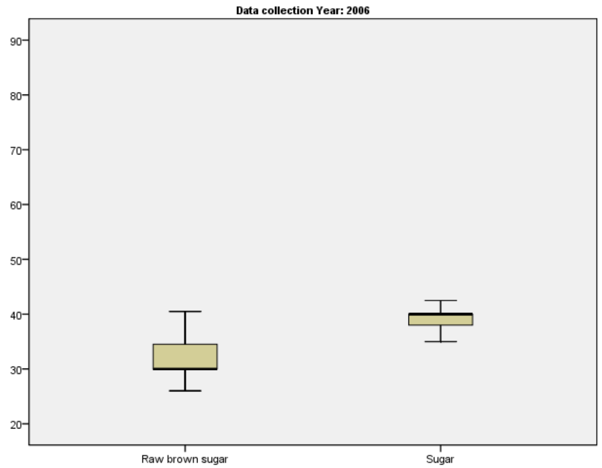

Data collection Year: 2006
300
250
200
150
100
50
0
15
Small fish
Silver carp
Big head
Mungri/ shingri
Common carp
Rahu
Gaincha /Latta

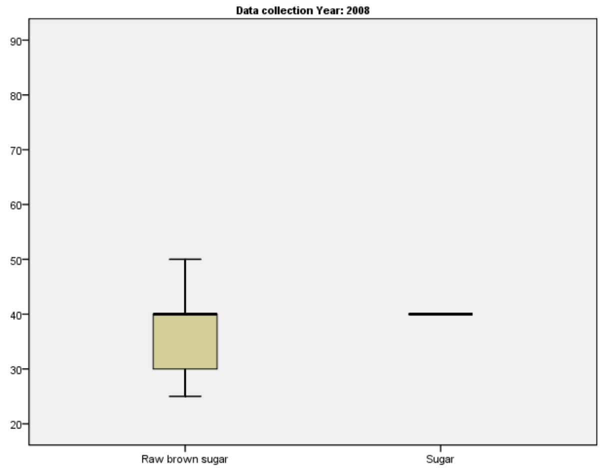

Data collection Year: 2008
300
250
200
150
100
50
0
89
55
54
69
59
Small fish
Silver carp
Big head
Mungri/ shingri
Common carp
Rahu
Gaincha /Latta

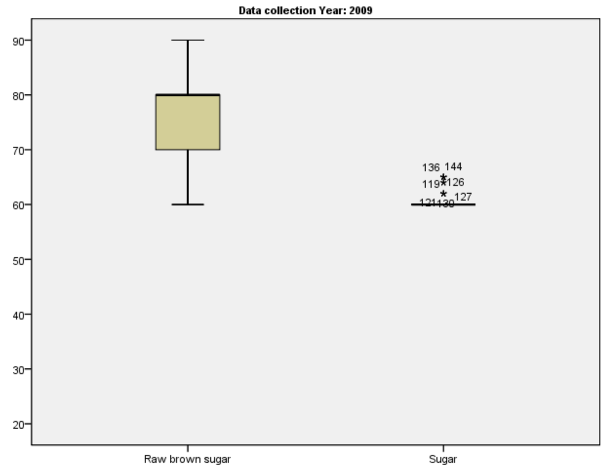

Data collection Year: 2009
300
250
200
150
100
50
0
Small fish
Silver carp
Big head
Rahu
Gaincha /Latta

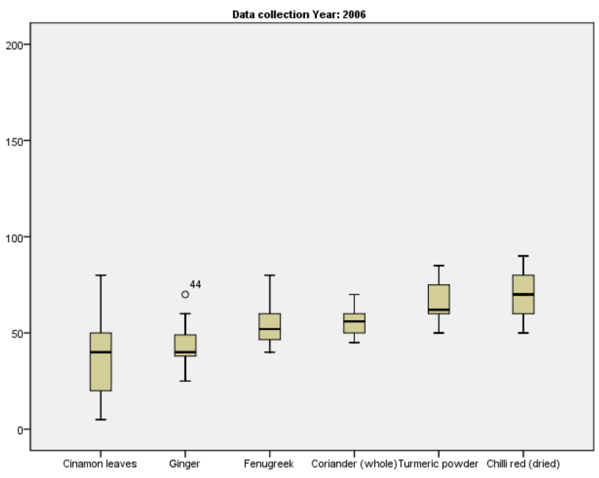

Data collection Year: 2006
Data collection Year: 2008
Data collection Year: 2009
500
400
300
200
100
0
Pigeon
Chicken (boiler)
Chicken (local)
Goat
32
36
44
13
12
4
138
114
112
111
15.0
12.5
10.0
7.5
5.0
Chicken egg (mass produced)
Chicken egg (local)

