

**Submission from Cancer Council Australia to  
Food Standards Australia New Zealand on Labelling Review Recommendation 17: Per  
serving declarations in the nutrition information panel**

**13 February 2015**

## **Introduction**

Cancer Council Australia welcomes the opportunity to comment on Recommendation 17 of the *Labelling Logic Report*:<sup>1</sup> that the declaration in the nutrition information panel (NIP) of amount of nutrients per serve be no longer mandatory unless a daily intake claim is made. This submission is made with the support of the Cancer Society of New Zealand.

Cancer Council Australia is a federated, community-funded organisation established to support the interests of its eight State and Territory members. Our mission is to lead a cohesive approach to defeating cancer through the development of prevention strategies, research into new treatments and cures, and by providing support to those affected by cancer.

There is convincing evidence that excess body fat is a cause of bowel cancer, post-menopausal breast cancer and cancers of the kidney, pancreas, oesophagus and endometrium. Excess body fat has also been shown to be a probable cause of ovarian, gallbladder and prostate cancer.<sup>2</sup> In addition, there is some evidence that a healthy body weight may prevent cancer recurrence and improve survival for people diagnosed with certain cancers.<sup>3,4,5</sup>

Cancer Council Australia advocates for policy and regulation that supports individuals to make healthy choices and reduce their own and their family's risk of developing cancer. We recognise the importance of clear food labelling as a source of nutrition information for both consumers and health professionals.

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<sup>1</sup> Blewett N, Goddard N, Pettigrew S, Reynolds C, Yeatman H (2011) *Labelling Logic: Review of food labelling law and policy* (2011). Department of Health and Ageing, Canberra, Australia. Available at: <http://www.foodlabellingreview.gov.au/internet/foodlabelling/publishing.nsf/Content/labelling-logic>. Accessed 13 January 2015.

<sup>2</sup> World Cancer Research Fund, American Institute for Cancer Research. *Food, nutrition, physical activity, and the prevention of cancer: a global perspective*. Washington DC: AICR; 2007.

<sup>3</sup> Chlebowski RT, Blackburn GL, Thomson CA, Nixon DW, Shapiro A, Hoy MK, et al. *Dietary fat reduction and breast cancer outcome: interim efficacy results from the Women's Intervention Nutrition Study*. Journal of the National Cancer Institute (2006) Dec 20;98(24):1767-76.

<sup>4</sup> Protani M, Coory M, Martin JH. *Effect of obesity on survival of women with breast cancer: systematic review and meta-analysis*. Breast Cancer Research Treatment (2010) Oct;123(3):627-35.

<sup>5</sup> Vrieling A, Kampman E. *The role of body mass index, physical activity, and diet in colorectal cancer recurrence and survival: a review of the literature*. American Journal of Clinical Nutrition (2010) Sep;92(3):471-90.

## Executive Summary

- Cancer Council Australia is in favour of maintaining the status quo, so that per serving declarations continue to be a mandatory inclusion in the NIP.
- Although serving size is not an appropriate basis for nutrition icons in Front-of-Pack Labelling (FoPL), serving size declarations should remain mandatory in the Back-of-Pack NIP.
- If Recommendation 17 were to be implemented, we consider that per serving declarations should remain mandatory where a % DI, nutrition content or health claim is made, or where a Health Star Rating is used. The potential interactions between Recommendation 17 and the Health Star Rating should be carefully reviewed.
- Although the evidence is mixed, some consumers and health professionals find the per serving declarations in the NIP useful, especially when comparing products that have the same serving size or for evaluating the nutrients in a product that contains a single serve or has a meaningful serving size.
- Implementing Recommendation 17 would introduce further inconsistencies in labelling between products because per serving declarations would continue to be required for caffeinated beverages and where a percentage daily intake (% DI), nutrition content or health claim is made.
- Consumers prefer familiar label formats and are able to use them more accurately. Inconsistent formats in labelling will increase consumer confusion.
- Cancer Council Australia acknowledges that serving sizes have limitations because they are nominated by manufacturers and not the Code.

### Overall Recommendation

That the declaration in the NIP of amount of nutrients per serve remains mandatory.

## Questions

### 1. How do you or your organisation use per serving information in the nutrition information panel on food labels?

The State and Territory members of Cancer Council Australia provide a range of nutrition programs that aim to encourage healthy eating to reduce overweight and obesity and improve quality of life for those recovering from cancer treatment. Label reading is incorporated into Cancer Council programs targeting a range of groups, such as parents, families, adults and cancer survivors.

Dietitians, nutritionists and public health professionals are involved in the design and delivery of these nutrition programs. Clients may be advised to check per serving information in circumstances such as the following:

- when choosing a discretionary item that contains less than 600 kJ per serve;
- to be able to conceptualise serving sizes and evaluate the extent to which these correspond with their own usual eating habits;
- when choosing a product that should be eaten only in very small serves eg. tomato sauce, vegemite or mayonnaise;
- when there is a medical need to monitor the consumption of certain nutrients closely. For example, carbohydrates for people with diabetes and sodium for people with

kidney disease. This information is more useful than per 100g when the serve is discrete.

**2. Are there any particular food categories or types of food packages (eg. single serve packages) for which per serving information is particularly useful? If so, what are they? Explain why the information is useful.**

A weakness of per serving information is that serving sizes are not prescribed by the Code and consumers may have difficulty interpreting them. There are situations, however, in which per serving information is particularly useful:

- when the serving is discrete (ie. single serve item or x slices/ biscuits are one serve) the per serving information allows people to see how that food will fit into their daily diet. It reduces the number of calculations they have to do and therefore decreases the burden of label reading;
- many consumers lack the numeracy skills to easily determine the nutrition information for the serve given 100g/100ml;
- some consumers with low numeracy may presume that, in the absence of a per serve column, the per 100 g/ mL nutrition information refers to one serve or the whole pack;
- per serving information allows consumers to compare single serve items and choose healthier options;
- per serving information is useful for people with special dietary needs who wish to evaluate the nutrients that they will actually consume from a product with a discrete serving size. For example, those monitoring carbohydrates for glycaemic control and those with cardiovascular disease or hypertension monitoring their sodium intake.

**3. The Labelling Review recommendation suggests that per serving information be voluntary *unless a daily intake claim is made*.**

**Do you support this approach? That is, do you think declaration of per serving information in the nutrition information panel should be mandatory if a daily intake claim is made (e.g %DI or %RDI)? Give reasons for your answer.**

Cancer Council Australia is in favour of retaining both the per serving and per 100g declarations in the NIP. Whilst we recognise that food labels are a finite space for providing nutrition information and that per serving information has some weaknesses, there is evidence that some consumers and health professionals find the per serving declarations useful especially when comparing products that have the same serving size or for evaluating the nutrients in a product that contains a single serve or has a meaningful serving size.

Consumers' preferences for either per serving or per 100g declarations appear to be fairly evenly spread. In a European review of the literature by Grunert & Willis (2007)<sup>6</sup>, studies showed mixed preferences among consumers for per serving information, per 100g and for providing both. One study indicated that these preferences varied by product and another suggested that it depended on the intended use of the information – comparing different products or evaluating the amount of a nutrient in a particular product.

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<sup>6</sup> K. Grunert & JM. Willis, *A review of European research on consumer response to nutrition information on food labels*. Journal of Public Health (2007) 15, 385-399.

The way that information is presented on the NIP can influence food choices.<sup>7</sup> A study of over 13,000 participants from six European countries found consumers factor serving sizes into their judgments of healthiness.<sup>8</sup>

Research summarised in the Consultation Paper indicates that consumers are divided over their preference for and use of per serving and per 100g declarations in the NIP. Australian and New Zealand participants in a study by Scott et al (1999)<sup>9</sup> were more likely to use the per serving information than the per 100g information, both for evaluating a single products and comparing products. Similarly, the per serving column was used by the majority of participants in a 2003 study for comparing products, regardless of whether the serving sizes were the same.<sup>10</sup> A more recent study found little differences in consumers' preferences for per serving or per 100g.<sup>11</sup>

Although the evidence is limited in amount and quality, it appears that some consumers may prefer per serving information. The Consultation Paper acknowledges that some consumers may find per serving information confusing, but the weight of evidence at this stage would support retaining both columns in the NIP.

Consumer's preferences for familiar label formats and consistency between products would also militate against implementing Recommendation 17. This is discussed in more detail in response to question 4 below.

If, however, Recommendation 17 is well supported by other stakeholders and is incorporated into the Code, Cancer Council Australia contends that it should not be interpreted or applied narrowly. Per serving declarations should continue to be mandatory where a product's packaging includes:

- % DI or a recommended dietary intake (% RDI) claims;
- nutrition content claims;
- health claims;
- any endorsements or implied claims;
- Health Star Ratings.

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<sup>7</sup> Antonuk B, Block LG. *The effect of single serving versus entire package nutritional information on consumption norms and actual consumption of a snack food*. Journal of Nutrition Education & Behavior (2006) Nov; 38(6): 365-70

<sup>8</sup> Raats MM, Hieke S, Jola C, Hodgkins C, Kennedy J, Wills J. *Reference amounts utilised in front of package nutrition labelling; impact on product healthfulness evaluations*. European Journal of Clinical Nutrition (2014) Nov 5; In-press

<sup>9</sup> V. Scott, J. Allen, F. Cumming. (1999) *Consumer Reactions to Three Different Nutrition Information Panel Formats*, Canberra.

<sup>10</sup> NFO Donovan Research (2003) Food Labelling Issues: Quantitative Research with Consumers. Evaluation Report Series No. 4, Canberra. Available at: <http://www.foodstandards.gov.au/publications/pages/evaluationreportseries/foodlabellingissuesquantitative/Default.aspx>. Accessed 13 January 2015.

<sup>11</sup> TNS Social Research (2008) Consumer Attitudes Survey 2007. Canberra. Available at: <http://www.foodstandards.gov.au/publications/pages/consumerattitudes/Default.aspx>. Accessed 13 January 2015.

Per serving information is critical to allow consumers to accurately interpret any claims about nutrition content, health or % DI. For example, whilst a product might provide 80% of an individual's niacin needs, it may also contribute 80% of their recommended maximum saturated fat intake. Supplying % DI information for only one nutrient does not allow the consumer to consider the whole food and how it fits in their diet.

- 4. As noted in section 4, there is currently variation in the format of NIPs on food labels because of voluntary permissions for the use of %DI labelling and the option to include a third column for foods intended to be prepared or consumed with at least one other food. If per serving information in the NIP was voluntary this would result in more variability in the format of NIPs across the food supply. Do you think this would be a problem? Why/why not?**

Increased variability in the format of the NIP between products should be avoided, where reasonably possible, to reduce consumer confusion. Implementation of Recommendation 17 would create further inconsistencies because per serving declarations would continue to be required for caffeinated beverages and where a percentage daily intake (% DI), nutrition content or health claim is made. In a systematic review by Campos et al (2011),<sup>12</sup> the authors observed that consumers prefer nutrition labelling to be consistent across products and manufacturers. This enables consumers to assess the information more easily. There is also evidence that consumers both prefer and are better able to understand labelling formats that they are already familiar with.<sup>13</sup> Rather than having the effect of simplification, Recommendation 17 could cause confusion for consumers because it would result in greater diversity in the appearance of the NIP and introduce a change to a now familiar format. This is particularly important for consumers with low literacy or numeracy levels or those with low English literacy.

- 5. If per serving information in the nutrition information panel was voluntary, do you think the inclusion of per serving information in the nutrition information panel should be mandatory when a nutrition content claim about vitamins, minerals, protein, omega-3-fatty acids or dietary fibre is made? Give reasons for your answer.**

Yes, per serving declarations in the NIP should be mandatory when any nutrition content claim is made. Consumers should be able to verify the nutrition content claims made by manufacturers by checking the per serving declaration in the NIP. This is particularly important for people with certain medical conditions.

People with some medical conditions would not be using % DI information as their needs would not be "average". Therefore they need the per serve information to make their own assessment of how that food fits in their daily diet.

- 6. If per serving information in the nutrition information panel was voluntary, do you think the inclusion of per serving information in the NIP should be mandatory in any other specific regulatory situations? Explain your answer.**

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<sup>12</sup> S. Campos, J. Doxey & D. Hammond, *Nutrition labels on pre-packaged foods: a systematic review* (2011) Public Health Nutrition 14(8), 1496-1506.

<sup>13</sup> Cowburn G. & Stockely L. *Consumer understanding and use of nutrition labelling: a systematic review*. (2005) Public Health Nutrition 8(1):21-28.

As the *Labelling Logic* report was released before the introduction of the voluntary Health Star Rating system, it is important to consider the possible implications of Recommendation 17. The Consultation Paper contemplates that per serving nutrient declarations will only remain mandatory if the Health Star Rating includes % DI information that is only included in the graphic for energy and only when the amount of energy is given per pack. If Recommendation 17 were adopted, nutrient content declarations could be made per pack or per industry agreed serving size in the Health Star Rating graphic, but would not be required to be listed in the NIP. This could create confusion for consumers. We would therefore recommend that per serving declarations continue to be mandatory when any kind of Health Star Rating is adopted.

**7. What additional studies examine consumer use and understanding of per serving information in the nutrition information panel on food labels? Please provide a copy of studies where possible.**

As noted in the Consultation Paper, there are limited studies in the peer reviewed literature that examine consumer use of per serving information in the NIP and few are in the Australian and New Zealand context. We have been able to locate some additional studies that may assist FSANZ with its review. These are provided with our submission as electronic attachments.

*S. Campos, J. Doxey & D. Hammond, 'Nutrition labels on pre-packaged foods: a systematic review' (2011) Public Health Nutrition 14(8), 1496-1506*

This is a systematic review of the literature on nutrition labels of pre-packaged foods. The review of 120 articles included four from Australia and New Zealand. The authors found that the self-reported use of nutrition labels varied considerably across different subgroups. Women, individuals with healthier diets and those with special dietary requirements or health conditions reported the greatest use of nutrition labels, with lower use among children, adolescents and older, obese adults. When interpreting nutrition labels, the authors reported that consumers may become confused when comparing products and determining the amount of energy per serving and per package.

*D. Gorton, 'Nutrition labelling – update of scientific evidence on consumer use and understanding of nutrition labels and claims' (2007) Prepared for New Zealand Food Safety Authority and the Ministry of Health. Available at:*

[http://www.foodsafety.govt.nz/elibrary/industry/signposting-nutrition-study-research-projects/signs-literature-review-report\\_final-2.pdf](http://www.foodsafety.govt.nz/elibrary/industry/signposting-nutrition-study-research-projects/signs-literature-review-report_final-2.pdf)

This review summarises the literature published between August 2005 and September 2007 on consumer use and understanding of nutrition labels and claims. An earlier review had found that although self-reported use of nutrition labels was high, actual rates of use and understanding were much lower. Forty-two papers were included, with one quarter of the research from Australia and New Zealand. The author concluded that labels should be simplified to facilitate understanding because consumers are often unable to use the information to determine whether a food is healthy. Percentage DI was not well liked or well understood by New Zealand consumers. Serving size information may influence the amount of food consumed, depending on the number of servings in a pack. Low income, low-education and ethnic minority populations were less likely to use and understand nutrition labels than majority populations. Those with low levels of literacy and numeracy had difficulties calculating amounts that differ from the serving size provided in the NIP. Consumers preferred standardisation and consistency in labels across different manufacturers.

*K. Grunert & JM. Willis, 'A review of European research on consumer response to nutrition information on food labels' (2007) Journal of Public Health 15, 385-399*

In this review of 58 studies conducted in the European Union between 2003 and 2006, the authors examined how consumers perceive and use nutrition labels. Self-reported use of nutrition labels was high but actual use was considerably lower. Consumers could apply the information in nutrition labels in simple tasks but may become confused as the complexity increased. In several studies, participants considered that nutrition information was more relevant for processed foods than for fresh foods. Consumers were generally positive about nutrition labelling, especially when applied systematically to all packaged products. On the presentation of information per serving or per 100g, the authors commented:

“Several studies have looked at liking of reporting nutrition information per 100g or per serving. Participants in these studies generally agreed that it is important that it is absolutely clear what a ‘serving’ is, and often this is far from the case, but apart from that preferences for these various formats seem to vary a good deal, with preference found both for information per 100g, for information per serving and for providing both. One study indicates that these preferences vary by product, and another indicated that preferences for one or the other may also depend on what the information is to be used for – comparison between products or how much of a nutrient is present in a serving of the product.”

*C.Ni Mhurchu & D. Gorton, 'Nutrition labels and claims in New Zealand and Australia: a review of use and understanding' (2007) Australia and New Zealand Journal of Public Health, 31(2), 105-112*

This is a review of Australian and New Zealand research on consumer use of nutrition labels published before the end of July 2005. The review identified 16 studies. The study of actual use showed that understanding of nutrition labels was moderate at best. The review noted a lack of research on the understanding of nutrition labels among low-income, low-education and ethnic minority populations.

*MM Raats, S. Hieke, C. Jola, C. Hodgkins, J. Kennedy, J. Wills. Reference amounts utilised in front of package nutrition labelling; impact on product healthfulness evaluations' (2014) European Journal of Clinical Nutrition Nov 5; In-press*

This study included over 13,000 participants from six European countries and examined whether different reference amounts used in front of package labels influence participants' evaluation of product healthfulness. Reference amounts included per 100g, 'typical portion' and 'half portion'. The study showed that when judging the healthfulness of food, consumers factor in the reference amount, which is the amount of food for which the nutritional information is presented. Across the three food categories (biscuits, sandwiches and yoghurts), the larger the reference amount the less healthful it was perceived to be.

*R. Rothman, R. Housam, H. Weiss et al. 'Patient Understanding of Food Labels: The Role of Literacy and Numeracy' (2006) American Journal of Preventive Medicine, 31(5), 391-398*

This study investigated the effects of literacy and numeracy levels on understanding of nutrition labels. Higher comprehension of food labels was significantly correlated with higher income and numeracy skills. Although most respondents reported using food labels, errors were common. The reasons for these errors included misapplication of serving size, confusion due to extraneous material and incorrect calculations. Only 37% of respondents

were able to calculate the number of carbohydrates consumed from a 20-ounce bottle of soft drink that contained 2.5 servings. Even respondents with higher levels of literacy and numeracy had difficulties with certain tasks, depending on the complexity.

