The Determinants of Discretionary Front-of-Package Food Labelling

by

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A thesis submitted in conformity with the requirements for the degree of Doctor of Philosophy
Department of Nutritional Sciences
University of Toronto

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ABSTRACT

Front-of-package (FOP) nutrition labelling is pervasive in Canada and occurs at the discretion of manufacturers. While there is evidence to suggest FOP labelling can impact product sales, other work has consistently demonstrated no association between the presence of a FOP reference and the nutritional quality of a product. A comprehensive examination of how manufacturers choose to engage in FOP labelling is needed to better understand the implications of this practice for consumers. Drawing on a survey of packaged foods sold in national chain retailers in Toronto the aims of this thesis were 1) to examine how the presence and nature of FOP references relate to a) level of food processing, b) product innovation (focusing on products designed as substitutes for traditional foods), and c) brand; and 2) to assess the nature of unregulated references through a systematic comparison of these references to nutrition labelling regulations. FOP nutrition references were more likely to appear on highly processed products, innovative foods and products manufactured by transnational brands, but they were less frequently displayed on products targeted to discount shoppers. A more in-depth examination of the nature of FOP material revealed a greater propensity for references highlighting ‘nutrients to limit’ (e.g., ‘trans fat free’, ‘low in sodium’) amongst highly processed products and those of transnational brands.
whereas innovative foods displayed a greater proportion of references which relayed information of ‘positive’ constituents (e.g., ‘good source of calcium’). Transnational brand products were more likely than other products to bear unregulated ‘natural’ references and less likely to display regulated ‘organic’ labels, potentially signalling their need to circumvent regulatory requirements that would vary across markets. Nearly a quarter of products surveyed bore unregulated nutrition references, and most of these relayed information for which regulated options exist. Taken together, the strategic distribution of FOP references observed on highly processed products, innovative products and those manufactured by transnational brands, and the myriad of unregulated text found on these products, suggest FOP labelling functions primarily as a marketing tool and point to the need for a more effective regulatory framework for nutrition communication to better support healthy food selection.
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<table>
<thead>
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<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>CCHS</td>
<td>Canadian Community Health Survey</td>
</tr>
<tr>
<td>DV</td>
<td>Daily Value</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>FAO</td>
<td>Food and Agriculture Organization</td>
</tr>
<tr>
<td>FDA</td>
<td>Food and Drug Administration</td>
</tr>
<tr>
<td>FOP</td>
<td>Front-of-Package</td>
</tr>
<tr>
<td>IFIC</td>
<td>International Food and Information Council</td>
</tr>
<tr>
<td>IOM</td>
<td>Institute of Medicine</td>
</tr>
<tr>
<td>NFt</td>
<td>Nutrition Facts table</td>
</tr>
<tr>
<td>NHANES</td>
<td>National Health and Nutrition Examination Survey</td>
</tr>
<tr>
<td>NHP</td>
<td>Natural Health Product</td>
</tr>
<tr>
<td>RDI</td>
<td>Recommended Daily Intake</td>
</tr>
<tr>
<td>TMAL</td>
<td>Temporary Market Authorization Letter</td>
</tr>
<tr>
<td>UK FSA</td>
<td>United Kingdom’s Food Standards Association</td>
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1.0 INTRODUCTION

Diet-related chronic diseases, including obesity, cardiovascular disease, and diabetes are among the leading causes of death and disability in Canada.\(^1\) Creating an enabling environment that supports healthy food selection has been deemed by leading health authorities as an important strategy to ameliorate this burden.\(^2\)\(^3\)\(^4\) This is complicated, however, by the fact that the current food environment provides a vast array of products from which to choose. In Canada, as elsewhere, current directions in food policy have focused on market-based interventions that aim to facilitate consumer choice but also support product manufacturing through industry voluntary self-regulation.\(^5\)\(^6\)\(^7\)\(^8\)

In grocery stores, where the majority of food selection occurs, nutrition information is provided on food packages in two forms. While the Nutritional Facts table (NFT) is mandatory and found on the back of most packaged foods, a variety of other front-of-package (FOP) nutrition references are also permitted.\(^9\) Some FOP material, such as nutrient-content and disease-risk reduction claims, is regulated through compositional criteria. Other FOP references, however, are entirely unregulated, and both regulated and unregulated FOP references are displayed at the discretion of the manufacturer.

Much of the related research to date has focused on evaluating the nutritional content of products bearing a FOP reference\(^10\)\(^-\)\(^14\) or characterizing consumers’ knowledge and behaviour regarding their use.\(^15\)\(^-\)\(^19\) While there is evidence to suggest FOP material is preferentially used to direct food purchasing,\(^15\)\(^-\)\(^19\) other work has consistently demonstrated no association between the presence of a FOP reference and the nutritional quality of a product.\(^10\)\(^-\)\(^14\) Given the potential for this nutritional guidance to impact on consumer diets, there is a need to better understand the determinants of this discretionary practice amongst manufacturers and the implications of this practice for population health.

The overall goals of this research are to characterize the practice of discretionary FOP labelling in Canadian grocery stores and elucidate the determinants of the display of this material on packaged foods. These goals are achieved through four distinct, but interrelated studies, drawing on data from a survey of packaged foods sold in national chain retailers in Toronto.\(^14\)\(^20\) Study 1 assesses the relationship between the presence of FOP references and the level of product
processing. Building on this work, Study 2 examines one particular domain of food processing through an assessment of the FOP material found on innovative foods designed as substitutes for more traditional counterparts (e.g. margarine versus butter). Recognizing that the practice of FOP labelling is at the discretion of the manufacturer, Study 3 examines how the presence and nature of FOP material differ by brands of different manufacturers and retailers. Finally, Study 4 examines how the practice of FOP labelling intersects with current nutrition labelling regulations through an investigation of the nature of unregulated references on products in grocery stores.

In the chapter that follows, the broad literature that provides the context for the studies in this thesis is reviewed. Each study is then presented in manuscript format, outlining the literature pertinent to the objectives of each study, as well as methods, results, and conclusions. The findings from these studies are synthesized into a final discussion, which considers their implications and significance with respect to the evolving policy discourse on FOP labelling.

2.0 LITERATURE REVIEW

2.1 Diet and chronic disease in Canada

In Canada, chronic, non-communicable diseases, including cardiovascular disease, type-2 diabetes and certain cancers, are the leading cause of disability and premature death. At the same time, almost two thirds of Canadian adults, and nearly a third of children between the ages of five and seventeen are either overweight or obese. The economic burden of these conditions is substantial: treatment of non-communicable disease is estimated to account for 67% of direct health care spending and costs the Canadian economy nearly $200 billion annually.

According to the Global Burden of Disease study, unhealthy dietary patterns have been the leading risk factor for illness, death and disability both in Canada and globally for the last two decades. The most recent data, gleaned from the 2004 Canadian Community Health Survey (CCHS), has indeed indicated widespread suboptimal dietary patterns. Canadians consume excessive amounts of sodium, have inadequate intakes of several micronutrients, and are failing to obtain the recommended servings of fruits and vegetables, an established proxy for healthy eating habits. It is important to note that systematic differences exist in the dietary intake patterns across socioeconomic groups. Higher household incomes and higher education
levels have been associated with increased consumption of fruits and vegetables, and the prevalence of inadequate nutrient intakes was found to be higher amongst those in the lowest level of income or education.  

2.1.1 The food environment

Food environments are a complex collection of the physical, economic, policy and sociocultural surroundings, opportunities and conditions that influence consumers’ food choices and nutritional status. These components determine food composition, food labelling, food marketing, food retail and manufacturing, food provision and food prices. Consumers interact with established food environments through a number of personal factors including habits, preferences, education and income which serve to mediate food selection and diet. Food environments can be broadly influenced by a) the food industries that create our food supply (which to a large extent determine food availability, quality and price); b) governments that are responsible for policies and regulations within which the private sector must operate and; c) society that establishes cultural norms and preferences for food and cuisine. One feature of our current Canadian food environment that sits squarely at the interface of these three influences is the dominance of ultra-processed products.

2.1.2 Processed foods, diet quality and health

A growing body of literature has begun to suggest a close relationship between food processing and the nutritional quality of foods and diets. While most foods now available for sale have been processed to differ from their original harvested state, food processing can vary from basic techniques such as salting or drying to complex manufacturing methods which completely transform a food’s characteristics. Foods considered most processed, or highly processed, typically are multi-ingredient, ready-to-eat products, which contain little or no whole foods. These include foods such as breakfast cereals, sweet and savoury snack foods, soft drinks and frozen ready-meals.
Examination of the CCHS has shown Canadians consume on average 48% of their calories from foods considered extensively processed, and for children and adolescents, these products represented 55% of total calories. Diets higher in foods considered to be highly processed had, on average, more free sugars, fat and saturated fat and were lower in protein, fibre, minerals and vitamins. Consumption of these foods was higher amongst men, less educated individuals, and people living in urban areas.

In addition to their poorer nutritional profiles, products characterized by a high degree of processing have been found to be less satiating and more hyperglycemic compared to less processed foods. They are considered to be hyper-palatable and are aggressively promoted, often sold in big portion sizes and designed to encourage ‘snacking’, all factors that induce passive energy overconsumption. Global expert committee reports have begun to acknowledge the link between the increased production and consumption of industrially processed foods and the current global epidemic of obesity and related conditions. Evidence from Canada, while ecological, has shown that the increased consumption of foods deemed most processed parallels the rise in obesity. Similar trends have also been documented in Sweden and across 12 Latin American countries through an examination by the Pan American Health Organization.

Direct evidence of the association between processed food and health has, for the most part, been derived from studies of specific products. A study of three US cohorts, for instance, showed consumption of various products including cookies, white bread, sweets and processed meats to be associated with weight gain in adults. Other studies have linked sugared drinks to obesity and processed meats to certain types of cancer. Recently, a cross sectional study of Brazilian adolescents identified a strong association between the consumption of highly processed products and metabolic syndrome, a finding that persisted even after adjusting for socio-demographic, behavioural and family history covariates. A second study from Brazil indicated that household availability of foods considered to be most processed was positively associated with both the average BMI and the prevalence of excess weight and obesity. Individuals in the highest quartile of household consumption of these products were 37% more likely to be obese compared with those in the lowest quartile. Additionally, a longitudinal examination of the association between processed foods and the incidence of overweight and obesity has been conducted in a study of middle-aged Spanish adults. After a 9 year follow-up, participants in the highest quartile of processed food consumption were at a 26% relatively
higher risk of developing overweight or obesity than those in the lowest quartile of consumption. A further study, gleaned from the same cohort, also found participants in the highest tertile of processed food consumption had a 21% relatively higher risk of developing hypertension than those in the lowest tertile.

2.1.2.1 Classification of processed foods

Evidence of the poor nutritional content of highly processed products has prompted the UN’s Food and Agriculture Organization (FAO) and the Pan American Health Organization to recommend the degree of product processing be used as a predictive indicator for diet quality. While the distinction of foods by the degree of processing has elicited increasingly more study in recent years several frameworks have been used to classify products across levels of processing. A number of different classification systems now exist, each developed and used for different purposes.

In Canada, secular trends in national dietary patterns and the impact of processed products on indicators of the nutrient profile of diets, as described above, have been assessed using the NOVA framework to classify the degree of food processing. In brief, this system was developed specifically to assess the role of food processing on the ‘nature of diets and related states of health and well-being’ and has been applied to dietary and purchasing data from a range of contexts including Brazil, the US, the UK and New Zealand. The NOVA framework scores products by the ‘nature, extent and purpose of industrialized food processing’ and divides all foods into four distinct categories: Group 1, minimally processed products, are whole foods that may have been subjected to some processes without having altered the compositional properties of the original food (e.g. fresh, dried or frozen fruit; skim milk); Group 2, processed culinary ingredients, are foods that have been extracted from whole foods and are mostly not consumed on their own, but used in the preparation of meals in combination with Group 1 products (e.g. oils, flour, sugar); Group 3 are processed foods products manufactured by adding foods from Group 2 (e.g. oils, sugars) to increase durability and palatability (e.g., canned vegetables, cheese, bacon); Group 4 products are defined as ultra-processed and contain little or no whole foods. These products are durable and often unrecognizable versions of foods.
Examples of ultra-processed foods are burgers, frozen ready meals, biscuits, breakfast cereal, soft drinks and various snack products.

In the US, population dietary patterns have been assessed using both NOVA and the International Food and Information Council’s (IFIC) classification for processed foods through examinations of the National Health and Nutrition Examination Survey (NHANES). The IFIC system was developed in their ‘Understanding Our Food’ Communications Tool Kit and was designed to ‘clarify misperceptions and relay important information ‘about the benefits and contributions of modern food production, processing and technology’. The IFIC system defines food processing as ‘any deliberate change made in a food from the time of origin to the time of consumption’. The classification relies on a ‘continuum’ of processing and the physical, chemical and sensory changes in food products caused by processing, while also differentiating convenience products within the same framework. Foods are grouped into minimally processed foods which retain most of their inherent properties; foods processed for preservation and to enhance their freshness; mixtures of combined ingredients; ready-to-eat processed foods requiring minimal or no preparation; and prepared foods/meals.

Both studies of the US NHANES, using NOVA and IFIC, yielded similar results with respect to the greater contribution of highly processed foods to macronutrient content, including total energy, saturated fat, total sugars and added sugar compared to less processed foods. Findings differed, however, with respect to the contribution of foods deemed most processed to the micronutrient intakes. Specifically, analysis using the NOVA system found the average content of micronutrients (e.g. vitamins A, C, D and E, zinc, magnesium, potassium, calcium) in the US diet to significantly decrease as the energy contribution of ultra-processed foods in the diet increased. Application of the IFIC framework to NHANES data conversely found products across processing levels contributed equally to daily micronutrient intakes. While these discrepancies may reflect methodological differences as well as differences in the survey cycles used in the respective analyses, they may also relate to differences in the conceptualization, and therefore categorization of processed foods, by the degree of processing. This inference is consistent with the results of a recent comparison of frameworks used to categorize products by the degree of processing in Australia that found only 70% of products surveyed were similarly classified across these two frameworks.
More recently, researchers from the US have adapted the NOVA system to better reflect the complexity inherent to the North American food supply and have developed a separate classification system to distinguish processing from convenience.\textsuperscript{40, 62} Specifically, this framework reclassifies highly processed products formulated with whole grains or flavoured dairy products from most processed, into lesser processed categories.\textsuperscript{40} While it has yet to be applied to food consumption data, analysis of consumer food purchases from the US revealed highly processed and ready-to-eat foods had substantially higher saturated fat, sugar and sodium content than less processed foods and foods requiring cooking, respectively.\textsuperscript{40} Assessment of the micronutrient content across these axes, however, was not conducted.

2.2 Canadian food-purchasing patterns

The vast majority of Canadians food purchasing occurs in grocery stores\textsuperscript{63}. In 2015 Canadians spent 73\% of their food budget in store, with the remaining 27\% spent on restaurant foods.\textsuperscript{63} While consumers are spending more on foods each year than in the past,\textsuperscript{63} the proportion of household incomes spent on restaurant foods, and in particular meals from ‘fast-food’ restaurants, is rising rapidly.\textsuperscript{64}

In stores, consumers spent 22\% of their food budget on meat products, 15\% on dairy and eggs, 12\% and 11\% on fruit and vegetables, respectively, and 6\% on cereal products.\textsuperscript{63} Application of the NOVA system for the classification of food processing to food expenditure data from Canada has shown that as of 2011, Canadians spent 54\% of their food budget on ultra-processed products\textsuperscript{32} and these foods represented 61\% of the total daily household energy available.\textsuperscript{46} In Canada, the food budget share of ultra-processed products has grown from 37\% in 1953 to 54\% in 2011, displacing unprocessed or minimally processed products whose budget share dropped by 15\% to 41\% in the same period.\textsuperscript{46} While the growth in sales of ultra-processed foods has, for the most part, stabilized since 2001,\textsuperscript{46} Canadians are now the second largest buyers of ultra-processed products after the US.\textsuperscript{45}

2.2.1 Factors affecting food purchasing
Evidence from Canada has indicated that nearly half of consumers, and particularly those with less income, view cost as an important determinant in their food selection, while thirty percent considered convenience important. Although most consumers think that nutrition is important, approximately 70% of Canadian adolescents indicated that their food choices were independent of health concerns. Females and individuals with high levels of education and income were most likely to report choosing or avoiding foods due to health concerns and food content.

Examination of the Canadian Family Food Expenditures survey has similarly indicated that household socio-demographic characteristics have a strong influence on food purchasing. Specifically, households with older adults were noted to spend a greater share of their income on fruits and vegetables. Higher incomes were associated with purchasing more of all food groups, and those with a university degree purchased significantly more vegetables and fruit, and less meat and alternatives and 'other' foods (as defined by Canada’s Food Guide), relative to households with the lowest education level.

2.3 Policy directions to promote healthy dietary patterns in Canada

The evidence presented above underscores the importance of public policies to support healthy dietary patterns. Nutrition recommendations outlined in the 2007 Eating Well with Canada’s Food Guide call for Canadians to limit foods and beverages high in calories, fat, sugar or salt, as well as increase consumption of whole grain products and fruits and vegetables. It has been estimated that over 30,000 deaths in Canada could be averted or delayed annually if diets complied with these recommendations. However, effective implementation of such guidance is dependent on the provision of synergistic policies to foster a food environment that enables healthy choices.

Policy interventions which attempt to impact on the nutritional composition of foods have historically related to enhancing the micronutrient density of our food supply. Specifically, deficiencies in micronutrients in the population have been remedied through mandatory fortification of staple foods such as the addition of iodine to salt and vitamin D to milk and margarine. More recently efforts have also been made to reduce the content of certain negative nutrients linked to chronic disease risk, although with less severe regulatory oversight. In 2010,
for instance, a multi-stakeholder Sodium Working Group, chaired by Health Canada, published Canada’s Sodium Reduction Strategy. The goal of the strategy was to reduce average sodium consumption to 2300 mg/day by 2016 primarily through work with the food industry to establish voluntary sodium reduction targets by food category. Although sodium reduction benchmark targets are still in place in Canada, the Sodium Working Group was disbanded prior to implementation of an evaluation framework.

While these initiatives represent attempts to optimize diets more directly by targeting food quality, current directions in Canadian food policy have predominately focused on individual based approaches aimed at behavior change, largely through the provision of nutrition labelling at the point-of-purchase. This information is intended to both provide consumers with information needed to make healthier choices and also, in some cases, indirectly provide incentive for manufacturers to improve the nutrient profiles of their products. The implementation of trans fat labelling on the NFt, for instance, has since resulted in considerable product reformulation by manufacturers. The following section will provide an overview of Canadian food labelling policies, with particular emphasis on discretionary FOP nutrition labelling, and examine what is known of the implications of this practice to encourage healthy diets.

2.4 Nutrition Labelling

2.4.1 Nutrition labelling regulations

Food labelling regulations in Canada have evolved in recent years to reflect changes to both the Canadian food supply and consumer interests. The labelling of food in Canada is principally governed through the Food and Drug Act under the jurisdiction of the Canadian Food Inspections Agency and Health Canada, and this applies to all foods sold in retail settings. Labelling regulations under the Act cover ingredient lists, the NFt and nutrient content and health claims.

Prior to 1988, when nutrition labelling guidelines were introduced, regulations related to the declaration of nutrients in food were predominately intended to manage the addition of nutrient
claims to packages and to allow distinction between added and natural vitamins and minerals. Nutrition information, which stated the value of energy, protein, carbohydrate and fat, was also only required on foods used for special dietary purposes and those containing artificial sweeteners. The *Guidelines on Nutritional Labelling*, while a strictly voluntary system, governed format, nutrient content information (core lists and optional nutrients) and a declaration of serving size. These *Guidelines* required the amounts of individual vitamins and minerals to be expressed as a percentage of a single set of nutrient reference values, or recommended daily intakes (RDI). These values were established in 1986 by Health Canada for 11 vitamins and 6 minerals.

In December 2005, amendments to the Food and Drug Regulations mandated the display of a NFt on most pre-packaged foods, with additional updates to consolidate nutrient content claims and the introduction of a new regulatory framework for diet-related health claims. The new regulations followed a 1996 action plan on nutrition, ‘*Nutrition for Health: An Agenda for Action*’, which identified the potential to ameliorate the accelerated chronic disease epidemic through dietary means. It aimed to strengthen nutrition labelling by increasing its availability and to broaden public education. A key objective in regulating the disclosure of nutrition information was to reduce the risk of diet-related disease and to manage chronic diseases of public health concern. A second objective was to encourage manufacturers to formulate products with superior nutrient profiles. At the time, Health Canada estimated that the regulation of nutrition labelling through the NFt would result in a savings of CAD$5 billion in health care costs over 20 years compared to the CAD$300 million cost to industry.

### 2.4.2 The Nutrition Facts Table

The mandatory NFt appears on most pre-packaged food products sold in Canada, with the exception of fresh fruits and vegetables or individual servings sold for immediate consumption. As outlined by Health Canada, the NFt primarily aims to: 1) enable consumers to make appropriate food choices in relation to reducing the risk of chronic disease; 2) encourage the availability of foods with compositions that reduce the risk of chronic disease; 3) allow harmonization with the US labelling system; and 4) provide information which allows comparison amongst foods at the point of purchase.
The NFt was initially derived from the American Nutrition Facts Box and it included information on energy and core nutrients displayed in a standardized format. Other nutrients from a permitted list may be included at the discretion of the manufacturer, and all micronutrients that have been added to foods during processing, or are subject to nutrient content claims, must also be declared. For instance, it becomes mandatory to display information on omega-6 content when a reference such as ‘source of omega-6 polyunsaturated fatty acids’ is made voluntary on-package. Core nutrients are determined through consultation and are largely based on their congruence with public health concerns. Nutrients are expressed in the table as a Percent Daily Value (%DV) with the exception of protein, which is considered to be consumed in sufficient quantities by Canadians. In 2007, the declaration of trans fat content on the NFt was mandated given evidence linking the consumption of trans fat to coronary heart disease. This labelling, in addition to heightening consumer awareness, prompted the removal of large amounts of trans fat by industry from the Canadian food supply.

Recently, the NFt has been updated from its original form as part of Health Canada’s broader Healthy Eating Strategy. Changes reflect the latest science as well as what was gleaned through a stakeholder consultation and engagement process. These changes specifically involve regulating serving sizes so that they are consistent, realistic and reflective of the amount typically consumed by Canadians.

Previously there was no specific regulation governing the use of serving sizes and reference values were intended merely as a guide. As a result, there was considerable inconsistency on the NFt, making it difficult for consumers to compare the nutrient content information of similar products. The updated NFt also displays revised %DV based on updated science and includes a new %DV for total sugars. There has furthermore been revision to the core nutrient list. Information on the vitamin A and C content of a product has been removed because there is currently no clinical evidence of deficiency among the general population. In their place, information on potassium content has been included, given the importance of this nutrient in the maintenance of healthy blood pressure. The final amendment to the Food and Drug Regulations as it pertains to the NFt was published in Canada Gazette, Part II in December 2016 and a five-year transition period has been established for industry to meet the new requirements.
2.4.3 Regulated nutrient content and health claims

In addition to the mandatory NFt, nutrition labelling regulations in Canada also cover a number of voluntary nutrition labels. These include nutrient content claims (e.g. ‘low in salt’, ‘trans fat free’), composition and quality claims, nutrient function claims (related to a food constituent’s biological role), and health claims, including general, disease-risk reduction, function and therapeutic claims. While use of these claims is at the discretion of the manufacturer, the wording displayed on packages is largely prescribed and compositional requirements must be met.

Nutrient content claims can be made in several ways in Canada. The majority, however, describe the quantity of energy or other nutrients in food, and only the wording outlined in the regulations is permitted. The regulations prescribe the compositional criteria, wording and reference amount required for the display of such content claims. Vitamin and minerals, for instance, must have established RDI and the food must, in general, contain a minimum of 5% of the DV of these nutrients.

In 2003, the first five health claims were allowed, with subsequent expansions to include additional disease risk reduction claims (e.g. ‘a healthy diet low in saturated and trans fat may reduce the risk of heart disease’). The establishment of a Natural Health Products (NHP) directorate in 2004 allowed NHPs in food format to apply an additional set of claims, following an approval process.

While a formal definition for the term ‘health claim’ does not exist in the regulations, these are generally considered to be “any representation in labelling and advertising that states, suggests, or implies that a relation exists between the consumption of foods or food constituents and health”. These include disease-risk reduction, function and general health claims. The different health claims permitted in Canada are subject to varied regulatory requirements, with disease-risk reduction claims required to adhere to rigorous criteria, whereas general health claims (e.g. ‘healthy choice’) are subject only to the Food and Drug Act’s prohibition of “false, misleading or deceptive product representation”.

Recently Canada, along with other countries and international agencies, has undertaken a review of the current system for the management of health claims as a consequence of mounting
pressure and criticism of their overall ineffectiveness in promoting healthy dietary patterns. At the same time, there is growing interest among stakeholders in more efficient and transparent processes for health claim approval. As a result of these pressures and influences, Health Canada was prompted to initiate a review of the current system for management of health claims and in 2008 undertook consultation with key stakeholders from across Canada to solicit policy preferences. This resulted in an action plan to create a ‘modernized framework’ for health claims on foods which focuses on three central tenets; 1) supporting consumer choice by allowing foods with health benefits to make substantiated claims, and 2) protecting consumers from misleading claims, while 3) balancing the interests of industry by supporting conditions for a fair and competitive market environment. There is also a planned investigation into the type of oversight required for unregulated FOP health claims and exploration of the need for potential core eligibility criteria for all forms of health claims. Completed actions since the report’s release in 2008 have included amendments allowing for Marketing Authorizations and Incorporation by Reference, tools which will allow faster approval of label claims by circumventing previous food prohibitions under the FDA.