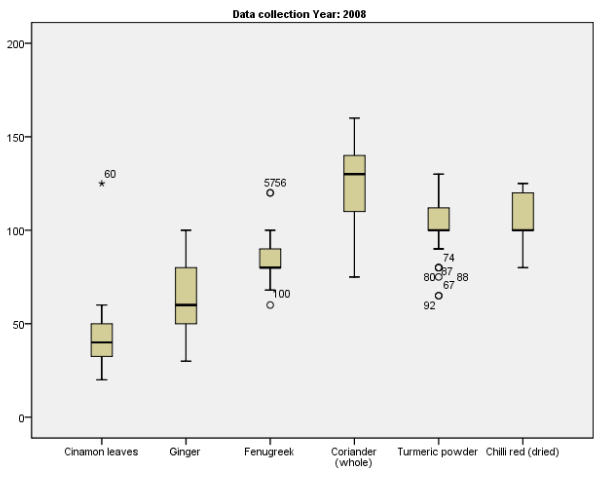

Data collection Year: 2006
0
20
40
60
80
100
120
140
160
Flax (alace) seed
Yellow mustard
Vegetable ghee
Mustard oil
Data collection Year: 2008
Flax (alace) seed
Yellow mustard
Vegetable ghee
Mustard oil
Data collection Year: 2009
Flax (alace) seed
Yellow mustard
Vegetable ghee
Mustard oil
Data collection Year: 2006
200
400
600
800
1,000
Ghee (buffalo)
Ghee cow
Data collection Year: 2008
Ghee (buffalo)
Ghee cow
Data collection Year: 2009
Ghee (buffalo)
Ghee cow

