Consumer testing of the acceptability and effectiveness of front-of-pack food labelling systems for the Australian grocery market

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SUMMARY

The placement of nutrition information on the front of food packages has been proposed as a method of providing simplified and visible nutrition information. This study aimed to determine the most acceptable and effective front-of-pack food labelling system for Australian consumers. Consumers' preferences and ability to compare the healthiness of mock food products were assessed for different front-of-pack labelling systems. Four systems were tested, including two variations of the Percentage Daily Intake system (Monochrome %DI and Colour-Coded %DI), which displays the proportion of daily nutrient contribution that a serve of food provides; and two variations of the Traffic Light (TL) system (Traffic Light and Traffic Light + Overall Rating), which uses colour-coding to indicate nutrient levels. Intercept surveys with 790 consumers were conducted, where each participant was exposed to a single labelling system for performance testing. Participants indicated strong support for the inclusion of nutrient information on total fat, saturated fat, sugar and sodium on the front of packages, and a consistent labelling format across all products. Using the TL system, participants were five times more likely to identify healthier foods compared with the Monochrome %DI system [odds ratio (OR) = 5.18; p < 0.001], and three times more likely compared with the Colour-Coded %DI system (OR = 3.01; p < 0.05). Consumers supported the introduction of consistent front-of-pack food labelling. The TL system was the most effective in assisting consumers to identify healthier foods. Mandatory TL labelling regulations are recommended to assist consumers in making healthy food choices.

Key words: food labelling; consumer; survey; signposting

INTRODUCTION

Food labelling provides a potentially direct and cost-effective vehicle for assisting consumers to identify healthy food choices. The Australia New Zealand Food Standards Code currently mandates that all packaged foods carry a nutrition information panel (NIP), with the

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exception of very small packages and those packaged for immediate consumption. NIPs are typically placed on the back or sides of packaging, and may not be immediately visible to consumers in the supermarket environment. Consumer research indicates that NIPs can be confusing (Byrd-Bredbenner *et al.*, 2000; Cowburn and Stockley, 2005; Feunekes *et al.*, 2008) and difficult to interpret (Jones and Richardson, 2007), and objective measures indicate that their use during food purchase is lower than what self-reports suggest (Cowburn and Stockley, 2005).

Presenting consumers with summarized nutritional information on the front of food packs could assist them in quickly identifying healthy food choices at the point-of-sale and at the time of consumption. Nutrition content claims on food packages have been found to induce consumers to truncate their information search to the front of packages, leading to more positive, quick and in some cases, misleading judgements of products (Roe *et al.*, 1999). Therefore, it is important that nutrition information presented on the front of food packaging gives a balanced account of a food's nutrition profile.

The inclusion of simplified nutrition information on the front of food packages, known as front-of-pack food labelling, has been proposed as a complementary scheme to the NIP to assist consumers in making more informed food purchases. Two major variations of front-of-pack food labelling have been considered for application in the UK and Europe. The first is the Traffic Light (TL) system, developed by the UK Food Standards Agency, where nutrients of greatest public health significance (total fat, saturated fat, sugar and sodium) are ranked and colour-coded as either high (red), medium (amber) or low (green), based on cut-points established by the European Regulation for Nutrition and Health Claims (Official Journal of the European Union, 2006). The second is the Percent Guideline Daily Amount (%GDA) system, which displays the percentage of daily requirements of energy, total fat, saturated fat, sugar and salt that a serve of a food provides. Information on fibre, vitamins and minerals may also be provided (Food Standards Agency, 2007).

Research conducted in the UK by the consumer organization, Which?, examined consumers' ability to use and interpret variations of these two front-of-pack labelling systems (Conquest Research, 2006). Findings from this research

indicate that the TL system allowed consumers to more easily and accurately select healthier food products, and that these product comparisons could be made at a glance (Conquest Research, 2006). This is consistent with the consumer research conducted by the UK Food Standards Agency during the development of the TL system (Food Standards Agency, 2008).

