

Impact on purchasing behaviour of implementing ‘junk free checkouts’: A pre-post study

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Abstract

In 2015, Tesco Express convenience stores implemented a healthy checkouts initiative; products high in fat, salt or sugar were removed from in-queue areas. We compare purchasing of less healthy foods before and after its introduction. Tesco provided store-level sales data ($n = 1151$) for Express stores in England over two 8-week periods, May–July 2014 and 2015. Paired t -tests examined if spending on less healthy foods (biscuits, cakes, crisps and confectionery), as a proportion of total spend, changed between 2015 and 2014. Analyses were repeated for the quantity of less healthy products sold. Compliance was measured through unannounced store visits ($n = 41$). Complete sales data were available for 1101 stores (96%). Mean overall spend increased in 2015 compared with 2014 (£666 079.70 [SD 406 385.00] vs. £653 786.59 [SD 447 580.77]; $p < 0.001$). The proportion of total spend from less healthy foods decreased in 2015 versus 2014 (8.03% [SD 2.07] vs. 8.21% [SD 2.17]; $p < 0.001$). Confectionery accounted for the largest proportion of less healthy product spend, showing the biggest reduction (3.91% [SD 1.16] in 2015 vs. 4.12% [SD 1.24] in 2014; $p < 0.001$). Results were similar for quantity of less healthy products sold. Like-for-like sales data from major supermarkets revealed spend on less healthy products rose across the UK over this period. Thirty-nine per cent of stores were fully compliant. In conclusion, following implementation of Tesco's healthier checkouts initiative, there was a small reduction in sales of less healthy foods, largely accounted for by confectionery products. These findings suggest that removal of less healthy products from checkouts might lead to healthier purchasing behaviour. However, store compliance was poor, suggesting scope for improvement.

KEYWORDS

consumer behaviour, nutrition, policy, public health, supermarket, supermarket checkout

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INTRODUCTION

There have been widespread calls over recent years for retailers to remove less healthy foods from supermarket checkouts, for example the 'Chuck Junk Off the Checkouts' campaign in the United Kingdom, the 'Model Healthy Checkout Aisle Ordinance' in the United States and the 'Parents' Jury Healthy Checkouts Campaign' in Australia (ChangeLabSolutions, 2015; Gannon et al., 2014; Sustain, 2012). This is in response to the increasing prevalence of obesity, especially in children (Di Cesare et al., 2019; Jaacks et al., 2019). The importance of addressing socio-environmental factors related to energy balance behaviours is increasingly acknowledged and promoted, although these have been challenging to implement (Bellew et al., 2019). This includes the food environment, with supermarkets and, in particular, supermarket checkouts, having been identified as possible targets for intervention. Numerous studies across different countries have demonstrated that supermarkets typically display less healthy foods and drinks at checkouts (Dixon et al., 2006; Grigsby-Duffy et al., 2020; Horsley et al., 2014). This does not appear to be confined to supermarkets, with many non-food stores also displaying foods, primarily less healthy, at their checkouts (Wright et al., 2015).

Foods purchased at the checkout tend to be 'additional' unplanned purchases and therefore likely to be driven by impulse. Placing products in prominent positions in store has been shown to substantially increase sales of these products (Cohen & Babey, 2012; DHSC, 2018; PHE, 2015) and retailers make great efforts to organise product displays in ways to maximise profit (Murray et al., 2010). There is evidence that impulsive purchases are associated with selecting less healthy food items (Crawford et al., 2007). Habitual purchasing behaviour may also contribute to the impact that foods at checkouts have on purchasing, whereby being in the queue acts as the contextual cue for selecting a food product. The purchasing of additional foods may occur in the absence of conscious decision-making and therefore be difficult to suppress, even if people do not intend or wish to purchase these foods (Lally & Gardner, 2013).

Removing less healthy foods from the checkout is an intervention guided by nudge theory; a 'nudge' being defined as 'an aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any option or significantly changing their economic incentives' (Thaler & Sunstein, 2009). Such interventions are environmental manipulations, which offer an alternative to educational interventions, the latter relying on individuals making rational decisions based on provided health information. In essence, nudge interventions make healthier choices easier, without removing freedom of choice. The literature suggests that nudge interventions can be effective

at increasing the healthiness of adults' diets (Arno & Thomas, 2016). Studies have also demonstrated that parents find checkouts stressful since children make requests or 'pester' for displayed foods, and that they would welcome the restriction of less healthy foods from checkouts (Campbell et al., 2012; Ford et al., 2020; Winkler et al., 2016). New UK legislation coming into force in October 2022 will restrict the promotion of products high in fat, salt and/or sugar in areas such as the checkout (DHSC, 2021), making this UK-based research particularly timely.