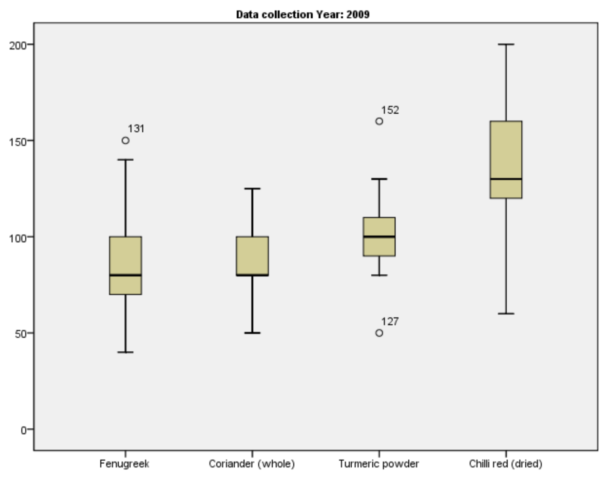

Data collection Year: 2006
90
80
70
60
50
40
30
20
Raw brown sugar
Sugar

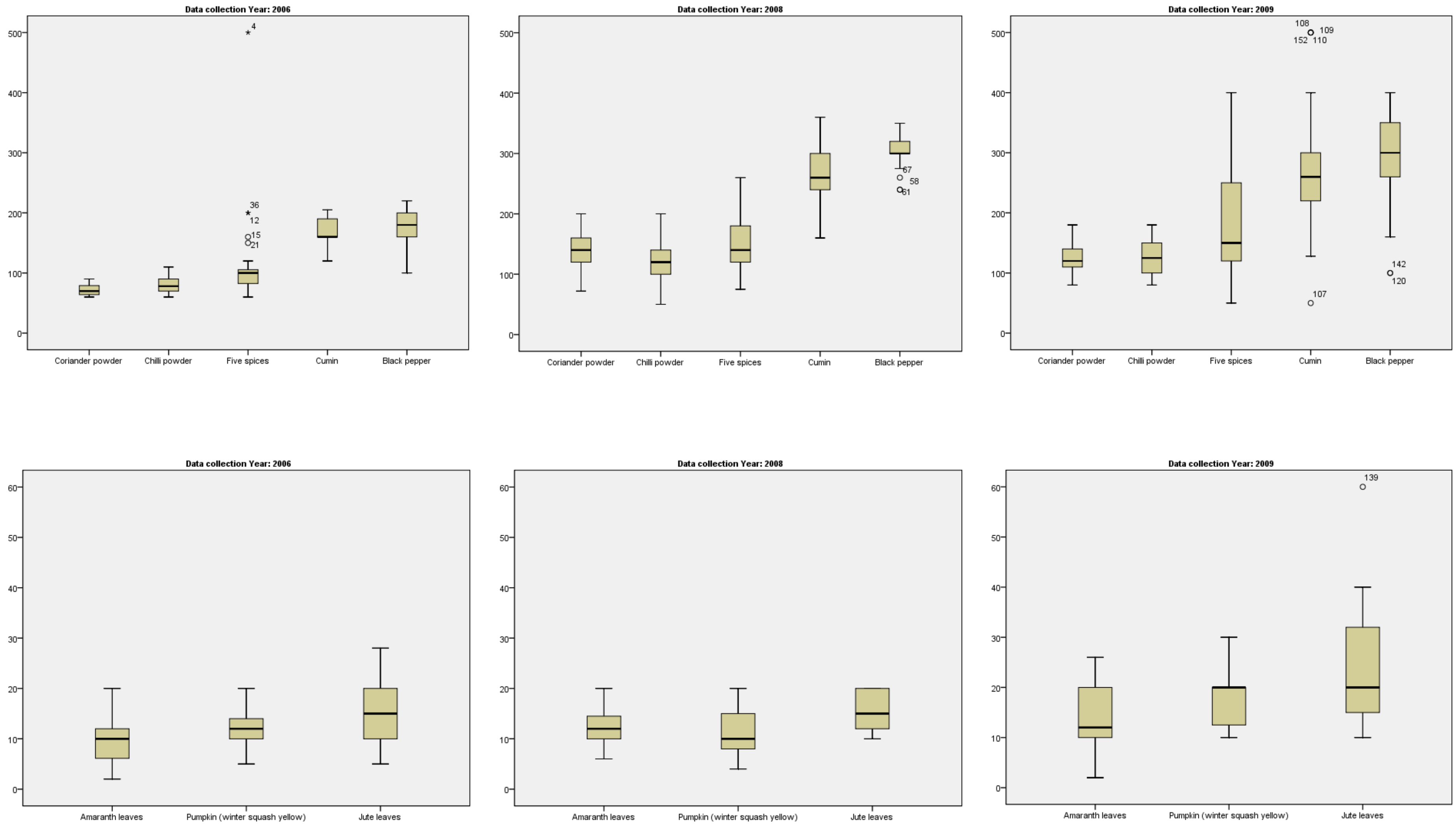

Data collection Year: 2008
90
80
70
60
50
40
30
20
Raw brown sugar
Sugar


Data collection Year: 2009
90
80
70
60
50
40
30
20
136 144
119 126
127
Raw brown sugar
Sugar

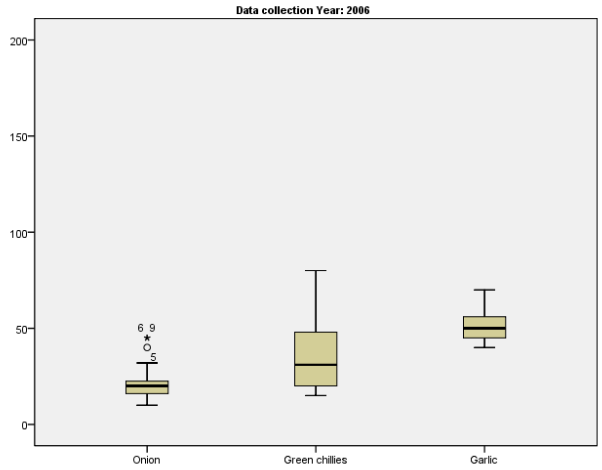

Data collection Year: 2006
200
150
100
50
0
44
Cinamon leaves
Ginger
Fenugreek
Coriander (whole)
Turmeric powder
Chilli red (dried)

