

**The development of restricting anorexia nervosa: does personality predict
individuals' responses to short-term fasting?**

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Thesis declaration form

I 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.

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Overview

This thesis begins with a review of the literature on interventions to reduce childhood overweight, and their impact on eating disorder psychopathology. The review includes 25 articles reporting on 24 interventions aimed primarily at reducing overweight in children aged five to 18, and focuses in particular on eating disorder pathology outcomes.

The literature review is followed by empirical paper on a study exploring the relationship between personality variables and responses to short-term fasting in healthy controls. The study focuses in particular on personality variables linked to restricting anorexia nervosa, that is, high persistence and constraint, and low novelty-seeking. The study assesses whether scores on these personality variables affect how individuals respond to 18-hour fasting in terms of mood, irritability, sense of reward, achievement, self-control, and pride.

The empirical paper is followed by a critical appraisal of the work. This appraisal reflects on the process of undertaking the literature review and empirical research. Some of the methodological limitations of the research will be discussed, including using a non-clinical sample, limitations of the statistical analyses used, and challenges of using personality measures. The ethical implications of the study will be considered. The process of conducting joint research will also be discussed, and recommendations for future research will be made.

Please note: this study was, in part, a joint project, with Sebastien Thompson (trainee clinical psychologist, UCL). The contributions made by each trainee are described in Appendix A.

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Part 1: Literature Review

The impact of child weight reduction programs on eating disorder pathology

Abstract

Aims. There is concern that childhood weight-reduction programs may lead to eating disorder (ED) pathology. The aim was to provide a recent review of the impact of weight-reduction interventions on ED psychopathology or risks.

Method. Reference lists and five electronic databases were searched to identify articles on overweight interventions for children aged five to 18, from 2008 to present. Papers were required to report on ED psychopathology.

Results. The search yielded 267 articles on obesity interventions, of which 54 reported on psychosocial variables. Twenty-five articles, covering 24 studies, reported specifically on ED pathology or risks, and met inclusion criteria.

Conclusions. Higher quality studies indicated that interventions had a beneficial or neutral influence on ED pathology. The ED pathology adversely affected included weight concern, body dissatisfaction, and weight-related teasing. Studies used varying methodologies and assessment tools, and often did not report effect sizes, limiting the conclusions that could be drawn.

The impact of child weight reduction programs on eating disorder pathology

According to the World Health Organisation (WHO), overweight and obesity are defined as excessive fat accumulation that may impair health. A crude measure of this is body mass index (BMI), which uses a ratio of body mass divided by height squared to classify overweight and obesity. Overweight and obesity are of interest because worldwide obesity has more than doubled since 1980 (WHO, 2012), with the annual direct cost of obesity to the NHS estimated to be around £5.1 billion (Department of Health; DOH, 2012). Obesity raises the risk of cardiovascular disease, diabetes, musculoskeletal problems and some cancers.

Of particular concern is the increase in overweight in children; in 2010 more than 40 million children younger than five were overweight (WHO, 2012), and in the Health Survey for England (HSE) in 2010, 30.3% of children aged two to 15 were overweight or obese (HSE, 2010). Overweight in childhood is moderately-highly predictive of overweight in adulthood (Freitas et al., 2012; Herman, Craig, Gauvin, & Katzmarzyk, 2009; Juhola et al., 2011), and in a systematic review, (Singh, Mulder, Twisk, van Mechelen, & Chinapaw, 2008) high-quality studies indicated that the risk of overweight children becoming overweight adults is at least double that of normal weight children.

Furthermore, in addition to increased physical health risk, childhood overweight that persists into adulthood has been linked with adverse psychological outcomes and lack of meaningful employment in women, and low educational achievement in men (Viner & Cole, 2005) and lower income, higher poverty, and lower marriage rates (Hwang et al., 2006). Childhood overweight has also been linked to eating disorder (ED) symptomology, including elevated risk of bulimia nervosa (Fairburn, Welch, Doll, Davies, & O'Connor, 1997; Stice, 2002; Striegel-

Moore, Silberstein, & Rodin, 1986) and binge eating disorder (Fairburn et al., 1998), with youth seeking weight-loss treatment often displaying binge-eating (Decaluwe, Braet, & Fairburn, 2003; Doyle, le Grange, Goldschmidt, & Wilfley, 2007; Eddy et al., 2007; Glasofer et al., 2007; Goosens, Braet, & Decaluwe, 2007). Overweight children have been found to engage in more eating disordered behaviour and experience more eating disorder related cognitions (Tanofsky-Kraff et al., 2004).

Much attention has been given, in the recent years, to the treatment and prevention of overweight and obesity in children. A meta-analysis of 55 studies reporting on outcomes of interventions to prevent obesity (Waters et al., 2011) demonstrated that programs reduced adiposity, particularly for children aged six to 12 years. However, not all interventions were effective and it was not possible to determine which components or treatments were most effective. No evidence of adverse outcomes such as unhealthy dieting or body dissatisfaction was found, however, only eight studies assessed adverse effects. Carter and Bulik (2008) also reviewed studies reporting on effectiveness of obesity prevention and found that, of 22 studies, none compared rates of eating disorders across control and intervention groups, and that potential iatrogenic effects were poorly assessed. In another review (van Wijnen, Wendel-Vos, Wammes, & Bemelmans, 2009) of 53 interventions, only seven measured psychosocial variables, one of which found a statistically significant decrease in use of purging or diet pills, and one of which found a decrease in ratings of aggression. The authors recommended that future programmes should be evaluated in a uniform way on a range of psychosocial outcomes.

Why measure psychological outcomes?

Given that overweight children are at increased risk of eating disorder symptomatology, they may represent a group particularly vulnerable to iatrogenic

effects of weight loss treatments. Neumark-Sztainer, Wall, Story and Sherwood (2009) used a longitudinal design to identify several risk and protective factors for disordered eating in overweight adolescents; risks that were highlighted included higher importance placed on weight, and reading magazine articles about weight loss. In males, depression was predictive of disordered eating, and for females, higher self-esteem was protective. Other protective factors included family connectedness and body satisfaction. Other research found that, in overweight children, increased negative affect, internalised thin-ideal, and decreased perfectionism were associated with more eating disorder symptomatology (Eddy et al., 2007). Research suggests that the relationship between overweight and disordered eating is mediated by weight and shape concerns (Russell-Mayhew, McVey, Bardick, & Ireland, 2012; Stice, 2002), for example, by leading to increased social pressure to be thin, body dissatisfaction, bingeing and dietary restraint (Goldschmidt, Aspen, Sinton, Tanofsky-Kraff, & Wilfley, 2008; Jacobi, Hayward, de Zwaan, Kraemer, & Agras, 2004; Stice, Presnell & Spangler, 2002; Stice & Whitenton, 2002; Strauss, 2000; Vander Wal & Thelan, 2000). Interestingly, obese individuals who underestimate their weight, perceiving themselves as overweight rather than obese, report significantly less eating disorder psychopathology than those who accurately perceive their weight as obese (Jones, Grilo, Masheb & White, 2010). Overweight adolescents at high risk for eating disorders, that is, those who are overweight and experiencing weight and shape concerns, are more likely to experience depression, anxiety, and stress (Doyle et al., 2007), which may also mediate the relationship between overweight and psychopathology (Burrows & Cooper, 2002).

Weight-related teasing has been found to predict weight and shape concern, over and above BMI (Eddy et al., 2007; Libbey, Story, Neumark-Sztainer, &

Boutelle, 2008; Sinton et al., 2011). A recent review suggested that weight-related stigmatisation and teasing are mediators between overweight and poor psychosocial outcomes (Russell-Mayhew et al., 2012). Russell-Mayhew et al. (2012) suggest that focusing on weight per se engenders discontent in overweight children and encourages unhealthy self-monitoring and weight control behaviour. They recommend a shift to using weight-neutral outcomes and highlight the benefits, both physiological and psychological, of approaches that aim for weight-neutral, as opposed to weight-loss, goals. Some recent randomised controlled trials (RCTs) of weight-neutral approaches in adults, which focus on healthy behaviour for people of all sizes without using weight as an outcome, have indicated significant improvements in psychological and behavioural outcomes (for example, Bacon et al., 2002; Bacon, Stern, Van Loan & Keim, 2005; Provencher et al., 2009). However, to our knowledge, programs of this kind have not been tested in children. Bacon and Aphramor (2011) suggest that body weight is an inappropriate target for public health intervention and they recommend that interventions should be holistic and encourage body acceptance, self-esteem and respect for body size diversity. Furthermore, when treating childhood overweight, attention should be paid to psychological variables such as binge eating, not only to monitor iatrogenic effects of treatment, but also because they have been linked to increased weight gain over time (Tanofsky-Kraff et al., 2006) and may attenuate weight loss in treatment (Braet, 2006).

This review follows earlier reviews of studies reporting on outcomes of obesity prevention programs (Carter & Bulik, 2008; van Wijnen, et al., 2009) which indicated that psychological variables were under-assessed. These reviews concluded that existing evidence did not indicate that obesity prevention programs increase

eating pathology. However, eating pathology outcomes were poorly assessed so it was not possible to draw firm conclusions. Therefore, this review will focus on whether studies of obesity prevention programs in children are now reporting more on psychological outcomes. Given research indicating elevated eating disorder symptomatology in overweight children, and the link with weight stigmatisation, and also the fact that iatrogenic effects are generally poorly measured in psychological treatments (Barlow, 2010), this review will focus on whether these interventions increase different types of eating disorder pathology. Loosely based on Carter & Bulik's review (2008), the current review will assess the impact of weight-reduction interventions on underweight or excessive weight loss, binge eating, bulimic symptoms, weight control behaviours, over-concern with weight or shape, body image or body dissatisfaction, self-esteem, weight-related teasing, parental attitudes and behaviour.

Method

Search strategy

A computerised search was carried out to identify publications. I searched five electronic databases; Medline, Embase, PsychINFO, CINAHL and Web of Science using the terms 'obesity' or 'overweight' combined with 'treatment', 'prevention' or 'intervention' as keywords. The 'limits' option was then used to confine the search to papers from 2008 to current (October 2012). In Medline, Embase, PsychINFO and CINAHL the limit was set to only search for papers referring to research with children up to the age of 18. The type of publication was limited to 'randomised controlled trials' or 'treatment outcome' in PsychINFO and 'controlled clinical trial' or 'clinical trial' in Medline, Embase and CINAHL. It was not possible to limit the results in Web of Science to research with children or by

publication type. Finally, reference lists of relevant articles were manually searched for other relevant papers.

Inclusion criteria. In this review only papers published in English were included; while this may lead to loss of information, it was not possible to translate articles. Articles were only included if they used a human population of children aged five to 18 and reported on the outcomes of an intervention aimed primarily at reducing overweight, obesity or risk of overweight or obesity. Papers were also required to report on eating disorder psychopathology or symptoms. In line with previous reviews (Carter, & Bulik, 2008; Waters et al., 2011) only papers reporting on interventions with a minimum duration of 12 weeks were included.

Exclusion criteria. Studies were excluded if they were published before 2008 as the literature prior to this was covered in a previous review (van Wijnen, et al., 2009). Studies were excluded if they were not written in English, used an adult population or children under the age of five, or reported only on general psychopathology, for example, wellbeing as opposed to eating disorder specific symptomatology. Non-data papers, for example, debates and editorials, were not included.

Results

The initial search yielded 2295 results. Once duplications were deleted this decreased to 1846. The abstracts were screened, applying exclusion criteria, and a further 1533 were excluded. This resulted in 353 abstracts, of which 267 were obesity interventions. Of these, 215 were excluded as they did not report on psychosocial variables. This left 54 articles that had measured psychosocial variables. Thirty of these reported specifically on eating disorder pathology or risks, as opposed to general psychosocial wellbeing. Four more were excluded as they focused on

interventions with durations shorter than 12 weeks or tested children aged under five.

This yielded a final selection of 25 articles reporting on 24 studies to be reviewed.

Figure 1 shows a flow chart of the selection process. Table 1 shows details of the 25

articles included in the review.

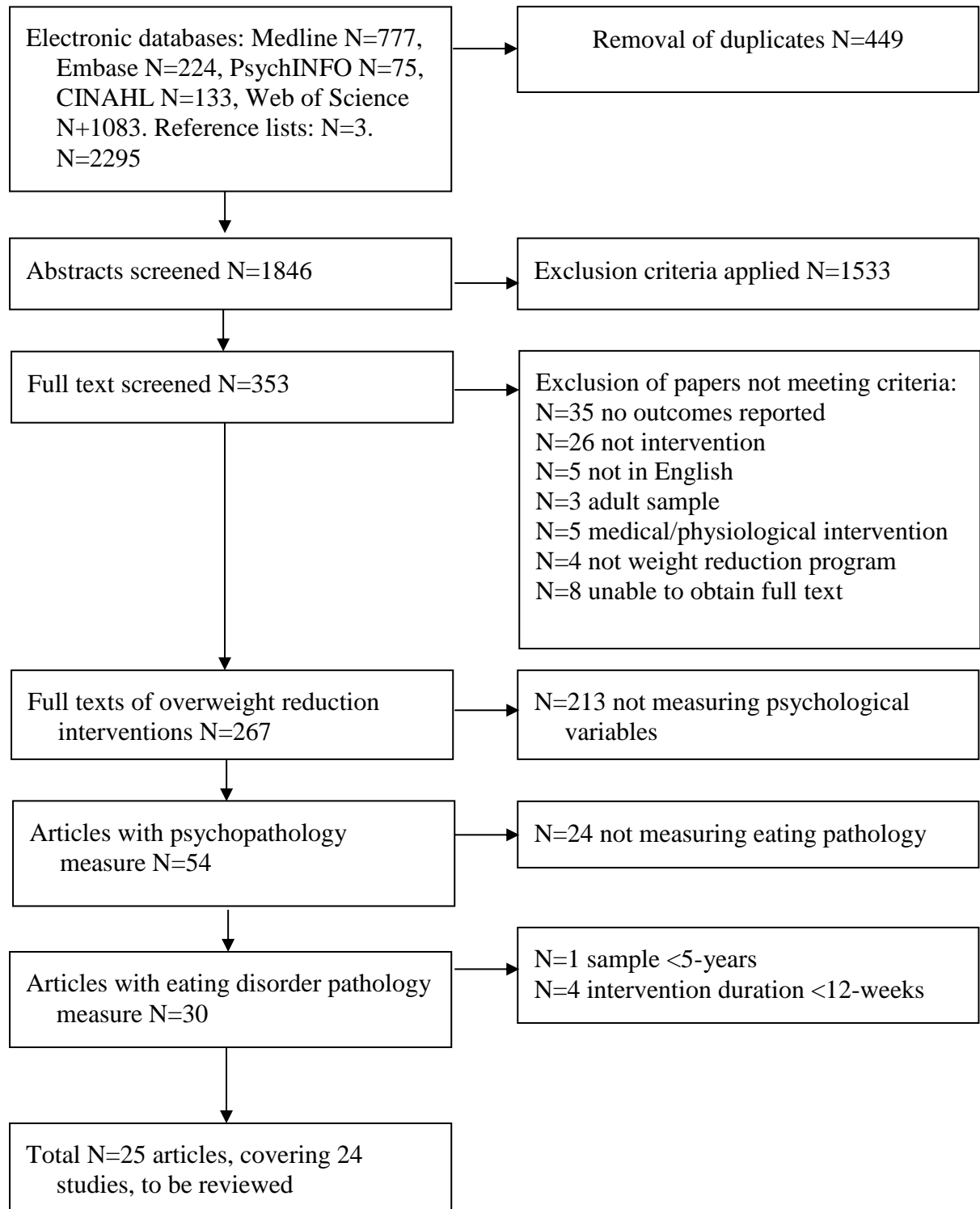


Figure 1. Flow chart of the selection process.

Table 1

Summary of studies included in this review, including eating disorder pathology outcomes

Authors (date)	Sample characteristics	Sample size	Study design	Treatment approach	Main outcome measures	Duration and follow-up	Brief description of eating disorder pathology outcomes
Adam, Westenhofer, Rudolphi & Kraaibeek, 2009	Obese children aged ≥ 10 in Germany	75 controls, 162 intervention group	Non-randomised controlled trial	Inpatient therapy for 6 weeks. Nutrition education, exercise and behavioural therapy. Then eleven 1-hour home-based sessions	BMI, eating behaviour using abridged version of the TFEQ (in German), food intake, PA, screen time, fitness, self-perception, quality of life	1 year. Measures at baseline and 6 months	Cognitive control, restrained eating and flexible control increased. Disinhibition decreased.
Brennan, Wilks, Walkley, Fraser, & Greenway, 2012 CHOOSE HEALTH	Overweight or obese children aged eleven to 18	N=63	RCT with waitlist control, single crossover design	CBT to improve diet and increase PA. Twelve 1-hour sessions and 1 phone session over 14 weeks. Followed by maintenance phase of two 1-hour sessions and seven 15-minute phone calls	Self-esteem, social support, familial/peer influence on health behaviour, psychopathology, eating/weight psychopathology (ADS, EDI-II and Automatic Thoughts Questionnaire) body satisfaction, perfectionism, social and family functioning,	Twenty weeks. Measures at baseline, 10 and 20 weeks	Increased ADS in treatment group, remaining higher at maintenance. No difference on EDI-II subscales, or automatic thoughts, between intervention and controls following treatment

Authors (date)	Sample characteristics	Sample size	Study design	Treatment approach	Main outcome measures and parenting	Duration and follow-up	Brief description of eating disorder pathology outcomes
Croker et al. 2012	Overweight / obese children aged eight to 12 in hospital setting	N=72	RCT with waitlist control	Family-based behavioural treatment based on learning theory. Fifteen groups for parent and child over 6 months. Improve diet, reduce sedentary behaviour, and increase PA	BMI, anthropometrics, self-esteem, mood, parent-reported child difficulties, QoL, diet, bulimia/food preoccupation, and oral control CHEAT subscales	6 months. Measures at baseline, post-test, and anthropom etric data at 12 months	No significant differences between groups for the bulimia/food preoccupation or oral control CHEAT sub-scales
De Niet et al. 2012	Overweight / obese children aged seven to 12 who had participated in the BFC interventions 2006-2009, recruited from Dutch hospitals	N=141 73= short messag e service mainten ance treatme nt 68=con trol	RCT with 2 arms (both groups had received weight-loss treatment)	Intervention group received weekly messages by telephone for 9 months after obesity treatment.	BMI, emotional eating, external eating, restrained eating (DEBQ), self-perceived scholastic, social, athletic, physical and behavioural competence, global self-worth, health related QoL	9 months. Measures taken at 3, 9 and 12 months	Small decrease in emotional eating in intervention group. Small reduction in external eating for intervention and control. No difference in emotional or restrained eating in intervention vs. controls

Authors (date)	Sample characteristics	Sample size	Study design	Treatment approach	Main outcome measures	Duration and follow-up	Brief description of eating disorder pathology outcomes
Follansbee-Junger, Janicke, & Sallinen, 2010	Overweight children aged eight to 13 and their parents. Rural communities in Florida	N=68	RCT with 3 arms; behavioural family intervention, behavioural parent only intervention and waitlist control	Either parent and child, or parents only attended twelve 90-minute groups over 16 weeks focusing on improving diet, increasing activity, reducing sedentary activity, self-esteem, body image, and healthy/unhealthy eating.	BMI, ChEAT, child-perceived peer victimisation, body image (The Children's Body Image Scale), and parental control over child's eating (Restriction and parent concern subscales of the Child Feeding Questionnaire)	16 weeks. Measures at baseline, post-treatment and 6 months follow up	Intervention group: no change in ChEAT scores. Baseline body dissatisfaction predicted eating attitudes at follow up. Disordered eating attitudes, body dissatisfaction, and parent reported concern about child weight/ restrictive feeding positively correlated with disordered eating attitudes at follow up. No change in unhealthy eating attitudes in intervention arms

BMI, dietary intake,

Authors (date)	Sample characteristics	Sample size	Study design	Treatment approach	Main outcome measures	Duration and follow-up	Brief description of eating disorder pathology outcomes
Foster, et al. 2008	Children aged 9-12 in 10 schools in a mid-Atlantic city, USA	N=1349	Cluster RCT with 5 intervention and 5 control schools	Intervention schools trained staff, 50 hours of nutrition education to pupils, improved nutritional standard of meals, and family outreach	physical activity, sedentary behaviour, body image (body dissatisfaction subscale of the Eating Disorder Inventory-2 (EDI-II))	2 years. Measures at baseline, 1 year later	No adverse effects on body image or prevalence of underweight, in intervention group
Gesell, Scott, & Barkin, 2010	Latino children aged 8-11 with BMI >85th percentile and parent	N=61	Pilot RCT, controls received baseline and follow-up standard care counselling	6x monthly sessions. First meeting at health clinic using MI, setting activity goals, 45-min session on lifestyle. Subsequent 5 sessions were at recreation centre, 1-hour session on PA	BMI, dietary intake, physical activity, sedentary behaviour, perceived body size (using pictures of body sizes)	6 months. Measures at baseline and 6 months	At baseline 39.3% children underestimated body size. Non-significant difference between intervention and control at 6 months; 40.7% intervention group and 21.2% controls rated body size accurately
Goossens, Braet, Verbeken, Decaluwe,	Overweight children aged ten to 17 who had undergone	N=56	Cohort study, pre-post follow up	Follow up of children who participated in a ten-month inpatient non-	BMI, ChEDE (restraint, eating, shape, weight concerns, loss of control, and weight	6 years. Measures at baseline (before 10	Baseline SBEs, and loss of control did not predict follow up. OBEs most

