

Impact of front-of-pack 'traffic-light' nutrition labelling on consumer food purchases in the UK

GARY SACKS^{1,*}, MIKE RAYNER² and BOYD SWINBURN³

¹School of Exercise and Nutrition Sciences and ²British Heart Foundation Health Promotion Research Group, Department of Public Health, University of Oxford, Oxford, UK and ³WHO Collaborating Centre for Obesity Prevention, Deakin University, Melbourne, Australia

*Corresponding author. E-mail: gary.sacks@deakin.edu.au

SUMMARY

Front-of-pack 'traffic-light' nutrition labelling has been widely proposed as a tool to improve public health nutrition. This study examined changes to consumer food purchases after the introduction of traffic-light labels with the aim of assessing the impact of the labels on the 'healthiness' of foods purchased. The study examined sales data from a major UK retailer in 2007. We analysed products in two categories ('ready meals' and sandwiches), investigating the percentage change in sales 4 weeks before and after traffic-light labels were introduced, and taking into account seasonality, product promotions and product life-cycle. We investigated whether changes in sales were related to the healthiness of products. All products that were not new and not on promotion immediately before or after the introduction of traffic-light labels were selected

for the analysis ($n=6$ for ready meals and $n=12$ for sandwiches). For the selected ready-meals, sales increased (by 2.4% of category sales) in the 4 weeks after the introduction of traffic-light labels, whereas sales of the selected sandwiches did not change significantly. Critically, there was no association between changes in product sales and the healthiness of the products. This short-term study based on a small number of ready meals and sandwiches found that the introduction of a system of four traffic-light labels had no discernable effect on the relative healthiness of consumer purchases. Further research on the influence of nutrition signposting will be needed before this labelling format can be considered a promising public health intervention.

Key words: barriers; diabetes; exercise

INTRODUCTION

The health burden from nutrition-related non-communicable diseases such as diabetes, cancer and cardiovascular disease is high and increasing in many countries around the world (Lopez *et al.*, 2006). Accordingly, governments are actively seeking policy options aimed at improving public health nutrition (World Health Organization, 2005). New forms of food labelling, and 'front-of-pack' nutrient signposting in particular, are viewed as potential tools for improving the nutrition of the population (Nestle and Jacobson, 2000). A number of

different front-of-pack nutrient signposting have been developed (Grunert and Wills, 2007) and the most effective format has been vigorously debated (Lobstein *et al.*, 2007).

A recent review of European research on consumer responses to front-of-pack labelling found that, while there are many studies into consumer preferences regarding front-of-pack labels, there is very little evidence and an urgent need for research into consumer use of front-of-pack nutrition information in a real-world setting (Grunert and Wills, 2007). Supermarket sales data have great potential to be used as a tool to monitor and assess the

impact of the introduction of new labelling schemes on food purchases (Tin Tin *et al.*, 2007).

In 2006, the UK Food Standards Agency (FSA) recommended that food retailers and manufacturers in the UK place front-of-pack traffic-light labels on products in a range of categories. The labelling format recommended by the FSA consists of four separate colour-coded lights indicating the level of fat, saturated fat, sugar and salt in the product. A 'red' light indicates a 'high' level of that nutrient, an 'amber' light indicates a 'medium' level and a 'green' light indicates a 'low' level, with nutrition criteria set by the FSA. The FSA states that a key objective of this traffic-light labelling is to help people make healthier food choices (Food Standards Agency, 2008).

In 2006 and 2007, several supermarket chains in the UK started to include front-of-pack nutrition information, some following the FSA recommendations, with others displaying percentage Guideline Daily Amounts (GDAs) with no colour coding. There has been no independent evaluation of the impact of these labels on consumer purchases.

This paper aims to examine the impact that the introduction of the FSA-recommended front-of-pack traffic-light labelling scheme has had on food sales in a major UK supermarket chain.

METHODS

This study used supermarket point-of-sales data from a major UK retailer (the Retailer). (Further details of the Retailer cannot be provided in order to protect the confidentiality of the Retailer.) The Retailer operates a chain of over 1000 supermarket stores across the UK. The customers of the supermarket chain are closer demographically to the average UK shopper than those of any other UK retailer.