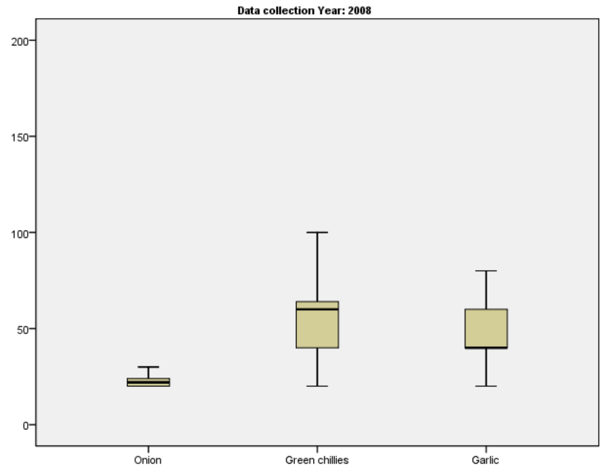

Data collection Year: 2008
200
150
100
50
0
60
5756
100
74
80
88
67
92
Cinamon leaves
Ginger
Fenugreek
Coriander (whole)
Turmeric powder
Chilli red (dried)

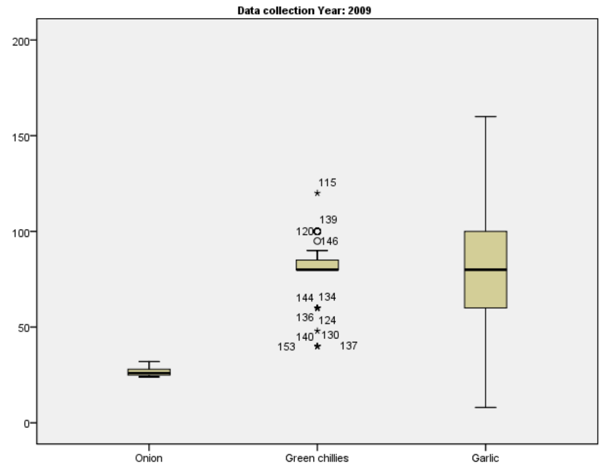

Data collection Year: 2009
200
150
100
50
0
131
152
127
Fenugreek
Coriander (whole)
Turmeric powder
Chilli red (dried)