**8. From your perspective, what are the advantages and disadvantages of per serving information in the nutrition information panel being voluntary? Please provide evidence where possible.**

**Disadvantages**

- It would modify a familiar label format, potentially increasing confusion among consumers;
- Further inconsistencies in labelling between products would be introduced because per serving declarations would continue to be required for caffeinated beverages and where a percentage daily intake (% DI), nutrition content or health claim is made;
- It may be detrimental to some consumers and health professionals who find the per serving declarations in the NIP useful, especially when comparing products that have the same serving size or for evaluating the nutrients in a product that contains a single serve or has a meaningful serving size.

**Advantages**

- Packaging is a limited space and removing per serving information in the NIP would provide manufacturers with greater flexibility;
- For consumers who prefer to use per 100g information, the omission of the per serving information column would simplify the NIP and may improve their comprehension.

**9. Do you think the declaration of the amount of energy and nutrients per serving in the NIP should be voluntary? YES/NO/UNCERTAIN**

No, Cancer Council Australia recommends that the declaration in the NIP of amount of nutrients per serve be mandatory for the reasons outlined in this submission. In particular, we would emphasise the following:

- Although Recommendation 17 aims to simplify the NIP, it may not have this effect because per serving declarations would continue to be required for caffeinated beverages and where a percentage daily intake (% DI), nutrition content or health claim is made. This would result in further inconsistencies in labelling between products, potentially causing confusion amongst consumers. This diversity would also make food labelling education and communication more difficult.
- Consumers are able to use familiar label formats more effectively, so in the absence of compelling reasons to change, the NIP should not be modified.
- Studies show that some consumers prefer to use per serving information when comparing products that have the same serving size or when evaluating the nutrients in a product that contains a single serve or has a meaningful serving size.
- The available evidence indicates that consumers are divided over their preference for and use of per serving and per 100g declarations in the NIP. This would support retaining both information columns in the NIP.

# Nutrition labels on pre-packaged foods: a systematic review

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## Abstract

**Objective:** To review research on consumer use and understanding of nutrition labels, as well as the impact of labelling on dietary habits.

**Design:** A systematic review was conducted by searching electronic databases. Relevant articles were screened by two reviewers and included if they met inclusion criteria, including eight methodological criteria. A total of 120 articles were included in the review, including cross-sectional surveys (*n* 96), experimental designs (*n* 17), 'natural experiments' (*n* 7) and longitudinal population-based surveys (*n* 2).

**Setting:** Articles covered seven jurisdictions: USA (*n* 88), Europe (*n* 12), Canada (*n* 9), Australia and New Zealand (*n* 4), Norway (*n* 2), Thailand (*n* 1) and Trinidad (*n* 1).

**Subjects:** Participants were from a wide range of age groups, socio-economic strata and geographical regions.

**Results:** Nutrition labels on pre-packaged foods are among the most prominent sources of nutrition information. Nutrition labels are perceived as a highly credible source of information and many consumers use nutrition labels to guide their selection of food products. Evidence also shows a consistent link between the use of nutrition labels and healthier diets. However, the use of labels varies considerably across subgroups, with lower use among children, adolescents and older adults who are obese. Research also highlights challenges in terms of consumer understanding and appropriate use of labelling information.

**Conclusions:** Nutrition labels on pre-packaged foods are a cost-effective population-level intervention with unparalleled reach. However, to capitalize on their potential, governments will need to explore new formats and different types of information content to ensure that nutrition information is accessible and understandable.

**Keywords**  
Nutrition  
Labels  
Food products  
Policy

The prevalence of overweight and obesity is increasing at an alarming rate<sup>(1,2)</sup>. Globally, approximately 1·6 billion adults are overweight and over 400 million are obese<sup>(2)</sup>. Although obesity is more common in high-income countries, increases in obesity have occurred in many low- and middle-income countries, particularly among urban populations<sup>(2)</sup>. The increasing prevalence of overweight and obesity places a considerable burden on public health, including increases in CVD, diabetes, arthritis, sleep and breathing disorders, depression, as well as functional limitations<sup>(3)</sup>. Diet is also estimated to account for approximately 30% of cancers in industrialized countries, making it the second largest modifiable risk factor after cigarette smoking<sup>(4)</sup>. The economic burden of overweight and obesity is considerable, with direct health-care costs in the billions for most Western countries<sup>(5)</sup>.

Nutrition labelling on food products has emerged as a prominent policy tool for promoting healthy eating<sup>(6)</sup>. As a health education intervention, mandatory nutrition

labels have broad reach and are present at the point of purchase, as well as when food is prepared or consumed<sup>(7)</sup>. The display of nutritional information on pre-packaged foods is mandatory in most high-income countries. In the USA, the Nutrition Labelling and Education Act of 1990 mandates that pre-packaged foods carry a nutrition label, with exceptions for foods intended for immediate consumption<sup>(8)</sup>. In Canada, mandatory nutrition labelling was first implemented on pre-packaged foods in December 2005 and became mandatory on virtually all pre-packaged foods in 2007<sup>(8–10)</sup>. Nutrition labelling on pre-packaged foods remains voluntary in the European Union, except in the case of health claims, although mandatory regulations are under development<sup>(11)</sup> (see Fig. 1 for examples of nutrition labels in the USA, Canada, Australia and the UK).

There is a large and growing evidence base on the impact of nutritional labels, including six literature reviews between 1991 and 2007<sup>(6,12–16)</sup>. The most recent reviews have focused on specific geographical areas, including European

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## USA

INGREDIENTS: FLAKED MILLED CORN, SUGAR/GLUCOSE-FRUCTOSE, MALT (CORN/FLOUR, MALTED BARLEY), SALT, NATURAL COLOUR, VITAMINS (THIAMIN HYDROCHLORIDE, NIACINAMIDE, PANTOTHENIC ACID, RIBOFLAVIN HYDROCHLORIDE, FOLIC ACID, d-CALCIUM PANTOTHENATE), IRON. BHT ADDED TO PACKAGE MATERIAL TO MAINTAIN PRODUCT FRESHNESS. CONTAINS TRACES OF SOYBEANS.

INGRÉDIENTS : MAÏS MOULU EN FLOCONS, SUCRE/GLUCOSE-FRUCTOSE, MALT (FARINE D'AVOINE, MALT D'ORGE), SEL, COLORANT NATUREL, VITAMINES (CHLORURE DE THIAMINE, NICOTINAMIDE, CHLORURE D'ACIDE PYRIDOXIQUE, ACIDE FOLIQUE, d-PANTHÉNATE DE CALCIUM), FER. POUR CONSERVER LA FRAÎCHEUR DU PRODUIT, DU BHT A ÉTÉ AJOUTÉ AU MATÉRIEL D'EMBALLAGE. CONTIENT DES TRACES DE SOYA.

Nutrition facts			
Serving size 1/2 cup dry (40 g)			
Servings per container: 13			
Amount per serving			
Calories 150		Calories from Fat 25	
		% Daily value*	
Total Fat	3 g	4 %	
Saturated Fat	0.5 g	2 %	
Trans Fat	0 g	0 %	
Cholesterol	0 mg	0 %	
Sodium	0 mg	0 %	
Total Carbohydrate	27 g	9 %	
Dietary Fiber	4 g	15 %	
Sugars	1 g		
Protein	5 g		
Vitamin A		0 %	
Vitamin C		0 %	
Calcium		0 %	
Iron		10 %	
*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.			
	Calories:	2,000	2,500
Total Fat	Less than	65 g	80 g
Sat Fat	Less than	20 g	25 g
Cholesterol	Less than	300 mg	300 mg
Sodium	Less than	2,400 mg	2,400 mg
Total Carbohydrate		300 g	375 g
Dietary Fiber		25 g	30 g

## United Kingdom

NUTRITION INFORMATION		
Servings per package: 3		
Serving size: 150 g		
	Quantity per serving	Quantity per 100 g
Energy	608 kJ	405 kJ
Protein	4.2 g	2.8 g
Fat, total	7.4 g	4.9 g
– saturated	4.5 g	3.0 g
Carbohydrate, total	18.6 g	12.4 g
– sugars	18.6 g	12.4 g
Sodium	90 mg	60 mg
Calcium	300 mg (38 %)*	200 mg
* Percentage of recommended dietary intake		
Ingredients: Whole milk, concentrated skim milk sugar, strawberries (9 %), gelatine, culture, thickener (1442).		

Nutrition information	
Typical values per 100 g	
Energy	245 kJ/58 kcal
Protein	4.6 g
Carbohydrate	7.2 g
of which sugars	6.5 g
Fat	1.2 g
of which saturates	0.2 g
Fibre	0.2 g
Sodium	0.1 g

**Fig. 1** Examples of nutrition labels on pre-packaged foods

The findings of these reviews are generally consistent: self-reported use of nutrition labels was found to be prevalent<sup>(6,12–16)</sup>; however, consumers often report

difficulty in interpreting quantitative information contained in labels<sup>(6,13,14,16)</sup>. Some consumers found different nutrition label formats confusing<sup>(15)</sup> and generally preferred graphical information to the traditional label<sup>(12)</sup>. Label use was more prevalent among the female population<sup>(6,13–15)</sup>, and could be predicted by health awareness<sup>(13)</sup>, income<sup>(6,14–16)</sup> and education level<sup>(6,13–16)</sup>. Finally, one review concluded a positive effect of nutrition labels on diet<sup>(14)</sup>.

The evidence base and regulatory practice have grown considerably in the 7 years since the last systematic review was conducted. Several countries have implemented mandatory nutrition labelling legislation within this time. Furthermore, many of the previous reviews did not include studies on the link between label use and diet<sup>(6)</sup>. In light of this, the current systematic review aims to examine the existing body of evidence regarding the prevalence of consumer use and understanding of nutrition labels, as well as the impact of nutrition labelling on consumer dietary habits.

**Methods**

***Inclusion criteria***

The present review was restricted to studies that examined consumer behaviour related to nutrition labels on pre-packaged foods, published in English in peer-reviewed journals or research reports completed on behalf of government agencies. Studies were included if they examined the prevalence or determinants of nutrition label use, or if they measured consumer knowledge, understanding, perceptions or format preferences related to nutrition labels. Articles that examined the relationship between nutrition label use or legislation and consumer diet were also included. Articles that only examined health claims, food safety labelling, brand naming, package design or shelf labelling were excluded, as were articles that focused on labelling at the point of purchase.

***Search strategy***

Electronic searches were conducted using the following databases: MEDLINE, CSA Illumina Social Sciences Subject Area (covering forty-six databases); Web of Science (including Science Citation Index Expanded (SCI-EXPANDED) – 1900–present); and the Cochrane Library. Additional searches using the reference lists of relevant articles were also conducted.

The initial search generated a total of 23 801 citations, of which 1450 titles appeared to meet the inclusion criteria and were reviewed. Of these abstracts, 247 were selected for article retrieval. Following review of the full-text articles, 109 were excluded on the basis that they did not meet the inclusion criteria. The remaining 138 articles were assessed using a data extraction form and were rated on eight methodological criteria (see Table 1).

**Table 1** Methodological evaluation criteria for including articles in the review

Criterion	Possible outcomes
1. Is the research question well stated?	Y/N
2. Is the sample/population identified and appropriate?	Y/N
3. Are the inclusion/exclusion criteria described and appropriate?	Y/N or N/A
4. If applicable, is the participation rate reported and appropriate?	Y/N or N/A
5. Is the same data collection method used for all respondents?	Y/N
6. Are important baseline variables measured, valid and reliable?	Y/N or N/A
7. Is the outcome defined and measurable?	Y/N
8. Is the statistical analysis appropriate?	Y/N or N/A

Y, yes; N, no; N/A, not applicable.

Studies were included in the review if they met all of the eight criteria. This led a total of 120 articles being included in the review.

**Results**

The 120 articles selected for review originated from seven jurisdictions: the USA (*n* 87), Europe (*n* 13), Canada (*n* 9), Australia and New Zealand (*n* 4), Norway (*n* 2), Germany (*n* 1), Thailand (*n* 1) and Trinidad (*n* 1), as well as one study jointly from the UK and the USA, and one including participants from the Netherlands, Germany, France and the UK. Cross-sectional surveys were the most common study design (*n* 96), followed by experimental designs (*n* 19), ‘natural experiments’ (*n* 7) and longitudinal population-based surveys (*n* 2). Thirteen of the surveys were based on nationally representative samples and thirty were conducted with individuals who reported being the primary food shopper for their household, or who were approached while shopping for food at the point of purchase.

***Prevalence of label use***

Of the 120 studies reviewed, sixty-five reported the frequency with which consumers attended or used nutrition labels on pre-packaged foods<sup>(12,15–79)</sup>. Among studies targeted at the general population, the prevalence of self-reported label use was generally high (e.g. 82% in New Zealand<sup>(64)</sup>, 52% in Canada<sup>(80)</sup>, 47% in the EU<sup>(69)</sup> and 75% in the USA<sup>(18)</sup>) according to the most recent nationally representative data in each country. Definitions of label ‘use’ varied across studies, complicating comparisons. For example, several studies defined users as those who cite nutrition labels as a source of nutrition information, rather than other sources such as health-care practitioners<sup>(32,43,44)</sup>. Studies also used different time frames for label use, including ‘ever’ use *v.* use in the past 1 month<sup>(12)</sup> or 12 months<sup>(53)</sup>. Overall, these studies indicate that use of nutrition labels among the general population is generally high and typically above 50%.

### Age

A majority of studies found that middle-aged or younger adults were more likely to use nutrition labels than were older individuals<sup>(25,32,37,42,44,47,69–74,80–84)</sup>, with several exceptions<sup>(20,30,35,85,86)</sup>. For example, a large survey of the nutrition perceptions of Americans found that older participants tended to trust nutrition labels as a source of accurate nutrition information to a less extent than younger respondents<sup>(44)</sup>.

Six articles examined the impact of nutrition labels on adolescents<sup>(36,54,87–90)</sup>. Of these, two studies indicated that use of nutritional labels was low among adolescents<sup>(54,90)</sup>. Only one 2004 study of youth at an urban primary care clinic in the USA reported a self-reported prevalence rate: 22% reported 'always' reading nutrition labels, 57% 'sometimes' and only 22% reported 'never' reading them<sup>(36)</sup>. Evaluations of a 2006 US web-based nutrition intervention in adolescents found no improvement in food label use as a result of the intervention<sup>(88)</sup>; however, a similar 2008 study found that web-based interventions increased adolescents' use of labels<sup>(89)</sup>. A single qualitative study examined the use of nutrition labels among children. The majority of US children in grades 3–6 had difficulty using nutrition labels and could not categorize healthy foods on the basis of label<sup>(91)</sup>.

### Gender

Women report using labels significantly more often than men in a majority of studies that include both genders<sup>(25,30,33,35,42–44,46,53,59,64,69,70,72–74,76,80,82,85,92,93)</sup>. Women were also more likely to report that nutrition labels had influenced their food choices<sup>(53)</sup> and to trust nutrition labels<sup>(44)</sup>. Similar rates of nutrition label use have been documented among women of different levels of income and socio-economic status<sup>(34,38,51,55,57)</sup>. Only four studies reported no significant difference between male and female participants' use of nutrition labels<sup>(17,46,94,95)</sup>.

### Income/education

Most studies have concluded that individuals with lower income are less likely to use nutrition labels<sup>(27,62,82,96)</sup>, with only two studies finding the opposite effect<sup>(67,86)</sup> and one reporting no significant effect of income<sup>(35)</sup>. Individuals with lower income were also more likely to have lower levels of nutrition knowledge<sup>(86,94)</sup>, which were associated with label non-use<sup>(50,63,80,97)</sup>. Similar effects have been observed for education levels: individuals with greater education have reported greater use of nutrition labels in most studies<sup>(17,30,41,42,44,62,63,67,70,73,76,80,86,92,93,96,97)</sup>, with only two exceptions<sup>(35,94)</sup>. Seven studies targeting socio-economically disadvantaged populations reported variable rates of nutrition label use, ranging from 20% to 74%<sup>(23,38,39,41,51,61,92)</sup>, although these rates were typically lower than those reported for the general population.

Mixed findings were observed with respect to the effect of employment<sup>(67,76,94,96)</sup>, job satisfaction<sup>(69)</sup> and rural

urban habitation on label use<sup>(35,37,62,82,98,99)</sup>. Only one study of older Americans in 1990 directly compared rural with urban groups, with no significant difference in label use<sup>(43)</sup>. Larger households and those with children were found to more likely use labels<sup>(41)</sup> and support their mandatory implementation<sup>(35,37)</sup>, as were married couples<sup>(27)</sup>.

### Race/ethnicity

A majority of studies have found that Caucasian participants are significantly more likely to use nutrition labels than are other ethnic groups<sup>(21,39,71,100)</sup>, with one study of African-American adults in North Carolina reporting high levels of use<sup>(30)</sup>. Studies with Latino adults in the USA also reported lower rates of label use<sup>(23,51)</sup>. For example, a study comparing ethnic groups in the USA found that only half of the proportion of Latinos, compared with their African-American and 'white' respondents, had 'ever used' labels<sup>(39)</sup>. Low rates have also been observed among ethnic minorities in New Zealand<sup>(61)</sup>. Racial/ethnic differences have also been observed with respect to the type of information sought from nutrition labels<sup>(25)</sup>. For example, Latinos were found to be more likely to check dietary fibre and Na information<sup>(72)</sup>.