We examined total weekly product sales across all of the Retailer's UK stores in 2007. The Retailer progressively introduced traffic-light labels on a number of its own-brand products across various food categories throughout 2007. The analysis reported here focuses on product sales in two categories: chilled pre-packaged meals ('ready meals') and fresh pre-packaged sandwiches ('sandwiches'). These categories were selected for analysis, firstly, because these categories contained the greatest

number of products with traffic-light labels and, secondly, because these categories included nutritionally diverse products. Prior to the introduction of traffic-light labels, all products in these categories had a table of nutrition information on the back-of-pack including information on percentage GDAs. Many products also had a summary of nutrition information on the front-of-pack. Besides the Retailer's own-brand products, no other products had traffic-light labels.

Our study investigated the initial impact of the introduction of traffic-light labels on product sales. In the selected categories, we examined all products for which there were sales data before and after the introduction of traffic-light labels, but excluded those products that were on promotion (discounted in price or part of a promotional campaign) in the 8-week period surrounding the introduction of labels. For the 'eligible' products, we compared sales in the 4 weeks before and the 4 weeks after the introduction of traffic-light labels. By focusing on sales in a 4-week period, we aimed to provide enough time to detect a discernable effect on sales due to the labels while minimizing the potential impact of other factors, recognizing that the supermarket is a highly dynamic environment. Weekly product sales as a percentage of total weekly sales in the category were examined in order to take account of seasonal fluctuations in the sales of the category as a whole. A linear mixed model was used to examine the association between weekly sales before and after the introduction of traffic-light labels. The model takes into account repeated measures of weekly sales for an individual product to examine the impact of traffic-light labels across the group of products over time.

The percentage change in sales of the eligible products in each category after the introduction of traffic-lights was compared with the relative healthiness of the products, using Spearman's rank correlation. The 'healthiness' was determined by assigning 3 points for each 'red' traffic-light label on the product, 2 points for each 'amber' light and 1 point for each 'green' light, meaning that products could score a theoretical minimum of 4 points ('healthiest' products) and a maximum of 12 points ('least healthy' products). While it is recognized that other more sophisticated methods of measuring healthiness are available (Stockley *et al.*, 2008), this method was selected for use in this study as it explicitly

uses the nutritional information portrayed by the traffic-light system under examination here.

The changes in product sales by different customer demographic groups were analysed by incorporating additional information from the Retailer's customer loyalty card scheme. The sales data used for these purposes represented a subset of the total sales data used for the previous analyses. Through this scheme, the Retailer is able to segregate customer purchases based on the demographic characteristics of their loyalty card holders. The Mosaic segmentation (Experian, 2007), which classifies UK consumers into 11 groups based on their socio-demographics, lifestyles, culture and behaviour, was used in segmenting customers into different groups. Eligible products were grouped according to their healthiness, and demographic differences in the change in the sales of these product groupings were examined.

All statistical analysis used SPSS statistical software (Version 14.0 for Windows, Chicago, IL, USA).

RESULTS

Ready meals

Traffic-light labels were introduced on a total of 23 of the Retailer's own-brand products (15% of total Ready Meal lines) at various

points during 2007. These products varied in their 'healthiness', with 12 products having no 'red' traffic-lights (only 'green' and 'amber' lights), six products having only one 'red' traffic-light and five products having more than one 'red' traffic-light. Only six of the 23 products were deemed eligible for an analysis of the impact of the introduction of traffic-light labels on sales. The other products were either on promotion immediately before or after the introduction of traffic-light labels ($n = 9$) or traffic-light labels were introduced on brand new products ($n = 8$) making it inappropriate to include them in the analysis.

Figure 1 depicts the sales of Ready Meals in 2007, with the sales of the six products deemed eligible for the analysis separately identified in the graph, and the 8-week period (Weeks 33–41) surrounding the introduction of traffic-light labels (Week 37) on these products highlighted. In addition to the introduction of traffic-light labels on these products at this time, the product packaging was changed, the product supplier was changed and the products were reformulated. As demonstrated in Figure 1, sales in the category were lower over the summer months (Weeks 14–40) compared with the winter months. Weekly spikes in sales were typically the result of individual product promotions. Ready Meals category sales increased by 2.5% in the 4 weeks after Week 37