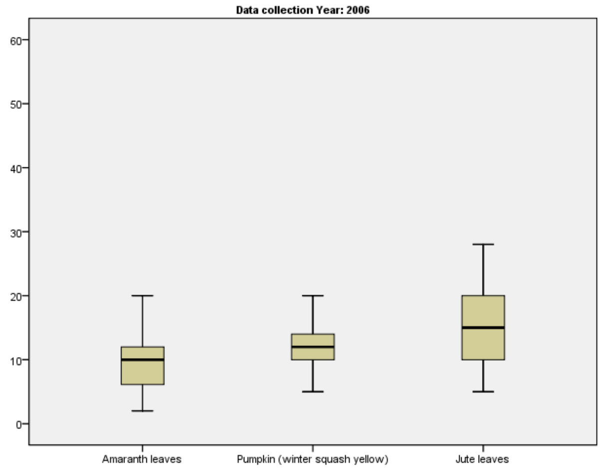


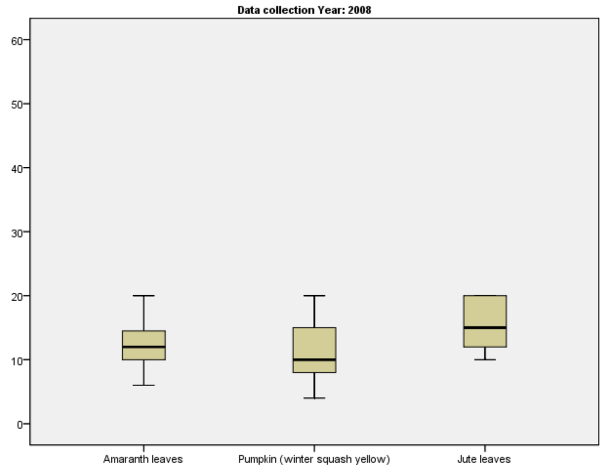
Data collection Year: 2006
500
400
300
200
100
0
4
36
12
15
21
Coriander powder
Chilli powder
Five spices
Cumin
Black pepper
Data collection Year: 2008
500
400
300
200
100
0
67
58
61
Coriander powder
Chilli powder
Five spices
Cumin
Black pepper
Data collection Year: 2009
500
400
300
200
100
0
108
109
152
110
142
120
107
Coriander powder
Chilli powder
Five spices
Cumin
Black pepper
Data collection Year: 2006
60
50
40
30
20
10
0
Amaranth leaves
Pumpkin (winter squash yellow)
Jute leaves
Data collection Year: 2008
60
50
40
30
20
10
0
Amaranth leaves
Pumpkin (winter squash yellow)
Jute leaves
Data collection Year: 2009
60
50
40
30
20
10
0
139
Amaranth leaves
Pumpkin (winter squash yellow)
Jute leaves