### Health behaviours

A wide range of studies have examined the association between label use and health practices. Individuals with healthier eating habits report greater use of nutrition labels, either as a result of personal preference<sup>(25,30,50,53,80)</sup> or because of the requirements of a health-related diet<sup>(25,37,41,43,64,67,68,76,86,96,101)</sup>. Greater use has also been reported by individuals more concerned with dietary guidelines<sup>(32,33,35,41,53,63,86,94,96)</sup> and by those who place greater emphasis on the nutritional quality of food while shopping<sup>(35,68,72,94,96,98,102)</sup>. Nutrition and label knowledge<sup>(17,31,35,59,80,86,98,103)</sup>, nutrition education<sup>(19,40,41)</sup> and knowledge of diet–disease relationships<sup>(17,29,31,33,60,71,72,82)</sup> or of specific diseases<sup>(29)</sup> have also been associated with label use, with few exceptions<sup>(69,85,94)</sup>. Weight control<sup>(30,33)</sup> and diagnosis of a disease<sup>(30,41,53,69,79,82,104–106)</sup> have also been associated with greater label use.

Grocery shopping habits have been identified as being a strong predictor of nutritional label use. Consumers who spend more time, or report having more time to shop for groceries, were more likely to be label users<sup>(86,96,98)</sup>, and lack of time was consistently reported as a reason for non-use<sup>(17,33,37)</sup>. Shoppers who placed less emphasis on price<sup>(67,86,96)</sup> were more likely to use nutrition labels, although one study reported no association<sup>(35)</sup>. The importance of taste was positively related to label use in three studies<sup>(35,94,96)</sup> and was negatively related by two others<sup>(63,86)</sup>. Meal planning<sup>(68,72,86)</sup> and grocery spending were other variables related to use<sup>(62)</sup>.

Among health behaviours not directly related to nutrition, using supplements, exercising regularly and not smoking were associated with the use of nutrition labels<sup>(19,30,40,68,85)</sup>.

### ***Attitudes/perceptions towards nutrition labels***

Many consumers have reported that nutrition labels are an important source of information<sup>(22,60,101,107,108)</sup>, although ingredients and health claims may be perceived as more important<sup>(108)</sup>. Most consumers were willing to use information if it was provided on the label<sup>(97)</sup>, although consumers' beliefs about the healthiness of foods did not necessarily depend on information on the label<sup>(109)</sup>. There was, however, popular support for mandatory labelling in studies, although conflicting findings have been found for consumers' willingness to pay extra for nutrition information<sup>(81)</sup>. Positive attitudes were higher among individuals reporting greater use of labels<sup>(56,59,85,108,110)</sup>; however, negative attitudes were also prevalent in the literature<sup>(41,48,111,112)</sup>. Many consumers believed that serving sizes and health claims were misleading and were sceptical of the compliance of labels to regulatory law<sup>(85,113)</sup>. The credibility of manufacturers' health claims was rated poorly, especially when these claims contradicted nutrition information on the label<sup>(59,85,114–116)</sup>; however, in one case, health claims helped consumers to choose more nutritious products<sup>(117)</sup>. Trust in labels also predicted use<sup>(44,60,69)</sup>, and was greater among younger respondents and among those with higher levels of education<sup>(44)</sup>.

### ***Comprehension and understanding of nutrition labels***

Studies suggest that consumers generally find nutrition labels to be useful<sup>(17,54,59,85)</sup>, although consumers in the USA<sup>(118)</sup> and Australia<sup>(26)</sup> report a desire for simpler presentation of information<sup>(26,49,118)</sup>. In one case, Australian participants requested more detailed information<sup>(26)</sup>. Following the Nutrition Labeling and Education Act in the USA, which implemented a consistent label format in 1993, 80 % of consumers thought that the label was more helpful and the proportions of those seeking more information declined, except with respect to cholesterol information<sup>(28)</sup>.

There is mixed evidence with respect to the ease<sup>(30,80,93)</sup> or difficulty of using nutrition labels<sup>(26,107,118)</sup>. Frequent label use was associated with better understanding in general<sup>(69,98,119)</sup>, with other studies providing mixed results<sup>(56,120)</sup>. Younger participants<sup>(53)</sup>, as well as those with higher education<sup>(52,53)</sup>, income, literacy and numeracy<sup>(52)</sup>, were more likely to report understanding nutrition labels. One longitudinal study found that self-reported awareness of nutrition terms, but not understanding, improved between 1984 and 1994 in Canada<sup>(32)</sup>.

Several studies reported a good understanding of nutrition labels based on consumers' performance on tasks requiring them to retrieve or manipulate information<sup>(56,95,121)</sup>. Understanding was greater in younger<sup>(110)</sup>, female, educated and white participants<sup>(121)</sup>, and was also related to knowledge<sup>(95,122,123)</sup>, perceived understanding<sup>(95)</sup>, attitude towards and motivation to use the nutrition

label<sup>(95,123)</sup>, as well as frequent label use<sup>(69,98,119)</sup>. Self-reported understanding is generally high among lower-income groups<sup>(38,41,51)</sup>; however, with the exception of one sample of individuals eligible for a US food supplementation programme<sup>(41)</sup>, most showed poor performance on items measuring their ability to use the label, especially when calculations were required<sup>(38,51)</sup>. Low perceived self-efficacy in using the label was also reported by women on social assistance<sup>(113)</sup>.

A variety of studies indicate that many consumers have difficulty with the quantitative information presented on labels, especially with respect to recommended daily amounts, per cent daily values, serving sizes or other forms of reference information on the label<sup>(17,21,31,52,54,81,85,120,124)</sup>. This difficulty was common among diabetics<sup>(106)</sup>, chronic kidney disease patients<sup>(79)</sup>, older adults<sup>(81,110,125)</sup>, adolescents<sup>(54)</sup>, infrequent label users<sup>(17)</sup> and those with less education<sup>(81)</sup>.

Other tasks that were reportedly confusing for consumers included comparisons between products<sup>(52)</sup>, determination of energy per serving and per package<sup>(126)</sup> and comprehension of E-numbers representing additives<sup>(42)</sup>. For example, 24 % of consumers in Trinidad read nutrition labels without understanding them<sup>(46)</sup>, and this was listed as a reason for non-use among many groups of consumers<sup>(37,46,93,125)</sup>. Several studies conducted among females in the USA and UK have also provided mixed evidence, showing that most participants could locate nutrition information, but had difficulties with per cent daily value and information on food claims<sup>(34,55,57)</sup>. Frequent label reading, better education, better self-assessments of diet quality, health status and nutrition knowledge were related to these skills<sup>(55)</sup>. Educational interventions targeting label knowledge and understanding have generally shown positive results in a range of sub-populations<sup>(21,22,54,125,127,128)</sup>, including among low-income and literacy groups<sup>(92)</sup>.

### ***Label format and content***

Compared with 'traditional' nutrition labels with quantitative information on nutrient content, several studies have reported greater effectiveness for labels using graphics and symbols<sup>(129–131)</sup>, adjective labels<sup>(132)</sup> and labels with minimal numerical content<sup>(76)</sup>. For example, information accompanied by graphics helped consumers to better apply reference information, especially consumers who had not seen labels before<sup>(61)</sup>. The use of well-recognized health symbols<sup>(7,106)</sup> and 'traffic lights' may be particularly effective<sup>(64,133,134)</sup>. For example, traffic light symbols – which typically display green, amber or red labels to indicate whether foods contain low, medium or high amounts of contents such as fat, saturated fat, sugars – have been found to increase consumer ability to identify healthier food options and consumer attention in general<sup>(133,135,136)</sup>.

Research also suggests that placing nutrition information on the front of packages is more effective than information positioned on the side or back of packages<sup>(15,87,137)</sup>.

Front-of-pack (FOP) labels may disproportionately benefit those with low-nutrition education and knowledge of nutrition labels<sup>(15)</sup>. For example, in a 2009 study conducted in Australia, consumers supported the idea of FOP labelling, especially when it is consistent across products and manufacturers<sup>(134)</sup>. Simple energy information on the FOP was also well received in a 2007 study conducted in Germany, The Netherlands, France and the UK<sup>(135)</sup>. Preliminary evidence suggests that FOP labels may also promote healthier food purchasing behaviours, although additional research is needed<sup>(7,15)</sup>.

Evidence is mixed with respect to the level of detail or complexity of information favoured by consumers. More detailed information was favoured by some consumers<sup>(76,79,131)</sup>, especially non-label users<sup>(17)</sup>, whereas frequent users preferred less detail<sup>(17)</sup>. Simplified labels have been shown to promote more accurate nutrition judgements of unhealthy products<sup>(74,84,119)</sup> and improved performance on diet-related tasks<sup>(121,131)</sup>, even when daily reference values were added<sup>(121)</sup>. The use of reference information, such as per cent daily value, is often welcomed by consumers<sup>(122,133,134)</sup>; however, many struggle to apply the quantitative values<sup>(7,124,138)</sup>. Labels presenting information in two columns side-by-side have also been shown to reduce food consumption by non-dieters when compared with a version presenting information as a single, longer column<sup>(139)</sup>. Consumers have also expressed a desire for nutrient information listed in the context of a healthy diet<sup>(93,131)</sup>; larger, more legible print<sup>(37,130)</sup>; simpler terms<sup>(76)</sup>; explanations of terms or nutrients<sup>(37,93)</sup>; the use of colour and a consistent appearance across nutrition labels<sup>(93)</sup>.

### **Types of nutrition information sought by consumers**

Consumers tend to look more closely at nutrients they wish to avoid<sup>(93)</sup>. To this end, the nutrients most commonly sought were fat<sup>(26,28,37,42,49,53,73,79,85,97,108,115,118)</sup>, energy content<sup>(28,37,53,79,97,118)</sup>, protein<sup>(49,79,97,118)</sup>, cholesterol<sup>(28,97)</sup>, carbohydrates<sup>(42,118)</sup>, vitamins and minerals<sup>(97,118)</sup>, types of fat<sup>(42,97)</sup>, serving size<sup>(85)</sup>, additives<sup>(42,73)</sup> and Na information<sup>(42,97,118)</sup>. Low-fat dieters were more likely to look at fat information<sup>(42,53,98)</sup>, and younger<sup>(67,73)</sup> female participants were more likely to look at energy than men<sup>(59,67)</sup>. Cholesterol was most often looked at by older<sup>(50,67,98)</sup>, suburban participants who believed in a diet-disease relationship<sup>(98)</sup> and had high cholesterol<sup>(53)</sup>, and less often looked at by white, well-educated individuals with low cholesterol intake<sup>(98)</sup>. Those with experience reading labels were more likely to use carbohydrates and fibre information<sup>(59)</sup>, and younger individuals were more likely to use vitamin and mineral information<sup>(67)</sup>.

Similar to the general population, adolescents were most likely to seek fat and energy information<sup>(87)</sup>. A range of studies have also examined information sought by a range of other sub-populations, including low-income women<sup>(38,41)</sup>, Latino populations<sup>(72)</sup> and diabetes patients<sup>(106)</sup>.

### **The impact of nutrition labels on diet**

Observational studies have consistently found an association between use of nutrition labels and healthier diets<sup>(70–72,82,103,140,141)</sup>. Several studies have reported an association between label use and lower fat consumption<sup>(70–72,82,140,141)</sup>. Label users are also more likely to eat healthier varieties of foods<sup>(140)</sup>, and to have reduced Na<sup>(72,103)</sup>, cholesterol<sup>(63,72)</sup> and energy intakes, coupled with increased fibre<sup>(72,142)</sup>, Fe<sup>(143)</sup> and vitamin C intakes<sup>(70)</sup>. Cross-sectional associations between label use and healthier diets are also related to socio-economic status<sup>(142)</sup>, education<sup>(71,82)</sup>, age<sup>(71,72)</sup>, gender<sup>(36,72)</sup> and ethnicity/race<sup>(71,72)</sup>.

Three longitudinal studies in the USA have evaluated the implementation of new nutrition labels on dietary patterns. In the USA, the 1990 Nutrition Labeling and Education Act came into effect in 1994 and required nutrition labels on all pre-packaged foods. A study comparing nationally representative surveys of consumers in 1989 and 1995 found that frequent label users in 1995 had a significantly greater probability of consuming a low-fat diet than both non-label users in 1995 and frequent label users in 1989<sup>(74)</sup>. In addition, fat intake among less-educated respondents decreased significantly during the 'pre-post' study period<sup>(74)</sup>. A second study found that BMI of nutrition label users fell significantly following implementation of the Act, with the greatest change among those with the highest BMI score<sup>(104)</sup>. In addition, low-fat and low-Na food purchases increased significantly following the impact of new labels, although the same effect was not observed for low-energy choices, or healthy nutrients such as vitamins and minerals<sup>(116)</sup>.

Evidence from five experimental studies is generally consistent with cross-sectional and longitudinal findings. Two experiments compared consumption of low-fat with energy-dense foods by randomizing participants to either a blind or information condition<sup>(144,145)</sup>. Both studies found that, although participants tended to consume greater amounts of reduced-energy food in terms of food weight, total energy intake was significantly lower among those who consumed reduced-energy food<sup>(144,145)</sup>. Only one study showed this effect on daily energy consumption, as opposed to short-term intake during the study<sup>(145)</sup>. Participants who received nutrition information consumed more of the low-energy version of the food<sup>(144)</sup>. A third experiment found no differences in participants' satiety after consuming fat-free compared with regular potato chips, irrespective of the provision of information<sup>(146)</sup>. Finally, providing nutrition information also increased healthier purchase intentions and accurate perceptions of nutrient content<sup>(147)</sup>.

### **Discussion**

Research conducted to date indicates that nutrition labels on pre-packaged foods are among the most prominent

sources of nutrition information. Evidence also suggests that consumers perceive nutrition labels to be a highly credible source of information, and many consumers report using nutrition labels to guide their selection of food products.

The use of nutrition labels varies considerably across population subgroups. Use is particularly high among individuals with health conditions and special dietary requirements – those with the greatest need for nutritional information. However, label use is notably lower among children, adolescents and older adults. More research targeting these populations is needed, given their increased prevalence of obesity<sup>(1,148)</sup>, nutrient deficiencies<sup>(149)</sup> and chronic disease<sup>(149–153)</sup>. Individuals with lower socio-economic status are also less likely to use nutrition labels, which is particularly problematic given that low socio-economic status is associated with an increased risk of being overweight and obese<sup>(154)</sup>.

The evidence in this review shows a consistent link between the use of nutrition labels and healthier diets. The causal nature of this association is likely bidirectional: nutrition labels may promote healthier eating, whereas individuals with healthier diets are more likely to seek out nutritional labels in the first place. However, there is sufficient evidence from a range of study designs to conclude that providing nutrition information on packages has a positive impact on diet. In countries such as the USA, government agencies and non-government organizations have estimated the impact of mandatory nutrition labelling to be in the range of billions of dollars<sup>(104)</sup>, although the magnitude of benefit and the extent to which it varies across different types of nutrition labels and population subgroups cannot be estimated with any precision from the existing evidence base.

Research to date also highlights the need to balance the complexity of information presented on labels with consumers' ability to process this information in a quick and meaningful manner. Nutrition labels that require calculations with respect to nutrient amounts and serving sizes are confusing to many consumers, particularly those with lower education and literacy skills<sup>(96)</sup>. Educational interventions aimed at improving the understanding of nutrition labels have shown promise and a broader application of these interventions may provide one potential solution<sup>(92,155)</sup>; however, the evidence highlights the need to improve the ways in which nutrition information is presented to consumers on food packages.

Future research should examine the effectiveness of using symbols, images and different graphical layouts to a greater extent. Indeed, there is growing evidence regarding the consumer-friendly nature symbols used by the industry, as well as the greater impact of FOP labels, compared with labels on the side or back of packages. These formats may be more consumer-friendly in part because nutrition information is more accessible and in part because of a widespread desire for more 'prescriptive'

information that identifies 'healthier' food from less-healthy options. Indeed, an expert panel commissioned by the UK Food Standards Agency recently concluded that FOP formats are effective and the strongest FOP label is one that combines the use of words 'high, medium and low', traffic light colours and percentage of Guideline Daily Amount, in addition to levels of nutrients in a portion of the product<sup>(156)</sup>.

More generally, there is increasing evidence that labelling regulations need to take the entire package into consideration to maximize their effectiveness. Industry 'health claims' are regulated to different extents across jurisdictions and the use of FOP symbols, which imply healthier alternatives, is largely unregulated. Ideally, consumers would use nutrition labels to help interpret health claims; however, in practice, many consumers rely solely on health claims<sup>(108)</sup>. Indeed, there have been mixed reports as to whether consumers can determine whether claims are truthful<sup>(56,114,120,157)</sup>.

### Limitations

This review is subject to several limitations. First, it is possible that relevant articles were not included in the review, given the rapidly evolving evidence base. Attempts were made to minimize this limitation by using a comprehensive searching strategy and a systematic selection process using two independent reviewers and inclusion criteria. Second, the articles included in this review were disproportionately from high-income Western countries, and from North America in particular. Therefore, it is unclear as to what extent the findings in this review apply to jurisdictions with different labelling regulations and in much different cultural and geographical contexts. Additional research on the impact of nutrition labels in low- and middle-income countries should be considered a priority. Even among the Western countries included in this review, there are important differences in labelling regulations that were not fully examined. The diversity in study protocols, measures and samples also presents challenges in terms of comparing studies. We have tried to note major differences wherever possible; however, it is likely that methodological differences between studies account for at least some of the variability in the findings. Finally, much of the evidence on the impact of nutrition labels is based on self-report data, which may over-report the use of nutrition labels, meaning that other factors, such as greater awareness of the link between nutrition and chronic disease, may be responsible for population-level changes over time that have been attributed to nutrition labels.

### Conclusions

Population-level interventions and changes to the food environment are necessary to halt the rising health and economic burden from obesity. The evidence to date

indicates that nutrition labels on pre-packaged foods are a cost-effective population-level intervention with considerable reach. In order to capitalize upon the potential of nutrition labels, governments will need to explore new formats and different types of information content to ensure that nutrition information is accessible and understandable. A number of jurisdictions are in the process of developing new formats and revising labelling standards, such as the European Union<sup>(158)</sup>. There is an immediate need for evidence to inform these regulatory developments. Regulators should also consider expanding the scope of mandatory nutrition labelling. In the vast majority of jurisdictions, nutrition labelling regulations are limited to pre-packaged food products and do not apply to foods served in restaurants or fast-food outlets, which account for a significant proportion of dietary intake in many high-income countries<sup>(159,160)</sup>. Mandatory display of nutrition information on menus and menu boards of food outlets may be a promising means of increasing the impact of nutrition labelling regulations<sup>(161)</sup> and harmonizing nutrient information across information channels.