Authors (date)	Sample characteristics	Sample size	Study design	Treatment approach	Main outcome measures	Duration and follow-up	Brief description of eating disorder pathology outcomes
& Bosmans, 2011	a 10 month inpatient, non-diet healthy lifestyle program 6 years earlier			diet healthy lifestyle program	control subscales). Objective and subjective binge episodes. EDI-II (drive for thinness, bulimia, body dissatisfaction), mood	month weight loss intervention) and 6 year follow up	stable pathology. Eating concern: moderately stable. Drive for thinness and body dissatisfaction: highly stable. Decrease in eating concern, drive for thinness, bulimia, body dissatisfaction
Jones et al. 2008	Adolescents at risk of overweight from 2 high schools in Idaho and California, USA. ≥ 85 th percentile for BMI, binge eating/overeating ≥ 1 times p/week	N=105	RCT, with waitlist control	Internet-based CBT weight management program to reduce binge eating/overeating, prevent weight gain, increase healthy eating, increase physical activity, reduce sedentary behaviour.	BMI, OBEs, SBEs and overeating (semi-structured interview adapted from the Eating Disorder Examination; EDE), dietary fat and sugar intake, depressive mood, program adherence	16 weeks. Measures at baseline, post-intervention, 9 month follow up	OBEs and SBEs reduced, weight/shape concern decreased in completers. No change in overeating. No relationship between change in BMI and binge eating. Larger decrease in BMI if more baseline

Authors (date)	Sample characteristics	Sample size	Study design	Treatment approach	Main outcome measures	Duration and follow-up	Brief description of eating disorder pathology outcomes bingeing
Lofrano-Prado et al. 2009	Obese adolescents aged 13-19 recruited from obesity intervention program outpatient clinic in Sao Paulo. BMI >95 th percentile	N=66	Pre-post comparison of 12-week short-term (ST) and 24-week long-term (LT) lifestyle interventions. No controls	Monthly meeting with endocrinologist, weekly groups on body image, eating disorders, food and feelings, and family problems. Weekly nutritional therapy, PA 3x weekly	BMI, body composition, anxiety, health related QoL, body dissatisfaction (Body Shape Questionnaire; BSQ), binge eating behaviour (Binge Eating Scale; BES), depression	12 or 24 weeks. Measures pre-post	Girls: decreased body dissatisfaction after LT treatment. Boys: decreased body dissatisfaction after ST treatment. Decrease in binge eating in all after LT treatment
Marcus et al. 2009	Children aged 6-10 from 10 schools in Stockholm County, Sweden	N=313 5	Cluster RCT with 5 intervention and 5 control schools	Intervention schools changed environment to increase physical activity, and improve diet	BMI, physical activity, eating habits, and eating attitudes (ChEAT)	4 years	No difference in ChEAT scores between intervention and control schools
Melin & Lenner, 2008	Overweight children aged 7 in 13 primary	N=20	Single group pre-post design, no	School nurses provided monthly meetings with child	BMI, wellbeing, lifestyle, perceived body size (figural	1 year. Measures at	Figural selection: 5 children could not answer questions at

Authors (date)	Sample characteristics	Sample size	Study design	Treatment approach	Main outcome measures	Duration and follow-up	Brief description of eating disorder pathology outcomes
	school in Sweden and their families		control group	and family in school. Diet and PA advice. Children weighed at each meeting	selection)	baseline, monthly weighing, and 1 year follow up	follow up, 5 were unchanged pre-post intervention, 6 felt smaller, 4 felt larger
Millar et al. 2011	Children aged 12-18 from secondary schools in Barwon-South West, Victoria, Australia	N= ~3406 at intervention schools	Quasi-experimental, longitudinal cohort follow up. Five intervention, 7 control schools	Community-based intervention increasing fruit and vegetable intake, improving school meals, promoting PA, and body satisfaction	BMI, percentage body fat, diet, PA, QoL, perception of body size and family and home environment, eating behaviour, body image, and attempts to lose weight	3 years. Measures at baseline and follow up	No increase in proportion of students trying to lose weight
Moens, Braet, & Van Winckel, 2010	Children (mean age 18 at follow up) aged who had participated in CBT lifestyle program to improve diet and increase PA from 1994-	N=90	Single group, 8 year follow up	CBT program to improve diet and increase PA. Groups for eight to 13 year olds, individual sessions for children <8 or >13. Six bi-weekly sessions in 12 weeks and follow up phase	BMI, Dutch Eating Behaviour Questionnaire; DEBQ, self-perception, parent-rated child emotional and behavioural problems, maternal psychological variables	1 year. Measures at admission, post and follow up	Age, adjusted BMI, and global self-esteem predicted weight change. Maternal psychopathology significant negative determinant of LT weight outcome

Authors (date)	Sample characteristics	Sample size	Study design	Treatment approach	Main outcome measures	Duration and follow-up	Brief description of eating disorder pathology outcomes
	1997						
Neumark-Sztainer, Haines et al. 2009 Ready. Set. ACTION!	Children aged 9-12 from 4 schools in MN, USA	N=96 children and 61 = parents	Pre-post, randomised controlled design feasibility study. Two intervention and 2 control schools	Theatre-based program using SCT. Intervention of fourteen 2-hour theatre sessions on behavioural change, diet, PA and body image	BMI, child behaviour, self-efficacy, weight concerns, body satisfaction, self-worth (assessed with survey designed for the study), family/home environment	Measures pre (autumn 2006) and post (spring 2007)	Intervention group: Small increase in weight concern and non-significant increase in body satisfaction. Slightly lower self-worth in intervention group post-intervention. Parental weight talk increased
Neumark-Sztainer et al. 2010 New Moves	Adolescent girls (mean age 15.8) from schools in Minnesota, USA. 46% were overweight/obese	N=356	Group RCT with 6 intervention and 6 control schools	Physical education classes and nutrition or social support/empowerment classes, individual counselling using MI. Focus on increasing PA, improving diet, and avoiding unhealthy weight control	BMI, percentage body fat, PA, sedentary activity, dietary intake, eating patterns, unhealthy weight control behaviours, body/self-image (measured using New Moves Survey designed for the study).	One year. Measures at baseline, post-intervention, 9 months	Decreased percentage of girls using unhealthy weight control. Intervention girls: increased body satisfaction, perceived athletic competence and self-worth. Non-significant

Authors (date)	Sample characteristics	Sample size	Study design	Treatment approach	Main outcome measures	Duration and follow-up	Brief description of eating disorder pathology outcomes
				behaviour. Used SCT			reductions in binge eating and improved self-perceived appearance
Nguyen et al. 2012 Loozit 12 month outcomes	Overweight and obese adolescents aged 13-16 at local community health centre in Sydney, Australia	N=151	Two-arm RCT, Loozit vs. Loozit Additional Therapeutic Contact (ATC)	Phase 1 (1-2 months): 75 min. weekly CBT groups separate for child and parents., Phase 2 (2-24 months): 3 monthly boosters, Loozit ATC had telephone/ electronic contact	BMI, metabolic profile, mental health, QoL, perceived body shape (silhouette figures), social status, self-perception/self-worth, dietary intake, PA, sedentary activity	24 months. Baseline, 2-month (end of phase 1), and 12-month measures	Reduced body dissatisfaction and increased global self-worth baseline-12 months. Most other domains improved over time except for lower scholastic competence in Loozit ATC
Robinson et al. 2010 Stanford Gems	African-American girls aged 8-10 with BMI \geq 25th percentile	N=261	2-arm RCT comparing after-school hip-hop to active placebo control of information-	Uses SCT, dance 5 days a week for a school year. Mentors offering home visits. Controls given health education newsletters	BMI/anthropometric, PA, screen time, diet, overconcern with weight/shape (McKnight Risk Factor Survey), perceived body shape, body dissatisfaction	Two years. Measures at six, 12, 18, and 24 months.	No increases in weight concern or body dissatisfaction. Significant decrease in depressive symptoms in intervention group. No significant

Authors (date)	Sample characteristics	Sample size	Study design	Treatment approach	Main outcome measures	Duration and follow-up	Brief description of eating disorder pathology outcomes
			based health education		(silhouettes), depression, self-esteem, and school performance		change in self-esteem
Salmon, Ball, Hume, Booth, & Crawford, 2008	Children aged 10-11 from 3 low SES schools in Melbourne, Australia.	N=268	4-arm group RCT comparing behaviour modification (BM), fundamental movement skills (FMS), combined BM-FMS, and waitlist control	Three intervention, 3 control school classes. SCT and behavioural techniques. All treatment delivered in usual physical education class over nineteen 40-50 min. lessons	BMI, PA, self-reported screen time, enjoyment of PA, fundamental movement skills, food intake, adverse psychological consequences (measured with 2 questions designed for the study)	One school year. Baseline - post, 6-month post, and 12-month post measures	No effect on unintended outcomes. Gender moderated intervention effects - boys in FMS and combination group significantly more satisfied with body shape after intervention compared to controls. No effect for girls
Sanigorski, Bell, Kremer, Cuttler, & Swinburn, 2008	Children aged 4-12 from 4 preschools and 6 primary schools in Colac, Australia.	839 completers in Colac and 979 controls	Quasi-experimental, non-randomised, pre-post intervention	Intervention schools reviewed governance, set objectives e.g. reducing screen time, increasing	BMI, adverse consequences including prevalence of underweight, behaviour increasing risk of ED, unhappiness with body	Measures at baseline in 2003 and follow up in 2006	No adverse effects; no increase in underweight or unhappiness with body size, not feeling good about

Authors (date)	Sample characteristics	Sample size	Study design	Treatment approach	Main outcome measures	Duration and follow-up	Brief description of eating disorder pathology outcomes
Active Eat Well	Australia vs. 16 stratified random comparison schools		vs. control	water consumption, small parent support program	size (measured using survey created for study)		themselves, attempts to lose weight in last 12 months, frequency of teasing about weight
Shrewsbury, et al. 2011 Loozit short-term outcomes – see Nguyen 2012							
Singhal, Misra, Shah, & Gulati, 2010	Asian Indian adolescents aged fifteen to 17 in 2 schools in N. India	N=201 11 th graders	Community based controlled trial. 1 intervention vs. 1 control school	Intervention received 6 months of nutrition education groups, weekly PA, group counselling by nutritionists. Control school: no intervention	BMI/ anthropometrics, PA, food knowledge and attitudes, lifestyle changes, body image, self-esteem (measured with questionnaire designed for the study)	Forty-two weeks, measures pre and post	Decrease in proportion of children in intervention school who stopped avoiding clothes that made them look overweight (compared to

Authors (date)	Sample characteristics	Sample size	Study design	Treatment approach	Main outcome measures	Duration and follow-up	Brief description of eating disorder pathology outcomes (increase in control school)
Van Vlierbergh e, Braet, Goossens, Rosseel, & Mels, 2009	Adolescents aged 14-18 with BMI $\geq 95^{\text{th}}$ percentile in obesity treatment centre, Ghent, Belgium	N=31	Single group cohort design	10-month inpatient treatment. Non-diet healthy lifestyle CBT program. Focus on healthy food choices, lifestyle, and PA	BMI, psychopathology, emotional and behavioural problems, eating disorders symptoms (ChEDE and EDE-Q)	10 months. Baseline, 1-month, 4-month, and post measures,	No change in restraint. Decreased eating concern, shape concern, weight concern. Reported binge eating decreased from 30.3% pre to 12.9% post-intervention
Wake et al. 2009 LEAP 2	Overweight/obese children aged between 5-10 recruited through GP in Victoria, Australia	N=258	RCT of GP-delivered intervention vs. controls receiving no intervention	Four GP consultations over 12 weeks. Solution focused approach to set and monitor lifestyle goals. Factsheets on diet, PA, sedentary behaviour, water, family eating	BMI, waist circumference, parental BMI, PA, nutrition, diet, health related QoL, body satisfaction (figural selection), physical appearance and self-worth (six statements with binary responses)	12 weeks. Measures at baseline, 6 and 12 months	No difference in body dissatisfaction between groups. No difference in rating of appearance and self-worth between groups

Authors (date)	Sample characteristics	Sample size	Study design	Treatment approach	Main outcome measures	Duration and follow-up	Brief description of eating disorder pathology outcomes
Weintraub et al. 2008	Children aged 9-11 with BMI \geq 85th percentile recruited through primary care, schools, and community in low SES area of California, USA.	N = 21	Two-arm pilot RCT. After-school soccer vs. Active placebo health education program for controls	Team sports program controls received information sessions on healthy diet and physical activity.	BMI, PA, screen time, self-esteem, depression, concern with weight and shape (McKnight Risk Factor Survey)	Six months. Baseline (pre-randomisation), 3 and 6 month measures	No significant changes in weight/shape concern. No significant changes in self-esteem.

Note. Abbreviations: BMI: body mass index. TFEQ: Three Factor Eating Questionnaire. CBT: cognitive behavioural therapy. PA: physical activity. RCT: Randomised controlled trial. ADS: Adolescent Dieting Scale. EDI-II: Eating Disorders Inventory-2. QoL: quality of life. MI: Motivational Interviewing. DEBQ: Dutch Eating Behaviour Questionnaire. ChEDE: Children's Eating Disorders Examination. SBEs: subjective binge episodes. OBEs: objective binge episodes. EDE: Eating Disorders Examination. SCT: social cognitive theory.

Characteristics of the selected studies

The majority of the studies targeted children aged between seven and 12. Nine of the studies focused predominantly on adolescents (Brennan, Wilks, Walkley, Fraser, & Greenway, 2012; Goossens, Braet, & Decaluwe, 2007; Jones, Grilo, Masheb, & White, 2010; Lofrano-Prado et al., 2009; Millar et al., 2011; Neumark-Sztainer et al., 2010; Nguyen et al., 2012; Singhal, Misra, Shah, & Gulatin, 2010; Van Vlierberghe, Braet, Goossens, Rosseel, & Mels, 2009). The interventions were multifaceted, targeting, most commonly, diet, physical activity (PA) and sedentary behaviour. The psychological models most commonly drawn upon were behavioural, cognitive-behavioural, and social cognitive theory. Mode of delivery varied, with nine being predominantly school-based, eight based in healthcare settings, and seven being community-based. Two of the interventions incorporated inpatient treatment. Nine of the studies reported on preventative interventions, all of which were school or community-based (Foster et al., 2008; Marcus et al., 2009; Millar et al., 2011; Neumark-Sztainer, Haines et al., 2009; Neumark-Sztainer et al., 2010; Robinson et al., 2010; Salmon, Ball, Hume, Booth, & Crawford, 2008; Sanigorski, Bell, Kremer, Cuttler, & Swinburn, 2008; Singhal et al., 2010). The remaining 16 interventions described treatment for children who were overweight.

The estimated quality of the studies rated using a methodological checklist (Downs & Black, 1998) is summarised in Table 2 (see Appendix B for Downs and Black checklist). Owing to a lack of information on the statistical power in many of the included studies, the question on statistical power was adapted; studies were given a score of zero if there was insufficient power or if it was not possible to determine, a score of one if they were adequately powered for some analyses but not others (for

example, only powered to detect clinically significant effects in primary outcome variables), and a score of two if they were adequately powered to detect statistically significant change in all outcomes. This meant that studies were given a total score out of a possible 28 rather than 32 as per the original checklist. Post-hoc power analyses were attempted on each study, but these were not always possible to do due to lack of information. The majority of the studies received the minimum score for statistical power because power analyses were either not reported or not performed, or they were performed for change in the primary outcomes, that is, change in weight. Therefore, it was often difficult to assess whether studies were adequately powered to detect changes in secondary variables.

The highest quality study was Wake et al. (2009), as this used a RCT design, had a large sample, computer randomisation was performed by an independent statistician with researchers being blind to group allocation, a power analysis was performed for the primary outcome variables, there was consideration of confounding variables, and an intention to treat analysis (ITT) was used. However, the sample may have been unrepresentative as only one third of families who were approached agreed to participate, and statistical power decreased due to attrition. Other high quality studies were also RCTs (Croker et al., 2012; Jones et al., 2008; Nguyen et al., 2012; Robinson et al., 2010), in which assessors were also blinded to participant condition for at least one time-point, and ITT analyses were used. However, Nguyen et al. and Robinson et al. used active rather than waitlist controls, which may have diluted the observable effects of the interventions. Foster et al. (2008) also produced a high quality study of a policy-based intervention with a large, representative, school-based sample, and a follow-up period of

two-years. However, researchers were not blinded to condition, and lengths of follow-up varied considerably depending on the child's school year at study commencement.

Among the lower quality studies was Melin & Lenner (2008), as it lacked statistical power and a control group, did not use standardised measures, and adherence to the intervention was variable. Adam, Westenhofer, Rudolphi, and Kraaibeek's (2009) study was also of lower quality due to lack of randomisation, unequal group sizes, not presenting data clearly, significant drop out from the control group, multiple statistical testing without adjustment for type I error, and the authors being employed by the funding body. Moens, Braet, and Van Winckel (2010) was also a lower quality study; its eight-year longitudinal design was a strength, but conclusions were limited by the fact that there was no control group, and 62% of children had sought additional treatment between baseline and follow-up. Similarly, Van Vlierberghe, Braet, Goossens, Rosseel, & Mels (2009) used a longitudinal cohort design, but there was no control group, and they studied a unique sample of children who had undergone inpatient weight-loss treatment, and only half of the original sample was followed up. Neumark-Sztainer, Haines et al. (2009) and Gessell, Scott, and Barkin (2010) were the lowest quality studies. Although both studies used a randomised controlled design, Neumark-Sztainer's study was underpowered for statistical testing, and adherence to treatment was low, and Gessell et al. did not report a power analysis, and no adjustments were made for multiple statistical tests being conducted, increasing the risk of type I error.

The remaining studies tended to be of modest quality, the reasons being that participants were not randomised and when they were, allocation was not blinded. Many studies did not perform a power calculation or were underpowered to detect changes in psychological variables, which were generally secondary outcomes. Additionally, often

multiple statistical tests were performed without adjustments made for type I error.

Furthermore, the studies lacked external validity due to stringent selection criteria or the intervention not being representative of general treatment.

Table 2

Summary of the estimated methodological quality of the studies included in the present review rated using Downs and Black's (1998) checklist

Authors (year)	Reporting	External validity	Internal validity, bias	Internal validity, confounding (selection bias)	Statistical power	Total score out of 28
Adam, Westenhofer, Rudolphi & Kraaibeek, 2009	6	1	4	2	0	13
Brennan, Wilks, Walkley, Fraser, & Greenway, 2012	8	1	5	5	0	19
Croker et al. 2012	9	2	6	5	0	22
De Niet et al. 2012	8	1	5	5	1	20
Follansbee-Junger, Janicke, & Sallinen, 2010	9	1	5	3	0	18
Foster, et al. 2008	10	1	5	5	0	21

Authors (year)	Reporting	External validity	Internal validity, bias	Internal validity, confounding (selection bias)	Statistical power	Total score out of 28
Gesell, Scott, & Barkin, 2010	4	0	5	2	0	11
Goossens, Braet, Verbeken, Decaluwe, & Bosmans, 2011	8	0	5	2	1	16
Jones et al. 2008	8	2	6	5	2	23
Lofrano-Prado et al. 2009	7	0	5	2	1	15
Marcus et al. 2009	9	1	4	4	0	18
Melin & Lenner, 2008	7	0	4	2	0	13
Millar et al. 2011	9	0	5	3	0	17
Moens, Braet, & Van Winckel, 2010	7	0	4	3	2	16
Neumark-Sztainer, Haines et al. 2009	5	1	3	2	0	11

Authors (year)	Reporting	External validity	Internal validity, bias	Internal validity, confounding (selection bias)	Statistical power	Total score out of 28
Neumark-Sztainer et al. 2010	8	1	4	2	1	16
Nguyen et al. 2012	10	0	4	6	2	22
Robinson et al. 2010	10	1	4	5	1	21
Salmon, Ball, Hume, Booth, & Crawford, 2008	9	1	4	4	0	18
Sanigorski, Bell, Kremer, Cuttler, & Swinburn, 2008	9	1	3	3	0	16
Singhal, Misra, Shah, & Gulati, 2010	8	0	4	4	1	17
Van Vlierberghe, Braet, Goossens, Rosseel, & Mels, 2009	6	0	5	3	2	16

Authors (year)	Reporting	External validity	Internal validity, bias	Internal validity, confounding (selection bias)	Statistical power	Total score out of 28
Wake et al. 2009	11	2	6	6	0	25
Weintraub et al. 2008	8	0	4	3	1	16

Note. Checklist has been adjusted so that ratings of statistical power range from zero to two, rather than zero to five as per original checklist (Downs & Black, 1998). A score of zero indicates either insufficient statistical power to detect a clinically important effect where the probability value for a difference being due to chance <5%, or unable to determine whether there was sufficient power. A score of one indicates sufficient power on some outcome variables. A score of two indicates sufficient statistical power to detect a clinically important effect in all outcome measures where the probability value for a difference being due to chance <5%.

The effect of interventions on eating disorder pathology

Underweight or excessive weight loss. All of the 24 interventions involved children being weighed. Studies largely reported group average BMI scores, which may mask changes at an individual level such as healthy weight children moving to the underweight range. One paper did report on individual weight loss, saying that one child in the control group reduced BMI by 4.2, but this is unlikely to have placed the child in the underweight range as participants were initially in the obese range (Croker et al., 2012). Of the preventative studies, three used prevalence and incidence of overweight and obesity as outcomes (Foster et al., 2008; Marcus et al., 2009; Sanigorski et al., 2008). Two checked prevalence of underweight (Foster et al., 2008; Sanigorski et al., 2008), and one considered whether there was a reduction in BMI in lean children (Marcus et al., 2009). The only other preventative intervention in which excessive weight loss was considered was Robinson et al. (2010) in which excessive decreases in BMI or weight loss were checked for. No studies reported a difference between intervention and control groups in the numbers of children who were underweight, moved from normal to underweight, or the prevalence of underweight (Foster et al., 2008; Marcus et al., 2009; Robinson et al., 2010; Sanigorski et al., 2008).

