The Effects of Nutrition Labels on Information Recall and Label Preference

by

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Abstract

Throughout the twenty-first century, nutrition and nutrition labelling have played an important role in healthy eating behaviours. The impact a nutrition label can have as a reliable source of nutrition information to help consumers make knowledgeable choices for living a healthy lifestyle has not yet been accepted within Canada. This could be due to the possibility that the current nutrition label employed in Canada is not effective and that an improvement to the label could also increase its use by consumers who want to make healthier choices. The current study (available online) aimed to explore the relationship between different product labels and consumer preference for a certain food label. A sample of two hundred participants (separated into four groups) were included in the analysis; nutrition understanding and accuracy of the Nutrition Facts Panel in portraying health information, label type preference and nutritional information recall were each assessed to determine which label will help consumers make healthier food choices. Overall, it was determined that the most preferred and effective label was the Multiple Traffic Light label, very closely followed by the current Nutrition Facts Panel. However, both the MTL and NFP label performed rather closely and should be considered on par with each other in terms of preference and recall accuracy. In addition, it is important to note the analysis showed that the current Nutrition Facts Panel is not completely effective in communicating nutritional information to consumers. The relevance of these findings in terms of nutrition labelling is outlined below, along with all considerations for future research.

Keywords: nutrition label, Nutrition Facts Panel, Front of package label, consumer preference, recall

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Introduction

Throughout the years, nutrition labels and their overall effectiveness have come under public and professional scrutiny. The role of a product's nutrition label is to provide the consumer with clear nutritional information, helping them make an informed decision. The research described sought to determine the degree to which consumers understand the information presented in the current Nutrition Facts Panel (NFP). Additionally, we investigated which type of label participants preferred and confirmed that the label preference was correlated to information retention. The current study also analyzed consumers' opinions and ratings of the existing NFP label and several alternative labels.

Front of package (FOP) labels are simply the nutritional information found on the front of food packaging that has information presented in a condensed, easy-to-read format. Additionally, a FOP label may include colour, symbols, and/or a simple text to help highlight the key nutritional information for the consumer. For example, the Multiple Traffic Light label uses red, amber, and green colour coding, which tells consumers immediately if the food has high, medium, or low amounts of fat, saturated fat, sugars, and salt. More specifically, red means high, amber means medium and green means low. Therefore, the more categories highlighted in green, the healthier the food product is. Other labels use larger fonts, star ratings, or grading systems to emphasize certain nutritional facts about the product. For the purposes of this study, the location of the FOP labels will not be studied. The label design and preference for a label commonly known as a FOP label will be the focus.

Food labels were added to packaging to help increase consumer nutrition knowledge and to use this knowledge to help consumers make better-informed food choices. Nutrition knowledge refers to how macronutrients impact diet and health. Having nutrition knowledge

helps with label reading and understanding. Miller & Cassady (2015) found a positive association between knowledge and food label use for both studies using self-reported measures and objective measures of knowledge. Clear food labels are imperative to the consumer's nutritional understanding of the product. The Food and Drugs Act first introduced nutrition labelling guidelines in 1988 and made them voluntary (IOM, 2003). As of 2007, nutritional labels must be found on all prepackaged foods as per the Government mandate to assist in making informed, healthy food choices (Health Canada, 2022). Currently, the NFP label is one of the primary sources of health information to help aid in decisions about better nutrition choices. Due to the need for the inclusion of health information on food packaging and the existence of FOP labels, Canada has been considering implementing this form of label to simplify the portrayal of nutrition information. It is hoped that better nutritional labels will lead to healthier choices and result in a healthier population.

Over the last few decades, there has been an increased level of interest in nutrition and diet, more specifically, the overconsumption of certain macronutrients (i.e., fat, protein, and carbohydrates) and micronutrients (i.e., sodium, iron, and potassium). When eaten in large quantities, certain nutrients can cause health concerns such as obesity, diabetes, cardiovascular disease, and many other serious health-related problems (Prieto-Castillo et al., 2015). Research has discovered that prevention or treatment of many health concerns, such as diabetes and obesity, are highly dependent on the management (quality but also quantity) of diet. Julia et al. (2016) stated that nutritional choices are an adaptable and individualized mechanism for preventing chronic diseases. Therefore, by providing consumers with relevant food information, they could alter their food purchases and consumption based on their unique needs. The primary use of the NFP label continues to be a reference for consumers to use when picking foods that

match their dietary requirements and restrictions. To manage their diet, consumers must be aware of what and how much they are putting into their bodies. Therefore, the use and understandability of nutrition labelling are vital in maintaining a proper diet and reducing health-related concerns. Based on existing research, there appears to be a disconnect between the consumer's understanding and the information portrayed through nutritional labels (Sharf et al., 2012).

Recent studies have questioned the effectiveness of the current structure of nutrition labels in conveying nutritional data in a form that consumers can read and easily understand (Cannoosamy et al., 2014). Several sources show that nutrition labels such as the current NFP label do not help consumers make healthier food choices (van Herpen & van Trijp, 2011). González-Vallejo et al. (2016) conducted a study to analyze consumers' assessment of the nutrition quality of individually packaged foods. This study had 196 participants complete an online study where they were asked to evaluate common packaged food items by answering questions through value selection (0 being "Not Healthy" to 100 being "Extremely Healthy") while being shown the front of the food packaging, the NFP label, and the ingredients list then hypothetically purchase the desirable item without consideration of cost (González-Vallejo et al., 2016). Results indicated that food selection was predicted by judged nutrition, familiarity, frequency of consumption and liking of the products and not information from the NFP label (González-Vallejo et al., 2016). Additionally, they concluded that even though many people report wanting to use a lot of information when making healthier choices, the reality is, simpler label formats can potentially increase understanding in comparison to complex labels. This was shown in their study when the NFP label, a complex label, produced low accuracy scores (González-Vallejo et al., 2016).

Another study conducted by Sharf et al. (2012) sought to determine how well consumers understood nutrition information. They found that food labels (specifically the NFP label for this study) did not accurately convey nutritional information for consumers to understand, contributing to a lack of healthier choices (Sharf et al., 2012). These examples help highlight the inefficiency of nutrition labelling (specifically the NFP label) in helping consumers make informed and healthy food choices.

In contrast, several experiments have shown that FOP labels are more efficient and understandable than the NFP label. Acton et al. (2018b) conducted a study with 675 respondents from Ontario, where they were required to view images of different beverages with four different FOP style labels and rate their healthiness. It was found that consumers could correctly identify healthiness levels (specifically in health star ratings and simplified traffic light labels). Additionally, this group of consumers almost unanimously supported implementing FOP nutrition labelling systems (Acton et al., 2018b).

Similarly, Andrews et al. (2021), conducted a study with over 2,000 primary food shoppers, examining the moderating impact of objective nutrition knowledge on key FOP nutrition symbols (Stop Sign labels, Traffic-Light labels, and a control condition) to discover the effects on nutrient perceptions, nutrition use accuracy, disease risk, brand attitudes, and purchase intentions. Their results indicate that FOP style labels are most effective for helping make nutrient evaluations, perceptions of disease risk, brand attitudes, and purchase intentions by targeting high levels of negative nutrients such as saturated fat and sodium compared to the NFP label (Andrews et al., 2021). They also found that the Traffic Light label obtained a higher accuracy score when utilizing a wider range of nutrients than the Stop Sign label (Andrews et al., 2021). These two examples highlight the FOP-style label leads to more accurate health decisions

and that there is consumer support for the implementation of a FOP-style label. The following literature review will discuss consumer understanding of the current nutritional label and the possible implementation of an alternative food label to increase the chances of detection to promote healthier eating habits.

History of the Nutrition Facts Panel

In the beginning, the Food and Drugs Act (FDA) was the principal federal statute that governed the labelling of food in the United States and Canada (IOM, 2003). The Food and Drugs Act of 1906 was the first federal written legislative regulation on food labelling that loosely prohibited misbranding or adulteration of food (IOM, 2003). This statute was in place for 32 years and did contribute to enhancing the safety of the food chain, but it lacked the authority to make all food labelling consistent and mandatory. The Federal Drug and Cosmetic Act of 1938 replaced the Food and Drugs Act of 1906 which gave the FDA more authority to strengthen rules against the adulteration of food and establish mandatory food standards (IOM, 2003). This new act allowed food labelling to prohibit false or misleading statements as well as required manufacturers to state the net quantity of contents and include a statement of ingredients (IOM, 2003). By 1973, the FDA adopted regulations that required nutrition labelling in a specific format and location on food packaging (IOM, 2003). Additionally, as of 1973, food labels were to include the number of calories, the grams of fats, and the percentage of a single set of nutrient reference values call U.S Recommended Daily Allowances (US RDAs) of vitamins A and C, thiamin, riboflavin, niacin, calcium and iron (Wartella et al., 2010). It was also at the manufacturer's discretion to include the percentage of sodium, saturated fatty acids and poly saturated fatty acids (Wartella et al., 2010). After 1973, scientific knowledge about the relationship between diet and health was rapidly increasing and consumers wanted to have more

information on their food labels, particularly processed foods (IOM, 2003; Wartella et al., 2010). Over the years, this consumer demand for more information led to many changes to nutrition labeling.

Nutrition labelling guidelines were introduced in Canada in 1988 as well as updates to the FDA regulations (IOM, 2003). These guidelines were voluntary. Nutrition information was portrayed in terms of serving size, vitamins and minerals were required to be stated in terms of percentage of a single set of nutrient reference values, Recommended Daily Intakes (per serving of stated size) and macronutrients were expressed in terms of weight (IOM, 2003). Including a NFP label on food packaging was made mandatory in 2002 for packaged food following the new regulations stated in the "Regulations Amending the Food and Drug Regulations (Nutrition Labeling, Nutrient Content Claims and Health Claims)" document (IOM, 2003). Companies were given until 2005 to comply with and implement the new regulations on their food packaging, apart from smaller manufacturers that had until 2007 (Goodman et al., 2011).

Since implementing the NFP label in the United States, many other countries have followed suit by creating nutrition labels of a similar format (Al-Khamees, 2018). Currently, Health Canada and the Canadian Food Inspection Agency (CFIA) regulate food labelling in Canada. However, the FDA signed an arrangement with the CFIA and the Department of Health Canada to recognize each other's food safety systems as comparable to each other (FDA, 2016). These two regulating bodies implemented the current NFP label on most packaged food except for certain foods such as fresh fruit and vegetables and single-ingredient meat. The original NFP label included calories and 13 nutrients in a specified order. Nutrient information (except for cholesterol) was to be expressed in terms of percent of daily value (%DV) which is based on Reference Values in the United States (Health Canada, 2015). Over the years, consumer demand

for more information led to changes to the NFP label. Several changes were made to the NFP label between 1990 and 2020. In 1999 Canada's Heart and Stroke Foundation created the Health Check program, which aimed to help consumers identify healthy food choices to achieve an overall healthy diet. Both the Heart Check and the Health Check programs included a single symbol that could appear on products meeting their respective nutrient criteria and were limited in scope to the risk reduction of cardiovascular disease. Food manufacturers did not participate in developing the criteria for these programs but were allowed to participate in the appropriate program for a fee and receive the right to use the health check symbol on products that met that system's criteria (Wartella et al., 2010). The most recent changes to the NFP label were proposed in 2016 and had to be implemented within a five-year period ending in 2021 (Health Canada, 2023). These changes included: making the serving size consistent for easier comparison across foods, and more realistic to reflect the amount that people in Canada eat in one sitting, increasing the font size of Calorie content and adding a bold line underneath it to make it easier to read and find, revised %DV, %DV for total sugars, adding potassium to the list of nutrients, removing vitamin A and C, adding milligrams for potassium, calcium and iron and adding a footnote at the bottom of the label to explain %DV and what would be considered "too little" or "too much" %DV (Health Canada, 2022).

Even with their widespread use, NFP labels are still being criticized for inefficiently presenting nutritional information impacting consumer habits. Criticisms range from the NFP label being too complicated or oversimplified, not easily understandable, too much writing within the label, too time-consuming to read, bland in terms of colour, font size too small, and more. As stated by Ikonen et al. (2020), all nutrition facts tables and percentages are based on a 2000 kcal diet which is not reflective of an individualized diet. Additionally, as discussed by

Abdukadirov (2015), the NFP label focuses on serving size as opposed to portion size which allows consumers to eat more than a healthy amount of food. There have been criticisms about NFP labels containing no nutritional implementations as they revolve more around aesthetics and sizing (Porter et al., 1990; Abdukadirov, 2015). With all the existing criticism, changes need to be made to increase consumer use and understandability.

Throughout the NFP label history, many changes have improved the overall use and comprehension of the label. Even though several modifications have been made, research has suggested that FOP-style labels may be more beneficial in reducing the amount of negative nutrient intake (Lim et al., 2020). Based on the critique that FOP-style labels may only help consumers who already want healthier food options, future research should investigate which types of labels help encourage nutritious food choices for those who are not as motivated to eat healthier (Ikonen et al., 2020). To do this, we first have to ensure the information is being presented in a way that consumers can understand and retain. The present study seeks to understand consumers' overall preferences and level of understanding of different forms of nutrition labels. Responses will be used to determine which nutrition labels (included in this study) are most beneficial for consumers due to their ability to increase overall understandability and recall of nutritional information.

Alternative Food Labels

Alternative food labels such as FOP style labels are a quick and easy-to-read visual cue on the front of food packaging that magnifies key nutritional information. Over time, several FOP labels have been created and are being used around the world. Many countries use different types of FOP labels to get their nutritional information across on their food packaging. It is important to note the different designs being used. Some FOP labels use colours, numbers,

letters, multiple nutrient explanations or a single digit or letter to explain overall healthiness. As stated above, for the purposes of this study, FOP style labels will be included for their design and not for their package location (front). Other studies that examine the effectiveness of the following alternative style labels will be looked at in the coming sections.

One type of alternative label is the Multiple Traffic Light Label (MTL). This label uses a combination of colour coding (traffic lights) and nutritional information to know, at first glance, if a product is high (red), medium (amber) or low (green) in fat, saturated fat, salt, and sugars, and how much energy (calories and kilojoules) it provides as shown in Figure 1. This label simplifies the information found on the current NFP label. The use of colours that consumers are familiar with helps make quick decisions as it uses a warning method to help consumers identify nutrients that are high or low to decide then if the full product is healthy or not. According to a review by Roberto et al. (2021), the MTL label is voluntary in the United Kingdom.