2.4.3.1 Natural Health Products and Nutrition Labelling

NHPs are a subcategory of drugs that can include some foods or food constituents. The definition of NHPs extends to products that “modify organic function” and are associated with the maintenance and promotion of health in ways other than what is generally recognized as being the primary purpose of drugs. Some products, such as beverages and cereals, lie at the NHP/food interface and contain bioactive ingredients often at levels not traditionally associated with the food. Initially, food-like NHPs were able to be marketed with little restriction under the NHP directorate established in 2004. As a result, similar products encountered different pre-market review of claim validity under the two regulatory frameworks (e.g. NHP Directorate and the Food Directorate). Furthermore, the potential for foods to be fortified without restrictions resulted in the food industry seeking accelerated market access for fortified foods by applying for product licences as NHPs, allowing for expanded additions of vitamin and minerals, often without clear public health rationale. It has been estimated that more than 750 food-like NHPs obtained market access through this route from 2004 until 2012.
Given the ambiguity surrounding the definition of food-like products and the expansion of discretionary fortification under NHP regulations, Health Canada eventually took the position that food-like products should not be regulated and sold as NHPs and these products were subsequently transitioned to a food regulatory framework. Products are classified as ‘foods’ on a case-by-case basis using four criteria: product composition; product representation, product format; and public perception and history of its use. The transition process was initiated in 2012 and the NHP directorate is no longer accepting NHP applications for products that are represented, packaged and sold as foods. However, many products previously marketed as NHPs are not legally eligible for sale as foods since they do not comply with the limitations on vitamin and mineral fortification outlined in the Food and Drug Regulations. To facilitate this transition, Health Canada, is currently using Temporary Marketing Authorization Letters (TMALs) to permit the sale of non-compliant foods while appropriate regulations are developed to address this gap. As a result, 370 TMALs were issued in this transitional period between 2012 and 2014, 173 of which are for caffeinated energy beverages, with the remainder representing products such as cereals, gums and sports and other novel drinks. While these products must comply with food labelling regulations under the Food and Drug Regulations, their highly supplemented nature continues to allow for marketing on the basis of these micronutrient additions.

2.4.4 Unregulated FOP nutrition references

While some of the nutrition information presented on packaged foods in Canada is mandatory and/or regulated, as discussed above, a number of nutrition references are entirely unregulated and currently not addressed by the Food and Drug Act. These include third-party symbols (e.g. The Heart and Stroke Foundation of Canada's Health Check, abolished in 2014) and manufacturer or retailer developed symbols and summary systems (e.g. Kraft’s Sensible Solutions) which display or score nutrient content using thresholds or proprietary algorithms. Ambiguous or implied nutrition references that appear in the form of brand names (e.g. Fibre 1), terms like ‘whole grain’, quantifying statements (e.g. ‘x grams of protein’) or symbols and graphics such as check marks or hearts that suggest a health benefit are also unregulated. Unregulated references can extend to whole product lines marketed as healthier or nutritionally improved alternatives (e.g. Presidents Choice Blue Label).
Recently, there has been increased concern regarding the proliferation of unregulated FOP summary systems and schemes. Critics have argued that the nutritional criteria underpinning these systems are not always comprehensive and may have nutritional standards that score products too favourably. In 2007, the Canadian Standing Committee on Health called on the federal government to “implement a mandatory, standardized, FOP labelling requirement on pre-packaged food for easy identification of nutritional value” in response to concerns about confusion and mistrust amongst consumers given the current landscape of nutrition labelling, but also to better support healthy food selection in the context of the increased prevalence of obesity and related chronic diseases. The Institute of Medicine (IOM) (now referred to as the National Academy of Medicine) also examined the increased display of unregulated FOP summary systems both in the US and globally and called for a standardized, regulated FOP system to encourage healthier food choices through “simplicity, visual clarity and the ability to convey meaning without written information”. To date, however, there is no scientific consensus with respect to the most effective system to communicate information to consumers or the nature of the nutritional criteria that would underpin its display.

2.4.5 Proposed directions in Canadian discretionary nutrition labelling regulations

On October 24, 2016, the Minister of Health launched a Healthy Eating Strategy as part of the Government’s ‘vision for a healthy Canada’, in response to several food and nutrition commitments identified in a 2015 Mandate Letter from the Prime Minister. The Strategy aims to unite Health Canada’s ongoing nutrition efforts and successes to date with new, complementary initiatives to help create a food environment that makes healthier eating choices easier for Canadians. One key initiative under the Strategy is to improve food labelling to help make it easier for Canadians to make healthier food choices. In addition to recent updates to the NFt, Health Canada is proposing to introduce three mandatory FOP warning labels on packaged foods high in sodium, sugars and saturated fat. These nutrients have been identified as public health concerns given evidence of their association with increased risk of chronic disease and dietary survey data indicating Canadians consume them in excess of recommended limits. The mandatory nature of such labelling is intended to best direct consumer choice and more effectively encourage product reformulation, thereby reducing risks to health.
2.5 Extent and nature of FOP nutrition labelling

While the NFt now appears on most packaged foods within the Canadian grocery channel, emerging evidence also points to the increased presence of discretionary nutrition references on products.\textsuperscript{10, 82, 86} The following section outlines the extent and nature of this FOP nutrition labelling, both in Canada and internationally.

2.5.1 Presence of FOP nutrition references

Surveys of on-package nutrition information in grocery stores, both within Canada and globally, have described the pervasiveness of FOP nutrition references, characterizing the presence of regulated nutrient content and health claims and/or unregulated FOP summary symbols and schemes.

A study which assessed all FOP systems and symbols and regulated nutrient content and disease risk-reduction claims on packaged foods sold across Canada between 2010 and 2011 found nutrition labelling on 48\% of all products.\textsuperscript{82} Of those with FOP nutrition labelling, nutrient content claims were most frequent (45.5\%), with disease risk-reduction claims on far fewer products (1.7\%),\textsuperscript{82} despite significant positive attention given to these by the food industry\textsuperscript{83} and Health Canada.\textsuperscript{79} Summary schemes and symbols were the second most prevalent type of FOP reference on products; these were found on 18.9\% of packages and presented in 158 unique formats.\textsuperscript{82} FOP nutrition labelling was most common on cereal products, soups, meal replacements, snack foods and beverages,\textsuperscript{82} which is consistent with other Canadian studies indicating a high concentration of FOP material on breakfast cereals,\textsuperscript{20, 87, 88} novel beverages,\textsuperscript{89} combination dishes\textsuperscript{88} and granola bars.\textsuperscript{87} These findings suggest that nutrition references are more frequent on foods characteristic of a high degree of processing. To date, however, there has been no systematic evaluation of the relationship between FOP labelling and the level of product processing.

The majority of regulated claims (e.g., nutrient content, disease risk reduction claims) found in the study of FOP material in Canadian grocery stores made reference to total fat and \textit{trans} fat.\textsuperscript{82} While these claims are consistent with directional statements in \textit{Canada’s Food Guide},\textsuperscript{90} other nutrients of concern appeared on products far less often. For instance, claims which highlighted
sodium and sugar content, food components that have been linked to a number of diet-related conditions, were far less prevalent.

Research examining nutrition labelling in other countries also indicates a widespread display of discretionary nutrition references. One US analysis, for instance, found 49% of products bore some form of FOP nutrition reference, categorized as either statements of fact, structure/function claims, nutrient content claims and/or US Food and Drug Administration (FDA) health claims. As with the study from Canada, the majority of FOP references were nutrient content claims (76%), with only 9% bearing an FDA-regulated health claim. Sixty-seven percent of products displayed unregulated FOP summary systems, up 11-fold since a similar audit from 2001. In Australia, a 2005 survey of pre-prepared meals reported that 36% of products bore a nutrient content claim and 14% carried a health-related claim. Data from the European Union (EU) in 2008 similarly found that on average, 48% of products displayed FOP nutrition references, but there was considerable variation across countries owing largely to jurisdictional differences in the regulations pertaining to the display nutrient and health claims at that time. New EU regulations in 2011, however, have prompted the harmonization of discretionary nutrition information on processed food products, and this is expected to increase the prevalence of nutrition labelling across European countries in coming years.

2.5.2 The relationship between FOP nutrition labelling and nutritional quality

A recent Canadian study found nearly two-thirds of products considered good sources of fibre did not display any relevant nutritional information, and many foods making a reference to fibre were categorized as ‘foods to limit’ by Canada’s Food Guide. A further examination of Canadian products bearing regulated nutrient content claims for fat across 40 product categories found that in over half of these categories, products with fat claims were not lower in fat than those without claims. Consistent with these findings from Canada, a survey of US supermarkets identified that 48% of products with discretionary nutrition labelling were high in saturated fat, sodium and/or sugar.

These trends appear starker when investigating foods marketed solely to children. One Canadian study found 62% of foods marketed to children (identified through the presence of child-oriented graphics) bore some form of FOP nutrition labelling, and 89% of these were classified as being of poor nutritional quality. Analysis of the US market again mirrored these findings with 71%
of products marketed to children using some form of nutrition labelling, 59% of which were found to be high in saturated fat, sodium and/or sugar.\textsuperscript{11}

An examination of products in Canadian grocery stores with unregulated FOP symbols found these products were not uniformly lower in calories, saturated fat, sodium, and sugar per reference amount than products without these symbols, in any food category.\textsuperscript{11} Similarly, a comparison of the nutritional quality of bread products bearing regulated fibre references to those making unregulated references revealed that products with regulated fibre content claims were significantly higher in fibre than those bearing unregulated alternatives.\textsuperscript{20} A further examination of the nutrient profile of baby and toddler foods from the US found that products bearing a FOP symbol which was either issued by government or a third-party health organization contained significantly more calcium, fibre, protein, vitamin A and C, and zinc and less sugar than products that bore an unregulated FOP symbol developed by a manufacturer.\textsuperscript{95} In the UK, evaluation of the unregulated, food industry-sponsored ‘Smart Choices’ scheme against the Food Standard Agency’s (UK FSA) nutrient profiling criteria found 64% of products with the designation would be considered unhealthy.\textsuperscript{18}

While these findings suggest that the presence of discretionary nutrition labelling may not differentiate products on the basis of healthfulness, and that products with a regulated label may be nutritionally superior to those bearing an unregulated reference, the literature is limited. Inconsistencies in the approaches taken to evaluate nutrition labelling against nutritional quality make it difficult to compare findings across studies. Most studies focussed on the quantification of negative attributes (e.g. salt, \textit{trans} fat, sugar, calories),\textsuperscript{10-12} and were restricted to information found on the NFt.\textsuperscript{18, 94, 95}

\textbf{2.5.3 Relationship between FOP nutrition labelling and product price}

Very few studies have examined the relationship between the display of a FOP nutrition reference and the price of a product. One study of unregulated whole grain references on bread products found that products bearing such labelling were less likely to be lower in price compared to those with no reference.\textsuperscript{14} Similarly, a study examining the relationship between price and the presence of nutrient content claims on margarines in Canada, found that products bearing a nutrient content claim were significantly more expensive than those without a claim.\textsuperscript{13} These findings are consistent with results from a study examining the implementation of
the US Nutrition Labelling and Education Act\textsuperscript{96} which suggested distinct labelling strategies amongst manufacturers, with some choosing to market certain products on the basis of price, and others on the basis of nutrition.\textsuperscript{96}

There is some evidence to suggest that price differences between labelled and unlabelled products may reflect the costs incurred by manufacturers and retailers to display such material.\textsuperscript{97} In addition to the potential cost of formulation to meet criteria for certain claims, costs related to research and development of unregulated references, including FOP summary systems and symbols, could also translate into increased product costs.\textsuperscript{97} Although more study is needed to elucidate the relationship between price and FOP labelling, insofar as these labels can drive up costs, this could have important implications for price sensitive consumers who use FOP nutritional guidance in their food selection practices.

2.6 Effectiveness of nutrition labelling

2.6.1 Impact of nutrition labelling on consumer behaviour

In Canada, nutrition labels, both mandatory and discretionary, are consumers’ primary source of nutrition information.\textsuperscript{65} It has been proposed that nutrition labelling is likely to impact consumer behaviour by enabling consumers to more readily assess the nutrition content of their foods, which in turn is expected to lead to healthier food purchasing and ultimately to healthier dietary practices.\textsuperscript{98} Whether or not people use nutrition labelling, however, is dependent on a number of factors including their nutritional knowledge and socio-economic constraints that often extend beyond the intent to eat healthfully.\textsuperscript{98} The following section describes what is known about the potential for nutrition labelling to promote healthy food selection. Much of the research to date has focused on consumers’ understanding and behaviour related to the mandatory NFt. Both this, and what is known with respect to discretionary FOP material, will be examined here.

2.6.1.1 Nutrition label-related knowledge and attitudes amongst consumers

In a 2008 study examining self-reported knowledge, attitudes and behaviours, 70\% of adult Canadians reported nutritional information from food labels to be an important and reliable source of information.\textsuperscript{65} More recent Health Canada-commissioned research, however, revealed that consumers displayed considerable confusion concerning the numeric aspects of the NFt and
were uncertain of how to interpret and contextualize the %DV. These findings are consistent with studies from other countries that show nutritional literacy and numeracy skills to be a critical barrier to interpreting labels. In studies of the general population, this difficulty was particularly common amongst people with diabetes, chronic kidney disease patients, older adults, adolescents and those with less education. Consumers have also reported confusion with regard to comparisons between products and the determination of energy per serving and per 100g.

It has also been found that nutrient content and health claims are the least-favoured form of nutritional information amongst Canadian respondents. This information was perceived to be misleading, confusing and the least useful information on the product. Two further studies conducted among post-secondary students and low-income food shoppers also showed consumer scepticism about the compliance of health claims to regulatory law.

With regard to unregulated FOP schemes, a comprehensive analysis recently conducted by the IOM found that single, standardized and interpretive systems are preferred by the average consumer to the wide range of proprietary ones currently found in the marketplace. These findings were based on data which showed that the coexistence of systems caused confusion in terms of interpretation and comparison of products. The UK FSA also evaluated consumer preference for various FOP labelling systems through a number of focus groups and concluded that participants desired a more simplified FOP label. While there seems to be clear preference for standardized directional summary formats, studies have found that this is generally not indicative of comprehension or ability to choose healthy products. A large study from Australia, for instance, concluded that while participants initially believed that FOP schemes which relayed information about the %DV would be easiest to use, traffic light labels that provide directional information related to total fat, saturated fat, sugar and sodium were significantly more successful in aiding healthier food selection.

Further work also suggests that consumers evaluate products best when using a multiple traffic light scheme (a colour based, directional summary system) compared to other FOP approaches. These findings were mirrored by a US study conducted by Unilever, who chose to forgo adopting such guidance on their products, instead endorsing the ‘Facts-up-Front’ system, a non-interpretive, %DV system criticized by multiple experts for its lack of public health utility.
As with the NFt, studies related to FOP summary systems and schemes have indicated a clear differential in use by consumers.\textsuperscript{18, 107} Younger participants and those with higher education, income and literacy and numeracy levels were better able to interpret labels based on a 24-item measure of food label comprehension.\textsuperscript{107} The disproportionate reach of these labels is particularly concerning given that socio-economic status is a strong determinant of health in Canada. Insofar as labels can direct consumers to healthier foods, there may be potential for labels to inadvertently further widen these inequalities.\textsuperscript{108}

2.6.1.2 Extent to which consumers use nutrition labelling in food purchasing

While consumers’ knowledge of, and attitudes toward, nutrition labelling have been extensively characterized, how this translates into consumers’ actual use of such information in directing food selection practices is less well understood.

In Canada, consumers report obtaining the majority of their nutrition information from food labels (68%), followed by the internet (51%), print-media (46%), health care professionals (40%) and government-issued material (22%).\textsuperscript{65} A 2008 survey found that 71\% of participants reported using the NFt to guide their food selection, with 21\% and 18\% looking for nutrient content and health claims on foods, respectively.\textsuperscript{65} An assessment by the Heart and Stroke Foundation of their now suspended Health Check symbol found that 74\% of Canadian respondents were more inclined to buy a food if it carried their label.\textsuperscript{109} These figures, while consistent with international data on consumer use of nutrition labelling, are likely to overestimate actual use given the self-reported nature of the data and the associated tendency to report what is believed to be socially desirable.\textsuperscript{110} Additionally, while a large proportion of the general Canadian population has reported using the NFt to compare food products,\textsuperscript{65} consumers appear not to use information on this specifically related to the %DV, relying more so on the absolute amounts of particular nutrients to guide their decisions and to compare the nutritional value of similar products, which is often less appropriate.\textsuperscript{110} Other barriers to consumer use of the NFt are largely related to limitations in nutrition knowledge, time-constraints and income.\textsuperscript{109} A recent US study found that post-secondary educated respondents, nearly 3 times more likely to use the NFt than those with a high-school education.\textsuperscript{110} Women were also 2.5 times more likely to use the NFt than their male counterparts.\textsuperscript{110}
While most Canadians say they use the NFt to guide their food selection, other work has indicated that 60% of Canadian adults have literacy and numeracy skills inadequate to effectively navigate the current health and nutrition environment. Several governing bodies have therefore proposed a standardized, easily interpreted FOP system as a means of circumventing issues with current nutrition labelling practices. However, research on the effects of FOP systems on purchasing behaviour within the grocery store is limited. A recent review of studies characterizing the effect of FOP nutrition labelling on consumers at the point-of-purchase found the current evidence base too heterogeneous to draw overall conclusions. While the review did not apply meta-analytic approaches in the synthesis of available evidence, the authors suggest divergent results were likely attributable to the length of the intervention period, the presence of additional intervention components, and the type of nutrients provided on the FOP. Implementation of food labelling interventions that targeted unhealthy nutrient constituents (e.g. trans fat, sodium, added sugar) fared better, both in terms of consumer preference and use, than those targeting healthy nutrients (e.g. vitamins, minerals, fibre), although labels that incorporated both positive and negative references were most effective.

A synthesis of existing field data related to FOP use conducted by the IOM also concluded that the literature was limited and inconsistent, with no evidence of one FOP system being superior to others in directing use. There was some evidence that FOP schemes could influence consumer purchases, although when food choice was economically constrained, healthier food selection is likely to receive little attention if it is not also affordable.

2.6.1.3 Impact of nutrition labelling on diet quality and health

Recent evidence points to Canadian food choices being increasingly driven by communicated health benefits in the form of nutrition references on food packages. Specifically, consumers tend to look for nutrients they wish to avoid, such as fat, energy, protein, sodium and additives, and a number of studies have shown that those who read the NFt have healthier diets. One US investigation, for instance, showed that label readers have diets higher in fruit, vegetables and fibre and lower in fat. It has also been shown that label users have diets lower in cholesterol than non-users. A more recent European assessment using a validated food label-use questionnaire similarly found that consulting the NFt was associated with better adherence to a Mediterranean diet, established as being of high nutritional quality, providing evidence that
food labels are associated not only with single nutrient modifications but also whole dietary patterns.\textsuperscript{114}

Few studies have examined the actual effects of FOP nutrition references on diet and health and only one investigated the effects of FOP labels on biomarkers in real life settings. A study conducted in Australia found significant reduction in urinary sodium concentration using a validated 24-hour urinary sodium measure among participants who were randomized to obtain nutritional counselling with respect to use of the Heart Foundation’s pick-the-tick label on foods.\textsuperscript{115} Additional research has relied on modeling approaches to assess long-term effects of FOP labelling on mortality and morbidity. One study evaluating the UK’s traffic light labelling system of negative nutrients concluded that FOP labelling was a cost-effective strategy in the prevention of obesity, with an estimated 10% increase in consumption of healthier options and reduced mean weight of 1.3 kg if traffic lights were to be used over a one year period.\textsuperscript{19} A similar study used Dutch consumption data to estimate population intake after replacing foods in the diet that did not comply with the ‘Choices’ label criteria for sodium, saturated fat and sugar with those that did.\textsuperscript{116, 117} Their findings suggest that consuming foods compliant with these nutrient thresholds would lead to moderate reductions in cardiovascular risk.\textsuperscript{116}

The bulk of these studies, however, were limited in their design and the majority employed cross-sectional data for which causal inferences with respect to label use and consumption patterns are not possible. It has been suggested that this relationship is bidirectional in that nutrition labels may promote healthier eating and consumers with healthier diets also may be more inclined to seek out labels in the first place.\textsuperscript{117}

\textbf{2.6.2 Impact on product reformulation and innovation}

While the primary goal of nutrition labelling, as defined by Health Canada, is to modify behaviour such that consumers adopt healthier eating habits,\textsuperscript{9} it has also been suggested that nutrition labels can indirectly impact diet and health by providing incentives for product reformulation by manufacturers. By making nutritional value apparent, labelling can not only raise awareness and increase demand for healthier products, but also stimulate the removal or addition of particular nutrient constituents to meet criteria necessary to display a logo or make a claim.\textsuperscript{2, 81}
The impact of nutrition labels on industry in Canada was seen following regulations that required trans fats to be listed on the NFt in 2005. The listing of trans fat on the label, in combination with a voluntary target for manufacturers, led to 76% of products meeting trans fat limits, subsequently resulting in a 35% reduction in trans fatty acid levels in breast milk and a 30% reduction in trans fat consumption in the general population. Similarly, mandatory trans fat labelling in the US was associated with reduced LDL cholesterol and triglyceride levels and an increase in HDL cholesterol levels. The mandatory disclosure of other negative nutrients of public health concern has also been shown to stimulate improvements in the food supply internationally. In Finland, for instance, introduction of mandatory ‘high-salt’ warnings on the FOP resulted in a 20-25% reduction in salt levels in foods and several high salt products being discontinued. The salt labels in Finland, in combination with consumer awareness campaigns which commenced in 1970 as part of the North Karelia Salt Reduction Project, led to a 40% reduction in population dietary sodium consumption.

Studies demonstrate that nutrition literacy is strongly correlated with the impetus for industry to reformulate products. A recent review of the effectiveness of mandatory trans fat labelling globally reported that where awareness of trans fats was low, manufacturers were less likely to reformulate their products. In Brazil, for instance, trans fat levels in some margarines remained over 50% of the recommended limit following mandatory labelling, which may be in part attributed to low levels of consumer awareness and demand.

With regard to voluntary nutrition labelling, few studies have examined industry reformulation of food products following implementation of FOP systems and references. A study from New Zealand evaluating the ‘pick the tick’ scheme found food companies that participated in the program eliminated 33 tons of salt through reformulation over a one-year period. These results were echoed in a larger, more recent examination of the Choices FOP system from the Netherlands. After introduction of the Choices logo, 168 products were reformulated and 236 newly developed to meet the logo criteria, with significant increases in fibre content in fruit juice and sandwiches. Sodium and saturated fat levels were also reduced in processed meats and soups, although energy was unchanged likely owing to the fact that the logo designation did not require this information at the time of the study. In neither case was the impact on product reformulation and innovation assessed against dietary and health outcomes. However, modeling
studies have found that display of these schemes on products across a range of food categories would be required to significantly impact intakes of saturated fat, sodium and sugar.\textsuperscript{116}

While the impact of nutrition labelling on product reformulation appears promising, there has been some concern that FOP labelling which incorporates positive nutrients in the profiling of nutrient quality may encourage superfluous additions of micronutrients to the food supply, given that these additions would improve ratings or allow for claim criteria to be met.\textsuperscript{83, 84} As a result, the proposed standardized system of FOP labelling put forward by the IOM does not include positive nutrients, nor does the UK FSA’s now implemented traffic light label.\textsuperscript{125}

2.7 ‘Organic’ and ‘natural’ FOP labelling

In addition to the use of FOP nutrition references, the discretionary display of information that relays the ‘organic’ and ‘natural’ qualities of a product has also become increasingly present in grocery stores.\textsuperscript{126, 127} Correspondingly, the demand for these products has increased substantially.\textsuperscript{126, 127} Canada’s organic market nearly tripled from 2006 to 2012, with national sales of certified organic food and non-alcoholic beverages reaching CAD$3 billion.\textsuperscript{126} In 2013, natural foods category sales in Canada surpassed those of organic products, comprising just over 50% of all natural and organic food and beverage sales, owing largely to the strength of a typically lower price point for products bearing natural versus organic labels.\textsuperscript{126}

The term ‘organic’ refers not only to the product itself but how it was prepared.\textsuperscript{128} As of 2009, foods labelled ‘organic’ must comply with Canadian Food Inspection Agency’s Organic Product Regulations.\textsuperscript{128} The regulations outline standards of organic production, including how livestock must be housed, fed, transported and slaughtered; how specific crops and produce are to be grown, extracted, processed and stored; how pests and diseases are to be treated; which substances, methods and ingredients may not be used; and what environmental factors must be taken into consideration.\textsuperscript{128} Products labelled as ‘organic’ must contain at least 95% organic content and be certified by an accredited certification body.\textsuperscript{128} Multi-ingredient products with 70-95% organic content may also bear the declaration ‘contains xx% organic ingredients’.\textsuperscript{128} These labelling standards are consistent with those found in other jurisdictions such as the US.\textsuperscript{129} While no clear definition exists for ‘natural’ foods, these are generally understood to be foods
which are minimally processed and contain no artificial or synthetic ingredients or additives. The use of the term ‘natural’ on products, however, is unregulated. This is also true of synonymous references to ‘pure’ and ‘real’.

Consumer research by the Canadian Organic Trade Association found 58% of Canadians purchase organic and natural products at least once a week. Consumers of these products were more likely to be university educated, be between the ages of 35 and 44 and live in households with children. These findings are consistent with work from the US which has found organic and natural consumers to be better educated, have higher incomes, live in large cities and be female. The literature, however, has noted confusion in consumer’s understanding of these terms. Interestingly, nearly half of respondents in one nationally representative US study believed the key attributes associated with organic products also applied to natural foods.

While some studies have indicated consumers are motivated to purchase organic and natural products due to environmental concerns, most studies conclude that sales in these categories are mostly driven by health. Although there is an increased consumer demand for organic and natural products, similar to consumer’s use of nutrition labelling, price has also been cited as a deterrent to purchasing amongst some consumers. There is indeed some evidence to suggest that organic products, in particular, are priced significantly higher than conventional counterparts, specifically in product categories such as fruits, vegetables and meat products.

2.8 FOP nutrition labelling as product marketing

Manufacturers’ commercial interests complicate the potential for discretionary nutrition labelling to serve as a viable public health intervention. Studies from the US have shown food companies spend US$11 billion annually on on-package advertising, the majority of which promote products that are already consumed in excess, such as convenience foods, confectionary and soft drinks. In contrast, only two percent of this advertisement budget is allotted to promote sales of fruit, vegetables, grains and beans. In addition, it has been shown that food companies focus this marketing on products with added value or on new product entrants to garner
consumer attention. As such, less emphasis is given to the inherent properties of fresh and whole foods, despite evidence that such marketing campaigns are also successful. A recent Canadian study found that an off-package television campaign to promote the nutritional value of broccoli increased sales by 8%, with a corresponding increase in consumer perceptions of broccoli as tasty and healthy. Evidence of a differential display of FOP material on new product entrants, or value-added foods may be related to the competitive nature of the current food environment. Consumers are now faced with an increasing selection of very similar products. In 2009 alone, manufacturers introduced approximately 20,000 new products into the North American food supply, up from 6000 new products a year in the 1980s. Indeed, many of these new products were ‘healthier’, manipulated versions of the existing 320,000 products available on retail shelves.

