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Review

A critical assessment of nutrition labelling and determinants of its use and understanding

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Summary. Over the years, nutritional information on food packages has gained popularity among food manufacturers and consumers due to increasing consumer interest in health and dietary issues. Nutrition label acts as a marketing tool for food manufacturers and is a source of information for the purchaser. It acts as a regulatory mechanism whereby consumers are protected and fair trading is encouraged. Despite its importance in assisting consumer in making informed dietary choices, nutrition labelling is not mandatory in all countries. There is a strong need for the development of a harmonised regulatory framework with stakeholders involved. The effectiveness of nutritional labels is also dependent on individual characteristics, health-related factors, and situational, attitudinal and behavioural factors. Numerous studies have investigated factors influencing nutrition labelling use and while some findings corroborated each other, others reported opposite findings. Possible ways to promote use and understanding of nutrition labels would be to present it in an appropriate format together with nutrition education being carried out for any nutritional information provided. This paper aims to critically assess the types of nutritional information provided, the regulatory issues and the research work carried out on its determinants of use and understanding.

Key words: nutritional information, labels, use, understanding

Nutritional information on food labels

An important underlying principle of promoting health is the creation of supportive environments that help people to make healthy choices. The nutritional information on food labels of food products is one means of informing consumers about the composition of food items and assists them in selecting foods in accordance with dietary recommendations (1). In this study, an extensive analysis of peer reviewed articles documenting the guidelines pertaining to nutrition information as well factors associated with determinants of nutrition label use are discussed. Scientific reports were downloaded from recognised databases, such as PubMed, Ebsco, Elsevier (Science direct), Springer and other online research databases using key words such nutritional information, nutritional labelling, label use, determinants of nutritional labels and understanding amongst others over the last 20 years.

In a climate where the prevalence of diet-, nutrition- and health-related disease is increasing, it is crucial that the nutritional information provided on food labels is appropriate and understandable to the consumer as it has an impact on food-choice behaviours. Food manufacturers can use this as a vehicle to communicate essential information about the nutritional value and composition of their product and represents a valuable tool to help consumers make informed decisions about their diet and lifestyle (2).

Nutrition label use appears to be a mechanism through which health conscious people make healthy dietary decisions. Even those people who do not give

importance to healthy meal preparation, use of nutrition labels leads to healthier dietary choices which suggest that irrespective of attitude towards healthy eating, nutrition label can independently relate to healthy dietary choices (3). However, Higginson et al. (4) concluded that considerable effort needs to be expended by nutrition educators and health promoters on consumer education in order for nutrition label information effectively facilitate healthy food choices.

Types of nutritional information

According to the World Health Organization and Food and Agriculture Organization of the United Nations (WHO/FAO) (5), there are three types of nutritional information that may be present on food labels: nutrition labelling, nutrition claims and health claims.

Nutrition labelling

Nutrition labelling is a description intended to inform the consumer of the nutritional properties of a food and consists of two parts namely nutrient declaration and supplementary nutrition information. Nutrient declaration means a standardised statement or listing of the nutrient content of the food and is mandatory for foods for which nutrition claims are made and voluntary for all other foods. Nutrient declaration should include energy value; amount of protein, available carbohydrate and fat; amount of any other nutrient for which a nutrition or health claim is made; the amount of any other nutrient considered relevant for maintaining a good nutritional status (5).

The declaration of nutrient content should be in numeric form. Energy value should be expressed in kilojoules and kilocalories per 100 g or 100 ml. Information on the amount of protein, carbohydrate and fat should be in the form of gram per 100 g or per 100 ml. Protein content may also be expressed as a percentage of the Nutrient Reference Value. The information on vitamins and minerals should be expressed in metric units and/or as a percentage of the Nutrient Reference Value per 100g or per 100ml. This information may also be expressed per package provided the package contains only a single portion. Additionally, per serving as quantified on the label or per portion may also be used if the number of portions contained in the prepackaged product is stated (5).

On the contrary, supplementary nutrition information is intended to increase the consumer's understanding of the nutritional value of their food and to assist in interpreting the nutrient declaration. However, the use of supplementary nutrition information on food labels is voluntary but should be given only along with the nutrient declaration and not replace it. This information should be accompanied by consumer education programmes to increase consumer understanding and use (5).