Binge eating. Some studies reported specifically on binge eating as opposed to bulimic symptoms. One study explicitly aimed to reduce binge eating (Jones et al., 2010). The Child version of the Eating Disorder Examination (ChEDE; Bryant-Waugh, Cooper, Taylor, & Lask, 1996) provides an accurate way of measuring binge eating using a standardised clinical interview. The ChEDE measures objective bulimic episodes/binges (OBE; overeating with loss of control), subjective bulimic episodes/binges (SBE; that is loss of control perceived by the individual but with the

absence of objective bingeing as assessed by the interviewer), and objective overeating episodes (OOEs; overeating without loss of control). One study reported a significant decrease in the number of binges pre-to-post treatment, and no children continued to meet criteria for binge eating disorder post-intervention (Van Vlierberghe et al., 2009). Jones, Grilo, Masheb, & White (2010) specifically targeted binge eating in an internet-facilitated intervention and found significant reductions in OBEs and SBEs pre-post treatment. Reductions in all variables were also observed in wait-list controls.

Other studies measured self-reported abnormal eating attitudes that may relate to binge eating, rather than presence of binge eating behaviour. Some studies found no effect of time or group on the Eating Attitudes Test (ChEAT; Maloney, McGuire, & Daniels, 1988) total score (Follansbee-Junger, Janicke, & Sallinen, 2010; Marcus et al., 2009). The ChEAT has a food preoccupation/oral control scale which assesses self-reported presence of binge eating episodes. Other studies used the Dutch Eating Behaviour Questionnaire (DEBQ; Braet, 2006) which assesses external, emotional, and restrained eating. External eating refers to eating in response to external stimuli regardless of the internal state of satiety and emotional eating refers to eating in response to internal affective states such as sadness, anger, or anxiety (van Strien, Frijters, Bergers, & Defares, 1986). Moens et al. (2010), in an eight-year follow up of treated obese children, found no associations between long-term weight outcome and DEBQ score, though pre and post data were not presented.

Seven studies reported improvements in aspects of binge eating. Croker et al. (2012) found improvements in total ChEAT score. Although in Follansbee-Junger, Janicke, and Sallinen's (2010) study total ChEAT score did not change significantly, the numbers of children in the intervention and control groups whose total ChEAT

score was within the clinical range at baseline were six and six, respectively, decreasing to three and two, respectively, at follow-up. In addition, one child out of 48 in the intervention groups indicated that they had the urge to vomit after eating post-intervention but no longer endorsed this item at follow up. At baseline, three intervention children and three controls reported binges where they felt unable to stop. This decreased to two children in the intervention group and no children in the waitlist control group at follow-up.

Other studies reporting a positive influence of intervention on self-reported attitudes that may link to binge eating included de Niet et al. (2012) who found that children who had received weight loss treatment experienced significant decreases in external and emotional eating, and Adam et al. (2009) who reported a decrease in disinhibition of control over eating in intervention children compared to controls. Of course, it is important to consider that although these self-reported attitudes may relate to binge eating, they may not translate to actual behaviour. Lofrano-Prado et al. (2009) also found a decrease in binge eating symptoms in adolescents after a long-term multi-disciplinary weight loss program using the Binge Eating Scale (BES; Freitas, Lopes, Coutinho, & Appolinario, 2001).

Only one study indicated that interventions may have a neutral impact, suggesting that OBEs were temporally stable throughout weight loss treatment (Goossens, Braet, Verbeken, Decaluew, & Bosmans, 2011).

Bulimic and purging behaviour. There is some overlap in the constructs measured as subscales often assess both bingeing and purging symptoms. Some studies focused more on purging or compensatory behaviour. No studies reported an adverse effect of interventions on purging behaviour. Croker et al. (2012) found improvements in total ChEAT score and bulimia subscale in the intervention group

compared to a worsening of these scores in controls. Improvements were reported on the Eating Disorders Inventory (EDI-II; Garner, 1991); Brennan, Wilks, Walkley, Fraser, and Greenway (2012) found that the CBT intervention group had significantly increased scores on impulse regulation subscale following treatment relative to controls, and Goossens, Braet, Verbeken, Decaluw, and Bosmans (2011) found significant reductions in the EDI-II bulimia subscale at a six-year follow up of children who had undergone weight-loss treatment.

Van Vlierberghe et al. (2009) reported that the one child who met criteria for bulimia at baseline no longer did so post-treatment. Neumark-Sztainer et al. (2010) evaluated binge eating and compensatory behaviour more informally using the New Moves Survey, which included items such as “I eat when I’m lonely/bored/hungry/upset/stressed, even if I’m not really hungry” and “In the last month in attempt to lose weight have you fasted/taken diet pills/smoked/vomited?”. They found a significant decrease in the percentage of girls using unhealthy weight control behaviours following intervention compared to controls.

Weight control behaviours. Thirteen studies considered unhealthy weight control behaviour, mostly unhealthy dieting and restraint. Despite the fact that 16 of the studies had physical activity (PA) as an outcome, none considered excessive exercising or presented individual data on children’s PA. The only study to distinguish moderate and unhealthy weight control was Brennan et al. (2012), who found that a CBT intervention led to a significant increase in normal dieting on the Adolescent Dieting Scale (ADS; Patton et al., 1997) in the intervention group, but that intervention and control groups did not differ on any EDI-II subscales following treatment.

Studies either reported no impact or positive effects of intervention on unhealthy weight control behaviour. Three studies found no effect on either the ChEAT total score (Follansbee-Junger et al., 2010; Marcus et al., 2009), or Oral Control subscale (Croker et al., 2012). Two studies used the DEBQ to assess restrained eating. Moens et al. (2010), in an eight-year follow up of treated obese children, found no associations between long-term weight outcome and DEBQ score, though pre and post data were not presented. De Niet et al. (2012) found no significant change in restrained eating over time in children who had undergone behavioural treatment. Van Vlierberghe et al. (2009) found no effect of an inpatient weight loss treatment on EDE-Q restraint subscale. Salmon, Ball, Hume, Booth, and Crawford (2008) found no effect of time on attempts to lose weight in the intervention group. However, actual data were not presented, for example, mean scores on measures of body satisfaction, items being endorsed, or changes in children's responses from pre to post intervention.

Most of the studies that assessed weight control indicated that it was positively influenced by interventions. Croker et al. (2012) reported improvements in total ChEAT score and Dieting subscale in the treatment group. In the Follansbee-Junger et al. (2010) study three intervention children said that they liked their stomach to be empty, with one child continuing to endorse this item at follow-up, whereas two controls endorsed this item at baseline and this increased to three children at follow up. Goossens et al. (2011) also used the EDI-II Drive for Thinness subscale and found a significant decrease from pre to post-intervention. Furthermore, on the ChEDE, eating concern decreased significantly over six years in children who had undergone treatment. Van Vlierberghe et al. (2009) also found significant decreases in eating concern on the EDE-Q subscale following treatment. Adam et al.

(2009) found both controls and children who underwent weight-loss treatment showed increases in cognitive control and restrained eating. However, the authors did not distinguish between increases in flexible control and rigid control, only the latter of which has been linked to overeating and weight gain (Westenhoefer, Stunkard, & Pudel, 1999).

Other studies assessed unhealthy weight control behaviour using idiosyncratic measures. Millar et al. (2011) used a survey asking whether children had attempted to lose weight and found no effect of intervention over time. However, it is not possible to ascertain whether this question about attempts to lose weight taps *unhealthy* weight control behaviour. On the one hand, attempts to lose weight may actually be desirable in overweight or obese individuals, not indicative of eating disorder pathology as would be the case in healthy weight children. On the other hand, however, overweight children are generally encouraged to keep their weight stable and become a more healthy weight for their height as they grow taller rather than attempting to lose weight, therefore, it is possible that the question accesses more unhealthy attempts to lose weight related to body dissatisfaction. Neumark-Sztainer et al. (2010) also used a survey incorporating questions about unhealthy weight control behaviour, for example, “In the last month in an attempt to lose weight have you fasted/taken diet pills/smoked/vomited” and found a 13.7% decrease in the number of girls who underwent weight-loss treatment endorsing these items compared to controls. Sanigorski, Bell, Kremer, Cuttler, and Swinburn (2008) asked children whether they had attempted to lose weight in the previous 12 months and found that the percentage of children trying to lose weight decreased in the intervention schools from 37.6 to 34.5% from baseline to follow-up, whereas it increased in the control schools from 42.5 to 45.2%.

Overconcern with weight or shape. Seven studies considered weight and shape concerns, one of which reported them to be positively influenced by treatment; Van Vlierberghe et al. (2009) found significant decreases in shape and weight concern from pre to post-treatment as measured by the EDE-Q.

Two studies used the McKnight Risk Factor Survey (Shisslak et al., 1999), both finding a decrease in overconcern with weight and shape in intervention groups over time, although these decreases were non-significant (Robinson et al., 2012; Weintraub et al., 2008). Goossens et al. (2011) found decreases over time on weight and shape concern as measured by the ChEDE, however, these were non-significant. Children who continued to experience loss of control over eating six years after intervention were those who demonstrated more shape concerns at baseline.

The ChEAT, which has a body and weight concern subscale, was used in two studies. However, the total score was used for analysis, hence it is not possible to examine the impact of the programme on body and weight concern specifically. Neither Marcus et al. (2009) nor Follansbee-Junger et al (2010) found evidence of increased pathology in intervention groups. However, in the study by Follansbee-Junger et al. three children out of 35 in the intervention group at follow up indicated that they felt very guilty after eating. This decreased to one child at post-treatment and then increased again to three children at follow up, whereas in the control group, the number of children endorsing this item decreased from four to one.

Another two studies indicated that weight and shape concern may be negatively influenced by interventions. Neumark-Sztainer, Haines et al. (2009) reported that girls who had undergone theatre-based obesity prevention showed an increase in weight concern compared to girls in control schools, though this was non-significant. This was measured using a survey asking girls to rate from “never” to

“always” in response to “In the past month how often have you: thought about having fat on your body; felt fat; worried about gaining 2 pounds; thought about wanting to be thinner?”. Melin and Lenner (2008) also reported that some parents expressed concern about their children’s experience of the intervention, for example, one parent said “My son became weight fixated” (p 502).

Body dissatisfaction. Sixteen studies included a measure of body image or body satisfaction, four of which required children to select silhouette figures. In this task, children select the figures they think look most like their body, and figures that look most like how they would like to look; a discrepancy score is then calculated between the actual perceived and ideal body shapes (Stunkard, Sorenson, & Schulsinger, 1983). Two studies reported no difference in body dissatisfaction on the figural selection task; Wake et al. (2009) found no difference between children who had received GP consultations, and standard treatment controls, which may be expected as they found no significant change in mean BMI. Robinson et al. (2010) made use of African American pre-adolescent silhouettes and found no difference in reports of body dissatisfaction between intervention and active placebo control groups; again this may have been expected given that there were no significant changes in BMI. Nguyen et al. (2012) reported significant reduction in body dissatisfaction over time in children who received weight-loss treatment, which may be linked to the significant decrease in BMI over time. Follansbee-Junger et al. (2010) did not provide pre and post data on the figural selection but they found that baseline body dissatisfaction was positively correlated with disordered eating at follow-up. Gessell, Scott, and Barkin (2010) found that Latino children who had undergone weight-loss treatment rated their body size more accurately than controls who had received standard care. At baseline 39.3% of the intervention group

underestimated their size, whereas post-intervention 40.7% accurately rated their body size. At post-intervention 59.3% continued to rate their body size inaccurately, however, it is not reported whether these children over or under-estimated their size.

Other studies used questionnaire measures to assess body dissatisfaction. The EDI-II has a body dissatisfaction subscale on which Brennan et al. (2012) found no significant differences between waitlist controls and children who had undergone a behavioural weight-loss programme post-treatment. This was surprising given that the intervention group showed significant decreases in BMI and weight compared to controls. However, this was possibly due to the study lacking adequate power to detect changes in secondary variables. Foster et al. (2008) found no significant changes in subscale scores in children in both control schools and schools receiving a policy-based intervention. In a six-year follow-up, Goossens et al. (2011) reported a significant decrease in body dissatisfaction on the EDI-II subscale, which may relate to the significant decreases in BMI from baseline to follow up. Lofrano-Prado et al. (2009) found that adolescent boys who had undergone a 12-week lifestyle intervention experienced significant reductions in body dissatisfaction; this fits with their findings that boys' BMI significantly reduced following the short-term (12 week) intervention. Females had higher baseline body dissatisfaction and saw improvements in body dissatisfaction after a 24-week intervention, during which they also started to show significant reductions in BMI.

Some authors used surveys designed for the purposes of their study; three of these found no significant difference in levels of body dissatisfaction between those who had received intervention and controls (Millar et al., 2011; Neumark-Sztainer et al., 2009; Sanigorski et al., 2008). Other studies reported improvements in aspects of body satisfaction; Neumark-Sztainer et al. (2010) found significant improvements in

body satisfaction in girls who had received treatment, however, they did not report whether there had also been significant improvements in the control group.

Interestingly, the study did not report significant changes in BMI so the changes in body dissatisfaction may have been related to factors other than actual weight.

Salmon et al. (2008) found that gender moderated intervention effects on satisfaction with body shape/weight; boys receiving treatment were significantly more satisfied with their body shape after intervention compared to controls. Only the intervention group who received a combination of a behavioural intervention and a movement skills intervention showed a significant decrease in BMI, therefore it would be interesting to know whether body dissatisfaction changed more in this group compared to the other groups. Singhal, Misra, Shah, and Gulati (2010) found a significant decrease in proportion of children in intervention schools as compared to control schools avoiding clothes that made them look overweight.

Melin and Lenner (2008) found that most children gave the same answers in a survey asking questions about their perceived body size pre and post intervention. However, at follow-up, although there was a reduction in mean BMI z-scores throughout treatment, four children felt larger than pre-intervention and thirteen of 20 included families expressed negative experiences of the intervention, for example, one mother said “My daughter did not eat her birthday cake, she felt fat and disgusting...” (p. 502).

Self-esteem or self-worth. The most commonly used measure of self-esteem was Harter’s (1985) Self Perception Profile for Children (SPPC) or an adapted version thereof, which were used in six studies. One found no difference in global self-worth between intervention and control groups following a GP delivered intervention (Wake et al., 2009). Two studies reported significant increases in global

self-worth following both a behavioural lifestyle intervention (de Niet et al., 2012), and a 12-month CBT based community intervention (Nguyen et al., 2012). However, neither of these studies used a waitlist control group. Neumark-Sztainer et al. (2010) also described significant increases in global self-worth in girls in a school-based program compared to girls in control schools. Moens et al. (2010) reported that global self-esteem predicted long-term weight change. Of concern, Neumark-Sztainer, Haines et al. (2009), with an adapted version of the SPPC, found that self-worth was higher in the control group than the intervention group who had received a theatre-based intervention.

Croker et al. (2012) utilised Harter's (1982) self-esteem scale, finding that global self-esteem marginally increased in children who had received a family-based intervention as compared to waitlist controls. Three studies made use of Rosenberg's Self-Esteem Scale (1965), all of which found no significant changes in self-esteem in children who had received weight-loss treatment compared to active controls (Robinson et al., 2010; Weintraub et al., 2008) or waitlist controls (Brennan et al., 2012). Adam et al. (2009) used a German measure of self-esteem (Wünsche & Schneewind, 1989) and found that all aspects of self-esteem improved significantly in the intervention group who had received combined inpatient and outpatient therapy as compared to waitlist controls. However, results should be interpreted with caution as the authors were employed by the funding body.

Weight-related teasing. Only one study assessed teasing with a standardised measure; Follansbee-Junger et al. (2010) used the Schwartz Peer Victimization Scale (Schwartz, Farver, Change, & Lee-Shin, 2002), finding that higher baseline levels of peer victimisation predicted more disordered eating attitudes at follow-up. Sanigorski et al. (2008) included one question assessing the frequency of weight-related teasing

and found no significant difference in frequency within or between intervention and control groups.

In Melin and Lenner's study (2008), qualitative feedback from parents included "...she felt fat and disgusting and said that nobody wanted to play with her", and "...he is teased because he cannot run as fast as other children" (p. 502).

Furthermore, it is possible that teasing not only occurs as a result of children being overweight, but also as a result of the stigma associated with interventions themselves. Five parents reported that their children felt stigmatised by the project in some way, for example, due to having to leave class to visit the school nurse.

Parental attitudes and behaviour. The majority of the interventions involved parents, with methods ranging from newsletters (for example, Marcus et al., 2009), to joint parent and child sessions (Croker et al., 2012), to parent only interventions (Follansbee-Junger et al., 2010). A diverse range of parental variables were assessed Brennan et al. (2012) measured family interaction and communication with the Parent Adolescent Communication Scale (PACS; Barnes & Olsen, 1982), and parenting with the Parenting Scale (Arnold, O'Leary, Wolf, & Acker, 1993). Adolescents reported significant improvements in social support from family, and in problem communication.

Follansbee-Junger et al. (2010) found that baseline levels of parent-reported concern about weight and restrictive feeding practices, as measured with the Child Feeding Questionnaire (Birch, Grimm-Thomas, Markey, Sawyer, & Johnson, 2001), were positively correlated with and accounted for around 3% of the variance in disordered eating at follow up. Furthermore, in an eight-year follow-up of children who had undergone weight-loss treatment, Moens et al. (2010) found maternal

psychopathology to be associated with negative outcome, accounting for around 8% of the variance in weight loss following treatment.

The only study to report iatrogenic effects of an intervention on parental behaviour was Neumark-Sztainer et al. (2009) who reported an increase in child-reported parental weight talk, assessed with seven questions rated in frequency. For example, questions included “In the past month how often have your parents made a comment to you about your weight that made you feel bad?” (p. 414). However, it was not possible for the authors to do formal statistical testing as the study was underpowered.

Other psychological variables. Other psychological variables, beyond the scope of this review, were measured across the studies. Seventeen studies included measures of other psychological factors such as psychopathology, quality of life, negative thoughts, social and family functioning, emotional and behavioural problems, and social status. In general either no differences were found between intervention and control groups or from baseline to follow up, or interventions had a positive impact on other variables. As mentioned above, one study found a negative impact of intervention on self-worth and parental weight talk post-treatment, although it was not possible to test for significance (Neumark-Sztainer, Haines et al., 2009).

Discussion

The purpose of this paper was to review the extent to which ED pathology is assessed in research on weight-loss treatment, and whether interventions have detrimental effects on ED symptomatology or risk factors.

Of the 267 obesity interventions, 54 reported on psychosocial variables either over time within intervention groups, or compared to controls, and eight papers

focused specifically on ED symptomatology or psychological factors as opposed to anthropometric outcomes. This is an improvement since previous reviews. On the whole, psychological outcomes were measured in order to assess the effect of the intervention on these factors, or to ensure no adverse psychological outcomes. However, one study reported on an intervention which specifically targeted eating disorder symptomatology simultaneously with weight management in a treatment to reduce binge eating and overweight (Jones et al., 2010). Another intervention aimed to improve accuracy of perception of body size (Gessell et al., 2010). Furthermore, one paper reported on how psychopathology hampers weight loss in treatment (Van Vlierberghe et al., 2009), while others reported on the stability of eating pathology through weight loss treatment (Goossens et al., 2011).

Higher quality studies indicated that childhood prevention and treatments for overweight and obesity either do not affect eating pathology or, at best, can have a beneficial impact. ED factors that were positively influenced were binge eating (de Niet et al., 2012; Jones et al., 2008; Van Vlierberghe et al., 2009), bulimic symptoms (Croker et al., 2012; Goossens et al., 2011), unhealthy weight control (Goossens et al., 2011; Neumark-Sztainer et al., 2010), weight and shape concern (Van Vlierberghe et al., 2009), body satisfaction (Goossens et al., 2011; Lofrano-Prado et al., 2009; Neumark-Sztainer et al., 2010; Nguyen et al., 2012; Salmon et al., 2008; Singhal et al., 2010), self-worth (Adam Westenhofer, Rudolphi, & Kraaiibeek, 2009; de Niet et al., 2012; Neumark-Sztainer et al., 2010; Nguyen et al., 2012), and family social support (Brennan et al., 2012).

ED risk factors or symptomatology that were most likely to be adversely affected in the included studies were weight concern, body dissatisfaction, and weight-related teasing. It is worth noting that the studies reporting adverse effects

tended to be of lower methodological quality. Neumark-Sztainer, Haines et al. (2009) reported that girls who had undergone a theatre-based intervention expressed more weight concern, lower self-worth, and more parental weight talk. The authors were not able to conduct formal statistical testing as the study was underpowered, therefore the results should be interpreted with caution. Melin & Lenner (2008) also reported adverse effects of the intervention, whereby 13 of nineteen families reported negative experiences of the treatment, for example, their children becoming “weight fixated” (p. 502). However, these data were not captured with standardised measures, making them difficult to compare across studies. This study involved children being weighed monthly, which may have contributed to the children’s concern with weight and shape. Furthermore, the treatment did not appear to have strong psychological underpinnings and was delivered by school nurses trained for the study; this may have increased the risk of pathologising overweight. The final study to report behaviour that may increase risk of EDs was Gessell et al. (2010), who reported that overweight Latino children who had undergone a physical activity intervention rated their body size more accurately post-intervention. Given previous research indicating that those who underestimate their weight report less ED pathology than those who give accurate estimates (Jones et al., 2010), this may be linked to risk factors for eating disorders. However, this has not been thoroughly researched and is beyond the scope of this review.

It is difficult to draw firm conclusions from the studies because effect sizes are often not reported, and the research uses varying methodologies and assessment tools. Furthermore, with the exception of the ChEDE, psychological variables tend to be assessed with self-report measures, which are less objective. Also, as psychological variables are generally secondary outcomes, studies are often

underpowered to detect changes in them, or moreover, power analyses are not performed at all, which may lead to overestimations of effects. In addition, studies tend to lack long-term follow-up of outcomes, as highlighted by Oude Luttikhuis (2008). Furthermore, study samples tend to be select, and treatments are often not representative of standard treatments available, which may make results less generalisable to wider populations. In general, Kazdin (2003) found that child and adolescent therapy research samples tend to have fewer comorbidities than those referred for routine treatment.