Figure 1

Multiple Traffic Light Label

The Facts Up Front label (FUF), is a simple and easy-to-use labelling system that displays key nutrition information on the front of food and beverage packages, as shown in Figure 2. This label provides information on multiple specific nutrients included in food items. It also has an increased font size; words are written in bold and capitalized and identifies the serving size. This label has been known to be in black and white or with a blue background. This label was created and is currently used on a voluntary basis in the United States (Roberto et al., 2021).

Figure 2

Facts Up Front Label

The Health Star Rating label (HSR) is a FOP labelling system that rates the overall nutritional profile of packaged food and assigns it a rating from 1/2 to 5 stars while showing some nutrition values. The more stars the healthier the product, as shown in Figure 3. This label includes both an overall evaluation of the product as well as a breakdown on nutrient content. The HSR label is currently a voluntary label in Austria and New Zealand (Roberto et al., 2021).

Figure 3

Health Star Rating Label

The Nutri-Score label is an easy-to-understand, science-based nutritional value labelling system found on the front of food packaging, as shown in Figure 4. A Nutri-Score calculation pinpoints the nutritional value of a product (based on the ingredients) and assigns it to one of the five colour-coded letter grade classes (A, B, C, D, or E). Products that get an A score have the highest nutritional value - those that score an E have the lowest nutritional value. This label opted out of all numerical values and explanations to quickly notify consumers whether a product is healthy, mediocre, or unhealthy. This label takes little time to analyze and gets its point across quickly but at the sacrifice of more detailed information. The Nutri-Score label is voluntary in Portugal, Spain, Austria, Belgium, France, Germany, Luxembourg and Switzerland (Roberto et al., 2021).

Figure 4

Nutri-Score Label

A final alternative label is the NuVal label. This label indicates the overall nutritional value of each food item by giving a score ranging from 1 to 100, as shown in Figure 5. The closer the score is to 100 the healthier the food item is. Like the Nutri-Score label, this label sacrifices explaining the specific nutrients within the food and gives one overall numerical score to determine healthfulness. The NuVal label was created and is used in the United States (Bernier, 2016).

Figure 5

NuVal Label

Effectiveness of Alternative Labels Around the World

According to the World Cancer Research Fund International (2019), FOP-style food labels effectively attract consumer attention and indirectly motivate companies to put healthier products on the market. When implementing a FOP label, each country must consider education levels, nutrition and health literacy levels, local culture, and the specific needs of disadvantaged populations. Talati et al. (2019) found that well-designed, salient, and intuitive FOP labels can be effective on a global scale as the impact of a FOP label is not bound to the country they originate from. FOP-style food labels are more easily understood by consumers at all literacy levels.

According to Statistics Canada (2015), on average, 51.5% of Canadians can read at a proficiency level of 3 or higher (average level), leaving 48.5% (just under half) of Canadians below the average literacy level. In terms of numeracy, 45.3% of Canadians can perform at the average level in tasks, including numbers and numerical operations. This information is important when considering nutrition labels, as consumers are required to read not only written words and sentences but numbers and percentages as well. The fact that most Canadians struggle with reading and numeracy could be a factor explaining the lack of nutritional label use in the current nutrition facts panel.

Although FOP labels have yet to be implemented in Canada, other countries around the world have embraced these condensed versions of the NFP label. Since 2010, close to 60% of government-led or government-supported FOP label systems captured by the World Cancer Research Fund International Nourishing database have been implemented (World Cancer Research Fund, 2019). Several organizations, such as the Health Evidence Network Synthesis Report by the WHO Regional Office for Europe (2018), WHO Commission on Ending Childhood Obesity Report (2016) and Institute of Medicine (IOM) Front-of-package Rating Systems and Symbols Promoting Healthier Choices (Phase II Report- 2011), have released reports recommending FOP labels. Although there does not seem to be a consensus on the specific label type or design. There are two main types of FOP labels. The first type of label is the non-directive system, such as the Facts Up Front label, which only show information about the nutrient content in an absolute value or as the percentage of the recommended daily intake. The second type of label is the semi-directive system that does the same; however, they also indicate whether the specific nutrient is low, medium, or high (bad, mediocre, or good) within their content, such as the Multiple Traffic Light label (Arrúa et al., 2017). Several countries have

already implemented different forms of FOP-style labels, but Canada and the United States have not; they have only modified the current label. Roberto et al. (2021) reported that 10 countries made FOP labels mandatory, and 29 countries made them voluntary. Chile was the first country to implement a mandatory FOP warning label policy in 2016 (Global Food Research Program, 2021). According to the Global Food Research Program (2021), Chile's FOP warning label policy has been linked to an approximate 24% decline in purchases of sugary drinks, 37% decline in sodium, 24% decline in total calories, 27% decline in sugar intake and 16% decline in saturated fat. Since the implementation of the warning label in Chile, momentum has continued to build across other countries. In 2019, Peru enacted policies requiring FOP warning labels like Chile, followed by Mexico in 2020 and Uruguay in 2021. In 2020, Israel implemented a policy to require negative warning labels for products high in sugar, sodium, or fat as well as a voluntary positive label for products that meet healthy nutrition standards (Global Food Research Program, 2021). Finally, Brazil and Colombia have passed their own laws that required FOP warning labels at the start of 2022 (Global Food Research Program, 2021). Canada and South Africa are currently in the process of developing their own policies (Global Food Research Program, 2021).

Many researchers have studied comparing and evaluating different FOP labels across different countries. The FOP label versions include Multiple Traffic Lights, Facts Up Front, Nutri-Score, and Health Star Rating, among many others. The Multiple Traffic Light system uses different colours (green-good, yellow-mediocre, and red-bad) to portray unhealthy or healthy levels of fat, trans fat, sugar, and salt within the product. The bill on the Promotion of Healthy Eating, also known as the "Front-of-package Labelling Law," was passed by the Argentine Congress in October 2021 (Castronuovo et al., 2022). A study by Castronuovo et al. (2022)

presented evidence from a multi-component study to generate results from Argentina to support effective FOP-style nutrient label policies in Brazil and Argentina. Their study sought to determine which FOP-style label (black octagonal warning system featuring nutrients in excess, Nutri-Score or Multiple Traffic Light) was better at facilitating healthier food choices among consumers in Argentina (Castronuovo et al., 2022). Results indicated that the black octagonal warning system significantly reduced purchase intentions and perceived healthfulness (Castronuovo et al., 2022). These results from Argentina help provide evidence that FOP labels that have straightforward warnings for large amounts of critical nutrients like sodium, fats and sugars have the greatest potential to influence consumer decisions.

As mentioned above, the Israeli government implemented new regulations requiring mandatory red warning FOP labels for high levels of sodium, sugar and saturated fats and a voluntary green positive FOP label for products with nutrients that fit the national nutritional recommendations. To analyze the new regulations, Shahrabani (2021) conducted a study with 507 Israeli individuals that had them participate in a questionnaire that analyzed nutrition habits, media exposure and extent of support for the reform, frequency of using FOP labels, intention to change purchasing and consumption habits in the coming year. Results indicate that 58.5% of participants reported using FOP labels to some extent, 90.5 % supported the food labelling reform, 51.5% indicated changing their buying habits to healthier products since the reform, and 70% indicated a willingness to change to healthier products in the coming year (Sharabani, 2021). This study provides further support of the effectiveness of FOP-style label implementation in helping consumers be more mindful of healthier food choices.

Egnell et al. (2018) conducted an online study within 12 different countries to assess consumer's ability to understand five different FOP labels (MTL, Nutri-Score, Reference intakes

and Warning symbol). Approximately 1000 participants per country were recruited. Participants were asked to rank three sets of label-free products according to nutritional quality (Egnell et al., 2018). Then participants were randomized to one of five FOP label conditions and were again asked to rank the same sets of products, but this time with a FOP label on the packaging (Egnell et al., 2018). Results found that all the labels improved the ability of participants to correctly rank products (Egnell et al., 2018). Additionally, in all 12 countries, the Nutri-Score label performed the best, followed by the MTL, HSR, Warning Symbol and Reference intakes (Egnell et al., 2018). In another study by Vanderlee et al. (2021), 1997 Canadian residents completed an online study to examine the impact of FOP labels on perceived healthfulness, purchasing intentions and understanding of common FOP labels. The labels included in this study were the MTL label, HSR label, 'high in' Warning Label and a no label condition. Participants completed a brief educational session and two experimental tasks (Vanderlee et al., 2021). In the first task, participants were shown healthy and unhealthy versions of four products and were asked to rate their healthiness and purchase intention on a seven-point Likert scale (Vanderlee et al., 2021). In task 2, participants then ranked three sets of five products from healthiest to least healthy (Vanderlee et al., 2021). Results found that all the FOP labels decreased the perceived healthiness of less healthy food, but the MTL and HSR labels specifically, increased the perceived healthiness of healthier products (Vanderlee et al., 2021). Additionally, for the second task, participants were better able to rank food items when the HSR label was present, followed by the MTL, Warning label and no-label conditions (Vanderlee et al., 2021).

The above studies have shown compelling evidence of alternative labels' effectiveness in supporting healthier choices. Not only have alternative labels been shown to be supported in

other countries as the primary or supporting food label, but they have also assisted in reducing negative nutrient intake.

Do People Understand Nutrition Labels?

Although socioeconomic factors often influence food decisions, other contributing factors include subjective decisions about the quality and understanding of nutrition (Gonzáles-Vallejo et al., 2016). Several factors contribute to the ability to read and understand the information on food labels, from what is reported, to the underlying messages conveyed through the breakdown of ingredients. National self-report surveys and point-of-purchase studies, where consumers were interviewed about their food choices in grocery stores, reported that consumer perceptions of the NFP label information vary depending on the individual's demographic and motivation characteristics (Carter & González-Vallejo, 2018). Factors influencing perceptions included age, sex, socioeconomic status, health goals, and dietary restrictions (Carter & González-Vallejo, 2018). The study also listed reasons why people do not use the NFP label including: they do not look at them, they do not believe the information the panel presents, and only care about specific elements on the panel like calories or carbohydrates (Carter & González-Vallejo, 2018).

According to multiple sources, it was noted that many consumers possess a lack of comprehension when it comes to nutrition and the labels attached to the products. A study sponsored by the American Dietetic Association reported that 67% of consumers stated that diet and nutrition were very important to them, but 41% of the respondents said that their poor understanding of diet and nutrition was one of the main reasons why they did not do more to achieve a healthy diet (Wartella et al., 2010). Similarly, a study by Prieto-Castillo et al. (2015) found that almost half of the consumers in their study reported that they did not fully understand the nutrition information, nor did they use it to plan their diet. In another study by Persoskie et al.

(2017), approximately 24% of people could not determine the calorie content of a full ice cream container, 21% could not estimate the number of servings equal to 60 g of carbohydrates, 42% could not estimate the effect on the daily calorie intake of 1 serving, and 41% could not calculate the percentage daily value of calories in a single serving. Therefore, due to the complexity of nutrition labels, consumers would rather cut their losses than attempt to strain themselves trying to figure out nutritional information they do not understand. Another factor is that consumers often choose foods that look like they taste good, that have popularity attached to them or that have been heavily marketed. Specifically, food choices can represent current societal trends and not healthy food choices (i.e., foods highly marketed or trending on social media). According to a survey done by the American Heart Association (2019), two in five people surveyed (43%) "always" look for healthy options, just over half (52%) "sometimes" do, and only 5% of surveyed consumers "never" look for healthy options. These findings are compelling evidence that consumers read the NFP label but still do not demonstrate whether they understand the information presented. In addition, based on the data they collected, it was found that locating healthy food, on average, is only moderately easy for most consumers (American Heart Association, 2019). More specifically, consumers find it somewhat easy to identify food labels, but factoring in barriers such as time constraints and education level, their understanding of the information on the labels could be improved.

For information to be understood and helpful to the consumer, it must be retained in memory and retrieved for decision-making. For information to remain in long-term memory, it must be rehearsed and refreshed. Therefore, for consumers to remember (keep in long-term memory) the location and content of nutrition labels, repetitive viewing must reoccur. It is important to note that there is a difference between what consumers think they know and what

they truly understand. Objective knowledge refers to factual and accurate information learned and stored in memory, whereas subjective knowledge is what one may think they know (Andrews et al., 2021). According to Andrews et al. (2021), examining the effects of what consumers actually know is an important gap in FOP nutrition label research; therefore, more knowledgeable consumers are better able and willing to process more detailed information than less knowledgeable consumers.

González-Vallejo et al. (2016) initially found that, after implementing the NFP label, reports claimed an increase in the use and understanding of nutrition labels. However, after more in-depth research, this finding was deemed incorrect as subsequent studies found no such evidence and concluded only a modest beneficial impact on public consumption habits (González-Vallejo et al., 2016). The change in results was possibly due to variability in the use of the information by different consumers like elders (60 years and older) compared to young adults (20 to 30 years old) or those who have a higher education to those who are less educated in nutrition. To support this idea, several pieces of literature have shown that those who are highly educated, female, and without children find it easier to shop for healthier food (González-Vallejo et al., 2016). Elderly (60 years old and above) and less educated individuals find the NFP label too challenging to interpret and require more or easier to understand information to make healthier food choices (Gonzáles-Vallejo et al., 2016). People who eat less healthy food are more likely to skip the nutrition facts, and those who are skeptical of nutritional facts are also less likely to use this information (Gonzáles-Vallejo et al., 2016). These findings could in part, be due to experience, education, health-related goals, and only considering personal preference.

The current literature reports that the following factors affect consumer nutrition label usage: age, gender, education, income, marital status, dietary status, number of people in the

household, location of residence, and health consciousness (Donga & Patel, 2018). Consequently, higher education (college and university) is correlated with using nutritional labels more, as those who are more educated are more health/nutrition conscious (Donga & Patel, 2018). Those with a higher degree of education typically have a better understanding and likelihood of using the NFP label when making food purchases. Financially stable people have also made healthier food choices in terms of income (Donga & Patel, 2018). Donga and Patel (2018) also found that females use nutrition labels more often than men as females are more likely to eat healthier, be more health-conscious, and have higher chances of doing food shopping for the household. They also report that those who are married as opposed to single are more likely to use nutritional information when purchasing food (Donga & Patel, 2018). Govindasamy and Italia (2000) found that household size significantly decreased the importance of nutritional labels due to the elevated number of family members within the home and less time to do groceries. They also found that those who lived in suburban areas had the greatest effect on nutritional label usage; when compared to urban residents, suburban residents were 23% more likely to be label users, and rural area residents were 20% more likely to be label users (Govindasamy & Italia, 2000). Prieto-Castillo et al. (2015) found in their study that people who lived with a partner or with children, those with higher educational levels, and young women showed the greatest information search behaviour for labels.