Nutrition claims

Nutrition and health claims are now established ways of communicating information about the healthiness of a food that contains extra or reduced ingredients. Relevant information on food content and the health benefits of the food are conveyed to the consumers to facilitate the making of well-informed food choices and which in turn contribute to improvements in public health (6). Nutrition and health claims are used by the food industry to inform the consumers of the health benefits of food products. In addition to the use of claims on the pack of food products, its scope also extends to advertisements, promotional campaigns, websites, catering establishments and menus among others (7).

According to the FAO/WHO (5), a nutrition claim is a representation stating, implying or suggesting that a food has particular nutritional properties which includes but is not restricted to its energy, protein, fat and carbohydrate content as well as the vitamins and minerals content. There are two types of nutrition claim which include the nutrient content claim and the nutrient comparative claim. Nutrient content claim is defined as a nutrition claim which describes the level of a nutrient contained in a food product. Examples of nutrient content claims are "source of calcium", "high in fibre" and "low in fat". On the contrary, a nutrient comparative claim is one that makes a comparison of the nutrients level and/or

energy value of two or more food products. Examples include "reduced", "less than", "fewer", "increased" and "more than".

Health claims

It was reported that the difference between a health claim and a nutrition claim lies in the fact that health claim imparts information about the effect of the food on health whereas a nutrition claim imparts information about the food content which is the reason why health claims undergo more stringent assessment process before authorisation (7). There are three types of health claim (5), as shown in Figure 1.

Nutrient function claim states that a nutrient present in the food can assist in the normal physiological growth, development and functions of the body. One example of such a claim is "folate is an important component in red cell formation" (8). The second type of health claim is the other function claim. The FAO/WHO (5) defines other function claim as claims which concern the specific beneficial effects of the nutrients or other substances of the food product, consumed on the context of a normal diet, on the normal functions or biological activities of the body. Other function claims distinguishes from nutrient function claims in that the former make claims that nutrients, or other substances present in the food product may cause improvements or modifications in the normal physiological functions of the body. One example include: "calcium may help improve bone density" (8).

Lastly, the third type of health claim is the reduction of disease risk claim. These claims refer to the fact that the consumption of the nutrients or other substances present in the food product as part of a normal diet may cause a reduction in the risk of developing a disease or a health-related condition (5). Further, risk reduction implies significantly altering one or more of the major risk factors of a disease or health-related disease and as diseases may have many risk factors, simply modifying one of these risk factors may or may not have a beneficial effect. Consequently, there is a need to ensure that consumers do not misinterpret these risk reductions claims as prevention claims. One example of such a claim is "A healthful diet rich in nutrient or substance A may reduce the risk of disease D or Food X is high in nutrient or substance A".

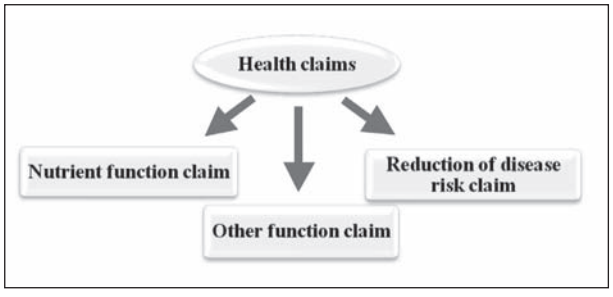

Figure 1. Types of health claims. Source: WHO/FAO, 2007

NLEA and Nutrition Facts Label

In 1990, the Nutrition Labeling and Education Act (NLEA) was passed in the United States. It amended the existing 1938 Federal Food, Drug and Cosmetic Act. The FDA, as directed by the NLEA, developed regulations that required the labelling of certain nutrients levels on packaged foods. The FDA also created a framework that would allow manufacturers to voluntarily use truthful and non misleading nutrient content claims and health claims on the food labels. As such, the NLEA gave the FDA the authority to protect the consumers from being misled. The NLEA also required that such information be consistent with the new regulations established by the government thus encouraging manufacturers to formulate foods with better nutrient profiles (9).

The Nutrition Facts panel serves as the cornerstone of nutrition labelling and provides the required declaration of the nutritional value of the food. It was developed as a tool to assist consumers in identifying foods that will make up a balanced diet, primarily through the comparison of the nutrient content of foods. However, providing information about the nutrient content of the food does not alone guarantee improved nutrition. Consumers should also possess the ability or willingness to act on that information in order to be able to make healthy dietary choices (9).