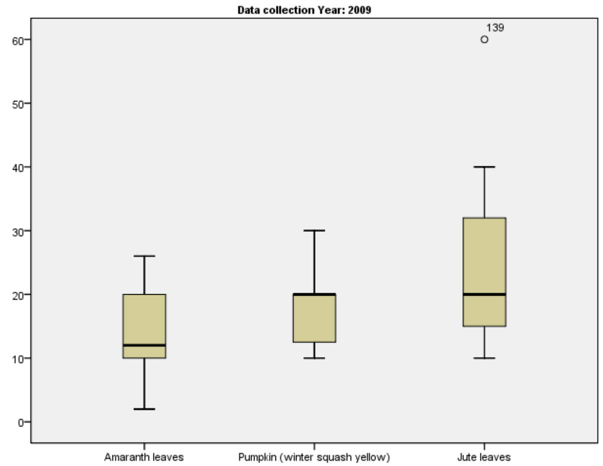

Data collection Year: 2006
200
150
100
50
0
6 9
5
Onion
Green chillies
Garlic

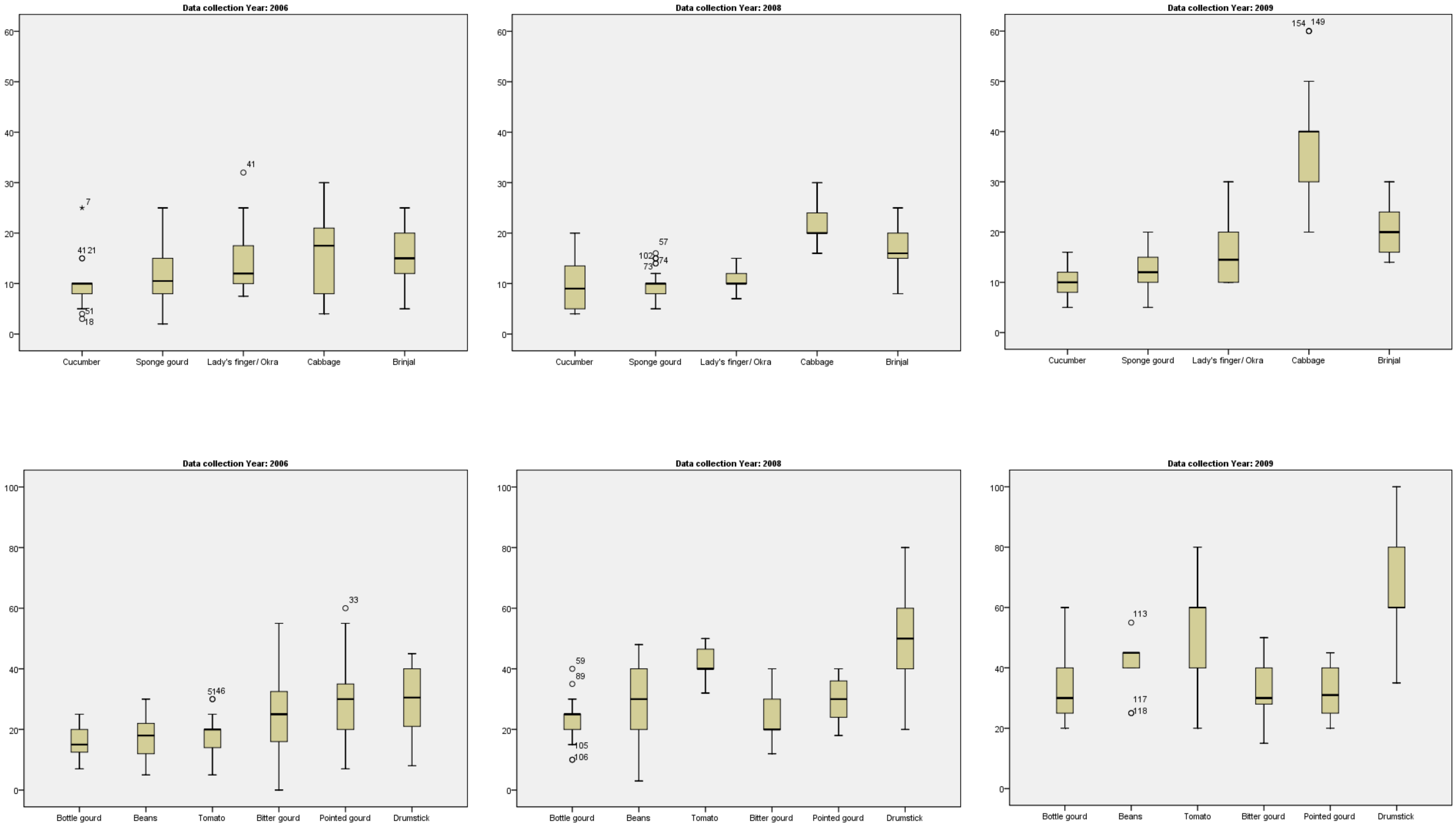

Data collection Year: 2008
200
150
100
50
0
Onion
Green chillies
Garlic


Data collection Year: 2009
200
150
100
50
0
115
139
120
146
144 134
136 124
140 130
153 137
Onion
Green chillies
Garlic


Data collection Year: 2006
60
50
40
30
20
10
0
Amaranth leaves
Pumpkin (winter squash yellow)
Jute leaves


Data collection Year: 2008
60
50
40
30
20
10
0
Amaranth leaves
Pumpkin (winter squash yellow)
Jute leaves


Data collection Year: 2009
139
60
50
40
30
20
10
0
Amaranth leaves
Pumpkin (winter squash yellow)
Jute leaves


Data collection Year: 2006
Data collection Year: 2008
Data collection Year: 2009
Cucumber
Sponge gourd
Lady's finger/ Okra
Cabbage
Brinjal
Bottle gourd
Beans
Tomato
Bitter gourd
Pointed gourd
Drumstick

Annex 7.1 Price survey questionnaire 2008 example (Page 1-2)

Questionnaire for Market price study in Dhanusha, Nepal 2008 ahf/ d'No cWoogsf] k|ZgfjnL

Identification information

VDC name ut=la=; =sf] gfd ____ VDCa=;= g+= ☐☐ Ward no.{ g+= ☐ Interviewer ID :f{sf/sf] cfO 8L g+= ☐☐

Tole name 6f]nsf] gfd ____ Market place name ahf/sf] gfd ____ Market place ID no. f] g+= ☐☐

Nepali Date of Visit: g]kfnL ldtL Day lbg ☐☐ Month dlxgf ☐☐ Year aif{ ☐☐ English Date of Visit: Day ☐☐ Month ☐☐ Year ☐☐

Instructions:

1. Record current and seasonal prices (up to one decimal point if applicable) for items listed below, and code 888.8 = Not available for particular season/ do not vary by season, 999.9 = missing data (data not collected).
2. Please use following codes for unit 1= Kg, 2= Liter, 3 = per animal/fruit, 4 = bundle, 5 = Dozen, 6 = others, specified.......