Limitations of the current review include the fact that there may be selection bias resulting from the search strategy. Of 267 identified papers reporting on interventions for overweight, 54 measured some sort of psychological variable, and only 24 included eating disorder pathology or risk factors. This raises the possibility that, as these studies considered ED pathology, the authors were more aware of the risk of negative ED related outcome and therefore design of the study included more safety measures. It is possible that studies that did not assess risk of ED following treatment pose greater risk of negative outcomes. Furthermore, the search strategy may have led to bias in other ways; not every available database was searched, in particular, dissertation abstracts and grey literature were not searched. It is possible that interventions showing negative psychological outcomes are less likely to be published. Moreover, exclusion criteria based on study methodology were not stringent, therefore, studies used a variety of designs and included studies were not limited to high quality research with lower risk of bias such as RCTs. As well as reducing confidence in the conclusions drawn, the variety of methodologies makes it difficult to compare results across studies. This review is limited by the methodological quality of some of the studies, for example, being under-powered,

not randomly allocating participants to groups, not blinding researchers to participant group allocation, or absence of control groups. However, this review incorporated an analysis of the methodological quality of the studies, and included a variety of study designs so as to broaden the scope of the review.

Implications for future research

There has been improvement in the number of studies measuring psychological variables since previous reviews were published (Carter & Bulik, 2008; van Wijnen et al., 2009). However, the majority of studies still do not assess psychological variables, in particular eating disorder pathology and risks. Furthermore, where these are assessed, long-term outcomes are rarely studied. Stice (2002) highlights the need for research into ED risk factors to use longer periods of follow up, as shorter periods of follow up have been associated with smaller effect sizes. Moreover, it is important to measure outcomes through the greatest period of risk, that is, adolescence. Therefore, it is still premature to draw definitive conclusions.

This review suggests that eating disorder pathology and risks are not significantly affected by obesity interventions in general, and can, in fact, be positively impacted. However, it still remains unclear which aspects of obesity interventions are the most effective for weight loss, and which may cause the most psychological risk. A few studies included in this review indicate that interventions can have an adverse effect, so it would be helpful if future research could identify which components of interventions may increase risk. Furthermore, as suggested in previous reviews, in the future, intervention studies should routinely measure psychological variables, using standardised measures, regardless of whether there is a psychological component to the intervention, using standardised measures to aid

comparison across studies. Furthermore, more research with ED pathology as primary outcomes would be beneficial so that studies are designed and powered to detect changes in these variables. It is also worth considering whether treatments with weight-neutral goals have a more positive impact on ED pathology, than conventional weight-loss treatments, as suggested by Bacon and Aphramor (2011).

Conclusions

This review suggests that ED pathology and risks can, at best, be positively impacted by interventions for overweight and obesity. However, some studies also reported iatrogenic effects. As these variables are still under-assessed, and the methodological quality of the studies is sometimes limited, it is still not possible to draw firm conclusions about the impact of these interventions on ED pathology.

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Part 2: Empirical Paper

The development of restricting anorexia nervosa: Does personality predict individuals' responses to short-term fasting?

Abstract

Aims. The study aimed to investigate affective responses to fasting, in particular whether personality traits of high persistence and constraint, and low novelty-seeking, which have been linked to restricting anorexia nervosa (ANR), affect these experiences.

Method. A non-clinical sample of 52 women with a mean age of 25 completed personality scales at baseline. A repeated-measures design was used, whereby participants provided diary measures of psychological variables throughout both 18-hour fasting and non-fasting periods.

Results. Fasting led to increased irritability, and also to positive affective experiences of increased sense of achievement, reward, pride, and control. Self-reported persistence, constraint, and novelty-seeking did not affect experiences of fasting, and personality variables were not significant predictors of fasting responses.

Conclusion. Even short-term fasting in healthy controls can lead to positive psychological experiences. This lends support to cognitive-behavioural and cognitive-interpersonal models of ANR, which suggest that dietary restriction is maintained through positive reinforcement.

Levels of persistence, constraint, and novelty-seeking did not affect responses to fasting, suggesting that personality variables do not affect eating disorder pathology via responses to fasting.

The development of restricting anorexia nervosa: Does personality predict individuals' responses to short-term fasting?

There is a wealth of research into the relationship between personality and eating disorders (EDs), often examining the role of personality in the development, expression and maintenance of EDs. However, a question remains as to the role of personality variables in the experience of starvation or fasting. This study aims to address whether certain personality variables affect the experience of fasting. If certain personality traits are associated with different subjective experiences of fasting, this may help to explain why some personality traits are associated with EDs, in particular restricting anorexia nervosa (ANR).

Personality and psychopathology

Personality is complex and there is a danger that research on personality and psychopathology can lead to the oversimplification of complex and heterogeneous clinical groups. However, research clearly indicates that personality variables contribute, at least in part, to psychopathology (Cloninger, Zohar, & Cloninger, 2012; Miettunen & Raevuori, 2012). The terms *temperament* and *personality* are sometimes used interchangeably, however, they are generally considered to be different constructs. Temperament forms a sub-class of traits that emerge early in life, are highly heritable, and show stability over time. Temperament is comprised of non-motivated, non-cognitive, stylistic characteristics that represent individual differences between people, and is thought to have observable neurobiological correlates. On the other hand, personality plays a more organisational role in forming coherent functioning from how one reacts to given attributes, thinks about themselves, and put this together to form a conceptual whole (Rutter, 1987).

Personality and eating disorders

The current ED literature suggests that there are distinct subtypes, which will be referred to throughout this paper. According to the new fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; APA, 2013) the first is anorexia nervosa (AN), in which the individual maintains weight at least 15% below that expected, through fasting, diet, and exercise as a result of a preoccupation with weight. For the benefits of clinical work and research, DSM-IV made a distinction between different subtypes of AN. The first was restricting anorexia nervosa (ANR), in which the individual is underweight, restricts food intake, and may engage in activity such as excessive exercise. The second was binge-purge AN (ANBP), in which the individual also engages in bingeing and/or purging. However, crossover between subtypes is common. Bulimia nervosa (BN) is characterised by episodes of binge eating followed by compensatory behaviour to avoid weight gain, for example, vomiting, fasting, purging, or exercise. Unlike individuals with AN, those with BN are not underweight.

Research into the relationship between personality variables and EDs can be helpful in understanding the predisposing factors for eating disorders, and predicting ED symptoms such as frequency of bingeing and purging (Westen, & Harnden-Fischer, 2001). Much of the research has made use of self-report measures such as measures of specific traits, or omnibus measures of dimensional traits. Omnibus measures have included the Multidimensional Personality Questionnaire (MPQ; Tellegen, & Waller, 1989), which measures four higher order traits, and 11 primary traits. Other studies have made use of Cloninger's Temperament and Character Inventory (TCI-R; Cloninger, 1994), which combines categorical and dimensional elements. Cloninger's model of personality defines temperament as heritable, stable,

emotional responses, mediated by neurotransmitter functioning. Character refers to self-concepts and goals or values that develop through experience.

Lilenfeld, Wonderlich, Riso, Crosby, and Mitchell (2005) have proposed four conceptual models of the relationship between personality and EDs. The first is a predispositional model, whereby personality constructs precede and increase the risk of EDs. The second is a complication model, in which personality variables are a product of EDs. The third model suggests that both personality variables and EDs share common underlying factors. The fourth is a pathoplasty model, whereby once EDs and personality traits are established they interact to modify the presentation and course of each other.

Some personality traits have been linked to more than one ED subtype. One of the most well researched traits is perfectionism; it is generally accepted that perfectionism is associated with anorexia nervosa (Fairburn, Cooper, Doll, & Welch, 1999; Tyrka, Waldron, Graber, & Brooks-Gunn, 2002), bulimia nervosa (Fairburn et al., 1999; Lilenfeld et al., 2000; Pratt, Telch, Labouvie, Wilson, & Agras, 2001), and binge eating disorder (Pratt et al., 2001) and higher levels of perfectionism continue after recovery from these EDs (Cassin & von Ranson, 2005). Other traits that have been linked to both anorexia nervosa (AN) and bulimia nervosa (BN), and have been found to persist after recovery from EDs include higher levels of obsessive-compulsive traits, neuroticism, negative emotionality, and harm avoidance, and lower self-directedness, and co-cooperativeness (Cassin & Von Ranson, 2005). Other personality traits appear to differentiate ED subtypes. Impulsivity is consistently found to be higher in those with BN than those with ANR and psychiatric controls, but has been found to decrease after reductions in bingeing/purging (Ames-Frankel et

al., 1992) suggesting that impulsivity may be exacerbated by erratic diet (Cassin & von Ranson, 2005).

There appear to be consistent differences in personality traits distinguishing those with restricting anorexia nervosa (ANR). In fact, Vitousek and Manke (1994) suggested that “*Among all forms of psychopathology, restricting anorexia nervosa may represent one of the strongest cases for a causal association between personality traits and a specific behavioral disorder*” (pp 143). In contrast to individuals with bulimia nervosa (BN) and other eating disorders with binge/purge symptoms, who report high impulsivity, sensation seeking, and novelty-seeking, individuals with ANR consistently show high constraint and persistence, and low novelty-seeking on personality measures (Cassin & von Ranson, 2005).

Constraint is associated with control, harm avoidance, and traditionalism. Individuals who score highly on this trait tend to describe themselves as cautious, averse to danger, and in favour of planning (Tellegen, 1982). Studies suggest that individuals with ANR are more constrained than controls and individuals with BN (Casper, Hedeker, & McClough, 1992; Claes, Vandereycken, & Vertommen, 2002; Fahy, & Eisler, 1993; Pryor, & Wiederman, 1996). Individuals with ANR have also been found to score highly on measures of persistence compared to those who binge (Fassino et al., 2002; Klump et al., 2000). Definitions of persistence have varied, however. Some researchers have defined persistence as sticking with a task even when it is difficult or laborious in order to achieve a goal (Serpell, Waller, Fearon, & Meyer, 2009). Whereas Cloninger, Dragan, Svrakic, & Przybeck (1993) suggest it is the extent to which a person will continue to seek rewards even when the desired outcome is only rarely successful, which may overlap with Serpell, Waller, Fearon, and Meyer’s (2009) definition of perseveration rather than persistence. Novelty-

seeking refers to behavioural activation and reward seeking (Cloninger, Dragan, Svrakic, & Przybeck, 1993), and individuals with ANR tend to show reduced levels of this trait compared to individuals with binge/purge symptoms and control women (Fassino et al., 2002; Klump et al., 2000). It is possible that individuals exhibiting elevated constraint and persistence, and low novelty-seeking are able to maintain strict, restrictive dietary regimens, thus maintaining ANR.

Further evidence for the link between personality and EDs is provided by research into personality variables and diagnostic crossover in EDs. Monteleone, Di Genio, Monteleone, Di Filippo, and Maj (2011) suggested that, amongst other things, higher novelty-seeking was associated with diagnostic crossover from ANR to bulimia nervosa. Higher novelty-seeking may reflect higher impulsivity and subsequent inability to maintain strict dietary regimen, thus leading to bingeing/purging behaviour.

The effects of starvation

One issue complicating research into personality and EDs is the question of whether self-reported personality features are indeed traits, or whether they represent less stable states or artefacts of the ED itself. The very nature of AN means that individuals are starving, which can be seen as a mixture of both short-term food deprivation and chronic malnourishment (Sidiropoulos, 2007; Vitousek & Manke, 1994). There is a dearth of research on the psychological effects of starvation in healthy controls, however, existing research indicates that starvation can lead to affective changes such as anxiety and irritability (Keys, Brozek, Henschel, Mickelson, & Taylor, 1950; Laessle, Schweiger, & Pirke, 1988). Furthermore, it can lead to rigidity and obsessionality (Keys et al., 1950). Interestingly, studies have indicated that unintentional weight loss can lead to AN (Epling, Pierce & Stefan,

1983; Kingston, Szmukler, Andrewes, Tress, & Desmond, 1996). This points towards the possibility that starvation itself can have an impact on the development or maintenance of AN. However, research has also indicated that certain personality traits are maintained even after recovery from EDs (Bloks, Hoek, Callewaert, & van Furth, 2004; Cassin & von Ranson, 2005), indicating that self-reported traits are just that, traits, rather than states associated with food restriction or binge-purge cycles.

The current study and hypotheses

This study aimed to elucidate, in part, the relationship between personality variables and the effects of fasting using healthy controls, in order to contribute to the understanding on ANR. Explanations for the effects of starvation tend to be physiological. However, clinical experience indicates that responses to hunger and fasting are varied, with certain individuals finding food restriction difficult and unpleasant, and others finding it less demanding. The study aimed to explore whether there were psychological factors that affected this by investigating responses to short-term fasting.

In addition this study aimed to shed light on whether there are personality variables that can predict responses to fasting in a non-clinical sample. Consistent differences exist in the literature between those whose eating disorders involve restriction and those who engage in binge-purge behaviour; it is possible that certain individuals find it more difficult to restrict because of underlying personality traits. To the best of our knowledge, the literature does not include a discussion of this.

This study examined whether personality variables affected responses to fasting in healthy controls. In particular, we assessed whether healthy controls who scored higher on constraint, persistence, and lower on novelty-seeking, (typically

associated with ANR) found fasting to be a more positive experience. The hypotheses were as follows:

- 1) The extent to which participants endorsed personality variables associated with ANR would significantly correlate with severity of ED symptomatology indicated by the self-report ED measure, in particular the restraint subscale.
- 2) There would be a main effect of fasting on visual analogue scale (VAS) measures of mood, reward, hunger, irritability, achievement, pride, and self-control. Due to the scarcity of literature on the psychological consequences of fasting, exploratory analyses were performed and no directional hypotheses were made with regards to this.
- 3) Higher baseline persistence scores would be associated with different responses to fasting, that is, fasting would be rated as more rewarding, more or less difficult, providing more sense of control, pride, or improvements in mood.
- 4) Higher baseline constraint scores would be associated with different responses to fasting, that is, it would be rated as more rewarding, more or less difficult, providing more sense of control, pride, or improvements in mood.
- 5) Lower baseline novelty-seeking scores would be associated with different responses to fasting, that is, it would be rated as more rewarding, more or less difficult, providing more sense of control, pride, or improvements in mood.

Method

Participants

Participants were 52 female volunteers with a mean age of 25.52 years ($SD = 9.82$, range 18 – 56). Participants were eligible if they were healthy, female, aged over 18, and spoke fluent English. Exclusion criteria included current diagnosis of an ED, pregnancy, or knowingly having any medical condition that would make fasting dangerous, such as diabetes. Of the total sample 73.1% ($N = 38$), said that they had never fasted before, 17.3% ($N = 9$) had fasted for dieting, and 9.6% ($N = 5$) had fasted for spiritual or religious reasons. Eligibility was assessed in a screening interview with researchers. Participants gave written consent to their participation in the study (see Appendix C for consent form) and were paid £15 or, if they were an undergraduate student, had the option of receiving course credits for their time. Table 1 summarises the participant characteristics.

Sample size

A power analysis for this study was carried out using G-Power (Faul, Erdfelder, Lang, & Buchner, 2007) based on estimates of effect size from ED research comparing a clinical sample with healthy controls (Lopez, Tchanturia, Stahl, & Treasure, 2009; Roberts, Tchanturia, Stahl, Southgate, & Treasure, 2007). It was estimated that a sample size of 34, with an alpha level of 0.05 would provide 80% power to detect a medium effect size. In order to allow for attrition and incomplete data, it was decided to aim to recruit 60 participants.

Table 1.

Demographic characteristics of the study sample

Participant characteristic	Number	Percent ^a
Age		
18 – 25	39	75.0
26 – 33	6	11.5
34 – 41	2	3.8
42 – 49	1	1.9
50 - 57	4	7.7
BMI		
15–16.4 severe underweight	1	1.9
16.5 – 18.4 underweight	8	15.4
18.5 – 24.9 normal weight	37	71.2
25 – 30 overweight	6	11.5
Ethnicity		
Chinese	15	28.8
White Other	11	21.1
White British	8	15.4
Asian Other	5	9.6
Black Other	1	1.9
Other	1	1.9
Education		
GCSE	1	1.9
A-level	19	36.5
Degree	11	19.2
Masters	10	21.2
Doctorate	0	0
Occupation		
Student	31	3.8
Employed	7	13.5
Unemployed	2	61.5

Note. ^aThe percent values given are calculated on the basis of the number of respondents who did provide information on the respective demographic variable

Setting

The study took place at University College London (UCL) from November 2011 to June 2013. Participants responded by e-mail or telephone either to a poster

(Appendix D) displayed at UCL, the UCL-based psychology subject pool website, or Expermatch (a national website aimed at recruiting volunteers for research).

Ethical approval

Ethical approval was granted by the UCL Research Ethics Committee (see Appendix E for the ethical approval letter). It was necessary to consider the ethical implications of asking participants to fast for 18 hours. Active steps were taken to minimise the risk associated with fasting including providing participants with an information sheet outlining the possible risks of fasting (Appendix F), providing advice on fasting (Appendix G), and informing participants to immediately stop fasting if they felt unwell. Participants were also offered a cereal bar at the end of the fasting condition.

Study design

The study used a within subjects, repeated measures design to test individuals' responses to 18-hour fasting and non-fasting periods in relation to their scores on certain personality measures. Participants were recruited jointly with Sebastien Thompson (trainee clinical psychologist), with whom I jointly tested the participants for our studies. For the purposes of this paper I will only explain the methods for my study, so as not to confuse the reader but please see Appendix A for details on the joint work. Participants met with researchers on three occasions; the first meeting consisted of a screening questionnaire and completion of ED and mood measures, and baseline personality measures of the extent to which they self-reported high constraint, high persistence, and low novelty-seeking. Researchers felt that it was important to meet with all participants at the first meeting, rather than conducting the measures over the telephone or internet in order to scan all participants' weight visually. Although this did not provide a reliable measure of a participant's weight,

this would have enabled researchers to raise with a participant any concerns there were about them taking part if they appeared too underweight. The second and third meetings followed the fasting and non-fasting conditions.

Participants were required to independently complete both an 18-hour fasting and an 18-hour non-fasting period; the order of the fasting and satiated conditions was randomised. Fasting and satiated testing conditions began from anywhere between 9:00 p.m. and 11:00 p.m., and continued for 18 hours, until between 03:00 p.m. and 05:00 p.m. the following day. Fasting and non-fasting conditions were at least a week apart to ensure no carry over effects of fasting for those who fasted first. During the fasting period participants were asked not to consume any food or drink other than water. Participants were asked to be truthful about whether they had adhered to fasting conditions. In order to promote adherence, participants were informed that a random sample of participants would be asked to provide a urine sample to check levels of ketones, biological markers of fasting. No urine samples were actually obtained as ketone levels are not an accurate indicator of fasting adherence due to biological homeostatic mechanisms (Bolton, Burgess, Gilbert, & Serpell, under consideration; Connan & Stanley, 2003). During the non-fasting period participants were told to eat and drink normally.

Throughout both the fasting and non-fasting conditions, participants were required to complete a diary measure of mood, sense of reward from fasting, sense of achievement, sense of self-control and difficulty fasting. Participants also provided Visual analogue scales (VAS) scores at the beginning of the fasting period to give a baseline. Throughout the non-fasting condition, participants were also asked to rate mood, irritability, sense of self-control and sense of achievement so that participants acted as their own controls by providing data on a non-fasting day. At the end of both

fasting and satiated conditions, participants met with researchers to provide their completed self-report measures and, at the end of the third meeting, participants were reimbursed and debriefed. Figure 1 shows a flow chart of the study process.

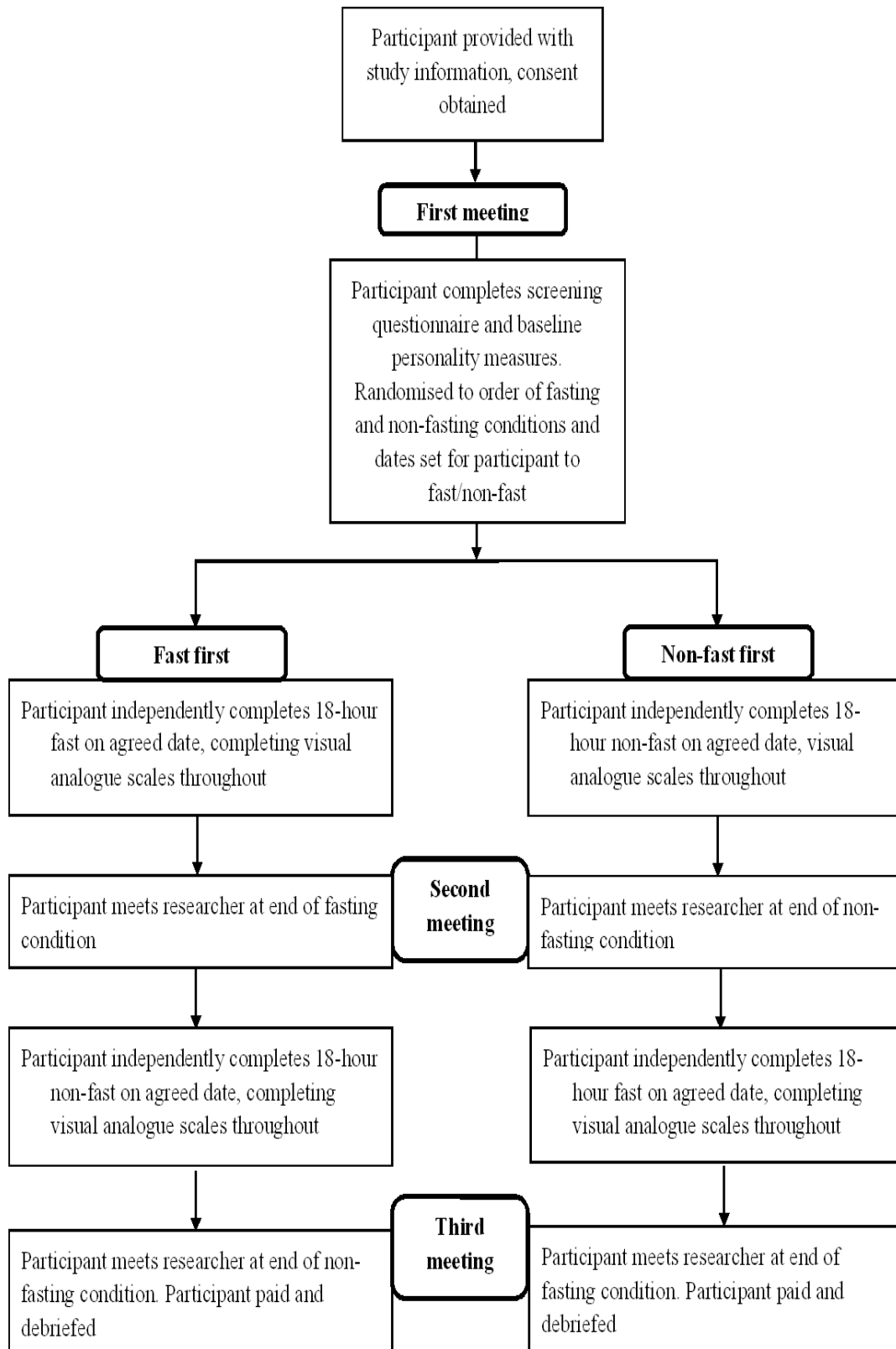


Figure 1. Flow chart of the study design.