In 2006, the Australian Food and Grocery Council introduced Percentage Daily Intake (%DI) front-of-pack labelling into the Australian grocery market as a voluntary labelling scheme, based on a variation of the European %GDA labelling system. As on December 2007, the %DI labelling system had been adopted by more than 15 major Australian food manufacturers (Food Magazine, 2007).

This study adapts consumer studies from the UK (Conquest Research, 2006) to the Australian context. Australian food labelling regulations differ from those in the UK, where NIPs are not mandatory on packaged food products, and Australian consumers have previously been exposed to %DI labelling. The aim of this consumer research was to determine which front-of-pack food labelling system would be most effective in assisting Australian consumers to make healthier, more informed food choices. This was achieved by identifying consumers' preferences for different front-of-pack labelling systems; ascertaining consumers' preferences for one or more labelling schemes; and examining the performance of each front-of-pack labelling system.

METHODS

Design

The experimentally manipulated independent variables included three food product categories [breakfast cereals, savoury snacks (crispbread) and frozen meals (lasagna)] and four label conditions:

(i) TL system ranking levels of total fat, saturated fat, sugar and sodium as either high, medium and low and assigned a red, amber or green colour-code, respectively;

(ii) TL + Overall Rating ($TL+$) system ranking levels of total fat, saturated fat, sugar and sodium as in the TL system, plus an overall rating for the product based on the proposed Food Standards Australia
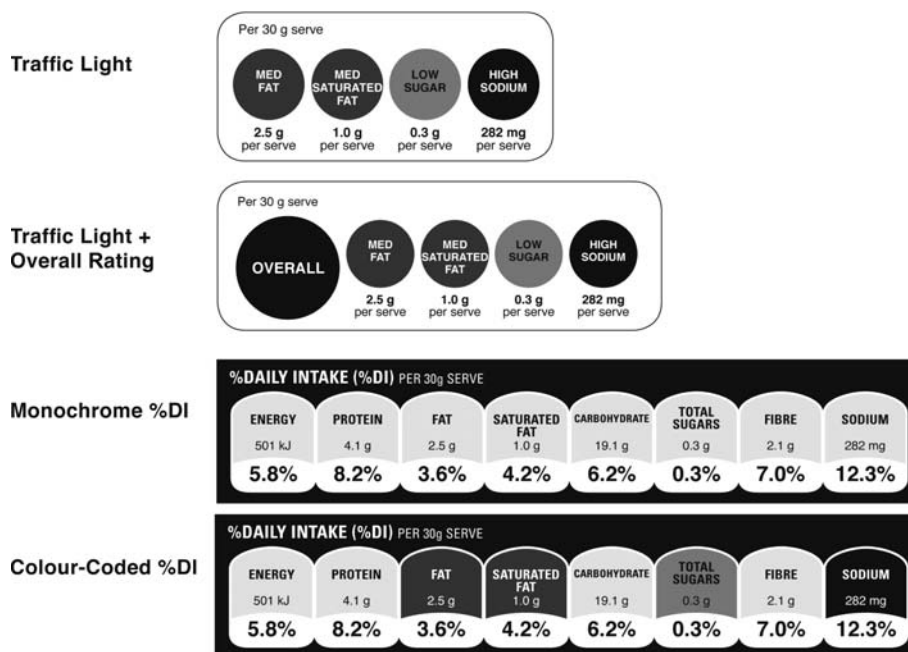
Fig. 1: Front of pack food labelling systems.

New Zealand (FSANZ) Nutrient Profiling criteria (Food Standards Australia New Zealand, 2007). Products with a Nutrient Profiling score <4 were classified as green overall; 4–10 as amber; and >10 as red;

(iii) Monochrome %DI (*M-%DI*) indicating the percent dietary contribution of energy, protein, total fat, saturated fat, total carbohydrate, sugar, fibre and sodium, based on the estimated nutrient requirements of a 70 kg adult with an energy requirement of 8700 kJ, as outlined in the Food Standards Code (Food Standards Australia New Zealand, 2008); and

(iv) Colour-Coded %DI (*CC-%DI*) system indicating the percent dietary contribution of energy, protein, total fat, saturated fat, total carbohydrate, sugar, fibre and sodium as in the M-%DI system, plus the relevant colour-code applied for total fat, saturated fat, sugar and sodium, based on nutrition criteria used in the TL system (Figure 1).