A. Price of food items

1. Cereals/ Staples

Food code	English Name	Nepali Name	Maithili name	OsfO	at{dfg d'No Current p	Hff8f]sf] d'No Winter	r}t a};fvsf] d'No Sp	aiff{bsf] d'No Monsoon	bz}, ltxf/ jf 5}7sf
1101	Basmati Paddy (finest)	af;dtL wfg	af;dtL wfg						
1102	Mansuli Paddy (fine/ medium)	dg;'nL wfg	dg;'nL wfg						
1103	Short grain Paddy (cheap)	df]6f] wfg	df]6sf wfg						
1104	Basmati Fine grain rice	af;dtL d;Lgf] rfdn	af;dtL d]xL rfpm/						
1105	Mansuli fine grain rice	dg;'nL d;Lgf] rfdn	dg;'nL d]xL rfpm/						
1106	Large grain rice	df]6f] rfdn	df]6sf rfpm/						
1107	Parboiled rice	pm;Lgf]sf] rfdn	pm;gf rfpm/						
1108	Puffed rice	e'hf	d'/xL						
1109	Beaten rice	Ro'/f	lrp/f						
1201	Wheat	ux'+	ux'd						
1202	White flour	d}bf	d}bf						
1203	Wholewheat flour	ux'+sf] lk7f] jf cf+6f	ux'd s] cf+6f						
1204	Semolina	;'hL	;'hL						
1205	Bread	kfp/f]6L	kfp/f]6L						
1301	Maize	ds}	dsO{						

Page 1

VDC no ☐☐ Ward no ☐☐ Market place no ☐☐

1. Cereals/staples

Food code	English Name	Nepali Name	Maithili name	OsfO	at{dfg d'No Current p	Hff8f]sf] d'No Winter	r}t a};fvsf] d'No Sp	aiff{bsf] d'No Monsoon	bz}, ltxf/ jf 5}7sf
1401	Kodo	sf]bf]	d?jf						

2. Root tubers

Food code	English Name	Nepali Name	Maithili name	OsfO	at{dfg d'No Current p	Hff8f]sf] d'No Winter	r}t a};fvsf] d'No Sp	aiff{bsf] d'No Monsoon	bz}, ltxf/ jf 5}7sf
2101	Potato	cfn'	cNn'						
2201	Taro/ Coco yam	lk08fnf]	c?jf						
2202	Yam/ White Yam	t?n	vdx?jf						
2203	Sweet potato	;v/v08	cn'jf						
2204	Elephant's foot (Ol)	cf]n	cf]n						

3. Vegetables

Food code	English Name	Nepali Name	Maithili name	OsfO	at{dfg d'No Current p	Hff8f]sf] d'No Winter	r}t a};fvsf] d'No Sp	aiff{bsf] d'No Monsoon	bz}, ltxf/ jf 5}7sf
3201	Amaranth leaves	n6] ;fu	78Lof ;fu						
3202	Broad leaf mustard	/fof]sf] ;fu	/fO{ s] ;fu						
3203	Lamb's quarter (Goosefoot)	a]y]	ay'jf						
3204	Jute leaves /White jute shoots	k6'jf	k6'jf						
3205	Coriander leaves	wgLofsf] kft	wgLof s] kOf						
3206	Spinach	kfn+'uf] ;fu	kfns s] ;fu						
3207	Fenugreek leaves	d]yL ;fu	d]yL s] ;fu						

Page 2

Annex 9.1 Wealth group representatives' interview form, included in Practitioners' Guide (FEG 2011)

Practitioners' Guide — Chapter 3: Annex A, Interview Form 4

1. ***FOOD AND CASH FROM CROP PRODUCTION:*** *Obtain quantified information on all food sources for a typical household in this wealth group in the reference year (remind participants of the specific year you are interested in).*

Own crop production: SEASON 1

Crop (food crops, cash crops, vegetables, residues)	Unit of measure and weight	Quantity produced	When	Quantity sold / exch.	Price sold per unit	Cash income	Other use*	Balance consumed (in kg)	% of HH food needs
Total crop food & income →									

