

# **Effectiveness of Alternative Approaches to Menu Labeling in Ontario Restaurants: An Eye Tracking Analysis**

by

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## **ABSTRACT**

### **EFFECTIVENESS OF ALTERNATIVE APPROACHES TO MENU LABELING IN ONTARIO RESTAURANTS: AN EYE TRACKING ANALYSIS**

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This research examines whether consumers observe and respond to the nutritional information on menu labels in Canada. It uses eye tracking technology to evaluate the effectiveness of the Health Menu Choices Act. We created an experiment to estimate participant responses to menu labels that would meet the requirements of the Act. We also evaluated alternatives menu labeling methods include percent Daily Value (%DV) of calories label, Traffic Light (TL) label, and Physical Activity Calorie Equivalent label. The results find that the TL label brought the most considerable visual attention. Percent DV labels affected the Canadian consumer the most as compared to other three labeling schemes, and significantly reduced total calories ordered by participants. Our study suggests that nutrition information label does have impacts on ordering fewer calories when consumers are familiar with the format of labels and nutrition information labels on the menu helped consumers to improve their food decisions.

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## TABLE OF CONTENTS

Abstract .....	ii
Acknowledgements .....	iii
Table of Contents .....	iv
List of Tables .....	vii
List of Figures .....	viii
List of Appendices .....	ix
1 Introduction.....	1
1.1 Background .....	1
1.2 Relevance and Motivation .....	4
1.3 Economic Research Problem .....	5
1.4 Purpose and Objectives .....	5
1.5 Thesis Organization .....	7
2 Literature Review.....	8
2.1 The Obesity Pandemic and Healthy Diet.....	8
2.2 Background on Nutrition Labeling .....	10
2.3 Percent Daily Value Labeling .....	15
2.4 Traffic Light Labeling.....	17
2.5 Physical Activity Labeling.....	20
2.6 The Nutrition Information on Restaurant Menus.....	22
2.7 Eye Tracking Technology.....	26
2.8 Eye Tracking Technology in Consumer Research.....	29
2.9 Research Gap .....	32

3	Conceptual Framework .....	33
4	Experimental Design and Data .....	35
4.1	Menu Design .....	35
4.1.1	Control Menu .....	36
4.1.2	Numeric Calorie Label .....	37
4.1.3	Percent Daily Value Label .....	37
4.1.4	Traffic Light Label .....	38
4.1.5	Physical Activity Calorie Equivalent Label .....	39
4.2	Sample Size Determination and Recruitment Process .....	40
4.3	Survey .....	41
4.4	Summary .....	42
5	Empirical Framework .....	43
5.1	Model .....	43
6	Results .....	45
6.1	Variable Descriptions .....	45
6.2	Descriptive Statistics .....	47
6.2.1	Sample Characteristics and Survey Data .....	47
6.2.2	Eye Tracking Data .....	56
6.3	Analytical Results .....	60
6.4	Summary .....	66
7	Conclusion .....	67
7.1	Policy Implications .....	68
7.2	Limitations and Suggestions for Future Research .....	69
	References .....	72

Appendices.....	79
Appendix A: Exit Survey.....	79
Appendix B: Menus .....	84
Appendix C: Consent Form .....	89

## LIST OF TABLES

Table 2.1: Daily values for nutrients in NFT (Government of Canada, 2019).....	16
Table 6.1: Variable Description.....	46
Table 6.2: Demographic Characteristics.....	49
Table 6.3: Psychographic Characteristics .....	51
Table 6.4: Responses to the use of Nutrition/Calorie labels questions.....	54
Table 6.5: Participants' response on calories per 355mL can of coke, nutrition knowledge test grades and total calories ordered by participants .....	56
Table 6.6: Total ordered results and eye tracking results .....	57
Table 6.7: Results on the average number of fixations and total fixation time on labels for different treatment groups and percentage of label perception.....	58
Table 6.8: OLS regression results.....	62
Table 6.9: Differentiated effects of variables and their interaction terms with menu treatment factors.....	65

## LIST OF FIGURES

Figure 2.1: Multiple Traffic Light labels adapted from the Food Standards Agency (2007). .....	18
Figure 2.2: An example of PACE label on package (Royal Society for Public Health, 2016). ...	20
Figure 2.3: Gaze plot: (A) First fixation; (B) Fixation; (C) Saccade.....	27
Figure 2.4: Heat maps denote tester gaze results in colored form. The darker the color, the more concentration of gaze; the lighter the color, the less concentration of gaze. ....	28
Figure 3.1: Menu one: control menu contains item name, item description, and price.....	36
Figure 3.2: Menu two: first treatment group, a presenting of numeric calories label.....	37
Figure 3.3: Menu three: second treatment group, numeric calories label in addition of percent daily value label. ....	38
Figure 3.4: Menu four: third treatment group, numeric calories label in addition of traffic light label with thresholds set to different item categories.....	39
Figure 3.5: Menu five: last treatment group, numeric calories label in addition of physical activity label.....	40



## **LIST OF APPENDICES**

Appendix A: Exit Survey

Appendix B: Menus

Appendix C: Consent Form

# **1 Introduction**

## **1.1 Background**

Consumers are relying more on the food service industry. Approximately a third of Canadian food dollar is spent on eating-out restaurants (Statistics Canada, 2017). Meals purchased outside of the home have larger portions, and contain more fats, and calories than home-cooked meals(Reale and Flint, 2016). This has a significant contribution to the obesity pandemic because consumers, including professionals with expertise in nutrition, usually underestimate the number of calories in meals purchased outside of the home (Bassett, et al., 2008, Block, et al., 2013). There is also evidence that fast food meals encourage overconsumption (Reale and Flint, 2016).

A report by Statistics Canada (2016) showed that over 14 million adults in Canada were overweight or obese as of 2014. That represents close to two-thirds of the Canadian population being overweight or obese. Obesity is a disease connected to nutrition and may lead to multiple health concerns and contribute to large economic costs (Arroyo-Johnson and Mincey, 2016, Lyons, et al., 2011). However, social and environmental factors can cause the individual to make healthy consumption choices (National Institute of Nutrition, 1999, Reale and Flint, 2016). The World Health Organization recommends that nutrition labels could help public health agencies in achieving reduced obesity rates by providing nutritional information to consumers and guiding consumers to make healthier food choices (World Health Organization, 2004).

In Canada, the Ontario government introduced the Healthy Menu Choices Act requiring the posting of calorie information in menus in food chains with more than twenty outlets in

Ontario in 2017 (Health Canada, 2015). The food facility includes restaurants, coffee shops, convenience stores, grocery stores, movie theatres, and public-facing cafeterias. The objective of the Act is to encourage informed and healthier choices for food that is ready for consumption. The economics of consumer purchasing behavior in the context of menu labeling in restaurants are not well studied in Canada. So far, Ontario is the only province that has required the implementation of menu labeling method in Canada. Many researchers from other countries have found positive results after implementing menu labeling (Littlewood, et al., 2016). The results of previous research do not show that presenting calorie information is the best approach to implementing labels on menus.

Littlewood, et al. (2016) reviewed 15 studies on calorie labelling, among which three found no significant effects (Dodds, et al., 2014, Elbel, et al., 2013, Roseman, et al., 2013). Reale and Flint (2016) found that the use of color and health logos led to a significant decrease in calories ordered compared to black and white labeling. Consumers require visual attention to use calorie labeling. Finkelstein, et al. (2011) found that calorie information presented in a drive-through fast-food menu had no impact on calories ordered. Restaurant setting also influences how effective menu labeling is. Calorie information alone resulted in the greatest calorie reduction in the case of sit-down restaurant setting. In the case of fast-food restaurants, calorie labeling paired with a percentage of daily recommended value resulted in the greatest calorie reduction (Zaffou and Campbell, 2015). The presence of information, such as calorie labeling, does not assure successful communication (Kim, et al., 2018, Qiang and Pitt, 2004). Littlewood, et al. (2016) found that the labeling of calorie information on menus did not have a significant

effect on calories ordered when less than 70% participants failed to observe the labeled information (Elbel, et al., 2013, Krieger, et al., 2013, Reale and Flint, 2016).

In our research, we used eye tracking technology to measure and record where and how long participants look at in a menu. The use of eye tracking technology allows us to capture consumer's visual attention on labels and also helps us to better understand the process through which menu labeling affects the decision-making process in addition to the decision that arises. Previous research had also used eye tracking technology and various experimental designs. Previous research used different sample sizes, data collection methods and menu labelling formats (Littlewood, et al., 2016). Research in Canada was only conducted in theoretical or experimental settings, without the use of eye tracking technology (Hammond, et al., 2013, Pang and Hammond, 2013). Eye tracking captures information, such as attention and focus on areas of interest (calorie labels), inaccessible through survey or interview methods (Graham and Jeffery, 2011, Graham, et al., 2012). Eye tracking technology also decreases the likelihood of biased results due to social desirability present in recall techniques (Graham, et al., 2012, Reale and Flint, 2016).

We studied consumers' food choices under the Healthy Menu Choices Act by using eye tracking technology. We wanted to find out whether the current Healthy Menu Choices Act affects consumer choices of menu items when they see the nutritional information presented on menu labels complying with the Act in order to develop an understanding of the effectiveness of this nutritional information labeling policy.

Furthermore, the study is conducted in Ontario (participants recruited in Guelph) and measure participants' eye movement path and time spent on the labels. This study uses data collected through an exit survey and eye tracker from participants, as well as recording their specific choices from the menu. We provided different menu label designs to participants. Our research contains one control menu with no nutrition information, and four treatment menus which contain numeric calorie label, percent daily value label, traffic light label, and lastly physical activity calorie equivalent label. It will attempt to evaluate the effectiveness of alternative labeling schemes in strengthening consumer's healthy choices.

## **1.2 Relevance and Motivation**

There is a clear priority within the Government of Ontario to encourage healthy eating. Several ministries are also involved in encouraging healthy eating including Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) and Ministry of Health and Long Term Care (MOHLTC). Public Health Ontario is also an important resource in promoting healthy eating. The results of this research could be of interest to the above institutions mentioned as their mandate includes improving healthy eating and consumer choices.

The increasing share of the food dollar spent in restaurants highlights how important food choices outside the home are. Developing a better understanding of the impact of menu labelling in Canada (in restaurants, online ordering and in grocery and convenience stores) is important to judge the effectiveness of the promotion of healthy eating. The restaurant industry may also have an interest in the results as understanding the process and the potential impact of the Act is critical for them to make strategic decisions going forward.

### **1.3 Economic Research Problem**

Many studies have examined chain fast food restaurant menu labeling and have reported mixed results (Bassett, et al., 2008, Brissette, et al., 2013, Kim, et al., 2001, Krieger, et al., 2013). Although the Healthy Menu Choices Act was been in force since 2017. It is not known whether the Healthy Menu Choices Act has different impacts on the context of dine-in restaurants in Ontario.

It is important to know how consumers react to different labeling schemes in compliance with the Healthy Menu Choices Act as it may inform improvements in menu labeling schemes to attract greater attention of consumers. Low observation rate of nutritional information on menus may limit the opportunities for consumers to choose healthy food. Strengthening the format of menu label may increase the potential for consumers to make healthy choices. Alternately, the mandatory labeling policy may have no impact on consumers' food choices,

This economic research problem falls under the category of measurement of consumer food choices, examining the effectiveness of nutritional information on menu labels. It will involve the analysis of existing menu labels to identify the rate consumers may observe the information on labels, as well as analyzing alternative approaches to menu labels and consumer's choice consequences.

### **1.4 Purpose and Objectives**

This study has three purposes:

1. To determine whether consumers observe the nutritional information on menu labels;

2. To evaluate the effectiveness of the current Healthy Menu Choices Act;
3. To identify potential approaches to improving dine-in restaurants' menu in order to promote healthy eating.

In order to achieve the purposes above, the following objectives are pursued:

1. To review the literature on menu labeling and consumer choices on menu labeling, as well as the literature surrounding the alternative approaches to improve menu labels. To gain a better understanding of the connection between menu labeling and consumer purchase behaviors, we will conduct a thorough review of the literature. We will also review the literature surrounding eye tracking technology;
2. To estimate whether the current Healthy Menu Choices Act and numeric calorie label impacts consumer choices in the context of dine-in restaurant menus;
3. To evaluate if the nutritional information provided by selected alternative approaches to the Healthy Menu Choices Act will improve on the numeric calories label outcomes. Alternative approaches include different formats of presenting nutritional information (percent daily value label, traffic light label, physic activity calorie equivalent label);
4. To assess how the eye movements and visual attention of an individual affect the total calories of food items chosen from the menu by conducting an in-person experiment using eye tracking glasses.

Following the economic research problem and specific objectives, this research will examine the effects of the mandatory labeling on menus that will help consumers to make healthy food choices. By examining the consumer perception of menu labeling in Canada, we will provide insights into how participants from this study react to different labeling schemes. By finding out where the consumer's visual attention is concentrated on the menu by using eye tracking technology, we will be able to understand which menu labeling scheme affects consumers' food choices when they are dining in full-service restaurants.

## **1.5 Thesis Organization**

This thesis contains six chapters. Chapter 1 introduces some background on the obesity pandemic issues worldwide and nutrition labeling systems. It then discusses the economic problem and economic research problem, followed by the purposes and objectives on this thesis. Chapter 2 provides a literature review of food-related health problem and previous research of the food nutrition information labeling system, followed by a discussion of the existing menu labeling formats. It then reviews the application of eye tracking technology in consumer research. Chapter 3 discusses in detail the experimental design and data collecting procedure. Chapter 4 outlines the empirical framework and the testable hypotheses. Chapter 5 discusses the results from survey data and eye tracking data. Finally, Chapter 7 expands the results to policy implication of this research and discusses the limitations of the experiment and data we used, as well as suggestions for future research in the area of food nutrition information labeling system.



## **2 Literature Review**

This chapter will present a review of previous literature focused on four methods of providing nutrition information on restaurant menus. First, we will review issues related to the global obesity pandemic and then briefly introduce the history of the use of nutrition information labeling around the world. Next, we will look at the existing literature on the effectiveness of four different nutrition labels (numeric calorie information label, percent daily value label, traffic light label, and physical activity calorie equivalent label). Finally, we will review the use of eye tracking technology in research and will summarize the literature gap on menu labeling in Canada.

### **2.1 The Obesity Pandemic and Healthy Diet**

Obesity has become a pandemic globally. Obesity is usually caused by excess caloric intake amount along with reduced physical activity and may lead to multiple health issues such as coronary artery disease, gallbladder disease, colon cancer, diabetes, stroke, breast cancer, postmenopausal endometrial cancer and hypertension (Arroyo-Johnson and Mincey, 2016). In 2014 worldwide, 15% of females and 11% of males were obese among adults over 18 years old. Meanwhile, there are more than 42 million children who were younger than five and overweight reported in 2013 (Arroyo-Johnson and Mincey, 2016). Obesity prevalence showed an increasing trend over the past two decades across the world as well as in Canada. In 2011, a report released by the Public Health Agency of Canada (PHAC) and Canadian Institute for Health Information (CIHI) pointed out that approximately one quarter of Canadian adults were obese according to results from 2007 to 2009 (Lyons, et al., 2011). Obesity-associated chronic diseases also have a close link to Canada's national economic costs which increased by 19% from \$3.9 billion in

2000 to \$4.6 billion in 2008 (Lyons, et al., 2011). This only counted eight kinds of obesity-related chronic diseases. The number increased to \$7.1 billion when considered 18 chronic diseases (Lyons, et al., 2011).