### 2.8.1 FOP nutrition labelling and product sales

A review of studies of supermarket sales data also found long-term increases in FOP nutrition labelled product purchases. Additionally, research has shown that firms with a higher proportion of sales in ‘healthier’ ranges, which are often marketed as such, demonstrate greater sales growth, returns to shareholders and company reputation. The benefit of health and nutrition labelling is therefore not overlooked by manufacturers. A wave of new industry sponsored FOP schemes such as Wal-Mart’s ‘Great for You’ initiative and the Grocery Manufacturers’ ‘Facts-up-Front’ program have appeared nationally. The Food Marketing Institute’s 2011 ‘Food Retailing Industry Speaks’ survey showed nearly half of all responding retailers to have some type of nutrition labelling program (double that from 2010), with another 15% in the process of implementing such initiatives.

More recently, evidence suggests the display of discretionary nutritional claims on product packages may be associated with a manufacturer’s financial performance. A US study of 38 publicly-held food corporations revealed a firm’s stock market performance and sales relate significantly and positively to both the type and degree of nutrition information presented on product packages. These findings are consistent with previous suggestions that FOP labelling is used to enhance a manufacturer’s profitability, but the findings could also speak to the ability of larger manufacturers, with greater revenue, to incur the production costs associated with FOP labelling.
2.9 Manufacturers of packaged foods

While consumers appear to prefer the simplified messaging provided by FOP references in guiding their food selection, the provision of this material is dependent on its display by manufacturers. Consumers are afforded more and more choice of products with grocery stores now stocking thousands of products. Given the competitive nature of the current food retail environment and the potential for nutrition information to motivate sales, there is considerable incentive for manufacturers to adopt this practice of discretionary labelling. However, nutrition information also appears to be selectively distributed across products in grocery stores. The following section will examine what is known about the behaviour of grocery manufacturers and retailers with respect to supporting healthy food selection, and in particular, how they engage in the practice of FOP nutrition labelling.

2.9.1 Manufacturers, retailers and the taxonomy of brand

While the retail landscape is vast and offers a wide range of products, the literature to date has examined products as either national or retailer-owned products. Retailer or private store brand products are brands owned by the retailer rather than the manufacturer, as is the case with national brand products.

Traditionally, private label products were thought of as providing generic, commodity-based value offerings to national brand counterparts. More recently, retailers have aligned private label brands with consumer trends, including quality, organic, wellness and health differentiated lines in the form of private premium lines. The premium products of private retailers are priced 40% higher than their generic or discount products and represent 70% of total private label sales.

Although private retail products have experienced considerable growth in the last decade, national brands represent over three quarters of the total retail food sales. National brands are distributed through various retail outlets, both nationwide and internationally, and as such, they also include brands of transnational or multinational food firms. Transnational food firms, otherwise known as ‘Big Food’, have come to dominate food sales. The ten largest of these,
including Nestle, PepsiCo, DANONE and Coca Cola, control nearly one quarter of global packaged food sales, with the top 100 corporations controlling three quarters of the global market.\(^\text{147}\)

2.9.1.1 The market dominance of Big Food

The dominance of ‘Big Food’ manufacturers, in both domestic and global markets, has been achieved through a range of strategies. In part, market dominance by these firms relates to the nature of the products they produce.\(^\text{87, 146, 148, 149}\) Big Food, for instance, holds over a third of the global market of highly processed products which are known to appeal broadly to consumers for their convenience and hyper-palatability. Products of Big Food manufacturers often have long shelf lives and are formulated with low-cost ingredients to increase profit margins.\(^\text{149}\) The dominance of Big Food firms also relates to their capacity to expand and maintain markets for their products,\(^\text{150}\) thereby benefiting from the economies of scale and scope. Specifically, these firms are able to lower per-unit costs of food and beverage products by expanding the number and variety of products manufactured, creating a ubiquitous presence in the market.

Market growth is thought to be further propelled through strategic marketing and advertising that influence consumption habits and create demand, in turn driving production and subsequently profit.\(^\text{150}\) According to the UN’s FAO, successful advertising by food companies has played a large role in the ‘rapid adoption of new foods in the diet’.\(^\text{5}\) As previously discussed, some food companies, and in particular transnational firms, have significant advertising and marketing budgets.\(^\text{146}\) Product promotion is done through a range of different media, including TV commercials, sales promotions, viral marketing, celebrity and sports sponsorships, product placement in films and television, in-school marketing and on package promotion to create perceived differences amongst similar products and relay the value and enhance the desirability of a product.\(^\text{5}\)

2.9.2 Diet-related disease and the role of food manufacturers

While supporting healthier food selection is considered a key strategy for reducing the burden of diet-related disease, the degree to which manufacturers can play a role in facilitating shifts towards healthier dietary patterns is the focus of much debate. Big Food was considered an important stakeholder at the UN’s high-level meeting on non-communicable diseases\(^\text{151}\) and in
Canada, the food industry has been encouraged to participate in consultations with ‘the intent to inform the development of policies, guidance or regulations related to healthy eating initiatives’. Governments, including Canada’s, have largely relied on self-regulation to encourage healthier product formulations and nutritional guidance. Big Food companies appear to have recognized the need for more positive responses to these health concerns by presenting themselves as part of the solution to these dietary health problems. This includes producing ‘healthier’ food products through the removal or addition of particular nutrient constituents, reducing portion sizes, creating new nutrition labelling initiatives, and launching nutrition education campaigns. These initiatives form a part of the Corporate Social Responsibility agendas of these firms.

However, the notion that food manufacturers should take responsibility for health is also heavily contested. Many public health and nutrition scholars argue that industry-led nutrition and health initiatives further industry’s commercial interests rather than those of public health. Voluntary efforts to reduce sodium in Canada and elsewhere, for instance, have been criticized for their slow progress and for selective reductions across product lines. Indeed, independent evaluations of some of these programs have shown that the reductions achieved to date have been modest at best. While similar efforts to reduce the trans fat content of packaged foods through voluntary efforts were largely successful in Canada, the lack of meaningful progress with respect to sodium is thought to relate to the lack of monitoring by government of sodium content.

The discretionary display of regulated FOP nutrient content and disease-risk reduction claims has been thought to promote ‘less-unhealthy’ processed products by isolating and focusing on single ingredients, independent of a product’s overall nutrient profile. The voluntary nature of this approach has also been argued to encourage ‘lowest common denominator practices’. For instance, where certain companies choose not to reformulate their products, others that do would be at a competitive disadvantage by providing healthier options while perhaps sacrificing taste.

The notion that transnational manufacturers are ultimately motivated by profits has been particularly apparent in their efforts to stave off more restrictive regulations that would place limits on the manufacturing and marketing of processed foods. In particular, transnational food firms have been known to lobby against public health promoting initiatives such as regulations with respect to soda tax in Mexico and New York City. In Europe, the food industry
reportedly spent nearly €1 billion to successfully lobby the European parliament to reject the compulsory implementation of a FOP traffic light scheme\textsuperscript{6} that would highlight certain products as unhealthy. Similarly, national proposals for mandatory nutrient warning labels have resulted in concerns being raised to the technical barrier to trade committee by members of the World Trade Organization.\textsuperscript{161} Member countries, often representing industry interest groups, have cited these labels as unnecessarily burdensome to transnational manufacturers who wish to harmonize labelling practices across markets and argued that less restrictive options that would encourage consumers to make healthier choices would equally fulfill stated policy objectives.\textsuperscript{161} For instance, in 2007 concerns were raised regarding Thailand’s proposal for a mandatory label ‘Children Should Take Less’ which would be placed on five categories of snack foods commonly consumed by children. As a result, Thailand has recently implemented an alternative ‘Consume small amounts and exercise for healthy condition’ warning on fewer categories of foods, for which no additional concerns were raised in the technical barrier to trade committee.\textsuperscript{161}

\subsection*{2.9.3 Food manufacturers’ use of discretionary nutrition labelling}

While there is an abundance of literature which characterizes consumers’ perceptions and purchase intentions with respect to discretionary FOP references\textsuperscript{17, 18, 65, 102, 104, 110, 162}, analyses of manufacturers’ responses to these, and their market impacts, are comparatively sparse. Studies drawing on Mintel’s Global New Products Database have begun to reveal differences in the marketing strategies of different manufacturers.\textsuperscript{163, 164} Work from the US which compared the use of FOP references (including nutrition, health and other quality and processing claims) across a range of product categories found that national brands display more of any type of claim than private label products. Over a three-year period (2009-2011), both private label and national brand products increased their display of references overall, however, the use of ‘organic’ labelling significantly decreased on certain product categories.\textsuperscript{163}

Using a similar study design, work from the UK aimed to determine the response of manufacturers to voluntary FOP schemes through product innovations\textsuperscript{164} in food categories targeted by the UK FSA for FOP labelling and those that were not. In the UK, private label brands appeared to dominate food innovations over a five-year period from 2002. The use of FOP labels, however, was found to be selective among companies and across food categories. Specifically, the industry-sponsored Guideline Daily Amounts label was more widely adopted
than the UK FSA developed traffic light system, although both were displayed with greater frequency on targeted food categories, including breakfast cereals, pre-prepared meals and processed meats. The authors suggest the density of FOP schemes on targeted food categories may reflect food companies’ attempts to pre-empt mandatory labelling policies but could also be in part attributed to the compositional characteristics of these products. None of the leading national brands displayed a traffic light scheme, and private label products displayed more of any FOP label than national brand counterparts. Taken together, these studies indicate a differential display of FOP material amongst brands of certain food firms and suggest that the practice of FOP labelling may be driven by the specific regulatory context (e.g. preponderance of FOP schemes on food categories targeted through the UK FSA regulations). These studies, however, were limited in examining the distribution of such FOP information amongst only new products and assessing the presence of FOP references by manufacturers using a dichotomized understanding of food brands.

2.10 Summary

The literature reviewed has indicated concerns related to current Canadian dietary practices that are associated with the increased prevalence of obesity and ongoing concerns related to diet-related chronic diseases. Emerging research suggests that one problem may be the increasing concentration of highly processed foods in Canadians’ diets. As food selection is most frequently done in the grocery store, providing point-of-purchase nutritional information to consumers is one strategy to support healthy food selection. Studies have indicated that consumers prefer the simplified and directive information provided by FOP labelling as compared to the more cumbersome nutritional information found on the NFt. There is also convincing evidence that FOP labelling impacts consumer purchasing and can drive product sales, although consumers who are economically constrained may be less inclined to purchase products on the basis of nutrition. While there is evidence that the presence of FOP label can stimulate reformulation, the existing research has also indicated that products displaying a FOP reference are not always nutritionally superior to those that do not and that products displaying an unregulated reference have nutritional profiles inferior to those displaying one that is regulated.
The display of discretionary FOP nutrition labelling has become pervasive in Canada\textsuperscript{82} and research has begun to show a clustering of this material on specific food categories\textsuperscript{82, 89, 94, 165} and on products manufactured by certain food firms.\textsuperscript{163, 164, 166-168} There is also some indication of an association between FOP labelling and product price.\textsuperscript{14, 169} Taken together, this work begins to signal a strategic positioning of FOP labelling in the food market place.
3.0 RESEARCH RATIONALE AND OBJECTIVES

FOP nutrition labelling is pervasive in Canada and occurs at the discretion of manufacturers. While there is evidence to suggest FOP material can impact product sales,\(^{15,16,18}\) other work has consistently demonstrated no association between the presence of FOP references and the nutritional quality of a product.\(^{11,12,14,169}\) A comprehensive examination of how manufacturers choose to engage in FOP labelling is needed to better understand the implications of this practice for consumers.

The following outlines the rationale and objectives of four studies designed to better understand the practice of discretionary FOP nutrition labelling. Given the intersection of product manufacturing and nutrition promotion, these studies will specifically examine how the extent and nature of FOP references relate to product manufacturing and manufacturers and further characterize one domain of FOP labelling through an assessment of the nature of the unregulated material not quantified in the previous studies. We consider all descriptive text on the front of packaged foods, including nutrient content claims, quantitative statements, generic and product-specific health claims, third-party and manufacturer- and retailer-developed symbols and summary systems, as well as any other descriptive or implied references emphasizing the presence or absence of a specific nutrient constituent, and references to ‘natural’ and ‘organic’.

**Objective 1: Assess the relationship between the presence and nature of FOP nutrition references on products and the level of food processing**

Foods characterized by a high degree of processing have become pervasive in Canadian grocery stores and are increasingly displacing minimally processed staple foods from the diet.\(^{32}\) Highly processed products are high in sugar, sodium, and saturated fats\(^{36,37}\) and concerns have been raised about their contribution to the escalating burden of diet-related disease.\(^{33,54,55}\) It has been suggested that the dominance of these products relates in part to their aggressive on-package marketing\(^{41,78}\) and indeed evidence gleaned from studies of particular product categories reveals a high density of FOP nutrition references on breakfast cereals, mixed dishes, novel beverages and meal replacements which are characterized by a high level of processing.\(^{10,82,86,89}\) To date, however, there has been no empirical examination of FOP references found on products by the
level of food processing. In the absence of a single, standardized classification system to grade the level of processing, work towards this objective utilized three distinct frameworks to define food processing to give consideration to the salient differences in the conceptualization of processing in this context.

Objective 2: Examine the presence and nature of FOP references on innovative foods designed as substitutes for more traditional counterparts

The second objective is to investigate the FOP material on innovative products designed as substitutes for traditional, less-processed alternatives. Innovative products have become increasingly pervasive in grocery stores, in part due to technological advancements in food manufacturing and engineering, but also through regulatory amendments which have encouraged product development.\textsuperscript{141, 170} Given arguments that highly processed foods have displaced more traditional foods in the diet,\textsuperscript{41, 78} in part through the use of aggressive and strategic marketing, this study aims to investigate this relationship more explicitly by comparing the FOP labelling on highly processed, relatively novel, innovative products to that on their less-processed, traditional counterparts.

Objective 3: Compare the use of FOP references on products manufactured by transnational food firms (i.e., ‘Big Food’) to that of other manufacturers and retailers

Transnational food and beverage companies, often referred to as ‘Big Food’, have come to dominate global food sales.\textsuperscript{146, 149} The market growth of these products may be propelled by strategic marketing and advertising, which influence consumption habits and create demand, in turn driving production and subsequently profit.\textsuperscript{150} Work has begun to signal the differential display of specific FOP material by certain food firms.\textsuperscript{163, 164} These studies, however, were limited in only examining the distribution of some FOP information on new product entrants and relying on a dichotomized understanding of brand (e.g. national brands owned by the manufacturer and private label brands owned by a retailer). Study 3 provides an expanded understanding of manufacturers’ behaviour with respect to discretionary FOP labelling through an analysis of the material found on the products of Big Food compared to that found on the
products of other manufacturers and retailers. A secondary objective is to examine the FOP material present on private retailer brand products to provide insight into the display of FOP material on products marketed on the basis of quality and those designed to be low in cost.

**Objective 4: Assess the nature of unregulated FOP nutrition references in contrast to current nutrition labelling regulations**

To date, much of the research on FOP nutrition references on products sold in grocery stores has focused on characterizing the presence of regulated claims. Studies of specific food categories, however, indicate that the presence of an unregulated nutrition reference may denote a product that is nutritionally inferior to those bearing regulated claims.\(^{20, 95}\) While there is evidence to suggest that the presence of a FOP reference can impact purchasing behaviour\(^ {138}\), consumers are unlikely to be capable of differentiating between FOP references that are regulated and ones that are not, raising concerns about the extent to which the current structure of FOP labelling serves to accurately guide consumer food selection.

Work towards these objectives drew on a comprehensive survey of packaged foods sold in three large nation chain grocery stores in Toronto.\(^ *\) While these retailers operate multiple store banners\(^ {171}\) this sample represents one of each conventional banner stores (i.e., *Loblaws*, *Metro*, *Sobeys*) in recognition of their dominance both in market share and retail square footage.\(^ {171}\) The following chapters detail the studies corresponding to these four objectives.

\(^*\) The collection of data from which these studies draw was funded by an operating grant from the Canadian Institutes of Health Research (MOP – 102655).
4.0 STUDY 1: FRONT-OF-PACKAGE NUTRITION REFERENCES ARE POSITIVELY ASSOCIATED WITH FOOD PROCESSING


Abstract

*Objective:* Foods characterized by a high degree of processing are pervasive in the global food supply and concerns have been raised about their contribution to the escalating burden of diet-related disease. It has been suggested that the dominance of these products relates in part to their aggressive on-package marketing. The purpose of this study was to assess the relationship between the extent and nature of FOP nutrition references on products sold in Canadian supermarkets and the level of food processing.

*Design:* FOP references were recorded from all packaged foods. Nutrition references were classified as ‘negative’ and ‘positive’ and further differentiated in terms of the use of regulated and unregulated text. Foods were coded for level of processing, using three different classification systems. Logistic and negative binomial regression analyses were conducted to assess associations.

*Setting:* Three large Toronto supermarkets, from the top Canadian food retailers.

*Subjects:* 20520 packaged foods.

*Results:* 41% of products had FOP nutrition references. Irrespective of the classification system considered, the most processed category comprised the greatest proportion of products and nearly half of these bore FOP references. Foods deemed most processed were more likely than less processed products to bear FOP references and regulated and unregulated references to negative ingredients, but they were equally or less likely to bear positive nutrition references, depending on the classification system.

*Conclusion:* The greater frequency of FOP nutrition references on heavily processed foods raises questions about the extent to which discretionary FOP labelling supports public health efforts to promote healthy eating.
4.1 Introduction

Ultra-processed foods have come to dominate the global food supply.\textsuperscript{31} In Canada, the contribution of ultra-processed products to household food purchases was 54.9\% in 2001\textsuperscript{32} and examination of the most recent Canadian Community Health Survey revealed these foods made up 48\% of calories consumed by Canadians.\textsuperscript{46} Similar trends have been observed in other high-income countries, and minimally processed, staple foods, are increasingly being displaced by ultra-processed products in low-and middle-income settings as well.\textsuperscript{35, 45, 145, 172} While a study of household purchasing patterns in the US between 2002 and 2012 suggests that trends in the purchase of highly processed foods and beverages have stabilized in that country, and this may be true in Canada as well, highly processed products comprised 61\% of energy purchased by US households in 2012.\textsuperscript{40} The high consumption of extensively processed foods is a matter of public health concern because of the nutrition profile of these products. Despite differences in the criteria applied by different research groups to identify processed foods, studies have consistently documented higher concentrations of sugar, sodium, and saturated fats amongst products deemed most processed.\textsuperscript{34, 36, 37, 40} Diets high in ultra-processed products have been found to increase risk of weight gain\textsuperscript{55} and the metabolic syndrome,\textsuperscript{54} and some authors have argued that the increased reliance on these foods has contributed to a parallel rise in the burden of chronic, diet-related disease.\textsuperscript{41, 45, 46}

It has been proposed that the dominance of ultra-processed foods and beverages in the diet relates to their aggressive and strategic on-package marketing,\textsuperscript{41, 145, 173} but there has been no systematic examination of the relationship between the level of food processing and nutrition labelling practices. In Canada, as in the US and many other countries, the only mandatory nutrition information appearing on packaged foods and beverages is a NFt, typically displayed on the back of package. The use of FOP nutrient content and disease risk reduction claims is regulated via compositional criteria and prescribed wording in Canada.\textsuperscript{9} Specifically, nutrient content claims exist for nutrients with established recommended daily intakes or reference standards, and their use is permitted on products containing prescribed amounts of these nutrients per serving.\textsuperscript{9} Disease risk reduction claims, similarly, are permitted on foods that contain set levels of energy and/or nutrients per serving based on scientific evidence that has established a relationship between certain elements of healthy diets and the reduction of the risk of developing chronic diseases.\textsuperscript{9} These claims are intended to provide readily-accessible information to help
guide consumers toward healthier food choices, while also creating incentives for manufacturers to reformulate products to improve their healthfulness. The decision of whether or not to display regulated claims rests with the manufacturer, however, and manufacturers are free to display other unregulated text, symbols, and rating systems. A myriad of such claims, symbols, and systems have been introduced by food manufacturers (e.g. Kellogg’s ‘Get the Facts’) and third parties (e.g., the Whole Grain Council); their use requires no compliance with the compositional criteria governing regulated claims.

A recent survey of packaged foods in Canada found discretionary nutrition labelling, including nutrient content, disease-risk reduction claims and summary systems on nearly half of products. Manufacturer and third-party endorsed summary indicator systems and symbols, were found on one-fifth of products and appeared in 158 unique formats. While most research has not differentiated regulated and unregulated FOP references, studies of specific food categories have found 30-60% of products bearing unregulated text. The high density of FOP nutrition references observed on breakfast cereals, mixed dishes, novel beverages and meal replacements suggest that discretionary on-package references to nutrition may be more common on products characterized by a high level of processing. It is well documented that FOP nutrition references are not necessarily indicative of nutritionally superior products, but there is also considerable evidence that the presence of such references influence consumer purchasing, raising questions about the extent to which processed food manufacturers’ use of FOP nutrition references function to reinforce the presence of these foods in the diet.

Drawing on data from a survey of packaged foods sold in Canadian supermarkets, the purpose of this study was to assess the relationship between the extent and nature of FOP nutrition references on products and the level of food processing. Our analysis of FOP text and graphics differentiated manufacturers’ use of regulated and unregulated text, while at the same time assessing the frequency of FOP references to nutrients and ingredients that are widely regarded as important to minimize, and those seen as important to maximize, in food selections for optimal health. In the absence of a single, standardized classification system to grade foods in the North American food supply by level of processing, we employed three distinct frameworks to define food processing to allow for consideration of salient differences in the conceptualization of processing in this context.
4.2 Methods

4.2.1 Data collection

A comprehensive survey of all labelling found on the front of all packaged foods and beverages sold in national chain retailers located in Toronto was conducted between July 2010 and August 2011. A single store was selected, by convenience sampling, from each of the top three food retailers in Canada (Loblaw, Metro and Sobeys), representing 71% of the total Canadian retail market-share. Data collectors systematically recorded all descriptive text on the front of packaged foods, including product identifiers (i.e. brand and product name, variety and product size), nutrient content claims, quantitative statements, generic and product-specific health claims, third-party- (e.g. The Heart and Stroke Foundation of Canada's Health Check) and manufacturer- (e.g. Kraft’s Sensible Solutions) developed symbols and summary systems which display or score nutrient content using thresholds or proprietary algorithms, as well as any other descriptive or implied references emphasizing the presence or absence of a specific nutrient or constituent. Fresh produce, meat, poultry and fish and dried herbs and spices were excluded from the sample because they were unlikely to bear nutrition labelling. Products found in the pharmacy and infant food sections were also excluded because these products are designed for specific population subgroups and special dietary usage.

After removing duplicate products (i.e., identical products found in more than one store), 20520 unique packaged items were captured in the database. Products were considered unique if they differed from similar products on the basis of any product identifier.

4.2.2 Data analysis

Each product was coded for the presence of any reference to nutrition (e.g. summary systems and symbols, quantifying statements, nutrient content and health claims). Nutrition references were further classified as ‘negative’ if they conveyed the reduction or absence of a nutrient or food constituent to discourage (e.g. ‘low sodium’, ‘trans fat free’, ‘no added sugar’), and ‘positive’ if they highlighted the presence or addition of a nutrient to encourage (e.g. ‘good source of calcium’, ‘high in fibre’). Positive and negative nutrition references were further differentiated
in terms of the use of regulated and unregulated text. Regulated nutrition references (i.e., nutrient content and disease risk reduction claims) were identified by the prescribed wording and permitted wording variations outlined in the Canadian Food and Drug Regulations\textsuperscript{72} and the Canadian Food Inspection Agency’s Guide to Food Labelling and Advertising.\textsuperscript{73} Regulated references which indicated reformulation through the reduction of a particular negative constituent (e.g., ‘reduced sodium’) were also identified. Unregulated nutrition references included all quantifying statements, summary systems and symbols issued by the manufacturer, retailer or third-party as well as any other text inconsistent with current prescribed wording for regulated claims. Finally, the total number of nutrition references appearing on a product was coded for each product. Verification of the data entry and coding was conducted on a subsample of products and discrepancies resolved by two members of the research team who were not involved in the data collection.

All products were classified by level of food processing, applying three distinct classification systems which have all been applied to the North American food supply\textsuperscript{32, 34-37, 40, 46, 62} but differ slightly in their determination of high levels of processing. The International Food Information Council’s (IFIC) classification system was developed by IFIC in the ‘Understanding our Foods Communication Toolkit’ and designed for use in high-income countries; its intended purpose was to define processed foods for consumers and clear ‘misinformation about modern food production’.\textsuperscript{61} It grades products based on the relative complexity of processing and the physical, chemical and sensory changes in foods resulting from processing, while also differentiating convenience products. IFIC’s classification of processed foods has been applied to consumption data from the US.\textsuperscript{34, 37} The NOVA system, developed by Monteiro and colleagues at the University of Sao Paulo, defines food processing as the physical, biological or chemical processes after their separation from nature and prior to ‘culinary preparation’ and differentiates foods by nature, extent and purpose of food processing.\textsuperscript{31, 41} NOVA was developed to assess the role of food processing on the nature of diets and related states of health and well-being and has been applied to food purchasing and consumption data from a number of countries, including Brazil, the UK and Canada.\textsuperscript{31} The classification system developed by Poti and colleagues, while guided by the NOVA system and also focused on the degree of industrial processing, reflects the complexity of food processing inherent to the US food supply.\textsuperscript{62} It has also been used in studies of food purchasing and consumption from the US.\textsuperscript{40, 62} A summary of key differences and similarities in the determination of the highest level of food processing in each classification...
Binary logistic regression models were used to assess the relationship between the presence and nature (i.e., ‘negative’ or ‘positive’) of nutrition references and the level of product processing. Similar models were used to examine the relationship between references classified as unregulated and regulated and level of processing. The association between the extent (i.e., total number) of nutrition references on a product and level of processing was assessed using negative binomial regression models, appropriate for count outcome variables of this nature (e.g. values of 0,1,2,3…).176

All analyses were conducted using SAS (version 9.4, SAS Institute, Cary NC, 2014). A p-value less than 0.05 was deemed statistically significant.