The components of the nutrition panel include mandatory and voluntary dietary information. The information in the main or top section can vary with

each food product; it contains product-specific information (serving size, calories and nutrient information). The bottom part contains a footnote with Daily Values (DVs) for 2000 and 2500 calorie diets. The footnote provides recommended dietary information for important nutrients which includes fats, sodium and fibre (10).

The serving size: The first component of the nutrition fact panel is the serving size and the number of servings in a food package. Serving sizes are standardised to make comparison of similar foods easier (10). They are expressed in common household and metric measures (11). According to Kessler et al. (12), the serving size on a product affects virtually every number on the Nutrition Facts label.

Calories (and calories from fat): Calories listed on the label provide a measure of how much energy is present in one serving of the food. This section can help in weight management, that is, weight gain, loss or maintenance. The 'calories from fat' part is a measure of how many calories comes from fat in one serving. The number of serving consumed determines the number of calories consumed (10). According to Gordon and Hayes (13), calorie labelling is one avenue for educating consumers about nutrition.

Nutrients: The nutrition facts label list the amounts of total fat, saturated fat, trans fat, cholesterol, sodium, total carbohydrate, dietary fibre, sugars, protein, vitamins A and C, calcium and iron that are present in one serving of the food. These nutrients are separated into two main groups: (i) Limit These Nutrients and (ii) Get Enough of These. Hence, this information can not only be used to limit the nutrients harmful to health but to also increase the nutrients needed to be consumed in greater amounts (10).

Understanding the footnote on the bottom of the Nutrition Facts labels: The footnote contains the Percent Daily Values. It reminds that these values are based on a 2,000 calorie diet and they vary depending on calorie needs. The remaining information may not be present on smaller nutrition labels and they are not product specific (10). The two major roles of percent Daily Values are to allow consumers to make comparison between similar products and evaluate how a product fits into an overall healthy diet (14).

The Codex Alimentarius and the regulation of nutrition labelling and claims

The Codex Alimentarius is a set of international standards, guidelines and related texts for food products which become effective upon adoption by the Codex Alimentarius Commission (CAC). These food standards and guidelines are recognised by the World Trade Organisation. Codex has two primary aims which are to protect the consumers' health through improve quality and safety, and assure fair practices in trade (15). Codex documents may be used as templates for individual national regulations or as the basis for international trade agreements (16).

The Codex Committee on Food Labelling has the responsibility of developing guidelines on nutrition labelling and claims and has the following objectives: "(a) to draft provisions on labelling applicable to all foods; (b) to consider, amend if necessary, and endorse draft specific provisions on labelling prepared by the Codex Committees drafting standards, codes of practice and guidelines; (c) to study specific labelling problems assigned to it by the Commission; and, (d) to study problems associated with the advertisement of food with particular reference to claims and misleading descriptions" (8). So far, according to Hawkes (8), the Codex Committee on Food labelling has developed the following standards and guidelines relevant to nutrition labelling and claims shown in Figure 2.

Overview of existing regulations on nutrition labelling and claims in different countries

Countries can be grouped into two broad categories based on type of regulations they have on nutrition labelling and claims (17). These two categories are mandatory or voluntary. *Mandatory:* Countries where nutrition labelling is mandatory, even in the absence of a nutrition or health claim. In addition, they provide guidelines on how nutrients must be listed and on what basis (for example, per serving/per 100g). Provision of additional nutrition information on a voluntary basis is also allowed. Countries having mandatory nutrition labelling include the European Union (EU) member states, United States, Canada, Mexico, Ar-

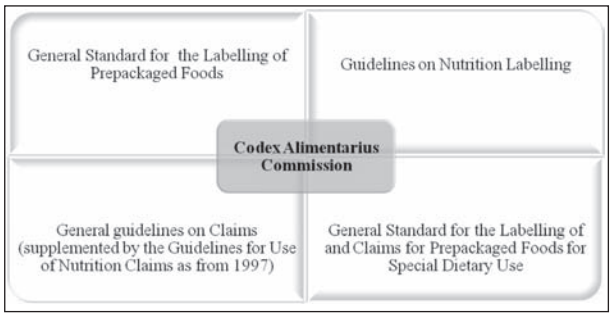

Figure 2. Standards and guidelines developed by the Codex Alimentarius Commission (Source: Hawkes 2004)