Although consumers have realized this on-going obesity pandemic in recent years and have tried various approaches to combat this problem, some misleading fad diets and cult diets are spreading adverse effects around (Jáuregui-Lobera, 2017). As Jáuregui-Lobera (2017) reported, fad diets often have exaggerated names like the moon diet, Palaeolithic diet, baby food diet, ketogenic diet, etc. As a matter of fact, they are often trying to promote supplement products, promising weight changes without lifestyle change, which can cause adverse side effects in the long term (Jáuregui-Lobera, 2017). Long stated diet suggestions are always better than novel diets. These include maintaining regular physical activity, consuming body required calories only, consuming fruits and vegetables more often than processed foods, reducing intake of sugar-containing beverages, considering portion size of food when dining out. These are basic rules suggested by a wide range of researchers (Arroyo-Johnson and Mincey, 2016, Government of Canada, 2020, Hall and Kahan, 2018, Jáuregui-Lobera, 2017, Mai and Hoffmann, 2012). Therefore, nutrition plays an important role in improvement of body health and prevention of obesity. Nutrition labels assist consumers to find and understand nutrition in foods they purchased. This reduction in search costs could improve healthy eating.

Many consumers do not know how to use the nutrition labels to make food decisions. Although they may use nutritional food labels but do not understand how to interpret calories information (Mai and Hoffmann, 2012). Some consumers are simply constrained by time or budget and only make decisions based on affordability in terms of time or cost (Mai and

Hoffmann, 2012). Under the time and budget constraints, search costs arise when consumers need to search for the right food items that meet their nutrition and cost requirements when they make a purchase decision. Tseng and Lee (2016) found that by providing complete information and increasing information disclosure help decrease consumer search costs when they look for information on foods. For consumers who want to improve their diets, detailed nutrition information may decrease their search costs and may help direct their food decisions towards healthier food products. Under this circumstance, many researchers call to continue providing more attainable nutrition labels to help them make healthier food choices.

## **2.2 Background on Nutrition Labeling**

Nutrition labels are intended to reduce obesity rates by providing nutritional information to consumers and guiding consumers to make healthier food choices (World Health Organization, 2004). Food nutrition labels are essential to consumers who have obesity-related chronic diseases such as diabetes and heart disease. Consumers who have such diseases can use nutrition labels as a guideline for their specialized diets and reduce their search costs for healthy food choices, but in general, nutrition labels are used to provide a tool for consumers to make their own choices about what they would purchase and consume (Government of Canada, 2019).

There is a long history of nutrition labeling in Canada. Early in 1985, the Food and Drugs Act applied the federal statute to different levels of foods sold in Canada (Institute of Medicine, 2003). Specific regulations under this Act covered guidelines of nutrition labeling, ingredient lists, and all kinds of claims (Institute of Medicine, 2003). The Food and Drugs Act required labels to display amounts of added minerals and vitamins in 100 grams serving of food, while the labeling of amounts of natural minerals and vitamins was not required (Government of Canada,

1985). It was not permitted to state a food product was a good source of nutrients if it only contained minimum levels of one or more of the nine essential nutrients in recommended daily intake (Government of Canada, 1985). Declaration of calories, protein, sodium, potassium, and carbohydrate were all permitted with the allowed expression and nutrition labeling was only required to apply to special dietary foods (Government of Canada, 1985).

When formal nutrition labeling guidelines were published in 1998, Food and Drug Regulations with amendments were mainly intended to improve the control of claims (Institute of Medicine, 2003). The Guidelines on Nutrition Labelling was a voluntary system that standardized the use of serving size and a food product had to follow the amended regulations once it applied a label on package (Institute of Medicine, 2003). Minerals and vitamins were required to be listed as per serving size, percentage of recommended daily intake value, and a percentage of one set of nutrient reference values rather than expressed in a total amount value (Government of Canada, 1985). In December 2002, the Government of Canada issued a mandatory labeling regulation named Regulations Amending the Food and Drug Regulations (Nutrition Labelling, Nutrient Content Claims and Health Claims) after Health Canada undertook a consultation for improving nutrition labeling and nutritional information on prepackaged food labels in early 2001 (Institute of Medicine, 2003).

The regulations are still in use today. The Health Canada and the Canadian Food Inspection Agency (CFIA) share a joint mandate for regulating the nutritional food labeling system in Canada. Health Canada is responsible for setting regulation requirements, and for creating policies related to food safety and nutrition labels in line with the Food and Drug Act, while CFIA is responsible for enforcing food labeling policies and regulations. The current

regulations require mandatory nutrition labeling notably the use of Nutrition Facts Table (NFT) on most prepackaged foods with the exception of unground raw meat and poultry, fish and seafood, fresh fruits and vegetables, alcoholic beverages, food prepared and processed in retail sectors, food prepared for immediate consumption, and food with low nutrient contents (Government of Canada, 2019).

The U.S. shares a similar format of mandatory nutrition labeling with Canada. The U.S. label is called Nutrition Facts Panels (NFP). The Nutrition Labelling and Education Act (NLEA) came into force in 1994, which was earlier than Canada (Institute of Medicine, 2003). However, there are some variations between NFT and NFP, in which the Food and Drug Administration (FDA) requires NFP on prepackaged food to include a statement in a footnote stating that "Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs," whereas it is optional on NFT (Food and Drug Administration, 1990, Government of Canada, 2019). Since the enforcement of the Healthy Menu Choices Act in Ontario, Canada, such a statement is mandatory to be displayed on menus for restaurant companies that have more than twenty outlets (Health Canada, 2015).

Many studies have been done since the implementation of nutritional food labeling systems. Studies show that consumers with higher education and higher annual household income are significantly more willing to use nutrition labels (Canadian Council of Food and Nutrition, 2008, Drichoutis, 2005, Satia, et al., 2005), and females are significantly more likely to read labels than males. Additionally, middle-aged adults use nutrition labeling more often than older adults (Drichoutis, 2005, Satia, et al., 2005). Parents are more likely to choose healthy food for their children with the usage of contrast between food labels. Food purchasing behaviors of

those who have overweight or obese children is significantly affected by food labels (Colson and Grebitus, 2017). Satia, et al. (2005) also found the same trend in self indicated obese adults that they are more likely to use nutritional food labels; however, this could be due to their special dietary requirements rather than self-motivated usage.

The impacts of nutrition labels on food purchasing behavior have been widely examined as well and showed mixed results. Neuhouser, et al. (1999) used a telephone survey among 1450 adults in Washington State and found that label users tended to have a decreased fat intake. Label user participants tended to be women and had levels of higher education (Neuhouser, et al., 1999). They were either concerned about healthy diet or seeking a low-fat diet. However, there was no significant relationship between fruit and vegetable consumption and nutrition label use (Neuhouser, et al., 1999). More recent research reported that significant differences exist in intakes of total calories, total fat, saturated fat, dietary fiber, sugars, and sodium existed between label users and non-users from self-reported surveys collected in the US (Ollberding, et al., 2011). Despite the fact that nutrition labels were found to have the effect of choosing low fat, low calories food and to help consumers make healthier food choices when comparing nutritional information between similar products, label use alone did not lead to better dietary outcomes and consumers did not necessarily try to alter their overall diets (Brennan, 2015, Ollberding, et al., 2011). Other researchers found that implementation of nutrition labels lead consumers to avoid purchasing less nutritious foods instead of increasing purchases of nutritious foods (Dowray, et al., 2013, Ducrot, et al., 2016). Researchers hypothesized that consumers who are trying to consume healthy foods but have a low level of nutrition knowledge seem to be the cause of this shift (Cawley, et al., 2015, Ducrot, et al., 2016).

Globally, Australia and the European Union (EU) have nutrition labeling systems that greatly differ from the North American format. Australia and New Zealand issued the Australia New Zealand Food Standards Code (ANZFSC) under the legislation of the Food Standards Australia New Zealand Act (FSANZ) in 1991 (Food Standards Australia New Zealand, 2011) which became mandatory in 2002. Differently from NFP and NFT, ANZFSC does not require information on the percent daily values on nutrients but requires percentage information of ingredient lists. Additionally, Australia and New Zealand nutrition labels contain the serving numbers per package which is not required in NFT. Information about dietary fiber and trans-fat are not included in ANZFSC, whereas all other nutrients need to show in amounts of per 100g and per serving size (Food Standards Australia New Zealand, 2011). According to the Commission of the European Communities (1990), the implementation of nutrition labeling is not mandatory in Europe unless claims are made on prepackaged foods with a standardized format. The significant difference is in the EU common food additives are assigned with a three or four digits code known as an E number; however, in North America, food additives must be listed in their common names on packages (Commission of the European Communities, 1990). In Europe, other minor difference including percent daily values are optional for all nutrients other than minerals and vitamins, all nutrient contents are provided per 100 grams and are not required to indicate the number of servings. Traffic light labeling and physical activity equivalent labeling are accessible in Europe if all nutrition information is available on a food package.

Although nutrition labeling is voluntary in Europe, Bonsmann, et al. (2010) found that 85% of food products contain back of the pack labels on average. Ireland, UK, and the Netherlands have the highest rate among 27 EU member countries; however, there is only 48%

penetration for the front of pack labels (Bonsmann, et al., 2010). Previous research indicated that fat and energy contents were the most looked for information on nutrition labels, and per 100 grams information was looked the most among different formats such as per serving size (Grunert, et al., 2010, Higginson, et al., 2002). Higginson, et al. (2002) also reported a similar result in the UK that consumers were more likely to compare nutrition information between the same kind of products with different brands based on limited self-reported data, and 69.4% of them compared nutrition labels. Whereas 21.1% of consumers made judgments based on whether a product was high, medium or low in specific nutrients, nutrition claims were only used by 2.2%, percent daily value was used the least that only 1.3% of consumers reported the claim of usage (Higginson, et al., 2002). This was also true in other countries such as in New Zealand, approximately 69% of consumers were reported to use nutrition labels and correctly estimated the amount of total fat per 100 grams (Gorton, et al., 2009). Similar to research in the context of North America, New Zealand consumers who had special dietary requirements tended to use nutrition labels more often than consumers with no special dietary requirements (Gorton, et al., 2009). Interesting research conducted in Croatia found that older consumers used nutrition labels for healthy eating habits and requested bigger letter size for understanding nutrition information, while younger consumers used labels because they were more curious to read about nutrition information and wanted better tools for interpreting and understanding nutrition labels (Ranilović, et al., 2011).

## **2.3 Percent Daily Value Labeling**

Percent daily value label is a comprehensive tool usually applied on the NFT to help a consumer determine the level of nutrient content with percentage expression. Percent daily



values are required to be displayed for total fat, saturated fat and trans-fat, cholesterol, sodium, carbohydrate, fiber, Vitamin A and C, calcium and iron; however, there are no requirements for sugar and protein contents since these nutrients do not have a baseline as a target to be healthy (Government of Canada, 2019). Daily values for fat and carbohydrates are based on a 2000 calories dietary, while daily values are based on recommended nutrient intakes for vitamins and minerals set in the Food and Drug regulations in 1985 (Government of Canada, 1985). The recommended maximum amounts of nutrients for all ages and gender (percent daily values are designed for all ages and genders) used to calculate percentage daily values are illustrated in Table 2.1

**Table 2.1: Daily values for nutrients in NFT (Government of Canada, 2019).**

<b>Nutrients</b>	<b>Daily Values</b>
Fat	65 g
Saturated and trans fat	20 g
Cholesterol	300 mg
Sodium	2400 mg
Carbohydrate	300 g
Fibre	25 g
Sugars	No DV
Protein	No DV
Vitamin A	1000 RE
Vitamin C	60 mg
Calcium	1100 mg
Iron	14 mg
<b>Note: RE = retinol equivalents</b>	

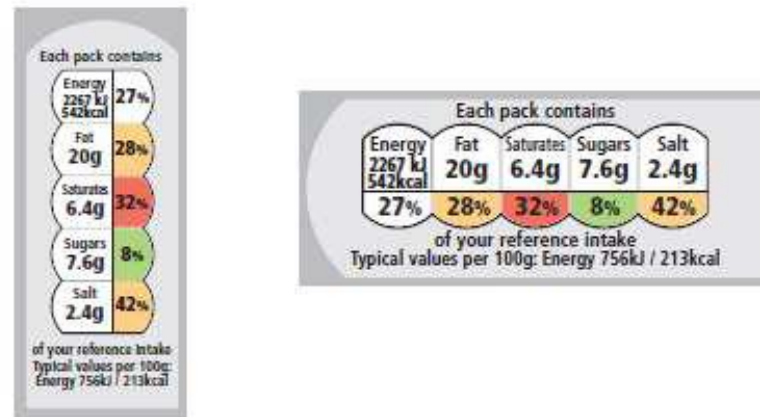
Studies showed different results on consumers' perception of percent daily value labels. A report prepared by International Food Information Council Foundation (2006) indicated that consumers were less likely to use percent daily value labels than other nutrition information like

gram information, calories content and serving size, and consumers found that percent daily value footnote was confusing and some of them thought percent daily value described the composition of a product. Consumers in New Zealand also found percent daily value was the least preferred label format and was less helpful to determine the healthiness of the product (Gorton, et al., 2009). Gorton, et al. (2009) discussed that percent daily value label required extensive nutrition knowledge and would be more useful for consumers who frequently used nutrition labels and were familiar with the expression of label formats. This contrasts with research conducted in Canada that Canadian consumers found percent daily value labels were significantly more useful than presenting gram information alone; however, this research is dated, newer research is required (National Institute of Nutrition, 1999).

## **2.4 Traffic Light Labeling**

Traffic light (TL) labels were first implemented on packaged food in the UK on a voluntary basis. Food products were labeled with color-coded strategies (Food Standards Agency, 2007). TL labels are almost the most popular non-numeric labeling format and have typically presented in two types: Simple Traffic Light (STL) categorizes the entire food product to three categories 1) "healthier food choice" (green light), 2) "ok food choice" (amber or yellow light) or 3) "less healthy food choice" (red light) (Food Standards Agency, 2007). Multiple Traffic Light (MTL) characterizes each nutrient content (fat, saturated fat, sugar, salt, sometimes calories) to high, medium, and low represented by red, amber, and green lights respectively as shown in Figure 2.1 (Food Standards Agency, 2007). Some UK food manufacturers have adopted TL label on their products, although TL labeling does not have uniform regulations, most systems followed generic formats that include nutrients such as fat, saturated fat, sugars,

and salt, some labels may include calorie amounts. As a result, TL labels vary across food brands; for instance, some labels only contain color codes with words "high", "medium" and "low", while others may include numeric information such as grams or percent daily values along with color-coded labels (Food Standards Agency, 2007).



**Figure 2.1: Multiple Traffic Light labels adapted from the Food Standards Agency (2007).**

International studies have found positive effects of TL labeling scheme on helping consumers to choose healthier foods and on increasing consumers' nutrition information comprehension (Borgmeier and Westenhoefer, 2009, Gorton, et al., 2009, Jones and Richardson, 2007, Kelly, et al., 2009, VanEpps, et al., 2016). VanEpps, et al. (2016) conducted a field experiment on the impact of TL labels on calorie intake for online workplace lunch orders, and participants were presented with menus which had either TL labels, numeric calorie labels, or both through a website questionnaire. Both TL label and TL label with numeric calorie label reduced lunch calories by approximately 10% when compared with a control menu which did not have any nutrition information, while nutrition knowledge was not improved by any formats of labeling (VanEpps, et al., 2016). VanEpps, et al. (2016) suggested that "consumers may benefit most from help in identifying relatively healthier choices but rely little on information about the

exact caloric content of items". Jones and Richardson (2007) found that TL labels had a positive impact on guiding consumers to pay more attention to important nutrients and helped consumers to rate the healthiness of food more accurately with the application of eye tracking technology.

Consistently, studies examining TL labels in Australia and New Zealand showed similar results. As mentioned previously, Gorton, et al. (2009) examined four labeling systems which were STL, MTL, NFT, and percent daily value, and found that STL and MTL labels had the highest comprehension level among all other formats across all ethnic and income groups, and MTL was the most preferred label format. On the other hand, Kelly, et al. (2009) tested consumers' preferences of label formats and the ability to compare the healthiness of food products by intercept surveys with 790 adults in Australia. They found that the TL label was the most effective system helping consumers to identify healthier foods. Furthermore, consumers were five times more likely to correctly identify healthier foods with TL labels than monochrome percent daily value labels, and three times more likely than color-coded percent daily value labels (Kelly, et al., 2009). The researchers recommended mandatory TL label regulations to assist consumers in making healthier choices on the food they purchased. Similarly, a randomized experimental study conducted in Germany among 420 adults found that consumers made the correct decisions on selecting healthier foods with TL label displayed (Borgmeier and Westenhoefer, 2009). Nevertheless, the influence of perceiving healthiness is unlikely to change consumer's food consumption and purchase choice, and will not result in the expectant consequences, to the extent that obesity-related diseases could be prevented and global obesity issues could be addressed (Borgmeier and Westenhoefer, 2009).