Participants

The sample comprised 790 adults (≥18 years) living in New South Wales, Australia, who had the primary or shared responsibility for grocery purchases for their household. Individuals who

themselves or had close family or friends employed in the food, marketing or market research industries, or who were dieticians or nutritionists were excluded, because their knowledge may not be representative of the general population.

Quotas were established for an approximately equal distribution of participants recruited from high, medium and low socioeconomic (SES) areas within Sydney. A proxy indicator of SES was assigned based on participant's residential postcode using the Australian Bureau of Statistic's Index of Relative Socioeconomic Advantage/Disadvantage (Australian Bureau of Statistics, 2007b). Index scores were divided into tertiles (1–3), with tertile 1 representing the area with the most disadvantage. The sample also aimed to achieve a spread of age groups, and included representation from a regional area (Newcastle).

MATERIALS

Mock packages

Two-dimensional mock packages for the three different product categories were created. Two products within each food category were
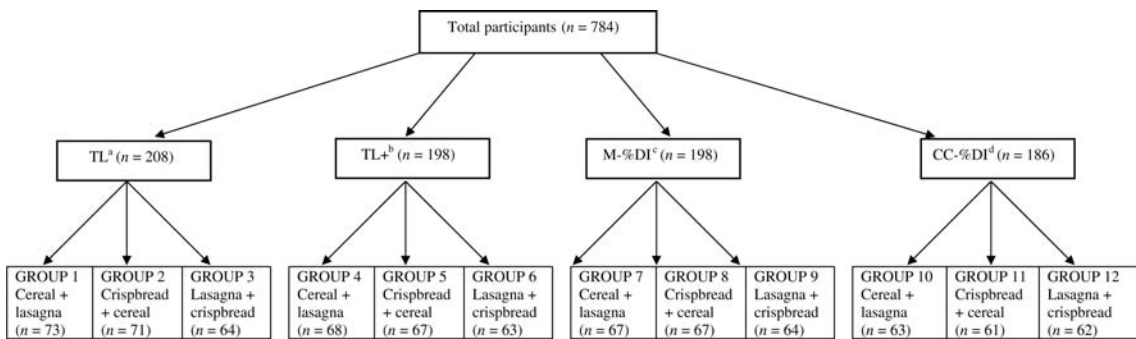
Fig. 2: Flow diagram of study procedure. [a]TL = Traffic Light; [b]TL+ = Traffic Light+Overall Rating; [c]M-%DI = Monochrome %DI; [d]CC-%DI = Colour-Coded %DI.

created, to represent one healthier and one less healthy option, designed to simulate commonly available food products. Products were considered healthy if they were eligible to make health claims according to the proposed FSANZ Nutrient Profiling (Food Standards Australia New Zealand, 2007).

Information displayed on these packages included a brand and product name, net weight, product image and the front-of-pack label, positioned on the top right-hand corner. Simulated product images and brand names were as similar as possible within each food category, and each labelling system occupied a similar surface area on the packages.

Response measures

The questionnaire was developed by the research team and informed by previous surveys on front-of-pack labelling (Conquest Research, 2006). Questions assessed consumer's perceptions of the importance of having information on specific nutrients on the front of packs; consumers' preferences for a consistent front-of-pack labelling scheme vs. multiple schemes; and the front-of-pack labelling system perceived to be the easiest to use, based on a sample of each of the labelling systems.

For performance testing, participants were shown one food product featuring one of the labelling systems. Participants were asked to assess the levels of total fat, saturated fat, sugar, and sodium within the food product, as either a lot, a moderate amount or a small amount. An aggregated score was calculated for the number of nutrients correctly identified, with a minimum score of zero, where no nutrients

were correctly identified, and a maximum score of four, where all nutrients were correctly identified.