Relatively little research has examined the impact of removing less healthy foods from checkout areas on purchasing behaviour. Two recent systematic reviews reported that the majority of nudge interventions focused on in-store promotions (for healthier foods), information provision, increased availability of healthier foods and, to a lesser extent, pricing (Adam & Jensen, 2016; Slapø et al., 2021). Nonetheless, the findings from these reviews are supportive of in-store interventions being beneficial for diet-related behaviours, although some caution is needed because of the lack of high-quality studies. Another review specifically looked at the impact of in-store food placement strategies (including manipulations to food availability at checkouts) on dietary behaviours (Shaw et al., 2020). Observational and intervention studies demonstrated associations between the positioning of foods and healthiness of diet-related behaviours, but many of the associations were not statistically significant. In addition, over half the identified intervention studies included placement manipulations as part of more comprehensive in-store interventions. A recent review focused on the impact of nudges on diet-related behaviours in real-life purchasing situations (Harbers et al., 2020). Information and position nudges were found to be most effective, but there were relatively few studies focusing on position nudges, and fewer still specifically on checkouts. Study quality was also generally poor. This not only suggests there is promise in the implementation of healthier checkouts but also highlights gaps in the literature which, of relevance here, were especially apparent in relation to position nudges.

The few studies which have specifically targeted the checkout area have not produced consistent results but are suggestive of interventions being beneficial. For example, experimental studies manipulating the availability of snack foods at supermarket checkouts have had mixed findings. Some studies have found limited impact on purchasing of less healthy foods (Huitink, Poelman, Seidell, Pleus et al., 2020; Winkler et al., 2016), while others found reduced sales of less healthy foods (Sigurdsson et al., 2014), a decrease in absolute number of snack foods purchased (Huitink, Poelman, Seidell, Kuijper, et al., 2020) or an increase in healthier foods purchased (Adjoian et al., 2017; Payne & Niculescu, 2018; Sigurdsson et al., 2014). In

a different setting, sales data from a hospital canteen indicated purchasing of healthier snacks increased when a greater proportion of healthier snacks were displayed at the checkout, but there was no impact on less healthy snack purchasing (Van Kleef et al., 2012). Using a different methodology, two interrupted time series studies in the UK using Kantar Worldpanel data found the implementation of healthier checkout policies by supermarkets had a variable impact on purchasing, but purchasing of less healthy foods tended to decrease in supermarkets with clear and consistent policies about healthy checkouts (Deavenport-Saman et al., 2019; Ejlerskov et al., 2018b). Other studies have included changes to food availability at the checkout as part of a broader set of interventions, so although positive changes in purchasing have been observed, these cannot be solely attributed to the checkout intervention (Deavenport-Saman et al., 2019; Foster et al., 2014). Another factor potentially influencing the effectiveness of healthy checkout interventions is how they were operationalised as this can vary greatly, but stores with clearer and consistent policies seem to achieve healthier checkouts (Ejlerskov et al., 2018c; Lam et al., 2018).

Another substantial challenge in evaluating in-store interventions is the access to appropriate data to evaluate them effectively. For example, Kantar Worldpanel data only present self-reported information from a sample of participants. Some research has collected till receipts as an objective measure of purchases (Ransley et al., 2001), but this remains restricted to a self-selecting sample. The use of sales transaction records directly from retailers is becoming more prevalent around the world, from a variety of retailers (Aiello et al., 2020; Clark et al., 2021; Jenneson et al., 2022).

Taken together, the evidence to date suggests that improving the food environment at supermarket checkouts offers a promising opportunity for improving the healthiness of food purchases. However, many of the studies described here were experimental and only carried out in a small number of stores, limiting the generalisability of findings. The data from Kantar Worldpanel primarily focus on foods taken into the home and only includes a sub-sample of panel members who self-report foods eaten out of the home. It is likely that a large proportion of snack foods purchased at store checkouts are consumed outside the home setting. In contrast, comprehensive transaction data recorded by retailers themselves provide the unique opportunity to objectively measure all in-store purchases from a large number of stores over an extended period of intervention. Tesco launched its 'healthy checkouts initiative' on 1 January 2015 in all UK Tesco Express convenience stores. This involved the removal of less healthy products, such as sweets and sugary snacks, from the checkout queue areas of Tesco Express stores. This initiative has not yet been subjected to external evaluation, despite having been rolled out on a mass scale.

Therefore, the aim of the current study was to compare the purchasing patterns of less healthy foods in Tesco Express stores (Tesco convenience store format) in England, using sales data from all these stores with checkout merchandising, over the equivalent 8-week period in the years before (2014) and after (2015) the introduction of the 'healthy checkouts initiative'. For wider market comparison, Tesco Express data were compared with data for the same food categories in all major UK food retailers. We hypothesised that removing less healthy foods from checkouts would reduce sales of less healthy foods.

MATERIALS AND METHODS

The intervention

Tesco launched its 'healthy checkouts initiative' on 1 January 2015 in all UK Tesco Express convenience stores in England. This initiative affected 67% of all Tesco Express stores ($n = 1151$), since the remaining stores did not have any merchandising in the queuing space. The principle of the 'healthy checkout initiative' was to exclude products high in fat, salt or sugar from the in-queue (checkout) area. The products targeted included sweets, chocolate, full-fat crisps, sweet biscuits, cakes, bakery products and some cereal bars, along with products that have confectionery items as a key ingredient (e.g., chocolate-coated raisins). Other products, including some drinks (sugar-sweetened soft drinks, energy drinks, non-nutritive sweetener carbonated drinks and alcohol), were also removed. The decision by Tesco to remove both sugar-sweetened and sugar-free carbonated drinks from the checkout area was based on feedback from their consumers. Products susceptible to pester-power, including food products overtly targeting children (as well as toys and games), were also removed.