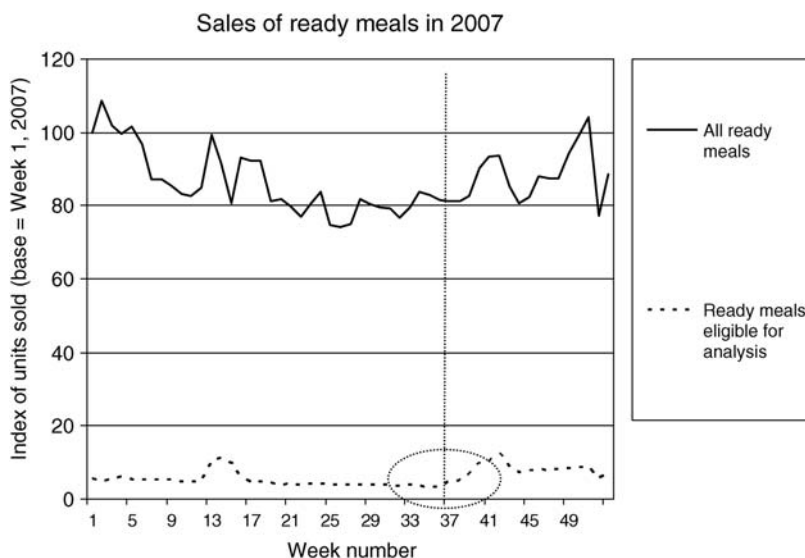


Fig. 1: Ready Meals sales in 2007 highlighting products eligible for analysis of impact of introduction of traffic-light labels in Week 37. Sales are expressed as units sold, indexed to sales in Week 1 of 2007.

compared with the preceding 4 weeks. For the set of six eligible Ready Meals, sales 4 weeks after the introduction of traffic-light labels increased by 2.4% (as a percentage of category sales) on sales 4 weeks before. By fitting a linear mixed model, we found that this difference in weekly sales (as a percentage of category sales) after the introduction of traffic-light labels was significant ($p = 0.03$).

Table 1 provides details of the changes in sales of each of the eligible Ready Meals after the introduction of traffic-light labels. Sales in all but one of the eligible products increased over this time, with changes in sales 4 weeks after the introduction of traffic-light labels ranging from a reduction of 31% to an increase of 148% for individual products compared with sales 4 weeks before.

Each of the products were allocated a healthiness score (Health Score) based on their traffic-light labels (Table 1). The healthiest of the six Ready Meals received a score of 5 (Shepherds Pie), with the unhealthiest scoring 10 (Beef Stew and Dumplings). Crucially, there was no association between the healthiness of the products and the change in sales measured as a percentage of category sales (Spearman's rank correlation = 0.21, $p = 0.69$).

We then analysed the change in sales of these products by different demographic groups, as it was considered possible that people from different groups may have responded differently to the introduction of traffic-light labels, e.g. the labels may have appealed only to health-conscious shoppers or people from upper socio-economic groups. Table 2 presents this analysis of the change in sales of the six eligible Ready Meals segmented by customer demographic group, using the Mosaic segmentation. Products were grouped, based on their Health Score, into healthier products, medium-healthy products and less-healthy products to enable an examination of the changes in sales based on the relative healthiness of the products. In almost all customer groups, the product classified as healthier increased in sales more than the products classified as less-healthy; however, in all groups, sales of the less-healthy products increased by more than the medium-healthy products. Thus, despite some differences in behaviour of different customer groups, this analysis still showed no consistent association between the healthiness of products and a change in sales after the introduction of traffic-light labels.

Table 1: Impact of traffic-light labels on sales of eligible Ready Meals

Product description	Traffic-light labels			Health Score (RANK) ^a	Sales for the 4 weeks BEFORE introduction of traffic-light labels (% of category sales)	Sales for the 4 weeks AFTER introduction of traffic-light labels (% of category sales)	CHANGE in sales after introduction of traffic-light labels (% of category sales) (RANK)	CHANGE in sales after introduction of traffic-light labels (% of own sales)
	Fat	Saturated fat	Sugar					
Shepherds Pie (400 g)	Green	Green	Green	5 (1)	0.9%	2.2%	1.3% (1)	148%
Cumberland Pie (400 g)	Amber	Red	Green	8 (3)	0.3%	0.3%	0.0% (5)	12%
Lancashire Hot Pot (400 g)	Amber	Red	Green	8 (3)	1.6%	1.1%	-0.5% (6)	-31%
Liver and bacon with mashed potato (400 g)	Amber	Red	Green	8 (3)	0.4%	0.7%	0.3% (4)	82%
Sausage and mash (400 g)	Red	Red	Green	9 (5)	0.8%	1.8%	0.9% (2)	116%
Beef stew and dumplings (400 g)	Red	Red	Green	10 (6)	0.6%	0.9%	0.3% (3)	62%
Total of eligible products					4.6%	6.9%	2.4%	55%

^aWhere products had the same health score, they received a 'mean rank'.