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**Nutrition labelling -  
Update of scientific evidence on  
consumer use and understanding of  
nutrition labels and claims**

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## **Executive Summary**

### ***Background***

Nutrition labelling has been mandatory in New Zealand since 2002. Currently, a back-of-pack nutrition information panel (NIP) displays the content of energy, fat, saturated fat, protein, carbohydrate, sugar, and sodium per serving and per 100 grams of food. However, nutrition labelling does not appear to be as effective as it could be in promoting healthier choices, due to limited consumer understanding. Understanding how consumers use and understand nutrition labels and claims, and their preferences for types of labels is the focus of this review.

The burden of nutrition-related disease in New Zealand is greater for Maori, Pacific, and Asian peoples<sup>1 2 3</sup>. Until recently these groups have not been well represented in nutrition labelling research. However, if we are to reduce health inequalities, it is essential that nutrition labels are well understood and can be used effectively by these populations.

This current review summarises literature published between August 2005 and September 2007 on consumer use and understanding of nutrition labels and claims. A previous review of the same topic found high self-reported rates of label use, with lower actual rates of use and understanding<sup>4</sup>. It concluded that consideration needs to be given to ways of making nutrition labels more accessible and understandable for consumers.

### ***Objective***

The objective was to update an earlier literature review of consumer use and understanding of nutrition labels, by reviewing relevant literature published since August 2005.

### ***Methods***

A structured search of academic databases, websites, and hand-searching for literature published between August 2005 and September 2007 was completed.

## ***Key findings***

Forty-two papers and reports met the inclusion criteria for the review. One-quarter of the research was from New Zealand and Australia, with much of the remainder from Europe and the United States. Nearly half of the research related directly to consumer use and understanding of nutrition labels and claims. Since the original review was completed, there has been an increased research focus on front-of-pack labels, and some initial research with Maori, Pacific, Asian and low-income consumers.

Key findings from this review include:

- Self-reported label use continues to be moderate to good, and may be increasing. However, research demonstrates that objectively measured use is substantially less than self-reports may indicate.
- Understanding of many labels still appears problematic for many consumers. The difficulty experienced by some consumers in understanding nutrition labelling makes simplifying labels a priority. There has been an increasing focus in the literature on the most effective format for front-of-pack labelling. The two formats most favoured in consumer research to date appear to be multiple traffic light labels and colour-coded guideline daily amount (GDA) labels.
- Multiple traffic light labels appear to provide the most consistent consumer benefits because they are well understood across multiple consumer groups including populations of different ethnicity, income, and education levels as well as amongst infrequent label users. They also increase objectively measured accuracy and speed of decision making. In a New Zealand context, they were the labels most preferred by consumers in a large survey<sup>5</sup>.
- The % daily intake label is not liked by New Zealand consumers and is generally not well understood<sup>5</sup>. It seems to be best understood by people who are currently using labels, and would require extensive consumer education in order to be successfully used<sup>6</sup>.

- Nutrition claims can be misleading and may even encourage increased consumption of the foodstuffs when consumers compensate for the claim by eating more of the food.
- Serving size information on labels may influence the amount of food consumed, by leading to either decreases or increases in consumption of the foods, depending on the number of servings in a pack.
- Qualitative and quantitative research has been undertaken with Maori, Pacific, and low-income shoppers. Whilst information can be found on NIPs, there is frequently difficulty in using the information to determine if a food is healthy. Maori and Pacific shoppers prefer traffic light labels and were able to use these labels to determine if a food was healthy.
- Consumers are asking for nutrition labels that are simple and easy to understand, colourful, in large print, standardised and consistent, on all foods, and that provide a benchmark for evaluating the healthfulness of food.

## ***Conclusions***

Many consumers are attempting to use nutrition labels. However, the level of success in correctly using nutrition label information varies. Consumers find current labelling schemes technical and confusing. Front-of-pack labels have been implemented in the UK, as a means of facilitating improved consumer understanding of nutrition labels. Front-of-pack labels have met with consumer approval in the UK and Europe, and New Zealand consumers have indicated a preference for multiple traffic light labels. However, debate still continues around the most effective signposting method. Whichever method is proposed, it is important that it is a format that is understandable for all the population, and not just well-educated consumers. It should also be standardised and consistent, to limit potential for further consumer confusion. Having the label on all products means it will be relevant for shoppers in all price and product categories.

There remains an obvious lack of research looking at the real world impact of nutrition label use on dietary behaviour. As nutrition labels ultimately aim to influence dietary behaviour, research urgently needs to be conducted in this area.

## Introduction

A previous review of consumer use and understanding of nutrition labels and claims was conducted in 2005 and the report describing the findings was published in July 2006. The purpose of this current report is to update the evidence presented in the previous review.

## Background

The burden of nutrition-related disease in New Zealand is substantial. Over 11,000 deaths each year are due to the joint effects of high cholesterol, high blood pressure, obesity, and inadequate fruit and vegetable intake<sup>7 8</sup>. Nutrition labels are intended as a tool to help people make healthier food choices at point of purchase, and thus improve nutrition. Their use and understanding by consumers was investigated in an earlier review of the literature, which identified a number of key findings including:

- There is an important gap between self-reported and actual understanding of nutrition labels and claims by consumers. Globally, the majority of consumers claim to understand nutrition labels “mostly” (43%) or “in part” (52%)<sup>9</sup>, but actual understanding of label terms and concepts appears poor across all types of nutrition information (Nutrition Information Panels [NIP], claims and endorsements).
- There is also a conspicuous gap between self-reported and actual frequency of use of food labels by consumers. Over 90% of people report checking nutrition information on packaged foods on at least some occasions<sup>9</sup>, yet observation of shoppers while they make food purchases and choices has shown relatively low rates of use of nutrition label information: one study found that label information was used during choice of just 4% of products purchased<sup>10</sup>, while another found that endorsements were used during choice of less than 1% of products purchased<sup>11</sup>.
- There has been a noticeable lack of nutrition labelling research internationally among low-income, low-education and ethnic minority populations. Such populations are less likely to use and understand nutrition labels than are

majority populations, yet few studies include them in sufficient numbers in order to conduct an appropriate population-specific evaluation.

- A number of studies have reported an association between nutrition label use and dietary quality but, since these studies have been largely cross-sectional in design, confounding is highly likely and it is impossible to attribute causality to this effect.
- Many studies to date have been cross-sectional in design; have used self-reported outcome data; and included small, non-representative study populations, thus limiting the reliability and applicability of study findings. There have been only three randomised trials of the impact of nutrition labels on consumer food purchases, and they have produced conflicting results.

Research continues into consumer use and understanding of nutrition labels, and this review summarises research published since mid-2005.

## **Objectives**

To aim of this review was to provide a comprehensive review of research into consumer use and understanding of nutrition labels and claims, published since mid-2005.

Specific objectives of the review were to assess:

- Consumer use and understanding of nutrition labels and claims
- The impact of nutrition labels and claims on consumer behaviour
- Research on nutrition labels and claims with low-income, Maori, and Pacific shoppers
- Research relevant to front of pack labelling schemes

## **Methodology**

A structured literature search was undertaken of research published between August 2005 and 20 September 2007. The original review included research to the end of July 2005. The search strategy used for the original nutrition labelling review was repeated.

### ***Inclusion criteria***

- Study relates to nutrition labelling and consumer understanding, use and behaviour
- Nutrition labels were considered to be any information placed on packaged foods relating to (a) the nutrition content of the food or (b) the nutritional properties of the food, other than health claims
- Literature relates to original research or a review of research

### ***Exclusion criteria***

- Research on health claims
- Research on general food labelling such as date marks or ingredient lists
- Research on labels relating to dietary supplements, functional foods, allergens, or genetic modification
- Research into labelling schemes for unpackaged or catered foods (including restaurants)
- Research into brand naming, package design, or quality assurance

### ***Search strategy***

The search strategy run in Medline, and adapted for other databases as necessary, was as follows:

1. Food Labeling/
2. nutrition label\$.mp.
3. Product label\$.mp.
4. (Label\$ adj3 (food or nutrition\$ or diet\$ or health food)).mp.
5. 1 or 2 or 3 or 4
6. Consumer\$.mp.
7. Customer\$.mp.
8. (Stakeholder\$ or Participant\$).mp.

9. 6 or 7 or 8
10. 5 and 9
11. (behavior\$ or behaviour\$ or understand\$).mp.
12. Perception/ or "discrimination (psychology)"/.mp. or social perception/
13. Awareness/ or comprehension/
14. Attitude/ or Attitude to health/ or Health knowledge, attitudes, practice/
15. Health education/
16. Public opinion/
17. Public health/
18. 11 or 12 or 13 or 14 or 15 or 16 or 17
19. 10 and 18
20. \*Food Labeling/
21. 19 and 20
22. Legislation/ or Legislation, food/
23. 20 and 22
24. exp Health promotion/
25. 20 and 24
26. Low income.mp.
27. Poverty/
28. Cultural deprivation/
29. 26 or 27 or 28
30. 5 and 29
31. (Maori\$ or Pacific or Indigenous\$ or Ethnic\$ or Cultur\$ or Minorit\$).mp.
32. African Americans/ or exp American native continental ancestry group/ or oceanic ancestry group/ or exp ethnic groups/
33. exp Australasia/
34. 31 or 32 or 33
35. 20 and 34
36. 35 or 21 or 23 or 25 or 30
36. limit 36 to yr="2005 - 2007"

All articles identified were exported into Endnote. Duplicate articles were removed. Titles and abstracts were screened for relevance. Where doubt existed, the full paper was obtained. Reasons for non-inclusion of studies were stated.

## ***Search results***

The number of articles identified in each database were Medline (65), Embase (41), CDSR (1), Central/CCTR (2), PsychInfo (2), CINAHL (32), AMED (0), ERIC (1), PAIS (1), Sociological abstracts (0), and Index New Zealand (0 articles from journals). A further 36 articles or reports were identified from other sources such as websites and from hand-searching.

Duplicate articles were removed leaving a total of 144 articles. A further 20 articles were removed as dates were not in the specified range, giving a total of 124 articles. Of these 82 were excluded because they:

- provided general information on nutrition labelling policy and processes but did not describe research relevant to the review (n=9)
- described research related to production processes, packaging or branding of food (n=11)
- described research related to genetic modification or organic labelling (n=1)
- were aimed at assisting consumers to read labels (n=3)
- related to labelling of menus in restaurants (n=6)
- related to health claims (n=3)
- related to research on allergen labelling (n=11)
- were not available in English or were unable to be obtained (n=6)
- were not research eg. letters, news items, opinion (n=14)
- were otherwise not relevant to the review eg. they related to labelling of supplements or functional foods, food safety, or nutrition labelling was not a focus of the research (n=18)

The remaining 42 studies were included, with results summarised according to the headings used in the original review.

## Abbreviations and Definitions

### *Abbreviations*

%DV	Percent daily value (US)
%DI	Percentage daily intake
EUFIC	European Food Information Council
FSA	Food Standards Agency (UK)
FSANZ	Food Standards Australia New Zealand
GDA	Guideline Daily Amount (UK)
IFIC	International Food Information Council
NHF	National Heart Foundation of New Zealand
NIP	Nutrition Information Panel
NZFSA	New Zealand Food Safety Authority
UK	United Kingdom
US	United States of America
USDA	United States Department of Agriculture
WHO	World Health Organization

### *Definitions*

The following definitions are used throughout the report:

**Label:** any tag, brand, mark, pictorial or other descriptive matter, written, printed, stencilled, marked, embossed or impressed on, or attached to, a container of food<sup>12</sup>

**Nutrition label:** a list of nutrients on a food label accompanied by some form of quantifying mechanism<sup>13</sup>

**Nutrition claim:** any representation which states, suggests or implies that a food has particular properties including, but not limited to, the energy value, the content of protein, fat and carbohydrates, and the content of vitamins and minerals<sup>13</sup>. Nutrition claims relate to what a product does or does not contain.

**% daily value:** the method of presenting information on the Nutrition Facts Panel in the US. It gives the percentage of the recommended daily intake provided per serve of food for a nutrient based on an average person on a 2000 calorie/day diet.

**% daily intake:** gives the percentage of the recommend daily intake provided per serve of food, based on an average adult diet of 8,700kJ/day, and is the format voluntarily used by some food manufacturers in New Zealand.

## ***Examples of nutrition labelling and front-of-pack signposting***

**Figure 1: Mandatory Nutrition Information Panel, New Zealand**

<b>NUTRITION INFORMATION</b>		
Servings per package: (insert number of servings)		
Serving size: g (or mL or other units as appropriate)		
	Quantity per Serving	Quantity per 100g (or 100mL)
Energy	kJ (Cal)	kJ (Cal)
Protein	G	g
Fat, total	g	g
- saturated	g	g
Carbohydrate	g	g
Sugars	g	g
Sodium	mg (mmol)	mg (mmol)
(insert any other nutrient or biologically active substance to be declared)	g, mg, µg (or other units as appropriate)	g, mg, µg (or other units as appropriate)

Figure 2: Mandatory Nutrition Facts Panel (US)

Sample label for Macaroni & Cheese			
Nutrition Facts			
Serving Size 1 cup (228g) Serving per Container 2			
Amount per Serving			
Calories 250		Calories from fat 110	
			% Daily Value
Total Fat 12g			18%
Saturated Fat 3g			15%
Cholesterol 30mg			10%
Sodium 470mg			20%
Total Carbohydrate 31g			10%
Dietary fibre 0g			0%
Sugars 5g			
Protein 5g			
Vitamin A			4%
Vitamin C			2%
Calcium			20%
Iron			4%
*Percent Daily Values are based on a 2,000 calorie diet. Your Daily Values may be higher or lower depending on your calorie needs:			
		Calories:	2,000 2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary fiber		25g	30g

Adapted from <sup>13</sup> (Figure 1(a), Examples of nutrition labels, Region of the Americas)

Figure 3: Multiple traffic light label (UK)



Figure 4: Preferred calorie flags (EUFIC)<sup>14</sup>



Figure 5: Pick the Tick logo (NHF)



Figure 6: Colour-coded GDA label (FSA)

<b>FAT</b>	GDA 70g	0.75g per serving
<b>SATURATES</b>	GDA 20g	0.3g per serving
<b>SALT</b>	GDA 6g	0.3g per serving
<b>SUGAR</b>	GDA 40g	11.7g per serving
<div> <div></div> HIGH           <div></div> MEDIUM           <div></div> LOW         </div>		

Figure 7: Monochrome GDA (FSA)

	Per serving	GDA
<b>FAT</b>	7.7g	70g
<b>SATURATES</b>	2.0g	20g
<b>SUGAR</b>	42.4g	40g
<b>SALT</b>	2.0g	6g

Figure 8: Simple traffic light label (FSA)

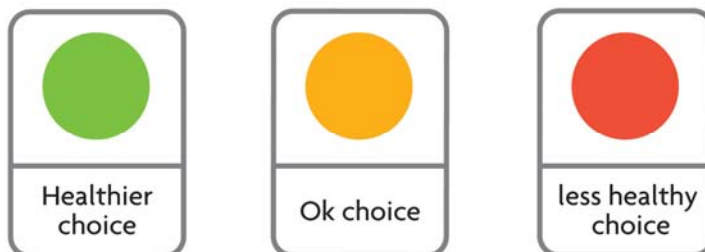


Figure 9: Percentage daily intake label (New Zealand)

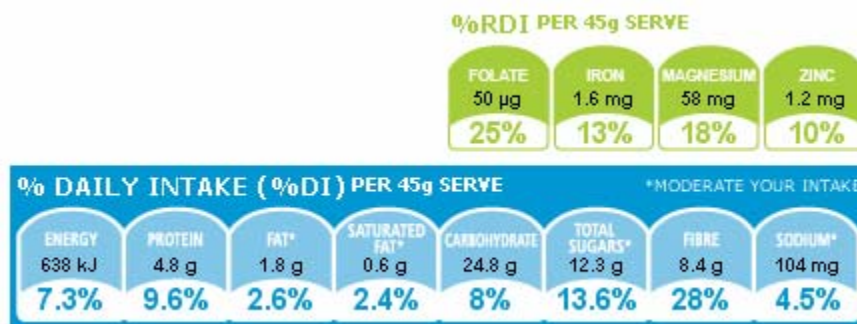


Figure 10: Front of pack labels compared in Which? research<sup>15</sup>

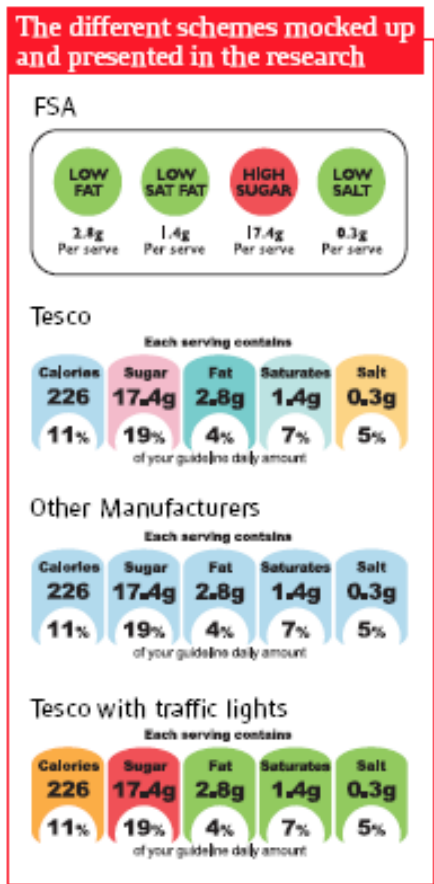


Figure 11: Single and dual column Nutrition Facts panel compared in Antonuk's research<sup>16</sup>