Participants were then presented with a second (less healthy) product within the same food category, featuring the same labelling system, and asked to indicate which was the healthier product. This choice task was repeated using the same labelling system, but with another pair of products so that each consumer was exposed to two sets of two food products. Participants were asked how they decided which was the healthier product, and verbatim responses were coded thematically. The perceived ease and speed of this comparison was also assessed.

The questionnaire was piloted using cognitive interviewing, where the questionnaire was checked for accuracy and comprehensibility. In this pilot, participants were recruited using convenience sampling, including both genders, and a variety of age groups ($n = 10$).

Procedures

Survey fieldwork was conducted in June 2008. Participants were recruited from shopping centres and face-to-face intercept questionnaires were administered. Participants were allocated to one of the 12 test groups based on the order in which they were interviewed (Figure 2). Each test group was assigned two of the three food product categories, and a single labelling system for performance testing. A commercial market research firm conducted the fieldwork, to allow timely data collection by experienced interviewers. The study was approved by the Cancer Council NSW Ethics Committee.

Analyses

Data were analysed using SPSS version 14.0 for Windows (SPSS Inc., 2004). Where statistical testing was performed on categorical data, χ^2 tests were used. One-way analysis of variance was used to compare the mean number of nutrients that were correctly identified for different labelling systems (continuous data), followed by Scheffe *post hoc* testing.

Performance testing was analysed based on participants' ability to identify healthy food products in both of the choice tasks. Multinomial logistic regression was used to compare the performance of different front-of-pack labelling systems, with TL labelling positioned as the reference group. Where age, gender, education level and household income were found to be significantly associated with ability to identify healthier food products in bivariate analyses, these were included in the multinomial regression analyses assessing performance of the food labelling systems. Comparisons between different SES groups and ability to interpret the front-of-pack labels were also conducted as an additional exploratory analysis. Results were considered significant at $\alpha = 0.05$ level.

RESULTS

Participants' characteristics

The majority of participants were females (68%), reflecting the fact that the sample comprised main/joint grocery buyers (Table 1). The age of participants was approximately normally distributed, with a median age group of 50–59 years. The overall response rate for the survey was 15.3%. There were no significant differences between the 12 test groups in the proportions of main vs. joint household grocery purchasing responsibility ($F_{11,\ 789} = 1.5$, $p > 0.05$), gender ($F_{11,\ 789} = 0.6$, $p > 0.05$), age group ($F_{11,\ 789} = 0.5$, $p > 0.05$), education level ($F_{11,\ 789} = 1.0$, $p > 0.05$) or household income ($F_{11,\ 789} = 0.9$, $p > 0.05$), indicating that randomization to test groups was successful.

Preference for nutrition information on the front of food packages

For each nutrient tested in the research the majority of participants supported displaying information about this nutrient on the front of food packages. Levels of agreement were highest for saturated fat (85%), sugar (84%), total fat (83%) and sodium (78%), followed by fibre (73%), carbohydrate (73%), energy (69%), protein (69%), and vitamin and minerals (68%).

Preference for consistent labelling vs. multiple labelling systems

Almost all participants (90%) perceived that consistent front-of-pack labelling across all food products would be the easiest to understand.
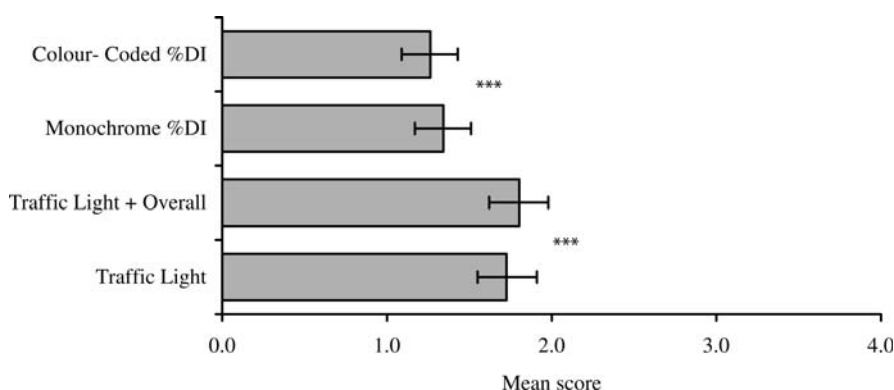
Table 1: Characteristics of survey participants ($n = 790$)