Table 2: Percentage change in sales of eligible Ready Meals (grouped according to relative healthiness) by Mosaic customer demographic group (Experian, 2007)

Customer group	CHANGE in sales 4 weeks before and 4 weeks after introduction of traffic-light labels (% of own sales)		
	Healthier products (health score ≤ 5) ($n = 1$)	Medium-healthy products (health score = 6, 7 or 8) ($n = 3$)	Less-healthy products (health score ≥ 9) ($n = 2$)
Symbols of success	81%	-19%	70%
Happy families	108%	-4%	69%
Suburban comfort	89%	-6%	46%
Ties of community	145%	2%	68%
Urban intelligence	47%	2%	82%
Welfare borderline	76%	-2%	32%
Municipal dependency	132%	17%	79%
Blue collar enterprise	110%	-5%	65%
Twilight subsistence	78%	7%	73%
Grey perspectives	92%	4%	83%
Rural isolation	103%	-3%	78%

Sandwiches

Traffic-light labels were introduced on a total of 49 own-brand products (14% of total Sandwich lines) at various points during 2007. These products varied in their 'healthiness', with 25 products having no 'red' traffic-lights (only 'green' and 'amber' lights), 13 products having only one 'red' traffic-light and 11 products having more than one 'red' traffic-light. As indicated in Table 3, only 12 of the 49 products were deemed eligible for an analysis of the initial impact of the introduction of traffic-light labels on sales. The other products were either on promotion immediately before or after the introduction of traffic-light labels or traffic-light labels were introduced on new products making it inappropriate to perform a direct 'before and after' comparison.

Figure 2 depicts the sales of Sandwiches in 2007, with the sales of the 12 products deemed eligible for the analysis separately identified in the graph, and the 8-week period (Weeks 37–45) surrounding the introduction of traffic-light labels (Week 41) on these products highlighted. The majority of these products were also reformulated just prior to the introduction of

traffic-light labels. As demonstrated in Figure 2, sales of sandwiches were slightly higher over the summer months (Weeks 14–40) compared to the winter months. As with the sales of Ready Meals, weekly spikes in sales were typically the result of individual product promotions. Sales in the sandwiches category decreased by 0.7% in the 4 weeks after Week 41 compared with the preceding 4 weeks. For the set of 12 eligible sandwiches, sales 4 weeks after the introduction of traffic-light labels decreased by 0.43% (as a percentage of category sales) on sales 4 weeks before. However, when this was fitted in a linear mixed model, the difference in weekly sales (as a percentage of category sales) after the introduction of traffic-light labels was not significant ($p = 0.14$).

Table 4 provides details of the changes in sales of each of the eligible sandwiches after the introduction of traffic-light labels. Sales of most of the eligible products decreased slightly after the introduction of traffic-light labels.

As with the Ready Meals above, each of the products was allocated a healthiness score (Health Score) based on their traffic-light labels

Table 3: Products in sandwiches category highlighting products eligible for analysis

The Retailer's own-brand products	Traffic-light labels not introduced	54
	Products on promotion immediately before traffic-light labels introduced	3
	Products on promotion immediately after traffic-light labels introduced	21
	Traffic-light labels introduced on brand new products	13
	Products with traffic-light labels eligible for analysis	12
Total products in category		355