Participant flow

Seventy-seven participants contacted researchers about participation. Of these, two did not meet inclusion criteria due to age or gender, and 12 did not attend the initial meeting. Sixty-three participants attended the initial meeting with researchers, of whom five dropped out before the second meeting. Five participants also dropped out after the second meeting, leaving 53 participants who took part in all stages of the study. One participant was excluded due to missing data. A diagram of the participant flow through each stage of the study can be seen in Figure 2.

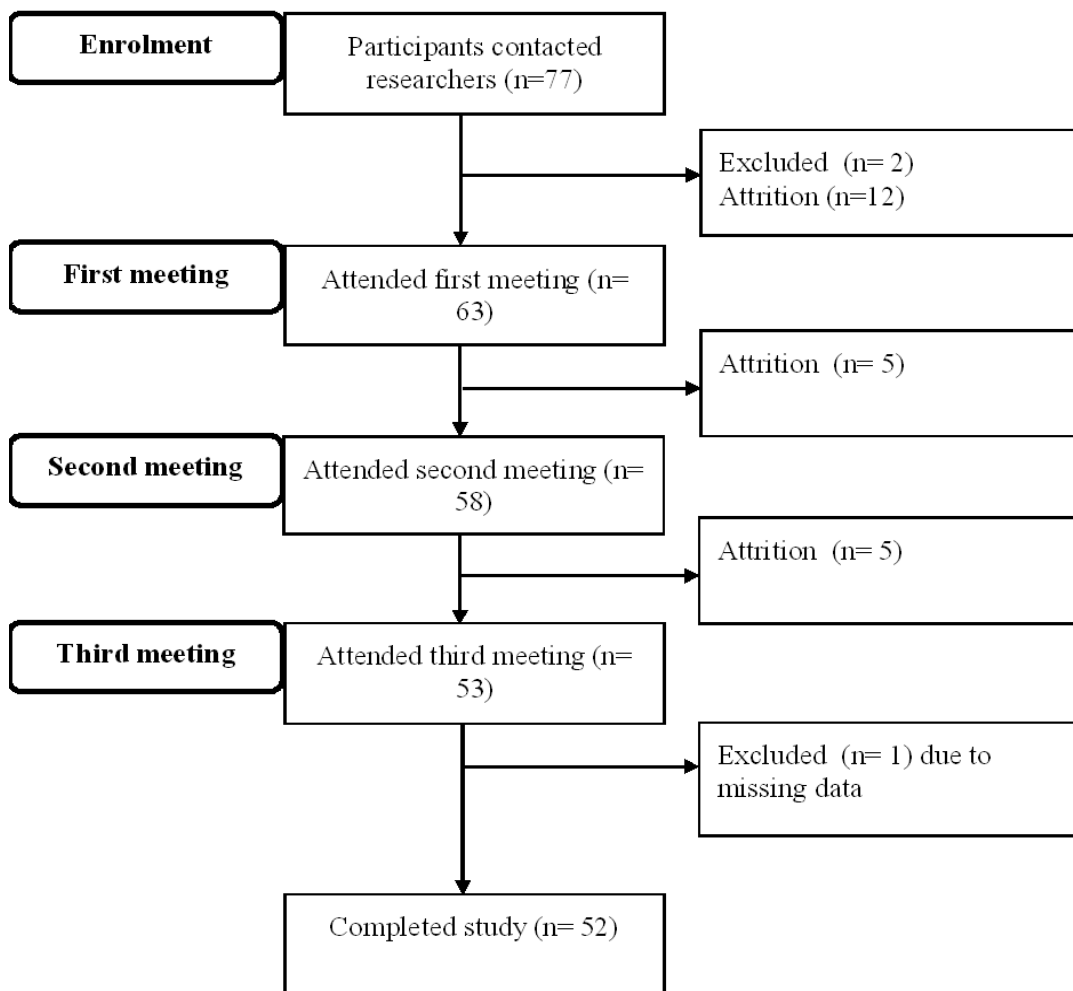


Figure 2. Participant flow through the study.

Measures

At the first meeting participants completed a screening questionnaire with the researcher. They were also required to complete measures online using Opinio, a UCL web-based survey tool. Participants completed the following measures (described below): the novelty-seeking and persistence subscales of the Temperament and Character Inventory (Cloninger, 1994, see Appendix H), the Multidimensional Personality Questionnaire (Tellegen & Waller, 1989, see Appendix I), the Eating Disorder Examination Questionnaire (Fairburn & Beglin, 1994, see Appendix J), the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983), and the Perfectionism, Persistence and Perseveration Questionnaire (Serpell et al., 2009, see Appendix K). Participants were also required to independently complete diary measures throughout the fasting and non-fasting conditions (see Appendix L).

Screening questionnaire. At the initial meeting, participants completed a screening questionnaire designed for the purposes of the study (Appendix M). This included basic demographic questions about current physical and mental health, and history of EDs. Participants were asked brief questions about their normal eating behaviour, that is, the number of meals they usually ate in a day, whether they had fasted before, and how they anticipated they would find fasting. Additionally, participants were asked to rate their mood on a VAS ranging from 0 (“not at all happy”) to 10 (“happiest I could be”).

Personality trait measures.

Temperament and Character Inventory - Revised (TCI-R). Participants completed the persistence and novelty-seeking subscales of Cloninger’s (1994) TCI-R (Appendix H). The TCI-R is a 240 item self-report measure assessing the seven

dimensions of personality. Both novelty-seeking and persistence are temperamental dimensions.

Both subscales contained 35 questions, which, along with one validity item, gave a total of 71 questions. For each question participants were required to rate how much a statement applied on a five-point Likert scale ranging from one (“definitely false”) to five (“definitely true”). Higher scores on the subscales indicate higher presence of the temperamental trait.

The original TCI has good apparent clinical relevance, has been used in a variety of populations, and has been translated into several languages. Reliability studies consistently report adequate reliability coefficient values for most of its scales, and, on the whole, satisfactory Cronbach’s alpha, internal consistency, and test-reliability has been found in clinical and non-clinical samples (Brändström et al., 1998; Cloninger et al., 1993; Cloninger, Przybeck, Svrakic, & Wetzel, 1994; De La Rie, Duijsens, & Cloninger, 1998; Sato et al., 2001). Some factor analysis studies have not found support for the latent distinction between temperament and character when joint factor analyses of both temperament and character facets are performed (Ball, Tennen, & Kranzler, 1999; De La Rie et al., 1998; Gutierrez et al., 2001; Herbst, Zonderman, McCrae, & Costa, 2000). However, studies have found evidence for the seven-factor structure when temperament and character scales were factor analysed separately (Brändström et al., 1998; Cloninger, et al., 1993; Cloninger, Przybeck, & Svrakic, 1991; Sato et al., 2001). One study indicated adequate reliability and validity of the French version of TCI-R, although no joint factor analyses of temperament and character facets were performed (Pelissolo et al., 2005). A study using the Italian version of the TCI-R with outpatients found good internal consistency reliability, and test-retest reliability. Furthermore, joint factor-analyses of

temperament and character facets supported the dissociation between character and temperament aspects of personality. The study also supported the predictive power of the TCI-R on personality psychopathology (Fossati et al., 2007).

Multidimensional Personality Questionnaire (MPQ). Participants also completed the MPQ (Tellegen & Waller, 1989). (Please see Appendix I). This is a dimensional personality questionnaire composed of 18 subscales; three assessing validity, four measuring broad or higher order traits, and 11 measuring primary trait dimensions. The questionnaire contains 276 items, most of which require a true/false response. The MPQ provided a measure of constraint, which is one of the higher order subscales. The MPQ contains inbuilt validity scales to detect invalid response patterns and ensure that respondents are attending to question content. In this sample no responses were deemed invalid according to these scales and the criteria suggested by Patrick, Curtin, & Tellegen (2002).

The MPQ was constructed through iterative rational processes and factor analysis; the scales were designed to be internally consistent (Tellegen, 1982) and independent. It is suggested that the scales show convergent and discriminant validity with other self-report personality measures (Tellegen & Waller, 1989).

Perfectionism, Persistence and Perseveration Questionnaire (PPPQ-22). As an additional measure of persistence, participants were asked to complete the PPPQ-22 (Serpell, Waller, Fearon, & Meyer, 2008), which is a 22-item self-report measure consisting of three subscales; perfectionism, persistence and perseveration (see Appendix K). Participants are asked to rate how much they endorse each item on a five point Likert scale ranging from 1 (“not at all true”) to five (“totally true of me”).

The PPPQ-22 has internal consistency in a non-clinical sample, and acceptable test-retest reliability (Serpell et al., 2009).

Self-reported ED pathology. Participants provided a self-report measure of ED symptomatology using the Eating Disorder Examination Questionnaire (EDE-Q6; Fairburn & Beglin, 1994; Appendix J)). This is a 28-item self-report questionnaire adapted from the Eating Disorders Examination Interview (Fairburn & Cooper, 1993). Participants are asked to rate on a 5-point scale on how many days in the last month they have experienced certain ED symptoms. The questionnaire provides four subscale scores; dietary restraint, shape concern, weight concern and eating concern, as well as yielding a global score. A study indicated that the EDE-Q6 has adequate reliability and validity in community samples (Passi, Bryson, & Lock, 2003).

Self-reported depression and anxiety. Participants completed the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983), which is a 14-item self-report measure with seven anxiety and 7 depression items. It provides separate subscale scores for anxiety and depression, as well as an overall score, and is frequently used in both research and clinical practice. For each question, participants are asked to select one of four statements, which they feel most applies. This yields a score of between 0 and 3 for each item. There is a maximum score for each subscale of 21. Higher scores indicate higher anxiety levels and depression symptomatology. The HADS has good levels of reliability and validity in a non-clinical sample (Bjelland, Dahl, Tangen Haug & Neckelmann, 2002).

Diary measures. Diary measures are shown in Appendix L. During the fasting condition participants were asked to rate mood, reward from fasting, sense of achievement, sense of self-control and difficulty fasting, using visual analogue scales

(VAS) ranging from zero (“not at all”) to 10 (“extremely”). Measures were completed every two hours throughout the fasting day, giving a total of five measures. Participants also provided VAS scores at the beginning of the fasting period to give a baseline. Throughout the non-fasting condition, participants were also asked to rate mood, irritability, sense of self-control and sense of achievement so that participants acted as their own controls by providing data on a non-fasting day. Again participants were asked to complete the VAS at the beginning and five times throughout the non-fasting period.

Randomisation

Participants were randomised to complete either the fasting or non-fasting condition first. For allocation to condition, a computer-generated list of random numbers was used, and participants were assigned to the list in the order that they entered the study.

Statistical analyses

Data were analysed using SPSS 19.0 for Windows. All statistical tests used a 0.5 significance level. All participants’ data were analysed together, and there were no outliers or data excluded. Data from visual analogue scales (VAS) on mood, reward, hunger, irritability, achievement, pride, and self-control covered six time points. Therefore, pre-post fasting and mean change scores were calculated for each variable, which were used in analyses.

Correlational analyses were used to assess whether there were significant relationships between the extent to which participants endorsed personality variables associated with ANR, and ED symptomatology as rated on the EDE-Q.

Effect of fasting was assessed using paired samples t-tests comparing VAS data before and after fasting. Then a repeated measures ANOVA was carried out to assess whether there was a significant effect of fasting.

In order to explore the relationship between personality variables and VAS data, correlational analyses were performed in the first instance to assess whether there were significant relationships between scores on personality subscales and VAS data. A repeated measures ANOVA was performed with personality variables as between group factors.

Results

Sample characteristics.

Mental health of participants. Of the total sample, 5.8% ($N = 3$) reported that they had had an ED in the past, and 3.8% ($N = 2$) reported having a current mental health problem.

Previous fasting and predicted difficulty of fasting. The majority of participants had no previous experience of fasting (73.1%, $N = 38$). Fourteen participants had fasted previously (26.92%). Of these, nine had done so for dietary or health reasons, and five had done so for religion. Six participants (11.5%) predicted that they would find fasting difficult, 14 (26.9%) anticipated that it would be easy, and half (50%, $N = 26$) predicted that it would be of medium difficulty.

Self-reported depression and anxiety. Of the total sample, 98.1% completed the HADS ($N = 51$). Cronbach's alpha of internal consistency reliability in the current sample was .87 for the anxiety scale, and .80 for depression, indicating that the scales were reliable. The mean anxiety score was 5.57 ($SD = 4.17$, range 0 – 18), and mean depression score was 2.82 ($SD = 2.83$, range 0 – 12). These are within one standard deviation of norms found in non-clinical populations previously, where mean anxiety was 6.14 ($SD = 3.76$), and mean depression was 3.68 ($SD = 3.07$)

(Crawford, Henry, Crombie, & Taylor, 2001). Clinical caseness is generally considered to be indicated by a score > 8 (Bjelland et al., 2002). Zigmond & Snaith (1994) suggested that scores of 8 – 10 indicate mild anxiety/depression, 11 – 15 indicate moderate anxiety/depression, and ≥ 16 indicate severe anxiety/depression. In this sample, on the anxiety scale, 17 participants (33.3%, $N = 17$) had scores ≥ 8 . The majority of these fell within the mild range ($N = 10$), 7 fell within the moderate range, and 1 was in the severe range. Three participants (5.9%) scored ≥ 8 on the depression scale, 1 in the mild range, and 2 in the moderate range.

Self-reported eating disorders. All participants completed the Eating Disorders Examination Questionnaire 6.0 (EDE-Q). Cronbach's alpha scores for the different subscales were restraint = .85, eating concern = .79, weight concern = .60, and shape concern = .76. The mean BMI was 21.19 ($SD = 3.22$, range 15.80 – 30.70). The ICD-10 diagnostic criteria for AN is a BMI of 15% less than expected, or < 17.5 kg/m^2 (WHO, 2010). In the current sample, four participants had a BMI below this clinical cut-off. It was decided to include these participants in the analysis for a number of reasons. Firstly, on other EDE-Q subscale scores, clinical cut-off is said to be indicated by a score of ≥ 4 (Luce, Crowther & Pole, 2008). Of the participants whose BMI was < 17.5 kg/m^2 , none scored in the clinical range on any of the EDE-Q subscales. Additionally, weight and height on the EDE-Q were self-reported and were therefore potentially underestimated. Researchers also met all participants and, though it was not a reliable measure, no participants appeared extremely underweight, which may indicate that some BMIs were miscalculated by participants. Finally, the participants who reported BMIs below clinical cut-off were of Chinese or Korean ethnicity, and previous research has indicated that in these groups average BMI is

lower than in Western samples (Arriaza & Mann, 2001; Jung & Forbes, 2007; Lee, Ho, & Hsu, 1993; Yates, Edman, & Arguete, 2004).

In the current sample, mean scores on all EDE-Q subscales were higher than in Fairburn and Beglin's (1994) normative sample. Mean scores on the global, restraint, shape concern, and weight concern subscales were within one standard deviation of Fairburn and Beglin's norms. Mean eating concern score was within two standard deviations of the norm. Higher means have been found in a sample of undergraduate women (Luce et al. 2008), however, the scores in the current sample were still higher, but all were within one standard deviation. Table 2 displays mean scores on EDE-Q subscales.

Table 2.

Mean scores on EDE-Q6.0 subscales in the current sample compared to Fairburn and Beglin's (1994) community norms

Subscale	Mean (SD) current sample ($N = 52$)	Mean (SD) Fairburn & Beglin (1994) norms ($N = 243$)	Mean (SD) Luce, Crowther, & Pole (2008) norms ($N = 723$)
Global	2.12 (1.00)	1.55 (1.21)	1.74 (1.30)
Restraint	2.18 (1.31)	1.25 (1.32)	1.62 (1.54)
Eating Concern	1.52 (.77)	0.62 (0.86)	1.11 (1.11)
Shape Concern	2.24 (1.12)	2.15 (1.60)	2.27 (1.54)
Weight Concern	2.60 (1.20)	1.59 (1.37)	1.97 (1.56)

T-tests revealed that mean global EDE-Q score was significantly higher than global score in Fairburn and Beglin's sample, $t(294) = 3.59$, $p < .001$, and global score in Luce, Crowther, and Pole's sample, $t(774) = 2.59$, $p < .001$. This suggests that the current sample expressed significantly more ED pathology than normative samples.

On the global subscale, 3 participants scored above clinical cut off. On the restraint subscale 9 participants scored above cut-off, 1 scored above cut-off on the eating concern subscale, 5 scored above cut-off on weight concern, and 7 scored above cut-off on shape concern. One participant scored above clinical cut-off on all subscales.

Frequency of reported bingeing is displayed in Table 3. In terms of bingeing behaviour, 5 participants (10.0%, Range 4 – 12) reported regular occurrence of objective binge episodes (OBEs), that is, overeating on ≥ 4 occasions with a sense of loss of control (LOC), in the past 28 days.

With regards to compensatory behaviour, the commonest method of weight control reported was exercising in a compulsive way, which 25% of participants reported doing at least once in the last 28 days. Of these 19.2% (Range = 0 -20) reported doing this regularly (≥ 4 times, or on average once a week in the past 28 days). Two participants (3.9%) reported that they had self-induced vomiting; one participant indicated that she had done so 15 times in the previous 28 days, and the other had done so on 5 occasions. In terms of laxative use 3 participants reported regular use (5.9%, Range = 7 – 10) of whom did so regularly.

Table 3.

Frequency of compensatory eating disorder pathology in the current sample compared to frequencies found by Mond, Hay, Rodgers, and Owen. (2006)

	SBEs	OBEs	Vomiting	Laxatives	Exercise
	%	%	%	%	%
Current sample regular occurrence (<i>N</i> = 52)	11.8	10.0	3.9	5.9	19.2
Mond et al. (2006) regular occurrence (<i>N</i> = 5231)	13.2	5.5	1.4	1.0	22.8

Note. Regular occurrence = on average one or more times per week (≥ 4) in the past 28 days. Abbreviations: SBEs: subjective binge episodes. OBEs: objective binge episodes.

Data on the EDE-Q global subscale were significantly non-normal, $D(46) = .14, p = .02$, as were data on the subscales of restraint, $D(46) = .21, p < .001$, eating concern, $D(46) = .27, p < .001$, and weight concern, $D(46) = .14, p = .02$. EDE-Q global score data were also significantly positively skewed (skewness = 2.84, $SE = .35$), as were data on the restraint (skewness = 1.19, $SE = .33$), eating concern (skewness = 1.94, $SE = .33$), and weight concern (skewness = .69, $SE = .34$) subscales. Eating concern subscale scores also showed significant kurtosis (kurtosis = 3.18, $SE = .65$).

A log transformation was performed on global EDE-Q scores, after which the data did not depart from normality, $D(47) = .89, p = 2.00$, and was no longer skewed (skewness = .27, $SE = .35$). The transformed global scores were used in the analysis. A log transformation was also applied to EDE-Q restraint subscale scores, after which data still departed from normality $D(47) = .15, p = .01$, however, they were no longer significantly skewed (skewness = .49, $SE = .33$). The transformed EDE-Q restraint scores were used in the analysis.

Results of specific hypotheses

Relationship between self-reported ED symptomatology and personality variables. The first hypothesis was that the extent to which personality variables associated with ANR were endorsed would significantly correlate with severity of ED symptomatology indicated by the EDE-Q. Pearson's correlational analyses were performed to assess the strength of relationships between global and restraint EDE-Q scores, and extent to which personality variables associated with ANR were endorsed (see Table 4 for correlations). As EDE-Q restraint subscale data were significantly non-normal, a non-parametric equivalent, Spearman's Rho, was used to assess the relation between personality variables and EDE-Q restraint scores. To control for the

risk of type-I error Bonferroni adjusted alpha levels of .0083 were used for these. As questionnaires contained multiple scales these values were corrected for the number of tests performed on each questionnaire scale. After adjustments had been performed to control for type-I error, there were no significant correlations, although there was a non-significant trend for higher PPPQ-22 perseveration to be associated with higher restraint scores. Overall, however, personality variables were not associated with ED symptomatology in this sample.

Table 4.