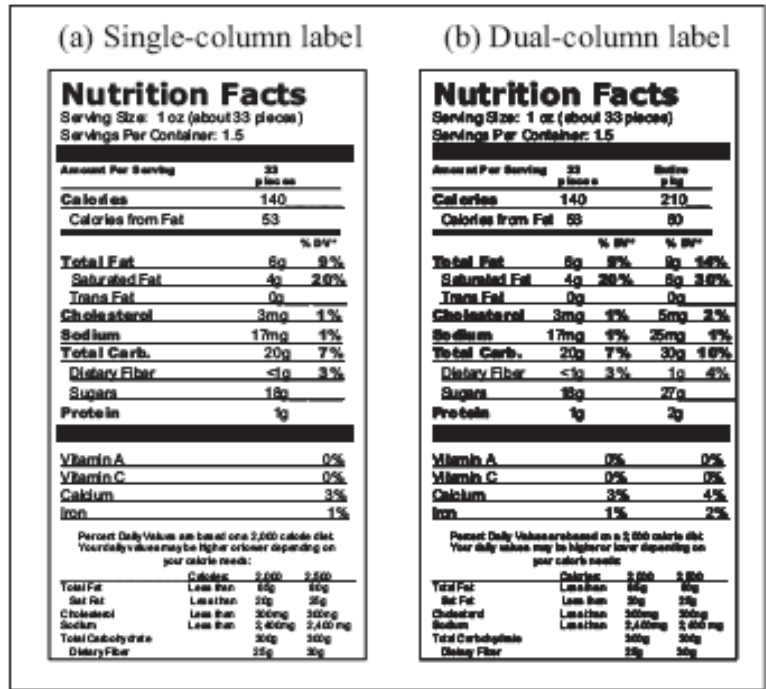
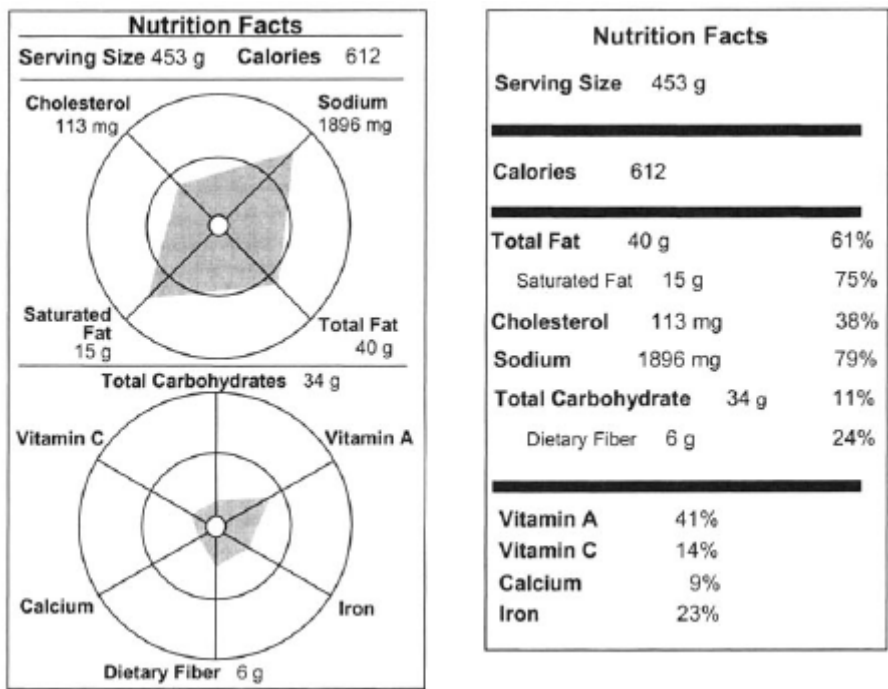


Figure 12: Configurational (left) and separable (right) label designs used in the study by Marino<sup>17</sup>



## Use and understanding of nutrition labels and claims

Nutrition labels are intended to be used to help people make healthier choices, and consumers recognise them as a tool to improve health<sup>18</sup>. In order to achieve their goal, they must first be used, and then understood. The original review identified good levels of use, however understanding was moderate at best<sup>4</sup>.

Eighteen studies/reports on consumer use and understanding of nutrition labels were published between August 2005 and September 2007 and are described in detail in Table 1. Four studies were carried out in the US<sup>18-21</sup>, one in Canada<sup>22</sup>, eight in the UK<sup>15 23-29</sup>, four in Europe<sup>14 30-32</sup>, and one in both the US and Europe<sup>33</sup>. While most still relied on self-reported data one UK study attempted to objectively measure how consumers used MTL and NIP labels with eye tracking technology<sup>23</sup>. Objectively measuring label use is technically difficult, as is measuring the impact of their use on dietary behaviour. However, it provides valuable information as it has been established that self reported label use overestimates actual use<sup>4</sup>.

Recent self-reported levels of label use range from a low of 37% using food labels as a source of nutrition information<sup>22</sup> to 83%\* checking labels at least sometimes or when buying foods for the first time<sup>18</sup>. The lower end of the range was a rating for sources of nutrition information, and nutrition labels were ranked behind sources such as magazines. One report mentioned an even higher estimate, where 95% of respondents to a Harris Interactive/Wall Street Journal web-based survey reported having used nutrition labels at some point<sup>34</sup>. This is likely to be a highly biased sample in terms of education and income. This report was not included in the review as it was published in a newsletter, and the original data could not be sourced. Energy (calories) and fat continue to be the items checked most often on labels<sup>19</sup>.

Understanding of labels continues to be problematic. One-quarter (UK) to one-half (France) of consumers report difficulties with understanding labels, describing them as complex and not clear or easy to read<sup>15 19 24 30</sup>. There is some evidence that labels are less well understood by people from lower socio-economic groups<sup>5 15</sup>.

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\* Please note that the methodology used to obtain this estimate was not reported

Nutrition-related claims also cause difficulty for consumers. Some claims were more difficult to understand than others, for example those that related to benefits for cardiovascular disease and plant sterols, whereas claims related to weight loss and fibre were easier to understand<sup>33</sup>. Whilst a review<sup>32</sup> found mixed results on the influence of claims on purchase intent, a further study showed that consumers had a higher purchase intent with either low-carbohydrate or low-fat claims, depending on their level of motivation<sup>20</sup>.

Alternative methods of labelling have been investigated in attempts to simplify label reading, especially front-of-pack labels. The multiple traffic light label has been suggested as one front-of-pack format signposting the nutritional quality of the food (Figure 3). Addition of a multiple traffic light label to an NIP was found to make label reading more accurate and to focus attention on the important nutrients, helping them to rate the healthiness of the product<sup>23</sup>. The authors reported that the multiple traffic light label reduced the cognitive workload in reading labels for consumers. Traffic light labelling, along with Guideline Daily Amount (GDA) (Figure 6 and 7) labelling was tested extensively by the Food Standards Agency (FSA) in the United Kingdom. They have since recommended implementation of front-of-pack multiple traffic light labels to the food industry. Multiple traffic light labels were the most effective and accurately used label out of those tested. Research with consumers since implementation of front-of-pack labels shows that traffic light labels serve their intended purpose of being quick and easy to use<sup>27</sup>.

Follow-on focus group work for the FSA delved further into consumers' interpretation of sugar labelling and claims on breakfast cereals (including a front-of-pack multiple traffic light label). Participants were surprised by the high level of sugar shown on the multiple traffic light label, as it differed from their previously held beliefs about the product<sup>26</sup>. When the high sugar content came from fruit it was felt there should be some differentiation for this on the label. Conflicts were seen between what the multiple traffic light label was saying and what marketing messages said and this angered some consumers.

Another method tested was front-of-pack calorie symbols (or flags) which highlighted the calorie content of the food (either per serve or per 100g). The two preferred flags are shown in Figure 4. Participants preferred symbols that were simple, clear, and quick to use. The addition of front-of-pack labelling was seen as an improvement on

the existing back-of-pack label, as it provided quick and easy to use information for consumers, while back-of-pack information could provide more detail for those who wanted it.

Front-of-pack labels are liked by consumers<sup>31</sup>, and seen as a useful addition to current labelling<sup>27</sup>. However, this is still no definite consensus amongst consumers on the preferred label type, most likely because they are looking for different things from labels and have different priorities<sup>31</sup>. However, for general ease of use and understanding multiple traffic light labels appear to perform best, whereas GDAs perform best for people who like more detailed information<sup>31</sup>.

The Nutrition Facts Panel in the US utilises % daily value labelling (Figure 2). Focus groups in the US reported that this concept was confusing, although it was felt it would be of benefit if explained to them<sup>18</sup>. One difficulty that can be experienced with this type of labelling was highlighted when consumers tried to work out their calcium intake from %DV labelling on the Nutrition Facts panel. Consumers, and the majority of physicians, could not work out how much calcium they were getting from a tub of yoghurt using label information. As calcium recommendations are given in milligrams per day, they had to convert %DV into milligrams using the statement that “one serve contains 45% of the daily value”. The first problem encountered was that participants did not know their own calcium requirements, let alone those for the average person. They then had to complete a mathematical calculation in their head which was too complex for most participants. Education with a conversion algorithm improved ability to interpret the information, however this is not feasible on a large scale. It should be noted that % daily intake labelling that has been appearing on products in New Zealand (Figure 9) partially overcomes this problem by including the total gram/milligram amount in a serving. However the serving information still applies to an average person, and individuals are not “average”.

**Table 1: Summary of consumer use and understanding of nutrition labels or claims**

Author, Year, Country	Study Design	Methods	Main Results	Limitations
Borra, 2006, United States <sup>18</sup>	<p><i>Design:</i> Summary of recent research</p> <p><i>Aim:</i> Highlights from recent quantitative and qualitative research</p> <p><i>Study population:</i> N/A</p>	<p>Selective summary of three recent research projects.</p> <p>No methodology or study population characteristics given.</p>	<p>Quantitative research by IFIC in 2003:</p> <ul style="list-style-type: none"> <li>83% of consumers looked at nutrition panels at least sometimes</li> <li>When choosing food, most concerned with calories (58%) and total fat (56%)</li> </ul> <p>2004 Food Marketing Institute's Shopping for Health survey:</p> <ul style="list-style-type: none"> <li>83% always or sometimes check the nutrition panel when buying food for the first time</li> <li>48% check the nutrition panel to buy health food for the family</li> <li>23% check the nutrition panel in order to lose weight</li> </ul> <p>Focus groups carried out by IFIC in 2004:</p> <ul style="list-style-type: none"> <li>Consumers recognised nutrition labels as a tool to improve health</li> <li>Many confused about the %DV. However they felt %DV for calories could be useful if explained to them.</li> </ul>	Brief report - neither methodologies nor study populations reported.

Author, Year, Country	Study Design	Methods	Main Results	Limitations
Jones, 2007, UK <sup>23</sup>	<p><i>Design:</i> Assessment of eye movement and healthiness ratings</p> <p><i>Aim:</i> To objectively assess use of a standard NIP (Label A) and NIP plus multiple traffic light label (Label B)</p> <p><i>Study population:</i> Staff or students at the University of Derby</p>	<p>92 participants completed the assessment. Eye movements recorded (using eye tracking technology) whilst participants rated healthiness of foods from sample labels.</p> <p>A 2 (label type) x 9 (nutrient) repeated measures design used.</p>	<p>Multiple regression analysis suggested that for Label A 9.5% of variance in healthiness ratings was related to some combination of the eight nutrients examined, whereas for Label B this was 39.7%.</p> <p>Label A showed no correlation between length of time spent looking at a nutrient and which nutrients participants placed importance on for rating healthiness. There was a significant correlation for Label B.</p> <p>The amount of error in rating the healthiness of a product significantly lower for Label B than Label A.</p>	<p>Likely to be significant selection bias.</p> <p>Experimental setting.</p> <p>Participants were only required to complete one type of label reading task.</p> <p>The multiple traffic light was presented next to the NIP rather than front-of-pack.</p>
Marquis, 2005, Canada <sup>22</sup>	<p><i>Design:</i> Web survey</p> <p><i>Aim:</i> Principal sources of nutrition information and their trustworthiness, segmented by geographical location and age</p> <p><i>Study population:</i> Visitors to the Canadian Dietetic's Association webpage</p>	<p>Web survey of 870 people posted on the Dietitians of Canada site.</p> <p>88% of respondents were female, 55% were from Quebec, and 27% in the 45-54 year age group.</p>	<p>37% (n=273) of respondents used food labels as a source of nutrition information. This was the fourth highest ranking, behind magazines (49%), books (42%), and the internet (40%).</p> <p>No statistically significant difference in label use by geographic location or age.</p>	<p>Sample not representative and likely to be respondent bias.</p> <p>Did not ask about trustworthiness of nutrition labels.</p>

Author, Year, Country	Study Design	Methods	Main Results	Limitations
IFIC, 2006, USA <sup>19</sup>	<p><i>Design:</i> Quantitative web based survey</p> <p><i>Aim:</i> Explore perceptions and behaviours regarding primary health-related issues</p> <p><i>Study population:</i> Americans</p>	<p>1060 participants surveyed. Asked questions relating to perceptions of health and information sources.</p>	<p>58% frequently use Nutrition Facts panel when deciding to purchase or eat food. 67% find Nutrition Facts panel easy to use, and about 1/3 describe it as very difficult, somewhat difficult or neither easy nor difficult.</p> <p>93% use at least one piece of information from Nutrition Facts panel, with more than half using up to four label elements. Calories used most often, followed by total fat, serving size, and sugar.</p>	<p>No indication of participant demographics, and unlikely to be representative due to being a web-based survey.</p> <p>Likely to be important respondent bias.</p>
van Kleef, 2007, France, Germany, UK, and Netherlands <sup>14</sup>	<p><i>Design:</i> Focus groups</p> <p><i>Aim:</i> Consumer appreciation of front-of-pack calorie labelling</p> <p><i>Study population:</i> Young adults, families, and empty nesters from a mix of social classes.</p>	<p>Eight front-of-pack calorie flags developed and tested on food products. Each flag shown on three different food products, with a mix of high and low calorie foods.</p> <p>12 focus groups ran with 8-10 consumers each, three in each country.</p> <p>Comprised 50% label users and 50% infrequent label users. 50% female, 50% professionally active.</p>	<p>Energy or calories were well understood, although many people did not know their daily energy requirement.</p> <p>Simple front-of-pack flags that were easy to use and interpret preferred eg. flags that only showed calories per serve or per 100g (Figure 4).</p>	<p>Non-representative sample</p>

Author, Year, Country	Study Design	Methods	Main Results	Limitations
Mannell, 2006, France <sup>30</sup>	<p><i>Design:</i> Face-to-face survey</p> <p><i>Aim:</i> To determine French consumers use of nutrition labels</p> <p><i>Study population:</i> Supermarket shoppers in Paris</p>	<p>Shoppers recruited at selected supermarkets throughout Paris, in low, medium, and high income areas, and commercial areas.</p> <p>355 surveys completed. 65% female, majority aged 18 to 55 years, with at least an undergraduate degree.</p>	<p>45% of participants reported using food labels (25% of men and 56% of women). 39% of label users only read them once in a while. Main reason for not using labels was lack of interest (47%) and lack of time (35%).</p> <p>54% thought label information was not clear or easy to read.</p> <p>36% wanted information that is easier to read, and 35% wanted nutrition terms explained on the label. 48% would prefer serving size presented as per 100g and per average portion.</p> <p>Those most likely to read labels were on a special diet, females, and older than 40 years of age.</p>	<p>Cross sectional survey with self-reported outcomes.</p> <p>Small sample size.</p> <p>Response rate of 47%.</p> <p>Well-educated sample.</p>
Which?, 2006, United Kingdom <sup>15</sup>	<p><i>Design:</i> Face-to-face Interviews</p> <p><i>Aim:</i> To compare consumer evaluations of four different label formats</p> <p><i>Study population:</i> Representative sample of shoppers in Great Britain aged 18 to 65 years of age, with a boost sample from lower socio-economic groups</p>	<p>Interviews with 636 people, who each rated one of four label formats (multiple traffic light, and three monochrome or colour-coded GDA formats [Figure 10]),.</p>	<p>One-quarter of people found nutrition labels difficult to understand, particularly people from lower SES groups.</p> <p>The multiple traffic light label was best able to be used to identify nutrient levels and to compare between products. 97% of participants able to correctly compare products using the label. It was seen as the easiest label to use and was quickest to use.</p> <p>People from lower SES groups able to use the multiple traffic light label more accurately (90%) than other labels.</p>	<p>Impact on purchasing behaviour not assessed.</p>

Author, Year, Country	Study Design	Methods	Main Results	Limitations
Synovate, 2005, United Kingdom <sup>24</sup>	<p><i>Design:</i> Interviewer administered hall test</p> <p><i>Aim:</i> Consumer understanding and preference for four signposting options</p> <p><i>Study population:</i> Representative sample of 16-70 year olds from England, Scotland, Northern Ireland, Wales, with boost numbers of Welsh and ethnic minorities.</p>	<p>2,676 interviews conducted</p> <p>Life size photographs of real products in five different product categories were used, with nutrition information on the back, and one of the front-of-pack schemes or no scheme on the front.</p> <p>Four front-of-pack labels compared: simple traffic light (Figure 7), multiple traffic light (Figure 3), colour-coded GDA (Figure 6), and monochrome GDA (Figure 7).</p>	<p>Multiple traffic light label performed best overall, producing quick and accurate responses. The majority of people found it easy to use and understand.</p> <p>Multiple traffic light labels performed best for individual product evaluations (by 21%), and the colour coded GDA performed best for between product comparisons (by 6%).</p> <p>96% thought front-of-pack labelling would be useful, and a similar amount preferred colour-coded signposting.</p> <p>The colour-coded GDA was the most favoured signpost.</p>	<p>Experimental setting.</p>
van Trijp, 2007, Europe and United States <sup>33</sup>	<p><i>Design:</i> Cross-national web-based exploratory survey</p> <p><i>Aim:</i> Investigate consumer perceptions of nutrition and health claims across different countries</p> <p><i>Study population:</i> Web-based consumer panels of a commercial market research agency in Italy, Germany, UK, and the US</p>	<p>Respondents selected by quota sampling on gender, age (18-55 years), and education level, and had a spread of socioeconomic characteristics.</p> <p>Five types of nutrition and health claims relating to six different health benefits were systematically varied and tested on 6,367 participants.</p>	<p>Consumers in different countries perceived nutrition and health claims differently.</p> <p>Different claim types showed little effect on perceived healthiness, health impact, and consumer appeal. However different claim types varied in their impact on credibility and difficulty to understand.</p>	<p>Self-reported understanding.</p> <p>Not a representative sample and likely to be respondent bias.</p> <p>Results may not be generalisable to foods other than yoghurt (the test product).</p>