Several factors influence the level of cognizance, such as price, the format of the label, terminology, small print size, lack of colour, familiarity with the product, too technical to understand, and too much information being displayed, causing feelings of being overwhelmed (Mackey & Metz, 2009; Moreira et al., 2019; Roberto & Khandpur, 2014). It has been found that people tend to focus on facts that are irrelevant to the total nutritional value of the food product;

they may base their decision on a few individual nutrient values instead of all the values or choose a food item based on a familiar brand (Vizcanío Velasco & Velasco, 2019). For example, it has been determined that people will rely on brand familiarity when purchasing food (Vizcanío Velasco & Velasco, 2019). This study by Vizcancío Velasco and Velasco (2019), presented some participants with familiar brands of yogurt, packaged ham slices, crackers, vegetable chips, and chocolate. The participants were first shown a food item with a familiar brand, including a traffic light label (the front and back of the food item was shown). Other participants were shown the same food items and brands but no traffic light label (no label) on the packing. Then participants were asked questions to be answered on a 7-point Likert Scale, such as, "How much do you like this product," "How much interest do you have in purchasing this product" and finally, "Did the product you just evaluated have a traffic light nutritional label." This statement highlights the influence of brand familiarity and brand trust on consumer perceptions of product healthiness. According to the study, these two factors can act as a shield against negative perceptions of a product's healthiness, even when warnings are present on nutritional labels (Vizcanío Velasco & Velasco, 2019). Additionally, the statement emphasizes the importance of marketing in creating brand awareness and how this awareness can influence consumers' considerations of a product's healthiness (Vizcanío Velasco & Velasco, 2019). Specifically, the more marketing that is done for a product or brand, the more likely consumers are to be aware of it, which can lead to them placing less importance on the product's healthiness. Essentially, even with the presence of a traffic light nutrition label, the familiarity with a brand of food overpowered all the information listed on the nutrition label. Finally, they may see a large quantity of a nutrient (sugar or saturated fats) and take this information as a positive fact instead of interpreting it as the health risk it is (Vizcanío Velasco & Velasco, 2019).

Research suggests that consumers face three pertinent types of costs in accumulating and comprehending information: collecting cost, which is the time and effort spent acquiring nutrition information; computational cost, which is the effort combining the relevant information into overall evaluation; and comprehension cost, the effort needed to understand the nutritional information (Lim et al., 2020). With the amount of effort, intake, comprehension, and ability to make overall evaluations consumers are expected to have and make, a nutrition label must be efficient in making these costs as easy and understandable as possible.

To improve nutritional label use, two key recommendations have been made. Firstly, recommendations have been proposed to improve the format of the NFP label by changing its layout and content. The current format of the NFP label has created some concerns in terms of how it presents information and how this information is thus understood by consumers. Roberto and Khandpur (2014) highlight issues concerning consumers' ability to understand serving sizes as all the information presented on the label are based on the specific serving size, low literacy and numeracy skills and the large amount of complicated information portrayed on the label. Some recommendations made within this article are to include serving sizes for both single consumption or full product consumption, educating consumers on nutrition knowledge by including it within the school curriculum and finally, consider eliminating some of the information presented and presenting more meaningful salient information to reduce the amount of information to observe and process. Adding colour, increasing font sizes, including what values are too high or too low, and implementing alternative labels may increase the chances of people noticing and comprehending nutrition labels.

Secondly, it is recommended that health education programs are introduced early in the school system to improve understanding of basic nutritional principles (Sharf et al., 2012).

Educating individuals starting at young ages may increase the likelihood of using dietary labels to purchase healthier food. Sharf et al. (2012) found that young adolescents and college students showed that subjects educated on dietary principles understood food labels better. These individuals are using education as a top-up approach through public health measures versus the bottom-up approach of our current health care system (Sharf et el., 2012). Based on the existing research, there is a gap in consumers' knowledge of food labels, thus directly impacting the development of healthy eating habits.

Even though it has been recommended that increased consumer awareness and education on nutrition will improve nutrition knowledge and purchasing intentions, as stated above in the Sharf et al. (2012) study, we cannot assume that increased awareness automatically leads to enhanced nutrition knowledge and improved dietary behaviour (Porter et al., 1990). Therefore, several recommendations for improving nutrition labels have included increased education, awareness of healthy amounts of food content, and understanding of food label information and food content. Even though there have been many modifications to nutrition labelling, there is always room for improvement to meet consumer requests.

How well consumers understand the information on the NFP label remains an unanswered question. Past and current research portrays differing results regarding the comprehension of the NFP label. Some individuals answered questions stating they had a thorough understanding and ability to use the NFP label, while others lacked these increasingly important skills. Of the above-mentioned studies, there are differing reasons as to why people struggle to understand the information presented on the NFP label. These reasons include insufficient literacy and numeracy skills, lack of time, not understanding serving sizes, use of percentages, fast food and snack food becoming more readily available, and others. If the NFP

label was modified to be clearer and more effective in portraying nutritional information, the percentage of consumers who use labels to make healthier food choices might increase. This current research study seeks to identify which labels are the most effective in displaying nutritional information.

Effects of Time Restriction on Food Label Use

Since time constraint has been identified as an exogenous variable capable of influencing consumer behaviour, modifications that make the current nutrition panel easier to read in a shorter amount of time have been considered (Suri & Monroe, 2003). Time has been identified as a contributing factor that may directly affect consumer decisions. Current research lists a "lack of time" as a common barrier to healthy eating, and research has explored the factors that lead to time restraints and their effects (Escoto et al., 2012). Many factors associated with time pressures, such as working late hours, having children present, short time blocks, and other shoppers, can impact the ability to make healthy food choices. Time pressure affects the amount of time consumers spend examining nutrition information which, in turn, leads to more intuition-based decisions than data-based decisions (Blitstein et al., 2020). Similarly, Welch et al. (2009) found that time pressure was reported as a barrier to healthy eating by 41% of women in their sample. These women were significantly less likely to meet fruit, vegetable, and physical activity recommendations and more likely to eat fast food more frequently. When there are time restrictions involved in choosing food, there may not be enough time to look at the nutrition label, thus increasing the probability that foods are selected for reasons other than their health benefit.

Reutskaja et al. (2011) state that consumers struggle to compare options in a choice set under significant time pressure. This finding highlights that when consumers are pressed for time

and are left to choose between options, they struggle to understand and process the information in front of them accurately. This leads to the conclusion that there needs to be a quick and easy way to help them make a healthier food choice. Escoto et al. (2012) found that over half of their student-based sample reported eating “on the run” and not having time to eat healthfully or read any form of a label. As stated by Porter et al. (1990), consumers must see information on the nutrition label before it will affect their food choice decision. Therefore, these studies help highlight that lack of time is a factor in not using and potentially not understanding nutrition labels.

A study done by Moreira et al. (2019) found that the most crucial reasons why consumers reported not reading food labels were "lack of time" (50%), considering they have excessive information (45%) and trust in the brand name (50%). This study helped identify that time constraints prevent consumers from taking the time to read the label when grocery shopping. Additionally, van Herpen and van Trijp (2011) found that more time and attention were needed when looking at the NFP label than the traffic light label or logos. This experiment sought to investigate the effect of time pressure on attention to nutrition labels and choice behaviour (van Herpen & van Trijp, 2011). The participants were 261 Turkish university students. They were randomly assigned in a 4 (labelling scheme: none, logo, MTL label, nutrition table) by 2 (time pressure: low vs. high) between subject’s design. Additionally, low time pressure was set at 16 seconds and high time pressure at 8 seconds. This study used multiple measures such as self-reported use, recognition, and eye-tracking to understand attention and processing of labels (van Herpen & van Trijp, 2011). Participants were exposed to 6 unfamiliar cereal products. After being exposed to the cereal products, participants were given questions to answer where they had to state which products, they believed to be the healthier option in a set amount of time.

Participants were also asked whether they felt time pressure when making their choice on a 7-point Likert scale (from not at all to very much). Results indicated that the participants under high time pressure reported more time pressure, whereas participants under low time pressure reported less time pressure (van Herpen & van Trijp, 2011). Additionally, results also indicate that although consumers evaluated the NFP label most positively, they paid little attention to it, and it did not stimulate healthy choices (van Herpen & van Trijp, 2011). In contrast, van Herpen and van Trijp (2011) found that traffic-light labels increased healthy product choices, even when consumers are under time pressure. This study helps prove that when under time pressure, alternative labels, such as traffic light labels, are more effective in promoting healthier choices than the NFP label.

If lack of time is being reported as a primary cause of unhealthy food choices, then a new approach to identifying healthy food options must be implemented. Some researchers have given ideas on how to reduce the time needed to make a healthy food choice by promoting label use. There have been recommendations in some literature to use both FOP (for quick information for those in a rush) and the NFP label (lengthier label for those who want all the information in less of a rush) on food packaging (Rønnow, 2020). This recommendation allows for both a quick scan label and a more detailed label, appeasing both consumers who are in a rush and those who prefer a full understanding of the nutrient content in their food. However, Watson et al. (2014) found that as purchase decisions in the supermarket are typically made quickly, and consumers will not have time to study two sources of information and, as a result, often ignore the lengthier NFP label when a FOP label is present. Therefore, if FOP labels are being given more attention and provide the same information in a timelier fashion then this is a good argument for trialling the replacement of the NFP label with a FOP label in Canada.

Overall, there is little research on time restraint and nutrition label use and comprehension. Within the existing literature, consumers have reported having a lack of time when grocery shopping, impacting the time needed to read labels (Moreira et al., 2019). Conversely, it was determined that nutrition labels (e.g., MTL systems) took less time to read and understand than the current NFP label. The following study will control for the time allowed to study the potential effects of time on nutrition label use. Participants will be given a set amount of time to view each label to identify which label is most effective when time is restricted to a comparable time that consumers would look at the label when shopping.

Implementation of Alternative Labels

It is possible that Canada could make the switch from the NFP label to an easier-to-read alternative (FOP) label in the near future. Some of the existing literature states that Canada has been moving towards implementing an alternative (FOP) label, but this change has not yet occurred (Global Food Research Program, 2021). It is important to note that implementing a FOP label is not only a change in location (from the back of the package to the front), but it could also involve the inclusion of colour as well as highlighting key nutritional information while sacrificing some of the more detailed information of the NFP label. Therefore, a change in label type has several factors to consider.

In 2018, as a key initiative under Canada's Healthy Eating Strategy, Health Canada put forward a regulatory proposal to introduce regulations requiring a "High in" FOP label on foods that exceed predetermined thresholds for sodium, sugars, or saturated fat (Health Canada, 2022). This regulation was proposed to determine if this new regulation would help consumers make healthier decisions. Mansfield et al. (2020) conducted a study with the above-mentioned "High in" FOP labels where consumers of varying health literacy levels were assigned a control

condition (current labelling with no FOP label) or one of four FOP label designs and completed six shopping tasks designed to control for internal motivations. Their results found that overall, FOP labels were significantly more effective than current labelling (NFP label) at helping consumers of varying health literacy levels to identify foods high in nutrients of concern and make healthier food choices. The reason Canada has not implemented an alternative label similar to other countries has not been made clear, but evidence suggests a change could happen soon as there has been communication about adding a FOP label (black and white 'high in' label) on the front of food packaging by 2026 (Health Canada, 2023).

Following all the criticism directed at the current form of nutrition labelling (Abdukadirov, 2015; Moreira et al., 2019; Porter & Earl, 1990), many researchers have suggested implementing FOP nutrition labels. FOP labels were created to be simplified interpretive versions that are easy to locate (Acton et al, 2018a). It is important to note that there is no single FOP label that is perfect. Each label has strengths and limitations that must be weighed against the purposes of FOP systems. For example, a recent meta-analysis published by Cecchini and Warin (2015) reported no difference in consumer choices when exposed to different types of FOP-style nutritional labels. However, other findings within the meta-analysis suggest that nutrition labelling may be a practical approach to motivate consumers to choose healthier products. The analysis also showed that interpretive labels, such as the Multiple Traffic Light label, may be more effective than the current label (Cecchini & Warin, 2015).

In 2010, the FDA announced that the goal of a FOP nutrition label is to increase the proportion of consumers who quickly notice, understand, and use the available information to make more nutritious choices for themselves and their families, which then can prevent or reduce obesity and other diet-related chronic diseases (Wartella et al., 2010). Given current public health

needs, FOP systems may have the best potential benefit if the nutrition components included are limited to those most closely related to prominent public health conditions (Wartella et al., 2010). With the rise in obesity rates and the production of processed food, change is needed to increase health awareness.

As pointed out in a review by Roberto et al. (2021), not only do FOP labels promote healthier food choices, but evidence by Mantilla Herrera et al. (2018) suggests that such labels prompt food and beverage industries to reformulate products so that they have a healthier nutritional profile. This could bring a big change to the food industry nationwide as companies would have no choice but to make their products healthier to obtain a healthy label rating. This could create a decline in the production of processed food and produce an increase in healthier food.

Lachat & Tseng (2013) reported on the current literature on FOP label systems. They analyzed various studies where participants were asked to choose which label, they preferred from different FOP style labels. The results of other studies they analyzed explain that consumers would benefit from a standard, trustworthy system based on simple, logical criteria and noted the positive effect FOP labels have on better food choices (Lachat & Tseng, 2013). Based on their compiled literature, the MTL label had the highest probability of helping consumers make healthier purchases in real-life settings (Lachat & Tseng, 2013). Similarly, a study by Goodman et al. (2013) reported that in comparison to four other versions of FOP labels, the MTL label was preferred by the selected sample of consumers. This study examined the efficacy of four types of FOP sodium labels at influencing consumers to choose food products lower in sodium (Goodman et al., 2013). Four hundred and thirty participants were recruited from community settings. Participants were randomly assigned to one of five experimental

conditions: control condition with no FOP label, basic numeric FOP label, numeric FOP label with 'high' and 'low' sodium content descriptors and numeric information and simple traffic light label with no numeric information (Goodman et al., 2013). Participants were shown pairs of grocery food products with different sodium contents and were instructed to choose a free sample. The primary behaviour outcome was the selection of low-sodium versus high-sodium products with additional ratings of effectiveness, understanding, liking and believability (Goodman et al., 2013). Results found that the three label conditions were significantly more likely to choose the lower sodium product compared to the control group (Goodman et al., 2013). They also found that the detailed traffic light label was rated easiest to understand and most effective at helping participants select low-sodium products. The UK FSA study found that the best predictor of successful label comprehension was the appearance of text indicating whether a product had 'high,' 'medium,' or 'low' levels of a specific nutrient (Hawley et al., 2013). Furthermore, it was noted that the favourable opinion toward the MTL label could be due to the fact that it does not require numeracy skills for comprehension (Goodman et al., 2013). This indicated that different labels might work better for different individuals.