Correlations between scores on personality scales and self-reported global ED symptomatology and self-reported restraint on the EDE-Q

	TCI Persistence	PPPQ-22 Persistence	PPPQ-22 Perseveration	MPQ Control	MPQ Constraint	TCI Novelty- Seeking
Mean EDE- Q global	$r = -.20$ $p = .18$	$r = .08$ $p = .60$	$r = .33$ $p = .02$	$r = .14$ $p = .35$	$r = .03$ $p = .82$	$r = -.08$ $p = .59$
Mean EDE- Q restraint	$r_s = -.11$ $p = .45$	$r_s = .01$ $p = .94$	$r_s = .36$ $p = .01$	$r_s = .08$ $p = .60$	$r_s = -.01$ $p = .94$	$r_s = -.06$ $p = .66$

Note. Bonferroni adjusted alpha levels of .0083 were used. Abbreviations = EDE-Q: Eating Disorders Examination Questionnaire 6.0 (Fairburn & Beglin, 1994). TCI: Temperament and Character Inventory (Cloninger et al., 1994). PPPQ-22: Perfectionism, Persistence and Perseveration Questionnaire (Serpell et al., 2008). MPQ: Multidimensional Personality Questionnaire (Tellegen, 1982).

Effect of fasting. The second hypothesis was that there would be a main effect of fasting on scores on VAS measures. Paired samples t-tests were used to compare mean scores on VAS measures at the start of fasting (F^1) and end of fasting (F^6). Bonferroni adjusted alpha levels of .00625 were used in order to control risk of type I error. Mean scores out of 10 (0 = “not at all”, 10 = “extremely”) on VAS measures revealed that at the end of fasting participants were significantly more

hungry ($M^{F1} = 1.56, M^{F6} = 5.93, t(47) = -9.05, p = <.001$), more irritable ($M^{F1} = 1.77, M^{F6} = 3.44, t(47) = -3.95, p = <.001$), had a significantly higher sense of achievement ($M^{F1} = 1.83, M^{F6} = 5.28, t(47) = -7.26, p = <.001$), pride ($M^{F1} = 1.77, M^{F6} = 4.86, t(47) = -6.43, p = <.001$), and self-control ($M^{F1} = 3.73, M^{F6} = 5.97, t(47) = -4.19, p = <.001$) than at the start of fasting. These can be seen in Table 5.

Participants also rated fasting as increasingly difficult throughout the fasting period, ($M^{F1} = 1.43, M^{F6} = 4.53, t(46) = -6.87, p = <.001$). Difficulty rating at the end of the fasting period (F^6) was significantly correlated with hunger, $r = .67, p > .001$, and irritability, $r = .68, p > .001$, at the end of fasting.

Table 5.

Mean scores on VAS measures at the start and end of fasting, and paired samples t-tests comparing mean scores on VAS measures from start of fasting (F^1) to end of fasting (F^6)

	Start of fasting F^1	End of fasting F^6	Paired samples t-tests of VAS scores from start of fasting F^1 and end of fasting F^6
	Mean, (SD), range	Mean, (SD), range	
Mood	6.58, (1.83), 0 - 10	6.00, (2.12), 1 - 10	$t(47) = 2.10, p = .04$
Sense of reward	4.67, (2.7), 0 - 9	4.94, (2.70), 0 - 10	$t(47) = -.66, p = .51$
Hunger	1.56, (2.09), 0 - 8	5.93, (2.54), 0 - 10	$t(47) = -9.05, p = .00^{**}$
Irritability	1.77, (2.15), 0 - 9	3.44, (2.71), 0 - 10	$t(47) = -3.95, p = .00^{**}$
Sense of achievement	1.83, (2.40), 0 - 8	5.28, (2.80), 0 - 10	$t(47) = -7.26, p = .00^{**}$
Sense of pride	1.77, (2.22), 0 - 7	4.86, (3.00), 0 - 10	$t(47) = -6.43, p = .00^{**}$
Sense of control	3.73, (3.40), 0 - 10	5.97, (2.70), 0 - 10	$t(47) = -4.20, p = .00^{**}$
Difficulty	1.43, (2.41), 0 - 10	4.53, (2.81), 0 - 9	$t(46) = -6.87, p = .00^{**}$

Note. Means, standard deviations, and ranges are calculated based on participants who provided data on respective variables. * indicates $p < .006$, which is the Bonferroni adjusted alpha level. ** indicates $p < 0.01$.

In contrast, paired samples t-tests showed that there was no significant difference on any VAS measures from the start of the non-fasting period (NF1) to the end of non-fasting (NF6), as can be seen in Table 6.

Table 6.

Mean scores on VAS measures at the start and end of non-fasting, and paired samples t-tests comparing mean scores on VAS measures from start of non-fasting (^{NF1}) to end of non-fasting (^{NF6})

	Start of non-fasting ^{NF1}	End of non-fasting ^{NF6}	Paired samples t-tests of VAS scores from start of fasting ^{NF1} and end of fasting ^{NF6}
	Mean, (SD), range	Mean, (SD), range	
Mood	6.32, (1.45), 2 - 10	6.34, (2.09), 0 - 9	$t(45) = .08, p = .94$
Sense of reward	4.38, (2.82), 0 - 10	3.95, (2.98), 0 - 10	$t(45) = 1.40, p = .17$
Hunger	2.04, (2.40), 0 - 9	2.62, (2.49), 0 - 9	$t(45) = -1.44, p = .16$
Irritability	2.15, (1.96), 0 - 8	2.51, (2.40), 0 - 9	$t(45) = -1.19, p = .24$
Sense of achievement	3.80, (2.90), 0 - 9	4.12, (2.99), 0 - 9	$t(45) = -1.08, p = .29$
Sense of pride	3.69, (2.72), 0 - 9	3.65, (2.96), 0 - 9	$t(45) = .19, p = .85$
Sense of control	5.31, (3.00), 0 - 10	5.24, (2.92), 0 - 10	$t(45) = .06, p = .95$

Note. Means, standard deviations, and ranges are calculated based on participants who provided data on respective variables. Bonferroni adjusted alpha levels were used.

T-tests were also performed comparing mean scores on VAS measures from the end of fasting ^{F6} and end of non-fasting ^{NF6} periods. These showed that at the end of fasting compared to the end of non-fasting participants experienced a significantly higher sense of reward ($M^{F6} = 4.96, M^{NF6} = 3.95, t(43) = -3.17, p = .003$), were significantly more hungry ($M^{F6} = 5.89, M^{NF6} = 2.62, t(43) = -6.99, p < .001$), had a significantly higher sense of achievement ($M^{F6} = 5.32, M^{NF6} = 4.12, t(43) = -3.83, p < .001$), and a significantly higher sense of pride ($M^{F6} = 4.93, M^{NF6} = 3.65, t(43) = -4.08, p < .001$). These are summarised in Table 7.

Table 7.

Results of paired samples t-tests between scores on VAS measures at the end of fasting^{F6} and end of non-fasting^{NF6}

	Paired samples t-tests of VAS scores from end of fasting ^{F6} and end of non-fasting ^{NF6}
Mood	$t(43) = .85, p = .40$
Sense of reward	$t(43) = -3.17, p = .00^{**}$
Hunger	$t(43) = -6.99, p = .00^{**}$
Irritability	$t(43) = -2.40, p = .02$
Sense of achievement	$t(43) = -3.83, p = .00^{**}$
Sense of pride	$t(43) = -4.08, p = .00^{**}$
Sense of control	$t(43) = -1.59, p = .12$

Note. * indicates $p < 0.05$. ** indicates $p < 0.01$. Significance values were Bonferroni adjusted alpha levels of .0071 were used.

A repeated measures ANOVA revealed that there was a significant main effect of fasting on VAS measures, $F(1, 41) = 46.92, p < .05$. There was a significant interaction effect between fasting condition and VAS measure rating, $F(4.31, 176.56) = 12.09, p = < .05$. This suggests that fasting impacted on participants' self-report ratings on VAS scales.

The relationship between personality variables and VAS measures. The final three hypotheses were that higher baseline persistence and constraint, and lower baseline novelty-seeking scores would be associated with different responses to fasting, that is, fasting would be rated as more rewarding, more or less difficult, providing more sense of control, pride, or improvements in mood

Self-reported persistence. In the current sample there was high internal consistency in the TCI persistence subscale, Cronbach's alpha = .95. Mean score on the TCI persistence subscale was 2.4 ($SD = .58$, Range = .89 – 3.8), which is within one standard deviation from norms found in a community sample using a Swedish version of the TCI by Brändström, Sigvardsson, Nylander, and Richter (2008), and

within two standard deviations of those found by Hansenne, Le Bon, Gauthier, & Anseau (2001) in a Belgian community sample.

Mean score on the persistence subscale of the PPPQ-22 was 3.5 ($SD = .7$, Range = 1.75 – 5.0), with good internal consistency, Cronbach's alpha = .86. This is similar to the study by Waller et al. (2012), in which a mean of 3.42 ($SD = 0.57$) was found for the non-clinical group. PPPQ-22 perseverance score was also analysed as earlier personality measures such as the TCI do not necessarily distinguish between persistence and perseverance. In this sample mean score on the perseverance subscale was 2.70 ($SD = .62$, Range = 1.63 – 4.63), which is within 1 standard deviation of the healthy controls in the study by Waller et al. ($M = 2.36$, $SD = 0.60$).

Persistence scores on the TCI and PPPQ-22 were significantly correlated, $r = .70$, $p < .001$, which indicated good convergent validity between scales. PPPQ-22 perseverance scores also positively correlated with PPPQ-22 persistence, $r = .49$, $p < .001$, and TCI persistence scores, $r = .57$, $p < .001$, which suggested that measures of persistence and perseverance overlapped.

Self-reported constraint. In the current sample the internal consistency of the MPQ control subscale was high (Cronbach's alpha = .88). The mean score on the MPQ control lower order scale was 14.94 ($SD = 6.07$, range = 0 – 24), which is within one standard deviation of that found by Harkness, Tellegen, & Waller (1995) in a student sample ($M = 14.32$, $SD = 5.33$). Mean on the higher order control scale was 47.88 ($SD = 17.89$, range = 0 – 76), which is within one standard deviation of norms found by Tellegen and colleagues (Tami Brown, University of Minnesota, personal communication, 21 December, 2011) in a community sample ($M = 59.16$, $SD = 15.19$).

Data was significantly non-normal on the higher order MPQ constraint scale, $D(46) = .15, p = .09$, and data were negatively skewed on both the lower order control (skewness = $-.52, SE = .33$), and higher order constraint (skewness = $-.64, SE = .33$) scales were negatively skewed. Therefore, the variables were reflected and square root transformations were performed, after which data were normally distributed on both the lower order control scale, $D(51) = .09, p = .20$, and the higher order constraint scale, $D(51) = .09, p = .20$. After transformations data were not significantly skewed on either the control scale (skewness = $-.24, SE = .33$), or the constraint scale (skewness = $-.24, SE = .33$). The transformed variables were used in the analysis.

Self-reported novelty-seeking. There was high internal consistency reliability on the TCI novelty-seeking subscale, Cronbach's alpha = $.85$. Mean overall raw total novelty-seeking score was 72.54 , which more than 2 standard deviations lower than means reported by Aluja, Blanch, Gallart and Dolcet (2010), where $M = 101.95, SD = 12.43$, and Garcia, Aluja, Garcia, Escorial, & Blanch (2012) where $M = 102.34, SD = 11.46$. This suggested that novelty-seeking was low in the current sample.

Relationship between personality variables and VAS measures. Correlations were performed to assess the strength of relationships between the personality variables persistence, constraint, and novelty-seeking, and mean change on VAS measures. Correlational analyses revealed no significant relationships as can be seen in Table 8.

Table 8.

Correlations between scores on personality scales and VAS data

	Mood mean change	Reward mean change	Hunger mean change	Irritability mean change	Achievem- ent mean change	Pride mean change	Control mean change
TCI Persistence	$r=-.05$ $p=.75$	$r=.25$ $p=.09$	$r=.16$ $p=.29$	$r=-.30$ $p=.85$	$r=.27$ $p=.07$	$r=.15$ $p=.33$	$r=.27$ $p=.07$
PPPQ-22 Persistence	$r=-.06$ $p=.71$	$r=.02$ $p=.88$	$r=-.01$ $p=.95$	$r=-.04$ $p=.77$	$r=.01$ $p=.95$	$r=.04$ $p=.81$	$r=.02$ $p=.87$
PPPQ-22 Perseverati on	$r=.00$ $p=.98$	$r=.02$ $p=.88$	$r=.04$ $p=.79$	$r=.13$ $p=.40$	$r=.02$ $p=.87$	$r=.01$ $p=.93$	$r=.09$ $p=.53$
MPQ Control	$r=-.09$ $p=.55$	$r=-.25$ $p=.10$	$r=.08$ $p=.61$	$r=.12$ $p=.44$	$r=-.14$ $p=.34$	$r=-.14$ $p=.37$	$r=.14$ $p=.35$
MPQ Constraint	$r=-.14$ $p=.36$	$r=-.17$ $p=.25$	$r=.17$ $p=.27$	$r=.24$ $p=.11$	$r=.02$ $p=.91$	$r=-.04$ $p=.82$	$r=.19$ $p=.22$
TCI Novelty- Seeking	$r=-.21$ $p=.16$	$r=-.17$ $p=.24$	$r=-.02$ $p=.90$	$r=.15$ $p=.31$	$r=-.14$ $p=.34$	$r=-.17$ $p=.25$	$r=.02$ $p=.91$

Note. Abbreviations = TCI: Temperament and Character Inventory (Cloninger et al., 1994). PPPQ-22: Perfectionism, Persistence and Perseveration Questionnaire (Serpell et al., 2008). MPQ: Multidimensional Personality Questionnaire (Tellegen, 1982).

In order to assess further whether high or low scores on personality measures affected mean change on VAS data repeated measures ANOVAs were performed.

VAS data were entered as within subject variables and high versus low scores on personality questionnaires were used as between subject factors. Scores on personality variables were categorised as high or low by way of a median split.

Effect of persistence and perseveration. During fasting there was no significant interaction between high or low scores on persistence measures and mean change in VAS scores. This was the case when persistence was measured with both the TCI, $F(1, 45) = 1.08, p = .30$, and the PPPQ-22, $F(1, 45) = .12, p = .74$. An

ANOVA was also performed to assess whether PPPQ-22 perseveration significantly interacted with mean change in VAS scores. No significant interaction was found, $F(1, 44) = .73, p = .40$.

Effect of constraint. There was no significant interaction effect between high and low constraint scores and VAS scores when measured with either the MPQ control lower order scale, $F(1, 44) = .45, p = .50$, or the MPQ higher order constraint scale, $F(1, 44) = .50, p = .48$.

Effect of novelty-seeking. During fasting, there was no significant interaction effect between novelty-seeking and VAS scores during fasting, $F(1, 45) = .08, p = .77$.

These results indicate that having a high or low score on certain personality variables did not affect participants' ratings of psychological variables during fasting.

Discussion

The current study set out to explore the relationship between personality variables associated with ANR (high persistence and constraint, and low novelty-seeking) and responses to short-term fasting in healthy controls.

Effect of fasting

The expectation that fasting would affect psychological variables was supported. As fasting progressed, participants reported that it was increasingly difficult and they became hungrier, however they also experienced an increased sense of achievement, pride, and control. Although sense of reward was not significantly higher from start to end of fasting, this may be due to the fact that even at the very start of fasting participants reported having a higher sense of reward. Sense of reward did continue to increase throughout fasting, though not significantly so given the higher rating of achievement at fasting baseline. Conversely, even at the start of non-fasting, sense of reward was rated as lower and this decreased

throughout non-fasting, leading to a significantly higher sense of reward at the end of fasting than end of non-fasting.

Previous research has suggested that fasting results in biological symptoms of depression, such as irritability, mood lability, and low libido, rather than cognitive/motivational symptoms. The results of the current study support these findings, as participants reported feeling increasingly irritable throughout fasting but did not report significant changes in overall mood.

However, as well as negative emotional correlates, this study also found that positive affective experiences, such as a sense of achievement, were associated with the fasting process.

Personality variables and ED symptomatology

The findings did not support the second hypothesis that endorsement of personality variables associated with AN-R (high constraint, high persistence, low novelty-seeking) would positively correlate with self-reported ED symptomatology. The results did not support previous findings that low novelty-seeking is linked to ED pathology, despite the fact that we found very low levels of novelty-seeking in the sample overall. However, these non-significant results may result from the fact that overall ED symptoms were low as it was a non-clinical sample, and we did not specify the type of ED symptomatology being reported. From previous research one would expect, say, low novelty-seeking to correlate with ANR but not BN symptoms.

In support of the findings by Serpell et al. (2009) that perseveration correlated with psychopathology, correlations between global EDE-Q scores and perseveration were approaching significance, however, were non-significant after correction for type-I error. In this sample, both mean PPPQ-22 persistence and perseveration were higher than means in both healthy controls and ED groups in the study by Waller et

al. (2012). However, there was no relationship between these traits and ED symptoms. This may be a result of recruiting a sample from higher education in which persistence may be highly valued or normalised. However, some of the healthy controls in the studies by both Waller et al., and Serpell et al. were also students, so it is unclear why there was not a stronger relationship between perseverance and EDE-Q scores in the current sample. It is likely that the current sample was not large enough to be able to detect a significant relationship.

It is possible that individuals in higher education may be more likely to focus their persistence on educational achievement rather than dietary restriction. Waller et al. (2012) suggested that persistence may predispose individuals to developing EDs and as the ED develops, the persistence becomes focused on ED behaviour and the individuals become relatively less persistent in other areas measured in the PPPQ-22, for example, work.

Personality variables and the effects of fasting

The findings did not support the hypotheses that higher persistence and constraint, and lower novelty-seeking scores would predict different responses to fasting. There could be several reasons for this null result. Chiefly, it is possible that personality variables do not influence ED pathology through responses to fasting. It is still conceivable that these personality variables affect the likelihood of an individual developing ANR. However, as Lilenfeld et al. (2005) emphasise, that conceptual models of the relationship between personality and EDs are poorly defined. Although personality variables have been associated with the course and outcome of EDs, it is not clear whether they act in a predispositional way, whether they are a complication of the ED itself, whether they interact with the ED once it is already established, or whether both the ED and personality traits are caused by a

third common factor or are even representations of the same underlying aetiology. Therefore, the field would benefit from more clearly defined conceptual models and the use of longitudinal, prospective studies. This study's paradigm implied a predispositional model approach, whereby we hypothesised that high constraint and persistence, and low novelty-seeking would predispose some individuals to respond differently to fasting.

There are a number of alternative reasons for the non-significant relationship between personality traits and fasting effects found here. These pertain to methodological limitations of the study. Firstly, the study used a non-clinical population, and even with the higher self-reported ED pathology compared to other non-clinical samples, the levels of ED symptomatology and personality variables may not have been high enough to detect any relationships in this sample. Additionally, personality variables were not correlated with ED symptomatology in the sample, but if this had been the case, then personality variables may still have affected fasting responses. Furthermore, participants in this sample would have displayed a variety of personality trait combinations other than high persistence, high constraint, and low novelty-seeking. We may have recruited participants who had some of the traits we were interested in, but we cannot be certain that we recruited any individuals with this precise combination of traits, which limits the conclusions that can be drawn. It would be interesting to replicate this research with individuals with ANR, although the ethical implications of this would need to be carefully considered.

As the study was focused specifically on personality traits consistently associated with ANR, other potentially important traits were neglected, for example, perfectionism, neuroticism, and obsessive-compulsiveness. Not including these traits

may have reduced the predictive power of the variables included, leading to the null finding. In reality, personality traits are unlikely to operate in isolation. Future research would benefit from including a more comprehensive range of variables.

Another possibility is that the measures did not tap the intended personality traits. Of particular concern is the TCI persistence scale, which may not distinguish between persistence and perseveration. This is evidenced by the fact that scores on the TCI persistence scale significantly correlated both with PPPQ-22 persistence and perseveration scores. Serpell et al. (2009) suggests that persistence is a helpful trait allowing one to continue with difficult or onerous activities to reach higher goals, for example, giving up smoking or passing an exam. In contrast, perseveration has been found to correlate more highly with psychopathology and relates to continuing with behaviour beyond the point of it being rewarding or useful (Serpell et al., 2009). Indeed, in the current sample, PPPQ-22 perseveration correlated most highly with ED pathology.

Clinical implications. The finding that fasting resulted in positive affect, for example, sense of achievement, reward, control, and pride supports cognitive behavioural and cognitive-interpersonal models of AN. The cognitive-behavioural model posits that AN is maintained, in part, by positive reinforcement from successful dietary restriction (for example, Fairburn et al., 1998; Garner & Bemis, 1982; Slade, 1982; Vitousek & Ewald, 1993). Fairburn, Shafran, and Cooper (1998) suggest that sense of control from restriction is particularly important, and they recommend shifting the focus of control from eating by helping patients to gain a sense of achievement, pride, or reward from other activities. Serpell, Teasdale, Troop, & Treasure (2004) also suggest that an individual may experience pros of AN such as it functioning as a communication of distress, or it leading to a sense of being

special through ability to maintain dietary restriction. Schmidt and Treasure's (2006) cognitive-interpersonal approach, combines both inter and intra-personal factors in the maintenance of AN. Like in earlier cognitive behavioural models, Schmidt and Treasure (2006) suggest that dietary restraint is positively reinforced with a sense of control early on in the disorder. However, they develop the model by including factors such as pro-anorectic beliefs, emotional avoidance, perfectionism and cognitive rigidity, and interpersonal reactions of family and peers to weight loss.

The current findings point to the benefits of using a cognitive-interpersonal model in the clinical treatment of AN. This may involve challenging pro-anorectic beliefs, reducing emotional avoidance, perfectionism, and cognitive rigidity, and working with other individuals in the client's system. Schmidt and Treasure (2006) also recommend the combining this with motivational interviewing techniques (Miller & Rollnick, 2002) in order to increase motivation to change. Given that this study suggests that fasting leads to positive affective experiences, it may be important to explore this with patients in order to understand what factors positively reinforce dietary restriction, and what pro-anorectic beliefs the individual holds. This may allow consideration of what other skills the individual could develop to provide a sense of pride or reward, for example.