Author, Year, Country	Study Design	Methods	Main Results	Limitations
Kemp, 2007, United States <sup>20</sup>	<p><i>Design:</i> Postal survey</p> <p><i>Aim:</i> Potential effects of a “low carbohydrate” claim relative to a “low fat” claim</p> <p><i>Study population:</i> Main household shoppers from a research mail panel in a southern state of the United States</p>	<p>3 (Nutrition Facts panel: low carb and high fat, high carb and low fat, or no nutrition info) x 3 (Claim: low fat, low carb, or no claim) between-subjects factorial design.</p> <p>Between 19 and 24 participants per cell, with a total sample size of 186.</p> <p>Response rate was ~68%.</p> <p>Each participant was shown one of nine mocked-up food packages then completed a survey.</p> <p>70% female, aged 28 to 86 years, 72% educated beyond high school, and 34% on a diet.</p>	<p>Participants with lower motivation to process nutrition information had increased purchase intent with a low-carbohydrate claim compared with participants with higher motivation. Neither claims nor the Nutrition Facts panel affected perceptions of disease risk.</p> <p>For those with higher motivation levels a low fat claim led to lower disease risk perception and higher purchase intent.</p>	<p>Not a representative sample and likely to be respondent bias.</p> <p>Experimental setting.</p> <p>Cross-sectional design with self reported outcomes.</p>

Author, Year, Country	Study Design	Methods	Main Results	Limitations
Forum Qualitative, 2007, United Kingdom <sup>26</sup>	<p><i>Design:</i> Discussion groups</p> <p><i>Aim:</i> Understand how consumers consider sugar information on breakfast cereal labels</p> <p><i>Study population:</i> Participants from different lifestages, gender, and socioeconomic status in seven localities in the United Kingdom</p>	<p>12 x two-hour discussion groups with 92 participants. A pair of cereal mock-ups with multiple traffic light signposting used during the discussion.</p> <p>36 randomly selected participants followed up by telephone questionnaire.</p>	<p>No awareness of recommended amount or limit for sugar, so participants unaware if they were eating too much.</p> <p>Many participants surprised by high fat and sugar contents highlighted on label, as it differed to their beliefs about cereals.</p> <p>Some angry that the label seemed to conflict with marketing messages about no added sugar or other claims.</p> <p>Participants wanted a standard serving size used across all brands.</p> <p>Food diaries indicated over <math>\frac{3}{4}</math> of servings greater than serving size specified on package, and many at least double.</p> <p>No differences noted between low-income and other groups.</p>	No dedicated research with ethnic or minority groups.

Author, Year, Country	Study Design	Methods	Main Results	Limitations
Navigator, 2007, United Kingdom <sup>27</sup>	<p><i>Design:</i> Focus groups</p> <p><i>Aim:</i> Consumer response to front of pack signposting schemes in the UK</p> <p><i>Study population:</i> Men and women in pre-family, family, and empty nest lifestages from the South, Midlands, and North of England</p>	<p>8 discussion groups with 6-7 participants in each.</p> <p>Front of pack labelling schemes from Marks &amp; Spencer, McCain, Tesco, and Sainsbury used in the discussion (to represent a traffic light pie design and both colour coded and non-colour coded GDAs).</p>	<p>Participants were aware of front-of-pack labelling schemes and felt a need for them, but not all had seen them whilst shopping. Some were annoyed that there was not one standardised system.</p> <p>Traffic light labels gave 'at a glance' information that was easy and quick. Each of the traffic light colours used to give an overall impression of the food, which was used as a filter, with more detailed examination if necessary. It was harder to arrive at a decision when the food contained a mixture of traffic light colours.</p> <p>GDA schemes seen as simpler and easier to use than the detailed nutrition panel. However they still had to be read, so consumers focused in on nutrients of particular interest rather than the whole product.</p> <p>Recommended serving sizes seen as deliberately misleading.</p>	<p>Label preferences could be due to familiarity from using that label at their supermarket chain.</p> <p>Did not specifically include ethnic minorities or people with a lower income.</p>

Author, Year, Country	Study Design	Methods	Main Results	Limitations
Grunert, 2007, Europe <sup>31</sup>	<p><i>Design:</i> Literature review</p> <p><i>Aim:</i> How consumers perceive, understand, like and use nutrition labelling. Updates the review by Cowburn &amp; Stockley (2005).</p> <p><i>Study population:</i> Research in the European Union from 2003 to 2006</p>	<p>Comprehensive structured search of academic databases, the internet, and key informants.</p> <p>58 studies identified.</p>	<p>Widespread consumer interest in labels. Women, parents, young women interested in their weight, older consumers, and people buying a product for the first time tend to read labels more. Time pressures and increasing interest in price decrease label reading. Fat and calorie information is read most often.</p> <p>Simple front of pack information liked, and generally understood, but varying formats preferred. This depended on whether preference is for labels that are simple and easy to use, the desire to know what the information stands for and how it was arrived at, or not to feel pressured into certain choices.</p> <p>Simple traffic lights and health logos least preferred. Some participants found them “too didactic” or “paternalistic”. Preference between multiple traffic lights and GDA systems not clear cut. Whilst multiple traffic light labels are simpler and easier to use, GDAs provide more information and may seem less coercive as the presence of numbers gives something to refer back to</p> <p>Virtually no insight into consumer use of labels in a real-world setting.</p>	Includes studies on European consumers only. No further description given of study populations.

Author, Year, Country	Study Design	Methods	Main Results	Limitations
Synovate, 2005, United Kingdom <sup>25</sup>	<p><i>Design:</i> Focus groups</p> <p><i>Aim:</i> Examine issues related to the implementation of either multiple traffic light or colour-coded GDA signpost labelling</p> <p><i>Study population:</i> Consumers with main or joint responsibility for the household food shopping, aged over 18 years</p>	<p>16 focus groups with 7-9 participants each.</p> <p>A multiple traffic light and colour-coded GDA were tested.</p> <p>Sample broadly reflective of UK population on age and socio-economic status.</p>	<p>Consumers find nutrition information on food packages complex and difficult to use.</p> <p>Multiple traffic lights were simple and easy to understand and quick to use.</p> <p>GDA was more comprehensive and seemed more credible as it included numbers, but some aspects caused confusion.</p> <p>Consumers wanted standardised signposting (eg. position and size) which applied to all food categories, but especially convenience foods, those eaten frequently, foods claiming to be healthy, or aimed at children.</p>	
Leathwood, 2007, Europe <sup>32</sup>	<p><i>Design:</i> Review</p> <p><i>Aim:</i> Examine understanding of nutrition and health claims from a consumer perspective and ways of measuring that understanding</p> <p><i>Study population:</i> N/A</p>	<p>Methodology not provided. Review appears selective.</p>	<p>Information processing models show that the full effect of a claim on a consumer must take into account possible inferences they may make about other aspects of the product, due to the claim.</p> <p>Five types of bias caused by claims have been identified: positivity bias, halo effect, magic bullet, interactive effect, or a boomerang effect.</p> <p>Research on the impact of claims on purchase intent has shown mixed results.</p>	<p>Unable to assess methodology.</p> <p>Uncertainty around how comprehensive the review is.</p> <p>Study results may have limited generalisability due to sampling, the research environment used, and measurement instruments altering behaviour.</p>

Author, Year, Country	Study Design	Methods	Main Results	Limitations
Block, 2006, United States <sup>21</sup>	<p><i>Design:</i> Three surveys (one-on-one or self-administered)</p> <p><i>Aim:</i> Can consumers calculate their calcium intake using the Nutrition Facts panel?</p> <p><i>Study population:</i></p> <p>Study 1: Florida residents aged 55+ years</p> <p>Study 2: Physicians</p> <p>Study 3: Pregnant or breastfeeding women</p>	<p><i>Study 1:</i> 37 respondents recruited from a promotional flyer in letterboxes to complete a face-to-face survey. 31% had osteoporosis, and 30% male.</p> <p><i>Study 2:</i> 20 physicians, who had practiced an average of 16 years, completed a self-administered questionnaire.</p> <p><i>Study 3:</i> 41 women ranging in age from 20 to 41 years completed a two-part survey. Part 1 asked about their knowledge of calcium requirements. In Part 2, half the sample were given an educational sheet on interpreting the Nutrition Facts Panel. Then all participants completed a three-day calcium food diary.</p>	<p><i>Study 1:</i> Respondents did not accurately know their required calcium intake. They had difficulty converting %DV on the label into a milligram amount, and only two respondents were able to do so.</p> <p><i>Study 2:</i> All physicians gave calcium recommendations in milligrams per day, and did not discuss translating it into %DV.</p> <p>Only 30% of physicians were able to correctly convert %DV calcium on the Nutrition Facts panel into a milligram amount.</p> <p><i>Study 3:</i> Respondents knew their calcium requirements, but were under-consuming it.</p> <p>Women who received the educational sheet on label reading for calcium increased their consumption during the intervention, whereas the control group did not. They felt more confident in their ability to understand calcium information on the Nutrition Facts Panel. A follow-up study determined this effect was due to the education sheet.</p>	<p>Small sample size.</p> <p>Not a representative sample.</p>

Author, Year, Country	Study Design	Methods	Main Results	Limitations
FSA, 2007, United Kingdom <sup>28</sup>	<p><i>Design:</i> Literature review</p> <p><i>Aim:</i> Consumer understanding and use of food labels</p> <p><i>Study population:</i> N/A</p>	Databases, the FSA library, EU member states, and websites of market research organisations were searched for studies since 2000 related to labelling.	<p>Consumers often have difficulty discriminating between health claims, endorsements, and assurance schemes.</p> <p>Consumers would like more signposting, the use of symbols, and more legible labelling.</p> <p>45% looked at food labels to determine how healthy the food is. 32% don't look at labels at all when buying food.</p> <p>Better educated, young people, and women make more use of food labels.</p>	The review excluded nutrition labelling. However as the review was on food labelling some information was relevant.
Garrett, 2007, United Kingdom <sup>29</sup>	<p><i>Design:</i> Conceptual review</p> <p><i>Aim:</i> Quickly review consumer use of nutrition labelling</p> <p><i>Study population:</i> N/A</p>	Database searches of literature reviews on nutrition labelling over the last 10 years and material from the FSA.	<p>Women more likely than men to read labels.</p> <p>Those with higher income or education, parents with children living at home, on a special diet, or with knowledge of the link between diet and health are more likely to use labels.</p> <p>Lack of time and placing importance on price are barriers to label use.</p> <p>Simple label formats that are colourful or graphical rather than numerical are preferred.</p> <p>Consumers prefer using a benchmark to judge how a food fits into the overall diet.</p>	<p>Reviews already included in this report.</p> <p>Not a comprehensive review.</p>

## **Impact of nutrition labels and claims on consumer behaviour**

The original review identified three randomised trials on the impact of nutrition labels on food purchases, which showed conflicting results. Two further studies have been carried out in this area.

The size of a serving specified on food labels is not regulated in New Zealand. There are no specifications around what constitutes a serve and manufacturers determine this themselves. This leads to often unrealistic serving sizes given on nutrition labels. The effect of serving size information on amount eaten was investigated and both studies demonstrated that serving size information may play a role in regulating food intake.

The US Nutrition Facts panel only provides per serving information. When participants were shown a label that included information on package size serving as well as serving size, they subsequently ate fewer M&Ms<sup>16</sup>. Whilst providing package serving size information was effective for non-dieters it was ineffective for dieters, who were already trying to limit intake.

The second study found that labelling foods as low-fat increased the amount of food consumed by up to 50%<sup>35</sup>. In normal weight participants, this increase was prevented by providing appropriate serving size information, whereas for overweight participants serving size information did not prevent them from overeating low-fat foods. If the food was labelled low-fat participants estimated an appropriate serving size to be larger by 20-25% than for a food with a regular label. Overweight consumers were more strongly influenced by the low-fat labelling, seeing it as a licence to eat more. Product surveys showed this reasoning to be counterproductive as whilst low-fat foods were lower in fat, they were not substantially lower in energy. Despite being a low-fat version of the food, increasing the amount consumed as much as participants did in this study would have led to 33% more calories consumed<sup>35</sup>.

**Table 2: Summary of impact of nutrition labels and claims on consumer behaviour**

Author, Year, Country	Study Design	Methods	Main Results	Limitations
Antonuk, 2006, USA <sup>16</sup>	<p><i>Design:</i> Between-subjects experimental study</p> <p><i>Aim:</i> To discover whether a dual-column Nutrition Facts panel (per serve and per packet nutrient information) changes consumption compared to a single-column label (per serve), and whether this is effected by dieting</p> <p><i>Study population:</i> Undergraduate students from an introductory marketing course</p>	<p>112 participants randomised to view either the standard single column Nutrition Facts panel, or a dual-column label (Figure 11).</p> <p>Participants were provided with 1.5 ounces of M&amp;Ms (1.5 serves) and a label. They completed a questionnaire about the label, and then watched a short video, during which they were allowed to eat the M&amp;Ms.</p> <p>A 2 (label) x 2 (dieting) ANOVA with age and gender as covariates was conducted.</p>	<p>There was a significant interaction between label use and dieting behaviour and a significant effect of age (older participants consumed more than younger participants).</p> <p>Non-dieters consumed significantly less when shown the dual-column label (mean of 21 M&amp;Ms vs 33) compared to the single-column label. This effect was not seen in dieters (mean 22 for single-column vs 26 for dual-column).</p> <p>Dieters reported paying more attention to labels and found the information easier to understand than non-dieters.</p> <p>Ability to understand the labels did not differ by label type.</p>	<p>Not a representative sample and likely to be respondent bias</p> <p>Experimental setting</p>

Author, Year, Country	Study Design	Methods	Main Results	Limitations
Wansink, 2006, United States <sup>35</sup>	<p><i>Design:</i> Series of three experiments: one lab study and two natural field studies</p> <p><i>Aim:</i> Do low-fat nutrition claims increase food consumption?</p> <p><i>Study population:</i> Study 1: adult family members participating in a university open day</p> <p>Study 2: adults from a university campus</p> <p>Study 3: university staff and students</p>	<p><i>Study 1:</i> 269 participants served themselves M&amp;Ms either from a bowl marked as “new colours of regular M&amp;Ms” or “new ‘low-fat’ M&amp;Ms”.</p> <p><i>Study 2:</i> Half of the 74 participants were shown a 10-oz serve of regular M&amp;Ms and a 10-oz serve of regular granola. The other half were shown the same amounts of reduced-fat M&amp;Ms and granola. They then estimated how much of the snack was an appropriate serve, and rated how guilty they would feel after consuming 2-oz of each snack.</p> <p><i>Study 3:</i> 210 participants told they were evaluating the pilot of a television show and were provided with a 160g bag of granola to snack on. Used a 2 (regular or low-fat label) x 3 (no serving size, 1 serving label, or 2 servings label) between-subjects design.</p>	<p><i>Study 1:</i> Low-fat labels increased the amount of M&amp;Ms taken over regular labels by 28%. Overweight participants increased the amount taken more (47%) than normal weight participants (16%).</p> <p><i>Study 2:</i> Participants shown low-fat labels estimated a 25% larger appropriate serving size than those who saw the regular label. Participants would feel less guilt eating the low-fat version. They expected low-fat M&amp;Ms to contain 20% less calories and low-fat granola to contain 25% less calories than regular versions.</p> <p><i>Study 3:</i> Participants with low-fat labels consumed 50% more granola. Participants who believed there were two servings per bag ate less than those who thought there was one serving. Overweight participants consumed more granola if labelled low fat regardless of serving size information.</p>	Likely to be significant respondent bias, as it was a nutrition department open day.

## **Associations between nutrition label use and dietary quality**

The original review found a number of mainly cross-sectional studies which reported an association between nutrition label use and dietary quality. There have been no further studies published in this area since 2005.

## **Impact of nutrition label use on health**

No studies were identified in the original review that measured the impact of nutrition labels on health, although estimates were made. No further research in the area was identified in this review.

## **New Zealand/Australian research**

One paper was published that summarises results related to New Zealand and Australia from our original review<sup>36</sup>. The majority of studies included in the review paper evaluated self-reported use and understanding of labels. Whilst self-reported rates of label usage appeared moderate to good, actual use was far less. The usefulness of labels appeared to be hampered by a lack of full understanding by consumers. The review also reported a complete lack of research amongst Maori, Pacific, and low-income shoppers. Subsequent research has attempted to address this area.

Two reports have been prepared which consider nutrition labels in relation to Maori, Pacific, and low-income consumers. The first study reported on focus groups carried out for the National Heart Foundation in relation to their Tick programme<sup>37</sup>. Participants reported that the Tick had little relevance to them, as it was perceived to be on expensive foods. Furthermore, nutrition labels were largely irrelevant as most purchasing decisions were based on cost. Some participants reported never having seen a NIP.

The second was a large survey of Maori, Pacific, and low-income Auckland shoppers<sup>5</sup>. Levels of label use were moderate to high, but did show differences by ethnic group. Overall, the survey found the NIP is only well understood by the New Zealand European and Other ethnic group, whereas traffic light label formats are well understood regardless of ethnicity or income level. Percentage daily intake labels were not well understood by most ethnic groups other than Pacific. The preferred label overall was the multiple traffic light format, and the least preferred was % DI.

Research on understanding of %DI labelling found the concept was difficult to grasp for participants who were not current NIP users<sup>6</sup>. The research suggests that the NIP will continue to be used by savvy consumers as it is seen as more credible. However, participants who rely more on claims without evaluating them would not start to use %DI labelling if it was provided. Therefore %DI labelling appears to be adding extra information for consumers who are already using and understanding NIP information, whereas the aim is to make labels more accessible for those who currently find them difficult to use. Percentage daily intake labelling is also likely to require extensive consumer education<sup>6 38</sup>.