Tesco used its 'health and nutrition profiling criteria' as the basis for selecting the range of foods available at checkout; these criteria form the basis of Tesco health brands and are used to determine the use of nutrition and health claims on Tesco branded foods (information provided by Tesco). These profiling criteria evaluate products based on their levels of sugar, fat, saturated fat and salt using a traffic light system (building on the UK Government's criteria for multiple traffic light front-of-pack labels [Government, 2016]). In addition, all products regardless of colour coding needed to meet the then Department of Health Salt Targets (PHE, 2018). Products included in the healthier checkout range were either: products classified as low or medium against all the profiling criteria (green or amber colour coding); products classified as high (red) but that contributed to the '5 A DAY' fruit and/or vegetable requirement (including products that might be labelled

green/amber against all criteria except a red for sugar, that is juices and smoothies or dried fruits); products in 'calorie controlled' packs (where calorie content is controlled via portion size or reformulation) regardless of nutrition front of pack traffic light colours—crisps and baked snacks were to ideally have less than 100kcal per portion and all other products, including nuts and seeds to be under 200kcal per portion. Any foods not fitting into these categories were not eligible for display at any tills and checkout areas.

Measures

Since the 'healthy checkouts initiative' targeted the removal of less healthy foods and drinks, rather than the promotion of healthier products, this study focuses on data related to the sales of less healthy products only. Furthermore, checkout areas in Tesco Express stores do not have refrigerated display units meaning customers were unlikely to purchase drinks from the checkout area for immediate consumption. Therefore, sales of sugar-sweetened beverages (SSB), non-nutritive sweetener beverages (NNSB) and alcoholic drinks were excluded from the analyses. The outcomes for this study were levels of purchasing of less healthy food products within four categories: biscuits (sweet biscuits and sugary cereal bars); crisps (fried potato crisps and savoury snacks); cakes (baked products containing fat and sugar); and confectionery (sweets and chocolate).

Tesco provided sales data for all 1151 participating Tesco Express stores over an 8-week period (12/05/2014–6/07/2014), prior to the introduction of the 'healthy checkouts initiative'. They also provided data for the same 8-week period (18/05/2015–12/07/2015) in 2015 following the roll-out of the 'healthy checkouts initiative' across all express stores on 1 January 2015. The months of May, June and July were chosen for study because they did not coincide with major national holidays (e.g., Christmas or Easter) or school summer holidays, periods linked with increased sales in confectionery or other less healthy food products (and associated promotions).

Data were available at the store level for total sales of each target food category (biscuits, crisps, cakes and confectionery) for each week of the 2014 and 2015 study periods. Data included (a) total spend (in GBP) by food category, store and week; (b) quantity (number of items) sold by food category, store and week; and (c) number of transactions that included at least one of each target food category (biscuits, crisps, cakes, confectionery, combined) by food category, store and week. Data for total sales by store and week, for all food purchases, for these three outcomes (a, b, c) were also available.

Along with sales data, Health Scores were also available. Health Scores were based on the Nutrient Profiling Model product scoring criteria (DH, 2011). Scores were calculated from the nutritional information

of all products bought in each study store for each week over the 2014 and 2015 study periods. For example, whole fruit was allocated a score of –4. A higher score indicates a less healthy product. The mean score of all products purchased was then calculated (at the level of the transaction and at the store level per week).

Market comparisons

To explore whether any changes in sales of less healthy products in 2015 compared with 2014 were unique to Tesco (and therefore potentially attributable to the 'healthy checkouts initiative'), rather than reflecting changes in food purchasing habits across the United Kingdom more generally, we compared Tesco sales for the four less healthy products to sales data for the same product categories from all the major UK food retailers (e.g., Sainsbury, Tesco, ASDA, Morrisons, M&S, Waitrose, Ocado and Iceland). These data were provided by IRI, a retail and FMCG market intelligence company (IRI, 2021). The food categories used for these analyses were derived by IRI and may therefore differ slightly from the categories used in the Tesco Express analyses but followed the same broad principles. The Tesco sales data provided by IRI were based on sales from all Tesco stores and were not unique to Tesco Express.

Analysis

Data were available for spend (£), quantity and number of transactions including at least one of each target less healthy food. These were available for cakes, biscuits, confectionery and crisps, and these four less healthy products combined. Data on spend and quantity were also available for all food products. The proportions of the total food spend, quantity, transactions for each individual less healthy food and combined less healthy foods were calculated. Data are presented as mean (SD) across the included stores. Stores with complete data for both time periods were included in the analysis. Differences between the stores in 2014 and 2015 were examined using paired samples *t*-tests for total spend (£), proportion of total spend (%), total quantity, proportion of total quantity (%), total transactions and proportion of total transactions (%). Due to the large dataset size and multiple tests carried out, we used a significance level of $p < 0.01$.