4.3 Results

4.3.1 Presence and nature of FOP references

Forty-one percent (n=8324) of all products surveyed bore some form of FOP nutrition reference, but there were marked differences in the proportion of products bearing FOP nutrition references within individual food groups (Figure 4.1). Of the products bearing FOP nutrition references, 38% referenced the absence or reduction of a negative nutrient, 29% the presence or addition of a nutrient to encourage, and 23% referenced both negative and positive nutrients. Ten percent of FOP nutritionally referenced products did not make specific reference to a single nutrient but included general health and wellness claims and manufacturer, retailer or third-party endorsed FOP summary systems or symbols. Twenty-two percent (n=4538) of products bore a regulated reference which was negative and 15% (n=2985) one which was positive. Negative unregulated references appeared on 10% (n=2110) of products and positive unregulated references on 8% (n=1689). Regulated references, which indicated reformulation were observed on 2% (n=492) of all products. In total, 23% (n=4774) of products bore an unregulated FOP nutrition reference.

4.3.2 Relationship between FOP references and level of processing
Irrespective of the classification system considered, the most processed category comprised the greatest proportion of products in our database and nearly half of these foods bore FOP nutrition references (Figure 4.2). The nature of FOP references found on products, by level of processing, is presented in Table 4.2. Almost one-third of foods in the most processed category of each classification system bore FOP references to the negative nutrients, but the proportion with references to positive nutrients ranged from 19.3% to 24.5%, (Table 4.2).

The most processed products were significantly more likely to have a nutrition reference than products in lesser-processed categories (Table 4.3), but they were also more likely to make FOP references to multiple nutrients. Results from the negative binomial model showed that across classification systems, foods deemed most processed bore, on average, significantly more nutrition references than did products in lesser-processed categories (Table 4.3).

Products in the most processed category of each classification system were significantly more likely than less processed products to bear a negative nutrition reference (Table 4.3). Both regulated and unregulated negative references were significantly more likely to appear on foods classified as most processed than on lesser-processed foods (Table 4.3). A closer examination of the negative references on products deemed most processed indicated that most referred to the fat content of the product (including references to total fat, saturated fat, and trans fat); least common were references to sodium (Figure 4.3). Irrespective of the classification scheme used, less than 3% of products deemed most processed bore regulated claims indicative of product reformulation to lower negative nutrients (data not shown).

While most positive nutrition references were found on products characteristic of the highest degree of processing (Table 4.2), when compared with lesser-processed products, they were less likely to bear this type of reference when the Poti et al classification system was applied, but results were inconsistent across the other two classification systems (Table 4.3). The presence of an unregulated positive nutrition reference was more likely to appear on ‘ready-to-eat’ processed foods, than on lesser-processed products when the IFIC classification system was applied, but results were inconsistent with the other two coding schemes (Table 4.3). No statistically significant differences were observed in the odds of ultra-processed products bearing unregulated positive references when they were compared to processed culinary ingredients, as coded by the NOVA system (Table 4.3). Similarly, the odds of unregulated positive references on highly
processed products were not statistically significant when compared to basic and moderately processed foods, as coded by the Poti et al system (Table 4.3). When processing was coded using the NOVA system, ultra-processed foods were significantly more likely than lesser-processed foods to bear a symbol or summary system, but no clear pattern was observed when assessing the presence of a symbol or summary system across levels of processing using the other two classification systems (Table 4.3).

4.4 Discussion

Our study represents the first systematic examination of the relationship between FOP references and the level of food processing. We found that, compared to less processed foods, those classified as most processed were more likely to bear FOP references and more likely to bear multiple references, regardless of the classification system used to define levels of food processing. In addition, products with the highest level of processing were more likely to bear FOP references to negative nutrients, including both regulated and unregulated references.

The prominence of ‘negative’ nutrition messaging on foods with the highest levels of processing, is consistent with the reportedly high density of nutrients of public health concern among these food products. The ubiquity of negative nutrition references on products in the highest category of processing must in part reflect the competitive nature of product marketing in this sector, but it may also reflect manufacturers’ attempts to respond to public health messaging and allay consumers’ concerns regarding excessive exposure to potentially harmful ingredients such as trans fat, added sugars, and sodium. The use of negative references may also signal reformulation efforts to reduce the concentrations of these particular ingredients in products. However, to the extent that we could identify product reformulation through manufacturers’ use of regulated claims indicating lower amounts of energy, fat, sugar, or sodium, we found little evidence of this practice, with fewer than three percent of the most processed products bearing such claims.

Nearly a quarter of all products in our dataset bore nutrition references which were unregulated, and unregulated references to negative nutrients were particularly prevalent on foods deemed most processed. While most work examining FOP references on pre-packaged foods has not
differentiated regulated and unregulated nutrition information, research conducted on some specific product groups suggests that the presence of an unregulated nutrition reference may indicate a product that is nutritionally inferior to those bearing a regulated claim.\textsuperscript{20,95} Insofar as public health authorities see the development of regulated FOP references as both a tool to provide nutritional guidance to consumers and an incentive for manufacturers to reformulate products to achieve better nutrient profiles,\textsuperscript{81} manufacturers’ use of unregulated text merits further study. It is important to recognize that consumers are unlikely to be capable of differentiating between FOP references that are regulated and ones that are not. Future research is needed to better understand manufacturers’ motivations for using unregulated references and the implication of these labels for product sales.

We employed three distinct classification systems in this study as a means to better understand the relationship between product processing and the presence of FOP nutrition references. All three systems yielded similar results with respect to the greater presence of FOP nutrition labels in general and negative nutrition references, in particular, on products considered to be in the highest category of processing. However, several discrepancies surfaced when we considered manufacturers’ use of positive nutrition references because different research groups classify some processed foods with particular nutritional properties differently. Closer examination of the discrepancies highlighted the effects of the differential classification of some specific food products across these three systems on our findings. For example, the highly significant lower odds of regulated positive nutrition references on highly processed foods than less processed food categories, as defined by Poti et al, reflect the exclusion of some products made with whole grains (e.g. whole-grain breads and cereals) and commonly labelled with regulated fibre claims from the most highly processed category in this system.\textsuperscript{40} This exclusion lessened the potential for positive nutrition references in this category relative to the most processed food category in the other two classification systems. Inconsistent results were also observed across systems when examining the presence of unregulated positive references. Foods classified as most processed under the IFIC system (i.e., ‘ready-to-eat’ processed foods) were more likely than others to bear positive unregulated references, but the pattern was less clear when examining this relationship using the other two systems. The explanation for this discrepancy appears to lie in the different classifications of convenience foods across the three systems. Convenience products, with a lower density of unregulated positive reference, were classified in the highest degree of processing under NOVA and Poti et al, but not in the highest category of IFIC.\textsuperscript{60} Although
subtle, the differences in food classification across systems may have important implications for research results, as demonstrated in our current analyses. Researchers should be cognizant of these differences when choosing a classification system to define food processing; the three systems applied here are clearly not interchangeable.

Although the work presented here represents a robust assessment of FOP nutrition references on processed foods, some limitations should be considered in the interpretation of our results. First, the data were collected over a one-year period in 2010-2011 and therefore may not be reflective of the current food marketplace. References to sodium, for instance, might be more prevalent on foods now than when our data were collected, given the heightened public awareness of sodium levels in the Canadian food supply following the release of Canada’s Sodium Reduction Strategy. Similarly, the more recent liberalization of fortification polices in Canada, which affords manufacturers expanded opportunities for micronutrient additions to processed food products, may now also translate into a greater frequency of positive nutrition references than observed on heavily processed products in the present study. More research is required to determine how dynamic manufacturers’ use of discretionary FOP nutrition references is in the face of shifting public health priorities and new opportunities for product innovation.

Our study was also limited by our lack of nutritional content information and data on product sales. Although there is considerable evidence to suggest that FOP nutrition references do not necessarily signify nutritionally superior products, there is limited research on the effects of these references on food selection and purchasing behaviors. Future work would benefit from an examination of how the use of FOP references by manufacturers impacts consumer behavior and the nutritional quality of their diets.

Our examination of FOP nutrition references on packaged foods sold in Canadian supermarkets reflects manufacturers’ practices at one point in time, in a regulatory environment where the use of some specific nutrient content claims are regulated but the display of both regulated and unregulated nutrition references is at the discretion of the manufacturer. Our finding that FOP nutrition references, and references to ‘negative’ ingredients in particular, were significantly more likely to appear on heavily processed foods raises questions about the adequacy of this form of nutrition guidance to direct consumers towards healthier food choices. The evolving discourse on FOP labelling in North America has so far focused on the nutrient requirements for a standardized, but still discretionary, FOP label that provides a more global assessment of the
nutritional value of a product. Our findings add to this discussion by highlighting the markedly different FOP labelling practices on foods with different levels of processing. Implementation of a mandatory, standardized system is necessary to ensure that the nutritional value of all foods available for sale is communicated to consumers. Failing this, regulators should perhaps consider calls for the abolition of the practice of FOP nutrition referencing, as put forward by others.
Table 4.1. Description of highest food processing categories and their distinguishing and common features, across three classification systems

<table>
<thead>
<tr>
<th>Classification System</th>
<th>Highest level of processing</th>
<th>Description</th>
<th>Distinguishing features</th>
<th>Examples of common foods</th>
</tr>
</thead>
<tbody>
<tr>
<td>International Food Information Council (IFIC)⁶¹</td>
<td>‘Ready-to-eat’ processed foods</td>
<td>Foods requiring minimal or no preparation, including packaged ready-to-eat foods and mixtures</td>
<td>Mostly stand-alone products such as crackers, sodas, energy bars (e.g. margarine, breads, sauces not included)</td>
<td>Chips, salty snacks, candies, crackers, nut butters, ice cream, granola bars, cookies, muffins, fruit chews, luncheon meats, hot dogs, hamburgers, energy, drinks, fruit drinks, carbonated beverages, french fries, energy bars, fortified meal replacements</td>
</tr>
<tr>
<td>NOVA⁴¹</td>
<td>Ultra-processed products</td>
<td>Foods typically containing little or no whole foods. Containing multiple ingredients, some of which are derived from whole foods but others by further processing. Majority of ingredients are preservatives including stabilizers, emulsifiers, flavours and colours</td>
<td>Includes products that can be consumed as additions (e.g. condiments, dips, sauces, toppings, margarine, bread) or alone (e.g. frozen meals, prepared mixed dishes)</td>
<td></td>
</tr>
<tr>
<td>Poti et al.⁶²</td>
<td>Highly processed products</td>
<td>Multi-ingredient industrially formulated mixtures processed to the extent they are no longer recognizable as their original source</td>
<td>Mostly consistent with the NOVA system, apart from exclusion of whole grain products without added sugar/fat (e.g. whole grain breads and breakfast cereals) from this category</td>
<td></td>
</tr>
</tbody>
</table>
Table 4.2. Frequency of FOP nutrition references, by level of processing, across three classification systems (n=20520)

<table>
<thead>
<tr>
<th>Type of FOP reference</th>
<th>Any negative</th>
<th>Any positive</th>
<th>Any regulated negative</th>
<th>Any unregulated negative</th>
<th>Any regulated positive</th>
<th>Any unregulated positive</th>
<th>Any symbol/system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>5148</td>
<td>4334</td>
<td>4538</td>
<td>2110</td>
<td>2985</td>
<td>1689</td>
<td>1529</td>
</tr>
<tr>
<td>IFIC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimally processed</td>
<td>266</td>
<td>609</td>
<td>191</td>
<td>167</td>
<td>358</td>
<td>237</td>
<td>80</td>
</tr>
<tr>
<td>Processed for preservation</td>
<td>593</td>
<td>766</td>
<td>571</td>
<td>140</td>
<td>611</td>
<td>194</td>
<td>287</td>
</tr>
<tr>
<td>Mixtures of combined ingredients</td>
<td>1434</td>
<td>840</td>
<td>1251</td>
<td>448</td>
<td>598</td>
<td>276</td>
<td>394</td>
</tr>
<tr>
<td>Pre-prepared meals</td>
<td>421</td>
<td>251</td>
<td>308</td>
<td>216</td>
<td>216</td>
<td>886</td>
<td>138</td>
</tr>
<tr>
<td>'Ready-to-eat' processed</td>
<td>2434</td>
<td>1868</td>
<td>2217</td>
<td>1139</td>
<td>1202</td>
<td>886</td>
<td>630</td>
</tr>
<tr>
<td>NOVA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimally processed</td>
<td>548</td>
<td>901</td>
<td>486</td>
<td>188</td>
<td>705</td>
<td>215</td>
<td>224</td>
</tr>
<tr>
<td>Processed culinary ingredients</td>
<td>191</td>
<td>13.1</td>
<td>342</td>
<td>183</td>
<td>37</td>
<td>270</td>
<td>139</td>
</tr>
<tr>
<td>Processed food products</td>
<td>466</td>
<td>17.5</td>
<td>435</td>
<td>364</td>
<td>205</td>
<td>303</td>
<td>131</td>
</tr>
<tr>
<td>Ultra-processed</td>
<td>3943</td>
<td>2656</td>
<td>3505</td>
<td>1680</td>
<td>1707</td>
<td>1204</td>
<td>1085</td>
</tr>
</tbody>
</table>

Poti et al.
<table>
<thead>
<tr>
<th></th>
<th>50</th>
<th>13.7</th>
<th>683</th>
<th>27.5</th>
<th>318</th>
<th>12.8</th>
<th>99</th>
<th>4.0</th>
<th>535</th>
<th>21.5</th>
<th>170</th>
<th>6.9</th>
<th>194</th>
<th>7.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unprocessed/min. processed</td>
<td>339</td>
<td>18.4</td>
<td>452</td>
<td>24.1</td>
<td>326</td>
<td>17.4</td>
<td>63</td>
<td>3.4</td>
<td>383</td>
<td>20.4</td>
<td>150</td>
<td>8.0</td>
<td>128</td>
<td>6.8</td>
</tr>
<tr>
<td>Basic processed</td>
<td>765</td>
<td>20.5</td>
<td>795</td>
<td>21.3</td>
<td>616</td>
<td>16.5</td>
<td>357</td>
<td>9.6</td>
<td>524</td>
<td>14.0</td>
<td>301</td>
<td>8.1</td>
<td>220</td>
<td>5.9</td>
</tr>
<tr>
<td>Moderately processed</td>
<td>3700</td>
<td>30.0</td>
<td>2404</td>
<td>19.3</td>
<td>3278</td>
<td>26.4</td>
<td>1591</td>
<td>12.8</td>
<td>1546</td>
<td>12.4</td>
<td>1068</td>
<td>8.6</td>
<td>987</td>
<td>7.9</td>
</tr>
</tbody>
</table>
Table 4.3. Odds of FOP nutrition references by level of processing, across three classification systems (n=20520)

<table>
<thead>
<tr>
<th>Type of FOP reference</th>
<th>Any nutrition</th>
<th>Any negative</th>
<th>Any positive</th>
<th>Any regulated negative</th>
<th>Any unregulated negative</th>
<th>Any regulated positive</th>
<th>Any unregulated positive</th>
<th>Any symbol/system</th>
</tr>
</thead>
<tbody>
<tr>
<td>IFIC</td>
<td>OR 95% CI</td>
<td>OR 95% CI</td>
<td>OR 95% CI</td>
<td>OR 95% CI</td>
<td>OR 95% CI</td>
<td>OR 95% CI</td>
<td>OR 95% CI</td>
<td>OR 95% CI</td>
</tr>
<tr>
<td>Minimally processed</td>
<td>0.54 0.48, 0.58</td>
<td>0.25 0.22, 0.29</td>
<td>0.97 0.87, 1.07</td>
<td>0.20 0.17, 0.23</td>
<td>0.40 0.34, 0.47</td>
<td>0.87 0.77, 0.99</td>
<td>0.78 0.67, 0.91</td>
<td>0.36 0.28, 0.46</td>
</tr>
<tr>
<td>Processed for preservation</td>
<td>0.68 0.62, 0.74</td>
<td>0.56 0.50, 0.62</td>
<td>1.13 1.02, 1.24</td>
<td>0.61 0.55, 0.67</td>
<td>0.29 0.24, 0.35</td>
<td>1.45 1.30, 1.62</td>
<td>0.55 0.47, 0.65</td>
<td>1.24 1.07, 1.43</td>
</tr>
<tr>
<td>Mixtures of combined ingredients</td>
<td>0.51 0.48, 0.55</td>
<td>0.69 0.64, 0.75</td>
<td>0.52 0.47, 0.57</td>
<td>0.66 0.61, 0.72</td>
<td>0.47 0.42, 0.53</td>
<td>0.61 0.55, 0.68</td>
<td>0.38 0.33, 0.43</td>
<td>0.80 0.70, 0.92</td>
</tr>
<tr>
<td>Pre-prepared meals</td>
<td>0.57 0.51, 0.64</td>
<td>0.72 0.64, 0.81</td>
<td>0.55 0.47, 0.63</td>
<td>0.55 0.49, 0.63</td>
<td>0.85 0.73, 0.99</td>
<td>0.80 0.68, 0.93</td>
<td>0.47 0.37, 0.58</td>
<td>1.00 0.83, 1.22</td>
</tr>
<tr>
<td>‘Ready-to-eat’ processed *</td>
<td>1.00 -</td>
<td>1.00 -</td>
<td>1.00 -</td>
<td>1.00 -</td>
<td>1.00 -</td>
<td>1.00 -</td>
<td>1.00 -</td>
<td></td>
</tr>
<tr>
<td>NOVA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimally processed</td>
<td>0.75 0.69, 0.81</td>
<td>0.42 0.38, 0.46</td>
<td>1.33 1.22, 1.45</td>
<td>0.43 0.39, 0.48</td>
<td>0.38 0.32, 0.44</td>
<td>1.64 1.49, 1.81</td>
<td>0.63 0.54, 0.73</td>
<td>0.74 0.64, 0.86</td>
</tr>
<tr>
<td>Processed culinary ingredients</td>
<td>0.55 0.49, 0.62</td>
<td>0.34 0.29, 0.40</td>
<td>1.18 1.04, 1.34</td>
<td>0.39 0.33, 0.45</td>
<td>0.17 0.13, 0.24</td>
<td>1.49 1.29, 1.72</td>
<td>1.02 0.85, 1.23</td>
<td>0.68 0.54, 0.86</td>
</tr>
<tr>
<td>Processed food products</td>
<td>0.58 0.54, 0.64</td>
<td>0.48 0.43, 0.54</td>
<td>0.75 0.67, 0.83</td>
<td>0.42 0.38, 0.48</td>
<td>0.57 0.48, 0.65</td>
<td>0.84 0.74, 0.96</td>
<td>0.50 0.42, 0.60</td>
<td>0.58 0.48, 0.69</td>
</tr>
<tr>
<td>Ultra-processed*</td>
<td>1.00 -</td>
<td>1.00 -</td>
<td>1.00 -</td>
<td>1.00 -</td>
<td>1.00 -</td>
<td>1.00 -</td>
<td>1.00 -</td>
<td></td>
</tr>
<tr>
<td>Poti et al.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unprocessed/min. processed</td>
<td>0.89 0.78, 0.93</td>
<td>0.37 0.33, 0.42</td>
<td>1.59 1.44, 1.75</td>
<td>0.41 0.36, 0.47</td>
<td>0.28 0.23, 0.35</td>
<td>1.92 1.72, 2.15</td>
<td>0.78 0.66, 0.93</td>
<td>0.98 0.84, 1.16</td>
</tr>
<tr>
<td></td>
<td>0.82</td>
<td>0.74, 0.79</td>
<td>0.53, 0.73</td>
<td>0.50, 0.56</td>
<td>1.33, 1.13</td>
<td>1.82, 1.03</td>
<td>0.59, 0.55</td>
<td>0.52, 0.60</td>
</tr>
<tr>
<td>----------------</td>
<td>------</td>
<td>-------------</td>
<td>-------------</td>
<td>-------------</td>
<td>-------------</td>
<td>-------------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Basic processed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderately processed</td>
<td>0.79</td>
<td>0.74, 0.85</td>
<td>0.53, 0.66</td>
<td>0.50, 1.24</td>
<td>1.33, 1.24</td>
<td>1.82, 1.28</td>
<td>0.59, 0.61</td>
<td>0.52, 0.81</td>
</tr>
<tr>
<td>Highly processed*</td>
<td>1.00</td>
<td>-</td>
<td>-</td>
<td>1.00</td>
<td>-</td>
<td>-</td>
<td>1.00</td>
<td>-</td>
</tr>
</tbody>
</table>

* indicates highest processing level for each classification system and reference category
Table 4.4. Results of negative binomial regression models on total number of FOP references by level of processing, across three classification systems (n= 20520)

<table>
<thead>
<tr>
<th>IFIC</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>β</th>
<th>SE</th>
<th>exp(β)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimally processed</td>
<td>2549</td>
<td>1.28</td>
<td>2.49</td>
<td>-0.49</td>
<td>0.036</td>
<td>0.61</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Processed for preservation</td>
<td>2860</td>
<td>1.66</td>
<td>2.13</td>
<td>-0.23</td>
<td>0.033</td>
<td>0.79</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Mixtures of combined ingredients</td>
<td>5835</td>
<td>1.33</td>
<td>2.60</td>
<td>-0.45</td>
<td>0.027</td>
<td>0.64</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Pre-prepared meals</td>
<td>1662</td>
<td>1.43</td>
<td>2.30</td>
<td>-0.38</td>
<td>0.42</td>
<td>0.68</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>‘Ready-to-eat’ processed *</td>
<td>7618</td>
<td>2.10</td>
<td>1.98</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NOVA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimally processed</td>
<td>6821</td>
<td>1.41</td>
<td>2.15</td>
<td>-0.36</td>
<td>0.024</td>
<td>0.69</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Processed culinary ingredients</td>
<td>755</td>
<td>1.58</td>
<td>2.60</td>
<td>-0.24</td>
<td>0.056</td>
<td>0.79</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Processed food products</td>
<td>2684</td>
<td>1.02</td>
<td>1.76</td>
<td>-0.67</td>
<td>0.035</td>
<td>0.52</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Ultra-processed*</td>
<td>10260</td>
<td>2.01</td>
<td>2.59</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poti et al.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unprocessed/min. processed</td>
<td>6852</td>
<td>1.73</td>
<td>2.36</td>
<td>-0.11</td>
<td>0.034</td>
<td>0.90</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Basic processed</td>
<td>991</td>
<td>1.28</td>
<td>2.14</td>
<td>-0.41</td>
<td>0.027</td>
<td>0.66</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Moderately processed</td>
<td>3212</td>
<td>1.49</td>
<td>2.58</td>
<td>-0.25</td>
<td>0.032</td>
<td>0.78</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Highly processed*</td>
<td>9465</td>
<td>1.92</td>
<td>2.53</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* indicates highest processing level for each classification system and reference category
Figure 4.1. Number of products with any FOP nutrition reference by food category (n=20520)
Figure 4.2. Proportion of FOP nutrition references on packaged foods, by level of processing, across three classification systems (n=20520)
Figure 4.3. Proportion of fat, calorie, sugar and sodium references among ‘negative’ referenced products in the highest level of processing, by classification systems. *‘Negative’ references were coded to include a variety of text under a single term (e.g. references that referred to the fat content of a product included trans fat, saturated fat, total fat content).
**Supplementary Table 4.1:** Category and definition for classifying processed foods across three systems of classification, with food product examples.

<table>
<thead>
<tr>
<th>IFIC Category/definition</th>
<th>Example</th>
<th>NOVA Category/definition</th>
<th>Example</th>
<th>Poli et al Category/definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimally processed</td>
<td>Packaged fruits and vegetables; roasted nuts; milk</td>
<td>Unprocessed and minimally processed Foods being of plant/animal altered in ways that do not add/introduce any substance, but that may involve subtracting parts of the food in ways not significantly affecting use</td>
<td>Fresh, chilled, frozen, vacuum-packed vegetables and fruits; grains (cereals); fruit juices; milk, plain yoghurt;</td>
<td>Unprocessed/minimally processed Single-ingredient foods with no or very slight modifications that do not change inherent properties of the food as found in its natural form</td>
<td>Milk, eggs, fresh/frozen/dried fruit; herbs and spices; brown rice</td>
</tr>
<tr>
<td>Processed for preservation</td>
<td>Canned tuna, beans and fruit; fruit juices; broth</td>
<td>Processed culinary ingredients Food products extracted and purified by industry from constituents of foods, or else obtained from nature, such as salt</td>
<td>Plant oils; animal fats; sugars and syrups; flours, uncooked ‘raw’ pasta</td>
<td>Basic processed Ingredients: Isolated food components obtained using processes that change inherent properties of the food For preservation: Foods modified for the purpose of preservation or precooking but remaining as single foods</td>
<td>Fruit juices; unsweetened canned fruit/veg.; whole grain flour; plain yogurt; oil; salt; unsalted butter; unsweetened/salted peanut butter</td>
</tr>
<tr>
<td>Mixtures of combined ingredients</td>
<td>Breads; sugars and sweeteners; cheese; margarine, sauces and dressings</td>
<td>Processed food products Foods manufactured by adding substances like oil, sugar or salt to whole foods. Generally produced to be consumed as part of meals, or used, together</td>
<td>Canned/bottled vegetables; tinned fish preserved in oil; salted nuts; bacon, smoked</td>
<td>Moderately processed Single minimally or moderately processed foods with addition of flavor additives; directly recognizable as original plant/animal source.</td>
<td>Sweetened/flavoured fruit juice, milk, yogurt peanut butter; cheese; salted butter; whole-grain breads</td>
</tr>
<tr>
<td>Visual appeal</td>
<td>with ultra-processed products, replacing freshly prepared dishes</td>
<td>fish; cheese</td>
<td>Grain products made from whole-grain flour, water, salt and/or yeast</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ready-to-eat processed Foods needing minimal or no preparation</td>
<td>Sodas, cookies; breakfast cereal; lunch meat, Ultra-processed products Foods typically containing little or no whole foods. Containing multiple ingredients, some of which are derived from whole foods but others by further processing. Majority of ingredients are preservatives including stabilizers, emulsifiers, flavours and colours</td>
<td>Chips; ice-cream; confectionery; breakfast cereals; margarine; sweetened yoghurts; pre-prepared dishes; meal substitutes</td>
<td>Highly processed Multi-ingredient industrially formulated mixtures processed to the extent they are no longer recognizable as their original source</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prepared foods/meals Foods packaged for freshness and ease of preparation</td>
<td>Prepared deli foods; frozen meals; pizzas</td>
<td>--</td>
<td>--</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Soda; bread; breakfast cereals; margarine; prepared dishes
5.0 STUDY 2: SUBSTITUTE FOODS ARE MORE LIKELY THAN THEIR TRADITIONAL FOOD COUNTERPARTS TO DISPLAY FRONT-OF-PACKAGE REFERENCES

Abstract

Innovative foods typically reflect a high degree of formulation and nutritional modification, and they are often designed to substitute for conventional, less-processed items in the diet. These products have become pervasive in Canada, aided by regulatory frameworks that encourage product development and enable on-package nutrition promotion. Our goal was to examine how the presence and nature of FOP references relate to product innovation, focussing on products with novel ingredients and/or formulation processes that have been designed as substitutes for traditional foods. FOP references were recorded from packaged foods in 3 national chain retailers located in Toronto (n=20520). Foods were categorized as substitute or traditional counterparts if these had 1) immediate interchangeability within the diet and 2) inherently different formulation. Nine substitute-traditional pairs were identified, comprising 20% of products in the dataset. Logistic regression analyses found substitute foods were more likely than traditional products to bear any nutrition reference, both regulated and unregulated, and to bear ‘organic’ and ‘natural’ references. Taken together, substitute foods bore 1.52 times more FOP references than their traditional counterparts. These findings suggest FOP labelling may serve as a strategic promotional tool to displace established traditional products from the diet, raising questions about the utility of this discretionary practice for nutritional guidance.
5.1 Introduction

In Canada, and in other jurisdictions, there has been a proliferation of innovative, novel food and beverage products on grocery store shelves. These products are characterized by deliberate modifications through nutritional engineering to alter conventional formulations and/or the introduction of novel compositional constituents (e.g. use of phytosterols in fat spreads; beverages with non-essential amino acids). Innovative foods typically reflect a high degree of processing and are thought to be designed to displace or substitute for traditional, less-processed options. The introduction of margarine, for instance, was fueled by a perceived need to provide a healthier and lower-cost plant-based alternative to butter. Butter and margarine are similar in their use (e.g. cooking; baking), while differing in their formulation and fat content.