In this study positive affective changes were induced in healthy controls even after short-term fasting. This makes it easy to see how even normal dieting may lead to longer term restriction through positive reinforcement. Therefore, it may be important to target this in treatment with individuals who do not already fast, especially given the high rates of diagnostic crossover in EDs. For example, an individual with BN or binge eating disorder may not routinely restrict food intake, and it may be valuable to include prevention of fasting as an element of treatment so

as to inhibit the development of ongoing dietary restriction. This may be addressed through, for example, psychoeducation about the risks of fasting.

In this sample, correlations between perseverance and EDE-Q global and restraint scores were approaching significance, although they were non-significant after correction for type-I error. This provides support for the findings by Serpell et al. (2009) that perseverance correlated with psychopathology. Therefore, it may be of benefit for ED interventions to explicitly address perseverance if this is partly maintaining ED symptoms. Perseveration could be addressed through use of typical cognitive-behavioural techniques such as cognitive restructuring, and behavioural experiments.

Limitations of the study

There were a number of other limitations to the study's design and methodology, which may have affected the results overall. The study relied on self-report data, which is potentially more fallible than data from objective assessments or semi-structured interviews because participants may misunderstand questions, and because responses are more open to distortion or social desirability bias. Responses on self-report personality measures are also more vulnerable to answers being affected by states, rather than stable traits.

Furthermore, data from the fasting and non-fasting periods was completed independently by participants. Although we asked participants not to retrospectively complete missed data points, they may have done so, and we had no way of checking whether participants had completed VAS scales at the correct time. However, many participants had missed data at one time point (often first thing in the morning), suggesting that, on the whole, they did not retrospectively complete measures, leaving them blank instead.

Data from the fasting and non-fasting periods was obtained using VASs. These have the benefit of allowing participants to rate subjective experiences in a graded way. Moreover, because data were gathered two-hourly throughout the fasting and non-fasting periods, it was not possible to use most standardised psychological measures of constructs such as mood, which tend to refer to longer time periods, for example, two weeks. The VASs provided a simple, fast, repeatable way of obtaining data without overwhelming participants. However, there were shortcomings to gathering data in this way. Aitken (1969) cautioned that different people will hold different understanding of the same affective label, and that comparable positioning of marks on VASs does not necessarily indicate the same subjective experience in two people. In attempt to overcome this, written labels were placed at either end of the VASs, however, responses would still have been affected by individuals' understandings of words and conceptualisations of different affective experiences. This was overcome to some extent with the repeated measures design, which meant that participants acted as their own controls, and therefore were likely to have used the same conceptualisation of affective experiences at all measurement points. However, it may be beneficial to repeat this research with use of more standardised measures of affective experiences.

Researchers did not objectively assess whether participants had EDs, for example, with the use of clinical interviews. Additionally, researchers had no way of determining whether or not participants had adhered to fasting conditions. However, the difference in VAS measures between fasting and non-fasting would suggest that participants did fast. Researchers and participants were aware of the condition, therefore, responses on VAS measures could have been biased by participants' expectations of the effects of fasting.

Although the study focused on personality variables in ANR, some participants reported more binge-purge type ED symptoms. In fact, in this sample there were higher reported levels of regular OBEs, vomiting, and laxative use than in other community samples (Mond, Hay, Rodgers, & Owen, 2006). It is possible that the personality variables associated with AN-R do not correlate with binge-purge EDs, and therefore any relationship in this sample was masked by grouping all participants together regardless of whether any reported ED symptoms were akin to AN-R or a binge-purge disorder. This study lacked statistical power to analyse participants according to reported ED symptoms. Future research using larger samples may benefit from analysing data in this way.

Finally, with regards to study design, it was exploratory in nature. Due to this, and having multiple hypotheses, multiple statistical tests were used, thereby increasing the risk of type-I error. Corrections were performed to account for this, however, it would be of benefit to repeat this research with a larger sample to allow for more rigorous statistical testing.

Aside from the aforementioned fact that the majority of participants were students, there were other limitations in terms of the sample. Principally, we recruited a non-clinical sample, therefore, it is possible that personality variables were not endorsed in the same way as in a clinical sample meaning that no significant relationships emerged. Moreover, these results cannot necessarily be generalised to individuals with EDs. It would be of benefit to replicate the research with a clinical sample, although the ethical implications of asking a clinical sample to fast should be carefully considered, especially in light of research on the effects of starvation and weight loss. However, t-tests revealed that the current sample expressed significantly more ED pathology than normative samples, which suggested

that the sample may not have been truly non-clinical, or that participants with existing EDs were attracted to the study. This limits the generalisability of the findings, and further research is required to address this.

It is possible that the study attracted individuals who liked fasting, already underwent fasting, or who experienced ED pathology. This would evidently cause a bias in the sample, particularly if participants regularly fasted for religious reasons and may associate it with positive effects. However, most participants reported that they had never fasted. Moreover, fasting was rated as increasingly difficult over time, indicating that even those who had fasted before found it difficult. In addition, participants may have been attracted by the monetary reward rather than an interest in EDs or fasting.

The largest ethnic group in the sample was Chinese, which could have posed several problems. Although all participants were fluent English speakers, if English was the second language of some participants this may have led to errors or misunderstanding when filling out questionnaires. It may also have resulted in participants having lower overall body weight (Lee, Ho, & Hsu, 1993). Furthermore, differences have been found in the expression of ED pathology in Chinese samples, for example, having no apparent fear of fatness, which may have affected responses on the EDE-Q. Chinese participants may also display cultural differences in values such as asceticism and expectations of achievement (Lai, 2000; Lee, Ho, & Hsu, 1993), potentially influencing responses to certain questions on the personality measures. However, the Chinese participants in the study were living and studying in the U.K. and so also likely to be affected by Western cultural ideals.

Furthermore, the study required commitment from participants in terms of meeting with researchers on multiple occasions and independently fasting and

monitoring variables. Therefore, it may have attracted individuals who felt confident that they could persevere through fasting, therefore being more persistent.

Alternatively, higher persistence scores may have led to participants to complete the study, therefore, leading to a more persistent sub-sample of people who participated in all stages. Repeating this research with a broader, larger sample may potentially resolve some of these concerns.

Strengths of the study

Several strengths of the study must also be acknowledged, including the within-subjects design whereby participants acted as their own controls. Additionally, asking participants to provide VAS measures of psychological variables two-hourly throughout the fasting period meant that we obtained rich data. To the best of our knowledge, this is one of the only studies to explore the effect of short-term fasting on psychological variables in healthy controls. Moreover, this is the only study to our knowledge, which explores the relationship between personality variables and the effects of fasting in healthy controls.

Future research

It would be useful for future studies to replicate this study using a larger sample comparing healthy controls, clinical comparisons and individuals with AN to assess whether the groups respond differently to fasting. Furthermore, it would be interesting to use this research paradigm with individuals with AN to test whether there are more notable links between the personality variables and effects of fasting, however, there are ethical concerns to this type of study.

Future studies should distinguish, as far as possible, between persistence and perseveration, perhaps using the PPPQ-22 in order to delineate the relationship between both constructs and EDs. Future research into personality and EDs should

also take into account the issues raised by Lilenfeld et al. (2005), in particular conceptual models being poorly defined.

Conclusion

This study aimed to explore the effect of persistence, constraint, and novelty-seeking on the effects of fasting in a non-clinical sample. The results showed that fasting led to negative affective states such as irritability, but also to positive psychological experiences such as increased sense of reward, achievement, pride, and control as participants reported increasing hunger and difficulty of fasting. To our knowledge, this is one of the only studies showing that these positive psychological experiences can result from fasting, even in healthy controls. These findings lend support to cognitive-behavioural and cognitive-interpersonal models of AN, which suggest that fasting is maintained partly through positive reinforcement, and may elucidate how extreme dietary restriction can result from ordinary dieting or fasting.

Findings did not support the hypothesis that individuals scoring higher on persistence and constraint, and lower on novelty-seeking would experience fasting differently.

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Part 3: Critical Appraisal

Critical appraisal

This appraisal will reflect on the process of designing and undertaking this literature review and empirical study. Some of the relevant methodological limitations will be discussed including use of a non-clinical sample, challenges in data gathering, and drawbacks to the statistical methods used. Ethical considerations will also be discussed. This appraisal will also consider some of the challenges of using personality measures, and the process of conducting joint research. Recommendations for future research will be made.

Origins of the study

I was drawn to undertaking a research project in the eating disorders (ED) field due to the profound consequences that ED pathology can have on sufferers. The National Institute of Clinical Excellence (NICE) guidelines for the treatment of EDs (2004) highlight that chronic starvation in AN can lead to physical problems such as reduced muscle strength and bone density, infertility, polycystic ovaries, and stunting of growth. Research has also indicated that AN can lead to persistent changes to brain anatomy, and abnormalities in executive functioning. Furthermore, AN has been found to have the highest mortality rate among all mental health problems (Harris, & Barraclough, 1998), and its incidence has risen in the at risk group of fifteen-to-19 year old females (van Son, Hoeken, Bartelds, van Furth, & Hoek, 2006). I was particularly interested in risk factors for AN, as these may help to elucidate routes to prevention and intervention.

I was also interested in the societal, political context of research into EDs and obesity as there is a curious paradox at present, whereby the rise in incidence of AN in some demographic groups has gone hand in hand with the doubling of worldwide overweight and obesity since 1980 (WHO, 2012). Therefore, I was keen to develop a

literature review and empirical paper, which considered a variety of risk factors for the development of EDs, that is, childhood overweight interventions, and personality traits. Of course, these still only represent a tiny fraction of the potential risks for AN but their diversity is fascinating nonetheless. It is also this multiplicity of risk factors, which presents such a challenge to those researching EDs. As well as personality, researchers have identified a multitude of other risk factors for EDs. These risks relate to genetics (Bulik & Tozzi, 2004), physiology or biology (Kaye, Frank, Bailer, & Henry, 2005), environment (Stice, 2002; Treasure, Claudino, & Zucker, 2010; Wade, Gillespie, & Martin, 2007), adolescence (Treasure et al., 2010), and psychological factors (Cavedini et al., 2006; Fairburn, Cooper & Shafran, 2003; Fairburn & Harrison, 2003; Lopez, Tchanturia, Stahl, & Treasure, 2008; Roberts, Tchanturia, Stahl, Southgate, & Treasure, 2007; Southgate, Tchanturia, & Treasure, 2008). This plethora of possible risk factors, combined with the potential biological effects of starvation or erratic diet, makes the task of identifying causal pathways in EDs a very challenging one indeed.

Literature Review

I had initially wanted to review the literature on personality and EDs. However, as Lilenfeld, Wonderlich, Riso, Crosby, and Mitchell (2006) suggest, the conceptual models of this are limited. Furthermore, I found much of the literature to be outdated and non-empirical. Several comprehensive reviews of the literature on EDs and personality already exist (Cassin, & von Ranson, 2005; Vitousek, & Manke, 1994). Therefore, I decided to focus my literature review on more contemporary research and the risks associated with emerging approaches to childhood weight.

Perhaps the most striking finding in the review was that of 267 papers on interventions for childhood overweight, only 24 included measures of ED pathology

or risk factors. Given the fact that childhood overweight and dieting have been found to adversely affect risk of later developing an ED (Stice, 2002), this seems like an oversight. As worldwide obesity continues to increase, use of interventions to reduce will likely become more common. Therefore, it is paramount to be aware of the potential risks involved and safeguard for these.

Methodological considerations of the empirical study

Use of a non-clinical sample. I chose to recruit a non-clinical sample as this allowed more scope for separation of the effects of short-term fasting from the effects of chronic starvation that would be present in clinical samples. Recruiting a non-clinical sample allowed for ease of recruitment, and the finding that short-term fasting has an impact on psychological variables even in healthy controls is potentially significant. However, there were several notable limitations to the use of a non-clinical sample. These include the generalisability of the results to a clinical population; it is possible that different processes occur in those who have already developed EDs and are chronically starved, to those who have undertaken short-term fasting. With that in mind this research may be better performed with a clinical population, some of whom will be starved because, ultimately, this is the population to whom results need to be generalised. It may be of benefit to repeat this research with a clinical population, although the ethical implications of this would have to be carefully considered. Recruiting a young, female population may be seen as beneficial as this represents the group most at risk of EDs. However, this may also limit the generalisability of the results to a well-educated, female population, therefore, future studies would benefit from recruiting a more educationally and socio-economically diverse sample.

Although we aimed to recruit a non-clinical sample, we did not perform objective assessments of BMI and ED pathology. As a result, we acquired a sample whose scores on some of the EDE-Q subscales were significantly higher than expected from other community norms (Fairburn & Beglin, 1994; Luce, Crowther, & Pole, 2008). It is possible that the nature of the study was attractive to individuals with some sort of existing ED pathology. From this, recommendations can be drawn to utilise more objective assessments of ED pathology, for example, the Eating Disorder Examination (Fairburn & Cooper, 1993) when recruiting non-clinical samples to ensure that the sample truly is non-clinical.

Ethical considerations. Another issue raised by the use of a non-clinical sample pertained to an ethical dilemma. As a trainee clinical psychologist I work clinically with individuals with mental health problems. During the process of statistical analysis it became apparent that a number of participants reported significant symptoms of depression, anxiety, or EDs. However, as participants' answers were anonymised, it was not possible for me to contact them with information on sources of support. If answers to questionnaires had not been anonymised, this would potentially have compromised how honest participants felt they could be. However, I felt uncomfortable that I was not able to sign-post participants who had expressed distressing symptoms to relevant sources of support. I think it would be important in future research to provide all participants with a list of relevant organisations such as B-eat eating disorders charity.

Another ethical issue that I faced in designing this study relates to asking participants to fast for 18-hours. I was aware from personal experience that hunger can be an uncomfortable experience! Therefore, I was keen to offer a substantial monetary reward to participants for their contribution. It is possible that participants

who like fasting, or who do not find fasting a terribly unpleasant experience may have been attracted to the study. Therefore, I attempted to account for this by asking participants whether they routinely fasted, and also to rate difficulty of fasting throughout the fasting period. However, a bias in the sample may have remained and future research may benefit from actively recruiting samples of people who are not attracted to the idea of fasting.

Additionally some previous research has indicated that fasting itself can contribute to the development of EDs (Dwyer, Horton, & Aamodt, 2011) in susceptible individuals with a defective starving response, or with perseverative traits. This potentially raises serious ethical concerns about this study. However, we asked participants to fast for a relatively short period of time, and many may have already fasted for periods of this length, say when physically unwell. In future research using a fasting paradigm, it would be helpful to make participants aware of this previous research in order that they can make a fully informed decision about participation.

Research suggesting that fasting can increase risk of developing EDs also raises questions about the safety of the newly popular 5:2 Intermittent Fasting (IF) diets, which involve eating normally on five days a week and fasting for two days, or alternate day fasting diets. IF regimes may, but do not necessarily, involve reducing calorie intake, instead frequency of food consumption is altered (Varady & Hellerstein, 2007). There is some evidence that IF is as efficacious as constant caloric restriction in weight loss (Harvie et al., 2011). IF has been found to have beneficial effects including reducing risk of cardiovascular disease, diabetes, and cancer (Harvie et al., 2011; Harvie & Howell, 2012; Kroeger, et al., 2012). However, more understanding is needed of the mechanisms by which this works, and research has yet to indicate the optimum schedule of calorie intake and fasting (Harvie &

Howell, 2012). Furthermore, to our knowledge, little research exists as to the relationship between IF and ED risk factors. This may be an area for future research.

Data gathering. One of the strengths of the study's design was the collection of data every two hours throughout the fasting period. Asking participants to provide data at certain time points meant that we gathered rich regular data throughout fasting and were able to track the change in variables. Furthermore, participants kept diaries in their natural environments rather than in a laboratory setting, increasing ecological validity. However, there was a concern that some participants may have retrospectively completed measures. I aimed to minimise the chances of this by asking participants to leave incomplete data points blank rather than retrospectively filling them out. Participants appeared to have followed these instructions as a number of them had incomplete diaries, with the early morning measures being the most commonly missed. However, we had no objective means of checking this. Smyth et al. (2001) have underlined some of the potential pitfalls of retrospective self-report including social desirability bias, biases in autobiographical memory recall, and reporting experiences in line with the most salient or recent experiences. The alternative, laboratory testing, has obvious limitations in terms of ecological validity, therefore, Smyth and colleagues recommend the use of ecological momentary assessment (EMA). EMA (Stone & Shiffman, 1994) involves prompting participants to provide data at given time-points with the use of an electronic signalling device such as a pager, or palmtop computer. Unfortunately, I was not able to use this method due to insufficient funding. However, future research would benefit from use of this method to gather rich, ecologically valid data to help elucidate complex causal models.

Use of a fasting paradigm. One of the strengths of the study was its experimental, repeated measures design, which allowed me to draw conclusions on the effects of fasting in the sample. As mentioned in part 2 of this thesis, the significant main effect of fasting suggested that participants had fasted, however, I was not able to check whether participants strictly adhered to fasting conditions. I attempted to overcome this by informing participants that we may randomly request urine samples to check ketone levels. However, some participants may have been aware that ketone levels are not an accurate marker of fasting (Bolton, Burgess, Gilbert, & Serpell, under consideration; Connan & Stanley, 2003), especially those who were medical students.

Another of my concerns about the fasting paradigm was the interaction and overlap between biological and psychological effects of fasting. It was difficult to know how biological effects of fasting, for example, low blood sugar, might be impacting on affective experience such as self-reported irritability. Dwyer, Horton, & Aamodt (2011) suggest that physiological responses to fasting play a significant role, whereby individuals with AN have an altered regulation of their starving response, including reduced appetite even after fasting, which contributes to the maintenance of the disorder. Dwyer et al. (2011) go as far as to suggest that personality variables, psychological and cultural variables may modify the course of AN but are unlikely to be causative agents.

Statistical analysis. An issue related to gathering data over several time points is that the abundance of data gathered precludes the use of some common statistical methods such as ANOVA (Smyth et al., 2001). This was a relevant issue for my study, which I had to overcome by creating new variables of the mean change in mood, hunger, reward, difficulty, sense of control, reward, and achievement.

Using aggregate measures of this sort is on method recommended by Smyth and colleagues, however, it has potential shortcomings, for example, obscuring unequal rates of change in measures over different points in time. Smyth et al. have drawn attention to recent statistical developments leading to statistical analytical procedures apt for use with this kind of data. However, the current study lacked the statistical power to use these.

Due to the exploratory nature of this study, multiple statistical tests were used. This is of concern as it potentially increases the risk of type-I error, or making a false positive result. Where possible I tried to control for this using Bonferroni corrections. However, future research would benefit from the use of a larger sample to allow for more robust statistical analyses.

Other considerations

Personality measures. One issue the study did not touch on was that of the overlap of personality traits and personality disorders (PDs). Some researchers have posited that ANR and obsessive-compulsive personality disorder share a common cause (see Lilienfeld et al., 2006 for a review). The conceptualisation of PDs has recently changed with the advent of the new fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; APA, 2013). Although the same PDs remain in the DSM-5, in order to address problems arising from the categorical conceptualisation of PDs a mixture of dimensional and categorical approaches will now be used in diagnosis. In the current study, I did not screen participants for presence of PDs, as I wanted to allow for variation in the sample. However, having a PD could have affected participants' responses to personality measures. Future researchers may benefit from screening participants for diagnosable PDs.

Joint work. This study was conducted jointly with Sebastien Thompson (Thompson, 2013; see Appendix A for details). Working in conjunction permitted us to pool our financial resources, which allowed us to reward participants with a substantial monetary incentive. Furthermore, it allowed us to recruit more participants than would have been possible independently as we were able to share the burden of meeting with participants on multiple occasions. It also meant that we were not “competing” to recruit the same participants. For a short period during the testing phase, we recruited the help of an honorary research assistant who conducted a small number of testing sessions with participants. This was a mutually beneficial arrangement insofar as the research assistant was keen to gain research experience and advice on applying to clinical psychology training, and we benefitted from support with testing participants. Working jointly with Mr. Thompson, enlisting the support of a research assistant, and discussing my research with individuals undertaking PhD research in EDs led me to appreciate the benefits of conducting research as part of a team, but also of the benefits of sharing resources, and creating research communities in which individuals can learn from one-another.

Conclusions

This study investigated the effect of certain personality traits on the effects of short-term fasting in healthy controls. There was a significant effect of fasting on participants’ ratings of psychological variables, indicating both negative and positive affective experiences as a result of fasting. However, contrary to the hypothesis, these affective experiences were not affected by the extent to which the personality traits persistence, constraint, and novelty-seeking were endorsed. The generalisability of the findings is limited by methodological drawbacks such as use of a non-clinical sample, limitations to statistical methods, and the complexities of measuring

personality constructs. However, there were also strengths to the design including regular data collection throughout the fasting period.

This research provides evidence for cognitive-behavioural and cognitive-interpersonal models of ANR. Furthermore, the findings in the empirical study, that even short-term fasting can lead to positive affective experiences, should be considered in the future design of childhood obesity interventions, such as those discussed in the literature review. The results indicate that methods of reducing calorie intake in obesity prevention need to be carefully considered, as simply fasting, or advocating dietary restriction may impact on future risk of developing an ED.

It may be of benefit to replicate this research with a larger sample, and addressing some of the methodological limitations discussed. Furthermore, it would be interesting to repeat this research with a clinical sample, however, the ethical implications of this would need to be carefully considered and weighed against the potential gains of this research in terms of understanding and treating ANR.

Reflecting on the process of conducting this research has led me to recognise that it is not possible to create a perfect piece of research, and that it always involves a process of balancing different elements, and an appreciation of both the strengths and limitations of a study's design.

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Appendix A

Details of joint work

This study was conducted jointly with Sebastien Thompson (trainee clinical psychologist). We both required participants to undergo an 18-hour fast so we jointly recruited and tested participants. This meant that some of the data collection for each of our studies was undertaken by the other trainee. For example, if Mr. Thompson met a participant at their first meeting, he would be responsible for obtaining personality questionnaires for my study. Likewise, if I met a participant at their third meeting I would be required to carry out a stroop task with them for the purposes of Mr. Thompson's study.