Validation: Store visits

To estimate levels of compliance with the healthier checkouts criteria, store visits were carried out in a sample of Tesco Express stores to monitor and record products

displayed at and around the checkouts. Visited stores were distributed across four of the nine Government Office Regions of England to provide a broad snapshot of compliance with the policy. Within these areas, stores were selected for visits based on convenience and accessibility to members of the team. The number of visits undertaken reflected the capabilities of researchers over the study period. Store visits all took place between 5 July 2015 and 31 July 2015, corresponding to the period of purchase analysis, by three researchers in London, South East, North West, and Yorkshire and Humber. At the end of June 2015, all Tesco Express stores involved in the 'healthy checkouts initiative' ($n = 1150$) were notified by letter of the possibility of a visit from a member of the research team. Beyond this, no advance notice of visits was given to store managers. During store visits, photographic and written records were made of the queue area, including the products displayed; in the display module in queue areas, in cardboard free-standing display units or in wire display stands; and other food and drink products in or directly adjacent to the queue area. The number of food and drink products not meeting the criteria in the queue area (i.e., not compliant with the initiative) and the number of products in close proximity of the queue area (area outside the scope of the initiative) were recorded. Where any doubt existed as to whether a product fell within the healthier checkout criteria, these were referred to Tesco nutritionists.

RESULTS

Sales data

Complete data for both study periods were available for 1101 (95.7%) of the 1151 eligible stores. The sales data are provided in [Table 1](#) and [Figures 1](#) (mean spend) and [2](#) (proportion of total spend). Overall mean spend on all food products per store increased for the 2015 8-week study period compared to 2014 study period (£665 295.78 [SD 405 263.62] vs. £653 581.64 [SD 447 446.22], $p < 0.001$), as did the total quantity of items sold (352890.12 [SD 101 219.31] vs. 333444.54 [SD 97655.62], $p < 0.001$). Of the less healthy products analysed for this study, confectionery accounted for the largest proportion of total spend (3.91% in 2015 and 4.12% in 2014). Crisps accounted for the second largest proportion of spend (2.39% in 2015 and 2.36% in 2014), followed by Biscuits and Cakes (both <1% in 2015 and 2014; [Figure 2](#)).

Spend on less healthy food products combined

Mean spending on all four less healthy categories combined during the study period increased in 2015 compared with 2014 (£46616.88 [SD 12730.48] vs.

£45664.86 [SD 12986.85], $p < 0.001$). However, the combined spend on less healthy products as a proportion of total spend was lower in 2015 compared with 2014 (8.03% [SD 2.07] vs. 8.21% [SD 2.17], $p < 0.001$). Similarly, the quantity of less healthy products sold was higher for 2015 compared with 2014 (53183.19 [SD 14276.98] vs. 50628.65 [SD 13969.30], $p < 0.001$), but the quantity of less healthy products sold as a proportion of all items sold decreased in 2015 compared with 2014 (15.29% [SD 2.17] vs. 15.40% [SD 2.22], $p < 0.001$). The number of transactions that included at least one less healthy product increased in 2015 compared with 2014 both in absolute terms (34750.90 [SD 10093.91] vs. 33294.93 [SD 10058.18], $p < 0.001$) and as a percentage of all transactions during these periods (39.87% [SD 5.42] vs. 39.30% [SD 5.15], $p < 0.001$).

Spend on individual less healthy product categories

Total spend on biscuits, cakes and crisps each significantly increased in 2015 compared with 2014 (all $p < 0.001$). When looking at the amount spent on these foods as a proportion of the total spend, there was an increase in 2015 compared with 2014 for crisps (2.39% [SD 0.63] vs. 2.36% [SD 0.66], $p < 0.001$), but a decrease for biscuits (0.98% [SD 0.29] vs. 0.99% [SD 0.30], $p < 0.01$) and no change for cakes (0.75% [SD 0.34] vs. 0.74% [SD 0.37], $p = 0.018$).

The quantity (number of items) sold of biscuits, cakes and crisps each significantly increased in 2015 compared with 2014 (all $p < 0.001$), as did the quantity sold of each of these categories as a percentage of all items sold (all $p < 0.001$). The same pattern of results was seen for both the absolute number of transactions involving biscuit, cake and crisp items, and the biscuit, cake and crisp transactions as a percentage of all transactions with all figures increasing significantly in 2015 compared with 2014.

A very different pattern of results was found for confectionery sales following the introduction of the 'healthy checkouts initiative' in 2015 compared with 2014. Spend on confectionery decreased significantly in 2015 compared with 2014 ($p < 0.001$), as did spend on confectionery as a proportion of total spend in Tesco Express stores over the same period (3.91% [SD 1.16] vs. 4.12% [1.24], $p < 0.001$). Similarly, while the absolute quantity of confectionery items sold did not significantly decrease in 2015 compared with 2014, the quantity of confectionery items sold as a percentage of all items sold did decrease (8.24% [SD 1.85] vs. 7.77% [SD 1.77] $p < 0.001$). The total number of transactions including a confectionery item also decreased ($p < 0.001$), as did confectionery transactions as a percentage of total transactions (17.90% [SD 3.31] vs. 16.83% [SD 3.34] $p < 0.001$).