## 2.5 Physical Activity Labeling

Another food nutrition label scheme that governments have developed, and researchers have investigated is physical activity calorie equivalent (PACE) label. The Royal Society for Public Health (2016) (RSPH) in the UK introduced this PACE calorie information to display on food packages along with current calorie information label which is the calculation of how much physical activity would be required to expend the calories in the product (Figure 2.2). RSPH suggests that consumers understand symbol format labels more easily than numeric form, and hence PACE label is suggested to be an easier reference for consumers less able to comprehend current FOP labels. The food and drink industry does not provide PACE information which would relate to how to expend calories taken from food through different forms of physical activities (Royal Society for Public Health, 2016). The purpose of promoting PACE labeling is to encourage people to be more physically active and understand how these calories they consumed related to their daily activities (Royal Society for Public Health, 2016).



Figure 2.2: An example of PACE label on package (Royal Society for Public Health, 2016).

Since previous researches showed restaurant menu labeling with calorie information had inconsistent and small effects on consumer behaviors, an online study intended to find PACE

labels' potential effects compared the effects of no nutrition information, calorie only label, and calories information with the addition of equivalent miles of walking label on fast food selection and attitudes toward physical activities (Lee and Thompson, 2016). Some authors reported that PACE labels had no significant effects on total calories ordered and had little impact on consumer ordering behavior (Liu, et al., 2012). They even found some counterintuitive increases in calories ordered such as increased calories ordered for salad, dessert, and drink items with PACE condition (Liu, et al., 2012). The findings that there were inconsistent and small effects of menu labeling contradicts with previous research conducted by Dowray, et al. (2013). Dowray, et al. (2013) used an online survey which assigned participants with one of four menus which were a control menu with no nutrition information, a menu with calorie information only, a menu with calorie information plus minutes of walk needed to burn calories ordered, and lastly a menu with calorie information plus miles to walk to burn calories ordered. They found an average of 1020 calories ordered from control menu, 927 calories ordered from menus with calorie information only, 916 calories ordered from minutes to walk labeled menus, and menus with a number of miles to walk to burn those calories were the most effective labeling and had an average of 826 calories ordered (Dowray, et al., 2013). Also 82% of participants showed a preference for PACE menu labels over calorie information only and no nutrition information labels (Dowray, et al., 2013).

James, et al. (2015) specifically looked at the impacts of PACE label among young adults made up with normal-weight, non-Hispanic white college students, and found that menu with labels displaying the minutes of brisk walking required to burn the calories in food item had a reduction of calories ordered and led to fewer calories consumed for post-lunch. Two back to

back studies were conducted by Antonelli and Viera in 2015 which observed the effects that PACE labeling had on adults ordering foods for themselves (Antonelli and Viera, 2015), and parents ordering foods for their children (Viera and Antonelli, 2015). In their first study, Antonelli and Viera (2015) examined data collected via an online survey from 1000 adults in the US randomly assigned with one of four menus that had the same content as Dowray, et al. (2013), and they found that PACE labels had significantly lowered the total calories ordered for themselves in fast food meals and may have an added benefit of encouraging exercise. In their second study, Viera and Antonelli (2015) looked at the effects that the PACE labels had on parents ordering fast food for their children. First, they randomly assigned one of four fast-food menus to parents through an online survey, then asked them to imagine that they would place an order for their child. At the end of the survey, all participants were asked to rate the likelihood that each menu would influence them to encourage their child to take more exercise. The authors found that two PACE labels can influence parent's decision on choosing fast food for their child and showed a reduction in calories ordered. Furthermore, PACE labels had greater impacts on encouraging their children to exercise than menu without nutrition information and menu with calorie information only (Viera and Antonelli, 2015).

## **2.6 The Nutrition Information on Restaurant Menus**

Another prevalent nutrition labeling method governments and researchers use to help consumers better understand the calories they consume from food is menu labeling. This method applies calorie information directly on restaurant menus for each food item, including drinks, which have been implemented in many countries (Littlewood, et al., 2016). Since January 2017, Ontario enacted the Healthy Menu Choices Act which required food premises, including

restaurants, coffee shops, convenience stores, grocery stores, movie theatres, and public-facing cafeterias with more than 20 outlets to display calorie information on their menus for all food items (Health Canada, 2015). Ontario is the only province in which menu labeling is implemented in Canada. Nielsen (2012) survey reported that 49% of respondents around the world supported calorie information on fast food restaurants and 31% of them thought fast food restaurants should sometimes include calorie labels, while 20% of consumers from the online survey indicated that fast food restaurants should never present calorie information. The attitudes towards full-service chain restaurants were similar with fast food restaurant settings that 41% of respondents around the world thought full-service chain restaurants should always post calorie information on their menus and 39% thought these restaurants should sometimes do so (Nielsen, 2012).

Reale and Flint (2016) discussed that the portion size and energy density of food purchased outside of the home had increased in the last 30 years which had a significant contribution to the obesity pandemic because consumers, even including professionals, with expertise in nutrition usually underestimated calorie contents in meals outside of the home. Fortunately, many researchers have found positive results after implementing menu labeling (Littlewood, et al., 2016). Littlewood, et al. (2016) conducted a meta-analysis with twelve peer-reviewed, full-text articles published between 2012 and 2014 and found that nine studies reported a statistically significant decrease in calories ordered and purchased by an average of 100.2 kcal and an average of 77.8 kcal, respectively in real-world settings, whereas three studies showed no effect of menu labeling.



The effects of menu labeling showed different results in experimental and real-world settings and in different types of outlets. Some researchers found that under fast-food restaurant settings, consumers over 55-year-old purchased food with fewer calories than those younger than 55 years of age (Brissette, et al., 2013). They also found that women purchased fewer calories than men, and consumers with a college degree or higher tended to order food with fewer calories than those with less education which are consistent with results found with prepackaged food labeling (Brissette, et al., 2013). Masic, et al. (2017) also found a significant reduction in calories ordered for snack foods and beverages with a labeled condition by an independent-groups design collected from 458 UK adults by online surveys. Many studies were based on typical fast-food restaurants (Bassett, et al., 2008, Block, et al., 2013, Brissette, et al., 2013, Elbel, et al., 2013) and found promising significant reduction in calories ordered or selected. These are encouraging since fast-food restaurants are affordable and convenient for most consumers as compared to other food outlets like full-service restaurants.

However, the impact of menu labeling on food choices was not consistent in full-service restaurant settings. Auchincloss, et al. (2013) collected cross-sectional survey data and transaction receipts from 648 customers at seven restaurants of a large full-service restaurant chain, and results showed that consumers at labeled locations purchased 151 fewer calories, 224 mg less sodium, 3.7 g less saturated fat than consumers at unlabeled restaurants. For consumers who reported that nutrition information would affect their decision purchased 400 fewer calories, 370 mg less sodium, and 10 g less saturated fat (Auchincloss, et al., 2013). On the contrary, Liu, et al. (2012) reported that there were no significant differences in calories ordered between

nutrition labeled and non-labeled menus, but participants in the calorie labeled group perceived that restaurant was a healthier choice.

Roseman, et al. (2017) looked more in-depth into why participants chose lower calorie meal with research conducted among college students and found that nutrition knowledge had a significant positive effect on choosing low-calorie food. Participants answered that consuming too many calories were not good for the human body and they should avoid over-consuming calories; however, they did not understand the reason of consuming lower calories and reduction of calories is not necessarily applicable for all individuals. Sacco, et al. (2017) reported the use of menu labeling specifically on children and youth using eleven separate studies and found that in experimental settings with hypothetical food purchases, nutrition information may have impacts of reducing calories ordered for adolescents and children in outlets such as restaurants and cafeterias. Despite the fact that school-based studies were generally found to have positive results, Sacco, et al. argued that results from real-world restaurant settings were less supportive. Many researchers discuss that nutrition labels should be able to educate consumers on nutritional knowledge on foods prior to placing information on packages or menus; nutrition knowledge and education can be improved by formatting and discovering necessary labeling strategies such as percent daily value labeling, traffic light labeling, physical activity equivalent labeling (Auchincloss, et al., 2013, Liu, et al., 2012, Masic, et al., 2017, Roseman, et al., 2017). Nutrition labels that successfully deliver desired information could reduce consumers' search costs on time and food quality manner.

## 2.7 Eye Tracking Technology

Eye tracking technology has been used not only in academic field such as disability studies, psychology, and applied human studies; but also much more by advertisement consultants including marketing and management applications (Holmqvist, et al., 2011). An eye tracker captures human eye's detailed movement information on timing and shifting events. Eye tracking provides multiple data points relative to eye movements. Two main types, fixation and saccade are used in various ways to analyze participant behavior. A fixation is that duration of time when eye temporarily stops at an object while saccade is the rapid motion that connects between fixations.

Area of Interest (AOI) is another tool to analyze an eye's movement captured by eye tracking technology. AOI is a region of tested scene to which a researcher wants to measure the duration of a participant's attention. AOI can measure one participant's separate visits on the same AOI, for example, counting the time difference spent on one AOI before and after a participant makes decision. Furthermore, AOI also records several measurements of eye's movements such as fixation duration, first fixation, number of fixations, and frequency of visiting. Holmqvist, et al. (2011) defines these properties as AOI hits, dwells, and transitions. AOI results are transferred and generated from Tobii Pro II glasses to raw data in numeric form by Tobii Pro analyzer software and validated by researchers.

Tobii Pro analyzer software also provides various results, like a gaze plot which is a graph shows the frequency and duration of eye movements as well as their order. Gaze plots allow us to observe detailed behaviors of a participant such as their first attention, and essential factors (by looking at fixation duration and visit counts). Another technique Tobii Pro analyzer

software provides is heat map, which graphs gaze data in a colored form. Heat map provides information such as the most viewed area on an AOI. Figure 2.3 and 2.4 show examples of a gaze plot and a heat map which are adapted from Tobii Pro website (Tobiiipro, 2020).

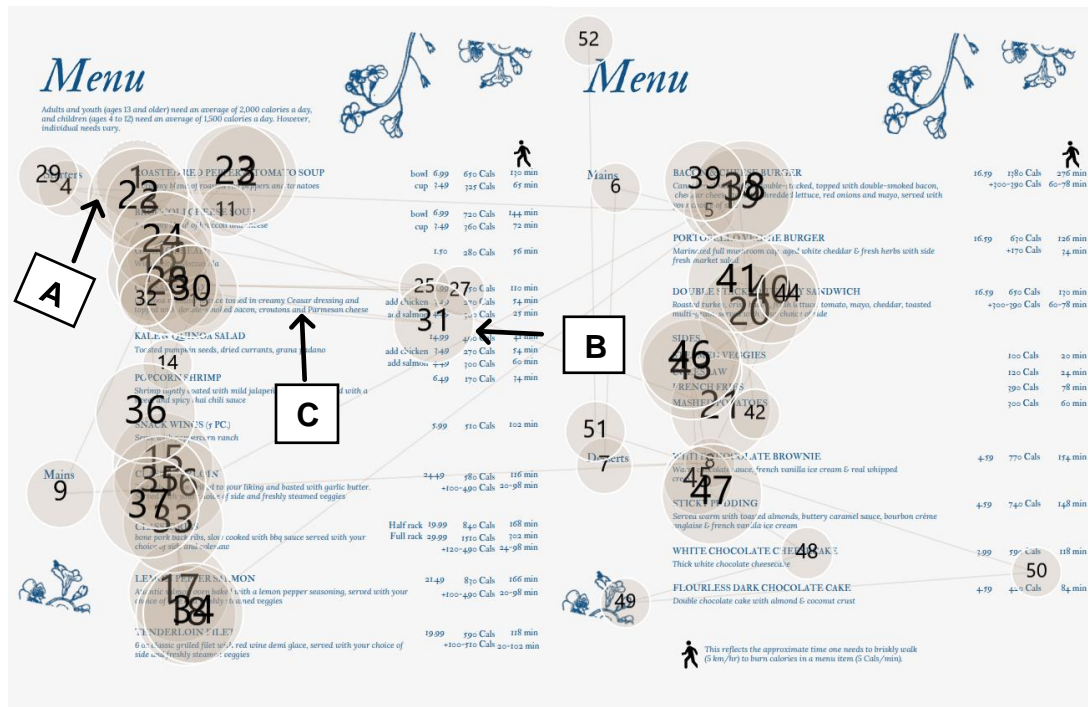


Figure 2.3: Gaze plot: (A) First fixation; (B) Fixation; (C) Saccade



**Figure 2.4: Heat maps denote tester gaze results in colored form. The darker the color, the more gaze concentration; the lighter the color, the less gaze concentration.**

The quality of eye tracking is affected by both mechanical setup and some other factors. Holmqvist, et al. (2011) denoted two major factors as accuracy and precision. Accuracy can be influenced by types of eye tracker, eye's anatomy such as eye physiologies and application of contact lenses. Precision can be influenced not only by eye tracking equipment, but also by the type of software used to visualize and evaluate the eye tracking data. In addition, other factors such as delay in capturing data, environment conditions, low level filtering of software can also have an impact on the quality of eye tracking (Holmqvist, et al., 2011). Therefore, the calibration process is a very important aspect to keep collected data accurate and precise and must take place before the start of experiment process.

There are three ways to calibrate which are operator controlled, participant controlled and automatically controlled by the recording software (Holmqvist, et al., 2011). For our research,

we used the combination of operator controlled and participant controlled process. However, eye tracking software does not provide standards of how to check the quality of calibration. We used gaze samples (a percentage value of dividing the number of correctly identified eye tracking samples by the theoretical maximum which is 50 samples per second for Tobii Pro Glasses) provided by Tobii Pro analyzer software as an indication of the quality of eye tracking data. Any gaze samples lower than 70% were excluded from our research to ensure the quality of the data. The mapping function coming along with the software is another advantage of extracting raw data from recordings since our experiment was designed to be still images. Therefore, we automatically mapped where each participant looked at menu as, and then manually corrected error plots on a menu picture be observed.

## **2.8 Eye Tracking Technology in Consumer Research**

In academic research, eye tracking technology is not a novel method and has been growing in recent years. In the early years, eye tracking technology was mostly used in the psychology fields, but more and more consumer research has incorporated eye tracking technology on investigating consumer perception and behavior. In previous literature, eye tracking technology had been limited to stationary computer eye trackers, in which a participant had to sit in front of a computer screen and eye trackers connected to computer recorded where the participant looked (Chandon, et al., 2006, Holmqvist, et al., 2011, Wedel and Pieters, 2017). More recent consumer research has used mobile eye trackers in the lab environment or in real stores in order to provide realistic results to the researcher (Graham and Jeffery, 2011, Reale and Flint, 2016).

Chandon, et al. (2006) used computer eye trackers to understand how consumers process information at the point of purchase using a picture of shelf planogram to analyze consumers' attention and choice of purchase. The authors found that products located near the center of the shelf were noticed by almost all consumers, and the amount of shelf space provided to a product with the package facing to consumer increased the probability of that product to be purchased (Chandon, et al., 2006). This provided the result that visual attention increases product consideration and hence enhances the point of purchase marketing activities (Chandon, et al., 2006). This is consistent with a literature review, which is reported by Wedel and Pieters (2017), who used eye tracking technology to discover how people look at print advertisements. Eye tracking results provided suggestions to redesign an ad in aspects of font sizes, locations of key elements such as brand name, text, headline, and pictorial, without changing in primary content. Wedel and Pieters (2017) also reported that there was no unitary agreement on the aspects of visual attention and the successful of advertisement.