gentina, Brazil, Chile, Colombia, Ecuador, Paraguay, Uruguay, Israel, India, Indonesia, China, Hong Kong, South Korea, Malaysia, Taiwan, Australia and New Zealand. *Voluntary:* Countries where state-sponsored guidelines are provided and can be followed voluntarily. Guidelines on how nutrients must be listed and on what basis are defined but nutrition labelling is not mandatory unless a nutrition or health claim is made or unless the food is for special dietary uses. Countries involved include Venezuela, Turkey, Singapore, Philippines, Thailand, Japan, Kenya, Mauritius, Nigeria and South Africa.

In Mauritius, according to Hawkes (8), nutrition labelling was introduced in the Food Regulations of 1999 (made under the Food Act 1998). The regulations established the specific nutrients that must be labelled for a series of selected nutrition claims. The labelling of protein, fat, carbohydrate, vitamin and mineral content on infant foods per 100g of the packaged food was also mandated. However, according to the Nutrition Unit of the Ministry of Health and Quality of Life of Mauritius (18), one of the objectives of the national plan of action for nutrition 2009-2010 will be the introduction of Front of pack nutritional signpost labelling. This new labelling system will aim at reinforcing information on healthy eating habits and increase understanding of the relationship between nutritional health and well-being, and also helps to reduce the risk of nutrition-related diseases. Further, the Food Regulations will be amended so as to make food labelling mandatory.

Current status of nutritional labelling and claims in the European Union.

The growing public interest in the relationship between diet and health and increasing public health problems in Europe were among the determining factors which made the European Commission to propose a harmonised legislation on nutrition labelling (19). In the European Union, nutrition and health are controlled by the Regulation (EC) No 1924/2006 of the European Parliament and of the Council of 2006 amended in 2008. This regulation set out the procedures required to ensure that claims made are meaningful, non-misleading and scientifically substantiated (20). Nutrition and health claims are considered as strong marketing incentives for the food industry; consequently, these should be strictly regulated in order to maintain consumer confidence (21). In 2011, the new EU regulation 1169/2011 brought considerable changes to existing legislation of food labelling. These changes included the provision of nutrition information on processed foods; labelling of country of origin of fresh meat from pigs, sheep, goats and poultry; highlighting allergens in the list of ingredients; better legibility, that is size of text; inclusion of information on allergens on non pre-packed foods including those sold in restaurants and cafés. The new regulations combine the two directives 200/13/EC (labelling, presentation and advertising of foodstuffs) and 90/496/EEC (nutrition labelling for foodstuffs) into a single legislation. The new rules have been in force as from 13th December 2014 and the obligation to provide information will apply from 13th December 2016 (22).

Consumers' perception on nutrition labelling and claims.

In order to have healthier diets, a change in people's dietary approach is necessary. A nutrition label is one area where consumers can be informed on the food products' nutrient content (23). Although, awareness of nutrition labelling tends to be high, not much is known about how consumers make use of these nutritional information in their daily shopping trips (4).

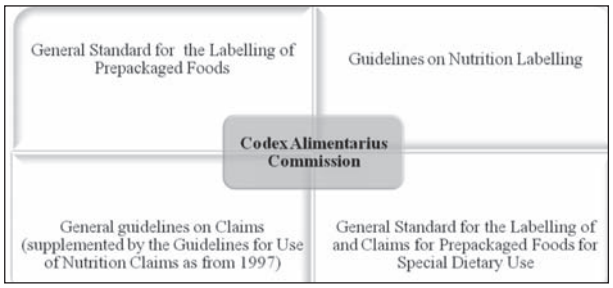

Figure 2. Percentage of hemolysis induced by AAPH
* Significant difference from baseline within group ($p < 0.05$)

Further, according to van Trijp and van der Lans (6), the Nutrition Fact Panel and presence of nutrition/health claims have independent effects on consumer belief formation and purchase intentions. Consequently, upon nutrition/health claims usage, consumers developed preconceived opinion. First, they tend to over-rate a product's overall positivity. Second, there may be a halo effect where consumer generalise the claim on a particular nutrient to other nutrients levels which are not necessarilies exist true. Last but not least, there may be a 'magic bullet' effect which makes consumers attribute inappropriate health benefits to a product (6). However, inconsistency between the information provided in the Nutrition Fact Panel and nutrition/health claims trust in the nutrition/health claim (6).