TABLE 1 Product sales over 8-week study period (May–July) in 2014 and 2015 for Tesco express stores ($n = 1101$)

Product category	Total spend (£) ^a mean (SD)		Proportion of total food spend ^b %		Total quantity ^c mean (SD)		Proportion of total quantity ^d %		Total transactions ^e mean (SD)		Proportion of total transactions ^f %	
	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
Cakes	5477.59 (1872.82)	5676.20 ^{**†} (1848.75)	0.74 (0.37)	0.75 (0.34)	3162.48 (1590.59)	3531.92 ^{**†} (1560.40)	0.93 (0.32)	0.99 (0.27) ^{**†}	2327.62 (1148.92)	2691.80 ^{**†} (1159.14)	4.85 (1.05)	5.02 (1.08) ^{**†}
Biscuits	4240.50 (2614.55)	4482.78 ^{**†} (2580.54)	0.99 (0.30)	0.98 (0.29) ^{*†}	5785.17 (1898.88)	6259.69 ^{**†} (1975.86)	1.74 (0.31)	1.78 (0.32) ^{**†}	4070.72 (1302.19)	4334.67 ^{**†} (1310.31)	2.73 (0.99)	3.07 (0.95) ^{**†}
Confectionery	22847.04 (6611.99)	22560.62 ^{**†} (6253.16)	4.12 (1.24)	3.91 (1.16) ^{**†}	26763.32 (38.07)	26692.11 (33.15)	8.24 (1.85)	7.77 (1.77) ^{**†}	15004.75 (4345.58)	14480.29 ^{**†} (3991.84)	17.90 (3.31)	16.83 (3.34) ^{**†}
Crisps	13099.73 (3929.81)	13897.28 ^{**†} (4029.71)	2.36 (0.66)	2.39 (0.63) ^{**†}	14917.68 (39.17)	16699.47 ^{**†} (52.56)	4.48 (0.95)	4.74 (0.90) ^{**†}	11894.32 (4692.11)	11894.32 ^{**†} (5026.82)	13.83 (2.56)	14.95 (2.54) ^{**†}
Less healthy products combined	45664.86 (12,986.85)	46616.88 ^{**†} (12,730.48)	8.21 (2.17)	8.03 (2.07) ^{**†}	50628.65 (13,969.30)	53183.19 ^{**†} (14,276.98)	15.40 (2.22)	15.29 (2.17) ^{**†}	33294.93 (10,058.18)	34750.90 ^{**†} (10,093.91)	39.30 (5.15)	39.87 (5.42) ^{**†}
All food products	653581.64 (447,446.22)	665295.78 ^{**†} (405,263.62)	-	-	333444.54 (97,655.62)	352890.12 ^{**†} (101,219.31)	-	-	85686.97 (26,534.24)	87989.35 ^{**†} (26,826.38)	-	-

^aTotal spend indicates the total monetary value (£) of sales of cakes/biscuits/confectionery/crisps/combined;

^bProportion of total food spend indicates the total monetary value (£) of items sold in that category as a proportion of the monetary value of all food products sold.

^cTotal quantity indicates the number of items sold of cakes/biscuits/confectionery/crisps/combined;

^dProportion of total quantity indicates the number of items sold in that category as a proportion of total items of all food products sold;

^eTotal transactions indicates the number of transactions which included at least one of cakes/biscuits/confectionery/crisps/combined;

^fProportion of total transactions indicates the proportion of transactions containing at least one item from the respective categories as a proportion of the total number of transactions; ^{**†} significant increase, $p < 0.001$; ^{*†} significant increase, $p < 0.01$; [†] significant decrease, $p < 0.001$; [†] significant decrease, $p < 0.01$; only includes stores with complete data.

FIGURE 1 Average spend (£) of less healthy foods across the intervention period—data shown for the same 8-week period before (2014) and after (2015) implementation of the healthy checkouts initiative

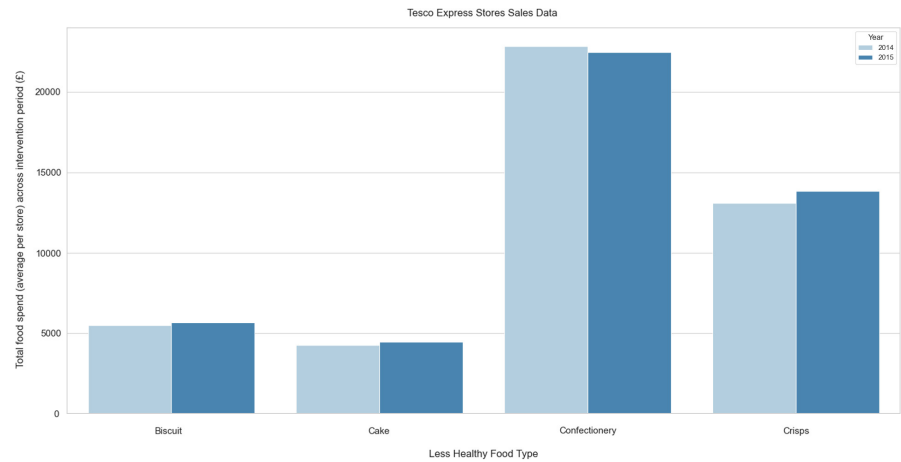
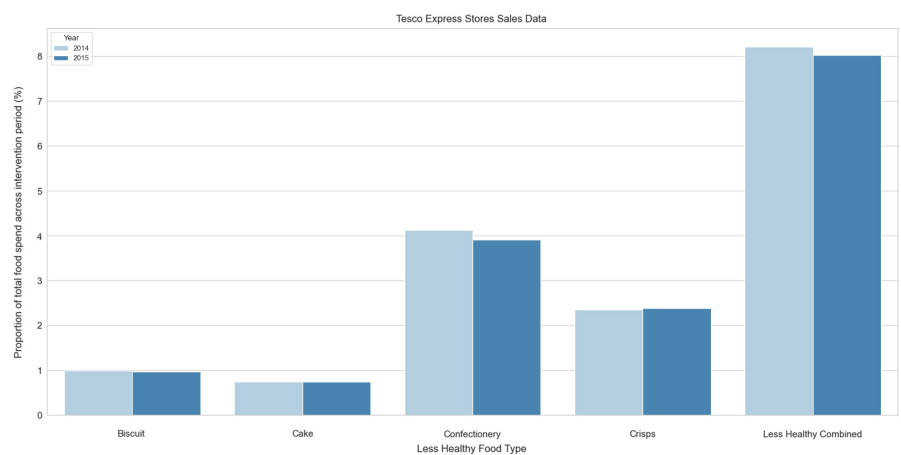