Eye tracking technology has also been applied to test the effectiveness of nutrition labeling. Although viewing nutrition labels does not guarantee using labels to make food choices or understanding nutrition information, self-reported using of nutrition labels is limited in many ways such that (Graham, et al., 2012):

1. It is difficult to report consumers' attention to specific nutrients;
2. Participants may misremember how nutrition labels affect their decision making process;
3. Participants may overreport their use of labels in order to look like more knowledgeable in health.

Graham and Jeffery (2011) examined the differences between consumers self-reported results on the use of nutrition labels and real eye-tracking results on their visual attention towards nutrition labels, and they found that on average participants looked at the nutrition labels much less often than they were self-reporting. Thirty three percent of them self-reported that they would always look at the nutrition information on NFTs, and 31%, 20%, 24%, and 26% of them stated that they would always look at total fat content, trans fat content, sugar content, and serving size on NFTs respectively (Graham and Jeffery, 2011). However, only 9% of them were found to have actually looked at calorie count for all products tested in the study, and only 1% of participants looked at specific nutrient contents on all labels (Graham and Jeffery, 2011). The location of labels is as important as products on a shelf. Graham and Jeffery (2011) found that labels located on the sides of the package were viewed less than the labels located in the center of the package and had 30% less viewing time than the same labels that were located in the center, while labels positioned at the top of the picture were viewed much more than labels placed at the bottom.

Reale and Flint (2016) explored the effects of providing nutrition information on fast food restaurant menus on consumers' food choices. They implemented three experimental conditions with starter, main and dessert on the menu, which are 1) calorie information in black text (nondirective), 2) health logos (semi directive), 3) color-coded TL calorie information (directive). The researchers found that participants assigned with black text menus ordered food containing significantly more calories than participants in conditions that nutrition information was presented in health logos and color-coded TL labels; furthermore, participants in semi directive and directive labeling conditions fixed on all nutrition information, while participants in



nondirective condition only fixed on 4.93% of nutrition information (Reale and Flint, 2016). This is consistent with a study conducted by Kim, et al. (2018). Kim, et al. (2018) reported that participants increased their visual attention when looking at PACE labeling and ended up choosing healthier items on the fast food menu, and participants tended to prefer PACE labels than calorie numeric labels and TL labels. This suggests that PACE was the most effective labeling format to deliver nutrition information

## **2.9 Research Gap**

Previous studies on calorie menu labeling have been mainly conducted in the US and Europe. Only a few studies had used the application of eye tracking technology to discover the effects of menu labeling on consumers' visual attention and decision-making process (Auchincloss, et al., 2013, Graham and Jeffery, 2011, James, et al., 2015, Liu, et al., 2012, Reale and Flint, 2016, Roseman, et al., 2017). In the Canadian context, research on the effectiveness of menu labeling has only been conducted in theoretical and survey formats without the use of eye tracking data (Hammond, et al., 2013, Pang and Hammond, 2013). This leaves us with a gap in the literature that this study aims to fill:

- How do Canadian consumers interact with nutrition information provided on the menu?
- How do different labeling schemes affect Canadian consumers' food choices from a restaurant menu?

### 3 Conceptual Framework

Under the time and budget constraints, search costs arise when consumers need to search for the right food items that meet their nutrition and cost requirements when they make a purchase decision. Tseng and Lee (2016) found that by providing complete information and increasing information disclosure help decrease consumer search costs when they look for information on foods. For consumers who want to improve their diets, detailed nutrition information may decrease their search costs and may help direct their food decisions towards healthier food products. Thus, the objective of this research is to determine whether consumers observe the nutrition information on menu labels and to evaluate the effectiveness of the current Health Menu Choices Act, as well as to identify potential approaches to improving dine-in restaurants' menu in order to encourage healthy food choices. I focus on the following research questions:

- Does the numeric calorie labeling method have an impact on reducing calories ordered?
- Do alternative labeling methods have more significant impacts on calories ordered than numeric calorie labeling method?

As previously stated, Littlewood, et al. (2016) reviewed 15 studies worldwide and 3 of them found that labeling calories on menus had no effect on calories ordered (Dodds, et al., 2014, Elbel, et al., 2013, Qiang and Pitt, 2004, Roseman, et al., 2013). The presence of information, such as calorie labelling, does not assure successful communication (Kim, et al., 2018, Qiang and Pitt, 2004). However, none of these were tested with eye tracking technology. Therefore, the following hypothesis was formed to answer the first research question.

- **H<sub>1</sub>: The numeric calorie labels required under the Healthy Menu Choices Act has an impact on reducing calories ordered from a full-service restaurant menu.**

The second research question is whether alternative labelling methods would encourage consumers to choose healthier foods. Previous literature found that the use of color and health logos led to a significant decrease in calories ordered comparing to black labelling (Reale and Flint, 2016). In the case of fast food restaurants, calorie labelling paired with a percentage of daily recommended value resulted in the greatest calorie reduction (Zaffou and Campbell, 2015). In this research, we will look at three alternative label methods, which are recommended daily value, traffic light label, and physical activity equivalent label.

- **H<sub>2</sub>: Alternative labelling methods have more significant impacts on calories ordered**

Multiple previous studies noted the labelling of calorie information on menus did not have a significant effect on calories ordered, when less than 70% participants failed to observe the labelled information (Elbel, et al., 2013, Krieger, et al., 2013, Reale and Flint, 2016).

Consumers require visual attention to use calorie labelling, this leads to our third hypothesis:

- **H<sub>3</sub>: When consumers observe nutritional information on menu labels, it will lead to a decrease in calories ordered**

## **4 Experimental Design and Data**

This chapter will detail the experimental design, the sample size calculation, the data collection and then describe the survey data and analysis process. Our experiment has one control menu with no nutrition information, and four treatment menus which contain numeric calorie labels, percent daily value labels, traffic light labels, and physical activity calorie equivalent labels. This experiment starts with a menu choice task involving an eye tracking device, followed by an online exit survey. The study was approved by the University of Guelph Research Ethics Board (REB#19-07-033). We used Tobii Pro eye tracking glasses at the West End Community Centre in Guelph, Ontario to collect real time eye tracking data and consumer choices from a menu. This location is chosen due to its high visitor flows and variety of community groups. The online survey was designed and collected in Qualtrics, and the data were analyzed in STATA.

### **4.1 Menu Design**

When we were creating the menu, we considered simulating existing menus from popular chain restaurants. Menu items, calorie information and prices were adapted from Moxie's Grill & Bar and Kelseys' Original Roadhouse to mimic menu offers in real restaurants. These restaurants are two chain restaurants in Ontario which have more than 20 outlets that are required to post nutrition information on their menus as required by the Healthy Menu Choices Act enforced by the Ontario Public Health Association. These restaurants were selected because both of them serve a variety of food items and they are well-known as family style full-service restaurants. The primary goal of creating menus was to present realistic menus to participants. In addition, menu items include three categories starter, entrée, and dessert, and we excluded a drink menu to

avoid creating noise in the data that would arise if consumers consider nutrition content in drinks. The menu items covered variety options of meat, seafood, vegetarian, soup, bread, salad, burger, steak, sandwich, in addition to four desserts varied in calorie contents.

To evaluate the effectiveness of different menu labelling methods, we proposed four menu labelling methods added to control menu as a cue so that nutrition information was distinct on menus. Four methods were calories in numeric calorie label, calories information with addition of percent daily value label which consumers frequently see on a food package nutrition fact table, traffic light label, and physical activity equivalent label.

#### 4.1.1 Control Menu

The menu used for the control group contained menu items, item description, and price of each item. An example of a menu item is shown in Figure 4.1. Full versions of all menus are available in the Appendix section. The styles of menu content, prices, and calories were adapted from actual settings of family style full-service restaurants. We adjusted item names to avoid recognition of any existing brand name. However, as price variation is not our main subject in this research, we did not vary price with calorie content between items but we provided portion size options for soups and ribs which were also common in real life setting. We used a limited menu to facilitate choices between products on a single page.

Starters	ROASTED RED PEPPER & TOMATO SOUP <i>A creamy blend of roasted red peppers and tomatoes</i>	bowl 6.99 cup 3.49
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**Figure 4.1: Menu one: control menu contains item name, item description, and price.**

In starter section, we chose two popular types of starter, soup and salad, with variation of price and calorie content to differentiate consumer choices affected by these factors. Bread,

seafood, and meat options were also presented in starter to mimic the menu offerings in real restaurants. Within the category of entrée, we offered classic ribs with options of half rack or full rack, which gave participants an opportunity to choose different sizes but keep a "healthy choice". We also offered meat burger, vegetable burger, and turkey sandwich with different calorie contents. Salmon was considered as a seafood option, meanwhile tenderloin filet was chosen as well to build variation of the menu. Full-service restaurants typically offer meals that have one entrée plus one or more sides. We followed this content and participants were asked if they would like to add any kinds of side among four options we provided (steamed veggies, coleslaw, French fries, mashed potatoes). We simplified desserts section with only four items included but in variation of price and calorie contents.

#### 4.1.2 Numeric Calorie Label

In 2017, the Government of Ontario required food service brands having 20 or more locations in Ontario to indicate calorie information on their food menus. Our first treatment group followed this requirement as shown in Figure 4.2. The calorie information was provided by restaurants on their official websites.

Starters	ROASTED RED PEPPER & TOMATO SOUP <i>A creamy blend of roasted red peppers and tomatoes</i>	bowl 6.99	650 cal
		cup 3.49	325 cal

Figure 4.2: Menu two: first treatment group, a presenting of numeric calories label.

#### 4.1.3 Percent Daily Value Label

The second experimental group used the format of percent daily value of calories in one serving of the individual menu item. The count of percent daily value is applied in nutrition facts table (NFT) format since implementation of food labelling regulations (Government of Canada,

2019). In NFTs, percent daily value calculation is only required for fat, sodium, carbohydrate, fibre, vitamins and minerals. Calories are not required because recommended daily calorie intake varies according to gender and body weight. However, detailed nutrients information was not provided by restaurants. The purpose of this research is to evaluate effectiveness of labelling methods; thus, we focused on adding the percent daily value of calories to the regular menu with numeric calorie information. The percent daily value of calorie was calculated by 2000 calorie per adult daily suggested by the most updated Canada's Food Guide (Government of Canada, 2020). The statement “Adults and youth (ages 13 and older) need an average of 2,000 calories a day, and children (ages 4 to 12) need an average of 1,500 calories a day. However, individual needs vary.” is displayed at the beginning of each menu. The layout of this method is presented in Figure 4.3.

Starters	ROASTED RED PEPPER & TOMATO SOUP <i>A creamy blend of roasted red peppers and tomatoes</i>	% daily value of calories*		
		6.99	650 cal	32.5%
		3.49	325 cal	16.3%

**Figure 4.3: Menu three: second treatment group, numeric calories label in addition of percent daily value label.**

#### 4.1.4 Traffic Light Label

Traffic light labels are one of the most common nonnumeric labels. They have been implemented in the United Kingdom since 2007 but only on packaged foods (Food Standards Agency, 2007). This label is designed to help consumers understand nutrition information on whether a food item contains high/unhealthy amounts of nutrients (which has a red light), medium/moderate amounts of nutrients (which has a yellow light), and low/healthy amounts of nutrients has a green light. Few studies have examined the impact of traffic light labels by rating each item based on combined information on multiple nutrients (Dodds, et al., 2014, Seward, et

al., 2016, Sonnenberg, et al., 2013). At the same time, Hammond, et al. (2013) and VanEpps, et al. (2016) assigned traffic light labels to each item based on only calorie information, which is similar to what we did in this study. We also assigned our traffic light thresholds according to calorie content in line with 2000 calories of recommended adult daily consumption.

We separated green lights from yellow lights for entrée at 400 calories, yellow lights from red lights at 550 calories considering that an adult needs at least 500 to 600 calories per meal. For all other items including starters, desserts and sides, we set first threshold at 100 calories to separate green lights from yellow lights, then second threshold at 300 calories to differentiate yellow and red lights. VanEpps, et al. (2016) created these thresholds in their search for starters, entrée and desserts on a full-service restaurant menu, and found that traffic light labels reduced the total calories ordered among participants. An example of traffic light label of one menu item is shown in Figure 4.4.

Starters	ROASTED RED PEPPER & TOMATO SOUP <i>A creamy blend of roasted red peppers and tomatoes</i>	bowl 6.99	650 cal	●
		cup 3.49	325 cal	●

**Figure 4.4: Menu four: third treatment group, numeric calories label in addition of traffic light label with thresholds set to different item categories.**

#### 4.1.5 Physical Activity Calorie Equivalent Label

Activity equivalent food label is another FOP labelling format which has been implemented in the UK since 2016 as required by the Royal Society for Public Health (RSPH) (Royal Society for Public Health, 2016). The RSPH introduced three formats of physical activity label, brisk walking as the most common physical activity, as well as two other cardiovascular exercises which are biking and swimming. RSPH also included formats of time or mileage



required to walk to burn off the total calories contained in one serving of menu items. We simplified this label by excluding biking and swimming and only calculated minutes of walking to have a clear message since many people do not swim or bike regularly. Several previous studies used descriptions of brisk walking for the average energy expenditure at the average body weight for a 160 lb adult (Hartley, et al., 2018, Swartz, et al., 2013). According to the guideline of Calorie Control Council (2017), a 160lbs adult walks at an average rate of 5 kilometers per hour in terms of 5 kcal per minute. To determine the number of minutes required to burn off calories from a menu item, the total calories in the item was divided by the energy expenditure rate and presented in the menu. Figure 4.5 shows an example of physical activity label.

Starters	ROASTED RED PEPPER & TOMATO SOUP <i>A creamy blend of roasted red peppers and tomatoes</i>	bowl 6.99	650 Cals	130 min
		cup 3.49	325 Cals	65 min

**Figure 4.5: Menu five: last treatment group, numeric calories label in addition of physical activity label.**

## 4.2 Sample Size Determination and Recruitment Process

A statistical software, G Power, was used to determine effective sample size of the experiment a priori. The sample size of this study was based on a power of 0.90, an alpha level of  $p < 0.05$ , and an effect size of 0.15 which is considered a small effect. A fixed multiple linear regression T test was applied. The minimum sample size required for each menu was 59. To minimize possible effect coming from the order in which menu items are presented, we created three versions for each menu by randomizing the order of menu items within each category. Therefore, each participant could receive a randomized menu which minimizes any potential bias coming from the order of presentation. Each specific menu was assigned with 20 participants in

total of 60 for one kind of menu. Total of 308 participants were recruited. A \$5 Tim Hortons gift card was given as an incentive to participate.

The participants were both females and males, ages between 18 and 65 years old who did not have ophthalmic conditions that meet minimum eligibility to use eye tracking glasses.

Participants were recruited at the West End Community Centre (WECC) in Guelph, Ontario from November 14<sup>th</sup> to November 30<sup>th</sup>, 2019 through a posting in WECC building and an oral introduction by researchers.

At the beginning of experiment, each participant was given the consent form and was asked to read it and ask any questions that they would have regarding the experimental procedure outlined in the consent form. Participants were then fitted with Tobii Pro eye tracking glasses; the Tobii Pro eye tracking glasses were then be calibrated to the individual. The participant was randomly given one of five menus and asked to choose as they do normally in a restaurant at dinner time. After completion of menu item selection, the exit survey was administered to all participants. Only data from participants who successfully completed both parts of experiment would be considered as valid. All participants completed eye tracking experiment and finished the survey. Observations with gaze points lower than 70% based on the eye tracking results were dropped from data set as well.