Own crop production: SEASON 2

Crop (food crops, cash crops, vegetables, residues)	Unit of measure and weight	Quantity produced	When	Quantity sold / exch.	Price sold per unit	Cash income	Other use*	Balance consumed (in kg)	% of HH food needs
Total crop food & income →									

* 'Other uses' for crops include: seed, payment for labour, repayment of loans, gifts (to other households, church, funerals, etc.), brewing, stored until next year

2. ***PURCHASE AND EXCHANGE of staple and non-staple FOOD for consumption (not for trade)***

Commodity (e.g. cereals, pulses, oil, sugar, meat)	**Unit of measure and weight**	**Quantity purchased**	**Frequency** (per week or month)	**Duration** (number of weeks or months)	**When** (which months?)	**Total kilos purchased**	**% of annual HH food needs**	**Price per unit**	**Total cost**
Purchased food & cost total →									

3. ***LABOUR EXCHANGE - payment in food (BUT NOT FOOD FOR WORK)***

Activity	**Unit of work** (e.g. day, hectare)	**Number of people doing this activity**	**Frequency** (per week or month)	**Duration** (no. of weeks or months)	**When** (which months?)	**Payment per unit of work**	**Total kilos received per year**	**Other use**	**Balance consumed**	**% of annual HH food needs**
Labour exchange total →										

4. ***RELIEF (including free distributions and food-for-work)/ GIFTS / LOANS / TARGETED FEEDING (food)***

Description	Quantity (and unit of measure)	Frequency (per week or month)	Duration (weeks or months)	When (which months?)	Total received	Quantity sold	Price per unit sold	Food income	Other use (e.g. gifts, exchange)	Balance consumed	% of HH food needs
Total →											

5. ***WILD FOODS, FISH AND GAME***

Description	Quantity (and unit of measure)	Frequency (per week or month)	Duration (weeks or months)	When (which months?)	Total collected	Quantity sold	Price per unit sold	Cash income	Other use (e.g. gifts, exchange)	Balance consumed	% of HH food needs
Total →											

6. ***OTHER FOOD SOURCES (e.g. stocks carried over from previous year)***

Commodity	Quantity	Other use	Other use	Balance consumed	% of HH food needs

7. CASUAL LABOUR / EMPLOYMENT / REMITTANCES IN CASH

Activity / income source[†]	Unit of work (e.g. day, acre)	Number of people doing this activity	Frequency (per week or month)	Duration (no. of weeks or months)	When (which months?)	Payment per unit of work	Receives lunch / cooked meal?	Total cash income per year
Total →								

8. SELF-EMPLOYMENT / SMALL BUSINESS / TRADE

Activity / income source[‡]	Unit of measure (e.g. bundle, sack, period)	Number of people doing this activity	Frequency (per week or month)	Duration (no. of weeks or months)	When (which months?)	Price or Profit per unit sold	Total cash income per year
Total →							

[†] Checklist: agricultural labour (clearing fields, preparing land, planting seeds, weeding, harvesting, threshing), construction, brick making, skilled casual labour (e.g. carpentry), salaried employment, domestic work, livestock herding, pension, remittances).

[‡] Checklist for self-employment: collection of firewood, charcoal, grass, handicrafts, brewing. Checklist for small business and trade: petty trade, trade, rental/hire, kiosks and shops.

9. OTHER CASH INCOME SOURCES – GIFTS / LOANS

Activity / income source	**Unit of measure** (e.g. bundle, sack, period)	**Number of people doing this activity**	**Frequency** (per week or month)	**Duration** (no. of weeks or months)	**When** (which months?)	**Price per unit sold**	**Total cash income per year**
Total →							

15. SUMMARY OF REFERENCE YEAR SOURCES OF FOOD AND CASH INCOME

SOURCES OF FOOD

	Crop production	Livestock production (milk/meat)	Purchase and exchange	Labour exchange	Relief	Gifts and loans	Wild foods	Other	TOTAL
Calculated (%)									

SOURCES OF CASH INCOME

	Sale of crop production	Sale of livestock and livestock products	Labour, employment and remittances	Self-employment, small business, trade	Other income	TOTAL
Calculated (cash)						