FIGURE 2 Average spend of less healthy foods (including combined less healthy foods) as a proportion of total food spend (%) across the intervention period—data shown for the same 8-week period before (2014) and after (2015) implementation of the 'healthy checkouts initiative'



Health score

The mean Health Score for all products sold in Tesco Express stores significantly improved in 2015, mean = 5.21 (SD 0.79), compared with 2014, mean = 5.28 (0.77) ($p < 0.001$).

Comparisons with national sales data

Comparison with market data from other major UK stores revealed mean sales of all less healthy categories in other UK stores combined in the 2015 8-week study period (£24 795 686) were higher than the same period in 2014 (£24 684 197). Increases were also seen individually for biscuit, cake and confectionery sales in 2015 compared with 2014, while sales of crisps seemed to decrease in UK stores in the 2015 compared with the 2014 study period. These figures suggest no general decline in sales of less healthy products (with the possible exception of crisps) in the UK market during the 2015 study period compared with same period in 2014. Data on sales from Tesco only for these same periods show a very slight decrease in sales for all less healthy

categories combined in 2015 (£1 368 167) compared with the same period in 2014 (£11 386 798). Slight decreases were also seen in sales of biscuits and confectionery, while sales of crisps and cake increased slightly in Tesco stores during the 2015 study period. These data are shown in [Figure 3](#).

Validation: Store visits

A total of 41 stores were visited by the research team. In-store visits were conducted in Greater London ($n = 17$), South East England ($n = 9$), North West England ($n = 13$) and Yorkshire and Humber ($n = 2$). All of the visited stores had food and drink products displayed in the queue area. Overall compliance with the Tesco health and nutrition profiling criteria across the stores and the product categories of non-compliant products is shown in [Table 2](#). Sixteen stores were fully compliant with the initiative (39%). Many of the stores which were compliant in terms of their display in the queue area had non-compliant foods and drinks displayed in close proximity to the queue area. The numbers of stores with non-compliant food items displayed



FIGURE 3 Line plot of average spend over time, displaying mean spend for each week of the intervention periods using Tesco Express store sales data and IRI data across other UK stores. Averages are plotted by less healthy food type as indicated by line colour. Store type (Tesco Express or other) and year (2014 or 2015) can be identified by line style (straight, dashed, semi-dashed and dotted) to determine outcomes from the intervention

in either the queue area or in close proximity to the queue (defined as within sight and within a few steps of the queue area) are also shown in [Table 2](#). Examples of non-compliant foods are shown in [Table 3](#).

DISCUSSION

Mean total spend significantly increased from 2014 to 2015, as did mean spend on combined less healthy foods, but as a proportion of total spend, the amount spent on less healthy foods significantly decreased. A similar pattern was seen for number of food items purchased. Reductions in less healthy foods purchased appeared driven by reduced confectionery purchasing. These findings suggest modest but significant reductions in purchasing of less healthy foods, especially confectionery, which may be attributable to the healthier checkout intervention.

Our findings are somewhat consistent with previous studies. Of the studies with a similar intervention to the current study (i.e., removing less healthy foods and replacing with healthier options), one case-control study carried out in Denmark found that replacing less healthy foods with healthier foods did not impact less healthy food purchasing, although there was a small increase in healthy food purchasing (Winkler et al., 2016). Two studies in the United Kingdom used an interrupted time series design, with purchasing data from a number of different supermarkets (Ejlervskov et al., 2018a, 2018b). Supermarket policies around healthy checkouts were

defined as clear and consistent; vague or inconsistent; or no policy. The clear and consistent policies comprised removing less healthy foods from checkouts (primarily sweets and chocolate) and replacing these with healthier options, equivalent to the intervention here (Ejlervskov et al., 2018a). Reduced purchasing of less healthy foods was observed for most of the supermarkets with clear and consistent policies (Ejlervskov et al., 2018a, 2018b). Two studies reported outcomes other than less healthy food purchasing. One study carried out in the United States found that more healthy items were purchased from the checkout only offering healthy foods compared with the standard checkout, but purchasing was generally low (Adjoian et al., 2017). Another study which used a pre-post design, in The Netherlands, found that the total number of snacks sold was 2.4 times lower when all less healthy foods were removed and replaced with healthier options (Huitink, Poelman, Seidell, Kuijper, Hoekstra, et al., 2020).