Characteristic	Number of participants, n (%)
Grocery buying responsibility	
Shared responsibility	562 (29)
Main responsibility	228 (71)
Gender	
Female	538 (68)
Male	252 (32)
Age	
18–19	13 (2)
20–29	85 (10)
30–39	135 (17)
40–49	131 (17)
50–59	186 (24)
60–69	157 (20)
70–79	66 (8)
80 and over	17 (2)
Household composition[a]	
Lives alone	137 (17)
Partner/husband/wife	520 (66)
Children ≤12 years	206 (26)
Adolescents 13–17 years	107 (14)
Other adults	237 (30)
Education[b]	
Less than secondary school	253 (32)
Secondary school	134 (17)
College diploma/certificate	186 (24)
University	210 (27)
Other	6 (1)
Household income[c]	
<$30,000	177 (22)
$30,000–$59,999	153 (19)
$60,000–$89,999	165 (21)
≥$90,000	207 (26)
Country of birth	
Australia	536 (68)
Other	254 (32)

[a]Multiple responses allowed; [b]Did not respond ($n = 1$); [c]Did not respond ($n = 88$).

Fig. 3: The mean number of nutrients correctly identified for all food product categories. ***$p < 0.001$.

Perceived ease of use of front-of-pack labelling systems

Before actually applying the labelling systems, 41% of participants reported that they would find the CC- %DI system to be the easiest to use, followed by the TL+ system (22%), M-%DI (21%) and TL (14%). Previous recall of %DI labelling was significantly associated with preference for either variant of the %DI system. Of those participants who had seen %DI labelling previously, 22% preferred the M-%DI system and 44% preferred the CC-%DI system, compared with 18% and 33% for those who had not previously been exposed to this labelling, respectively ($\chi^2_{12} = 34.36$, $p < 0.001$).

Performance of front-of-pack labelling systems: assessment of nutrients in food products

Across all food product categories, the mean number of nutrients that were correctly identified was significantly higher for both variants of the TL system, compared with both variants of the %DI system ($F_{3, 789} = 9.20$, $p < 0.001$; Figure 3).

Performance of front-of-pack labelling systems: ability to select healthier food products

Overall, 81% of participants using the TL system were able to correctly identify the healthier food product from both sets of products, compared with 78% of participants using the TL+ system, 70% for the CC-%DI system and 64% for the M-%DI system.

Compared with the TL system, participants using the M-%DI system were five times less

Table 2: The odds ratio [OR; 95% confidence interval (CI)] of correctly identifying the healthy product from both sets of food products, according to labelling system

Labelling system	OR	95% CI	*p*-value
Traffic Light (reference group)	1.0		
Traffic Light + overall rating	0.6	0.2–1.9	>0.05
Monochrome %DI	0.2	0.1–0.5	<0.001
Colour-Coded %DI	0.3	0.1–0.9	<0.05

likely to be able to identify the healthier food items (OR = 0.2; 95% CI 0.1–0.5), and those using the CC-%DI system were three times less likely to be able to identify the healthier products (OR = 0.3; 95% CI 0.1–0.9), after controlling for gender, age, education level and household income (Table 2).

There were no significant differences in participants' ability to identify the healthier food products between the TL and the TL+ systems.

Compared with participants who lived in the most socially disadvantaged areas, those from the least disadvantaged areas were six times more likely to be able to identify the healthier food products from both sets of products using the M-%DI system (OR = 6.3; 95% CI 1.4–29.2; Table 3). No significant differences between SES groups were evident for other labelling systems.