The proliferation of innovative products has in part been aided by technological advancement in food manufacturing and nutritional engineering. In Canada, some product innovation has additionally been enabled by regulatory amendments that encourage product development through expanded opportunities for discretionary fortification, permitting greater nutrient additions to foods irrespective of public health need. However, the proliferation of innovative products may also relate to their nutritional promotion. It has been argued that highly processed foods have displaced more traditional foods from the diet, in part through the use of aggressive and strategic marketing. FOP nutrition references have been shown to influence consumer’s purchasing behavior, and there is some evidence that they are more prevalent on novel, substitute foods. An examination of ‘novel beverages’ sold in Canadian grocery stores, for instance, found that nearly all energy drinks, vitamin waters and nutrient-enhanced fruit beverages displayed some form of nutrition reference, a finding in stark contrast to research reporting that only a third of traditional fruit juices bore nutrition references. Similarly, an earlier study of margarines found that over half of these relatively innovative foods displayed a nutrient content claim. Longitudinal studies of new product launches have documented an increased prevalence of FOP references on these products in recent years, but to date there has been no systematic, empirical assessment of the on-package nutritional promotion of innovative products. The goal of this study was to examine the propensity for FOP labelling to displace less processed items from the diet by explicitly pairing highly processed,
innovative products to their more traditional counterparts. Specifically we aimed to examine how the presence and nature of FOP references relate to product innovation, focusing on products with novel ingredients and/or formulation processes that are designed as substitutes for traditional foods.

5.2 Methods

5.2.1 Data collection

Our study drew on a larger survey of FOP references found on foods and beverages sold in national chain retailers in Toronto, conducted between July 2010 and August 2011. A single store was selected from the top three food retailers in Canada (Loblaw, Metro and Sobeys), representing 71% of the total Canadian retail market-share. Data collectors systematically recorded all descriptive text on the front of packaged foods, including product identifiers (i.e. brand and product name, variety and product size), nutrient content claims, quantitative statements, generic and product-specific health claims, third-party- (e.g. The Heart and Stroke Foundation of Canada's Health Check) and manufacturer- (e.g. Kraft’s Sensible Solutions) developed symbols and summary systems, as well as any other descriptive or implied references emphasizing the presence or absence of a specific nutrient. References to ‘natural’, ‘pure’ or ‘real’, (henceforth all referred to as ‘natural’) and ‘organic’ references were also noted in recognition of work which has documented an expanded demand for products marketed with this additional discretionary FOP material.

After removing duplicate products, 20520 unique packaged items were captured in the database for analysis. Products were considered unique if they differed from similar products on the basis of any product identifier.

5.2.2 Data analysis

For the purposes of this study, innovative products were defined as foods that i) are designed to function as alternates or substitute foods for traditional foods in the diet and ii) have been created through the use of novel or unusual ingredients and/or formulation processes. All products
were classified by food category using The Bureau of Nutritional Sciences’ food grouping developed by Health Canada.\textsuperscript{182} This categorization was expanded to more fully capture major differences in composition, variations in modes of preparation and form of presentation (e.g. frozen fruit versus dried fruit). Food categories were then screened to identify foods that comprised substitute-traditional pairs, defined as foods that had interchangeable use within the diet, but inherently different formulations, such that the substitute member had innovative ingredients and/or processing. Following these criteria, products that differed by a single adulteration (e.g. plain yogurt and yogurt with inulin) were not included in the analysis.

Each product was coded for the presence of any form of nutrition reference (e.g. summary systems and symbols, quantifying statements, nutrient content and health claims). To investigate the nature of the nutrition references present on substitute-traditional pairs, these references were further classified as ‘negative’ or ‘positive’. Negative references were defined as those which conveyed the reduction or absence of a nutrient for which there is public health messaging to limit exposure (e.g. ‘low sodium’, ‘\textit{trans} fat free’, ‘no added sugar’).\textsuperscript{2,69,71} Positive nutrition references were those that highlighted the presence or addition of a nutrient deemed beneficial (e.g. ‘good source of calcium’, ‘high in fibre’). FOP nutrition references were also categorized as being regulated (e.g. nutrient content and disease risk reduction claims) or unregulated, following previous work which suggests the use of unregulated references may signal lower concentrations of a particular nutrient than is found in a product displaying regulated references.\textsuperscript{20,95} Regulated nutrient content and disease-risk reduction claims, in addition to product specific claims (e.g. claims permissible only on meal replacements, NHPs), were identified based on the prescribed wording and permitted wording variations outlined in the Canadian Food and Drug Regulations\textsuperscript{72} and Canadian Food Inspection Agency’s Guide to Food Labelling and Advertising.\textsuperscript{73} All other FOP nutrition references, including quantifying statements (e.g. ‘x grams of protein’) and those which appeared to more deliberately avoid compositional requirements through wording manipulation (e.g. regulated ‘plus energy’ versus unregulated ‘\textit{energy+}’) were classified as unregulated. The total number of references on the FOP, including nutrition, ‘organic’ and ‘natural’ references, was also coded for each product.

Multilevel logistic regression modeling was conducted using PROC GLIMMIX in SAS statistical software (version 9.4, SAS Institute, Cary NC, 2014) to assess the relationship between the presence and nature of FOP references and product innovation, accounting for the fact that
products are nested within their individual substitute-traditional pairs. The association between the extent (i.e., total number) of the nutrition, ‘organic’ and ‘natural’ references on substitute-traditional pairs was examined by fitting a negative binomial distribution, appropriate for count outcome variables of this nature (e.g. values of 0,1,2,3…),\textsuperscript{176} to the PROC GLIMMIX model.

Recognizing that the direction of one of these pairs, fruit/vegetable drinks-juices, diverged from the pattern observed amongst the others, a detailed examination of the nature of FOP nutrition references on these products was undertaken (\textbf{Supplementary Table 5.1}). Multilevel logistic regression modeling, excluding this pair, was also repeated as a robustness test to confirm that the effect of this divergent pair was to attenuate the findings of the analyses described above. As expected, removing drinks/juices from our models strengthened the magnitude of our observed effects (\textbf{Supplementary Tables 5.2a/5.2b}).

\textbf{5.3 Results}

Nine substitute-traditional food pairs were identified (\textbf{Table 5.1}), representing 20\% (n=4015) of the 20,520 products in the database. Table 1 describes these pairs and displays the proportion of products with FOP nutrition references and the frequency of specific nutrition references within pairs. In 8 of the 9 pairs, substitute foods had a greater proportion of nutrition references than did their traditional counterparts (\textbf{Table 5.1}). An inverse relationship was seen in the fruit/vegetable drinks-fruit/vegetable juices pair; drinks bore a greater proportion of nutrition references than their traditional juice counterpart (\textbf{Table 5.1}; \textbf{Supplementary Table 5.1}).

An in-depth assessment of the nature of nutrition messaging found on substitute and traditional pairs revealed that, in some instances, references on substitute products asserted nutritional superiority, denoting food attributes not found on traditional products (\textbf{Table 5.1}). These included claims such as ‘lactose free’ on non-dairy milks, for instance, and those highlighting the removal of certain negative ingredients, such as claims indicating a reduction in fat. While such claims also appeared on some traditional counterparts, they were far less frequent. Other references on substitute foods asserted nutritional equivalence to traditional products. Meat alternatives and egg substitutes, for instance, displayed ‘a good source of protein’ claims, and non-dairy items highlighted the presence of calcium.
Substitute foods were 1.64 times more likely to bear a nutrition reference than traditional foods (Table 5.2). Results from the negative binomial model also found substitute foods bore, on average, 1.52 times more FOP references than did their traditional food counterparts (Table 5.3).

Examination of the nature of these references similarly showed substitute foods to also be more likely than their traditional counterparts to display negative or positive nutrition reference and to assert nutrition references using both regulated and unregulated language (Table 5.2). Substitute foods were also more likely than traditional products to bear ‘organic’ and ‘natural’ references (Table 5.2).

5.4 Discussion

The results of this study revealed that FOP references, irrespective of their nature, were more common on products with innovative ingredients and formulations that had been designed to substitute for traditional foods. Insofar as nutritional messaging and references to ‘organic’ and ‘natural’ can drive product purchasing,16, 138 their use by manufacturers may be a means for substitute foods to attract consumer attention and gain entry into the market and subsequently the diet.

Investigation into the nature of FOP references showed that both negative and positive nutrition references appeared with greater likelihood on substitute foods than traditional food counterparts, with the exception of the juice-drink pair. The compositional elements highlighted on-package appeared to be specific to a particular pairing. Meat product alternatives, for instance, primarily referenced the absence of fat and/or the presence of protein – both characteristics of conventional meat products, while non-dairy milks highlighted the absence of trans fat and lactose. Substitute foods as a group, however, displayed proportionally more positive references than negative nutrition references. Further investigation into the nature of ‘positive’ nutrition references found on substitute foods revealed that this messaging related to asserting nutritional equivalence to their traditional counterpart or superiority with respect to nutrient enhancements often unattainable by their less processed, more natural pair. Enhanced water beverages, for instance, referenced micronutrient enhancements and the reduction or absence of calories. These findings lend weight to arguments that innovative foods are manufactured to displace traditional foods.
from the diet, employing product enhancement and promotional strategies, capitalizing on the increasing consumer demand for nutritionally improved products.

While the mandatory NFt enables motivated consumers to compare the nutritional content of substitute and traditional items, the importance of FOP references in establishing product equivalence and superiority hinges on the visibility and simplicity of this information. FOP nutrition references on substitute products that highlight superiority or equivalence with respect to the reduction in total fat or the presence of protein or calcium, for instance, can be verified by comparing the NFt of different products. Consumers are powerless, however, to assess the relative merits of innovative products marketed through references to nutrients that are not mandatory on the NFt. In addition, regardless of whether compositional information with respect to a certain nutrient is found on the NFt, studies have indicated that most consumers lack the nutrition literacy required to critically appraise the nutritional content of a product or its value in the diet and prefer the simplified messaging present on the FOP in their food selection.

Investigation into other FOP marketing tactics showed substitute foods were more likely to display ‘natural’ and ‘organic’ references than their traditional counterparts, although ‘natural’ references appeared at three times the rate of ‘organic’ references. Foods differentiated along these axes have resulted in expanded consumer demand in recent years, owing largely to perceptions that these products are ‘healthier’ safer, with fewer additives and less adulteration than conventional products. However, the fact that much of this labelling is found on highly processed, innovative products is counter-intuitive and may reflect manufacturers’ attempts to blur the processed/unprocessed food distinction. While organic labelling must comply with strict regulatory standards, the term ‘natural’ is undefined, and its use is entirely unregulated. However, consumers associate ‘natural’ foods with organic foods, and manufacturers therefore may seek to use ‘natural’ labels as a means to confer the notion of quality without adhering to organic certification processes.

Examining individual substitute-traditional pairs revealed that the pattern of FOP references observed overall differed in one instance. The greater proportion of nutrition references on traditional juice products than on their more formulated drink counterparts can be explained by a high prevalence of references to the absence of added sugars and the presence of vitamin C claims on juices. Manufacturers’ highlighting of the inherent nutrition profile of juices may be a
strategy to compete with fruit and vegetable drink products, which are often enriched with vitamins or formulated with artificial sweeteners and promoted as such. The anomaly observed within this pairing with respect to the concentration of FOP references, however, may also speak to price differences between drink and juice products. Since fruit drinks are priced up to a third lower than more natural, whole juice products, it may be that product innovation here has been intended to construct a value offering. Given evidence that the price of a product trumps nutritional quality in food purchasing amongst low-income, price-conscience consumers, it is less probable that value offerings would bear FOP references and market products by their nutritional attributes. More research is needed, however, to examine the price of innovative products in relation to the display of FOP references.

Our work is the first study to investigate the presence of FOP references on foods constituting substitute-traditional pairs. In the absence of an established definition of substitute and traditional products, a framework was developed here, driven by our understanding of innovative foods as those which could displace existing traditional products from the diet through novel and distinct formulations. There are other products, however, that could be considered as substitutes for traditional foods. Products such as breakfast cereals, for instance, which are known to be marketed based on nutrition properties, are difficult to pair with a specific traditional food since these serve as substitutes for entire meals. Food pairs that differed by only a single ingredient, such as yogurts fortified with inulin or enriched with probiotics, also fell outside of our definition as they did not display sufficient heterogeneity to be deemed distinct products, but they may otherwise be considered as alternatives to more conventional formulations (i.e., plain yogurts). Fresh, unpackaged foods were excluded from our dataset and therefore from this analysis, but certain unpackaged products such as fresh meat could be considered as traditional counterparts to the meat alternatives examined here. Nevertheless, the conservative definition of substitute-traditional pairs applied in the current work enabled the assessment of 20% of products collected and allowed for significant positive associations of the presence of FOP references on substitute, relative to traditional, foods to be observed. More research is needed to elaborate the notion of substitute-traditional pairs, including what consumers choose as substitutes for existing traditional foods in their diets.

Whether product innovation signals a nutritionally superior product is beyond the scope of this study, although the question warrants further investigation. In some cases, the products identified
as substitute foods may confer important benefits for some consumers. Non-dairy substitutes, for instance, represent important alternatives for those with lactose intolerance. Similarly, reduced- or no-calorie sweeteners may represent a necessary sugar substitute for people with diabetes. No such argument can be made for the promotion of innovative products such as enhanced water beverages and energy drinks, however, because the micronutrients in these products are generally unrelated to need. The aggressive messaging seen on highly formulated substitute foods also raises concerns with regards to the promotion of such processed products. Highly processed or ultra-processed foods have come under scrutiny recently for contributing to dietary patterns which can lead to negative health outcomes. While most nutrition references in our sample represented regulated claims, there was also a strong positive association between substitute foods and the display of unregulated references indicating that manufacturers are also more likely to engage in labelling practices that do not require approved nutrient criteria and therefore the relative nutritional quality of a product is not assured.

Although the research presented here represents a novel assessment of innovative food substitutes gleaned from a large number of products, some additional limitations must be considered in the interpretation of our results. While data collection was situated in three large grocery stores of retail chains representing 71% of the total Canadian retail market-share, it was limited to the Toronto area, so our results may not be generalizable across Canada. Furthermore, the data were collected over a one-year period from 2010-2011 and therefore may not reflect the current food marketplace. The development and marketing of innovative products is a dynamic process, and it is likely that some of the products analysed are no longer present on grocery shelves, while others have since been introduced as substitutes to replace other traditional products.

Our finding that substitute foods are more likely than their traditional counterparts to display FOP references, with the exception of one pair, is congruent with previous arguments that suggest manufacturers seize the marketing opportunities available to them in the garnering of market-share to establish a particular food’s dominance in the diet. Insofar as food purchasing behaviours are influenced by FOP messaging, the disproportionate use of nutrition references on substitute foods raises important questions with respect to the utility of this discretionary practice of FOP labelling as a tool for nutritional guidance.

Table 5.1. Presence of FOP nutrition references amongst 9 substitute-traditional pairs (n=4015)
<table>
<thead>
<tr>
<th>Substrate-traditional pair</th>
<th>N</th>
<th>Any nutrition reference (%)</th>
<th>Frequency of nutrition references (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Margarine</td>
<td>93</td>
<td>85</td>
<td>Omega-3 (57), Total Fat (56), Saturated Fat (35), Vitamin D (13), Sodium (4)</td>
</tr>
<tr>
<td>Butter</td>
<td>41</td>
<td>15</td>
<td>Omega-3 (5), Total Fat (7), Light (7), Sodium (7)</td>
</tr>
<tr>
<td>Fruit/veg drinks</td>
<td>443</td>
<td>48</td>
<td>Vitamin C (25), Calories (15), Sucralose (13), Sugar (9), Vitamin A (1)</td>
</tr>
<tr>
<td>Fruit/veg juices</td>
<td>555</td>
<td>65</td>
<td>Vitamin C (40), Sugar (32), Unsweetened (26), Calcium (4), Vitamin D (3), Antioxidants (3), Vitamin A (2), Fibre (2), Sodium (2)</td>
</tr>
<tr>
<td>Non-dairy milks</td>
<td>154</td>
<td>96</td>
<td>Calcium (78), Total Fat (58), Protein (39), Cholesterol (32), Omega-3 (27), Vitamin D (18), Trans Fat (16), Vitamin A (15), Lactose (14)</td>
</tr>
<tr>
<td>Milks</td>
<td>241</td>
<td>78</td>
<td>Calcium (16), Total Fat (11), Vitamin D (62), Vitamin A (51), Omega-3 (6), Vitamin B (4)</td>
</tr>
<tr>
<td>Meat alternatives</td>
<td>120</td>
<td>77</td>
<td>Total Fat (38), Protein (37), Trans Fat (27), Cholesterol (15), Iron (5), Omega-3 (3), Sodium (2)</td>
</tr>
<tr>
<td>Meats</td>
<td>588</td>
<td>39</td>
<td>Total Fat (17), Protein (26), Trans Fat (7), Sodium (7), Calories (3), Vitamin B (3)</td>
</tr>
<tr>
<td>Egg substitutes (e.g. powdered egg replacer)</td>
<td>11</td>
<td>100</td>
<td>Cholesterol (90), Total Fat (90), Protein (45), Calories (9), Omega-3 (9)</td>
</tr>
<tr>
<td>Eggs</td>
<td>63</td>
<td>57</td>
<td>Omega-3 (32), Total Fat (12), Protein (11), Trans Fat (11), Vitamin B12 (3)</td>
</tr>
<tr>
<td>Enhanced water beverages (e.g. VitaminWater)</td>
<td>133</td>
<td>58</td>
<td>Calories (26), ‘Vitamin and Minerals’ (20), Vitamin C (17), Sucralose (17), Vitamin B (17), Sugar (14), Sodium (10), Vitamin E (2)</td>
</tr>
<tr>
<td>Bottled water</td>
<td>75</td>
<td>4</td>
<td>Sodium (2), Minerals (1), Magnesium (1)</td>
</tr>
<tr>
<td>Non-dairy cheeses</td>
<td>29</td>
<td>72</td>
<td>Total Fat (72), Cholesterol (65), Lactose (50), Calcium (34), Trans Fat (17), Ginseng (5), Sugar (2)</td>
</tr>
<tr>
<td>Cheeses</td>
<td>1117</td>
<td>23</td>
<td>Total Fat (11), Calcium (11), Calories (8), Protein (4), Trans Fat (2)</td>
</tr>
<tr>
<td>Energy drinks</td>
<td>54</td>
<td>96</td>
<td>Energy (70), Taurine (57), ‘Vitamin and Minerals’ (30), B vitamins (22), Guarana (20)</td>
</tr>
<tr>
<td>Caffeinated cola beverages</td>
<td>215</td>
<td>47</td>
<td>Calories (41), Sugar (21), Sucralose (12)</td>
</tr>
<tr>
<td>Sweeteners</td>
<td>48</td>
<td>83</td>
<td>Calories (79), Sugar (18)</td>
</tr>
<tr>
<td>Sugar</td>
<td>35</td>
<td>0</td>
<td>-</td>
</tr>
</tbody>
</table>

68
### Table 5.2. Odds of FOP reference on substitute versus traditional foods (n=4015)

<table>
<thead>
<tr>
<th>Type of FOP reference</th>
<th>Substitute foods (N=1027)</th>
<th>Traditional foods (N=2988)</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any nutrition reference</td>
<td>660 (64)</td>
<td>1186 (42)</td>
<td>1.64</td>
<td>1.39, 1.94</td>
</tr>
<tr>
<td>Any negative reference</td>
<td>335 (33)</td>
<td>577 (19)</td>
<td>1.64</td>
<td>1.38, 1.95</td>
</tr>
<tr>
<td>Any positive reference</td>
<td>510 (50)</td>
<td>874 (29)</td>
<td>1.42</td>
<td>1.20, 1.69</td>
</tr>
<tr>
<td>Any regulated reference</td>
<td>522 (51)</td>
<td>993 (33)</td>
<td>1.29</td>
<td>1.09, 1.52</td>
</tr>
<tr>
<td>Any unregulated reference</td>
<td>427 (42)</td>
<td>663 (22)</td>
<td>1.92</td>
<td>1.62, 2.22</td>
</tr>
<tr>
<td>Any organic reference</td>
<td>125 (12)</td>
<td>149 (5)</td>
<td>1.61</td>
<td>1.21, 2.15</td>
</tr>
<tr>
<td>Any natural reference</td>
<td>343 (33)</td>
<td>621 (21)</td>
<td>1.26</td>
<td>1.05, 1.52</td>
</tr>
</tbody>
</table>

OR, odds ratio and 95% confidence intervals derived from multilevel logistic regression models

### Table 5.3. Results of negative binomial regression model on total number of FOP references by product innovation (n= 4015)

<table>
<thead>
<tr>
<th>Product innovation</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Model</th>
<th>β</th>
<th>SE</th>
<th>exp(β)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional foods</td>
<td>2988</td>
<td>1.68</td>
<td>6.25</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Substitute foods</td>
<td>1027</td>
<td>3.07</td>
<td>3.26</td>
<td>0.42</td>
<td>0.19</td>
<td>1.28</td>
<td>&lt;0.0001</td>
<td></td>
</tr>
</tbody>
</table>
**Supplementary Table 5.1.** Nature of FOP nutrition references amongst fruit/vegetable drinks-juices (n=998)

<table>
<thead>
<tr>
<th>Type of FOP reference</th>
<th>Fruit/veg drink (N=443)</th>
<th>Fruit/veg juice (N=555)</th>
<th>P value*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td></td>
</tr>
<tr>
<td>Any nutrition reference</td>
<td>213 (48)</td>
<td>361 (65)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Any negative reference</td>
<td>87 (20)</td>
<td>169 (30)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Any positive reference</td>
<td>152 (34)</td>
<td>266 (48)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Any regulated reference</td>
<td>151 (34)</td>
<td>317 (57)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Any unregulated reference</td>
<td>148 (33)</td>
<td>210 (38)</td>
<td>0.1472</td>
</tr>
<tr>
<td>Any organic reference</td>
<td>19 (4)</td>
<td>61 (11)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Any natural reference</td>
<td>188 (42)</td>
<td>297 (54)</td>
<td>0.0005</td>
</tr>
</tbody>
</table>

*Compared by $\chi^2$ test.
Supplementary Table 5.2a. Odds of FOP reference on substitute versus traditional foods, excluding fruit/vegetable juice-drinks (n=3017)

<table>
<thead>
<tr>
<th>Type of FOP reference</th>
<th>Substitute foods (N=642)</th>
<th>Traditional foods (N=2375)</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any nutrition reference</td>
<td>447 (77)</td>
<td>885 (36)</td>
<td>4.19</td>
<td>3.51, 5.71</td>
</tr>
<tr>
<td>Any negative reference</td>
<td>224 (43)</td>
<td>408 (17)</td>
<td>3.11</td>
<td>2.50, 3.87</td>
</tr>
<tr>
<td>Any positive reference</td>
<td>358 (61)</td>
<td>608 (25)</td>
<td>2.91</td>
<td>2.32, 3.65</td>
</tr>
<tr>
<td>Any regulated reference</td>
<td>371 (64)</td>
<td>676 (28)</td>
<td>3.35</td>
<td>2.66, 4.23</td>
</tr>
<tr>
<td>Any unregulated reference</td>
<td>279 (48)</td>
<td>453 (19)</td>
<td>3.51</td>
<td>2.81, 4.38</td>
</tr>
<tr>
<td>Any organic reference</td>
<td>106 (18)</td>
<td>88 (4)</td>
<td>3.89</td>
<td>2.65, 5.62</td>
</tr>
<tr>
<td>Any natural reference</td>
<td>155 (27)</td>
<td>324 (14)</td>
<td>1.71</td>
<td>1.32, 2.22</td>
</tr>
</tbody>
</table>

OR, odds ratio and 95% confidence intervals derived from multilevel logistic regression models

Supplementary Table 5.2b. Results of negative binomial regression model on total number of FOP references by product innovation, excluding fruit/vegetable juice-drinks (n=3017)

<table>
<thead>
<tr>
<th>Product innovation</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Model</th>
<th>β</th>
<th>SE</th>
<th>exp(β)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
<td>SD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traditional foods</td>
<td>2375</td>
<td>1.38</td>
<td>2.08</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Substitute foods</td>
<td>642</td>
<td>3.92</td>
<td>3.65</td>
<td></td>
<td>0.65</td>
<td>0.059</td>
<td>1.93</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>
6.0 STUDY 3: ‘BIG FOOD’ AND NUTRITION MARKETING: EXAMINING THE PRESENCE AND NATURE OF FRONT-OF-PACKAGE LABELS BY BRAND

Abstract

Transnational food and beverage companies, often referred to as ‘Big Food’, dominate global food sales. The market growth of their products is thought to, in part, be driven by strategic marketing which influences consumption habits and creates demand. One such strategy is the nutritional promotion of products through discretionary FOP labelling. While research has begun to signal the differential display of this material amongst brands of certain food firms, these studies have been limited in their examination of FOP references and they have relied on a dichotomized understanding of brand. The goal of this study was to provide an expanded examination of manufacturers’ behaviour with respect to FOP labelling through an analysis of the material found on the products of Big Food in comparison to that found on the products of other manufacturers and retailers. FOP references were recorded from all packaged foods in 3 national chain retailers in Toronto (n=20520). Nutrition references were classified by their nature (e.g. ‘nutrients to minimize’; vitamin or mineral content) and also in terms of the use of regulated and unregulated text. Foods were coded as belonging to brands of either transnational, ‘other manufacturers’, private premium or private discount brands. Logistic regression analyses were conducted to assess associations, accounting for the fact that products are nested within specific food categories and controlling for the level of food processing. FOP nutrition references were more frequent on products of transnational brands and less frequent on private discount brands. Transnational brand products displayed more references to ‘nutrients to minimize’ than other nutrients and 35% of these products bore unregulated references. Transnational brand products were less likely than others to bear ‘organic’ labels, which are regulated, but more likely to bear ‘natural’ references, which are not. The greater propensity for unregulated references on transnational brand products may speak to efforts to harmonize labelling across jurisdictions which may differ in their regulatory frameworks. Taken together, these findings signal a strategic use of FOP references amongst brands and lend support to recent calls for mandatory FOP labelling to create an even playing field across manufacturers and maximize exposure to this nutritional guidance for all consumers.
6.1 Introduction

What we eat is increasingly driven by a handful of the transnational food and beverage companies, often referred to as ‘Big Food’, that have come to dominate global food sales. In North America, the 10 largest food companies, including Nestle, PepsiCo, Coca-Cola and DANONE, control over half of all food sales, and worldwide this proportion is nearly 15% and rising. Concerns have been raised about the nutritional quality of their products and their displacement of whole, traditional foods from the diet. One distinguishing feature of Big Food is their very large advertising budgets and marketing of products often through the invocation of nutrition references or other quality assertions at the point-of-purchase.