We found that there appeared to be larger reductions in confectionery purchasing compared with other foods. This is perhaps unsurprising since confectionery has been shown to be the most common type of food presented in checkout areas (Thornton et al., 2012). The removal of less healthy foods may therefore have the highest impact on confectionery purchases. This, coupled with the fact that confectionery products are particularly appealing and therefore likely to be bought on impulse, has made confectionery a focus of public health campaigning (BMJ, 2012; Cohen & Babey, 2012). Our findings suggest that this focus is well placed.

TABLE 2 Food and drink products in queue area and in close proximity to the queue area

	Number of stores (n = 41)	%
Foods/drinks present in the immediate checkout area ^a		
Non-compliant foods and drinks	25	61.0
Non-compliant foods (excluding drinks)	23	56.1
Fully compliant	16	39.0
Non-compliant food/drink type		
Confectionery ^b	9	22.0
Biscuits	3	7.3
Cakes	0	0
Crisps and snacks	4	9.8
Nuts	6	14.6
Other food products	3	7.3
Soft drinks	5	12.2
Alcohol	12	29.3
Foods/drinks present in proximity to queue area ^a (within sight and within a few steps of the queue area)		
Non-compliant foods and drinks	37	90.2
Non-compliant foods (excluding drinks)	26	63.4
Fully compliant	4	9.8
Non-compliant food/ drink type		
Confectionery ^b	20	48.8
Biscuits	3	7.3
Cakes	3	7.3
Crisps and snacks	8	19.5
Nuts	6	14.6
Other food products	3	7.3
Soft drinks	11	26.8
Alcohol	28	68.3

^aFoods in the immediate checkout area (including products in queue display modules, temporary wire or cardboard displays or stacked in the queue area) were subject to the healthy checkouts initiative, those in proximity to the queue area were outside the scope of the initiative;

^bincludes products with a confectionery ingredient; compliance is based on meeting Tesco health and nutrition profiling criteria.

However, our study design does not allow us to attribute the small changes seen to the implementation of the 'healthy checkouts policy', since we cannot rule out that other external factors may be responsible. However, examination of like-for-like sales data revealed that spend on less healthy foods rose in the United Kingdom over the study period. This suggests that external factors such as public health campaigns are unlikely to be responsible for the decreased spending on less healthy foods and number of less healthy food items purchased in Tesco Express stores that we observed.

One reason for the modest effects observed is that, from our visits in a sub-sample of stores, compliance with the checkout policy was low, with only around one third of stores visited being fully compliant. In most cases, the products incorrectly displayed in the queue area made some claim to 'healthy' or 'natural' qualities. They were also most likely to be packaged in multipacks, which may make them less likely to be purchased on impulse. Encouragingly though, there were no queue module displays of traditional chocolate bars or 'full-fat' crisps of the type that were usual before the 'healthy checkouts initiative' in any of the visited stores. Even among the stores which fully complied with the 'healthy checkouts policy' in relation to having no non-compliant products displayed in the immediate queue and checkout areas, the presence of displays of confectionery, crisps, soft drinks and alcohol in close proximity was very common. These products were often displayed at the end of an aisle directly adjacent to the queue area or in nearby free-standing display units. This suggests that customers would still be able to pick up these items if they wished once they had joined the queue, although the trouble of stepping out of the queue and the possibility of losing one's place may have acted as a deterrent. Nudge theory suggests that this would be an effective deterrent (Thaler & Sunstein, 2009). However, it may be even more effective to completely remove less healthy foods from the vicinity of the checkout. Our findings indicate there is scope for increasing compliance with healthier checkout initiatives, which in turn may increase any impacts on purchasing behaviour. Studies in the United Kingdom have shown that supermarkets with clear and consistent checkout policies are more likely to have healthier foods in the checkout area than those with vague or inconsistent policies, although this was not the case for foods in the vicinity of the checkout (Ejlervskov, Stead et al., 2018; Lam et al., 2018). This suggests that supermarket policies can result in changed food environments at the checkout and changes are greater with better-implemented policies.

The results from this work add to the growing evidence base that healthier checkouts are a potentially effective approach for reducing sales of less healthy foods and thereby potentially improving population diet. Advantages of this approach are the wide use of supermarkets by individuals across the social spectrum, meaning broad exposure to the intervention. However, previous research has not consistently demonstrated a positive impact and the current study is limited by its observational approach, meaning causality cannot be inferred. Nevertheless, evidence indicates high acceptance by consumers (Huitink, Poelman, Seidell, Pleus, et al., 2020; Winkler et al., 2016) without obvious adverse effects on diet-related behaviours, although the food industry has voiced concerns over negative impacts for them and implementation