To illustrate this, Méjean et al. (2012) studied patterns of perceptions of FOP nutrition labels, social factors, nutrition knowledge and attention to packaging features related to such patterns. They measured perception using three simple labels and two detailed labels: the 'Green Tick', the logo of the French Nutrition and Health Programme (PNNS logo), Simple Traffic Light (STL), Multiple Traffic Light (MTL) and 'Colour Range' logo (CR). This study consisted of 38,763 participants obtained through the French NutriNet-Santé cohort study. Results found four perception patterns. Poorly educated individuals were most often found to favour simple formats, men and the elderly preferred the colour range logo, poor nutrition knowledge

individuals preferred the simple traffic light label, and individuals with substantial knowledge favoured the multiple traffic light label. Of all the clusters found above, the MTL label was the most favoured amongst their participant pool.

In another study by Franco-Arellano et al. (2020), the efficacy of different FOP labels was analyzed. In this study, 1,997 participants were randomized into one of four FOP labelling conditions (control, warning label, health star rating and traffic light labelling). Participants were shown four drinks (a healthier drink with or without a disease risk reduction claim, a healthier drink with or without a nutrient content claim, a less healthy drink with or without a disease risk reduction claim and a less healthy drink with or without a nutrient content claim). Participants rated perceived product healthfulness and purchase intentions using a 7-point Likert scale. Results found that less healthy drinks displaying any FOP labelling were perceived as less healthy compared to the control. The Health Star Rating and MTL labels decreased consumers' perception of product healthfulness in less healthy drinks compared to the control condition and these two labels increased purchase intentions of healthy drinks compared to the control condition (Franco-Arellano et al., 2020). Therefore, FOP labelling had a significantly stronger influence than nutrition claims on consumers' perceptions.

To explain the effectiveness of colour-coded nutritional labels (like the MTL label) we can look to the colour-in-context theory. According to the colour-in-context theory (Elliot & Maier, 2012), colour meanings and behavioural responses to colours vary as a function of the context in which the colour is perceived. Behavioural responses to coloured stimuli develop through repeated pairings of colours to specific messages through learned associations (Lemos et al., 2020). In relation to this study, the colour red has been paired with danger and avoidance, as seen in the MTL label and Nutri-Score label. Similarly, including traffic light colours or warning

labels can induce emotional reactions such as anxiety about one's health. Additionally, a study done by Schuldt (2013) found that when analyzing the role of colour on health messages, when the colour green was incorporated, it was considered healthier than the colour red. The colours red and green have been linked to associations such as "stop" vs. "go" or "good" vs. "bad." The practical value of including cautionary colours is that consumers are accustomed to their meanings, and even in a rush, they would be able to recognize the product's healthfulness.

In a study by van Herpen and van Trijp (2011), traffic-light labels and especially logos increase healthy food choices, even when consumers are put under time pressure. The inclusion of colour to quickly identify healthy from harmful content is a factor consumers appreciate. This study will incorporate FOP style labels (the label's location will not be focused on) in the list of label choices to determine if having an alternative and simpler nutrition label will help consumers identify healthier food and make more accurate health decisions. This study will also include coloured labels to analyze if the inclusion of colour is also a factor that influences healthier decisions. To make better food choices, we will measure consumer preference and recall of nutritional information based on the information portrayed through alternative labels to determine which label is preferred and easily remembered in short periods.

Purpose of the Current Study

This study will focus on five specific alternative labels and the current NFP label. The first label that will be used is the MTL label. This label uses traffic light colours (red, amber, and green) as cautionary colours to inform consumers of the level of healthiness of each food element. The second label included is the Facts Up Front label (FUF), a quick-fact version of the current nutritional label that shows food content in a blue box with individual boxes representing different elements. The third label is the Nutri-Score label. This label uses a lettering system (A-

E), where an A or B rating means the healthier foods, and the unhealthy options range from C to E. The fourth label is the Health Star Rating (HSR) label which uses half a star to five stars, with five stars being the most beneficial. The final label is the NuVal label. This label rates food from 1 to 100; the higher the rating number, the healthier the food.

The current study aims to expand on the growing body of research regarding nutritional labelling and the if there is an alternative label that helps consumers make healthier food choices better than the NFP label. More specifically, this study will determine the level of accuracy of the NFP label to increase healthier food choices, analyze opinions and ratings of the NFP and alternative labels and analyze consumer retention of nutrition information from various nutrition labels. The results of this study will contribute to determining if a change from the current NFP label to increase customer nutritional comprehension is warranted.

Research Hypotheses

Most of the research on nutrition labelling is divided between favouring the current NFP label and seeking a new, more straightforward label. There has been little focus on consumer preference to decide what form of a label would increase consumer use and understanding. This study aims to examine various nutritional labels' effectiveness and identify the most “user-friendly” nutrition label. The background literature says there is a lack of clear understanding of the mass amount of information portrayed on the current label (Sharf et al., 2012). Therefore, if a label is too hard to follow, a simpler label with less information to analyze will help consumers focus on the most important information when purchasing food. González-Vallejo et al. (2016) state that there is a disconnect between consumers understanding of the NFP label and it does not produce completely accurate results in choosing healthier foods. Accordingly, the first hypothesis states that the current NFP label does not provide participants with 100% accuracy

when making food decisions. Existing research, as stated above, has proven that alternative labels such as the MTL labels had a high preference rate and have been proven to be the most successful in helping consumers make healthier food choices (Herpen & van Trijp, 2011). Thus, the second hypothesis predicts that the MTL label will be the most preferred label. Furthermore, we aim to analyze the reasons why participants prefer a certain label compared to others and ways in which labels can be improved. Studies such as Andrews et al. (2021) have shown that participants accuracy scores for nutrition are highest with the MTL label. Additionally, cognitive research has demonstrated that increasing the meaningfulness of information can directly impact memory, for example, traffic light colour association (Amer et al., 2018; Schmidt et al., 1999; Skinner & Price, 2019). Therefore, the third hypothesis states that an alternative food label, specifically the MTL label, will have higher nutrition information recall scores than the current NFP label.

Methodology

Participants

This study was approved by Laurentian Universities Ethics Board. Two hundred participants took part in this online study, with the minimum age being 17 years old. The minimum age of 17 was decided because this is the age at which individuals usually leave the family home to go to college or university and live independently where they are required to do their own food shopping. Participants were primarily recruited from Laurentian University and social media platforms (e.g., Facebook and Instagram). To recruit participants for the study, social media posts, word of mouth (directing to social media) and Laurentian University's SONA extra credit system were used. Participants were shown a poster that provided individuals with a

brief description of the study as well as a link to follow that led them directly to the online study. The current study had 86% female participation and 56% university/college student participation.

Materials

This study was available online via the Redcap platform, requiring a computer, tablet, or phone to complete the survey. To begin, participants were given an informed consent document to sign, which informed them of their right to withdraw at any point. A short questionnaire created by Gasparis (2020) was used to assess participants' current familiarity with the existing NFP label (see Appendix C).

For this study, various pictures of international food items were included to attempt to avoid any familiarity bias. In addition, six different food labels were included: Multiple Traffic Light (MTL), Facts up Front (FUF), Nutri-Score, Health Star Rating (HSR), NuVal and the current Nutrition Facts Panel (NFP) used in Canada (see Appendix D). A no-label condition was also included as well (food items with no label). These labels were chosen based on their inclusion in different studies within the current literature.

Design

This experiment used a repeated measures (within subject) design with 7 treatment levels. This study included three tasks. The independent variable for the first task was the presentation of the NFP label (label present vs no label present), and the dependent variable was the understandability of the NFP nutrition label information. The second task included 7 label conditions (six label conditions and a no label condition) that participants had to rate based on their preference. There were two independent variables for this task. The first independent variable was the type of label, and the second was pre- and post-exposure to the labels. The dependent variable was preference for a specific label. Preference was defined as the choice

made by participants regarding the most understandable and practical nutrition label in their opinion to predict which form of label encouraged healthier food choices. For the third and last task, the independent variable was the type of label, and the dependent variable was the recall of nutrition information to answer nutrition-based questions. Recall was defined as how much information participants could remember regarding food content from a specific nutrition label.

Procedure

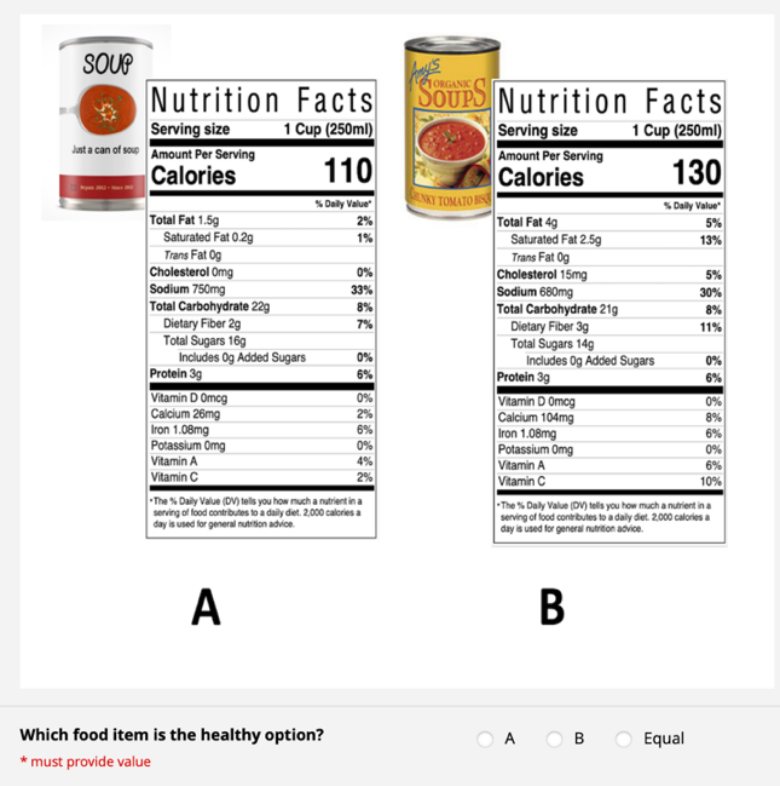
To begin, participants were informed that they were participating in an online research study exploring the effects of nutrition and nutrition labels on consumer food purchasing. Then participants completed an informed consent form. Following this, participants completed a demographic questionnaire to record their background information (see Appendix A). Participants were asked basic personal information such as gender, age, highest achieved educational level and relationship status. Then, a short questionnaire was given to assess the participants' current familiarity and understanding of the existing Nutrition Facts Panel (see Appendix B). This step was included to see where participants stood in terms of use and understanding of the current NFP label before the tasks began.

To assess participants' current ability to read the NFP label, a base test was used created by Gasparis (2020), which was composed of ten multiple-choice questions (see Appendix C). These questions were used to determine if consumers understood the current NFP label or if they were lacking some or all understanding of the label. It was also used to determine if familiarity with the labels was correlated with nutrition label knowledge. After this test, participants were randomly assigned to four different groups (through the Redcap platform), where the item presentation was counterbalanced to avoid order effects.

The first task presented participants multiple times with two food items that either both had no label (control condition) or both had their current NFP label. One item was healthier than the other. Participants were asked to identify the healthier item. For this study, the label for each food item was not altered from its label in real life. Therefore, the healthier food item was determined with the assistance of a dietitian based on the number of calories, sugars, and fat (whichever had the least amount). In total, participants were shown 20 food items. Specifically, they were shown two of the same food items from different manufacturers per screen (i.e., two bottles of orange juice, each from a different manufacturer). Participants were shown 10 pairs of food items, 5 pairs with a food label and 5 pairs with no label. Three options were presented for participants to check off under the food items, “a,” “b,” or “equal.” Participants checked off one of three boxes depending on which item they felt was healthier (item A or item B) or if they felt there was no difference (equal) as shown in Figure 6. The goal was to test participants' understanding of nutrition information to identify the healthier food. As previously stated, international food items were used to avoid familiarity bias. Food items included: Kid Cuisine frozen dinners, Simply Tasty prepackaged meals, ice cream, plain chips, juice, packaged cookies, yogurt, tomato soup, protein bar and peanut butter. This task determined whether having a label present on a food item helps consumers more accurately decide the healthiness of a food item. If NFP labels help, we would expect the label condition would result in much better accuracy than the no-label condition. The data was analyzed using a paired samples t-test.

Figure 6

Task 1



In the second task, all participants were shown the current Canadian standard nutrition label, the Nutrition Facts Panel (NFP), and some alternative food labels, Multiple Traffic Light (MTL), Facts Up Front (FUF), Nutri-Score, Health Star Rating (HSR) and NuVal (see Appendix D). Participants were asked to rate each label on a 7-point Likert scale based on their preference for each label. The scale ranged from 1 being “not at all,” 2 “slightly dislike,” 3 “moderately dislike,” 4 “neither dislike or like,” 5 “slightly prefer,” 6 “moderately prefer,” and 7 “strongly prefer.” Additionally, the same 7-point Likert scale was used to measure which label was the clearest (clarity) in giving nutrition information for all six labels (see Appendix E). The data was to be analyzed through a chi- square goodness of fit test. When they chose their most preferred and least preferred, they were asked to explain why they made these choices through means of a “pros” and “cons” checklist (see Appendix F). Each list gave participants reasons why they liked

a particular label and another list of why they disliked it (including tips for modifications). This task was included to see which label was preferred and disliked the most before the third task. This information was then compared to the results of the third task to see if the labels participants preferred were in actuality the easiest label to understand and remember. In addition, this information from this task helped shed light on what consumers wanted to see (or not see) on their nutritional label to make the labels more effective.