### **4.3 Survey**

An exit survey was designed as the second part of our study after participants completed the menu choice task while wearing the eye tracking glasses. This survey was designed to be completed in 15 to 20 minutes depending mostly on how long a participant spends on the

mathematical questions. The survey consisted of purchasing behavior, nutritional knowledge test, and general demographic questions. In purchase behavior section, questions include consumer attitudes towards menu labelling, the frequency that they visit different kinds of restaurants. Nutritional knowledge test was measured in a 20-points scale, a full version of test which is shown in Appendix. Test questions were created based on the latest Canada's food guide and with combination of survey questions used from previous literatures (Malam, 2008, Sturm, et al., 2018). Demographic questions collected participants' anonymous information about their gender, age, household income, education level, self-reported health condition, and dietary restrictions

#### **4.4 Summary**

This chapter outlined the experimental design and a description of the control menu and four treatment menus and outlined the survey data and eye tracking data. The control menu does not contain any nutrition information, and four treatment menus include labels such as numeric calorie amount, percent daily value, traffic light, and physical activity calorie equivalent labels. Participants were assigned with one of the five menus and then chose food items from the menu. Eye tracking data were recorded while participants were making decisions. After we recorded participants' choices from the menu, they would finish an exit survey to complete the experiment.

## 5 Empirical Framework

This chapter describes empirical model used in this research. We used Ordinary Least Squares estimator (OLS) to evaluate the effect of different attributes of the menu labeling schemes. This chapter outlines the specific models that were used in this research.

### 5.1 Model

The OLS estimator we used in this research has a dependent variable of total calories that each participant ordered. We first assigned our base regression by including gender and purchase behavior effects, which can be expressed as the following:

$$\text{totalcal} = \alpha + \beta_1 \text{female} + \beta_2 \text{looklowcal} + \varepsilon$$

Then we further investigate the effect of attention by incorporating eye tracking data and also consider treatment effects, both for the overall treatment groups and separate treatments. This allows us to explore the treatment effects in general as well as the effects of separate treatments. The two regressions that we used can be represented as:

$$\begin{aligned} \text{totalcal} = \alpha + \beta_1 \text{female} \\ + \beta_2 \text{influencedecision} + \beta_3 \text{looklowcal} + \beta_4 \text{labelrecognition} + \beta_5 \text{menu2} \\ + \beta_6 \text{menu3} + \beta_7 \text{menu4} + \beta_8 \text{menu5} + \varepsilon \end{aligned}$$

$$\begin{aligned} \text{totalcal} = \alpha + \beta_1 \text{female} + \beta_2 \text{influencedecision} + \beta_3 \text{looklowcal} + \beta_4 \text{labelrecognition} \\ + \beta_5 \text{treatment} + \varepsilon \end{aligned}$$

To expand our understanding of relationships between individual characteristics and treatments, we introduced interaction terms to our regression, which allows us to test more hypotheses. One possibility is that gender would show various outcomes with different labelling

schemes. Another possibility is that participants' self-reported purchase behavior and their attitudes towards mandatory labelling tend to have heterogeneous results with each experiment menu. Lastly, we interpreted interactions between menus and label recognition effect. If there is a presence of a significant coefficient estimate, it indicates that the effects of treatment menus are different depending on individual characteristics and behavior. Thus, we estimate four following regressions:

$$\text{totalcal} = \alpha + \beta_1 \text{female} + \beta_2 \text{menu}_i + \beta_3 \text{female} \times \text{menu}_i + \varepsilon$$

$$\text{totalcal} = \alpha + \beta_1 \text{lookloacal} + \beta_2 \text{menu}_i + \beta_3 \text{looklowcal} \times \text{menu}_i + \varepsilon$$

$$\text{totalcal} = \alpha + \beta_1 \text{influencedecision} + \beta_2 \text{menu}_i + \beta_3 \text{influencedecision} \times \text{menu}_i + \varepsilon$$

$$\text{totalcal} = \alpha + \beta_1 \text{labelrecognition} + \beta_2 \text{menu}_i + \beta_3 \text{labelrecognition} \times \text{menu}_i + \varepsilon$$

where I is from 2 to 5.

## **6 Results**

This chapter provides a detailed discussion of the results of this study. The first section outlines all variables used in the study and explained the data manipulation process. The second section outlines the descriptive statistics from the survey data and eye tracking data. The last section of this chapter presents a quantitative analysis of data.

### **6.1 Variable Descriptions**

The dependent variable, total calories ordered by each participant could be any positive whole number starting from zero. Since females tend to order fewer calories and use nutrition labels more often than males, male was set as the baseline. During the survey, participants were asked to indicate how often they were looking for foods with low calories. Participants who stated themselves that they always look for low calorie foods are expected to order fewer calories. “Looklowcal” is a binary variable in which answer “always” is 1 and all the other responses are 0. Participants who have higher concern for food nutrition labelling and responded “yes” for question “Would the labelling of calories information influence your decision to purchase a product” are expected to use more nutrition labelling, so it is expected to have a negative effect on dependent variable.

The variable “label recognition” is based on the information captured by eye tracking device. The variable has a value of 1 if a participant spent more than 600 ms (0.6 seconds) looking at the labels on treatment menus, and 0 otherwise. We expect that label recognition will have a negative effect on calories ordered. The menu treatment groups have two methods of analysis, the first is an aggregate effect represented by a binary variable “treatment” which

control menu with no nutrition information is 0 and all treatment menus are 1 and is expected to have a negative impact. We considered the separate effect of each menu as well with four binary variables using the name “menu<sub>i</sub>”. These are expected to have mixed effects. Interaction terms between each independent variables and menu treatment groups are also contained in regressions.

**Table 6.1: Variable Description**

<b>Variable</b>	<b>Type</b>	<b>Representation in Model</b>	<b>Expected Sign</b>
<b>Total calories</b>	Total count (cal)	Numeric calorie count	N/A (DV)
<b>Female</b>	Binary	1 = Female; 0 = Male	$\beta < 0$
<b>Looking for low cal food</b>	Binary	1 = Always looking for low calorie food; 0 = All other responses	$\beta < 0$
<b>Label influences decision</b>	Binary	1 = Menu labelling will influence purchase decision; 0 = No influence	$\beta < 0$
<b>Label recognition</b>	Binary	1 = Recognized labels; 0 = Did not recognized labels	$\beta < 0$
<b>Menu<sub>i</sub></b>	Binary	1 = Received menu i; 0 = Received other menus	$\beta < 0$ or $> 0$
<b>Treatment</b>	Binary	1 = Treatment menu; 0 = Control menu	$\beta < 0$
<b>Female × Menu<sub>i</sub></b>	Binary	Interaction term between gender and each menu treatment group	$\beta < 0$
<b>LookLowCal × Menu<sub>i</sub></b>	Binary	Interaction term between looking for low cal food and treatment group	$\beta < 0$
<b>InfluDecision × Menu<sub>i</sub></b>	Binary	Interaction term between influence decision term and treatment group	$\beta < 0$
<b>LableRecog × Menu<sub>i</sub></b>	Binary	Interaction term between label recognition term and treatment group	$\beta < 0$

## **6.2 Descriptive Statistics**

### **6.2.1 Sample Characteristics and Survey Data**

Demographic characteristics for all participants (n=308) are presented in **Table 6.2**. The data were compared with the 2019 Census Profile for Canada provided by Statistics Canada (Statistics Canada, 2019). In the exit survey, a total of 308 participants with 174 females (approximately 56.5%) and 134 males (43.5%) completed the experiment process. Compared with Canada's 2019 Census profile, our sample had slightly more women than men (50.31% of the population are women in Canada as 2019). The age of our sample ranged from 19 years old to 60 years or older. The reason why the majority of participants fell into the category of 40 to 59 years of age with 51% is because the experiment was taken at the West End Community Centre in Guelph in which the majority of visitors were parents with their children. Our participants are more educated compared to the Canada Census Profile, 58% of participants completed university degree or higher, about 28.6% of participants received college diploma or equivalent certificates, approximately 13.0% of our sample finished high school or less. Canada's Census Profile showed that 23.3% of Canadian population received degree at bachelor level or above, 58.5% of people have postsecondary certificate, diploma or degree below bachelor level (Statistics Canada, 2016). When further looking at employment status, 79.5% of our participants were either working in a full-time position or a part-time position, and only 5.2% of them were unemployed which was very close to the unemployment rate (5.67%) reported by (Statistics Canada, 2019). We had more participants with annual household income greater than \$75,000 (56.2%) compared to 52.06% reported by Statistics Canada (2017). It should be noted that, sociodemographic characteristics are available on all respondents, but there were "prefer not to



answer" responses to some survey questions such as household income, which could decrease the percentage of people in the income groups lower than \$75,000 per year. When examining participant differences among all five groups, there were no statistically significant differences for Gender ( $X^2(1, N=308)=0.3428, p=0.99$ ), Age ( $X^2(3, N=308)=17.1268, p=0.14$ ), Education ( $X^2(2, N=308)=7.3879, p=0.50$ ), Income ( $X^2(3, N=308)=13.4688, p=0.34$ ), however, Employment status ( $X^2(2, N=308)=20.2168, p=0.0095$ ) showed a significant difference at 5<sup>th</sup> percentile level. Therefore, all five menu groups are comparable in terms of most of the demographic characteristics.

Table 6.2: Demographic Characteristics

	<b>Overall (n=308)</b>	<b>Menu 1: Control (n=63)</b>	<b>Menu 2: Numeric calorie (n=62)</b>	<b>Menu 3: %DV (n=62)</b>	<b>Menu 4: TL (n=60)</b>	<b>Menu 5: PACE (n=61)</b>
<b>Gender</b>						
Female	174 (56.5%)	34 (54.0%)	36 (58.1%)	36 (58.1%)	33 (55%)	34 (55.7%)
Male	134 (43.5%)	29 (46.0%)	26(41.9%)	26 (41.9%)	27 (45%)	27 (44.3%)
<b>Age</b>						
Below 25	20 (6.5%)	5 (7.9%)	4 (6.5%)	2 (3.3%)	2 (3.3)	7 (11.5%)
25-39	95 (30.8%)	20 (31.7%)	19 (30.6%)	22 (35.5%)	20 (33.3%)	14 (23.0%)
40-59	157 (51.0%)	31 (49.2%)	25 (40.3%)	33 (53.2%)	32 (53.3%)	36 (59.0%)
60+	36 (11.7%)	7 (11.1%)	14 (22.6%)	5 (8.1%)	6 (10%)	4 (6.6%)
<b>Education</b>						
Completed high school or less	40 (13.0%)	5 (7.9%)	8 (12.9%)	12 (19.4%)	5 (8.3%)	10 (16.4%)
Completed college	88 (28.6%)	15 (23.8%)	19 (30.6%)	16 (25.8%)	20 (33.3%)	18 (29.5%)
University graduate or higher	180 (58.4%)	43 (68.3%)	35 (56.5%)	34 (54.8%)	35 (58.3%)	33 (54.1%)
<b>Employment Status</b>						
Employed	245 (79.5%)	51 (81.0%)	42 (67.7%)	44 (71.0%)	54 (90%)	54 (88.5%)
Unemployed	16 (5.2%)	6 (9.5%)	5 (8.1%)	3 (4.8%)	1 (1.7%)	1 (1.6%)
Other (Homemaker, Retired)	47 (15.3%)	6 (9.5%)	15 (24.2%)	15 (24.2%)	5 (8.3%)	6 (9.8%)
<b>Household income</b>						
Less than \$25,000	22 (7.1%)	6 (9.5%)	6 (9.7%)	2 (3.2%)	7 (11.7%)	1 (1.6%)
\$25,000-\$75,000	71 (23.1%)	14 (22.2%)	18 19.6%)	16 (25.8%)	13 (21.7%)	10 (16.4%)
\$75, 000 or more	173 (56.2%)	35 (55.6%)	29 (46.8%)	36 (58.1%)	30 (50%)	43 (70.5%)
Prefer not to answer	42 (13.6%)	8 (12.7%)	9 (14.5%)	8 (12.9%)	10 (16.7%)	7 (11.5%)

Psychographic characteristics for all participants (n=308) are reported in **Table 6.3**. The rate of participants who received a doctor's health advisory on losing weight was not high, which is 18.9%. However, 44.5% of the total sample thought they were over-weight and 40.9% of participants set to lose weight as their diet goal. In total, 7.9% and 9.9% of participants received doctor's health advisory on reducing sodium or salt, reducing cholesterol, respectively. However, only 8.5% and 4.9% of them tried to reduce intakes of sodium and cholesterol. Moreover, 256 participants out of 308 did not follow a special dietary requirement, so that our menus provided appropriate flexible items to 83.12% of our sample; although we included vegetarian and seafood items, the menus were not explicitly designed for people who are vegetarian, vegan, pescatarian or following a religious practice.

**Table 6.3: Psychographic Characteristics**

<b>Overall (n=308)</b>	
<b>Doctor's Advisory (can choose more than one)</b>	
Lose weight	67 (18.9%)
Reduce sodium or salt	28 (7.9%)
Reduce Cholesterol	35 (9.9%)
Others	33 (9.3%)
None of above	191 (54.0%)
<b>Dietary requirements (can choose more than one)</b>	
Vegetarian	29 (9.2%)
Vegan	6 (1.9%)
Pescatarian	18 (5.7%)
Religious practice	8 (2.5%)
None of above	256 (80.8%)
<b>Self-reported body shape</b>	
Overweight	137 (44.5%)
Underweight	4 (1.3%)
Just about right	164 (53.3%)
Others	3 (0.9%)
<b>Self-reported diet goal</b>	
Lose weight	126 (40.9%)
Reduce sodium or salt	26 (8.5%)
Reduce cholesterol	15 (4.9%)
Other diet goals	42 (13.6%)
None of the above	99 (32.1%)

In our sample, 80.52% of participants indicated that they would support mandatory labeling of calorie information on restaurant menus; however, only 62.66% of participants stated that the labeling of calorie information would influence their decision to purchase a product as shown in **Table 6.4**. This implies that the support of mandatory labeling may not necessarily change consumers' purchase behavior and improve their food choices. Although these two metrics are not directly related to each other, they demonstrate the public preference for mandatory nutrition information labeling on food products, and this may lead to a potential increase in the percentage of public looking and using nutrition information to make healthier food choices with a decrease in search costs.

The survey also asked respondents to answer the following questions:

- How often do you look at nutrition and/or ingredients labels on the foods you purchase?
- How often do you compare nutritional information between foods?
- How often do you look for foods with low calories?

The response categories (and corresponding code value in the analysis file) were: (1) always, (2) most of the time, (3) about half the time, (4) rarely, (5) never and (6) prefer not to answer. A summary of responses to the three questions is shown in **Table 6.4**. The rate of nutrition label use was fairly moderate, with more than 50% of participants indicated that they "always" or "most of the time" looked at nutrition or ingredient labels on the food they purchased, and about another half of participants stated that they only "about half of the time", "rarely", or "never" looked at nutrition labels. The rate of using nutrition information to compare

foods was lower than approximately 26% of participants indicated that they "always" or "most of the time" used labels to compare foods. This could be attributed to high search costs, meaning that looking at nutrition information between food products can be expensive in regard with time and resources factors. In contrast, consumers who use nutrition information labels were not necessarily looking for foods with low calories, since only 5.5% of participants stated that they "always" looked for low-calorie foods, and 19.16% of them looked for low-calorie foods at "most of the time". More than 75% of participants indicated that they "about half of the time", "rarely" or "never" searched for low-calorie foods.