TABLE 3 Examples of non-compliant products found in the queue area

Food or drink type	Example products in queue
Confectionery ^a	Trebor Softmints (4 pack) Whitworths Fruity Biscuit Shot (25g) Atkins Chocolate Decadence Bar (60g)
Biscuits	Nature valley Maple and Pecan Bars (5×42g) Eat Natural Dark Chocolate Fruit and Nut Bars (5 pack) Natures Store Chocolate and Orange Rice Cakes (100g)
Crisps and snacks	Seabrook Crinkle Seasalt Crisps (31g) Walkers Sunbites Sour Cream and Black Pepper (28g) Tyrells Mixed Root Vegetable Crisps (40g) Walkers Baked Salt and Vinegar crisps (37.5g) Walkers Wotsits (6×16.5g)
Nuts	Tesco Almonds (200g) Tesco Roasted Monkey Nuts (250g) Tesco Roasted Salted Cashews
Other food products	Kelloggs Crunchy Nut Cornflakes (500g) Kelloggs Krave cereal (375g)
Soft drinks	Lipton's Ice Tea Lemon (500ml) Coke (1 L)
Alcohol	Kopparberg Mixed Fruits (500ml) Stella Artois (12×330ml) Castillero del Diablo Sauvignon Blanc 750 ml WKD Blue 700ml

^aIncludes products with a confectionery ingredient; non-compliance is based on not meeting Tesco health and nutrition profiling criteria.

challenges (Jenneson & Morris, 2021). The latest raft of proposals for addressing obesity in England includes legislation for restricting location-based promotions, including checkouts (DHSC, 2020; DHSC, 2021), with legislation expected to come into force in October 2022. Our research and that of others suggest that it would be prudent to take into account the challenges that stores experience in implementing healthy checkout policies. More research using robust study designs on the impact of different types of checkout interventions, and also whether impact varies by social class/other factors, would be informative. Further research using qualitative process evaluation could usefully explore ways of increasing store compliance.

Given the strong associations between obesity and social class (Bann et al., 2017), it is important to consider how public health interventions impact populations. There is some evidence that stores in areas of higher deprivation and with higher levels of obesity have less healthy checkouts (Cameron, 2018; Cohen & Babey, 2012), although findings have not been consistent (Thornton et al., 2012; Vandevijvere et al., 2018). This suggests individuals from more deprived backgrounds may be disproportionately impacted by less healthy checkouts and could therefore benefit most from the removal of less healthy foods. The study by Ejlerskov et al. (2018c) showed that the most and least deprived groups experienced the greatest benefits from the implementation of healthy checkouts. Another study that took place in a deprived

neighbourhood in New York found that the presence of healthy foods at checkouts increased healthy purchases (Adjoian et al., 2017). These findings suggest individuals from more deprived backgrounds can benefit from this type of intervention. Future work should explore this further.

Limitations and strengths

The strengths of this study include the outcome measure, real-world purchasing data, which was objective and that stores across the country were included, increasing representativeness. We avoided major holiday periods in our data collection period, meaning that our findings should reflect 'usual' purchasing patterns. However, there are limitations. Most notably, the lack of a control group means that reductions in less healthy food purchasing observed cannot be directly attributed to the intervention, although descriptive comparisons with like-for-like sales data over the same time period, which showed increases in less healthy food purchasing, gives some confidence. While we observed statistically significant reductions in sales of less healthy foods across the majority of outcomes and products, they were small and it is important to consider how meaningful these changes may be in terms of public health. There may also be limitations to comparing sales from the same time period in the previous year due to market price changes,

manufacturer-related promotions or weather changes that were not specifically captured. However, we mitigated this through comparison to sales in the same food categories from other major UK food retailers for the same time period. These data did not tell us whether other retailers were running similar interventions at this time. Unfortunately, it was not possible to obtain the wider market data exclusively for stores with the same convenience store format as Tesco Express outlets but we believe this comparison to be a strength alongside our within-store comparison for the previous year.

Compliance with the intervention was measured by researchers during unannounced visits; ideally, we would have compared compliant and non-compliant stores but this would have required many more store visits to be completed which was outside of the resources available for this project. We focused on less healthy food purchases since these foods are most commonly displayed at checkouts and most prone to impulse purchasing. While it may also have been interesting to examine impacts on healthier food purchasing, this again was outside the scope of the current work. Although we could not identify whether less healthy items were purchased from the checkout area, or from elsewhere in the store, the aim of the study was to investigate whether removal of these items from the checkout reduced overall sales in these less healthy categories so this limitation did not impact our study.

CONCLUSION

Following the implementation of the nationwide 'healthy checkouts initiative' in Tesco Express stores, there was a small reduction in the sales of less healthy foods which was largely explained by sales of confectionery products. Comparison with sales data from other major supermarkets provides some support for these changes being due to the initiative. Compliance with the initiative was low however, suggesting there is scope for improved implementation. We hypothesised that removing less healthy foods from checkouts would reduce purchasing of less healthy foods, and our findings were supportive of this. The finding that confectionery purchasing in particular appeared to reduce hints at reduced impulse purchasing as a mechanism. These results are therefore supportive of healthier checkouts being a useful target for public health policy, especially where the target is reducing less healthy food purchasing. Our findings indicate that greater focus on increasing compliance would be useful, as well as exploring in more detail the potential benefits of these types of interventions in deprived areas.

AUTHOR CONTRIBUTIONS

H.C. and P.L. conceptualized the study. H.C, A.F. and P.L. contributed to methodology and writing—original manuscript preparation. A.F and M.M involved in formal analysis. A.F. and P.L. investigated the study. H.C, A.F., P.L., M.M. and A.D. contributed to writing—review and editing. A.D. visualised the study. A.L. and P.L. supervised the study and administrated the project. H.C. acquired the funding.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data for the study belong to Tesco. Restrictions apply to the availability of these data, which were used under license for this study.

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