The terminology used on labels is often not consumer friendly. Most consumers did not differentiate between sodium and salt and were unable to determine the amount of salt based on sodium levels<sup>39</sup>. Whether the inability to do this is actually detrimental to health is questionable, but it could be misleading if people assume recommendations for salt and sodium are the same thing. Regardless, the terminology does cause consumer confusion. This difficulty with terminology was also found in the focus groups with Maori, Pacific, and low-income peoples, who reported terms such as 'saturates' had little meaning for them<sup>37</sup>.

Trustworthiness of labels is a common issue for consumers, especially in relation to claims<sup>36</sup>. An Australian study looked at the accuracy of information on the NIP. A certain margin of error is to be expected, as the NIP can be calculated based on information from nutrient databases rather than laboratory analysis. A small number of products had nutrition information on the NIP that corresponded exactly with laboratory analysis, and overall 86% were within 20% of the stated values. However that left 14% of labels with substantial variances from the values published on the NIP. Furthermore, of the products tested that carried a low-calorie claim, 66% had a higher level of energy than that stated on the NIP. So while we focus on ensuring shoppers can use and understand nutrition labels, the other side of the equation is that information must be reliable in order for choices to improve health.

Nutrition claims are widespread. The original review reported on an Australian study in 2001 looking at the frequency of nutrition claims on products (35%). This product survey was repeated in 2003 and found substantially fewer products carrying claims (14%)<sup>40</sup>. Some food categories still carried very high proportions of claims, mainly sports and energy drinks and foods. A reason for this decrease was not suggested. However, market surveys carried out in 2003 and 2005, found an average 42% of products carrying claims in Australia and New Zealand, which remained unchanged over that period, and was closer to the 2001 estimate of 35%<sup>41</sup>. Whilst claims are widespread, New Zealand research also suggests that they can be misleading, especially to some ethnic and low-income groups<sup>5 42</sup>. There appears to be a "halo effect", where people believe a food to be automatically healthy due to the presence of a claim.

**Table 3: Summary of New Zealand and Australian research**

Author, Year, Country	Study Design	Methods	Main Results	Limitations
Lanumata, 2006, New Zealand <sup>37</sup>	<p><i>Design:</i> Focus groups/hui/fono</p> <p><i>Aim:</i> Evaluate effectiveness of Pick the Tick for Maori, Pacific, and low-income peoples</p> <p><i>Study population:</i> Maori, Pacific, and low-income shoppers in Wellington</p>	<p>121 people participated in six focus groups (one Maori, one Samoan, one Tongan, and three low-income).</p> <p>Food labels discussed in the focus groups were the NIP, Tick, multiple traffic light, simple traffic light, the Tick plus pyramid, and a multilingual Tick.</p>	<p>Pick the Tick is rarely used by Maori, Pacific, and low-income shoppers.</p> <p>This is due to the absence of the Tick on low cost foods, lack of time to read labels, not being aware of the Tick, and shopping by habit.</p> <p>NIPs are not well understood, thought to be confusing, and are rarely used.</p> <p>Participants preferred pictorial labels that were simple, bright, and big.</p> <p>Simple and multiple traffic light labels were preferred, however the word 'saturates' was not understood.</p>	<p>Not generalisable to other groups.</p> <p>Did not assess understanding.</p>
Ni Mhurchu, 2007, New Zealand <sup>36</sup>	<p><i>Design:</i> Structured review</p> <p><i>Aim:</i> To determine how well NZ and Australian consumers use and understand nutrition labels and claims</p> <p><i>Study population:</i> N/A</p>	<p>Scientific review of literature on Australasian consumer's use and understanding of nutrition labels up to July 2005.</p> <p>16 papers were included.</p>	<p>Consumers generally have difficulty using the NIP, especially if comparing more than one nutrient.</p> <p>Nutrient claims are commonplace but frequently misunderstood, and consumers often sceptical about the trustworthiness of claims.</p>	<p>Did not include relevant international research.</p>

Author, Year, Country	Study Design	Methods	Main Results	Limitations
Clinical Trials Research Unit, 2007, New Zealand <sup>5</sup>	<p><i>Design:</i> Survey</p> <p><i>Aim:</i> To determine use and understanding of nutrition labels amongst Maori, Pacific and Asian shoppers</p> <p><i>Study population:</i> Stratified sample of Maori, Pacific, Asian, and other Auckland shoppers</p>	<p>1,525 shoppers recruited from 25 Auckland supermarkets completed a paper-based survey with the assistance of an interviewer.</p> <p>Labels compared were the NIP, simple traffic light, multiple traffic light, and %DI label.</p>	<p>Self-reported use of labels was moderate to high.</p> <p>Little difference in participants' ability to find information on the NIP by ethnicity or income. However, there were significant differences by ethnicity in ability to use NIP to determine if a food was healthy.</p> <p>Overall, participants preferred the multiple traffic light label format. Both simple and multiple traffic light label well understood. The NIP and %DI labels showed wide variability by ethnicity in ability to be used to determine if a food was healthy.</p> <p>'97% fat-free' and 'no added sugar' claims misled consumers. Up to ¼ of some ethnic groups thought a food was automatically healthy due to presence of a claim.</p>	<p>Label use was self-reported.</p> <p>Cross-sectional study so causality cannot be determined.</p>

Author, Year, Country	Study Design	Methods	Main Results	Limitations
TNS Social Research, 2007, New Zealand and Australia <sup>6</sup>	<p><i>Design:</i> Face-to-face interviews</p> <p><i>Aim:</i> Consumers' perceptions and potential use of %DI labelling and %RDI</p> <p><i>Study population:</i> People from New Zealand and Australia living in metropolitan areas.</p>	<p>51 in-depth interviews.</p> <p>69% female</p>	<p>Current use of %RDI (when available) very low.</p> <p>Consumers would require hands-on guided education on %DI labelling to be able to confidently use it. %DI did not add value for a significant proportion of participants. Non-NIP users or participants with English as a second language were unable to grasp the concept.</p> <p>Participants liked having information in large, colourful print on front of pack. If %DI is provided, it is preferred for all nutrients.</p> <p>Information on the back of the pack appears more credible, and will continue to be used by "savvy" consumers, rather than %DI on the front of packs.</p>	<p>Sample included only one city in New Zealand</p> <p>Low representation of indigenous peoples and people from non-English speaking backgrounds.</p>
FSANZ, 2007, New Zealand <sup>38</sup>	<p><i>Design:</i> Literature review</p> <p><i>Aim:</i> Summarise the literature on %DI labelling</p> <p><i>Study population:</i> N/A</p>	Methodology not provided	<p>%DV labelling:</p> <ul style="list-style-type: none"> <li>▪ required consumer education and increased the importance of educating consumers on label reading;</li> <li>▪ did not improve accuracy or time required to make decisions;</li> <li>▪ often caused confusion for consumers and was difficult to understand;</li> <li>▪ more likely to be used by well educated consumers; and</li> <li>▪ gave consumers the impression that %DV did not apply to them because they did not eat a 2000 calorie/day diet.</li> </ul>	<p>Unable to assess review methodology</p> <p>Literature from the US and UK and therefore may not be directly relevant to NZ</p>

Author, Year, Country	Study Design	Methods	Main Results	Limitations
Gilbey, 2005, NZ <sup>39</sup>	<p><i>Design:</i> Regional survey</p> <p><i>Aim:</i> To determine knowledge regarding salt and sodium and ability to use NIP to determine salt intake</p> <p><i>Study population:</i> People from multiple locations in a small city in the North Island, NZ</p>	226 participants surveyed about whether they monitor salt intake, and the maximum recommended level of salt intake. They were then asked how much salt was in one serving of a food, using the NIP.	<p>70% believed they could find how much salt was in the product. Of those, 83% interpreted sodium as meaning salt.</p> <p>Less than 2% participants could calculate amount of salt using sodium on the NIP, and understood that salt and sodium are not interchangeable.</p>	<p>Unlikely to be a representative sample (only age and gender details given).</p> <p>Small sample size.</p> <p>Survey response rates not reported.</p>
Williams, 2006, Australia <sup>40</sup>	<p><i>Design:</i> Product survey</p> <p><i>Aim:</i> Describe the use of nutrition function, health and related claims on packaged food for sale in Australia</p> <p><i>Study population:</i> N/A</p>	7850 food products in 47 different categories on sale in NSW in 2003 were examined for the presence and type of claims.	<p>Across all food categories, the mean number of health claims per product was 0.4. Overall, 14% of products carried some type of nutrition function, health, or therapeutic claim. General level claims were found on 9.8% of products.</p> <p>Foods with the highest use of claims were sports drinks (92%), energy drinks (84%), sports bars (57%) and breakfast cereals (54%).</p>	<p>Excluded nutrient content claims.</p> <p>Some food categories not included (eg. confectionary, nuts and seeds).</p> <p>Multiple pack sizes of the same product were included, creating potential for overestimation.</p>

Author, Year, Country	Study Design	Methods	Main Results	Limitations
Fabiansson, 2006, Australia <sup>43</sup>	<p><i>Design:</i> Nutrient analysis</p> <p><i>Aim:</i> To quantify precision of nutrition labelling on food products</p> <p><i>Study population:</i> N/A</p>	Five samples of 70 different food products purchased from supermarkets at different times. They were analysed for nutrient content, which was compared to stated level on NIP.	<p>Only 7% of analyses for individual nutrient components corresponded exactly with the NIP. Average difference ranged from -13% for potassium to +61% for trans fat. The range for trans fat was -98% to 1200%. Overall, 86% of label information within <math>\pm 20\%</math> of actual results (excluding variations in minor amounts).</p> <p>19 products carried a low energy or low fat claim. 19% exceeded the stated fat content, and 66% exceeded the value given for energy.</p>	Method for selecting products not given. No indication of whether samples were major or minor brands, or representative of what people usually buy.
TNS Social Research, 2006, New Zealand <sup>44</sup>	<p><i>Design:</i> Email survey</p> <p><i>Aim:</i> To investigate consumer interpretation of a 'no added sugar' claim</p> <p><i>Study population:</i> New Zealand and Australian members of an online market research panel aged over 18 years</p>	<p>1,007 respondents, comparable to Census demographics (ethnicity not reported), apart from lower representation of low-income groups.</p> <p>Response rate 35%, but no major differences between responders and non-responders.</p> <p>Participants shown a product mock-up which contained natural sugar and carried a 'no added sugar' claim. Half of the sample also saw a disclaimer on the label saying 'contains natural sugar'.</p>	<p>Good level of awareness that products with a 'no added sugar' claim may contain natural sugar.</p> <p>Adding a disclaimer that the product may contain natural sugar gave a small increase in the number who thought the product contained sugar.</p> <p>Participants appeared to have difficulty correctly assessing level of sugar in products, although this may be a function of the question asked and differences in classification of foods if using per serve or per 100g information.</p> <p>Whilst ~60% claimed to use the NIP in the study, only 33-39% actually turned the product over to look at it. ~ 80% of those who used the NIP looked at the sugar content.</p>	<p>Cross-sectional survey so cannot show causality.</p> <p>Minority and indigenous groups may have been under-represented.</p> <p>Low-income groups under-represented.</p> <p>Online market research so important respondent bias likely.</p>

Author, Year, Country	Study Design	Methods	Main Results	Limitations
AgriQuality, 2006, New Zealand and Australia <sup>45</sup>	<p><i>Design:</i> Product survey (2005)</p> <p><i>Aim:</i> Proportion of products carrying claims and their compliance with regulations</p> <p><i>Study population:</i> N/A</p>	<p>1399 food labels collected from retail food outlets in Auckland, Wellington, Christchurch (New Zealand) and Victoria (Australia).</p> <p>2% of SKUs from 14 food categories collected.</p>	<p>42% of the labels assessed carried claims. Of those, 96% carried nutrition claims and 25% carried health claims. 5% of labels carried NHF's Tick. The proportion of products carrying claims the same as in 2003.</p> <p>The food category with the greatest proportion of nutrition claims was foods intended for a particular dietary purpose (83%), followed by 68% of cereals, and 66% of dairy products.</p> <p>Most claims (84%) consistent with labelling requirements.</p>	<p>Sampling bias may have been introduced due to non-random product selection.</p> <p>Products primarily collected from major supermarket chains.</p>

## **Modelling studies**

No further modelling studies were identified.

## Intervention studies

The majority of nutrition labelling research continues to be surveys and focus groups and to rely on self-reported data. This type of research is limited by its inability to determine causality. Intervention studies, on the other hand, can determine the direction of cause and effect.

One further intervention study was identified in this review: an educational intervention with adolescents, which was a non-randomised study. An educational session on how to use the Nutrition Facts panel and %DV information led to an improvement in adolescents' overall ability to read labels. However, areas that caused more difficulty were changing serving sizes (as the Nutrition Facts panel only provides information per serving), determining which product had the highest or lowest level of a nutrient, and interpreting the relevance of the amount of a nutrient. The proportion of correct answers post-test generally showed moderate to good levels of understanding.

**Table 4: Summary of intervention studies**

Author, Year, Country	Study Design	Methods	Main Results	Limitations
Hawthorne, 2006, United States <sup>46</sup>	<p><i>Design:</i> Questionnaire; pre- and post-test</p> <p><i>Aim:</i> Assess adolescents' understanding of the Nutrition Facts Panel, and their response to an education program on it</p> <p><i>Study population:</i> Ethnically representative sample of adolescents aged 11 to 14 years in the Greater Houston area</p>	A questionnaire was given to 34 adolescents, followed by a one-hour education session and pre- and post-test on the Nutrition Facts panel.	<p>The Nutrition Facts Panel influenced knowledge on healthfulness of a food never (32%), sometimes (36%) or very (32%) [sic].</p> <p>Test scores improved significantly after education session, from 55% correct answers to 70%. However, increase only significant for three out of twelve individual questions.</p>	<p>Small sample size.</p> <p>Relatively few African-American and Asian-American meant ethnic variations could not be determined.</p> <p>It is possible children were from families with a high level of nutrition interest.</p>

## **Research with specific population groups**

### ***Age***

One study looked at Nutrition Facts panel understanding amongst adolescents<sup>46</sup>. Most adolescents were able to find calorie information provided on the label, however % daily value provided on the US Nutrition Facts panel meant little to them. Understanding improved substantially once they had attended an education session on its meaning.

### ***Ethnicity***

The original review identified a noticeable lack of research on nutrition labels among low-income, low-education, or ethnic minority populations. A report on focus group work carried out with Maori, Pacific, and low-income shoppers<sup>37</sup> and a report on a large nutrition labelling survey<sup>5</sup> have been the only recent research in this area, and are discussed in the section on New Zealand and Australian research.

### ***Income and education***

Income and education were found to be weakly associated with label reading in a study in Romania<sup>47</sup>, whereas label use increased by almost a third with each increase in level of educational attainment in the US<sup>48</sup>. Higher performance in using nutrition labels was associated with higher income and education<sup>49</sup>. In New Zealand, education was not associated with label use, however participants with a medium household income (\$40-\$80k) had 1.7x greater odds of label use than those from a low-income household (<\$40k)<sup>5</sup>. In focus groups in New Zealand, 80% of low-income participants did not use the NIP when deciding which foods to buy, as cost was more important<sup>37</sup>.

### ***Factors influencing use and understanding of nutrition labels***

The price sensitivity of shoppers influences label reading, with shoppers who were more price sensitive slightly less likely to read nutrition labels<sup>50</sup>. This has been supported in other research - where price is the main priority, healthfulness of the food often takes lesser priority<sup>37</sup>.

Numeracy and literacy are two skills that are frequently necessary to be able to understand nutrition labels. In a study assessing the impact of numeracy and literacy on label reading, it was found that many people struggled to understand the label and made mistakes interpreting the information, despite reporting they were easy to understand<sup>49</sup>. Whilst 69% of survey questions were answered correctly, some individual tasks, such as calculating how much carbohydrate was consumed in a bottle of drink, were only calculated correctly by 32% of participants. Difficulties were experienced when calculating amounts that differed from the serving size provided on the Nutrition Facts panel.

Design of the label may also impact on ease of understanding. One study aimed to match type of cognitive processing required with label design, and found matching the two produced quicker and/or more accurate decisions<sup>17</sup>.