**Table 6.4: Responses to the use of Nutrition/Calorie labels questions**

<i>Survey Question</i>	<i>Responses (n=308)</i>					
	Always	Most of the time	About half of the time	Rarely	Never	Prefer not to answer
<b>How often do you look at nutrition and/or ingredients labels on the foods you purchase?</b>	60 (19.48%)	102 (33.12%)	84 (27.27%)	55 (17.86%)	7 (2.27%)	0
<b>How often do you compare nutritional information between foods?</b>	18 (5.84%)	62 (20.13%)	52 (16.88%)	119 (38.64%)	55 (17.86%)	2 (0.65%)
<b>How often do you look for foods with low calories?</b>	17 (5.52%)	59 (19.16%)	88 (28.57%)	102 (33.12%)	42 (13.64%)	0
	<i>Responses (n=308)</i>					
	Yes		No	Other		
<b>Do you support mandatory labeling of calorie information in restaurants?</b>	248 (80.52%)		18 (5.84%)	42 (13.64%)		
<b>Would the labeling of calorie information influence your decision to purchase a product?</b>	193 (62.66%)		70 (22.73%)	45 (14.61%)		

To evaluate participants' knowledge of calorie amounts in food items, the survey included a section of the nutritional knowledge test (shown in Appendix), as results are shown in **Table 6.5**. One question asked participants to estimate the number of calories in a 355 mL can of coke in which the correct number is 140 calories. Although many consumers who do not consume coke regularly would lose the perception of the nutrition information in a can of coke, we still chose this particular soft drink since it is one of the most commonly recognizable food and drink products. Other soft drinks may have slightly different calorie contents; thus, participants' answers may depend on how familiar the participant is with this soft drink or other soft drinks. In the survey, participants had to enter a number, and there was also an option for "do not know" which was assigned zero point. When doing the regression analysis, we assign the score of one point for numbers around the correct answer and zero for any number outside of the range. Nutritional knowledge test contains other questions such as true or false in regard to food choice statements and simple math questions related to the reading of NFT in total of 20 points. Detailed test questions are available in Appendix section. The purpose of this test is to distinguish individuals who have some understanding of nutrition labels from those who have no or very little understanding.

Overall, the mean estimate of calorie contents in a can of coke by all respondents was 301.1 Cals. As shown, the variation in the responses was high, with a standard deviation of 211.1 Cals. The maximum calorie amount indicated by a participant was 2000 Cals and the minimum amount was 42 Cals. This result illustrated that participants overestimate the number of calories in unhealthy foods, which had been found in previous study as well (Roberto, et al., 2013). The mean test grade was 11.9 points out of 20 with a standard deviation of 3.12 points. The lowest



test grade was 0 points, and the highest test grade received was 19 points. Table 6.5 also shows the calories chosen overall. The mean of total calories ordered was 1583.8 Cals, with a standard deviation of 611.2 Cals. The highest number of calories ordered was 3740 Cals and the least was 170 Cals.

**Table 6.5: Participants' response on calories per 355mL can of coke, nutrition knowledge test grades and total calories ordered by participants**

<b>n=308</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>
<b>Calorie per can of coke</b>	301.1 Cals	211.1 Cals	42 Cals	2000 Cals
<b>Test grade (total 20 points)</b>	11.9	3.12	3	19
<b>Total calories ordered</b>	1583.8 Cals	611.2 Cals	170 Cals	3740 Cals

### 6.2.2 Eye Tracking Data

As Tobii Pro indicated that blinking usually causes around 5-10% data loss during a recording (Tobii Pro, 2020). Also, if participants looked outside of the glasses, then eye tracker cannot find the eyes or if operator took the glasses from the participant before stopping the recording would also count towards the % loss. We found that when gaze samples were less than 70%, there were large gaps of data from the eye tracker and software was not able to analyze. Thus, any gaze samples lower than 70% were excluded from our research leaving us with 298 observations. With the sample of 298 observations, **Table 6.6** shows that on average, the total time a participant spent looking at the entire menu was 62.8 seconds, the total time spent looking at item name and item description was 27.6 seconds, and total time spent on price was 1.6 seconds, and lastly, the total time spent looking at labels was 3.7 seconds across the four labeling schemes.

**Table 6.6: Total ordered results and eye tracking results**

<b>n=298</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>
<b>Total time spent to look at menu</b>	62.8 s	29.5 s	9.6 s	188.5 s
<b>Total time spent to look at item</b>	27.6 s	14.0 s	2.3 s	77.4 s
<b>Total time spent to look at price</b>	1.6 s	2.3 s	0 s	14.7 s
<b>Total time spent to look at label</b>	3.7 s	4.6 s	0 s	26.6 s

The results for the total average time spent looking at labels and the number of fixations a participant had on labels of four treatment menus are presented in **Table 6.7**. Physical Activity Calorie Equivalent (PACE) label had the highest total duration of time on labels (5.27 seconds) followed by Traffic Light (TL) label, percent daily value (%DV) label, and calories only label of 5.25 seconds, 4.61 seconds and 2.89 seconds, respectively. A study conducted by Clement, et al. (2013) examined the effects of package design features, and they found that the average duration of one fixation was 0.46 seconds. When we calculated average fixation time on one fixation, we divided total fixation time by a number of fixations on labels. PACE label had 0.71 seconds followed by TL label, %DV label, and numeric calorie label with average duration of fixation of 0.67 seconds, 0.67 seconds, and 0.57 seconds. These are higher than the average time found by Clement, et al. (2013). One reason could be that Clement, et al. (2013) conducted the experiment in a local grocery store and shoppers had an idea of which products they were purchasing, and this would imply the degree of familiarity with products and thus reducing the time required to search a product. In contrast, although our menu was adapted from existing restaurant menus, the presence of labels was new to participants and may have increased the time needed to explore the menu and search for information.

Another way to interpret the information is to measure the percentage of label perception. Participants who spent more than 0.6 seconds (600ms) looking at all the labels would be considered as they recognized the label. Brunye, et al. (2019) reviewed several studies that set 600ms threshold, fixations durations shorter than threshold indicated failing to recognize the critical regions, however, it is not the perfect approach to identify successful recognition since each study can indicate their own perceptual uncertainty preceding incorrect recognition even if they assumed that lengthy fixation durations indicated successful recognition. **Table 6.7** shows that TL label had the highest perception rate of 91.7% whereas only 74.2% of participants looked at the calories only label. This may be due to color-coded labels that are more attractive than other labeling formats, and the higher familiarity of calories information on either food product packages or fast-food restaurant menus. The number of fixation results showed a similar trend with label perception rates. TL label had an average of 7.82 fixations per participant, and calories only label had the fewest average fixation counts which were 5.08 times per participant. In general, participants had relatively high perceptions of nutrition information labels; however, this is not necessarily related to the use of labels and may not change consumers' food choices. Long duration time can also be affected by the way that participants interpret labels. Further analysis will be discussed in the next section.

**Table 6.7: Results on the average number of fixations and total fixation time on labels for different treatment groups and percentage of label perception.**

	Total fixation time in seconds		Number of fixations on labels		Percentage of participants who observed a label
	Mean	Std. Dev.	Mean	Std. Dev.	
<b>Calories only (Menu2)</b>	2.89	2.81	5.08	3.68	74.2%
<b>%DV (Menu 3)</b>	4.61	4.84	6.90	5.99	80.6%
<b>TL (Menu 3)</b>	5.25	5.09	7.82	5.13	91.7%
<b>PACE (Menu 4)</b>	5.27	5.63	7.45	6.06	86.9%

A one-way ANOVA was applied to visual attention results to measure if any one of four treatment menus was noticed differently than others. The total duration of fixation time and a number of fixations were the primary measures applied with one-way ANOVA. The Tukey post-hoc test showed that total average fixation time for all three alternative labeling methods was different from numeric calorie label. Despite the fact that %DV label was not significantly different from numeric calorie label, the total average fixation time was increased by 1.71 (95% CI [-0.53, 3.96];  $p=0.200$ ). The difference in fixation time between the TL label and the numeric calorie label (2.36, 95% CI [0.134, 4.59];  $p=0.033$ ) and between the PACE and the numeric calorie label (2.38, 95% CI [0.15, 4.61];  $p=0.031$ ) were significant. An increase in fixation time from TL label (0.65, 95% CI [-1.60, 2.89];  $p=0.88$ ) to %DV label, from PACE label (0.66, 95% CI [-1.58, 2.91];  $p=0.87$ ) to %DV label were not significant. These are slightly contradictory to the results found by Kim, et al. (2018) in the US that all three labeling conditions (caloric numeric label, TL label, PACE label) were different from each other, for both burgers/sandwiches and snacks/sides categories, the caloric numeric condition was not significantly different from the TL condition, but the PACE condition was significantly higher than both the TL condition and the numeric condition.

In terms of the number of fixations on labels, the TL label increases fixation counts significantly from the numeric calorie label (mean difference 2.73, 95% CI [0.23, 5.24];  $p=0.026$ ), and also did PACE label but with a 90% confidence interval (mean difference 2.37, 95% CI [-0.14, 4.87];  $p=0.071$ ). fixation count on percent daily value label (1.81, 95% CI [-0.71, 4.34];  $p=0.25$ ) was not different from numeric calorie label; PACE label was not different from %DV (0.55, 95% CI [-1.97, 3.08];  $p=0.94$ ) and TL labels (-0.37, 95% CI [-2.87, 2.14];

$p=0.98$ ). These results were also slightly different from Kim, et al. (2018) 's research that the caloric numeric condition was not significantly different from the TL condition but the PACE condition was significantly higher than both the TL condition and the numeric condition. Overall, this demonstrates that TL and PACE labels increase consumer's visual attention on nutrition information labeling compared to numeric calorie labels but have different effects in the US and the Canadian sectors.

### 6.3 Analytical Results

**Table 6.8** shows OLS regression results that first focus on the demographic characteristics and then the visual attention of participants as well as menu treatment effects. The outcome variable is the total calories ordered by a participant. The goodness of fit test was performed by an F test. The linear regression (1) in Table 6.8 established that gender of participants and looking for low-cal foods could statistically significantly affect the total calories ordered by participants with F-value equaled to 6.72 and a p-value of 0.0014. Females tend to order 146.0 fewer calories than males, and the difference is statistically significant with a 5% level of significance; meanwhile, participants who said that they were looking for low-calorie foods ordered 206.5 fewer calories than other participants with a 5% level of significance. Much previous studies found the same results that females purchased fewer calories than males (Brissette, et al., 2013, Canadian Council of Food and Nutrition, 2008, Neuhouser, et al., 1999, Satia, et al., 2005).

The linear regression (2) in Table 6.8 Includes additional explanatory variables to regression (1), and the variables are jointly significant with F-value of 3.91 and p-value of 0.0019. Females keep having negative statistically significant effects on calories ordered, while

the effects of looking for low-cal foods are not significant anymore. A new variable, mandatory nutrition labeling would influence purchase decision, has a negative and significant coefficient estimate with 10% level of significance. This suggests that participants who indicated that nutrition information labeling would affect their purchase decision actually used labels to make orders. Interestingly, participants who recognized labels ordered 153.9 more calories than those who did not recognize labels, with 10% level of significance. Lastly, the coefficient estimate on 'Treatment' suggests that being assigned in one of the treatment groups (menus 2 through 5) does not have statistically significant impacts on total calories ordered, which might be due to the mixed effects of different labeling schemes.

The linear regression (3) in Table 6.8 examined the effects of each treatment separately. The variables are jointly significant with F-value of 3,86 and p-value of 0.0002. In regression (3), female, label influences decision, label recognition factors have the same sign on the total calories ordered as in regression (2) but in slightly different magnitudes. People who were looking for low-calorie foods ordered significantly fewer calories by 153.5 calories with a 10% level of significance. When considering each menu treatment, the percent daily value (%DV) label significantly encourages participants to order 253.7 fewer calories than the menu with no nutrition information labeled. Although the numeric calorie label and PACE label have increased calories ordered as compared to no nutrition information menu, they are not statistically significant. This is contradictory to previous studies in the US and New Zealand found that consumers were less likely to consider the %DV label as an effective tool to make healthier food choices (Gorton, et al., 2009, International Food Information Council Foundation, 2006). However, our results are consistent with research reported in Canada in 1999 that Canadian

consumers found %DV labels were significantly more useful since Canadian consumers were more familiar with the expression of %DV format (National Institute of Nutrition, 1999).

**Table 6.8: OLS regression results.**

	<b>(1)</b>		<b>(2)</b>		<b>(3)</b>	
	total Cals		total Cals		total Cals	
<b>Female</b>	-146.0**	(-2.22)	-142.9**	(-2.16)	-130.2**	(-1.99)
<b>Look low cal food</b>	-206.5**	(-2.54)	-140.0	(-1.59)	-153.5*	(-1.76)
<b>Label influences decision</b>			-138.2*	(-1.78)	-134.0*	(-1.75)
<b>Label recognition</b>			153.9*	(1.65)	169.3*	(1.83)
<b>Treatment</b>			-31.70	(-0.31)		
<b>Menu2 (Numeric Cals)</b>					86.20	(0.74)
<b>Menu3 (%DV)</b>					-253.7**	(-2.09)
<b>Menu4 (TL)</b>					-14.50	(-0.12)
<b>Menu5 (PACE)</b>					6.247	(0.05)
<b>Constant</b>	1718.3***	(32.54)	1697.5***	(16.82)	1687.9***	(16.93)
<b>Observations</b>	298		298		298	
<b>t statistics in parentheses</b>						
** p<0.10      ** p<0.05      *** p<0.01"						

**Table 6.9** revealed different effects of gender, look for low-cal food, label influences decision, and label recognition variables and their interaction with each menu treatment. The linear regression (1) in Table 6.9 revealed that the gender of participants and interactions between gender and menu treatments could jointly statistically significantly affect the total calories ordered by participants together with F-value of 2.89 and p-value of 0.0027. Among those who received the TL labels (menu 4), females ordered 419 fewer calories than males, which is statistically significant at a 10% level of significance. However, TL labels increased the amounts of calories ordered by males in by 352.3 calories at a 5% level of significance.

The linear regression (2) in Table 6.9 established that looking for low-cal foods, menu treatments and interactions between them jointly could statistically significantly affect the total calories ordered by participants with F-value of 2.52 and p-value of 0.0086. However, none of the interaction terms between menu treatments and look for low-cal foods was statistically significant. This implies that the implementation of nutrition information does not differentially affect the total calories ordered by the participants who look for low-calorie foods.

The linear regression (3) in Table 6.9 examined the participants' perceived effects of mandatory labeling on decision-making, each menu treatments, and their interaction effects. It established that these variables are jointly statistically significant for total calories ordered by participants with F-value of 2.30 and p-value of 0.0168. For participants who thought that the mandatory labeling would affect their decisions on food products ordered 294.9 fewer calories than those who thought food labeling would not affect them at a 10% level of confidence. Those who indicated that their decisions are not influenced by labels decreased the calories ordered (by -400.2), whereas those who indicated that their decisions are influenced increased the calories ordered (by 383.8) when given the %DV menu. This contradictory result might be due to for participants who think that the menu label will make a difference might not be more familiar with the label but might be more familiar with nutritional contents. But for participants who are less familiar with nutrition labeling may see more impact because they are more surprised by how many calories are contained in a food items or by how much of their recommended daily intake it represents. Overall, this demonstrates that Canadian consumers are significantly affected by %DV labels than other labeling formats, and unfamiliarity of other labeling formats would reduce the influence on choosing foods with lower calories.



The last regression (4) presented in Table 6.9 looked at the effect of recognizing the labels, captured by an eye-tracker on consumer's purchasing behavior together with interaction terms between label recognition and menu treatments, which jointly statistically significantly affect the total calories ordered with F-value of 2.10 and p-value of 0.0292. Participants who recognized %DV labels ordered 491 fewer calories compared to those who did not recognize the %DV labels. This would highlight the influence of %DV labels on Canadian consumers.