Across all front-of-pack labelling systems, participants were most likely to refer to the relative fat (28% of all participants shown the TL system, 25% TL+, 35% M-%DI;, 34% CC-%DI) and sodium content (28% TL, 23% TL+, 27% M-%DI, 28% CC-%DI) of each product in deciding which was the healthier

Table 3: The odds ratio [OR; 95% confidence interval (CI)] of correctly identifying the healthy products from both sets of food products, according to labelling system and socioeconomic status (SES)

	SES		
	Tertile 1 (Reference group, most disadvantaged)	Tertile 2, OR (95% CI)	Tertile 3 (least disadvantaged), OR (95% CI)
Traffic Light	1.0	1.1 (0.3–3.9)	3.7 (0.4–31.7)
Traffic Light + overall rating	1.0	4.4 (0.5–39.0)	0.7 (0.2–2.5)
Monochrome %DI	1.0	1.3 (0.5–3.4)	6.3 (1.4–29.2)*
Colour-coded %DI	1.0	0.8 (0.2–2.9)	1.4 (0.3–6.1)

*$p < 0.05$.

product. The sugar content of products was also frequently used (15% TL, 14% TL+, 16% M-%DI, 15% CC-%DI).

Perceived ease in comparing the healthiness of products

For all front-of-pack labelling systems, after using the system the majority of participants reported that they found it 'very easy' or 'fairly easy' to use, from a five-point likert scale, even though many made incorrect judgements. A slightly higher proportion of participants reported that it was 'very easy' to use the TL system (56% of participants compared with between 41% and 45% for the other systems; ns).

Perceived speed in comparing the healthiness of products

Participants who were presented with the TL and the TL+ systems were significantly more likely to perceive that they could compare the healthiness of the products 'at a glance', than those presented with the M-%DI and the CC-%DI systems (39% and 30% vs. 29% and 20%, respectively; $\chi^2_9 = 20.62$, $p < 0.01$).

DISCUSSION

This study indicates strong consumer support for nutrition information to be included on the front of food packaging, in particular, information about saturated fat, sugar, total fat and sodium. Furthermore, when making product comparisons, participants were most likely to refer to these nutrients to inform their decisions.

This study also highlights consumers' preference for consistent front-of-pack labelling across all food packages, with consumers perceiving the use of multiple and inconsistent systems as more difficult to understand. Considering the plethora of front-of-pack labelling systems that have emerged in international grocery markets under voluntary labelling schemes (Which?, 2006), it is likely that regulations for mandatory labelling are required to ensure that all food manufacturers and retailers provide nutrition information in a consistent format.

There appears to be a disjuncture between the front-of-pack labelling system that consumers initially perceived to be the easiest to use and their actual ability to interpret this system. Based on preference testing, the highest proportion of consumers reported that they preferred the CC-%DI system. However, consumers' ability to interpret this system was significantly lower than for the TL system. Consumers using the TL system were three times more likely to identify the healthier food products than consumers using the CC-%DI system, and five times more likely compared with consumers using the M-%DI system. Further, the M-%DI system was associated with a positive gradient between increasing socioeconomic disadvantage and comprehension of the labelling systems, whereas the TL labels resulted in equitable performance across SES groups. These results present strong evidence that the TL system more effectively allows consumers, particularly those in lower SES groups who are most at risk of obesity (McLaren, 2007), to make healthier food choices.

Consumers' reduced ability to use the CC-%DI and M-%DI systems, which contain larger amounts of information than both variants of the TL system, is consistent with previous literature indicating that consumers have

a finite capacity to absorb and process information during a short time. Beyond this capacity overload occurs leading to poorer decision-making (Malhotra, 1982).

The major strengths of this study include the use of monadic testing, whereby each participant was exposed to a single labelling system for performance testing. This method allowed each system to be tested independently, minimizing the interaction between labelling systems.

To ensure that survey findings could be attributed to the front-of-pack labelling, mock food packages excluded information such as the NIP, ingredients list and nutrition claims, to prevent this information influencing survey responses. The use of mock products reduced the potential bias from preconceived notions about known brands. Finally, the survey used an objective performance measure to assess the application of the labelling systems. Results from studies that only assess consumer preferences for different labelling systems, may be affected by other factors, including people's familiarity with a particular system and social desirability associated with particular responses, such as choosing the system that is seen to portray the most information.