Consumers' desire for nutritional information on Menus has also gained attention and according to Cranage et al (24), restaurant managers who give their customers nutrition information on the menu may achieve better customer satisfaction and higher repurchase intentions. Hwang and Lorenzen (25) found that when restaurants provided nutrition information on menus, customers were more likely to select healthy food items over unhealthy ones. Also, the nutrition-related attitudes and overall attitudes toward a menu item were influenced by the nutrition information provided and the customers were willing to pay more for that food item. Likewise, labelling of genetically modified food gained significant attention. However, Noussair et al (26) found that consumers are typically unaware of genetically modified organism content labelling and that the nutritional information provided was unlikely to increase the willingness to pay more. According to Petrovici et al (27), individual characteristics, health-related factors like nutritional knowledge, situational, attitudinal and behavioural factors are factors that affect the use of nutritional information and claims. However, concern about nutrition and family preferences increases label use while this is less likely among shoppers for whom "taste" is an important driver of food purchasing behaviour.

Analysis of determinants of nutrition label use and understanding

Nutrition knowledge

Shine et al. (28) found a significant relationship between a respondent's perceived knowledge of nutrition and use of nutrition labels. It was observed that over half of the respondents who read labels believe that they have an excellent or good knowledge. Drichoutis et al. (29) made similar observation that nutrition knowledge had a significant impact on nutritional label use. They cited that nutrition knowledge may facilitate label use by increasing its perceived benefits and by increasing its efficiency. Drichoutis et al. (29) put forward the fact that although it was reasonable to expect that nutrition knowledge can affect nutritional label use; it was also possible that label use can affect nutrition knowledge. In fact, Drichoutis et al. (30) found that label use in general and use of vitamins/minerals and ingredients information improve consumer's nutrition knowledge. However, Grunert et al. (31) reported that nutrition knowledge had no significant effect on nutritional label use. They found that nutritional information use was mainly due to interest in healthy eating rather than nutrition knowledge. In one study by Rothman et al. (32), it was found that even though the participant had adequate literacy skills but inadequate numeracy skills, they expressed difficulty in using nutritional labels

Gender

Drichoutis et al. (29) found that gender affects nutritional label use such that being female positively

affects nutritional labels use as they perceived it as a means to make healthy food choices. In contrast, males did not view nutritional information provided as useful and health was not a matter of importance for them. Similarly, Grunert et al. (31) found that gender had a significant indirect effect on the use of nutrition information and women were found to be more interested in healthy eating. Studies from UK, USA and Australia have found that when purchasing food products, women are more likely to consult nutritional labels than men (8, 33-38). According to Nayga (35), this have been attributed to the fact that men are less likely to accept that nutritional label information are useful and contrary to women, men are generally less interested in nutrition and health. However, Nayga (39) reported that a male and a female consumer possessing the same level of nutrition knowledge do not differ significantly in their probability of food label use.

Age

According to Ippolito and Mathious (40), individual characteristics affect nutritional information search and age was one of the most common characteristics used in studies on nutritional label (30). Several studies have found that age affects nutritional label use in different ways and the majority of studies found that middle-aged adults were more likely to use nutritional labels than older individuals (41-43). Burton and Andrews (42) determined that lower frequency of nutritional labels use among older people was due to the fact that they found it less understandable. Additionally, studies by Kim et al. (44, 45) and Cole and Balasubramanian (46) also found that as age increases, use of nutritional labels decreases. Contrarily, studies by Coulson (47), Drichoutis et al. (30) and Govindasamy and Italia (48) found that nutritional label usage was proportional to increase in age. The trend observed in these studies may be explained by the fact that as older individuals might be more cautious about what they eat for medical reasons, contrary to their younger counterparts, they may be more likely using nutritional labels.

Education level

Bender and Derby (49) found that people with a higher educational level are more likely to read food labels than people with a lower education level. Less educated people are more likely to focus on only nutritional labels whereas more educated people look at both nutritional labels and ingredient lists. Shine et al. (28) found that factors that affect nutritional label use include gender and educational level. Respondents who read nutrition labels tend to be female and have completed tertiary education. Recently, Singla (50) reported that ease of usage of nutritional labels is significantly affected by education level such that consumers having higher level of education found labels easier to read and understand than those who were not so highly educated. One of the main reason cited by consumers in the study was the inability to understand the terminology used, hence, this explains why a higher level of education rendered nutritional label use easier. Moreover, according to Nayga (51), higher educated individuals are more likely to be exposed to health/nutrition related news sources. Education may then increase their desire to know about the nutritional aspects of the food they are eating. Moreover, education may help them to interpret the information provided (52).