**Table 6.9: Differentiated effects of variables and their interaction terms with menu treatment factors.**

<b>n=298</b>	<b>(1)</b>		<b>(2)</b>		<b>(3)</b>		<b>(4)</b>	
	total Cals		total Cals		total Cals		total Cals	
<b>Female</b>	-31.09	(-0.20)						
<b>Menu2</b>	144.9	(0.89)	163.7	(1.25)	141.9	(0.77)	195.7	(1.05)
<b>Menu3</b>	-137.1	(-0.88)	-212.0	(-1.64)	-400.2**	(-2.16)	81.96	(0.35)
<b>Menu4</b>	352.3**	(2.20)	117.9	(0.92)	57.20	(0.33)	-197.3	(-0.69)
<b>Menu5</b>	313.1*	(1.95)	158.6	(1.23)	54.29	(0.29)	45.00	(0.18)
<b>Female × Menu 2</b>	43.84	(0.20)						
<b>Female × Menu 3</b>	-16.96	(-0.09)						
<b>Female × Menu 4</b>	-418.6*	(-1.92)						
<b>Female × Menu 5</b>	-353.4	(-1.62)						
<b>look low cal food</b>			-194.1	(-1.19)				
<b>LookLowCal × Menu 2</b>			-28.94	(-0.12)				
<b>LookLowCal × Menu 3</b>			175.5	(0.69)				
<b>LookLowCal × Menu 4</b>			-111.1	(-0.44)				
<b>LookLowCal × Menu 5</b>			-256.5	(-1.05)				
<b>Label influences decision</b>					-294.9*	(-1.82)		
<b>InfluDecision × Menu 2</b>					41.56	(0.18)		
<b>InfluDecision × Menu 3</b>					384.8*	(1.67)		
<b>InfluDecision × Menu 4</b>					63.45	(0.28)		
<b>InfluDecision × Menu 5</b>					98.28	(0.43)		
<b>Label recognition</b>							338.8**	(2.00)
<b>LableRecog × Menu 2</b>							-241.2	(-0.97)
<b>LableRecog × Menu 3</b>							-491.3*	(-1.73)
<b>LableRecog × Menu 4</b>							120.0	(0.37)
<b>LableRecog × Menu 5</b>							-140.9	(-0.48)
<b>Constant</b>	1547.5***	(13.78)	1595.6***	(16.89)	1722.6***	(13.17)	1429.3***	(15.41)
<b>t statistics in parentheses</b>								
** p<0.10 ** p<0.05 *** p<0.01"								

## 6.4 Summary

This chapter outlined the descriptive statistics and results from the Ordinary Least Square estimations. The primary finding is that the TL label brought the most considerable visual attention, followed by PACE, %DV, and numeric calorie labels. However, the perception of menu labeling does not affect consumer's food choices when such labeling methods are not acknowledged by consumers. Nutrition information label does have impacts on ordering fewer calories when consumers are familiar with the format of labels and nutrition information labels on the menu helped consumers to improve their food decisions. Overall, numeric calorie labels do not have a significant reduction on total calories ordered, but %DV labels affected the Canadian participants the most as compared to other three labeling schemes. TL labels affected females and males differently in which TL labels significantly affected females by ordering foods with fewer calories, whereas TL labels increased the amounts of calories ordered by males.

## 7 Conclusion

This research uses realistic experiments and eye tracking technology to estimate the effectiveness of presenting nutrition information on full-service restaurant menus. Using eye tracking glasses and realistic menus, we had participants view five different menus and tracked where they observed as they looked through the menu and made orders. Each participant was assigned one of five menus and made choices out of menu items for dinner.

While previous literature indicated inconsistent results, our research provided evidence to support the effectiveness of the four menu labeling schemes which are numeric calorie, percent daily value (%DV), traffic light (TL), and physical activity calorie equivalent (PACE) labels. The results from eye-tracking data indicated that the three alternative labeling schemes increased consumers' visual attention on labels compared to numeric calorie information, which is consistent with previous literature. The presence of TL and PACE labels appeared to have significant positive effects on attracting participants' visual attention. Both TL and PACE labels significantly increased the duration of fixation and numbers of fixation counts as compared to numeric calorie labels. Overall, the numeric calorie label that is currently implemented in Ontario may not be effective in influencing consumers' food purchasing behavior; although the TL and PACE labels showed the highest visual attractions, percent daily value label increased the probability of ordering foods with fewer calories. It could be due to the lack of comprehension of unfamiliar label formats, or the gap between nutrition knowledge education and public perception about food labeling systems. Given the inconsistent results that most of the participants were supporting mandatory labeling on menus and the experimental result which show that participants were not necessarily affected by labels when making their choices, we

found the potential to promote nutrition information labeling designed to reduce search costs and facilitate healthy food choices.

## **7.1 Policy Implications**

Mandatory labeling is a trending topic in food regulations perspectives. Changes in food labeling are aiming to influence purchasing behavior and to improve public health. Our research found that labeling methods that are unfamiliar to Canadian consumers such as TL and PACE labels may have limited impacts on changing their purchasing behaviors. Meanwhile, mandatory numeric calorie labels regulated by the Healthy Menu Choices Act had smaller effects than percent daily value (%DV) labels. Educating consumers about legislated nutrition information labels may lead to stronger responses among label users and motivate label use among non-users. Although our study may not be representative of broader demographic groups, it provides a baseline for potential policy changes. If the policy implications are linked to the goal of improving consumers' food choices, our research provides some evidence to support the effectiveness of mandatory labeling on restaurant menus. Evidence showed that %DV labels tended to have larger impacts than numeric calorie labels on reducing calories ordered for Ontario consumers.

It is well known that policy implication alone may not automatically result in healthier food choices; it requires coordination of changes in the nutritional quality of restaurant menu offerings, such as reducing portion sizes, reducing sodium and fat contents in menu items. Our findings can inform the chain restaurants that are considering modifying their menu offerings to increase healthier options in reactions to the proposed regulations that require disclosing calorie and nutrition information in full-service chain restaurants. Mandatory labeling already has

impacts on fast-food menus; for instance, KFC introduced grilled (unfried) chicken as their new menu item when they were required to provide nutrition information for all food items. This grilled chicken offered reduced fat contents and improved calorie profile compared to fried chicken. Such offers have been made by other fast-food restaurants, including McDonald's 260 calories snack wrap, Burger King's apple fries, etc. In addition, chain restaurants may consider adding more healthy items to existing menus like vegetables and salads with lower-calorie sauces and dressings or reducing portion sizes of less healthy items so that calorie contents may be reduced to reasonable levels. These changes could help consumers to reduce caloric intake regardless of their uses of nutrition information labels.

Calorie disclosures should provide opportunities to health conscious consumers to be better equipped with information to satisfy their food choices and dietary requirements; however, previous research indicates that nutrition labels may not easily change consumers' purchasing behavior and are not easy to encourage consumers to actually choose healthier alternatives. Our research suggests that calorie information presented in a numeric form and other formats have significantly different effects on consumer perceptions of restaurants foods, especially for those who are highly motivated to pursue nutrition information.

## **7.2 Limitations and Suggestions for Future Research**

Although this study is one of the first experimental studies conducted to examine the effectiveness of the Healthy Menu Choices Act using eye-tracking data, it has limitations that could merit future research. The primary limitation is that our experiment was done in a hypothetical setting in which participants did not actually receive foods for what they ordered, and the experiment did not involve monetary transactions in a real restaurant-like environment

although we required all participants to consider their typical budget. Furthermore, our research is limited to one data collection location with one month data that is collected after the implementation of the Healthy Menu Choices Act. So, the sample was homogeneous in the way that participants are mainly mid-age high income and high education families. Although the results show a reduction of calorie ordered which is consistent with previous literature, future studies should replicate these results using a sample with a wider variety of age, education, marital status, socioeconomic status and should collect data at different time settings or more extended time periods before firm conclusions can be made regarding as the impact of mandatory menu labeling in Ontario or even in Canada. These future studies could include several sizeable national chain restaurants or other types of food premises since our study only examined the full-service restaurants' menus. Meanwhile, we found the results that TL and PACE labels had longer fixation duration time than other two labeling formats but was not as effective as %DV labels, future researches can be supplements to our study.

Another limitation of this research is that the lack of particular subgroups that may be of interest for policy purposes; for example, parents ordering for their children, patients with chronic diseases or health conditions who are more motivated to choose healthier foods. Future studies could analyse specific subgroups that may benefit from mandatory menu labeling and could examine which mandatory menu labeling schemes encourages changes on the supply side and how these changes affect food purchases of consumers using chain restaurants. Supply side changes may affect the reformulation of existing food products or in-store promotion strategies. Our study also held constant other potentially confounding restaurant-level factors such as item

prices, special menu offerings, and restaurant marketing and promotions. These are some potential future researches that can be conducted in these areas.

There are some limitations to using eye tracking data as well. Visual attention is measured by participants' eye movements and used to capture part of the decision making process and consumer preference. However, peripheral vision is hard to be captured by using fixation data only, and it may not be accurate as we do not know what an individual's actual thoughts are. While the current mandatory menu labeling regulations focus primarily on calorie intake, there is an issue of overconsumption of sodium that can be investigated in future research. More research will be needed in the future to study the longitudinal effects of nutrition information on food choices, and the inclusion of more nutritional information or other labeling formats.



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## APPENDICES

### Appendix A: Exit Survey

#### Part I: Purchasing Behaviour

**Q1:** How many meals a day do you typically eat?

0 (1) 1 (2) 2 (3) 3 (4) 4+ (5) Prefer not to answer (6)

**Q2:** Are you responsible for purchasing food for yourself?

Not at all (1) Sometimes (2) Most of the time (3) Don't know (4) Prefer not to answer (5)

**Q3:** Are you the primary grocery shopper for your household?

Yes (1) No (2) Share equally with other(s) (3) Don't know (4) Prefer not to answer (5)

The following questions (Q4-Q10) are about your purchasing frequency.

How often do you choose to purchase food from the following types of restaurant per month?

	Daily (1)	2-5 times per week (2)	Once per week (3)	2-3 times per month (4)	Less than once per month (5)	Never (6)	Prefer not to answer (7)
<b>Q4:</b> Fast food restaurants (e.g. McDonald's, Pizza Pizza, Popeyes)?							
<b>Q5:</b> Fast casual restaurants (Higher quality and higher priced fast food, e.g. Freshii's, Five Guys, Chipotle Mexican Grill)?							
<b>Q6:</b> Family style restaurants (e.g. Boston Pizza, East Side Mario's)?							
<b>Q7:</b> Fine dining (e.g. The Keg, Aberfoyle Mill)?							
<b>Q8:</b> Café or Deli (e.g. Starbucks, Tim Hortons)?							
<b>Q9:</b> Buffet restaurant?							
<b>Q10:</b> Food truck?							



**Q11:** How often do you look at nutrition and/or ingredients labels on the foods you purchase?  
Always (1) Most of the time (2) About half the time (3) Rarely (4) Never (5) Prefer not to answer (6)

**Q12:** How often do you compare nutritional information between foods?  
Always (1) Most of the time (2) About half the time (3) Rarely (4) Never (5) Prefer not to answer (6)

**Q12:** How often do you look for foods with low calories?  
Always (1) Most of the time (2) About half the time (3) Rarely (4) Never (5) Prefer not to answer (6)

**Q14:** Do you support mandatory labelling of calories of foods in restaurants?  
Yes (1) No (2) Don't know/ Not sure (3) Prefer not to answer (4)

**Q15:** Would the labelling of calories information influence your decision to purchase a product?  
Yes (1) No (2) Don't know/ Not sure (3) Prefer not to answer (4)

## **Part II: Nutritional Knowledge**

Please answer the following questions to the best of your ability.

This is a survey, not a test. Your answers will help identify which dietary advice people find confusing. It is important that you complete it by yourself. Your answers will remain anonymous. If you don't know the answer, mark "not sure" rather than guess. Thank you for your time.

**Q16:** The next few items are about health risks related to diet. Tick a box.

Decreased intakes of sodium is associated with decreased blood pressure.

Correct ☐      Incorrect ☐      Not sure ☐

Increased intakes of sugar sweetened beverages is associated with decreased risk of weight gain, overweight and obesity.

Correct ☐      Incorrect ☐      Not sure ☐

Increased intakes of sugar-containing beverages is associated with increased risk of dental decay in children.

Correct ☐      Incorrect ☐      Not sure ☐

Replacement of saturated fat with monounsaturated fat is associated with higher cardiovascular risk factors.

Correct ☐      Incorrect ☐      Not sure ☐

Replacement of unsaturated fat with saturated fat is associated with lower cardiovascular risk factors.

Correct ☐      Incorrect ☐      Not sure ☐

Replacement of saturated fat with monounsaturated fat is associated with lower type 2 diabetes risk.

Correct ☐      Incorrect ☐      Not sure ☐

Increased intakes of processed meat is associated with increased risk of cancer.

Correct ☐

Incorrect ☐

Not sure ☐

**Q17: Healthy eating recommendations**

According to Health Canada's Dietary Guidelines, it is recommended that... (tick a box):

Vegetables, fruit, whole grains, and protein foods should be consumed regularly.

Correct ☐

Incorrect ☐

Not sure ☐

Among protein foods, consume plant-based more often.

Correct ☐

Incorrect ☐

Not sure ☐

Foods that contain mostly unsaturated fat should replace foods that contain mostly saturated fat.

Correct ☐

Incorrect ☐

Not sure ☐

Water should be the beverage of choice.

Correct ☐

Incorrect ☐

Not sure ☐

Sugary drinks and confectioneries should not be consumed regularly.

Correct ☐

Incorrect ☐

Not sure ☐

Eating with others is a recommended way to decrease risk of obesity:

Correct ☐

Incorrect ☐

Not sure ☐

**Q18:** On average, how many calories should a healthy, moderately active adult [male/female] consume each day to maintain a healthy weight?

Enter number: [numeric, 0-100,000 limit]

Don't know [valid answer]

Prefer not to answer

**Q19:** Do you count the calories you consume each day?

Always (1) Most of the time (2) About half the time (3) Rarely (4) Never (5) Prefer not to answer (6)

[If sometimes or most of the time, ask:]

**Q20:** How many calories do you try to consume each day?

Enter number: [numeric, 0-100,000 limit]

Don't know

Prefer not to answer

**Q21:** How many calories are there in a can (355ml) of coke?

Enter number: [numeric, 0-100,000 limit]

Don't know

Prefer not to answer

This information is on the back of a container of a pint of ice cream.

The next few questions are about interpreting calories information for ice cream

Nutrition Facts			
Serving Size		½ cup	
Servings per container		4	
Amount per serving			
Calories	250	Fat Cal	120
			%DV
<b>Total Fat</b>	13g		20%
Sat Fat	9g		40%
<b>Cholesterol</b>	28mg		12%
<b>Sodium</b>	55mg		2%
<b>Total Carbohydrate</b>	30g		12%
Dietary Fiber	2g		
Sugars	23g		
<b>Protein</b>	4g		8%

\*Percentage Daily Values (DV) are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

**Ingredients:** Cream, Skim Milk, Liquid Sugar, Water, Egg Yolks, Brown Sugar, Milkfat, Peanut Oil, Sugar, Butter, Salt, Carrageenan, Vanilla Extract.

**Q22:** If you eat the entire container, how many calories will you eat?

Enter number: [numeric, 0-100,000 limit]

Don't know

Prefer not to answer

**Q23:** If you are allowed to eat 60 grams of carbohydrates as a snack, how much ice cream could you have?

Enter number of cup(s): [numeric, allow decimals]

Don't know

Prefer not to answer

**Q24:** Your doctor advises you to reduce the amount of saturated fat in your diet. You usually have 42 g of saturated fat each day, which includes one serving of ice cream. If you stop eating ice cream, how many grams of saturated fat would you be consuming each day?

Enter number of grams: [numeric, 0-100,000 limit]

Don't know

Prefer not to answer

**Q25:** If you usually eat 2,000 calories in a day, what percentage of your daily value of calories will you be eating if you eat one serving?

Enter percentage: [numeric] %

Don't know

Prefer not to answer

**Q27:** Are you allergic to the following substances (choose all that apply):

Penicillin (1) peanuts (2) latex gloves (3) bee stings (4) None of above (5)

**Q27:** Pretend that you are allergic to the following substances: penicillin, peanuts, latex gloves, and bee stings. Is it safe for you to eat this ice cream?

Yes

No, why not? [open-ended]

Don't know

Prefer not to answer

### **Part III: Demographic Information**

**Q28:** What is your gender?

Woman (1) Man (2) My gender identity is not listed above (3) Prefer not to answer (4)

**Q29:** Age Group

20-25 (1) 25-29 (2) 30-39 (3) 40-49 (4) 50-59 (5) 60-69 (6) 70-79 (7) 80+ (8)

**Q30:** Do you currently work at a job or business?

Yes- Full Time (1) Yes- Part Time (2) No- Looking for Work (3) No- Not looking for work (4)  
No- I'm a student (5) Homemaker (6) Retired (7) Prefer not to answer (8)

**Q31:** What is the highest degree or level of school you have completed?

If currently enrolled, please select the highest degree you have received.