**Table 5: Summary of research with specific population groups**

<b>Author, Year, Country</b>	<b>Study Design</b>	<b>Methods</b>	<b>Main Results</b>	<b>Limitations</b>
Petrovici, 2006, Romania <sup>47</sup>	<p><i>Design:</i> Face-to-face questionnaires</p> <p><i>Aim:</i> Identify factors that impact on dietary health preventative behaviours</p> <p><i>Study population:</i> Sample of main household shoppers residing in Bucharest, Romania</p>	Random route sampling following stratification of the city into 120 residential areas. 485 interviews carried out at participant's residence.	<p>The frequency of reading food labels was weakly but positively associated with health motivation, income, education level, and particularly by nutrition knowledge, and negatively associated with age.</p> <p>Whilst self-reported nutrition knowledge was associated with label use, objectively measured knowledge was not.</p>	<p>Nutrition knowledge scale not validated.</p> <p>Limited set of variables measured.</p> <p>Cross-sectional data.</p>

Author, Year, Country	Study Design	Methods	Main Results	Limitations
Blitstein, 2006, USA <sup>48</sup>	<p><i>Design:</i> Cross-sectional telephone survey</p> <p><i>Aim:</i> To evaluate characteristics associated with label use among persons responsible for household food purchasing</p> <p><i>Study population:</i> Representative sample of adults aged &gt;18 years</p>	<p>Survey respondents recruited using random digit dialling. 1139 interviews completed.</p> <p>Response rate 28%</p> <p>A sub-sample of 390 adults who live with at least one minor child was used for this analysis.</p>	<p>Age, sex, education, and marital status significantly related to nutrition label use.</p> <p>Females more likely than males to use labels; married people more likely than unmarried to use labels; likelihood of label use increased ~30% for every increase in level of education; and likelihood of label use increased ~3% for each additional year of age.</p>	<p>Sub-sample were more likely to be younger, married, and black or Hispanic than those in the original representative survey.</p>
Rothman, 2006, United States <sup>49</sup>	<p><i>Design:</i> Cross-sectional study</p> <p><i>Aim:</i> Examine patients' ability to read and understand food labels, and the relationship of comprehension with numeracy and literacy</p> <p><i>Study population:</i> Primary care patients aged 18 to 80 years</p>	<p>200 participants completed a questionnaire to assess behaviours related to nutrition label use, health-literacy, mathematics skills, and food label comprehension.</p> <p>68% had some college education, and 77% had a minimum of 9<sup>th</sup> grade level <i>literacy</i>. 63% had less than 9<sup>th</sup> grade <i>numeracy</i>. (percentages don't add up ??? 63% vs 77%)</p>	<p>89% reported using food labels. Many confused by complexity of Nutrition Facts panel and could not find proper information on the label, or incorrectly used information when it was irrelevant. More likely to make errors if involved fractions or decimals.</p> <p>69% questions answered correctly. Only 32% participants correctly calculated amount of carbohydrates in a 20-oz bottle of soda that had 2.5 servings. Only 60% calculated the amount of carbohydrate in half a bagel, when the serving size was the whole bagel.<sup>†</sup></p> <p>Higher performance on the labelling survey was significantly correlated with higher income, higher education, higher literacy skills, and higher numeracy skills.</p>	<p>Cross-sectional so cannot prove causality.</p> <p>Not a representative sample.</p> <p>Small sample size.</p>

<sup>†</sup> Note that US Nutrition Facts labels usually only present amount per serve information

Author, Year, Country	Study Design	Methods	Main Results	Limitations
Marino, 2005, United States <sup>17</sup>	<p><i>Design:</i> Within-subject experimental study</p> <p><i>Aim:</i> To see if decisions were better when the label format matched the cognitive processing required for the type of decision making</p> <p><i>Study population:</i> 25 participants from the University of Georgia undergraduate research pool</p>	<p>Two types of label were tested: the US Nutrition Facts panel was used as a separable design (for making comparisons) and a radial spoke was used as a configural design (for filtering and integrating decisions) (Figure 12). The %DV for each nutrient was plotted on a spoke of the radial, then joined together to make a polygon. The greater the area of the polygon, the greater the %DV.</p> <p>Three experiments were carried out with participants asked to complete 50 decision making tasks using each label type.</p> <p>72% of participants women, and participants had a mean age of 19 years.</p>	<p>When asked to compare two products, decisions were quicker but no more accurate with a configural design.</p> <p>When asked to assess overall nutritional quality of a food, a configural design enabled quicker and more accurate decisions.</p> <p>When asked to calculate the number of serves of a food needed to meet %DV of a particular nutrient, a separable label design led to a higher proportion of correct answers, but no difference in decision time.</p> <p>Matching the decision task to type of visual display may enhance the usefulness of nutrition labels. However, one label format cannot support all tasks equally well.</p>	<p>Participants were college students, and therefore likely to be a biased sample.</p> <p>Although not necessarily proposed as a final label format, the radial spoke design was large and is likely to require extensive consumer education to understand.</p> <p>Small sample size.</p>
Bowman, 2006, United States <sup>50</sup>	<p><i>Design:</i> National survey</p> <p><i>Aim:</i> To compare the SES, dietary practices, and health of women shoppers who considered food price very important with those who did not.</p> <p><i>Study population:</i> Women in the USDA Diet &amp; Health Knowledge Survey</p>	<p>Face-to-face and telephone interviews with 2594 women.</p> <p>Data is from the US Dept of Agriculture's Diet and Health Knowledge Survey 1994 to 1996 and Continuing Survey of Food Intake by Individuals 1994 to 1996.</p>	<p>Women shoppers who were price sensitive read the ingredients list less often (31%) than those who were not price sensitive (37%). They also read the nutrition panel less often (40% vs 47%).</p>	<p>Study not designed to primarily look at label use.</p> <p>Women in the 'price not very important' category included women who had said price was somewhat important.</p>

## Other

Four other studies were found in this review that do not fall within the previous categories. In Canada, margarines that carried a claim were more expensive, although this did not apply to oils<sup>51</sup>. The healthier margarines (those with lower levels of saturated and trans fat) were also more expensive. For oils, a positive association was seen between price and saturated fat content, however this was mostly due to olive oil, which had both a high price and the highest saturated fat content compared to other oils (the other oils are not specified, but are likely to be oils such as canola, sunflower, and safflower oil). Once it was removed from analyses, this effect was not seen.

A theoretical examination of the value of labelling to consumers found people were theoretically prepared to pay a small premium to have nutrition labelling on food<sup>52</sup>. There are a wide range of labelling schemes in use in the US, Canada, Australasia, and Europe, many of which show a symbol if the food meets certain criteria<sup>53</sup>. There seems to be little consistency between labelling schemes<sup>53</sup>, and consumers have indicated they would like standardisation and consistency in labels across manufacturers<sup>54</sup>.

Author, Year, Country	Study Design	Methods	Main Results	Limitations
Ricciuto, 2005, Canada <sup>51</sup>	<p><i>Design:</i> Product survey</p> <p><i>Aim:</i> To examine the relationship between price and amount of saturated and trans fat in margarines and oils, and the relationship between price and presence of nutrient content claims</p> <p><i>Study population:</i> N/A</p>	<p>A survey of all margarines and oils sold in nine major supermarkets in the Greater Toronto area. Data on 229 margarines (34 brands) and 342 oils (67 brands). Brand, package size, regular price, fat composition, nutrient content claims, and company contact information recorded.</p>	<p>Half the margarines displayed nutrient content claims.</p> <p>Margarines with a claim were significantly more expensive (average 37% higher price) than those without a claim. For oils, price was not associated with the presence of a claim.</p> <p>Margarines lower in saturated and trans fat cost significantly more than margarines with higher amounts of these fats.</p> <p>For oils, there was no significant positive association between price and saturated fat content, once olive oil excluded from analysis.</p>	<p>Did not determine impact on actual purchases.</p>
Loureiro, 2006, Spain <sup>52</sup>	<p><i>Design:</i> Face-to-face survey</p> <p><i>Aim:</i> To analyse the economic value consumers place on nutrition labelling</p> <p><i>Study population:</i> Residents of Zaragoza. Representative of Spanish population, except for fewer minority groups.</p>	<p>400 Spanish food shoppers randomly selected and surveyed outside a representative sample of grocery stores.</p> <p>72% female, average age 47 years, 35% with children under the age of 18 years. Mean household income €1,500-€2,000/month.</p> <p>&lt;1% of shoppers considered to be in low social class category (self-classified). 18% with low household income.</p>	<p>40% of sample paid attention to whether food carries a nutrition label (nutrition labelling not mandatory).</p> <p>Only 6% rarely or never read nutrition labels.</p> <p>76% preferred to buy a food with a nutrition label</p> <p>Consumers would be willing to pay 11% more for a product with a nutrition label than one without. Participants with health conditions willing to pay 13% more, whilst participants without health conditions willing to pay 9% more.</p> <p>Age, income and education significant determinants of willingness to pay for the group with health conditions, but there was no influence in the group without health conditions.</p>	<p>Highly theoretical and results unlikely to apply in real world situations.</p> <p>Very small number of shoppers from low social class.</p> <p>Sample contained fewer people from minority groups than general population.</p>

Author, Year, Country	Study Design	Methods	Main Results	Limitations
Stockley, 2007, Europe <sup>53</sup>	<p><i>Design:</i> Report / review</p> <p><i>Aim:</i> Review of front of pack nutrition labelling schemes</p> <p><i>Study population:</i> N/A</p>	<p>Literature and web based search.</p> <p>Included information published since 2000 in the USA, Canada, Australia, New Zealand, and Europe.</p>	<p>Consumers prefer schemes that are not fee-based and are credible and authoritative.</p> <p>More point-of-purchase schemes (symbol only on healthier food choices) are in existence than banding schemes (indicate nutrient levels on all foods). This is possibly because point-of-purchase schemes are more acceptable to the food industry.</p> <p>Schemes comprise a mixture of food category-specific and across-the-board nutrition criteria.</p> <p>The most established government scheme is the Green Keyhole in Sweden. The UK has instituted a multiple traffic light scheme.</p> <p>Non government organisations are prominent in the development of front of pack schemes. Where schemes are fee-based they have resulted in self-selected participation by companies and some consumer cynicism.</p>	<p>The literature review only highlighted one paper (Marino<sup>17</sup>) since Cowburn &amp; Stockley's paper which was discussed in the original review.</p>

Author, Year, Country	Study Design	Methods	Main Results	Limitations
FSA, 2006, United Kingdom <sup>54</sup>	<p><i>Design:</i> Workshop sessions</p> <p><i>Aim:</i> To determine information consumers want on labels</p> <p><i>Study population:</i> Representative sample of the food-buying population from locations across the UK</p>	<p>Ten workshop sessions held with 8-10 participants each. Six workshops exploratory and four solution-focussed.</p> <p>Amongst the wide array of labelling stimulus material used were a nutrition table, nutrition signposting (eg. high or low fat/sugar), and guideline daily amounts.</p>	<p>Food labelling often hard to use.</p> <p>Front-of-pack icons to communicate product information such as nutrition were well liked and widely used. They added most value when colour was used to signify high, medium, or low level of a nutrient. Inclusion of % GDAs seen as overcomplicated or repetitious of nutrition table.</p> <p>Inconsistency in labelling between different manufacturers and retailers causes difficulty.</p> <p>Consumers want to retain most of the information on packages, as long as it is presented in an understandable way.</p> <p>Wanted to simplify food labelling by standardising it.</p>	Results were in relation to all of the food label, not just nutrition information

## Key findings and recommendations

There is an increasing focus on communication of nutrition messages and nutrition labelling. As such, consumer use and understanding of nutrition labels and their impact on behaviour is a growing area of research. This review summarises 42 relevant studies published between August 2005 and September 2007. New Zealand and Australia has contributed nearly a quarter of these studies. Many studies included in the review have used self-reported outcomes, non-representative samples, and few focussed on ethnic minorities or low-income groups. Whilst the research includes many cross-sectional surveys, there has also been a substantial amount of qualitative research. Some studies have used experimental settings which are different to a normal food shopping or eating experience. The applicability of results may therefore be limited.

From the review it seems that rates of self-reported use of nutrition labels may be increasing in some groups. The upper end of label use reported was higher than estimates in the original review. However, it is also evident that when objectively measured, many consumers still find nutrition labels difficult to understand.

It is clear that there is an increasing focus in the literature on front-of-pack labels in efforts to simplify nutrition labelling for consumers. This has been largely driven by research in the UK, where front-of-pack labels are being implemented. Whether this labelling will actually improve dietary choices, and indeed whether nutrition labels themselves improve dietary choices, is still to be determined. However, anecdotal evidence exists from Tesco's and Sainsbury's supermarkets in the UK that introduction of their front-of-pack signposting systems have led to increasing sales of healthier products and reduced sales of food with less favourable nutrient information<sup>31</sup>. Tesco's uses a non-colour coded GDA label, and Sainsbury's a traffic light pie design.

There is still some way to go in delivering nutrition labels that achieve high levels of consumer understanding. The original review noted that no consensus had emerged on the most useful label format and this remains the case. Despite this, the number of front-of-pack signposting schemes is increasing globally<sup>55</sup>. In Europe, it is now felt that front-of-pack labelling has been accepted by the food industry and the conversation has moved from whether there will be front-of-pack labelling to what type of labelling<sup>56</sup>.

More than one-third of the UK retail market has signed up to a voluntary front-of-pack labelling scheme, and it was expected that 30-40,000 products in the UK would be carrying signposting by January 2007<sup>55</sup>. However, the food industry in the UK has also been criticised for not taking fully on board the FSA's recommendations, and for developing their own versions of front-of-pack labels<sup>56</sup>. The wide range of labelling schemes being developed and the lack of consistency between them risks causing consumer confusion. Front-of-pack labels do, however, have good levels of consumer acceptance, and the need for them is recognised. The main types of front-of-pack labels investigated in the literature over the past two years have been traffic light labels, GDA labels, and % daily intake labelling. There has also been continued examination of % daily value on the Nutrition Facts Panel, and of the NIP.

Whilst it is obvious that one type of label will not suit everyone, research indicates that % daily intake labels seem of most use to a select group of people, who already use labels and are unlikely to gain much additional benefit from another label. Furthermore, they are likely to require a substantial commitment to education of consumers. New Zealand research shows that it is not a popular method of labelling and is not well understood. A further problem with % daily value labelling is the difficulty people experience in calculating amounts when serving sizes are different to those listed on the pack. The mathematical skill required to make this calculation is beyond much of the general population. Consumers are asking for nutrition information that is simpler and easier to use. Percentage daily intake labels generally do not achieve this, other than for experienced label readers. Having said this, colour-coded GDA labels in the UK, which work on a similar concept, were popular with consumers in pre-testing. Subsequent analysis again suggests they may be more useful to specific groups of people. One of the reasons hypothesised for their popularity was that the increased level of detail gave reassurance about how the colour-coded recommendations were decided<sup>31</sup>. However, if traffic light labels were implemented, this reassurance could be provided by retaining the NIP on the back of food labels.

People often do not have a context in which to place the nutrition information they obtain from labels. So whilst, they might be able to find nutrient information, they often do not know what it means in a dietary context. This limits the usefulness of the information to them. Therefore, providing labelling that assists consumers to interpret nutrition information would appear to be beneficial. Traffic light coloured labels assist

with this interpretation by telling consumers whether the nutrient level is high, medium, or low and thereby provides them with a benchmark.

There are two forms of traffic light labels – simple traffic lights with an overall red, orange, or green rating for the food, or multiple traffic lights with individual ratings for specific nutrients in the food. Multiple traffic light labels have received considerable attention and appear to be an easily and quickly understood label format across all groups of people. They are better able to be used and understood by ethnic minorities and low-income groups. Multiple traffic light labels were recommended for implementation in the UK. Simple traffic light labels were not as well-liked by UK consumers, and this was also found in New Zealand research, despite being well understood. There has been a suggestion that the two traffic light labels could be combined front-of-pack and this would give consumers an overall food healthiness rating, whilst allowing them to see how that rating was achieved, or to focus on individual nutrients of interest.

Other systems tested were calorie flags which highlighted calorie or energy content per serve or per 100g of food. The simplest calorie flags were favoured. Labels that use only serving size information would require standardisation of serving sizes if implemented in New Zealand and Australia. A supermarket chain in the United States has also implemented a star rating for foods, which it reports having been successful in guiding consumer choice<sup>57</sup>.

Nutrition labels and food packaging are the interface between food manufacturer and consumer. The food manufacturer, on one hand, is naturally trying to differentiate their product from the competition and sell more of it. The consumer is trying to determine if the food will meet their needs. Regulation exists to ensure that consumers are not misled in the manufacturer's attempt to sell the product, and that a minimum level of information is available on which to base their decision. However this does lead to tension between what is in the interests of the consumer, and what the manufacturer wishes to present in order to sell their product. Claims on food are one example of this. Whilst they seem to influence intent to purchase foods, they also create misperceptions for consumers, for example that they can eat more of the food because it is low fat, or no added sugar means there is no sugar whatsoever in the food. They can be particularly misleading for some ethnic or lower-income groups. When up to three-quarters of some groups are misinterpreting a claim as meaning that a food is

automatically healthy, the claims do not appear to be serving a useful purpose for consumers. The value of claims on food packages is therefore questionable, especially if front-of-pack labels were introduced. Front-of-pack labels should provide quick consumer guidance making nutrition claims unnecessary.

It is encouraging to see some progress in examining nutrition label use and understanding amongst Maori, Pacific, and low-income shoppers. If we are serious in tackling health inequalities, nutrition labels must meet the requirements of groups who suffer disproportionately from nutrition-related disease. Traffic light labels have been shown to be better understood than other label formats by low-income/low-socioeconomic status or ethnic minority groups both in New Zealand and the United Kingdom. The lack of use of the Tick by Maori, Pacific, and low-income groups highlight the importance of across-the-board labelling schemes that are on all food products, not just premium products. This ensures the label has relevance to the types of foods purchased by all groups in our population.

There are still some key gaps in the literature, most notably objective evidence on the impact of nutrition label use on food purchasing behaviour and dietary quality. Put simply, does using nutrition labels lead to healthier choices? This is the ultimate purpose of nutrition labels, but as yet we cannot be certain they are serving their intended purpose. We still do not have good understanding of how nutrition labels are used in a real-world setting.

Based on the research presented in the review, our recommendations are as follows:

- Make enhancing understanding of nutrition labels for consumers a priority. Front-of-pack labelling that is quick and easy to understand, without the need for extensive education, is beneficial. Overall consumers seem to prefer labels that rely less on numerical data, are colourful, and assist with interpretation of nutrition information.
- Ensure labels meet the needs of ethnic minorities, indigenous, low-income, and other vulnerable groups at greater risk of health inequalities.
- Aim for standardisation and consistency with labels, and implement at a national level.
- Examine the role of claims, as they appear to mislead many consumers, and seem to serve more of a marketing role than proper consumer education.

- Conduct more high quality, rigorous intervention studies to measure the effect of nutrition labels on consumer behaviour and food purchases.
- Conduct rigorous evaluation of sales data and consumer views prior to and following implementation of new nutrition labels.

## **Conclusions**

The main priorities for nutrition labelling are to enhance its usability for consumers, and to determine the impact of label use on consumer behaviour. Focus has now shifted to the most appropriate front-of-pack label to achieve greater consumer understanding. However, one label is unlikely to suit everyone. As the NIP is likely to remain on the back-of-pack for consumers who currently use it, front-of-pack labels should target those who currently find labels difficult to understand. A front-of-pack label should aim to overcome disadvantages of back-of-pack labels for many people such as time taken to read it, numeracy skills required, and print being too small. We have learnt from the NIP that labels which require some education in order to understand them are never going to be well understood by large segments of the community. Front-of-pack labels should therefore focus on what people like – a simple, colourful guide that is quick to use and easy to understand whilst retaining credibility.

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