Lastly, the third task presented participants with different food items in different orders. Participants were shown 21 different food items (3 items for each of the six label conditions and 3 items for the "no label" control condition). Before the task began, participants were notified that they were being timed during the task. Participants were given 20 seconds to view each food item. Once the 20 seconds were complete, participants were shown the same food item, but without the label. Participants were then asked to state whether the food item was healthy or not without having the label in front of them using only the information they could recall. To do so, participants used a 7-point Likert scale to dictate whether they thought the food they saw was healthy or not. The closer the rating was to 7, the healthier the food was perceived; the closer to 1, the unhealthier the food was perceived, and if the choice was placed in the middle, the participant was considered unsure. Participants then answered six additional questions (see Appendix G) to test their ability to recall information they observed on the food labels. This task was analyzed through a one-way ANOVA repeated measures test. This task measured how accurately participants could interpret the information presented on 6 different food labels (same labels as the above tasks) or simply their packaging (no label) to answer health-related questions about each food item. This task tested which label or labels most accurately allowed consumers to gain nutritional information about the products they were shown. The time it took participants

to respond was also recorded to see how fast participants could answer the questions. This was included to see which label produced the fastest correct answers. Information recall was measured using multiple-choice and fill-in-the-blank questions. Correct answers were predetermined with the help of a dietitian. A final question was included at the end of the third task to re-assess each participant's preferred label. More specifically, this additional question was included to see if after using the labels in an experimental setting their preference for a certain label changed based on how helpful it presented as being in answering nutrition questions when having to use it compared to simply judging the labels based on appearance. Many of these labels have not been seen before and they were picking them based on appearance and not familiarity. In the end, the label with the most correct responses in total was highlighted as being the label that most accurately helped consumers in making healthier food decisions.

Results

Sample Characteristics

Two hundred participants (164 females, 35 males, and 1 non-binary individual) aged 17-65 years (*M*=30.18, SD= 12.07) were included in the current study's analysis. Two hundred and forty-one participants quit the study before it was fully completed and were not included in the analysis as well as 9 participants were excluded due to missing data. Of this sample, 14.5% of participants reported not using the NFP label when purchasing food and 32% reported always using the label. Participants were randomly sorted into 4 groups (randomly done through the Redcap platform) to avoid order effects. The first group consisted of 46 participants, the second group had 55 participants, the third group had 59 participants, and the fourth group had 40 participants. The four groups were not equal as a direct impact of the participant dropout

Table 1

Sample Demographic Characteristics

Baseline characteristic	Group 1		Group 2		Group 3		Group 4		Full Sample	
	n	**%**	***n***	***%***	**n**	**%**	***n***	**%**	***n***	**%**
Gender										
Female	8	17	11	23	9	40	7	17.5	35	17.5
Male	38	83	44	27	50	60	32	80.	164	82
Other	0	0	0	0	0	0	1	2.5	1	0.5
Age										
17-19	7	15.2	6	10.9	11	18.6	7	17.5	31	15.5
20-29	14	30.4	32	58.2	26	44.0	19	47.5	91	45.5
30-39	15	32.6	4	7.3	9	15.3	6	15.0	34	17.0
40-49	6	13.0	6	10.9	8	13.6	5	12.5	25	12.5
50-59	3	6.5	4	7.3	3	5.1	2	5.0	12	6.0
60-69	1	2.1	3	5.4	2	3.4	1	2.5	7	3.5
Marital status										
Single	10	21.8	17	31.0	17	28.9	13	32.5	57	28.5
In a Relationship	15	32.6	16	29.1	21	35.6	11	27.5	63	31.5
Married	17	37.0	17	31.0	12	20.3	11	27.5	57	28.5
Divorced	0	0	0	0	2	3.4	2	5.0	4	2.0
Common Law	3	6.5	5	9.1	7	11.9	3	7.5	18	9.0
Widowed	1	2.2	0	0	0	0	0	0	1	0.5
Highest Education Level										
Some High School	1	2.2	2	3.6	0	0	0	0	3	1.5
High School	17	37.0	17	31.0	23	39.0	20	50.0	77	38.5
College	16	34.8	17	31.0	23	39.0	9	22.5	65	32.5
Bachelor's Degree	11	24.0	14	25.5	11	18.6	10	25.0	46	23.0
Master's Degree	1	2.2	4	7.3	2	3.4	1	2.5	8	4.0
PhD. Or Higher	0	0	0	0	0	0	0	0	0	0
Trade School	0	0	0	0	0	0	0	0	0	0
Prefer not to say	0	0	1	1.8	0	0	0	0	1	0.5
Employment										
Fulltime	23	50.0	23	42.0	21	35.6	17	42.5	84	42.0
Part-Time	6	13.0	16	29.1	15	25.4	8	20.0	45	22.5
Seeking Opportunities	1	2.2	0	0	4	6.8	0	0	5	2.5
Student	16	40.0	12	21.9	17	28.9	14	35.0	59	29.5
Retired	0	0	2	3.6	1	1.7	1	2.5	4	2.0
Prefer not to say	0	0	2	3.6	1	1.7	0	0	3	1.5
Annual Household Income										
Less than $25,000	8	17.4	9	16.4	11	18.6	6	15.0	34	17.0
$25,000- $50,000	6	13.0	5	9.1	8	13.6	10	25.0	29	14.5
$50,000- $100,000	11	24.0	13	2.4	17	28.9	7	17.5	48	24.0
$100,000- $200,000	14	30.4	20	3.7	14	23.7	8	20.0	56	28.0
More than $200,000	2	4.3	1	1.8	3	5.1	4	10.0	10	5.0
Prefer not to say	5	10.9	7	12.7	6	10.7	5	12.5	23	11.5

Note. N = 200 (*n= 46 group 1, n=55 group 2, n=59 group 3 & n=40 group 4*). Participants were on average 30.18 years old (*SD* = 12.1).

Percent of Use of Nutrition label on Overall Understandability

The overall level of use and understanding of the current NFP was calculated. As shown in Figure 7. 32% of our participant pool reported consistently using the existing NFP label when purchasing food. Therefore, less than half of our sample used the current label every time they purchased food. Additionally, 14.5% of participants reported not using the NFP label at all. The remaining 53.5% of participants vary between using the NFP label most of the time to rarely ever. Participants that reported using the NFP label further explained what parts of the label they did not understand. As shown in Figure 8. 63% of participants reported they understood all the categories on the current label. Of the remaining participants, low percentages vary for the categories that were not understood. The least understood categories were "Trans Fat" and "Saturated Fat." Overall, this task highlighted that for the most part, consumers occasionally use nutrition facts when purchasing food, but the level of complete understanding could be improved as further tasks and analyses of this study will show.

Figure 7

Participant Use and Frequency of Nutrition Facts Panel

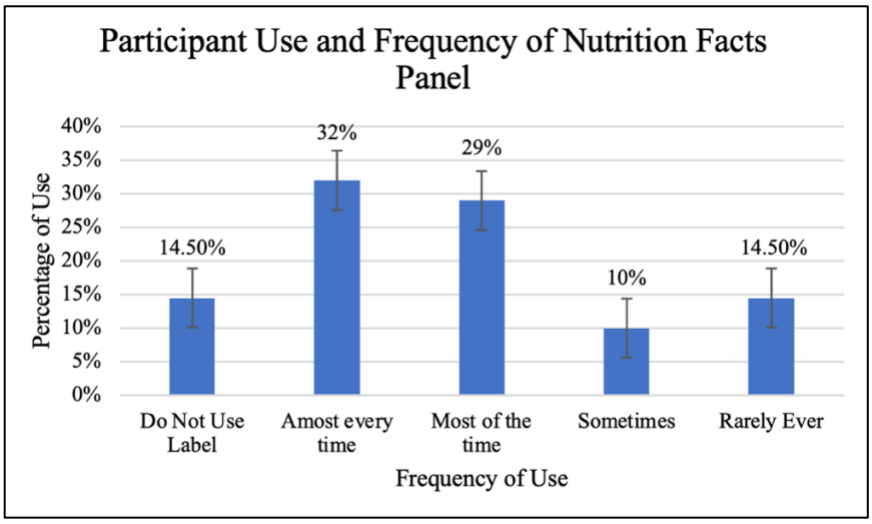
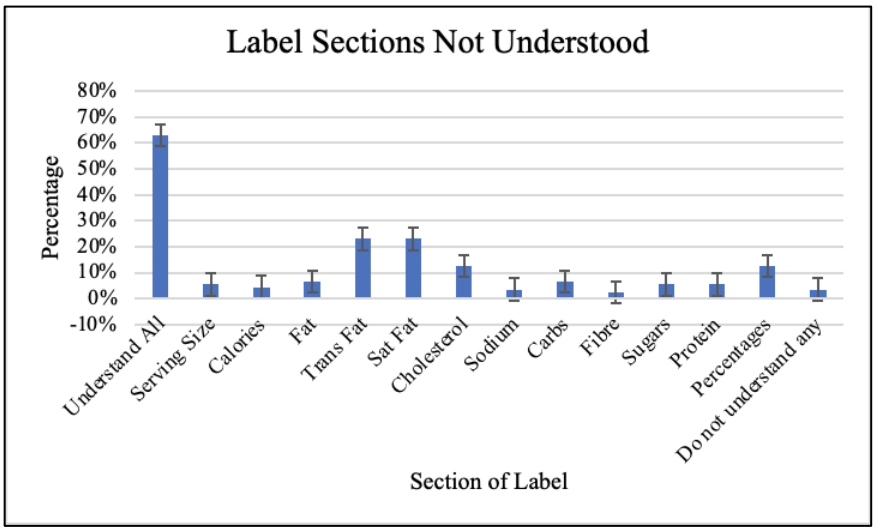


Figure 8

Nutrition Facts Panel Sections Not Understood



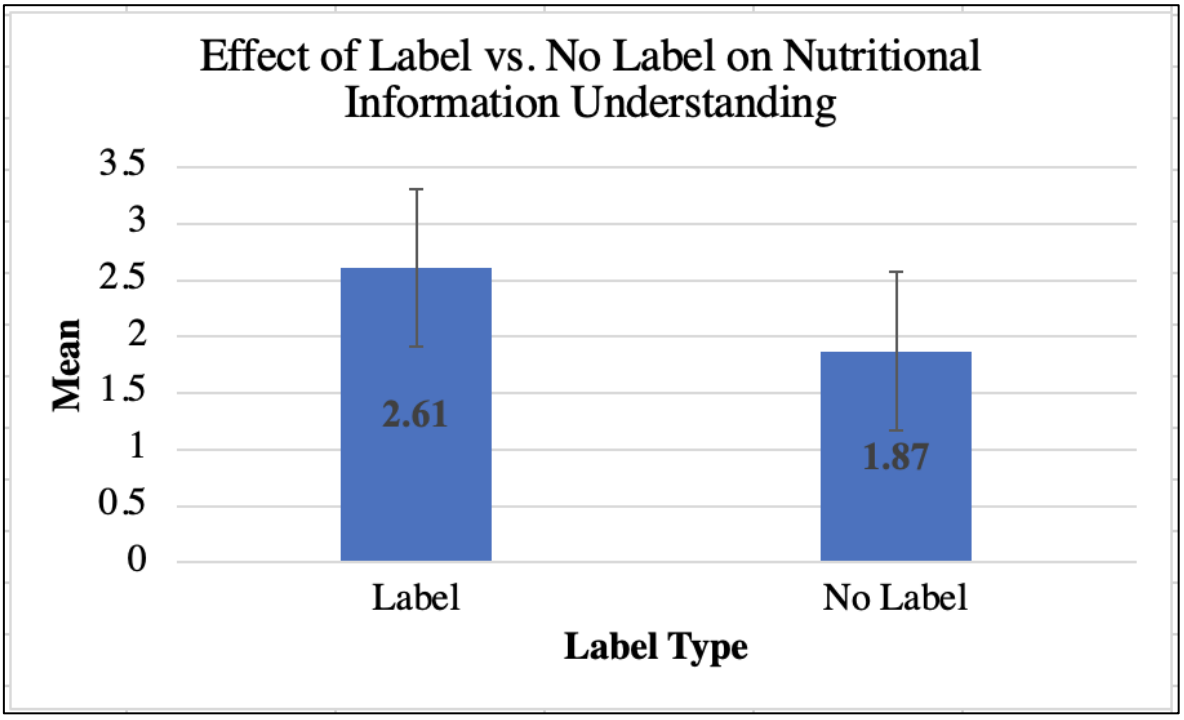
Label Use and Understandability in Decision Making

In the first task of the study, participants were shown two food items (one with the NFP label and one with no label) and then asked to identify which food item was healthier or if they were of equal health value. The data was analyzed using a paired samples t-test. This task was used to compare the understandability of the current NFP within the label and no-label conditions. If participants understood the NFP label, we would expect better accuracy in identifying healthier food items. Results were analyzed by collecting the total sum of correct answers for the label and no-label conditions. The label condition averaged 2.63 out of a possible maximum of 5, whereas the no label condition averaged 1.87 out of a possible maximum of 5. There was a significant difference between correct answers scores for the label (M=2.63, SD=1.1) and no label (M=1.87, SD= .9); t (199) =7.717, p<.001 (see Figure 9). Food packaging with a label showed better accuracy scores than food packaging without a label. These results suggest that participants were more accurately able to decipher which of the two food items was healthier based on food packaging with a label than food packaging without a label. This is

important because it shows that labels make an overall difference. Also, important to note that even though the mean score for the label condition was higher, the sum of scores was just above 50%. If the current Canadian NFP label was successful in relaying nutrition information to consumers, we would expect to see an average score close to 5. This shows that even though participants performed better with a label, accuracy in identifying the healthier food option with the NFP label was not effective enough to say this form of label is the best choice for helping consumers make healthier choices. More specifically, if the NFP label was effective the score should have been 5 or close to 5 because participants had the nutritional information right in front of them to make an accurate decision.

Figure 9

Effect of Label and No Label Conditions on Nutritional Information Decision Making



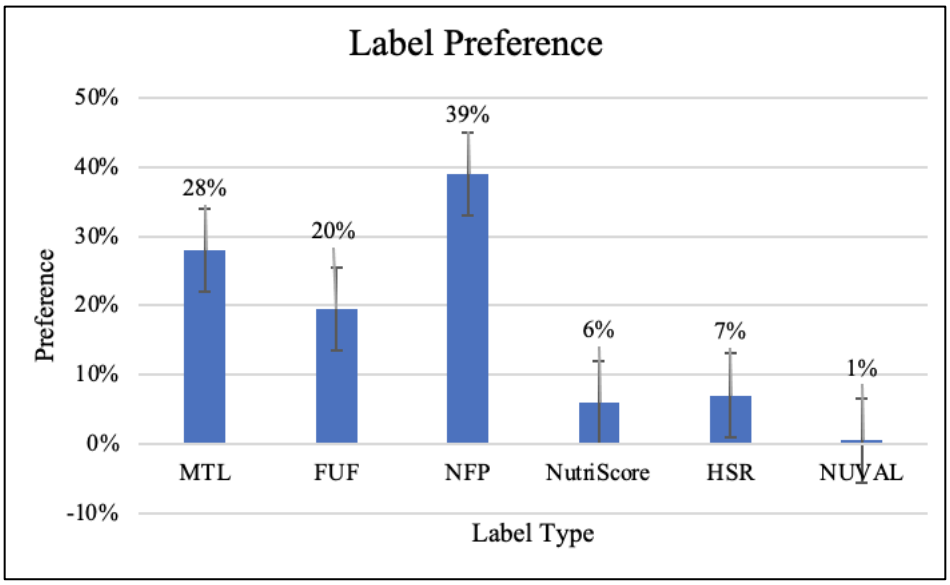
Note. Means for correct identification of the healthier food based on NFP label compared to no label, t (199) = 7.717, p < .000, effect size d= 0.75.