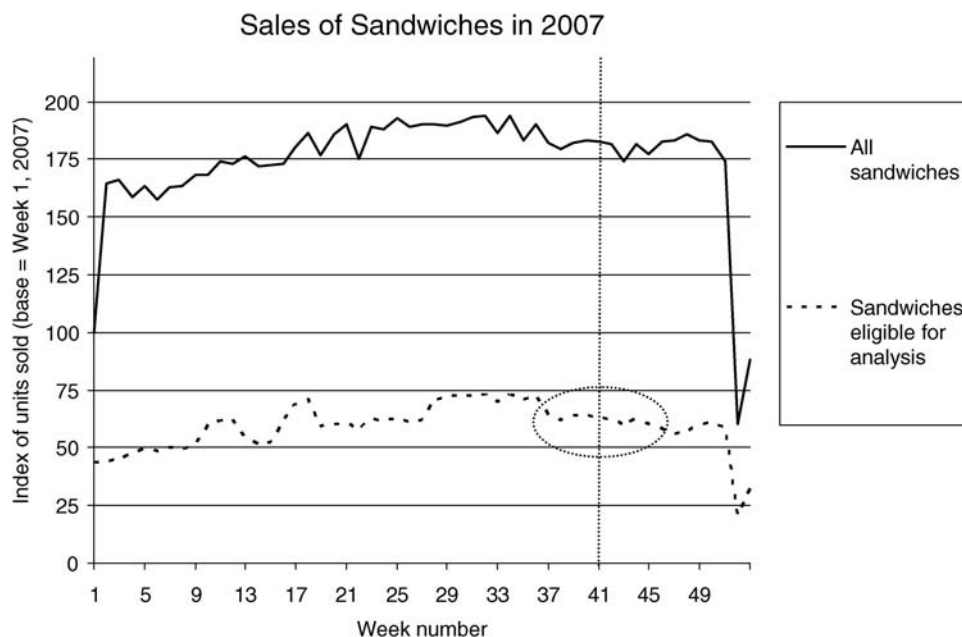


Fig. 2: Sandwiches sales in 2007 highlighting products eligible for analysis of impact of introduction of traffic-light labels in Week 41. Sales are expressed as units sold, indexed to sales in Week 1 of 2007.

(Table 4). The healthiest of the 12 Sandwiches received a score of 6 (Chicken Salad Sandwich, Chicken Stuffing & Red Onion Sandwich, Ham Salad Sandwich, Peking Duck Wrap, Prawn Mayonnaise Sandwich, Tuna and Sweetcorn Sandwich), with the unhealthiest scoring 9 (Cheese Sandwich, Cheese Ploughman's Sandwich, Cheese and Onion Sandwich). As with the Ready Meals, there was no association between the healthiness of the products and the change in sales measured as a percentage of category sales (Spearman's rank correlation = -0.47 , $p = 0.12$). Analysis by customer demographic group also revealed no association between product 'healthiness' and change in sales for any of the customer groups.

DISCUSSION

This study of a small sample of products over a short time period found that sales of Ready Meals increased immediately after the introduction of traffic-light labels, whereas sales of sandwiches did not change significantly after the labels were introduced. However, it is difficult to attribute the observed increase in sales of Ready Meals to the introduction of traffic-light

labels as the products examined were also reformulated at the time the labels were introduced and the product packaging and manufacturer was changed. Most critically from a public health perspective, this study found no association between the 'healthiness' of the products and the change in sales.

We made an effort to minimize the effect of influences other than the introduction of traffic-light labels on sales. We focused only on products for which we could perform a direct before and after comparison of sales, taking into account the seasonal fluctuations in sales without the need to adjust sales figures for the effects of promotions, discounts and the impact of product life-cycles. This approach has several limitations. First, the products we analysed represent only a small subset of the products that had traffic-light labels introduced. Secondly, we were only able to assess the immediate impact (4 weeks) of traffic-light labels on sales. It is possible that consumers take longer than this to adjust their habits and that the impact of the labels could be greater over a longer period of time. Thirdly, we were not able to account for all factors influencing sales.

This is the first independent study to use supermarket sales data to analyse the impact of the