High school diploma or equivalent (1) Trade certificate or diploma from a technical/vocational school or apprenticeship training (2) Diploma or certificate from community college or CEGEP (other than trades certificates or diplomas) (3) Bachelor's degree (e.g., BA, BSc) (4) University degree above the bachelor's level (e.g., Master's, professional school, doctorate) (5) Prefer not to answer (6)

**Q32:** My current relationship status is?

Married (1) Cohabiting (2) Divorced (3) Separated (4) Single, never married (5) Prefer not to answer (6)

**Q33:** What was your total household income before taxes in the last tax year?

Less than \$25,000 (1)

\$25,000 to \$34,999 (2)

\$35,000 to \$49,999 (3)

\$50,000 to \$74,999 (4)

\$75,000 to \$99,999 (5)

\$100,000 or more (6)

Prefer not to answer (7)

**Q34:** Has a doctor ever advised you to do the following? (Select all that apply)

Lose weight (1) Reduce Sodium or salt intake (2) Reduce cholesterol in your diet (3) Other diet advice (4) None of the above (5) Prefer not to answer (6)

**Q35:** Would you describe yourself as: (select all that apply)

Vegetarian (1) Vegan (2) Pescatarian (3) Following a religious practice for eating:  
\_\_\_\_\_ (Please Specify) (4) None of the above (5) Prefer not to answer (6)

**Q36:** Do you consider yourself...?

Overweight (1) Underweight (2) Just about right (3) Don't know (4) Prefer not to answer (5)

**Q37:** Would you like to weigh...?

More (1) Less (2) Stay the same (3) Prefer not to answer (4)

**Q38:** Which of the following are you trying to do about your weight?

Lose weight (1) Reduce Sodium or salt intake (2) Reduce cholesterol in your diet (3) Other diet goal (4) None of the above (5) Prefer not to answer (6)

## Appendix B: Menus

Menu		
Starters	<p><b>ROASTED RED PEPPER &amp; TOMATO SOUP</b> A creamy blend of roasted red peppers and tomatoes</p> <p><b>BROCCOLI CHEESE SOUP</b> A creamy blend of broccoli and cheese</p> <p><b>GARLIC BREAD</b> With melted Mozzarella</p> <p><b>CAESAR SALAD</b> Chopped romaine lettuce tossed in creamy Caesar dressing and topped with double-smoked bacon, croutons and Parmesan cheese</p> <p><b>KALE &amp; QUINOA SALAD</b> Toasted pumpkin seeds, dried currants, grana padano</p> <p><b>POPCORN SHRIMP</b> Shrimp lightly coated with mild jalapeño seasoning, served with a sweet and spicy chili sauce</p> <p><b>SNACK WINGS (5 PC.)</b> Serve with peppercorn ranch</p>	<p>16.99 16.99 1.50 11.99 14.99 6.49 5.99</p>
Mains	<p><b>CLASSIC SIRLOIN</b> 7 oz. sirloin grilled to your liking and basted with garlic butter. Served with your choice of side and freshly steamed veggies</p> <p><b>CLASSIC RIBS</b> bone pork back ribs, slow cooked with bbq sauce served with your choice of side and coleslaw</p> <p><b>LEMON PEPPER SALMON</b> Atlantic salmon oven baked with a lemon pepper seasoning, served with your choice of side and freshly steamed veggies</p> <p><b>TENDERLOIN FILET</b> 6 oz classic grilled filet with red wine demi glace, served with your choice of side and freshly steamed veggies</p>	<p>24.49 19.99 21.49 19.99</p>

Menu		
Mains	<p><b>BACON &amp; CHEESE BURGER</b> Canadian chuck patties double-stacked, topped with double-smoked bacon, cheddar cheese, tomato, shredded lettuce, red onions and mayo, served with your choice of side</p> <p><b>PORTOBELLO VEGGIE BURGER</b> Marinated full mushroom cap, aged white cheddar &amp; fresh herbs with side fresh market salad</p> <p><b>DOUBLE STACKED TURKEY SANDWICH</b> Roasted turkey, crisp bacon, fresh lettuce, tomato, mayo, cheddar, toasted multi-grain, served with your choice of side</p> <p><b>SIDES</b> STEAMED VEGGIES COLESLAW FRENCH FRIES MASHED POTATOES</p>	<p>16.49 16.59 16.59</p>
Desserts	<p><b>WHITE CHOCOLATE BROWNIE</b> Warm chocolate sauce, french vanilla ice cream &amp; real whipped cream</p> <p><b>STICKY PUDDING</b> Served warm with toasted almonds, buttery caramel sauce, bourbon crème anglaise &amp; french vanilla ice cream</p> <p><b>WHITE CHOCOLATE CHEESECAKE</b> Thick white chocolate cheesecake</p> <p><b>FLOURLESS DARK CHOCOLATE CAKE</b> Double chocolate cake with almond &amp; coconut crust</p>	<p>4.59 4.59 3.99 4.59</p>

Appendix B 1: Menu 1 is the control Menu which only contains menu items, item descriptions, and prices.

Menu			
Starters	ROASTED RED PEPPER & TOMATO SOUP	bowl 6.99 650 cal cup 3.49 325 cal	
	<i>A creamy blend of roasted red peppers and tomatoes</i>		
	BROCCOLI CHEESE SOUP	bowl 6.99 720 cal cup 3.49 360 cal	
	<i>A creamy blend of broccoli and cheese</i>		
	GARLIC BREAD	1.50 280 cal	
	<i>With melted Mozzarella</i>		
	CAESAR SALAD	11.99 550 cal	
Mains	<i>Chopped romaine lettuce tossed in creamy Caesar dressing and topped with double-smoked bacon, croutons and Parmesan cheese</i>		
		add chicken 3.49 270 cal add salmon 4.49 300 cal	
	KALE & QUINOA SALAD	14.99 490 cal	
	<i>Toasted pumpkin seeds, dried currants, grana padano</i>		
		add chicken 3.49 270 cal add salmon 4.49 300 cal	
	POPCORN SHRIMP	6.49 170 cal	
	<i>Shrimp lightly coated with mild jalapeño seasoning, served with a sweet and spicy thai chili sauce</i>		
	SNACK WINGS (5 PC.)	5.99 510 cal	
	<i>Serve with peppercorn ranch</i>		
	CLASSIC SIRLOIN	24.49 580 cal +100-490 cal	
	<i>7 oz cab, sirloin grilled to your liking and basted with garlic butter. Served with your choice of side and freshly steamed veggies</i>		
	CLASSIC RIBS	Half rack 19.99 890 cal Full rack 29.99 1290 cal +120-490 cal	
	<i>bone pork back ribs, slow cooked with bbq sauce served with your choice of side and coleslaw</i>		
	LEMON PEPPER SALMON	21.49 870 cal +100-490 cal	
	<i>Atlantic salmon oven baked with a lemon pepper seasoning, served with your choice of side and freshly steamed veggies</i>		
	TENDERLOIN FILET	19.99 590 cal +100-510 cal	
	<i>6 oz classic grilled filet with red wine demi glace, served with your choice of side and freshly steamed veggies</i>		

Menu			
Mains	BACON & CHEESE BURGER	16.49 1380 cal +700-390 cal	
	<i>Canadian chuck patties double-stacked, topped with double-smoked bacon, cheddar cheese, tomato, shredded lettuce, red onions and mayo, served with your choice of side</i>		
	PORTOBELLO VEGGIE BURGER	16.59 630 cal +170 cal	
	<i>Martinated full mushroom cap, aged white cheddar &amp; fresh herbs with side fresh market salad</i>		
	DOUBLE STACKED TURKEY SANDWICH	16.59 650 cal +300-390 cal	
	<i>Roasted turkey, crisp bacon, fresh lettuce, tomato, mayo, cheddar, toasted multi-grain, served with your choice of side</i>		
SIDES	STEAMED VEGGIES	100 cal	
	COLESLAW	120 cal	
	FRENCH FRIES	390 cal	
	MASHED POTATOES	300 cal	
Desserts	WHITE CHOCOLATE BROWNIE	4.59 770 cal	
	<i>Warm chocolate sauce, french vanilla ice cream &amp; real whipped cream</i>		
	STICKY PUDDING	4.59 740 cal	
	<i>Served warm with toasted almonds, buttery caramel sauce, bourbon crème anglaise &amp; french vanilla ice cream</i>		
	WHITE CHOCOLATE CHEESECAKE	3.99 590 cal	
	<i>Thick white chocolate cheesecake</i>		
	FLOURLESS DARK CHOCOLATE CAKE	4.59 420 cal	
	<i>Double chocolate cake with almond &amp; coconut crust</i>		

**Appendix B 2: Menu 2 presents items, item descriptions, prices plus numeric calorie label for each item.**

*A creamy blend of roasted red peppers and tomatoes*

% daily value  
of calories\*

*A creamy blend of broccoli and cheese*

cal	36%
cal	18%

With melted Mozzarella

1.50    280 cal    14%

Chopped romaine lettuce tossed in creamy Caesar dressing and topped with double-smoked bacon, croutons and Parmesan cheese

	11.99	550 cal	27.5%
add chicken	3.49	270 cal	13.5%
add salmon	4.49	300 cal	15%

Toasted pumpkin seeds, dried currants, grana padano

	14.99	490 cal	24.5%
add chicken	3.49	270 cal	13.5%
add salmon	4.49	300 cal	15%

Shrimp lightly coated with mild jalapeño seasoning, served with a sweet and spicy thai chili sauce

6.49	170 cal	8.5%
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Serve with peppercorn ranch.

5.99 510 cal 25.5%

7 oz cab, sirloin grilled to your liking and basted with garlic butter.  
Served with your choice of side and freshly steamed veggies

2449	580 cal	29%
+100-490 cal		5-245%

bone pork back ribs, slow cooked with bbq sauce served with your choice of side and coleslaw

Half rack 19.99	890 cal	4+5%
Full rack 29.99	1290 cal	6+5%
	+120-490 cal	6-24+5%

Atlantic salmon oven baked with a lemon pepper seasoning, served with your choice of side and freshly steamed veggies

21.49	830 cal	41.5%
+100-490 cal		5-24.5%

6 oz classic grilled filet with red wine demi glace, served with your choice of side and freshly steamed veggies

19.99	590 cal	29.5%
	+100-510 cal	5-24.5%

\* % daily value of calories: based on 2000 calories per day for an adult

Canadian chuck patties double-stacked, topped with double-smoked bacon, cheddar cheese, tomato, shredded lettuce, red onions and mayo, served with your choice of side

% daily value  
of calories\*

*Marinated full mushroom cap, aged white cheddar & fresh herbs with side fresh market salad*

16.59	630 cal	31.5%
	+170 cal	8.5%

Roasted turkey, crisp bacon, fresh lettuce, tomato, mayo, cheddar, toasted multi-grain, served with your choice of side

16.59	650 cal	32.5%
	+300-390 cal	15-19.5%

## STEAMED VEGGIES

100 cal 5%

120 cal 6%

390 cal 19.5%

300 cal 15%

Warm chocolate sauce, french vanilla ice cream & real whipped cream

459 770 cal 38.5%

Served warm with toasted almonds, buttery caramel sauce, bourbon crème anglaise & french vanilla ice cream

459 740 cal 37%

Thick white chocolate cheesecake

3.99 590 cal 29.5%

Double chocolate cake with almond & coconut crust

459 420 cal 21%

\* % daily value of calories: based on 2000 calories per day for an adult

86









## Appendix C: Consent Form

### CONSENT TO PARTICIPATE IN RESEARCH

#### Eye Tracking and Consumer Choice

You are invited to participate in a research project at the University of Guelph. This project is funded by Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) Research Fund.

**If you are between 18 and 65 years old and fluent in English for reading, please consider taking part in this research study.**

The purpose of this form is to provide you with the information needed to make an informed decision about participating in this research.

#### The Researchers

Principal Investigator: Dr. Michael von Massow, Associate Professor, Department of Food, Agricultural and Resource Economics, University of Guelph, [mvonmass@uoguelph.ca](mailto:mvonmass@uoguelph.ca), 519-824-4120 ext. 56347

Other Investigator: Dr. Yu Na Lee, Assistant Professor, Department of Food, Agricultural and Resource Economics, University of Guelph, [ylee13@uoguelph.ca](mailto:ylee13@uoguelph.ca), 519-824-4120 ext. 53427

Other Investigator: Yeyang Zhang, Masters Student, Department of Food, Agricultural and Resource Economics, [yeyang@uoguelph.ca](mailto:yeyang@uoguelph.ca)

If you have any questions or concerns about the research, please feel free to contact the principal investigator.

#### PURPOSE OF THE STUDY

The purpose of this project is to identify how consumers interact with visual information when making purchasing decisions.

#### PROCEDURES

If you agree to participate in this study, we would ask you to do the following things:

You will be asked to use the adjusted eye tracking glasses to complete a simple task by looking at a menu. You will be asked to think about your typical budget and choose normally. After removing the glasses, you will be asked to complete a short exit survey and then be debriefed.

If at any point through the survey you do not feel comfortable answering a question or would rather not answer the question, please leave that response area blank.

Completing the experimental procedure should take 20-30 minutes, however there are no time restrictions and you make take as long as you like to make your choices in the experiment.

## RISKS AND BENEFITS

There are no risks to you when participating in this project. The eye tracking equipment collects only video data regarding what you are looking at – it collects no images of your face. Eye tracking equipment is sanitized between participants using a microfibre cloth and a mild cleaning solution. No data will be transferred electronically (through email). All data transfers will take place through hard wired computer connections or password protected USBs. Participants confidentiality cannot be guaranteed when in transit across the internet.

If you would like to have a summary of the results, you can leave your contact information (either a mailing address or an email) and we can send you a brief report at a later date. If you have more questions, please feel free to contact the principal investigator.

By participating in this experiment you are contributing to research that helps to develop an understanding of the effectiveness of this nutritional information labelling policy and to provide potential approaches to improving dine-in restaurants' menu and also to give potential advises to improve the menu labelling application. You will also receive a \$5 Tim Hortons gift card as reimbursement for your time.

## PARTICIPATION AND WITHDRAWAL:

You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. The survey data will be linked with the eye tracking data using an anonymized identifier, that is not linked to your personal information. Due to the lack of individual identifiers in the data, upon completion of the experiment and your departure from the lab there is no way to remove your responses from the data set. You may also refuse to answer any questions you do not want to answer and still remain in the study. The investigator may withdraw you from this research if circumstances arise that warrant doing so.

## RIGHTS OF RESEARCH PARTICIPANTS

You do not waive any legal rights by agreeing to take part in this study.

This project has been reviewed by the Research Ethics Board for compliance with federal guidelines for research involving human participants. If you have any questions regarding your rights and welfare as a research participant in this study (REB 19-07-03) please contact: Manager, Research Ethics, University of Guelph, [reb@uoguelph.ca](mailto:reb@uoguelph.ca), 519-824-4120 ext. 56606.

## CONFIDENTIALITY

No individual identifiers will be attached to the survey data or the video from the eye trackers. This written consent form will be stored separately from the other data. Your responses on the survey will be anonymized. Trained student enumerators conducting the survey will have access to the data until the documents are delivered to the primary investigator, which will occur directly after the survey session has concluded. After the survey has concluded, the raw data collected will only be available to the researchers associated with the University of Guelph: the primary investigator (Michael von Massow and Yu Na Lee) and the other investigator (Yeyang Zhang).

## SIGNATURE OF RESEARCH PARTICIPANT

I have read the information provided for the study “Consumer Shopping Behaviour” as described herein. My questions have been answered to my satisfaction, and I agree to participate in this study. I have been given a copy of this form.

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Name of Participant (please print)

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Signature of Participant

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Date

If you would like to receive a copy of the results, please provide us with your mailing address or an email address:

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