Nutrition Label Effects on Preference Ratings

For the second task in the study, participants were instructed to rate six different food labels (Multiple Traffic Light, Facts up Front, Nutrition Facts Panel, Nutri-Score, Health Star Rating and NuVal) on their overall preference level and on the labels' overall clarity. A chi-square test of goodness-of-fit was performed. This test not only showed which label was preferred but also highlighted the differences between labels and how significant these differences were. This test was used to analyze if the six labels were equally preferred or if there was a label that was more preferred than others. Additionally, the inclusion of the NFP label was there to determine if the current label (NFP) was effective in conveying nutritional information or, alternatively, if its format was too confusing. Eventually, the results from this phase were compared to the preference after task three to see if their preference had changed after using all the labels. Analysis results show that preference for the six labels was not equal, χ^2 (199, N=200) = 132.460, $p < .001$. In the second task (Figure 10) the highest preference rating was given to the NFP label (78), which differed significantly from the preference for MTL (56), FUF (39), Nutri-Score (12), HSR (14) and NuVal (1). It was also found that, MTL (56) had a higher preference than FUF (39), Nutri-Score (12), HSR (14) and NuVal (1). FUF (39) had a higher preference than Nutri-Score (12), HSR (14) and NuVal (1). HSR (14) had a higher preference than Nutri-Score (12) and NuVal (1). Finally, Nutri-Score (12) had a higher preference than NuVal (1). These results suggest that before being exposed to the different labels in task three (experiment setting), participants preferred the label they were used to, the NFP label.

Figure 10

Effect of Label Type on Preference Before Exposure



Note. Percentages of preference for a certain label pre-experimental setting, post-exposure $\chi^2(5)=$ 132.460, p<.000 also shown by the effects of size, d= 0.81.

At the end of this task, participants were asked to provide feedback on their most preferred and least preferred label through a checkbox list of "pros" and cons." The original preferred label was the NFP label (78 out of 200 participants). The reasons participants preferred this label included a good level of detail, well organized and easy to read (full list of reasons included in Figure 11). Additionally, participants were asked to provide elements of the NFP label that could be improved. Such elements included font being too small, more colour was needed, and the information presented was too hard to understand (full list of elements included in Figure 12). Overall, there were several reasons why the NFP label was the most preferred in this sample of participants. However, there were still elements of the label that were suggested should be improved to make this label better.

Figure 11

Reasons for NFP Label Preference

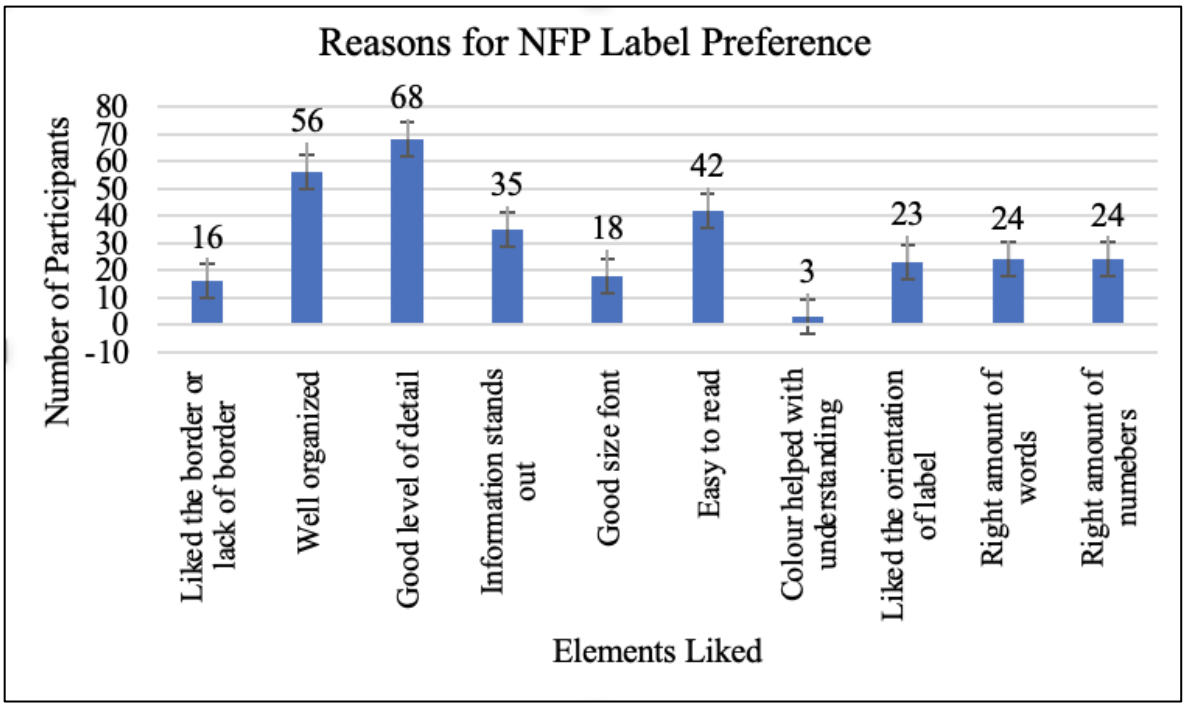
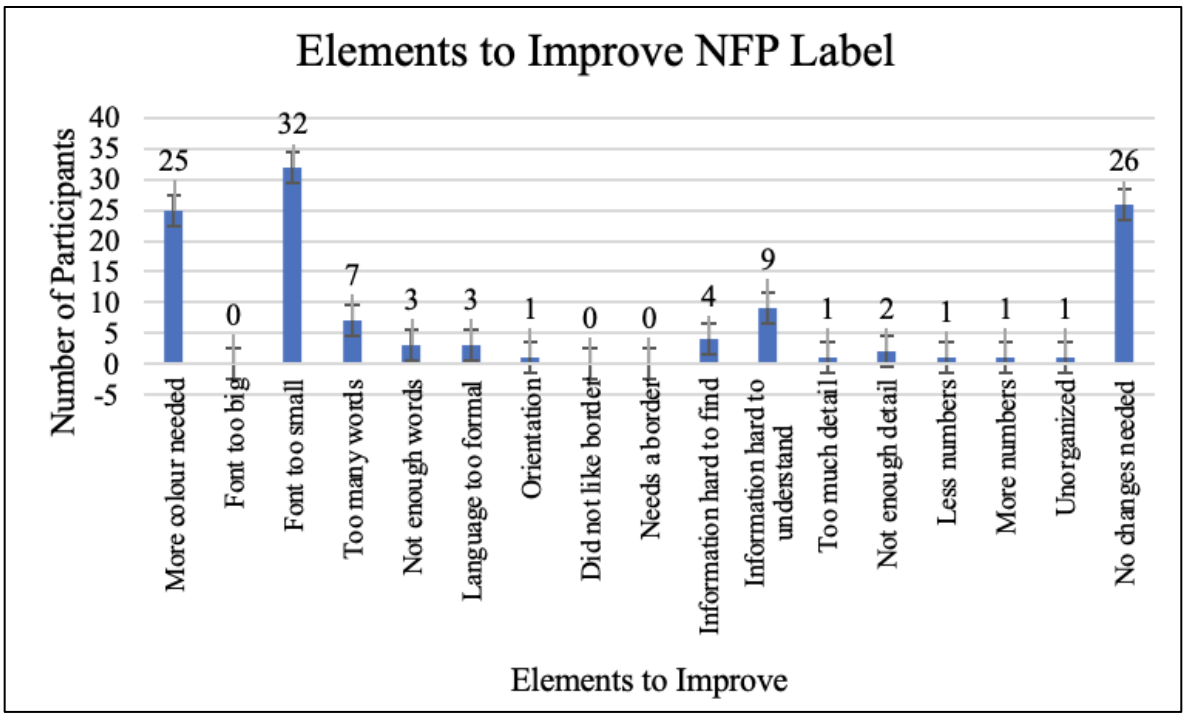


Figure 12

Effect of Label Type on Preference



Nutrition Label Knowledge on Recall

For the third task of this study, where participants were presented with a food item with a label, then the label was removed, and they were asked to answer a series of nutritional questions about the product. A One-Way ANOVA repeated measures test was used to analyze the results. This test was used to determine if label-specific information recall varied significantly amongst the six different nutritional labels, $F(6, 1194) = 64.7$, $p < .001$, $\eta p^2 = .245$. Mauchly's test indicated that the assumption of sphericity had been violated, $\chi^2(20) = 174.003$, $p<.001$, therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ($\varepsilon= .713$).

Results of a pairwise comparison test showed that participants recalled more information from the MTL label (M= 12.13, SD= .244) compared to FUF label (M=10.14, SD = .243), p<.001, p<.001, HSR label (M= 9.91, SD= .239), the no label condition (M=9.18, SD= .315), p<.001, Nutri-Score label (M= 7.52, SD= .201), p<.001, and NuVal label (M= 7.06, SD= 1.80), p<.001.

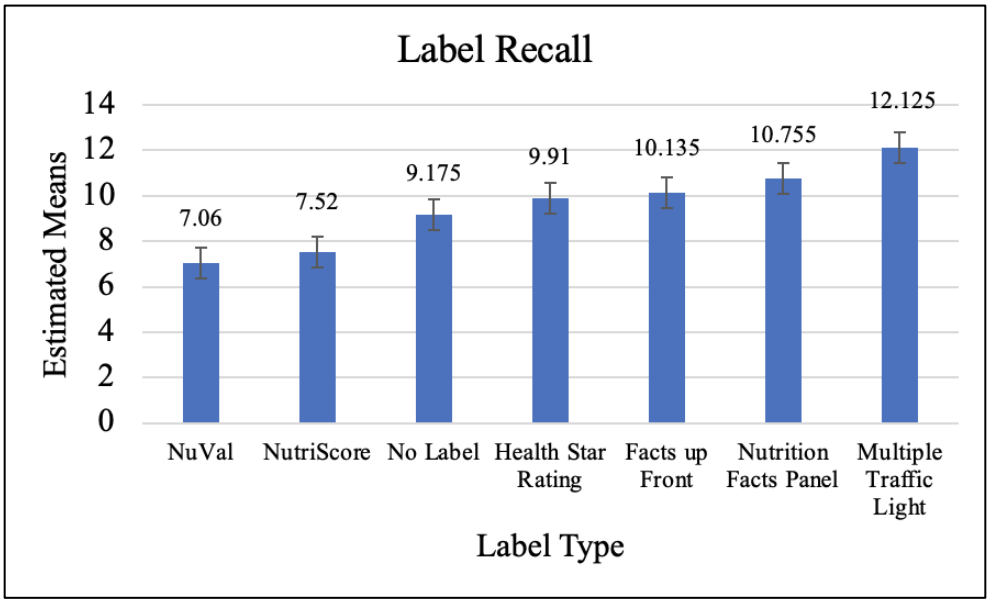
Scores for the NFP label were significantly higher than the Nutri-Score label, p<.001, the NuVal label, p<.001 and the no label condition, p<.001. Scores for the FUF label were significantly higher than the Nutri-Score label, p<.001, and the NuVal label, p<.001. Scores for the HSR label were significantly higher than the Nutri-Score label, p<.001, and the NuVal label, p<.001. Scores for the no-label condition were significantly higher than the Nutri-Score label, p<.001 and the NuVal label, p<.001.

These results demonstrate that participants performed best at recalling information from the MTL label than all other labels but was very close to the NFP label (see Figure 13). Results of this task indicate that after testing use and understanding, not only did an alternative label

prevail as the most preferred but an inefficient label (such as the NuVal) was shown to impair performance (compared to no label at all). More specifically, when we tested participant understanding of the different labels, the no-label condition outperformed the Nutri-Score and NuVal labels. Both labels use one letter or one number to portray health level, but as our results show, this type of label produced worse performance scores than having no label at all.

Figure 13

Effect of Label Type on Recall



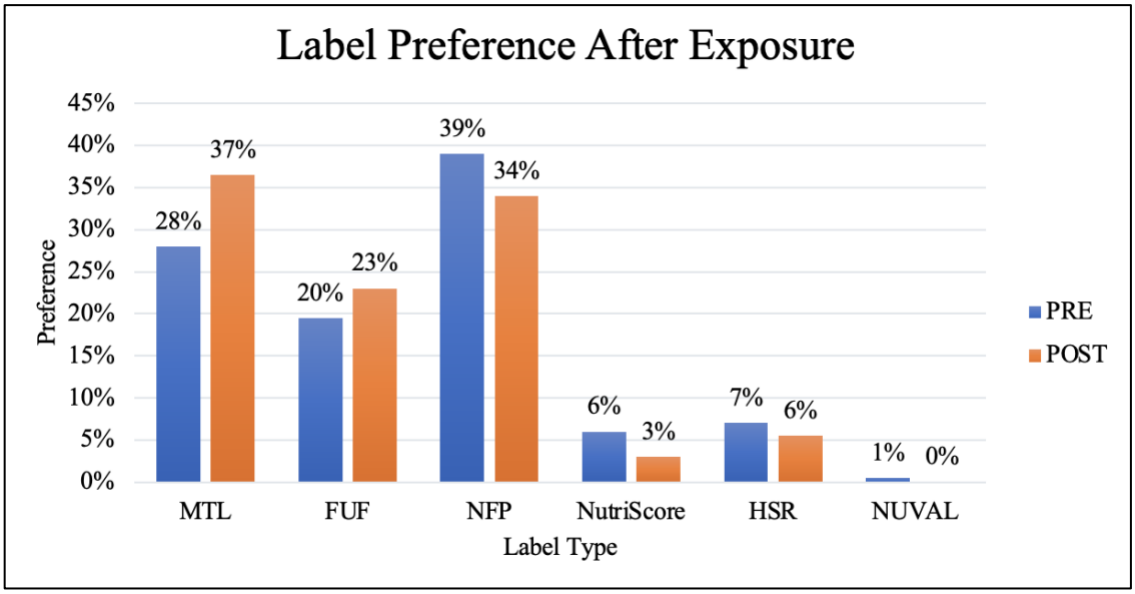
Note. Means of correct recall scores obtained for each label, $F(6,1194)= 64.7$, $p < .001$, $\eta p^2 = .245$.