Recent work from the UK and the US has signalled differences in the presence of FOP nutrition messaging by manufacturer, or brand. While these analyses both relied on a dichotomized interpretation of brand (e.g. national versus private brands), jurisdictional differences in the market share of private to national brand products (e.g. greater share of private to national brand products in the UK as compared to North America), as well as differences in the food categories examined and the nature of FOP material collected, make it difficult to compare results across studies. These studies, furthermore, did not examine the discretionary nutritional material on the products of Big Food firms specifically.

There is now convincing evidence that FOP labelling can direct product sales and therefore impact consumers’ diets and health more broadly. Given that the display of FOP references is at the discretion of the manufacturer or retailer, a better understanding of how specific firms engage in this practice is necessary, particularly in the context of an evolving discussion on how to optimize this type of nutritional guidance to best direct consumers. The purpose of this study is to assess the relationship between the extent and nature of FOP references and brand, considering brands owned by large transnational food firms (i.e., Big Food brands), ‘other manufacturer’ owned brands, and the brands of private retailers. Our analysis draws on a comprehensive survey of packaged foods sold in Canadian supermarkets. Our primary objective is to compare the use of FOP nutrition references by Big Food to that of other brands. In addition, we conduct a sub-analysis of private premium and private discount brands to garner a better understanding of the use of FOP nutrition-related marketing on products that are differentiated by quality and cost.
6.2 Methods

6.2.1 Data collection

A comprehensive survey of FOP labelling found on all packaged foods and beverages sold in national chain retailers in Toronto was conducted between July 2010 and August 2011.\textsuperscript{14,20} A single store was selected from each of the top three food retailers in Canada (Loblaw, Metro and Sobeys), representing 71\% of the total Canadian retail market-share.\textsuperscript{171} Data collectors recorded all descriptive text on the FOP, including product identifiers (brand and product name, variety, product size), nutrient content and disease risk reduction claims, quantitative statements, generic and product-specific health claims, third-party (e.g. The Heart and Stroke Foundation of Canada’s Health Check), manufacturer (e.g. Kraft’s Sensible Solutions) or private retailer (e.g. President’s Choice Blue Menu) issued summary systems and symbols, as well as any other descriptive or implied references (e.g. Fibre 1) emphasising the presence or absence of a specific nutrient constituent. References to ‘natural’, ‘pure’ or ‘real’, (henceforth referred to only as ‘natural’) and ‘organic’ were also noted. Fresh produce, meat, poultry, fish and dried herbs and spices were excluded from the sample, as were products found in the pharmacy and infant food sections, because these products are designed for specific population subgroups and special dietary usage.

After excluding products found in more than one store, 20520 unique packaged items were included in the database for analysis. Products were considered unique if they differed from similar products on the bases of any product identifier (e.g. product name, flavour, size). The inclusion of different package sized products ensured that FOP labelling highlighting product reformulation would be included in the sample. Furthermore it was recognized that larger package sizes had the potential for more FOP labelling.

6.2.2 Data analysis

Products were classified by food category using the Bureau of Nutritional Sciences’ food groupings developed by Health Canada.\textsuperscript{182} Each product was coded for the presence of any form of FOP nutrition reference, and any ‘organic’ or any ‘natural’ reference. To characterize the nature of nutritional messages, FOP nutrition references were further classified as ‘negative’ if they conveyed the reduction or absence of a nutrient for which there is public health messaging to
limit exposure (e.g. ‘low sodium’, ‘trans fat free’, ‘no added sugar’). ‘Positive’ references, which highlighted the presence or addition of a nutrient seen as beneficial (e.g. ‘good source of calcium’, ‘high in fibre’), were further coded into four groups to characterize the particular food or nutrition attributes component being promoted on the FOP. These were: 1) the presence of any vitamin or mineral reference; 2) the presence of any whole grain or fibre references; 3) the presence of any protein or energy reference and 4) the presence of any ‘other’ positive reference including omega-3, omega-6 references, probiotic and antioxidant claims and references to other phytochemicals or novel ingredients.

FOP nutrition references were also classified as being regulated or unregulated. Regulated nutrition references are required to meet certain compositional criteria (i.e., nutrient content, disease risk reduction claims, product specific health and function claims), and they were identified from the prescribed wording and permitted wording variations outlined in the Canadian Food and Drug Regulations72 and Canadian Food Inspection Agency’s Guide to Food Labelling and Advertising.73 All other FOP nutrition references, such as quantifying statements and summary systems and symbols, were classified as unregulated. Summary symbols and systems were further coded as being issued by the manufacturer, retailer or third-party, given prior research which showed products with nutritional symbols developed by government or health professionals had a different nutrient profile than those created by the manufacturer.95 Finally, the total number of FOP references on each product, including nutrition, ‘organic’ and ‘natural’ references, was assessed.

Recorded brand identifiers were used to categorize all products into one of four brand categories: transnational, ‘other manufacturers’, private premium or private discount brands. Transnational brands were defined as those owned by large transnational food manufacturers operating in multiple markets.87, 146, 149, 170 ‘Other manufacturer’ brands were those owned by a manufacturer that is not transnational. These included brands owned by large Canadian food manufacturers (e.g. Maple Leaf Foods) and smaller scale, boutique manufacturers which often developed single product lines under a sole brand. Private label brands were those owned by a retailer rather than a manufacturer142, 143 and were differentiated as either private premium brands (e.g. Loblaw’s ‘Black Label’, Metro’s ‘Life Smart’) or private discount brands (e.g. Loblaw’s ‘No Name’, Metro’s ‘Smart Choice’) to allow for the investigation of marketing strategies of products that are manufactured on the basis of quality and cost. Classification of individual products by brand was confirmed through brand information presented on manufacturer websites.
Recognizing that transnational firms are the primary purveyors of highly processed foods and our previous work that has shown a strong positive association between the presence of FOP references and product processing (Study 1), the level of a product’s processing was also considered in the following analyses. Foods were evaluated and coded for level of processing using a classification system developed by Poti et al. This system differentiates foods by the nature, extent of industrialized processing and, while guided by the NOVA system, it has been specifically designed to capture the complexity of the North American food supply.

Logistic regression using generalized linear mixed models (PROC GLIMMIX) for dichotomous outcomes were used to assess the relationship between the presence and nature (e.g. ‘negative’, regulated, ‘organic’, etc) of FOP references and brand category, using a random intercept term to account for the nesting of products within specific food categories. Transnational brands were set as the reference category in recognition of their dominance in market share. The association between the extent (i.e., total number) of the nutrition, ‘organic’ and ‘natural’ references and brand was examined by fitting a negative binomial distribution, appropriate for count outcome variables of this nature (e.g. values of 0,1,2,3…), to the PROC GLIMMIX model.

PROC GLIMMIX was also used to compare the presence of FOP references on private discount and premium brand products. Private discount products were assessed only against private premium brand products to ensure that private discount brand offerings were not compared with potential ‘discount’ products of other manufacturers, which could not be discerned from our data. To assess whether the relationship between FOP labelling and private label brands (i.e., discount and premium) differed across retailers, effect modification was tested using an interaction term approach. Specifically, this allowed us to determine whether associations between FOP labelling and private manufacturer brands varied across the three retail stores (i.e., the modifier) where data were collected. Effect modification by store was not observed based on a non-statistically significant (p=0.696) interaction term (store X brand). The main effect of store on the presence of FOP labelling was also non-significant (p=0.789). The store from which private label items were collected was therefore not considered in the models used to examine our secondary objective.

All analyses were conducted using SAS (version 9.4, SAS Institute, Cary NC, 2014). A p-value less than 0.05 was deemed statistically significant.
6.3 Results

6.3.1 Brand category

Most food categories were made up of products from each brand category (Figure 6.1). Transnational and ‘other manufacturer’ brands comprised the majority of our sample (Table 6.1) and dominated most food categories, with the exception of the fish and meat and meat alternatives categories, which also possessed a considerable share of private premium brand products (Figure 6.1).

The distribution of each category of processing within each brand category is shown in Figure 6.2. Highly processed products comprised 61% of our sample and 74% of products manufactured by transnational brands were classified as highly processed (Figure 6.2).

6.3.2 Relationship between FOP nutrition references and brand category

Forty-one percent (n=8324) of all products surveyed made some kind of nutrition reference on the FOP (Table 6.1). Twenty-five percent of products referenced a nutrient to minimize and 21% a positive nutrient. The majority of positive references highlighted the presence of a vitamin or mineral (Table 6.1). Thirty-two percent of all products displayed a regulated FOP nutrition reference while 23% displayed one that was unregulated (Table 6.1). Among all products, 20% were labelled as ‘natural’ and 7% as ‘organic’ (Table 6.1).

Transnational brands were more likely than all other brands to bear FOP nutrition references (Table 6.2). Considering the nature of FOP nutrition references, transnational brands were more likely than others to reference a nutrient to minimize, a vitamin or mineral and protein or energy (Table 6.2). Transnational brands were more likely than ‘other manufacturers’ and private discount brands, but as likely as private premium brands, to display whole grain or fibre references (Table 6.2). No clear pattern emerged when examining the presence of other positive nutrition references (Table 6.2).

6.3.3 Use of regulated and unregulated nutrition references
Transnational brand products were more likely than other products to display both regulated and unregulated nutrition references (Table 6.2).

An examination of one specific domain of unregulated nutrition references, summary symbols and systems, showed that those issued by the manufacturer or a third-party were more prevalent on transnational brand foods than on other products (Table 6.3). The summary systems developed by private retailers were almost exclusively found on their premium brand offerings (Table 6.3).

6.3.4 Use of FOP ‘organic’ and ‘natural’ references

Transnational brand products were less likely than other brands, apart from discount brand products, to bear an ‘organic’ reference and more likely than all other brands to make a reference to the ‘natural’ quality of a product (Table 6.4).

6.3.5 Extent of FOP references by brand category

Table 6.5 displays the mean number of FOP references found on products by brand category. Results from negative binomial regression analyses showed that after controlling for the levels of processing, products manufactured by transnational firms bore, on average, up to 60% more FOP references than did other brand products (Table 6.5).

FOP references, irrespective of their nature, appeared far less frequently on private discount products than on private premium products (Table 6.5).

6.4 Discussion

We found that transnational manufacturers disproportionately displayed FOP nutrition references and multiple references, a good proportion of which were unregulated. Assessment of other FOP references showed transnational brands were more likely to display ‘natural’ references, but less likely than others to display ‘organic’ references. Our analysis of private label products to examine FOP references in the context of manufacturing practices that target different consumer groups revealed that discount products were far less likely than their premium brand counterparts to display any form of FOP reference.
While other literature has suggested a clustering of FOP references within specific product domains,\textsuperscript{10, 20, 82, 89} the density of FOP references found on products of transnational firms, after controlling for the level of processing and considering food category, indicates that this discretionary labelling behaviour transcends the nature of the product. Given the documented formulation costs incurred to be able to display some FOP claims, in addition to the cost associated with the development of unregulated symbols and schemes,\textsuperscript{97} it may be that market leaders are better positioned to engage in this practice across their diverse range of products.

Other research has documented a positive association between nutritional claims and a food firm’s financial performance.\textsuperscript{138} The fact that we found transnational products, which dominate food sales in North America, to display significantly more material on the FOP than the other brands is consistent with previous research suggesting that the degree of ‘nutritional emphasis’, or the number of nutritional claims on a product, is positively associated with a firm’s sales and value.\textsuperscript{138} In accordance with marketing theory, the use of multiple claims promoting a food’s benefits may increase the persuasiveness of an advertising message, giving consumers more reasons to purchase a product.\textsuperscript{190}

Our study expands upon previous findings by signalling a strategic display of FOP references on specific brands through a disaggregated assessment of brand category, specifically comparing FOP material on transnational foods with that on other brand products. Our findings are consistent with other studies that have documented a greater prevalence of FOP labelling on products of market leading firms and also suggested that these firms aim to maintain market-share through the use of on-package promotional opportunities.\textsuperscript{138, 142, 149} Previous work, however, drew on longitudinal datasets of new product entrants.\textsuperscript{163, 164, 166-168} Our work differs in that it represents a snapshot of the FOP material in grocery stores at one point in time, and as such, inferences with respect to how the use of FOP references by transnational products has enabled their dominance in, or expansion of, market share cannot be made from our results. This study nonetheless provides valuable insight into the extent of consumers’ exposure to FOP material by different brand products within the Canadian food retail environment.

We found that transnational brand products were more likely than others to display nutrition references, irrespective of the nature of the nutrition reference, with one exception. Transnational brand products were less likely than private premium brand products to bear a whole grain or fibre reference, although this relationship did not reach statistical significance. This discrepancy
could relate to the nature of the particular products bearing such references. While our analyses considered the clustering of products within their individual food categories, these models may not have sufficiently controlled for differences in the types of products sold by these firms.

Although regulated nutrition references were more likely to appear on transnational brand products, transnationals were also more likely to display unregulated references. While there have been calls for a regulated, standardized, but still discretionary system of FOP labelling\textsuperscript{79, 83, 84} which would score product quality against a set of nutrient thresholds, there has been little effort to develop such a system in Canada. The greater prevalence of unregulated references, including summary systems, on products manufactured by transnational firms may be an effort by these companies to offset demands for future regulations.\textsuperscript{85, 164} Transnational brands, however, were also more likely to display third-party derived FOP labels and displayed these more frequently than their own proprietarily developed labels. The greater prevalence of third-party issued systems and symbols on transnational brands, including those developed by the American Heart Association, the Whole Grain Council and the Heart and Stroke Foundation, suggests that there could be similar uptake of a standardized government-developed system if one were introduced.

Findings with regard to ‘organic’ and ‘natural’ references differed from those seen in analyses of nutrition references. Specifically, transnational brand products were more likely than other brands to display a ‘natural’ reference, but less likely than others, except private discount brands, to display an ‘organic’ reference. This may be the result of efforts by transnational firms to introduce quality-differentiated products as a means to compete at the brand level with private premium or ‘other manufacturer’-owned organic product lines without adhering to stringent organic certification processes which can differ across markets. The display of ‘natural’ references in Canada, as in most other jurisdictions, is entirely unregulated.\textsuperscript{127, 128, 130} While ‘organic’ and ‘natural’ describe inherently different manufacturing processes and product attributes,\textsuperscript{128} research has shown that consumers have trouble differentiating the terms. Nearly half of respondents in one nationally representative US study, for instance, believed the characteristics associated with organic products also applied to natural foods.\textsuperscript{130} There may then be little incentive for transnational manufacturers to take on organic product development and marketing when ‘natural’ references, with no regulatory oversight, are interpreted by many consumers as equivalent. Although the presence of unregulated FOP references has yet to be characterized in other countries, the density of unregulated material on products of transnational
manufacturers, both in terms of nutrition and ‘natural’ labelling, may also signal efforts by these firms to harmonize marketing strategies across the various jurisdictions in which they operate by using FOP references that are not affected by interjurisdictional differences in labelling regulations.

The lack of nutrition references on private discount brand products is consistent with market research which indicates a splintering of private branded products into premium and discount ranges to appeal to price-sensitive or quality-seeking consumers. While consumers have been shown to use FOP references in their food decision-making, the price of a product can eclipse nutritional guidance in determining food purchasing, particularly amongst lower-income shoppers. Interestingly, retailer-developed nutrition summary schemes and symbols appeared almost exclusively on their premium brand offerings (e.g. Complement’s ‘Sensations’), while discount counterparts produced by the same retailer (e.g. Complement’s ‘Essentials’) bore nearly no FOP references. Whether premium or higher cost products are in fact nutritionally superior is beyond the scope of the current research and requires further examination, but our findings suggest that premium products are being marketed as such. To the extent that FOP messaging provides valuable nutritional information, including that which is not displayed on the mandatory NFt (e.g. the presence of whole grains), these findings raise questions with respect to the benefit of current FOP labelling practices for consumers of discount products. Our findings are additionally concerning in the context of consumer research from Canada indicating that shoppers lower on the socioeconomic spectrum have lower nutrition literacy and prefer the simplified messaging provided by FOP nutrition claims over the more cumbersome information displayed on the NFt. Insofar as FOP nutrition information can shape a consumer’s impression of food products, the higher concentration of such references on private premium versus discount products could serve to further fuel the perception that healthy foods are luxury foods and out of reach for some.

Although the research presented here represents a robust assessment of a large number of products (n=20520), some limitations must be considered in the interpretation of our results. While the differentiation of private label products into discount and premium lines allowed for an important and novel assessment of the social stratification of FOP labelling practices, it is conceivable that other food firms might also be producing discounted offerings. These products, however, were not identifiable in our database. Insofar as retailers demonstrated distinct marketing behaviour on their premium and discount product lines, this may have biased our
findings. Furthermore, there was considerable heterogeneity in the types of brands housed in the ‘other manufacturer’ category, including both larger manufacturer brands and smaller boutique brands, and it is possible that these products also exhibited different FOP labelling behaviours. Specifically, there is some indication that larger manufacturers, including some of the domestic food firms housed in this group, are more likely to display nutritional marketing both to retain market share and also because they are better positioned to incur the associated costs. Given our primary interest in identifying the marketing behaviours of Big Food, coupled with the sheer volume of brands within the ‘other manufacturer’ category (i.e., 1779 unique brands), conceptualizing homogenous groupings within this category was beyond the scope of the current analysis. Regardless, while much of the literature to date presents a dichotomized understanding of brand, the expanded definition of brand developed here, which has allowed for the identification of transnational brands, has facilitated an advanced understanding of brand strategy as it relates to nutrition marketing.

Our data, which were collected from 2010-2011, may not reflect the current food marketplace. Since the collection of our data, the display of unregulated discretionary nutrition labelling has accelerated in the Canadian retail environment, with Loblaw now issuing a nutrition shelf label, the ‘Guiding Stars’ program which scores all products sold in their stores. Given the myriad of other nutritional information displayed on the FOP, the impact of this system on the future use of discretionary FOP nutrition references is unclear. It is conceivable that Loblaw could rely solely on the Guiding Stars system in the nutritional promotion of their private label products. Given the limited FOP nutrition references observed on private discount products in this work, the guiding star system could also serve to benefit price-conscious consumers in evaluating the healthfulness of these products. Evaluations of the guiding star program suggest these shelf labels increase the sale of positively scored products, but the presence of FOP references was not considered in these analyses. Given evidence that FOP labelling can drive product sales, the presence of these on-package nutritional assertions may have served to modulate the observed effect of the self-label on product sales. How the display of FOP nutrition references relates to a product’s nutritional score on the shelf label, however, is not known. While manufacturers may be able to counter less favourable nutritional assessments provided by the shelf label with FOP material, given that transnational brands are manufacturing products for sale in multiple retail outlets and multiple jurisdictions, it is unlikely that their FOP marketing practices will be affected by an on-shelf labelling system implemented by one company in one region. As shelf label programs
become more pervasive, however, there is a need for research to see how they impact on-package nutrition-related marketing.

Our data collection, while situated in three large grocery stores of retail chains, was limited to the Toronto area, and our results, particularly with respect to private label products that are specific to a particular retailer, may not be generalizable to the greater Canadian context. It is also important to note that sales data were not available to us, so the relationship between different brands’ use of FOP nutrition references and their product sales could not be assessed. Future work would benefit from examining how FOP reference adoption impacts not only consumer purchasing, but also the nutritional quality of the diet.

In conclusion, our finding that the practice of displaying discretionary FOP nutrition references was most prevalent among transnational manufacturers and least among discount products of private retailers in Canadian supermarkets represents an important extension to the existing body of knowledge on FOP labelling. While there have been calls for a standardized but still discretionary system of FOP labelling, the differential use of FOP references by manufacturers lends support to recent calls put forward by Health Canada for mandatory FOP labelling to create an even playing field across manufacturers and maximize exposure to this nutritional guidance for all consumers.
Table 6.1. Presence and nature of FOP reference by brand category (n=20520)

<table>
<thead>
<tr>
<th>Brand</th>
<th>N (% of total)</th>
<th>Any nutrition n (% of total)</th>
<th>Nutrient to minimize n (% of total)</th>
<th>Vitamin/mineral n (% of total)</th>
<th>Whole grain/fibre n (% of total)</th>
<th>Protein/energy n (% of total)</th>
<th>‘Other’ positive n (% of total)</th>
<th>Regulated n (% of total)</th>
<th>Unreg’d n (% of total)</th>
<th>‘Organic’ n (% of total)</th>
<th>‘Natural’ n (% of total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transnational</td>
<td>6012 (29)</td>
<td>3345 (55.6)</td>
<td>2048 (33.9)</td>
<td>814 (13.8)</td>
<td>583 (9.7)</td>
<td>253 (4.2)</td>
<td>275 (4.5)</td>
<td>2663 (44.3)</td>
<td>2104 (34.9)</td>
<td>209 (3.4)</td>
<td>1528 (2.5)</td>
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<tr>
<td>‘Other manufacturer’</td>
<td>9097 (44)</td>
<td>3168 (34.9)</td>
<td>1923 (21.1)</td>
<td>738 (8.1)</td>
<td>587 (6.5)</td>
<td>337 (3.7)</td>
<td>446 (4.9)</td>
<td>2489 (27.5)</td>
<td>1637 (18.1)</td>
<td>928 (1.0)</td>
<td>1890 (2.1)</td>
</tr>
<tr>
<td>Premium</td>
<td>2568 (13)</td>
<td>1034 (40.2)</td>
<td>701 (27.3)</td>
<td>257 (10.0)</td>
<td>250 (9.8)</td>
<td>144 (5.6)</td>
<td>107 (4.2)</td>
<td>844 (33.0)</td>
<td>794 (31.3)</td>
<td>238 (9.3)</td>
<td>388 (15.1)</td>
</tr>
<tr>
<td>Discount</td>
<td>2843 (14)</td>
<td>785 (27.6)</td>
<td>476 (16.7)</td>
<td>230 (8.1)</td>
<td>73 (2.6)</td>
<td>22 (0.8)</td>
<td>38 (1.4)</td>
<td>667 (23.5)</td>
<td>239 (8.4)</td>
<td>30 (1.1)</td>
<td>236 (8.3)</td>
</tr>
<tr>
<td>Total</td>
<td>20520</td>
<td>8324 (40.6)</td>
<td>5148 (25.1)</td>
<td>2039 (9.9)</td>
<td>1493 (7.3)</td>
<td>688 (3.4)</td>
<td>866 (4.2)</td>
<td>6663 (32.5)</td>
<td>4774 (23.3)</td>
<td>1405 (6.9)</td>
<td>4042 (19.7)</td>
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</table>
## Table 6.2. Presence and odds of FOP nutrition reference by brand category (n=20520)

<table>
<thead>
<tr>
<th>Brand</th>
<th>Any Nutrition</th>
<th>Nutrient to minimize</th>
<th>Vitamin/mineral</th>
<th>Whole grain/fibre</th>
<th>Protein/energy</th>
<th>'Other' positive</th>
<th>Regulated</th>
<th>Unregulated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% (OR 95%CI)</td>
<td>% (OR 95%CI)</td>
<td>%* (OR 95%CI)</td>
<td>% (OR 95%CI)</td>
<td>% (OR 95%CI)</td>
<td>% (OR 95%CI)</td>
<td>% (OR 95%CI)</td>
<td>% (OR 95%CI)</td>
</tr>
<tr>
<td><strong>Transnational</strong></td>
<td>55.6 (1.00)</td>
<td>34.1 (1.00)</td>
<td>13.5 (1.00)</td>
<td>9.70 (1.00)</td>
<td>4.21 (1.00)</td>
<td>4.57 (1.00)</td>
<td>44.5 (1.00)</td>
<td>35.0 (1.00)</td>
</tr>
<tr>
<td>'Other manufacturer'</td>
<td>34.7 (0.43, (0.40, 0.46)</td>
<td>21.1 (0.49, 0.57)</td>
<td>8.11 (0.46, 0.58)</td>
<td>6.45 (0.54, 0.72)</td>
<td>3.70 (0.47, 0.70)</td>
<td>4.90 (0.80, 1.12)</td>
<td>27.7 (0.45, 0.53)</td>
<td>18.0 (0.40, 0.47)</td>
</tr>
<tr>
<td>Premium</td>
<td>40.3 (0.49, 0.59)</td>
<td>27.3 (0.66, 0.81)</td>
<td>10.0 (0.65, 0.90)</td>
<td>9.74 (0.94, 1.36)</td>
<td>5.61 (0.59, 0.97)</td>
<td>4.17 (0.62, 1.01)</td>
<td>33.1 (0.58, 0.71)</td>
<td>30.9 (0.79, 0.97)</td>
</tr>
<tr>
<td>Discount</td>
<td>27.6 (0.29, 0.35)</td>
<td>16.7 (0.36, 0.45)</td>
<td>8.09 (0.55, 0.76)</td>
<td>2.57 (0.17, 0.29)</td>
<td>1.16 (0.15, 0.32)</td>
<td>1.34 (0.21, 0.42)</td>
<td>24.0 (0.38, 0.47)</td>
<td>8.41 (0.15, 0.20)</td>
</tr>
</tbody>
</table>

*%, Percent of brand products with reference. OR, odds ratio and 95% confidence intervals derived from multilevel logistic regression models adjusted for level of processing.
Table 6.3. Presence of FOP summary schemes and symbols on products by brand category

<table>
<thead>
<tr>
<th>Brand</th>
<th>Source of summary scheme or symbol</th>
<th>Manufacturer</th>
<th>Private retailer</th>
<th>Third party</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td># of products with reference</td>
<td>% with reference</td>
<td># of products with reference</td>
</tr>
<tr>
<td>Transnational</td>
<td></td>
<td>6012</td>
<td>267</td>
<td>4.44</td>
</tr>
<tr>
<td>‘Other manufacturer’</td>
<td></td>
<td>9097</td>
<td>159</td>
<td>1.75</td>
</tr>
<tr>
<td>Premium</td>
<td></td>
<td>2568</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Discount</td>
<td></td>
<td>2843</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>20520</td>
<td>326</td>
<td>3.26</td>
</tr>
</tbody>
</table>
Table 6.4. Presence and odds of FOP ‘organic’, ‘natural’ reference by brand category, (n=20520)

<table>
<thead>
<tr>
<th>Brand</th>
<th>Any ‘organic’</th>
<th>Any ‘natural’</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% with reference</td>
<td>OR (95%CI)</td>
</tr>
<tr>
<td>Transnational</td>
<td>3.48</td>
<td>1.00</td>
</tr>
<tr>
<td>‘Other manufacturer’</td>
<td>10.2</td>
<td>3.60 (3.07, 4.23)</td>
</tr>
<tr>
<td>Premium</td>
<td>9.27</td>
<td>3.40 (2.79, 4.15)</td>
</tr>
<tr>
<td>Discount</td>
<td>1.06</td>
<td>0.32 (0.22, 0.48)</td>
</tr>
</tbody>
</table>

OR, odds ratio and 95% confidence intervals derived from multilevel logistic regression models adjusted for level of processing.