Table 4: Impact of traffic-light labels on sales of eligible sandwiches

Product description	Traffic-light labels				Health score (RANK) ^a	Sales for the 4 weeks BEFORE introduction of traffic-light labels (% of category sales)	Sales for the 4 weeks AFTER introduction of traffic-light labels (% of category sales)	CHANGE in sales after introduction of traffic-light labels (% of category sales) (RANK)	CHANGE in sales after introduction of traffic-light labels (% of own sales)
	Fat	Saturated Fat	Sugar	Salt					
Chicken and onion sandwich (deep fill)	Amber	Green	Green	Amber	6 (3.5)	2.4%	2.3%	-0.09% (11)	-4.6%
Chicken salad sandwich	Amber	Green	Green	Amber	6 (3.5)	3.8%	3.6%	-0.18% (12)	-5.4%
Ham salad sandwich	Amber	Green	Green	Amber	6 (3.5)	3.3%	3.2%	-0.07% (9)	-2.8%
Peking duck wrap	Amber	Amber	Green	Green	6 (3.5)	1.7%	1.7%	0.05% (2)	2.0%
Prawn mayonnaise sandwich	Amber	Green	Green	Amber	6 (3.5)	3.3%	3.3%	-0.04% (7)	-1.8%
Tuna and sweetcorn sandwich	Amber	Green	Green	Amber	6 (3.5)	2.1%	2.1%	0.00% (4)	-0.7%
Chicken salad sandwich (deep fill)	Amber	Amber	Green	Amber	7 (7)	2.8%	2.7%	-0.03% (6)	-1.7%
Egg and bacon sandwich (deep fill)	Red	Amber	Green	Amber	8 (8.5)	3.4%	3.4%	-0.08% (10)	-3.1%
Ham and cheese sandwich	Amber	Red	Green	Amber	8 (8.5)	3.7%	3.6%	-0.03% (5)	-1.4%
Cheese sandwich	Red	Red	Green	Amber	9 (11)	2.6%	2.6%	0.07% (1)	1.9%
Cheese ploughmans sandwich (deep fill)	Red	Red	Green	Amber	9 (11)	3.2%	3.2%	0.02% (3)	0.0%
Cheese and onion sandwich	Red	Red	Green	Amber	9 (11)	4.0%	4.0%	-0.05% (8)	-2.0%
Total of eligible products						36.1%	35.7%	-0.43%	-1.9%

^aWhere products had the same health score, they received a 'mean rank'.

introduction of traffic-light nutrition signposting on consumer food purchases. The strength of using supermarket sales data is that it reflects people's actual purchasing behaviour in the 'real-world'. Interestingly, the results do not correspond with the anecdotal evidence by UK supermarkets that indicated consumer shifts towards healthier products in response to front-of-pack nutrition signposting (Sainsbury's, 2006; Tesco, 2006). These supermarkets did not disclose sufficient details of their methods when reporting their results to allow a more detailed comparison with the results presented here. Our results can be contrasted with previous research examining the way in which people believe they will respond to front-of-pack nutrition labels. Whereas people may have intentions of using front-of-pack labelling to select healthier options, this study indicates that this may not be reflected in their actual shopping behaviour.

Traffic-light labels have been widely promoted by public health groups around the world as a promising policy option for the promotion of public health nutrition based, at least in part, on the presumption that they would lead to a shift in consumer purchases towards healthier products. One possible explanation for the results of this study is that consumers did not understand the labels. This may imply that the formatting of the labels needs to be changed or that more effort needs to be spent on educating consumers on how to use the labels. Another potential explanation is that, in the categories investigated, traffic-light labels were only present on a small proportion of the products. It can be argued that the labels will have a greater and therefore more detectable effect on sales when all products are labelled in the same way, allowing consumers to more readily compare the information provided by traffic-light labels across products. There are a large number of other potential explanations and it is suggested that future research in this area incorporate the views of customers and other contextual factors.

It is important to note that this study has not looked at all the potential effects of the introduction of traffic-light labelling. Future research could examine longer-term impact of traffic-light labelling on sales, the impact of this labelling format on the reformulation of products, and on consumer awareness of what they are eating, regardless of the effects on purchasing behaviour.

CONCLUSION

This study provides evidence that the introduction of traffic-light labels did not substantially influence supermarket sales of Ready Meals and Sandwiches in the stores of one particular retailer in the UK. While these findings need further examination in other contexts, in other food categories and over a longer-time period, the results indicate that the use of front-of-pack labelling in this format and at this level of use may not be sufficient to influence consumer behaviour in a major way.

However, this study should not preclude the possibility of traffic-light labelling delivering public health benefits, e.g. in situations where it is used on more products or when it is used in conjunction with other in-store activities designed to promote healthier choices. Furthermore, the study has not looked at all the potential effects of the introduction of traffic-light labelling, e.g. the reformulation of products to avoid 'red' lights and the level of nutrition awareness in the population.

Studies such as this should be used to develop and refine food labelling policies to meet the stated objectives of the policy. These findings should serve as a challenge to proponents of different forms of front-of-pack labelling to demonstrate the impact of other nutrition signpost formats on consumer purchases.

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AUTHORS' CONTRIBUTIONS

G.S. worked with the Retailer to obtain the data, jointly analysed the results and drafted the manuscript.

M.R. jointly analysed the results and reviewed the manuscript.

B.A.S. jointly analysed the results and reviewed the manuscript.

All authors reviewed and approved the final manuscript.

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