Household income

Studies have consistently reported that individuals with lower income are less likely to use nutrition labels. Individuals who had lower income were also more likely to have lower nutrition knowledge which might explain the rare usage of nutritional labels (44, 53, 54). Drichoutis et al. (29) found that higher income respondents were more likely to agree on the usefulness of nutrition information and that nutritional information provided was reliable, which can be a motivation in the purchase of new products. This has been attributed to two main factors. First, lower level of income limit the amount of choice consumers have over products and/or the fact that consumers are actively looking for price information, which impacts upon their examination of nutritional information, (30). In addition, it is more probable that higher income household use nutritional information concerning calories, sodium, fibre, fat and cholesterol content (51). However,

Drichoutis et al. (29) reported that irrespective of their income levels, people who attach importance to nutrition are more likely to search for nutrition information. Similarly, Singla (50) and Shine et al. (28) found that income level did not play a role in the usage of nutritional labels by the consumers.

Health status and occupation

A wide range of studies have examined the association of nutrition label use and health status (30, 43, 49, 54, 55). Greater use of nutrition labels have been reported because of the dietary requirements of a health-related situation. Awareness of the diet-disease relation, due to the presence of a medical condition may also positively affect the likelihood of consumers paying attention to the caloric content of foods on nutritional labels (29). Conflicting results have been obtained on the effect of occupation on nutritional label usage. Nayga (39) and Nayga et al. (54) found that a higher frequency of nutritional label use was found among unemployed and retired household heads. Employment status was hypothesised to represent the time constraints involved with label use, consequently, unemployed individual were more able to allocate time to the use of nutritional labels. In addition, employment may reflect the value of time and the cost of gathering nutrition information for the household, in this perspective, unemployed main meal planner were more likely to use nutritional information compared to employed main meal planners (51). On the contrary, research by Drichoutis et al. (30) found that it was working people who are more likely to use the nutrient information.

Household size and type

The type of the household has an effect on label usage. Households with preschool children and married consumers are more likely to search for nutrition information (56) (57).Wang et al. (58) found that larger households are more likely to use nutritional labels in general. Govindasamy and Italia (48) found that household size of four or more were 17 % less likely to use nutrition labels. However, Grunert and Wills (59) found that being a parent increased the respondents' likelihood of using nutritional labels and therefore it was suggested that a household size of at least three members would be more likely to use nutritional labels. This may imply that main meal planners of larger households are more likely to use information concerning these contents on food packages. The reason for this result may be that the use of nutritional information on food packages is viewed as beneficial by main meal planners because they are extended to more persons. Consequently, the relative value of the time spent in information search is higher for larger households than for smaller households (51).

Implications and recommendations

In brief, nutritional labels present as a useful tool to allow consumers to make informed food choices. The prevalence of diet-related disease is on the rise thus there is need to make appropriate and understandable nutrition labelling formats to positively impact on dietary behaviours. However, there is a strong need of regulations for nutritional labels since these are strong marketing incentives that can mislead consumers. Nutrition educators and health promoters should put further efforts into consumer education on nutritional labels and factors such as consumers' nutrition knowledge, age, gender, income, educational level and household size should be taken into consideration as these affect label use. Consumer education should be carried out for any nutrition information provided on nutrition labels. Further, a consensus as to the development of a harmonised regulatory framework for nutrition labelling and claims should be developed. This could be achieved by developing an international regulatory body and mention the Nutrition Facts Panel, and this will also increase consumers' trust in the information provided. Nutrition education strategies for nutrition label use should be designed by food manufacturers and government to prevent consumers from misinterpreting claims and how to apply the nutritional information in their daily shopping trips to maintain healthy dietary habits. Nutrition interventions programs should target on (1) how to clarify serving size and how it relates to the entire nutrition information provided and (2) how to simplify and improve Percentage Daily Values use and comprehension. Future

research should focus on cues such as colour, language and label presentation among others that may increase interest in nutrition label use and promote positive behaviour change.

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