If the task of data collection had not been shared, it would have been unwieldy as we met each participant on three occasions. Sharing the task of recruitment allowed us to individually obtain more participants, as the number of people willing to fast for 18 hours is limited. Furthermore, it also allowed us to pool our financial resources so that we were able to give participants a reasonable monetary reward for participation in fasting and three meetings with researchers.

Appendix B

Downs and Black (1998) methodological quality checklist

Appendix C

Participant consent form

Informed Consent Form for *Participants* in Research Studies

Please complete this form after you have read the Information Sheet and/or listened to an explanation about the research.

Title of Project: **Short term fasting and its relationship to personality, emotional and attentional processes**

This study has been approved by the UCL Research Ethics Committee (Project ID Number): 3529/001

Thank you for your interest in taking part in this research. Before you agree to take part, the person organising the research must explain the project to you.

If you have any questions arising from the Information Sheet or explanation already given to you, please ask the researcher before you to decide whether to join in. You will be given a copy of this Consent Form to keep and refer to at any time.

Participant's Statement

I

have read the notes written above and the Information Sheet, and understand what the study involves.

understand that I must not take part if I have a diagnosed eating disorder or a health condition that may make it dangerous for me to fast, for example, pregnancy, diabetes

understand that if I decide at any time that I no longer wish to take part in this project, I can notify the researchers involved and withdraw immediately.

understand that should I feel unwell due to fasting I am free to stop fasting immediately and eat something.

consent to the processing of my personal information for the purposes of this research study.

understand that the information from the study may be published. Confidentiality and anonymity will be maintained and it will not be possible to identify me from any publications.

understand that such information will be treated as strictly confidential and handled in accordance with the provisions of the Data Protection Act 1998.

agree that the research project named above has been explained to me to my satisfaction and I agree to take part in this study.

Signed and date:

Appendix D

Recruitment poster

Volunteers Needed



FASTING STUDY



We are looking at the effects of short-term fasting on emotional and attentional processes, as well as how our personality might impact how difficult we perceive fasting to be.

Are you?

- A healthy volunteer
- Not currently suffering from an eating disorder
- Not suffering from diabetes or any other medical condition that might make fasting inadvisable
- Keen to take part in innovative research
- Looking to earn £15 or 2 course credits

Fit all of the above? Want to find out more?

Please contact: Sebastien Thompson or Ellen Watkins
 By email:
 OR phone/text:

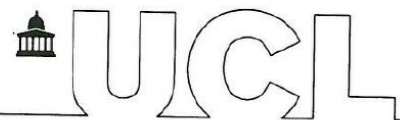


This study has been approved by the UCL research ethics committee.

Fasting study	OR
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Appendix E

Letter of ethical approval



Dr Lucy Serpell
Department of Clinical, Educational and Health Psychology
UCL

16 May 2012

Dear Dr Serpell

Notification of Ethical Approval
Project ID: 3529/001: Predicting individual responses to fasting

I am pleased to confirm that your study has been approved by the UCL Research Ethics Committee for the duration of the project i.e. until June 2013.

Approval is subject to the following conditions:

1. You must seek Chair's approval for proposed amendments to the research for which this approval has been given. Ethical approval is specific to this project and must not be treated as applicable to research of a similar nature. Each research project is reviewed separately and if there are significant changes to the research protocol you should seek confirmation of continued ethical approval by completing the 'Amendment Approval Request Form'.

The form identified above can be accessed by logging on to the ethics website homepage: <http://www.grad.ucl.ac.uk/ethics/> and clicking on the button marked 'Key Responsibilities of the Researcher Following Approval'.

2. It is your responsibility to report to the Committee any unanticipated problems or adverse events involving risks to participants or others. Both non-serious and serious adverse events must be reported.

Reporting Non-Serious Adverse Events

For non-serious adverse events you will need to inform Helen Dougal, Ethics Committee Administrator (ethics@ucl.ac.uk), within ten days of an adverse incident occurring and provide a full written report that should include any amendments to the participant information sheet and study protocol. The Chair or Vice-Chair of the Ethics Committee will confirm that the incident is non-serious and report to the Committee at the next meeting. The final view of the Committee will be communicated to you.

Reporting Serious Adverse Events

The Ethics Committee should be notified of all serious adverse events via the Ethics Committee Administrator immediately the incident occurs. Where the adverse incident is unexpected and serious, the Chair or Vice-Chair will decide whether the study should be terminated pending the opinion of an independent expert. The adverse event will be considered at the next Committee meeting and a decision will be made on the need to change the information leaflet and/or study protocol.

On completion of the research you must submit a brief report (a maximum of two sides of A4) of your findings/concluding comments to the Committee, which includes in particular issues relating to the ethical implications of the research.

With best wishes for the research.

Yours sincerely

~~Professor John Foreman~~
~~Chair of the UCL Research Ethics Committee~~

Cc: Sebastien Thompson & Ellen Watkins

Appendix F

Information sheet for participants including information about risks of fasting

Information Sheet for *participants* in Research Studies

You will be given a copy of this information sheet.

Title of Project: **Short term fasting and its relationship to personality, emotional and attentional processes**

This study has been approved by the UCL Research Ethics Committee (Project ID Number): 3529/001

We would like to invite _____ to participate in this research project.

We are recruiting healthy female volunteers aged over 18. If you decide to take part you will be given this information sheet to keep and be asked to sign a consent form.

Details of Study:

This study focuses on understanding the different ways that people can feel when they have not eaten. Some people find it easy to go without food, while others find it very difficult; we are interested in whether there are any personality traits that affect how difficult or rewarding people find fasting to be. We are also researching how emotional and attention processes are affected when people haven't eaten.

What will happen to me if I take part?

You will be asked to speak to a researcher, either over the phone or face to face, so that we can answer any questions that you might have and, if you are happy to take part, begin the study. We will be as flexible as possible to accommodate the most feasible time for you for this conversation.

Initially we will ask you to complete some questionnaires about your personality, mood and eating habits either face to face or over the phone. For the next phase of the study you will be required to complete questionnaires every two hours through both an 18 hour period where you fast (not consuming any food and drinking only water) and an 18 hour period where you have not fasted. (You will not be asked to complete the questionnaires throughout the night). The fasting and non-fasting phases will take place one week apart. At the end of both the fasting and non-fasting periods you will be asked to meet with a researcher to complete some more questionnaires and practical tasks. The fasting period can be from 10pm to 4pm the following day, or 11pm to 5pm the following day; the date and time of these periods will be agreed with a researcher beforehand and we are happy to remind you so that you remember when to fast and complete questionnaires.

Example of the stages of the study:

Stage 1: Speak with researcher to complete questionnaires about personality, mood and eating habits. Agree with researcher when you will carry out 18 hour fasting period and 18

hour non-fasting period.

Stage 2: Independently carry out 18 hour fasting period completing questionnaires throughout. At the end of the fasting period meet with a researcher to complete more questionnaires and some practical tasks.

Stage 3: Independently carry out 18 non-fasting period, where you eat normally, completing questionnaires throughout this. At the end of the non-fasting period meet with a researcher to complete more questionnaires and some practical tasks. Receive £15 payment/course credits for your participation and debrief with researcher.

What are the possible disadvantages and risks of taking part?

During the study, it is possible that you will have some unpleasant experiences as a result of being hungry. It is important that you consider the potential effects of fasting before you agree to participate. The study may also cause emotional distress; if this happens, we will provide you with information on how to access relevant sources of help or support. If you have a concern about any aspect of this study you should contact Ellen Watkins or Sebastien Thompson who will do their best to answer your questions.

What are the possible benefits of taking part?

There are no direct benefits to you of taking part in the study; however, some people find fasting to be a positive experience. We also hope you will find it a positive experience and the knowledge gained from this study will be of help to you and other people in the future.

Will my taking part in the study be kept confidential?

Yes, your confidentiality will be safeguarded during and after the study, which is conducted in accordance with the Data Protection Act 1998. An identification code will be allocated to you so that data are anonymous. The information we collect will be recorded and put into electronic databases using this code rather than your name.

The data will be used for research purposes only and will be analysed by the research team. None of the researchers will have access to your personal data. The data will be disposed of in a secure manner after the completion of the study. As participation is anonymous it will not be possible for us to withdraw your data once you have completed the study. No information about you will be disclosed to a third party.

What will happen to the results of the research study?

The data and results from this study may be published in medical journals or used in scientific reports. All data will remain anonymous so it is not possible to identify anybody who has taken part.

Who is organising and funding the research?

The principal researcher, Dr. Lucy Serpell, is organising the research, which is sponsored by

University College London.

Who has approved this study?

This study has been approved by the UCL Research Ethics Committee and has been registered with the University College London Data Protection Officer.

Further information and contact details:

Researchers:

Ellen Watkins and Sebastien Thompson, Research Department of Clinical, Educational and Health Psychology, University College London, Gower Street, London, WC1E 6BT.

Please keep this leaflet for your information.

Please discuss the information above with others if you wish or ask us if there is anything that is not clear or if you would like more information.

It is up to you to decide whether to take part or not; choosing not to take part will not disadvantage you in any way. If you do decide to take part you are still free to withdraw at any time and without giving a reason.

All data will be collected and stored in accordance with the Data Protection Act 1998.

Appendix G

Advice on fasting for participants

Participant advice and instructions for fasting

Advice

You are asked to fast before one of your testing sessions. It is important that you follow the instructions given to you in order to

- i) Ensure your safety and
- ii) Make sure that the results of the study are valid

Please do not fast if you have diabetes, there is a possibility that you are pregnant, you have problems with your blood sugar, have been advised to not fast by a medical professional or have any other health conditions that may put you at risk if you fast. Please also do not fast during a period when you will be driving, operating heavy machinery or doing dangerous activities.

While you are fasting your blood sugar may decrease, you may feel hungry, have a headache, experience slight nausea or heartburn. You may also feel lower in mood, find it hard to concentrate or feel irritable.

Instructions for fasting

- i) The day before your testing session on _____ please eat as normal and then fast between _____ and _____ the following day.
- ii) During fasting you may only drink water. Please do not eat any food, or drink any caffeinated drinks such as tea or coffee or any sugary drinks such as coke.
- iii) When you are fasting do not drink any alcohol.
- iv) It is common to feel slightly faint when fasting but if you feel very faint or are concerned about any symptoms you are experiencing then please stop fasting immediately and eat something.
- v) Throughout fasting please ensure you drink lots of water to prevent dehydration.

Appendix H

Novelty-seeking and persistence subscales of the Temperament and Character

Inventory (TCI; Cloninger, 1994)

(Removed for copyright purposes)

Appendix I

Multi-dimensional personality questionnaire (MPQ; Tellegen & Waller, 1989)

(Removed for copyright purposes)

Appendix J

**Eating Disorders Examination Questionnaire 6.0 (EDE-Q; Fairburn & Beglin,
1994)**

(Removed for copyright purposes)

Appendix K

Perfectionism, Persistence and Perseveration Questionnaire (PPPQ-22; Serpell, Waller, Fearon, & Meyer, 2008)

PPPQ-22

This questionnaire contains a number of statements about how people might behave or think. Please read each item carefully and place a tick in the box which most applies to you.

	Not at all true of me	A little true of me	Somewhat true of me	Very true of me	Totally true of me
1. I hate making mistakes					
2. I keep trying to sort out problems in a relationship, even if I know it's not going to survive.					
3. If a friendship seems to be running into difficulties, I will keep trying to resolve things, in case it's just a hiccup.					
4. If I have an appointment, I always check my travel arrangements carefully in advance to make sure that I have plenty of time to get there and not be late.					
5. When reading a book or magazine, I often feel that I must begin at the first page and read through to the very end, even if some of the parts are of no interest.					
6. When reading a book or magazine, I keep going until I have read all the necessary material, even when the concepts are difficult to understand.					
7. I tend to keep going with a long task until it is complete, rather than giving up quickly.					
8. When I phone someone to get a decision, if I get an engaged tone then I tend to keep ringing back every minute or so, even when the deadline for the decision has passed.					
9. If I have an important test coming up, I am likely to plan carefully which topics I will need to cover, making a revision timetable to ensure I get everything done.					
10. One of my goals is to be perfect in everything I do.					
11. When studying for an important test, I tend to stay up working late into the night, even though I know I am no longer taking in the material and that the studying will not help my performance.					
12. People describe me as someone who can stick					

at a task, even when it gets difficult.					
13. When calling a tradesman to arrange for him to come to my home, I may continually ring and leave messages on the same number, even though I know that they are not being picked up or responded to.					
14. If I try to solve a problem or puzzle, I do not stop until I find an answer.					
15. Once I have decided to do something, I keep going until I reach my goal.					
16. When calling a tradesman to arrange for him to come to my home, I try all the contact numbers I have for him in the hope of catching him.					
17. Even when I do something very carefully, I often feel that it is not quite right.					
18. When calling a tradesman to arrange for him to come to my home, I would make sure I had all the relevant paperwork and measurements ready.					
19. If I have a problem in my relationship, I will work hard at sorting it out, even if this takes a long time.					
20. When shopping in the supermarket, I walk down the aisles one-by-one until I have covered the whole store, even if I only need a couple of items.					
21. If I am trying to get to an appointment but my car has broken down, I do my best to get there in time by investigating other routes (e.g., finding out if I can get a bus, train or taxi).					
22. Sometimes I find myself continuing to do something even when there is no point in carrying on.					

Thank you very much for completing this questionnaire.

Please check that you have answered each question and that you have put the date at the top of the questionnaire

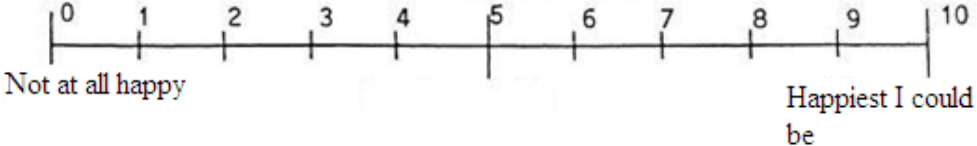
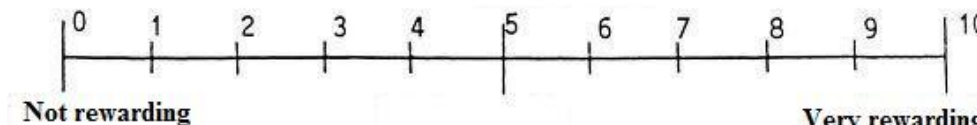
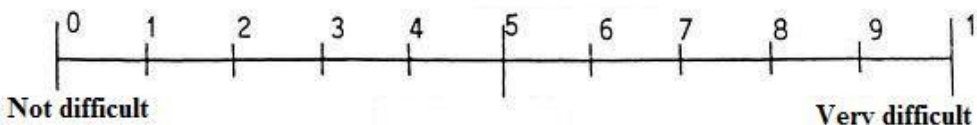
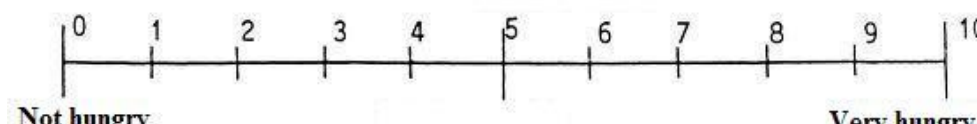
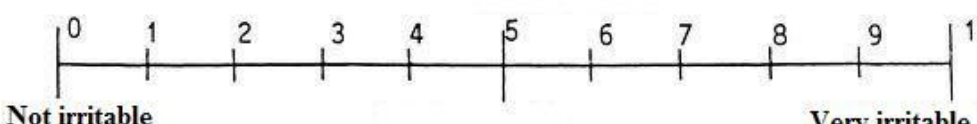
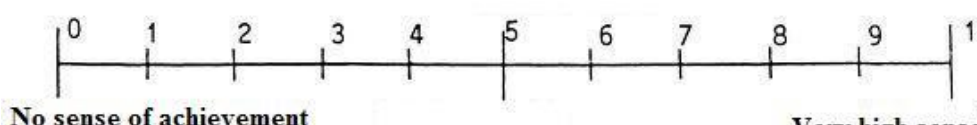
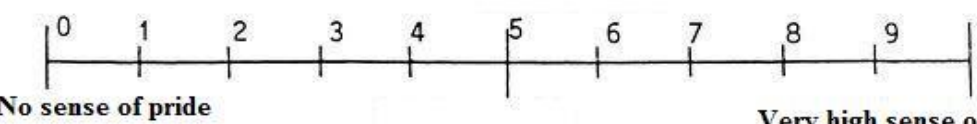
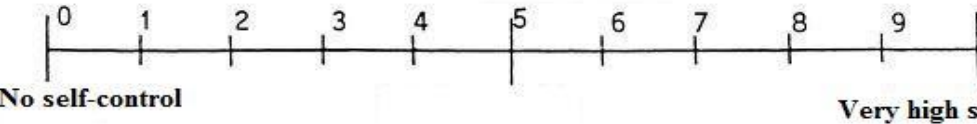
Appendix L

**Visual analogue scale (VAS) diary measures for one time point in the fasting condition,
and one time point in the non-fasting condition**

Time 1 – Exact time of rating

Please note: please do not complete these measures retrospectively. If you forgot to complete them at the correct time then please leave the page blank and fill out the next set of questions at the next time slot.

Please use these scales to rate your mood, how rewarding and difficult you're finding the fasting, how hungry and irritable you're feeling and the level of sense of achievement, pride and self-control that you're experiencing at present.

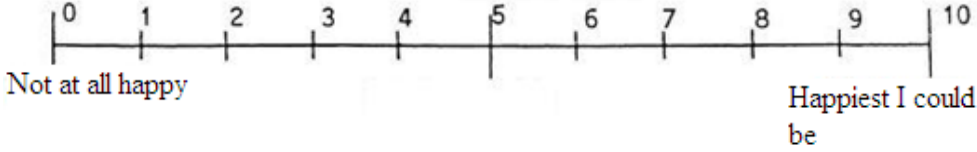
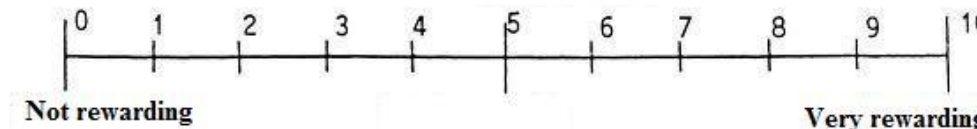
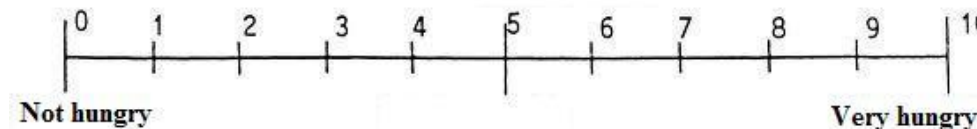
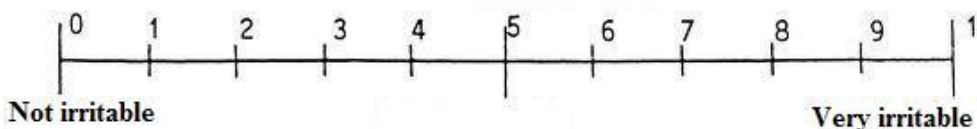
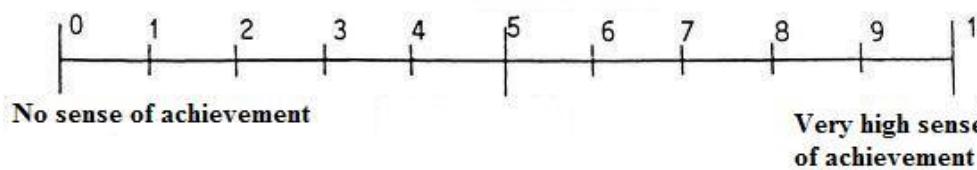
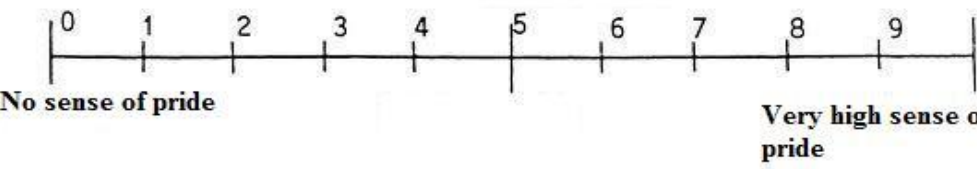
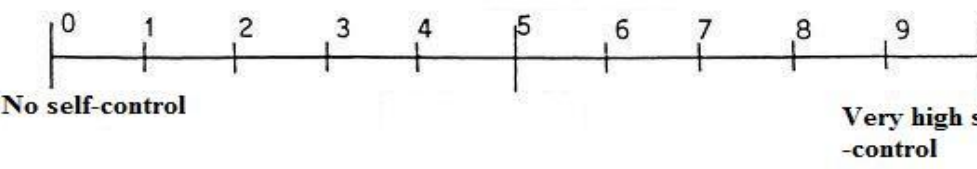
Mood	
Sense of reward	
Difficulty of fasting	
Hunger	
Irritability	
Sense of achievement from fasting	
Sense of pride from fasting	
Sense of self-control from fasting	

***Now please turn over the page and leave it open on the next page ready to complete the measures at the next time point.**

Time 1 – Exact time of rating

Please note: please do not complete these measures retrospectively. If you forgot to complete them at the correct time then please leave the page blank and fill out the next set of questions at the next time slot.

Please use these scales to rate your mood, how rewarding and difficult you're finding the fasting, how hungry and irritable you're feeling and the level of sense of achievement, pride and self-control that you're experiencing at present.

Mood	
Sense of reward	
Hunger	
Irritability	
Sense of achievement	
Sense of pride	
Sense of self-control	

***Now please turn over the page and leave it open on the next page ready to complete the measures at the next time point.**

Appendix M

Screening questionnaire