After being exposed to the different labels in the third task and being asked to re-assess their preference, many participants switched their overall preference to the MTL label. This task asked participants if their preference for a specific label changed and to leave a comment in a blank box on why they changed their preference. Participants' comments highlighted the effectiveness of the alternative labels to convey nutrition information, the use of colour to capture attention, and an appropriate amount of words and numbers. Another Chi-Square

goodness of fit test was done to test participants' preferences after being exposed to the labels and using each one in the third task. As shown in Figure 14. preference for the MTL label (73) differed statistically significantly from the preference for FUF (42), NFP (70), Nutri-Score (5), HSR (10) and NuVal (0), χ^2 (5) = 102.950, p<.001. More specifically, not only did participants state they changed their preference from the NFP label to the MTL label, but they also performed better with the MTL label in the third task. After one exposure to the alternative labels compared to the current NFP label, there was a shift in preference and performance to the MTL label. Therefore, the recall task increased the preference rating for the MTL label. Comments left on the MTL label preference were that values were easier to remember, the label was well organized, information stood out, the label was easy to read, and the inclusion of colour helped overall understanding.

Figure 14

Effect of Label Type on Preference After Exposure



Note. Percentages of preference for a certain label post-experimental setting, post-exposure χ^2 (5)= 102.950, p<.001 also shown by the effects of size, d= 0.71.

Discussion

The goal of this study was to gain a deeper understanding of the viewpoint and opinions and how information is recalled from the consumer on whether the current NFP label is efficient at presenting nutrition information, or whether an alternative method of delivery is more effective in allowing information to be encoded and recalled. In other words, is less more when it comes to learning and memory. The evidence from this study supports the notion that changing the food label to a simpler and easier-to-understand label can increase awareness and recall of healthier food content and improve healthier eating.

The current experiment investigated consumers' current level of understanding and use of the standard NFP label as well as consumer preference for a possible new label. This experiment consisted of three phases. The first phase tested if the NFP label was able to clearly convey nutritional information to people looking right at it. First, participants were asked to share how much they use the current Nutrition Facts Panel on a scale from never to all the time. Then participants were presented with 20 food items, half of which had food labels and the other half did not. Participants were asked to identify which of the two food items were healthier with a food label or without. It was found that while people were more accurate when the NFP label was present their accuracy was still only roughly 50% when the label was present.

The second phase exposed participants to the current NFP label and five other alternative labels (MTL, FUF, NSCR, HSR and NuVal). Participants were required to compare the different labels and choose which label they preferred best and which they least preferred. It was found that participants preferred the label currently in use, the NFP.

The last phase took all six labels mentioned above with the inclusion of a no-label condition and paired them to a food item; then, gave participants a set amount of exposure time

(twenty seconds) to the label and then removed the label and asked participants to answer nutritional questions related to the food item. It was found that the MTL label produced the best scores. After this task, participants were again asked to indicate which nutritional label they preferred. This time the participants preferred the MTL label (closely followed by the NFP).

The three key hypotheses were: (1) the current Nutrition Facts Panel is not 100% accurate in portraying nutrition information to help consumers identify healthier food choices; (2) the MTL label would be the most preferred label; (3) an alternative food label, specifically the MTL, will have higher nutrition information recall scores than the current NFP label.

Results of the first task where participants shared their level of use and how well they understood the information presented within the NFP label revealed that 32% of consumers reported "always" using the NFP label when purchasing food. This percentage is less than half of our total sample. This percentage is also lower than the percentage found by the American Heart Association (2019), where forty-three percent of consumers reported "always" looking for healthy options. Sharf et al. (2012) stated that there is a lack of understanding on the consumer's side when making sense of the information portrayed through nutrition labels, and our results, though different in nature, show the same trend.

When asked what they did not like about the NFP label, participants indicated that some, if not all the percentages included in the current label were hard to understand. More specifically, as shown in Figure 8., every section of the label has a percentage of participants that lacked understanding, such as the twenty-three percent of participants that did not understand the "trans-fat" and "saturated fat" sections. This finding suggests that sections of the current label are harder to understand and could be improved. Overall, this proves that having a label present on food packaging is helpful, but this type of label may not be the best representation of the

nutrition information. The next task further broke down the effectiveness of the NFP label in comparison to other types of labels to see which type of label consumers prefer to help them make healthier food choices.

In the second part of the first task, we presented participants with two food items, one with the current NFP label and one with no label at all and asked them to use the information displayed to identify the healthier option. Results of this task indicate that participants were more accurately able to identify the healthier food item when the NFP label was present. These findings highlight that having a nutrition label on food items does help consumers make healthier food choices. The range of scores was 0 to a max score of 5 amongst all participants. Participants had a higher success rate (M=2.61) when a label was present than when there was no label at all (M= 1.87). For the NFP label condition, the percentage of correct answers (52.5%) was just above half so while it still outperformed the no label condition correct answers (37.4%), it was not close to being near 100%, which is the number you would expect to see if the label was clear in letting consumers know how healthy an item is. This finding confirms our first hypothesis that the NFP label does not provide consumers with 100% accuracy when making food decisions. This finding is similar to the findings of Persoskie et al. (2017) and Sharf et al. (2012) that found that the NFP label leads to some difficulties in accurately identifying nutritional content and higher reported comprehension than actual comprehension. Additionally, Kim et al. (2021) also found that participants were better at locating health information than they are at manipulating the information on the NFP label in order to understand and make healthier food choices. The current study can add to these findings that there is a lack of complete understanding of the NFP label with every section having a portion of participants that did not understand, and when participants had to use the label information and decide which food was healthier the accuracy

rate was much lower than expected, which suggests the current NFP label is not 100% accurate in displaying health information. More specifically, the information portrayed in the current NFP label may be too confusing to understand on its own and made worse when this information must be manipulated or calculated to get a full picture of what each nutrient means when considering serving size and all the information as a whole.

The second task of this study presented participants with five alternative nutritional labels (MTL, FUF, HSR, Nutri-Score and NuVal) in addition to the current NFP label and had participants choose which label they preferred the most and which they least preferred. Initial preference ratings favoured the current NFP label. In addition, participants were asked to provide feedback on what aspects of the label they liked. Participants shared in their comments that they preferred this label because it is detailed and has more information, includes all the necessary information, is well organized, the information stands out, and it is easy to read (refer to Figure 11). They also shared reasons the label should be improved to make it better, such as more colour needed, the font being too small, too many words and information being hard to find and understand (refer to Figure 12). These reasons as to why the label should be improved are similar to findings and suggestions made by Mackey & Metz (2009) and Roberto and Khandpur (2014).

The NuVal and Nutri-Score labels were least preferred among our participant pool within our sample of labels provided. These two labels did not give enough information to make a health decision and were rated as “not at all” preferred or clear by many participants in this sample. They lack detail and specifics when comparing these two labels to the NFP or MTL labels. Both labels provide one number or one letter to provide a full-scale health advertisement. The lack of detail seems to have done more harm to performance scores. This finding supports previous studies, such as Castronuovo et al. (2022), which demonstrate that overly simplistic

labels like the Nutri-Score label are not preferred by consumers, nor do they improve perceived healthfulness. These findings suggest that while some labels may be beneficial, others may undermine their intended purpose.

Previous cognitive research has demonstrated that increasing the meaningfulness of information can have a direct impact on memory, specifically information that is consistent with prior knowledge has been shown to be judged as easier and better to remember (Amer et al., 2018; Schmidt et al., 1999; Skinner & Price, 2019). Moreover, individuals with prior nutrition knowledge are better equipped to comprehend and recall food label information, which can inform their food choices (Miller & Cassady, 2015). While simpler information requires less visual attention, more meaningful information allows individuals to better understand its purpose and context. For instance, Gabor et al. (2020) found that while the Nutri-Score label required minimal visual attention, it resulted in inflated estimates of nutritional value, whereas the MTL label, which incorporated meaningful colours, required more visual attention, but led to more accurate estimates. Additionally, as discussed in a review by Muller and Prevost (2016), processing numbers requires more cognitive resources and effort than processing colours as numbers must be read, understood and a threshold has to be decided, whereas processing colours requires fewer steps and are usually automatically processed based on the associated meaning each colour has been given (e.g., red is associated with stop, bad or warning). Additionally, Oswald et al. (2022) found in their study that FOP labels that include colour are more visually attractive than black and white labels. The findings of the present study further support the above finding that incorporating more meaningful information, such as traffic light colour coding, can enhance memory and recall of nutritional information. The inclusion of colours was identified as a key factor in facilitating memory. Specifically, the use of personally relevant information, such

as traffic light colours, proved helpful in identifying the healthiness of different food items, as red, amber, and green are familiar warning signals that people easily associate with their meaning (bad, mediocre and good). In contrast, the single-factor labels that required participants to remember a single digit or letter proved to be too difficult when trying to recall specific information (too much to guess). Therefore, it is important to consider these findings when selecting alternative food label designs in the future. Labels should encompass all necessary information, utilize meaningful colour coding effectively, and avoid oversimplifying the healthiness of a food item to a single value.

At the end of the study (following task 3), preference was re-assessed to see if their preferred label from task two remained the same after using all six labels to answer questions related to nutrition content. It was thought that after using the labels, one or more of the unfamiliar labels might now be preferred because the participants would experience what it was like to use them. At the end of the study, when participants were asked to re-assess their preferred label, the overall preferred label changed to the MTL label, closely followed by the NFP label. This finding partially confirms our second hypothesis that the MTL label had higher preference ratings, but only after being exposed to the label in an experimental setting. When it came to the MTL label, participants reported appreciating the inclusion of colour while incorporating the good (green), mediocre (amber) and bad (red) (colours they are familiar with using in rating systems) to know if the food item was healthy or not. Participants left comments at the end of the study explaining their reasoning for the shift in preference was because the NFP label was too confusing and included too much information to process in a short amount of time, whereas the MTL Label included colours to help distinguish good from bad and condensed the information into an easier format to read and remember quickly.

These findings indicate that relying solely on label perception is insufficient in promoting healthier consumer choices. Like the results of Goodman et al. (2013) that found that the MTL label was most preferred in terms of being easiest to understand and most effective in helping consumers identify accurate choices. Additionally, results from a study conducted by van Herpen and van Trijp (2011) found that participants rated the NFP label as best and most likely to be used in choice, but when tested, the MTL label and logo raised choices of healthy options. This again suggests that label perception is not always accurate. This finding suggests that having a label that incorporates meaningful information and is easier to remember leads to more accurate health choices compared to single-factor labels like the NuVal label. Previous research has demonstrated that familiarity plays a significant role in shaping our skepticism, particularly towards unfamiliar stimuli (Fenko et al., 2016). In the context of this study, participants initially preferred the current NFP label due to its familiarity but were skeptical towards other labels. However, upon experimental testing, this skepticism diminished, and an alternative label emerged as the most preferred and effective in promoting accurate recall (MTL). This aligns with previous research on memory, which highlights the importance of meaningful information in facilitating recall and decision-making.

In the final task of this study, participants were exposed to multiple labels for a short time and asked to recall information to answer questions. Among all six labels and a no-label condition, recall abilities were best represented with the MTL label. Participants were able to accurately answer nutritional questions after exposure to the MTL label than any other label included in this study but was very closely followed by the NFP label. This finding partially confirms our third hypothesis that the MTL label is on par with the NFP label in terms of participants' ability to recall the information portrayed. Hawley et al. (2013) also found that the

MTL label most consistently helped consumers identify healthier food products. Participants were able to accurately answer nutritional questions after exposure to the MTL label than any other label included in this study (Hawley et al., 2013). Due to their familiarity with the traffic light colours, participants may have been able to remember the colours green, amber, or red and connect that range to one of the answers provided. Compared to the NFP label, participants explained it was hard to remember all the information from this label in 20 seconds to recall any of it for the questions that followed. It was specified that there was too much information in a cluttered format to concentrate enough on remembering certain aspects. This finding is also similar to results found by Gorski-Findling et al. (2018) that there was no clearly superior label. The current study found similar results between the MTL and NFP labels making a significant claim that one is better than the other difficult. However, the study by Gorski-Findling et al. (2018) found that all the FOP labels they included in their study (no label, single traffic light, multiple traffic light, facts up front, NuVal or 0-3 star ranking) helped participants accurately assess products' nutrition information and that the NuVal and MTL labels produced the greatest accuracy scores at identifying the healthier of two products, which was not the case for the current study. The current study found that some labels, particularly the NuVal and Nutri-Score labels produced worse scores than having no label present at all. A notable takeaway from this study was that the no-label condition outperformed the NuVal label and Nutri-Score labels. Participants received more correct answers when having no label on a food item than when the NuVal or Nutri-Score labels were displayed. This finding suggests that there are poorly made labels that do an inefficient job of portraying nutrition information and produce poorer nutrition decisions than having no label at all. Therefore, label type did have a significant effect on participant knowledge and recall, with the best performance coming from an alternative label.

This finding also highlights the fact that labels that summarize nutritional information into one general score did not assist participants in answering nutrition questions. Both the NuVal and Nutri-Score labels give one score that leaves the consumer to use their discretion on whether they believe that overall score to be healthy or not. These labels potentially left too much room for assumption or gave a false sense of healthiness based on the score they presented. Whereas for the foods that had no label, participants had to guess the answers based solely on the packaging and their knowledge of the contents of that food item. This finding suggests that having no nutrition information was better than having a single score health indicator. More specifically, no label was better than having a bad label. Notably, a good nutrition label is vital to understanding and retaining information to make an accurate and informed decision when purchasing food. This finding provides evidence that the MTL label led to more accuracy, but not enough to state that it is better than the NFP label at increasing recall and accuracy of nutrition information.

Conclusion

Overall, the current findings produce empirical evidence to support the idea having a food label present on food packaging is important for making healthier food choices. Therefore, the NFP label and the MTL label were the best labels in terms of preference and accuracy. The MTL label outperformed the current NFP label, which came in second despite being the one participants were most familiar with after years of exposure to it. Understanding the degree to which consumers can use a nutrition label to make healthier food choices is imperative for increasing nutrition knowledge and healthier lifestyles. The purpose of this experiment was to determine the level of accuracy of the NFP label to increase healthier food choices as well as analyze opinions, ratings and retention of nutrition information from various nutrition labels.