Findings from the current study corroborate research from the UK, which under a similar testing design, indicated that significantly more consumers identified healthier products using the TL labelling system (Conquest Research, 2006), and that this system was the easiest to use for comparing relative healthiness between products. While more research is needed to explore consumers' actual food purchasing behaviour following exposure to front-of-pack labelling, such as observational studies of supermarket purchasing behaviour or the investigation of supermarket sales data following the introduction of front-of-pack labelling, research indicates that consumers' intent to purchase food is modified by their exposure to TL labelling, with consumers reporting a reduced intention to purchase products with red and amber nutrient classifications (Conquest Research, 2006).

If consumers played out such intentions in the marketplace, or if manufacturers anticipated this impact on purchase decisions, compulsory TL labelling could provide impetus for food manufacturers to improve the nutritional profile of their products in order to achieve a more favourable TL rating.

Despite findings from the UK, the Commission of European Communities in the European Union (EU) has proposed regulations for %GDA front-of-pack labelling to be applied to food products across the EU, with the opportunity for Member States to devise or approve alternative systems within their own jurisdictions (Official Journal of the European Union, 2006). In contrast to the %GDA system (which refers to the amount of each nutrient provided per 100 g/ml of a food or beverage product), the Australian equivalent (%DI) is based on the level of nutrients per serve. This poses a potentially significant limitation of the %DI system, considering the absence of standard serving sizes in Australia. Without standard serving sizes, consumers' ability to compare nutrition criteria between products with different serving sizes may be severely hindered, and there is a possibility that food manufacturers will manipulate serving sizes in order to portray a food product as having a healthier nutrient profile. In contrast, nutrient classification for TL labelling is based on the level of each nutrient per 100 g/ml of a product.

Notably, the UK Food Standards Agency has recently amended its TL food labelling criteria to include nutrient cut-points for a serve of food. These cut-points exist alongside criteria for nutrients per 100 g/ml, and specify that where a product contributes more than 30% of the recommended upper intake for total fat, saturated fat and sugar, and 40% for sodium per serve, it is automatically labelled as red for that nutrient (Food Standards Agency, 2007). These criteria may be useful in classifying products that are sold and consumed in larger portions, such as frozen meals.

Previous research has appraised the TL system as insufficient in differentiating between healthier and less healthy products within certain categories (Feunekes *et al.*, 2008). For example, this system does not provide any distinction between breakfast cereals that are high in added sugar and those that have a high sugar content because of the presence of dried fruit.

The TL system has also been criticized for implying that some core foods are unhealthy, thereby potentially discouraging their consumption. For example, many cheeses would be labelled with red or amber lights for total fat, saturated fat and sodium, yet consumers are encouraged to choose dairy products because of other nutritional benefits. This highlights the need for public education campaigns to accompany the introduction of any front-of-pack

labelling system to inform consumers about how to interpret this labelling in the context of other nutrition guidelines. The development of specific nutrient criteria for certain food categories may be considered.

The limitations of this study should be noted. While efforts were made to include people from non-English speaking backgrounds, consumers who were not sufficiently fluent in English to complete the survey were excluded. That said, while only 32% of the sample comprised people born overseas, this is comparable with the proportion of people living in major urban centres in NSW who have been born overseas (31%) (Australian Bureau of Statistics, 2007a). The present study was primarily interested in assessing consumers' ability to use a variety of front-of-pack labelling systems; therefore participants did not have access to other information that might also be used when selecting foods. Further, only three food product categories have been tested in this study. While the overall response rate was low, at 15.3%, this figure includes consumers who refused to participate prior to knowing the survey context, and is comparable with the response rates documented for other supermarket intercept surveys (Maubach and Hoek, 2008; Yoo *et al.*, 2006).

This study indicates that TL front-of-pack food labelling is the most effective system for assisting consumers to identify healthier food products, and that product comparisons can be made quickly and easily. While consumer preferences are important, the critical issue in the development and implementation of front-of-pack food labelling is whether consumers can use the information provided to make healthier food choices.

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