Table 6.5. Results of negative binomial regression models on number of FOP reference by brand category (n=20520)

<table>
<thead>
<tr>
<th>Brand</th>
<th>Mean</th>
<th>SD</th>
<th>Median</th>
<th>Range</th>
<th>β</th>
<th>SE</th>
<th>exp( β )</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transnational</td>
<td>2.25</td>
<td>2.63</td>
<td>1.00</td>
<td>0, 23</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>‘Other manufacturer’</td>
<td>1.50</td>
<td>2.33</td>
<td>0</td>
<td>0, 21</td>
<td>-0.346</td>
<td>0.025</td>
<td>0.71</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Premium</td>
<td>1.79</td>
<td>2.41</td>
<td>1.00</td>
<td>0, 17</td>
<td>-0.174</td>
<td>0.034</td>
<td>0.84</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Discount</td>
<td>0.83</td>
<td>1.51</td>
<td>0</td>
<td>0, 11</td>
<td>-0.953</td>
<td>0.037</td>
<td>0.39</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

* adjusted for level of processing
Table 6.6. Odds of FOP nutrition reference by private retailer brand (n=5411)

<table>
<thead>
<tr>
<th>Type of FOP reference</th>
<th>Any Nutrition</th>
<th>Nutrient to minimize</th>
<th>Vitamin/mineral</th>
<th>Whole grain/fibre</th>
<th>Protein/energy</th>
<th>‘Other’ positive</th>
<th>Regulated</th>
<th>Unregulated</th>
<th>‘Organic’</th>
<th>‘Natural’</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR (95%CI)</td>
<td>OR (95%CI)</td>
<td>OR (95%CI)</td>
<td>OR (95%CI)</td>
<td>OR (95%CI)</td>
<td>OR (95%CI)</td>
<td>OR (95%CI)</td>
<td>OR (95%CI)</td>
<td>OR (95%CI)</td>
<td>OR (95%CI)</td>
</tr>
<tr>
<td><strong>Premium</strong></td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>0.56 (0.50, 0.64)</td>
<td>0.51 (0.44, 0.68)</td>
<td>0.83 (0.14, 0.19)</td>
<td>0.19 (0.20, 0.30)</td>
<td>0.30 (0.24, 0.36)</td>
<td>0.62 (0.54, 0.70)</td>
<td>0.20 (0.17, 0.23)</td>
<td>0.09 (0.06, 0.13)</td>
<td>0.49 (0.41, 0.59)</td>
<td></td>
</tr>
<tr>
<td><strong>Discount</strong></td>
<td>0.64 (0.59, 0.97)</td>
<td>0.59 (0.97)</td>
<td>0.25 (0.43)</td>
<td>0.54 (0.70)</td>
<td>0.23 (0.13)</td>
<td>0.13 (0.59)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OR, odds ratio and 95% confidence intervals derived from multilevel logistic regression models adjusted for level of processing.
**Figure 6.1.** Distribution of food category by brand category (n=20520)
Figure 6.2. Level of product processing by brand category (n=20520)
7.0 STUDY 4: EXAMINING THE PRESENCE AND NATURE OF UNREGULATED FRONT-OF-PACKAGE NUTRITION REFERENCES

Abstract

Discretionary, FOP nutrition labelling is pervasive on foods sold in Canadian grocery stores. While the nutrient content and disease risk reduction claims found on the FOP reflect prescribed wording and are regulated through compositional criteria, a slew of other nutrition information can be found on food packages. Studies of unregulated references on specific product categories suggest that their presence may indicate a product that is nutritionally inferior to those bearing a regulated claim. The aim of this study was to assess the nature of unregulated nutrition references in contrast to current nutrition labelling regulations. FOP references were recorded from all packaged foods in 3 national chain retailers in Toronto (n=20520) and classified as unregulated if they did not conform to the prescribed wording and permitted wording variations outlined for regulated references in the Canadian Food and Drug Regulations. Whereas 32% of products bore one or more regulated FOP nutrition references, 23% bore at least one FOP reference that was unregulated. Seventy-one percent of products with unregulated references displayed references to nutrients for which regulated options exist. Twenty-one percent of products with unregulated references made references to nutritional properties for which there is no regulated option; 59.5% of these were references to whole wheat or whole grains. Nearly a third of products with unregulated references displayed manufacturer, retailer or third-party derived summary schemes and symbols. Products displaying both regulated and unregulated references were more likely to use unregulated references for attributes for which no regulated options exist, suggesting manufacturers of these products could be inclined to adopt regulated references if they were available. Insofar as FOP nutrition references guide consumers’ choices, the widespread use of unregulated FOP text and symbols is concerning because consumers are unlikely to differentiate between FOP references that are regulated and ones that are not. While some unregulated material presents valuable nutritional information otherwise unavailable to consumers, the unstandardized display of these and the myriad of other unregulated references identified warrant more effective nutrition labelling regulations to better support healthy food selection.
7.1 Introduction

Discretionary, FOP nutrition labelling is pervasive on foods sold in Canadian grocery stores. The nutrient content and disease risk reduction claims found on the FOP reflect prescribed wording and are regulated through compositional criteria, aiming to facilitate healthy food purchases and encourage better product formulations by manufacturers. Specifically, these claims exist for nutrients with established recommended daily intakes or reference standards, and in most cases were based on scientific evidence that has established a relationship between certain elements of healthy diets and the reduction of the risk of developing chronic diseases. A slew of other nutrition information, however, can be found on packages that is entirely unregulated, requiring no compliance with the compositional criteria governing regulated claims. Unregulated FOP references often take the form of ambiguous text, symbols or graphics and summary systems developed either by a manufacturer or third party, but to date there has been very little study of these references.

Research from Canada has found FOP summary systems and schemes on 18% of products surveyed, but other unregulated references were not itemized. Studies of specific food categories have found 30-60% of products bear unregulated text, and there is some indication that the presence of an unregulated nutrition reference may denote a product that is nutritionally inferior to those bearing only regulated claims. An examination of the FOP information related to fibre on breads sold in Canadian grocery stores, for instance, found foods with unregulated references to fibre were associated with lower fibre content than those with regulated claims. But, there are also instances where unregulated references, such as those which highlight the whole grain content of a product, provide valuable nutritional information, otherwise not available to the consumer.

While there is evidence to suggest that the presence of a FOP reference can impact purchasing behaviour, consumers are unlikely to differentiate between FOP references that are regulated and ones that are not, raising concerns about the extent to which the current structure of FOP labelling serves to accurately guide consumer selection. Consumers have been shown to prefer the simplified and interpretative guidance presented on the FOP over the more complex information on the mandatory NFt. However, the array of unregulated and unstandardized
labelling systems makes it difficult for shoppers to accurately evaluate and compare the nutritional profiles of foods. Indeed, it has been suggested that multiple FOP labels in the market can hinder consumer understanding and lead to confusion. Critics have also argued that the nutritional criteria underpinning the various FOP summary systems and schemes now found on foods are not always comprehensive and have nutritional standards that score products too favourably. As a result, the IOM and some other health governing bodies have proposed a single, standardized FOP nutrient scoring system which would comprehensively assess and interpret the healthfulness of a product. Health Canada recently proposed a mandatory warning label for products high in sugar, sodium, or saturated fat, but in Canada manufacturers continue to be permitted to display unregulated references at their discretion.

The proceeding studies in this thesis have revealed unregulated nutrition references to be more likely to appear on highly processed foods (Study 1), innovative products designed as substitute for more traditional foods (Study 2) and on products manufactured by transnational food firms (Study 3). The current study builds on this work by examining the nature of unregulated FOP nutrition references in relation to current regulations. Drawing on a survey of packaged foods for sale in 3 national chain retailers in Toronto, we specifically aimed to differentiate unregulated references to nutrients or dietary ingredients for which a regulated claim option existed from those for which there was no regulated alternative, and characterized the display of FOP manufacturer, retailer or third-party derived summary schemes and symbols. We further aimed to garner a better understanding of what determines the practice of unregulated nutrition labelling by examining how the presence and nature of unregulated FOP material relates to the display of nutrition references that are regulated.

7.2 Methods

7.2.1 Data collection

Our study drew on a large survey of FOP references found on foods and beverages sold in national chain retailers in Toronto conducted between July 2010 and August 2011. A single store was selected from each of the top three food retailers in Canada (Loblaw, Metro and Sobeys), representing 71% of the total Canadian retail market-share. All descriptive text on
the front of packaged foods, including product identifiers (i.e. brand and product name, variety and product size), nutrient content claims, quantitative statements, generic and product-specific health claims, third-party- (e.g. The Heart and Stroke Foundation of Canada's Health Check) and manufacturer- (e.g. Kraft’s Sensible Solutions) developed symbols and summary systems, as well as any other descriptive or implied references emphasizing the presence or absence of a specific nutrient constituent.

After removing duplicate products, 20520 unique packaged items were captured in the database for analysis. Products were considered unique if they differed from similar products on the basis of any product identifier.

7.2.2 Data analysis

Products were classified by food category using the Bureau of Nutritional Sciences’ food groupings developed by Health Canada. Each product was coded for the presence of any reference to nutrition and each reference was classified as ‘regulated’ or ‘unregulated’. Regulated nutrition references (i.e., nutrient content and disease risk reduction claims) were identified by the prescribed wording and permitted wording variations outlined in the Canadian Food and Drug Regulations and the Canadian Food Inspection Agency’s Guide to Food Labelling and Advertising. Additional product specific regulated references were also identified. These included, for instance, claims which relayed the role of a product in weight maintenance, permissible only on meal replacement items but also a number of other approved health and function claims whose display was permissible only on foods which at the time of our study were regulated as NHPs. All other nutrition references, including quantifying statements, FOP summary systems and symbols issued by a manufacturer-, retailer- or third-party and other text inconsistent with current prescribed wording for regulated claims, were classified as unregulated.

Unregulated references identified in our sample were additionally categorized into three mutually exclusive groups based on their content and relationship to regulated references. These build on our previous work and work by other researchers that has examined particular domains of unregulated material. The groups included: 1) unregulated references which highlight a nutrient or compositional element for which a regulated option existed (e.g. regulated ‘good source of fibre’ vs. unregulated ‘x g of fibre’); 2) unregulated references for which no regulated
alternative was available (e.g. ‘whole grain goodness’ ‘electrolytes’) and 3) unregulated FOP summary schemes and symbols (e.g. Kraft’s Sensible Solutions). The compositional criteria of these were gleaned through the issuer’s (i.e., manufacturer, retailer, third-party) website. It should be noted that our coding of FOP summary schemes and symbols included The Heart and Stroke Foundation of Canada’s Health Check symbol, which has been disbanded but was present at the time of data collection.

Descriptive statistics (frequencies, proportions) were computed for products bearing any regulated FOP reference and for those with any of the three unregulated FOP categories described above. Logistic regression using generalized linear mixed models (PROC GLIMMIX) for dichotomous outcomes with a random intercept term were used to examine how the display of regulated references related to display of those that are unregulated, accounting for the fact that products are nested within specific food categories. The analysis was run on a subsample of products displaying one or more unregulated references (n=4774). Specifically, we aimed to test the hypothesis that products with regulated references, indicating some engagement of the manufacturer in the existing regulatory framework for FOP labelling, were more likely to display unregulated references for which no regulated option exists when compared to products bearing only unregulated references.

All analyses were conducted using SAS 9.4 (SAS Institute, Cary, N.C., USA).

7.3 Results

Forty-one percent of products (n=8324) bore some form of FOP nutrition reference, of these 60% (n=4999) bore more than one reference. The number of nutrition references on a single product ranged from 1 to 21. Thirty-two percent (n=6663) bore at least one regulated reference, and 23% (n= 4774) bore at least one that was unregulated (Table 7.1).

Of the products bearing any unregulated nutrition reference, 71% had an unregulated reference for a nutrient for which a regulated option existed (n=3379). In some instances, these were minor variations on the prescribed wording of regulated text (e.g., ‘energy +’ versus regulated ‘plus energy’; ‘rich in nutrients’ versus regulated ‘rich in x essential nutrients’; ‘C+’ versus regulated ‘vitamin C added’) (Table 7.2). Other references represented quantifying statements (e.g. ‘x g
protein; ‘x calories’) or an ambiguous text such as a reference to a nutrient in a product name (e.g. *Fibre 1*).

Twenty-one percent of products with an unregulated reference (n= 1000) bore one which highlighted nutritional properties for which there is no regulated alternative (e.g. whole grains, electrolytes). References in this category could broadly be characterized as relaying information about the function of the product (e.g. ‘control appetite’, ‘enhance mental alertness’, ‘for good health’, ‘immune support’) or highlighting product composition, including a myriad of nutrition and dietary ingredients such as whole grains, ginseng, guarana, taurine, lycopene and other novel ingredients. The majority of these, however, made reference to whole wheat or whole grains (n=595) (e.g. ‘get wise to whole grain goodness’ ‘multigrain goodness’).

Nearly a third of products with unregulated nutrition references (n=1529) displayed FOP summary schemes and symbols (Table 7.3). These appeared in 17 unique formats, with the nutritional quality of a product scored against a variety of different nutritional criteria. Eight of these had nutrient criteria that were not publicly available. Of the 9 for which underlying nutrient criteria were available, the criteria were highly variable. Some scored products using established requirement estimates, including nutrients to limit and/or micronutrients, while others were based on contributions to intakes of food categories (e.g. fruit and vegetables; whole grains), and some merely displayed nutrient composition (Table 7.3).

### 7.3.1 Relationship between unregulated and regulated references

Of the products bearing any regulated reference (n=6663), 47% (n=3113) bore at least one additional references that was unregulated. Most of these highlighted a nutrient for which a regulated option exists (n= 2408) (Figure 7.1).

Products with both types of references were 1.5 times more likely (95% CI: 1.29, 1.73) than those with only unregulated references to display unregulated references for which no regulated option exists and 0.71 times less likely (95% CI: 0.60, 0.83) to display an unregulated references for which a regulated option was available. Products with both types of references were also 2.5 times more likely (95% CI: 2.22, 2.93) than those with only unregulated references to display an unregulated FOP summary system or scheme.
7.4 Discussion

We found that nearly a quarter of all products displayed some form of unregulated FOP nutrition reference. While 21% of these bore unregulated references to nutritional properties for which there is no regulated alternative, the majority of products with unregulated material (71%) displayed unregulated references to nutrients for which regulated options did exist. A third of products with unregulated references displayed these in the form of summary schemes and symbols.

The display of an unregulated reference, in many instances, accompanied ones that were regulated. Further investigation of the relationship between regulated and unregulated references revealed a greater propensity for products with regulated references to display unregulated references for attributes for which no regulated options exist. While this might imply that the manufacturers of these products would be inclined to adopt regulated references if they were available, the majority of unregulated references found on these products, and indeed observed overall, relayed nutrition information for which a regulated option exists.

More research is needed to determine whether manufacturers’ decisions to deviate from regulated text indicate the nutrition-related marketing of products of suboptimal nutritional quality or if there are other barriers to the use of regulated text that can be addressed. The use of nutritional cues observed in product names (e.g. *VitaminWater; Fibre 1*) and lines (e.g. *High Liner Health Benefits*), for example, may be a strategy used by manufacturers to convey the very embodiment of a product’s nutritional attributes. It is also conceivable that manufacturers choose to forgo regulated claims, which often require cumbersome wording, to instead provide consumers with more user-friendly, simplified material. The display of more streamlined text, such as that used for quantifying statements (e.g. ‘x grams of protein’) which made up the majority of unregulated references (data not shown), may allow for faster processing by consumers and facilitate the display of more nutrition information per package.

Our study follows from an assessment of unregulated FOP messages related to fibre which identified significantly higher fibre content on bread products bearing a regulated reference than those bearing one that was unregulated. A deeper examination in our current study of the nature of unregulated references for which a regulated option exists, revealed slight variations of the
prescribed wording for regulated claims. This suggests that some manufacturers may be systematically manipulating the permitted wording and the corresponding compositional requirements of regulated claims to mislead consumers. The fact that our previous work has indicated a greater propensity for unregulated references on highly processed products (Study 1), which have consistently documented higher concentrations of sugar, sodium, and saturated fats also calls into question the reliability of these nutritional assertions. While FOP labels have been shown to impact food selection practices, it has also been suggested that consumers are more inclined to take up nutritional guidance if they perceive it to be issued by a credible source, namely government. Given the plethora of unregulated material, however, and the subtle differences observed between claims that are regulated and those that are not, it cannot be expected that the average consumer has the level of nutrition literacy required to differentiate the two. In fact, there is some indication that consumers are unable to determine if a claim is truthful.

Nearly a quarter of products with unregulated material provided information about a product attribute for which no regulated option existed. Such labelling could be thought of as conveying important nutrition information otherwise not available to consumers. One example is the display of references that communicate the whole grain content of a product. Whole grain foods are recognized as an essential component of a healthy diet, yet whole grain labelling is entirely unregulated and consumers rely on the information placed on packages by the manufacturer. A past assessment of whole grain references found these to exist in several different formats which may be confusing to consumers wishing to practice comparative shopping. Indeed we observed whole grain references to make up the majority of references in this category. We also found that these references were more likely to appear on products whose manufacturers were also engaging in the regulatory framework for FOP labelling. Taken together these findings may speak to the need for regulated whole grain references. We observed wide variation, however, with regard to the nature of other references for which regulated options do not exist. These references included unusual assertions highlighting chlorophyll, taurine, guarana and other novel ingredients for which there is limited consensus regarding any dietary importance.

Much of the recent focus related to optimizing nutritional guidance has been on the development of simplified and standardized nutrition information on the FOP. The IOM has proposed a system that would provide a comprehensive, interpretive assessment of the healthfulness of a product
without requiring consumers to possess advanced nutrition knowledge or numeracy skills. In the absence of meaningful action towards these recommendations, however, manufacturers, retailers and third-party organizations are free to continue displaying their own systems to convey the nutritional merits of products. We found that of the products bearing unregulated material, 32% displayed one of the 17 unique FOP summary schemes and symbols identified. These labels were also more likely to appear on products which simultaneously bore regulated references suggesting that these products would also be inclined to display a standardized, regulated system, if it were made available.

While the current display of FOP summary systems and symbols is self-regulated through proprietarily developed criteria, these criteria are inconsistent across systems rendering it difficult for consumers to make sound comparisons across products. The fact that some of the criteria exists outside of the public domain is further cause for concern. Critics have argued that privately derived FOP systems are particularly susceptible to industry manipulation, incorporating arbitrary nutrient standards and establishing scoring systems with thresholds that are too low to indicate healthy choices. Indeed, one US assessment of the FOP information on baby and toddler foods found that, irrespective of what was highlighted on the reference, those with FOP systems developed by the manufacturer had significantly more sugar, and less fibre, protein, calcium, vitamin A, C and zinc than did those with FOP systems issued by government or a third-party health organization. Food firms appear also to practice differential display of FOP systems, even across their own product lines. Our findings from Study 3 have also shown that certain food firms appear to practice differential display of FOP systems even across their own product lines. Retailer derived FOP systems, for instance, were almost exclusively found on their premium brand offerings rather than on discount brand products. Although the majority of summary systems found in our dataset were the now-discontinued Heart and Stroke Foundation’s Heart Check, other researchers found that only 17% of products meeting the nutrient criteria to qualify for this label actually carried it. In the context of a food environment that permits discretionary FOP labelling, one regulated, standardized FOP label would continue to be limited in guiding all consumers to healthier choices unless universally applied to all grocery products.

To the best of our knowledge, this study represents the first assessment of the nature of unregulated FOP nutrition references, drawing on a dataset of 20520 products sold in Canadian grocery stores. Our study was limited in that the data collection took place over a one-year period
in 2010-2011, as such these findings may not be indicative of the current food marketplace. At the time of our data collection food-like NHPs were regulated under the NHP directorate which permitted the display of a number of health and function claims upon approval. As these products have now been transitioned to be regulated as foods, the nature of their nutritional promotion will have also changed to comply with food labelling requirements under the Food and Drug Regulations. The Heart and Stroke Foundation’s Heart Check has also since been disbanded. More recently, however, other studies of FOP material have noted an increase in prevalence of unregulated summary FOP systems. While these studies did not differentiate between regulated and unregulated references more broadly, it may be that unregulated material, other than summary systems, has also become more pervasive since the time of our data collection. Our study was also limited in that sales weighted data and nutritional content information were not available to us and therefore consumers’ exposure to unregulated FOP material and the nutritional quality of products bearing these labels could not be assessed.

Although most nutrition references identified here were regulated, the breadth and volume of unregulated material observed, the majority of which referenced a nutrient for which a regulated option exists, signals the complexity faced by consumers wishing to use FOP nutrition labelling to support healthy food selection. Insofar as FOP nutrition references guide consumers’ choices, the widespread use of unregulated FOP text and symbols is concerning as consumers are unlikely to differentiate between FOP references that are regulated and ones that are not. Some of the unregulated material we identified may speak to the need for more regulated options to provide both standardized information otherwise not available to consumers and also simpler, summarized messaging. Other unregulated references, however, might reflect deceptive marketing that should be prohibited. More work is needed to better understand manufacturers’ motivations to use unregulated text and how their FOP labelling practices can better align with labelling regulations so to more reliably communicate a product’s nutritional value to consumers.
Table 7.1. Presence of regulated and unregulated FOP references (n=20520)

<table>
<thead>
<tr>
<th>Any unregulated reference n (% of total)</th>
<th>No</th>
<th>Yes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any regulated references n (% of total)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>12196 (59)</td>
<td>3550 (17)</td>
<td>15746 (77)</td>
</tr>
<tr>
<td>Yes</td>
<td>1661 (8)</td>
<td>3113 (15)</td>
<td>4774 (23)</td>
</tr>
<tr>
<td>Total</td>
<td>13857 (67)</td>
<td>6663 (33)</td>
<td>20520 (100)</td>
</tr>
</tbody>
</table>
Table 7.2. Examples of FOP unregulated references and existing regulated alternatives with compositional requirements.