This research demonstrated that there is a lack of comprehension of the current NFP label. We furthered this finding by proving that there is a need for a nutrition label to be present on food packaging, but the current NFP label did not produce as high of an accuracy score as would have been expected. This finding highlights the need for a label but also demonstrates that an alternative label could increase comprehension of information in order to identify healthier food products. Our research demonstrated that before an experiment setting, the NFP label was preferred. After the experiment setting, the MTL and NFP labels had very similar ratings with MTL being slightly more favoured. Participants shared that the MTL label was better at conveying health information due to the inclusion of colour, the appropriate number of words and numbers, the easy-to-read design, and the use of a familiar colour scheme.

Furthermore, this study not only discovered that the MTL and NFP labels were the most preferred, but they both also helped participants in recalling the most correct answers to health-related questions. This suggests that the MTL and the NFP labels were the most efficient labels to relate health information to help participants recall and identify correct nutrition questions. Additionally, this study found that there are labels that are too condensed and do not provide enough health information to consumers. Specifically, the NuVal and Nutri-Score labels that provide one single overall health rating (one number or one letter) were outperformed by a no-label condition. This finding suggests that not all food labels efficiently portray health information and can leave too much room for guessing what the overall rating means. Specifically, remembering information that has meaning is easier than recalling vague information (Amer et al., 2018; Schmidt et al., 1999; Skinner & Price, 2019). It is important to note that this finding may seem counterintuitive, as having fewer things to remember could be perceived as easier. However, when considering single-factor labels such as Nutri-Score and

NuVal, it is evident that while it may be easier to remember one number or letter, not everyone can interpret what it means in its entirety. On the other hand, linking meaningful information to commonly recognized warnings, such as traffic light colours, makes it easier to remember and make connections. Moreover, this study was conducted in a controlled environment where participants were shown a label and then it was removed. However, in real-life situations, consumers can view the label at their own pace without relying on quick recall to make a decision.

Consumers do not always have ample time to stop and thoroughly analyze the NFP label of each food item they are purchasing. Consumer opinions of nutrition labels have now been considered not only in terms of what they would like as a label but also what they perform better with to make healthier food choices. The results demonstrate that the current label may not be as effective as alternative labels, such as the MTL label, in helping consumers make informed decisions about the healthiness of different food items. Since the MTL and NFP labels performed similarly in the recall tasks, this finding suggests that Canada should consider combining these two labels into a hybrid label by incorporating meaningful colour with detailed nutrition information. This may be more beneficial than a complete label change. However, before making any changes to the current labeling system, further studies should be conducted to ensure that any modifications are evidence-based and effective in promoting healthier food choices. This study's results offer compelling evidence to support the effectiveness of FOP style labels, a conclusion also supported by previous studies (Franco-Arellano et al., 2020; Méjean et al., 2012; van Herpen and van Trijp, 2011). While one study alone may not suffice to trigger significant changes like modifying or changing the Canadian food label, this study's findings contribute to the existing body of literature, reinforcing the idea that alternative labels, such as the MTL label,

are effective in communicating health information. All to say that the implementation of a hybrid combination of the MTL and NFP labels could improve consumer choices, as well as manufacturers, compelling them to reconsider what they are putting into their products, which will hopefully start producing healthier food options.

Limitations and Future Directions

Despite significant findings, there were limitations to the current experiment that should be considered for future research development.

First, the length of the current study potentially created participant fatigue. This may have contributed to the high participant dropout. If the study (particularly the recall task) had been shortened to avoid participant fatigue, fewer participants may have dropped out, and more data could have been obtained. Additionally, a shorter study may have increased the quality of responses and the outcome of each task may have been more pronounced. Participant fatigue may have affected their ability to do the recall task as well. It is worth noting that the sample for this study had a higher participation rate of females than males (82%), and over half of the participants (56%) were university students. These factors may have influenced the results of the study, potentially skewing the outcomes in favour of university-educated females who are likely used to memorizing larger amounts of information. As was stated in the findings of Donga and Patel (2018) females and those with a higher education level are correlated with high nutritional label use and understanding. Therefore, in this sample, the higher representation may have skewed the results of the NFP label to be higher than if it was a representation of the general population. However, it is also possible that the results for the MTL label could have been even more pronounced if compared to the general population, given that educated and female participants tended to outperform their peers when using the NFP label. Future studies with more

diverse samples (general population sample) could help to better understand the potential impact of label perception and recall. Additionally, to participate in this study, an electronic device with an internet connection was required, which excluded anyone without these means from participating.

With the information revealed in this study that the MTL and NFP labels performed similarly in terms of preference and recall, future studies should compare the MTL label to only the NFP label to see if there are more pronounced differences without the presence of other labels. Comparing the two labels strictly to each other may provide more in-depth significance that one label is better than the other and could reduce participant fatigue. It would be interesting to follow up on this finding to see if the preference difference is even more drastic than what was found in this study if the focus was solely on these two labels. Additionally, future studies should further the distinction of what demographic of people are most likely to use the nutrition label on food packaging. Similarly, to a suggestion made by Trudel et al. (2015), future studies should find out more information on underlying motivations and dimensions of explaining the effects of labelling on different people. By better understanding which demographic uses food labels when making nutrition decisions, health promotion advocates could then tailor their education programs to specific age ranges to produce higher understanding and use in all ages.

With the results found in this study as well as results found in a study by Dubois et al. (2021) that FOP nutrition labels can significantly influence food choices in laboratory settings, future research now needs to take these results and test them in realistic settings. Future studies should create a more realistic setting (i.e., mock grocery store) for this study or others in the field to get a better understanding of realistic decision-making and healthy food distinction and purchasing. In other words, would the same results occur, if the study was done in person? It is

important to try and shift the current “taste vs. health factor” mindset and educate consumers on the importance of healthy behaviours and actions and not simply knowing what is healthy and what is not.

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Appendices

Appendix A
Demographic Questionnaire

1. What gender do you identify as?
    a. Male
    b. Female
    c. Other
    d. Prefer not to say

2. If you stated “other” in the above question please specify.

3. What is your age? Please write in the box below.

4. Please specify your ethnicity.
    a. Caucasian
    b. African American
    c. Latino or Hispanic
    d. Asian
    e. Native American
    f. Native Hawaiian or Pacific Islander
    g. Two or More
    h. Other/Unknown
    i. Prefer not to say

4. What is the highest degree or level of education you have completed?
    a. Some High School
    b. High School
    c. Bachelor's Degree
    d. Master's Degree
    e. Ph.D. or higher
    f. Trade School
    g. Prefer not to say

5. If you are currently enrolled in school, what is your current program of study? Please write in the box below and if you are not enrolled in school, click next to continue.

6. What is your relationship status?
    a. Single
    b. In a relationship
    c. Married
    d. Divorced
    e. Common Law
    f. Widowed

7. What is your annual household income?

a. Less than $25,000
b. $25,000 - $50,000
c. $50,000 - $100,000
d. $100,000 - $200,000
e. More than $200,000
f. Prefer not to say

8. What is your current employment status?
a. Employed Full-Time
b. Employed Part-Time
c. Seeking opportunities
d. Student
e. Retired
f. Prefer not to say

9. How many children do you have?
a. None
b. 1
c. 2-4
d. More than 4
e. Prefer not to say

10. If applicable, please specify your religion.
a. Catholicism/Christianity
b. Judaism
c. Islam
d. Buddhism
e. Hinduism
f. Atheist
g. Agonist
h. Other: _____
i. Prefer not to say

11. If you stated “other” in the above question please specify.

12. Do you have any of the following health concerns/diseases.
a. Eating disorder
b. Diabetes
c. Heart disease
e. High blood pressure
f. Other:_____
g. Prefer not to say

13. If you answered “other” to the above question, what health concern do you face? Please write in the box provided if other was selected.

Appendix B

Nutrition Label use and Understanding Questions

1. Do you use the Nutrition Facts Panel when purchasing food?
    a) Yes
    b) No

2. If yes, how often do you use the Nutrition Facts Panel
    a) Almost every time (over 90%)
    b) Most of the time (61-89%)
    c) Sometimes (21-60%)
    d) Rarely (less than 20%)

3. Do you understand ALL the information portrayed on the Nutrition Facts Panel?
    a) Yes
    b) No

4. If you answered "no" please click on all the parts you don't understand.
    - Serving Size
    - Calories
    - Fat
    - Trans Fat
    - Saturated Fat
    - Cholesterol
    - Sodium
    - Carbohydrates
    - Fibre
    - Sugars
    - Protein
    - All the percentages
    - All the above

5. What are you looking for in a nutrition label? Please provide things you look for in a label to help as a consumer when purchasing food items.

Appendix C

Knowledge of Nutrition Questions

1. What is a serving size?
    a) The amount of food in the box.
    b) The portion of food I should eat.

2. What's the number one thing you should look at on a label to determine nutritional value?
    a) Serving size
    b) Calories
    c) Ingredients
    d) Vitamin and mineral values

3. When looking at the ingredients, what is the biggest red flag for unhealthy food?
    a) Added sugar listed in the first two or three ingredients.
    b) Refined grains, like wheat flour and all-purpose flour.
    c) Ingredients containing gluten.
    d) Both A and B

4. How much saturated fat is too much?
    a) More than 1g
    b) More than 2g
    c) More than 5g
    d) Anything that has saturated fat is bad.

5. How can you determine if the carbohydrates in a product are healthy for you?
    a) If the carbs also contain dietary fiber.
    b) If the carb count is low.
    c) All carbs are bad.

6. What does it mean if the number of sugars is higher than the number of dietary fibers?
    a) Nothing, sugar and fiber are not correlated.
    b) The food is not nutrient dense and therefore is unhealthy.

7. True or False. Products labeled "Trans Fat-Free" and "Sugar-Free" are really free of those ingredients.
    a) True
    b) False

8. What's more important: the ingredients listed on the label or all the other information on the label?
    a) The ingredients.
    b) The rest of the label.

9. How much sodium is too much?
    a) More than 100mg

b) More than 500mg
c) More than 800mg

10. True or False. The ingredients on a label are listed in order of quantity.
a) True
b) False

Appendix D

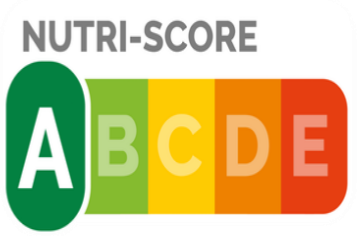
Different Labels Included

A) Multiple Traffic Light

B) Health Star Rating

C) Facts up Front

D) Nutri- Score



E) NuVal

F) Nutrition Facts Panel

Nutrition Facts

1 serving per potato

Serving size 1 potato (148g/5.3oz)

Amount per serving	
Calories	**110**
	% Daily Value*
Total Fat 0g	**0%**
Saturated Fat 0g	**0%**
Trans Fat 0g	
Cholesterol 0mg	**0%**
Sodium 0mg	**0%**
Total Carbohydrate 26g	**9%**
Dietary Fiber 2g	**7%**
Total Sugars 1g	
Includes 0g Added Sugars	**0%**
Protein 3g	
Vitamin D 0mcg	0%
Calcium 20mg	2%
Iron 1.1mg	6%
Potassium 620mg	15%
Vitamin C 27mg	30%
Vitamin B_6 0.2mg	10%

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Appendix E

Preference and Clarity Scale

Preference

1. “not at all”
2. “slightly dislike”
3. “moderately dislike”
4. “neither dislike nor like”
5. “slightly prefer”
6. “moderately prefer”
7. “strongly prefer”

Clarity

1. “not at all clear”
2. “slightly unclear”
3. “moderately unclear”
4. “neither unclear nor clear”
5. “slightly clear”
6. “moderately clear”
7. “very clear”

Appendix F

Checkbox options

CONS

- ☐ More colour needed
- ☐ Font too big
- ☐ Font too small
- ☐ Too many words
- ☐ Not enough words
- ☐ Language too formal
- ☐ I did not like the orientation of the label (vertical or horizontal)
- ☐ Did not like border
- ☐ Needs a border
- ☐ Information hard to find
- ☐ Information hard to understand
- ☐ Too much detail
- ☐ Not enough detail
- ☐ Less numbers
- ☐ More numbers
- ☐ Unorganized
- ☐ No changes are needed

PROS

- ☐ Liked the border or liked lack of border
- ☐ Well organized
- ☐ Good level of detail
- ☐ Information stands out
- ☐ Good size of font
- ☐ Easy to read
- ☐ Colour helped with understanding
- ☐ I liked the orientation of the label (vertical or horizontal)
- ☐ Right amount of words
- ☐ Right amount of numbers

Appendix G

Recall Task and Questions

How healthy would you consider this food item based on the label you just saw?
* must provide value

- 1 "not healthy"
- 2 "moderately not healthy"
- 3 "half healthy/unhealthy"
- 4 "moderately healthy"
- 5 "healthy"

reset

Was this food item high, medium or low in sugar content?
* must provide value

- High
- Medium
- Low

reset

What was the fat content in the food item you just observed?
* must provide value

- 7g
- 10g
- 16g

reset

What was the saturated fat content in the food item you just observed?
* must provide value

- 3g
- 5g
- 10g

reset

What was the sodium content in the food item you just observed?
* must provide value

- 500g
- 640mg
- 700mg

reset

How many calories per serving size were in the food item you just observed?
* must provide value

How many healthiness categories were included in the label you just observed?
* must provide value

- 0
- 1
- 3
- 5
- 6
- 10+

reset

1. How healthy would you consider this food item based on the label you just saw?
    a) not healthy
    b) moderately not healthy
    c) half healthy/unhealthy
    d) moderately healthy
    e) healthy

2. Was this food item high, medium, or low in sugar content?
    a) high
    b) medium
    c) low

3. What was the fat content in the food item you just observed? (Answer options vary)
    a) 10g
    b) 15g
    c) 20g

4. What was the saturated fat content in the food item you just observed? (Answer options vary)
    a) 3g
    b) 7g
    c) 10g

5. What was the sodium content in the food item you just observed? (Answer options vary)
    a) 220mg
    b) 330mg
    c) 410mg

6. How many calories per serving size were in the food item you just observed?
    Fill in the blank

7. How many healthfulness categories were included in the label you just observed?
    a) 0
    b) 1
    c) 3
    d) 5
    e) 6
    f) 10+