<table>
<thead>
<tr>
<th>Nutrient or dietary component</th>
<th>Unregulated example(s)</th>
<th>Regulated option(s)⁹</th>
<th>Compositional requirements⁹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>‘Energy+’ ‘Maximum energy’ ‘Nutrition to stay healthy, active and energetic’</td>
<td>‘More energy’ ‘Plus energy’</td>
<td>The food provides at least 25% more energy, totalling at least 100 more Calories or 420 more kilojoules per reference amount of the food, than the reference amount of the reference food of the same food group or the similar reference food</td>
</tr>
<tr>
<td>Fibre</td>
<td>‘Fibre benefits of whole wheat’ ‘Fibre and Omega-3’ ‘Fibre 1’ ‘X % DV fibre’</td>
<td>‘Added fibre’ ‘Source of fibre’</td>
<td>Food contains 4 g or more of fibre per reference amount and serving of stated size</td>
</tr>
<tr>
<td>Calories</td>
<td>‘X calories’ ‘Calorie wise’ ‘Burn calories’ ‘Save 10000 calories per month’</td>
<td>‘Low Calorie’ ‘Low in calories’ ‘Low source of calories’ ‘Useful in weight reduction only as part of an energy-reduced diet’</td>
<td>40 Calories or 167 kilojoules or less per reference amount and serving of stated size Meal Replacements, Nutritional Supplements, Prepackaged Meals and Foods Sold by Weight Reduction Clinics providing a minimum of 225 kcal per serving; not less than 15% and not more than 40% of energy available derived from its protein content</td>
</tr>
<tr>
<td>Probiotics</td>
<td>‘Probiotic daily nutritional drink’ ‘Active probiotic fibre’</td>
<td>‘Provides live microorganisms that naturally form part of the gut flora’</td>
<td>A serving of stated size of a product should contain a minimum level of $1.0 \times 10^9$ cfu of one or more of the eligible microorganism</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>‘Vitamin C’ ‘X g Vitamin C’</td>
<td>‘A valuable source of Vitamin C’</td>
<td>≥50% of RDI for vitamin C</td>
</tr>
<tr>
<td>Vitamins and Minerals</td>
<td>‘Daily essentials’ ‘vitalizes body and mind’ ‘vitamin and mineral blend for good health’ ‘with minerals added for great taste’</td>
<td>‘Enriched’ ‘Added vitamins’ ‘Fortified/enriched with (naming the vitamin or mineral nutrient)’</td>
<td>Permitted additions of vitamins and mineral nutrients are listed in D.03.002 of the Food and Drug Regulations</td>
</tr>
</tbody>
</table>
Table 7.3. Identified unregulated FOP summary systems and symbols

<table>
<thead>
<tr>
<th>FOP System</th>
<th>System developer</th>
<th># of products bearing symbol</th>
<th>Criteria publicly available</th>
<th>Description of system/Basis for nutrient criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart Check</td>
<td>Third-party; American Heart Association</td>
<td>5</td>
<td>Yes</td>
<td>Symbol. Extensive nutrient criteria, specific for food category, based on %DVs.</td>
</tr>
<tr>
<td>Blue Menu</td>
<td>Retailer; Loblaw</td>
<td>315</td>
<td>No</td>
<td>Product line. Products developed to meet at least one of the following nutritional criteria: more omega-3s, more fibre, less calories, less fat, soy protein or less sodium than reference food.</td>
</tr>
<tr>
<td>Compliments</td>
<td>Retailer; Sobeys</td>
<td>99</td>
<td>No</td>
<td>Product line. Better-for-you products that have been evaluated by registered dietitians.</td>
</tr>
<tr>
<td>Health Check</td>
<td>Third party; Heart and Stroke Foundation of Canada</td>
<td>583</td>
<td>Yes</td>
<td>Symbol. Nutrient criteria based on Canada’s Food Guide. Product must meet “entry-level” maximums for total fat, saturated fat, protein and sodium content.</td>
</tr>
<tr>
<td>Get the Facts</td>
<td>Manufacturer; Kellogg’s</td>
<td>35</td>
<td>Yes</td>
<td>Nutrient specific system. Presents select information from the NFt. such as fat and calories per serving accompanied by %DV.</td>
</tr>
<tr>
<td>Sensible</td>
<td>Manufacturer; Kraft</td>
<td>187</td>
<td>Yes</td>
<td>Symbol. Nutrient criteria based on Dietary Guidelines for Americans</td>
</tr>
<tr>
<td>Solutions</td>
<td>Manufacturer; Lassonde</td>
<td>39</td>
<td>Yes</td>
<td>Symbol. Fruit juices only. Product must be made from 100 % juice have no added sugar, be a good source of vitamin C and contains 2 servings of fruits or vegetables per 250 mL serving</td>
</tr>
<tr>
<td>Goodness Corner</td>
<td>Manufacturer; General Mills</td>
<td>2</td>
<td>Yes</td>
<td>Nutrient specific system. FDA regulations for nutrient content claims</td>
</tr>
<tr>
<td>High Liner</td>
<td>Manufacturer; High liner Retailer; Metro</td>
<td>11</td>
<td>No</td>
<td>Product line. -</td>
</tr>
<tr>
<td>Health Benefits</td>
<td></td>
<td>125</td>
<td>No</td>
<td>Product line. Lower amounts of salt, sugar, fat, etc. and more ‘healthy nutrients like vitamins and calcium’</td>
</tr>
<tr>
<td>Life Smart</td>
<td></td>
<td></td>
<td></td>
<td>Symbol. -</td>
</tr>
<tr>
<td>Better Choices</td>
<td>Manufacturer</td>
<td>4</td>
<td>No</td>
<td>Symbol. Nutrient criteria based on Canada’s Food Guide. Products must contain at least 8g of whole grain per serving.</td>
</tr>
<tr>
<td>Whole grains</td>
<td>Industry and non-industry consortium</td>
<td>77</td>
<td>Yes</td>
<td>Product line. -</td>
</tr>
<tr>
<td>council stamp</td>
<td>Manufacturer</td>
<td>9</td>
<td>No</td>
<td>Symbol. -</td>
</tr>
<tr>
<td>Lifestyle</td>
<td></td>
<td></td>
<td></td>
<td>Symbol. -</td>
</tr>
<tr>
<td>Guarantee</td>
<td></td>
<td></td>
<td></td>
<td>Symbol. -</td>
</tr>
<tr>
<td>Post nutrition</td>
<td>Manufacturer; Post</td>
<td>10</td>
<td>No</td>
<td>Product line. -</td>
</tr>
<tr>
<td>benefits</td>
<td></td>
<td></td>
<td></td>
<td>Symbol. -</td>
</tr>
<tr>
<td>Program</td>
<td>Manufacturer; PepsiCo</td>
<td>Symbol</td>
<td>Nutritional Criteria</td>
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<tr>
<td>Smart Spot</td>
<td>10 Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smart Choices</td>
<td>Industry and non-</td>
<td>8 Yes</td>
<td>Symbol. Nutrient</td>
<td></td>
</tr>
<tr>
<td></td>
<td>industry consortium</td>
<td></td>
<td>criteria based on</td>
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<td></td>
<td>Dietary Guidelines</td>
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<td>for Americans.</td>
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<td>Specific qualifying</td>
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<td>criteria developed</td>
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<td>for 19 product</td>
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<td>categories, based on</td>
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<td>the presence of</td>
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<td></td>
<td>nutrients to limit</td>
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<td>(e.g., fats and added</td>
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<td></td>
<td>sugars), nutrients to</td>
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<td></td>
<td>encourage (e.g.,</td>
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<td></td>
<td>calcium, vitamin C),</td>
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<td>and food groups to</td>
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<td></td>
<td>encourage (e.g.,</td>
<td></td>
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<td></td>
<td>fruits and vegetables,</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>whole grains).</td>
<td></td>
</tr>
<tr>
<td>Smart Selections</td>
<td>10 No</td>
<td></td>
<td>Symbol. -</td>
<td></td>
</tr>
</tbody>
</table>

Figure 7.1. Nature of unregulated reference amongst products displaying both regulated and unregulated references and products with only unregulated references
8.0 GENERAL DISCUSSION

The work presented in this thesis represents a novel examination of the extent and nature of discretionary FOP references across three axes and is the first to characterize the practice of unregulated nutrition labelling. The non-random distribution of FOP references identified, specifically on highly processed products, innovative foods and those manufactured by transnational food firms, in addition to the breadth of unregulated material displayed on these products, lends empirical weight to suggestions that FOP labelling is primarily used for strategic marketing purposes. As such, this work provides valuable evidence to inform the evolving policy debate regarding the practice of discretionary FOP labelling.

8.1 Summary and key findings

As most food selection occurs in the grocery store, nutrition labelling on packaged foods is recognized as an important tool for directing healthy food selection and improving dietary patterns.\(^2\,9\,81\) Discretionary FOP references have elicited attention from public health professionals and organizations given the simplified, interpretive guidance they provide to consumers who may be unable to conceptualize the more cumbersome information provided on the mandatory NFt\(^17\,65\,83\). Much of the research on FOP labelling to date has focused on evaluating the nutritional content of products bearing FOP references\(^11\,12\,14\,169\) or characterizing consumers’ knowledge and behaviour regarding the use of FOP references.\(^15\,16\,18\) While there is evidence to suggest FOP material is preferentially used by consumers to direct food purchasing,\(^15\,16\,18\) other work has consistently demonstrated no association between the presence of FOP references and the nutritional quality of a product.\(^11\,12\,14\,169\) As such, there is a need to better understand determinants of this discretionary practice amongst manufacturers.

Study 1 complements prior research, which has shown FOP labelling to be a weak predictor of a product’s healthfulness,\(^15\,16\,18\) by demonstrating that nutrition references were positively associated with highly processed products, irrespective of how the level of processing was coded. A more nuanced investigation of the nature of nutritional messaging revealed this relationship to be particularly apparent when investigating the presence of negative nutrition references, and these did not appear to indicate reformulation efforts to better the product. As highly processed
products have recently come under scrutiny for contributing to dietary patterns that are high in
nutrients to limit, the reinforcement of these products through aggressive nutritional
promotion raises questions about the extent to which FOP labelling supports public health efforts
to promote healthy diets. Inconsistent findings with respect to the display of positive nutrition
reference across the 3 classifications systems used in this study to define level of processing
highlight salient differences in the conceptualization of processing. While the patterning observed
under the NOVA and IFIC systems was less consistent, a clear gradient emerged when examining
the display of positive references under the Poti et al classification. This finding reflects the
nature of this classification system which was designed to capture the complexities and extreme
heterogeneity inherent to the North American food. Our findings indicate that at least with
respect to FOP labelling, the Poti et al system provides a more linear gradient in processing.
Future research which aims to assess products against levels of processing should be cognisant of
the differential classification of products across these systems given their potential to impact on
findings.

Building on findings from Study 1, Study 2 examined one domain of food processing focusing on
relatively innovative products designed as substitutes for traditional, less-processed alternatives.
Given arguments that highly processed foods have displaced more traditional foods from the diet,
in part through the use of aggressive and strategic marketing, this study aimed to investigate
this relationship more explicitly by pairing highly processed, relatively novel products with their
less-processed traditional counterparts. As with highly processed products, substitute foods were
more likely to display FOP references than their traditional counterpart. In contrast to the FOP
material observed on highly processed products more broadly, however, substitute foods as a
group displayed a greater concentration of positive than negative nutrition references. This
finding is consistent with suggestions that innovative products are specifically engineered to
convey nutritional benefits, and in part, it may reflect the greater use of claims that
highlight nutrient additions permitted through expanded opportunities for discretionary
fortification. A closer examination of the nature of the references on substitute foods revealed
these to specifically assert nutritional equivalence or superiority with respect to compositional
enhancements often unattainable by less-processed counterparts. These findings therefore support
arguments that manufacturers use FOP references on innovative products as a means to attract
consumers’ attention and displace traditional products from the diet.
Further understanding of manufacturers’ discretionary labelling practices was gleaned from a comparison of FOP references found on products of transnational (i.e., ‘Big Food’) brands to those found on other brand products. While transnational food firms are considered the primary purveyors of highly processed products, their disproportionate display of FOP references on products was independent of the level of processing. As transnational firms dominate Canadian food sales, these findings are consistent with work that has shown the degree of nutritional promotion on a product is positively associated with both a firm’s sales and value. Given the cross-sectional nature of these and most other data, however, the extent to which FOP material operates to maintain or garner market-share could not be inferred.

Examination of the nature of nutrition references by brand revealed that transnational brands were more likely to display references to nutrients to limit and, as with innovative foods examined in Study 2, they were also more likely to display positive references than other brand products. When positive references were further disaggregated to reflect different food and nutrition attributes, it became apparent that the higher prevalence of positive references on products manufactured by transnational brands was largely reflective of assertions related to a product’s vitamin and mineral content. It is also in keeping with suggestions that transnational manufacturers have expanded their market into health-differentiated product lines, in part through the addition of micronutrients and other ‘functional’ components to appeal to health conscious consumers. A good proportion of the nutrition references on transnational products were also found to be unregulated. Similarly, assessment of other FOP material revealed that products of transnational brands were more likely to display unregulated ‘natural’ references, and less likely than other brands to display ‘organic’ labels which fall within a strict regulatory framework. Given that transnational firms develop products for multiple markets, it may be that the use of unregulated references, which are not affected by interjurisdictional differences in labelling regulations, allows for the harmonization of marketing strategies across markets.

Some insight into FOP labelling on products differentiated by quality and cost was gleaned through a sub-analysis of private retailers’ brands. Premium products were more likely than discount brand products to display any FOP material. Particularly noteworthy was the nearly exclusive display of retailer-derived summary systems and symbols on premium offerings, while discount products of the same store-brand bore nearly none of these. These findings are consistent with evidence that has suggested products based on their health and nutritional
attributes are often higher priced than comparable products without such discretionary labelling.\textsuperscript{14, 169} The density of nutritional promotion on premium products may be a reflection of the population subgroup to whom these products are targeted, as consumers who base food purchasing decisions on nutrition information are not likely to be those for whom product price plays an important role.\textsuperscript{65} Insofar as FOP references can convey important nutrition information, such as the whole grain content of a product,\textsuperscript{14} these findings suggest price-conscious consumers may not be exposed to, and therefore potentially not benefit from, these labelling practices. In these cases consumers of discount products who do wish to purchase healthier options will be forced to use the mandatory NFt to guide their food selection. While consumers lower on the socio-economic spectrum are particularly sensitive to product affordability than to nutritional composition in their food selection,\textsuperscript{18, 65, 110} it is conceivable that the purchase of discount products is not limited to these individuals. To what extent the infrequency of FOP references on discount products constitutes a nutritional disadvantage to consumers of these products warrants further examination.

Although regulated nutrition references were the predominant type of labelling observed in Studies 1 to 3, the considerable presence and the non-random distribution of unregulated references necessitated further investigation. Contrasting unregulated references to current nutrition labelling regulations revealed that the majority of products with unregulated messages referenced nutrients for which regulated options existed. While these could signal attempts by manufacturers to provide more simplified, consumer friendly guidance, they may also reflect their inability to meet nutrient requirements for regulated options. Indeed, some of this unregulated material represented slight variations from the prescribed wording of regulated text, suggesting that manufacturers may be systematically manipulating labelling regulations to avoid compositional constraints, and thereby misleading consumers.

Fewer products with unregulated material displayed information for which no regulated option existed, but the majority of these highlighted whole grain content. This finding may speak to the need for more regulations to accurately convey important nutritional information to consumers. Unregulated references that highlighted ingredients for which regulated alternatives do not exist were more likely to appear on products that also made a regulated reference, suggesting that manufacturers of these products would be inclined to adopt regulated options if they were available.
Other unregulated FOP references were classified as FOP summary symbols or systems, which appeared in a myriad of forms. The criteria underpinning the display of these labels also differed across systems, limiting their utility for consumers wishing to compare the nutritional quality of similar products made by different manufacturers. The breadth of unregulated references identified in Study 4 further signals the complexity consumers face in navigating the food retail environment and the need for more reliable regulatory framework to better assist consumers in identifying healthy food choices.

8.2 Strengths and limitations: discretionary FOP labelling data

The study of discretionary nutrition labelling is a nascent field. Large datasets are required to capture the complexity of the North American food supply and to allow the subtleties inherent to the practice of discretionary labelling to be observed. Compromises are often made both in the extent of products sampled and in the material collected, and this serves to complicate comparisons of findings across studies. A number of strengths and limitations are inherent to the dataset from which the studies in this thesis draw and should be considered both in the interpretation of these results and in their comparison to the existing literature.

8.2.1 Sampling frame

Variation in datasets of discretionary labelling exist with respect to the sampling frame used to gather data. Studies have sampled foods sold by a single retailer or by multiple retailers, or a subsample of foods or food categories sold in selected retail outlets. Others still are gleaned from data of new product entrants only. Only a few studies, including the ones presented in this thesis, drew on information collected from all packaged foods available on the store shelves of multiple retailers. Given evidence of a greater density of FOP material amongst specific product categories, data collection from all packaged products was necessary to examine how the presence of FOP references relates to both product innovation and brand, considering the nesting of products within food categories (Studies 2-4). Much of the literature to date has relied on a descriptive examination of the presence of FOP labelling in grocery stores. The studies in this thesis go further by conceptualizing and deriving a
number of explanatory variables and testing them in multivariable analyses to better isolate determinants that predict the display of FOP references.

Furthermore, as our data were gleaned from multiple stores, we included information related to different store-brand (private label) product lines specific to the particular retailer. This enabled a robust assessment of the FOP material on private retailer products in Study 3 and allowed us to determine whether the associations between FOP labelling and private retailer brands (e.g., premium and discount) varied across the three stores where data were collected. Although other studies of FOP material included store-brands in their analyses, none have differentiated store brand products in this way. While the effect of brand on FOP nutrition references has been the subject of some inquiry, previous studies have drawn on databases of new product launches (e.g., Mintel Global New Product Database), defined as individual products with new packaging, new varieties, and reformulated or novel products not present in the preceding years. While this work allowed for the assessment of manufacturers’ and retailers’ use of particular FOP labels, it was limited in its ability to draw inferences with regard to the nutrition references consumers observe in the grocery store.

Although the work presented in this thesis provides a snap-shot of the FOP labelling present on all packaged products in selected grocery stores, it should also be noted that in the case of these, and most other data of similar nature, sales-weighted information was not accessible and therefore a more reliable estimation of consumers’ exposure to FOP references could not be assessed. While our sample drew on stores of retailers who collectively comprise the vast majority of the Canadian grocery retail market share, data collection was restricted to just one conventional store of each parent retail company. These retailers also operate discount banner stores which could stock items different from those in their conventional banners. This could have been particularly true with respect to the provision of private discount and private premium products (i.e., more private discount products in discount banner stores) and as such influenced the findings reported here. Discount stores of these retailers (e.g., No Frills, FreshCo) however comprise a small fraction of retailers’ total market share and as such it is unlikely that parent companies would be generating unique private label items targeted at only a small segment of their market.
8.2.2 Scope and nature of data

Considerable variation also exists in the granularity of data collected amongst studies of FOP material. Some studies recorded the presence or absence of any information or claims\textsuperscript{93, 197}, whereas others collected more detailed data on the nutrient referenced\textsuperscript{14, 20, 169} the type of label\textsuperscript{10, 82, 86} or even the precise wording\textsuperscript{14, 87, 89, 94}. It should be noted, however, that for most studies, the extent of nutritional information collected, or how far the definition of ‘nutrition’ labelling extended, was unclear. This is perhaps the result of a current lack of a consistent taxonomy for the classification of nutrition labelling that would aid in anchoring both data collection and description.

The analyses presented in this thesis have drawn on more comprehensive FOP data by capturing material beyond what has traditionally been recorded (e.g. nutrient content claims, FOP summary systems, quantifying statements). Specifically, this dataset included additional unregulated material such as more ambiguous text, which imply the nutritional or health benefits of a products, including that which may be found in a product or brand name. These data also reflect an extended definition of ‘nutrition’, to include references on composition elements or ingredients that are not typically considered ‘nutrients’, but were highlighted in a way that conveyed dietary or health importance (e.g. ‘advanced electrolyte system’; ‘appetite control’). The collection of this information allowed for a more nuanced and novel assessment of the nature of FOP material across axis of negative and positive, regulated and unregulated, and permitted the quantification of the total number of references appearing on a products, to better examine the aggressiveness this practice.

The data utilized in the foregoing studies, however, is limited to discretionary references appearing only on the FOP and it is therefore inevitable that the full extent of this practice by manufacturers was underestimated. For instance, some products display nutrition references on the sides or back of packages. This may also have been the case where lengthier text is required, such as the prescribed wording outlined for certain disease-risk reduction claims\textsuperscript{9}. Research on consumer purchasing behaviours, however, suggests the average shopper spends no more than 10 seconds, depending on the food category, selecting a particular product, and only a fraction of consumers assess the products of two or more brands\textsuperscript{198}. Given the competitiveness of today’s food retail environment, manufacturers may therefore be less inclined to make nutrition and health assertions on parts of the package that are not likely to grab the consumer’s attention.
Data collection, furthermore, only captured health or nutrition related graphics that were known to be associated with a FOP scheme or summary system (e.g., the Heart and Stroke Foundation’s Health Check). There is evidence to suggest that the subtle, symbolic elements of food marketing are significant in shaping consumers’ perceptions of healthfulness. Research on foods targeted at children has noted the ambiguous display of images depicting physical activity, for example, raising questions about the relationship between the active nature of the image and the actual nutrition contained within the package. Similar graphics (e.g. pictures of grains, fruits) on products across the grocery store could also function as nutrition communication but were not examined.

Finally, the lack of nutritional content information limited the capacity to draw inferences with respect to the nutritional quality of products bearing FOP material. While the literature to date has indicate that the presence of a FOP nutrition reference is not necessarily indicative of a nutritionally superior product, this relationship has not been examined across the axes examined in this thesis. Although attempts were made in Study 1 to garner a some insight into whether FOP references on highly processed foods were indicative of reformulation to create a ‘better’ processed food item, the extent to which the presence of FOP labelling was reflective of nutritionally superior highly processed foods is unclear. Similarly, it could not be determined whether FOP labelling on innovative, substitute products signalled nutritional enhancements relative to unlabelled traditional counterparts (Study 2), and we are unable to determine whether private label premium products were in fact ‘premium’ from a nutritional perspective (Study 3). The lack of nutritional content information also hindered our ability to determine whether the presence of an unregulated reference for a nutrient for which a regulated option existed was in fact more common on products that did not satisfy the compositional requirements of regulated claims (Study 4).

8.2.3 Age of dataset

The data utilized in the studies from this thesis were collected over a one-year period from 2010 to 2011 and as such may not be representative of the current food market place. It is conceivable, for instance, that the nature of the nutrition references found in Canadian grocery stores has changed as awareness of specific nutrition concerns evolve amongst consumers. While fat and
calorie references were most frequently observed in Study 1, the more recent emphasis on sodium and sugar could have translated into the increased display of claims pertaining to these nutrients in order to meet consumer demands. Indeed, in 2015, more Canadian consumers reported choosing foods on the basis of sodium and sugar content than fat,\textsuperscript{162} which was the most important nutritional determinant of food selection reported in the same survey in 2008.\textsuperscript{65} At the time of our data collection food-like NHPs were regulated under the NHP directorate which permitted the display of a number of additional approved health and function claims.\textsuperscript{77} As these products have now been transitioned to be regulated as foods, the nature of their nutritional promotion will have also changed to comply with food labelling requirements under the Food and Drug Regulations. These products, however, represented only a small number (n=94) of products in our sample and as such changes in their nutritional marketing unlikely to have changed our findings significantly.

Although more recent examinations of the Canadian landscape of discretionary nutrition labelling have not occurred, evidence from the US has shown a 20% increase in the prevalence of discretionary FOP material from 2007 to 2014.\textsuperscript{10, 86} Interestingly, the greatest increase was observed for unregulated ‘food company’ (e.g., manufacturer, retailer) developed symbols, which increased by 16% from 2007 to appear on over 20% of products in 2014; representing the most frequently observed type of nutrition marketing.\textsuperscript{10, 86} Similar FOP material appeared on only 7.5% of products examined in this thesis, the majority of which represent the now suspended Heart and Stroke Foundation’s Health Check. The greater array of manufacturer developed systems present in more recent analyses from the US, many of which are developed by manufacturers who operate transnationally, is likely to also be true in the current Canadian marketplace.

The extent to which any changes in the degree and nature of nutrition references would affect the relationship observed in this thesis between FOP labelling and the axes examined is unclear. With respect to food manufacturers and retailers, a 2014 market analysis by Agriculture and Agri-Food Canada has indicated some growth in the private label market since 2010, with private retailers increasingly offering more products for consumers to choose from.\textsuperscript{141} US research, gleaned from databases of new product launches, has shown a greater rate of increase amongst private label products when compared to manufacturer-owned products (e.g. products of national and transnational brands).\textsuperscript{166} Insofar as results from Study 2 suggest that product innovation is associated with the display of FOP references and other work has indicated that newly launched
products are more likely to be marketed,\textsuperscript{138} it may be that differences in the presence of FOP labelling amongst private label and transnational brand products have narrowed. More research, however, is needed to prospectively monitor manufacturers’ display of this material and how it relates to public health priorities and consumer’s nutritional concerns as they continue to evolve.

8.3 Future Research Directions

With obesity and other nutrition-related diseases on the rise, it is unclear how this trend could be reversed through nutritional guidance on the FOP. Although there have been attempts to better understand how the presence of a FOP reference can direct consumer purchasing, this work has been limited to the assessment FOP summary systems, mostly restricted to a small number of product categories\textsuperscript{11, 19} or undertaken in a single supermarket chain.\textsuperscript{116, 117, 124} While more recent work has shown that FOP material, including nutrition, organic and natural references, drives sales,\textsuperscript{138} product-specific data are necessary to better understand the association between an individual product’s sales and its FOP references.

More work is also needed to assess how FOP labelling is affecting dietary patterns more broadly. Insofar as FOP labelling can direct food purchasing, the observed prevalence of FOP material on highly processed products (Study 1) and the wide spread use of unregulated material (Study 4), for which compliance with approved compositional criteria is not required, raise questions about the implications of this practice on diets and health. To date, work to this end has aimed at investigating the potential effects of FOP labelling on nutrient intakes through modelling exercises based on highly selective assumptions.\textsuperscript{17, 18, 116, 200} Linking food consumption and food composition data to comprehensive information about the degree and nature of the FOP material on products would greatly enhance the possibility of examining the impact of this discretionary practice on population health.

While the studies in this thesis investigated the nature of FOP references across several different axes (i.e., negative, positive, regulated, unregulated), the associations observed between the presence of such labelling and the domains examined did not differ greatly by the type of reference. Whether or not the nature of nutrition references affects the relationship between FOP labelling and food quality and sales may warrant consideration. The fact that most unregulated references in Study 4 were found to be those for which a regulated option exists, raises questions
with respect to manufacturers’ motivations to bear this type of labelling. More research is needed to understand whether these labels are indicative of products of lesser nutritional value than those bearing a regulated counterpart.

How the benefits and risks of FOP labelling distribute across the population also merits investigation. Our work examining the nutrition references on private label brands (Study 3) found higher-priced premium offerings to be more likely to display FOP references than their discount counterparts, suggesting a stratification of this practice based on price. While price-conscious shoppers are less likely to make food purchases based on nutritional characteristics, evidence also suggests those lower on the socio-economic spectrum prefer the simplified messaging provided on the FOP and therefore may stand to benefit most from exposure to FOP references. More work is needed to understand the utility of FOP labelling for consumers of lower-cost foods and to ensure that current inequities in nutrition and health are not exacerbated by differential access to products marketed as healthier options.

8.4 Implications for policy and practice

Given the concerning rates of obesity and diet-related chronic diseases in Canada, together with excessive sodium intake, suboptimal intake of fibre, and poor fruit and vegetable consumption, shifts in dietary patterns are urgently needed across the population. A food environment that supports healthy eating has been deemed by leading health authorities as an important strategy for improving nutrition and health outcomes. Current directions in Canadian food policy have focused on market-based interventions that aim to facilitate consumer choice and also support product manufacturing through industry voluntary self-regulation. At this intersection is an increasingly complex food environment whereby manufacturers are able to engineer products and promote specific constituents in a myriad of forms using both regulated and unregulated text. While the presence of a FOP reference may indicate a product which contains or lacks a particular ingredient of public health concern, the voluntary nature of this practice, not only in terms of what attributes are highlighted and how, but what products bear references, raises questions about their value in guiding consumers to healthy options. The work charted in this thesis has indicated a greater propensity for FOP promotion on highly processed products; this
finding sits in direct opposition to nutritional guidance, including that found in *Canada’s Food Guide*, which aims to encourage intake of unprocessed, whole foods.  

While the Food and Drug Regulations state that no nutritional information should be false or misleading, the majority of the FOP references observed in this work, and in other work from Canada,\textsuperscript{82} were regulated nutrient-content and disease-risk reduction claims that predominantly highlight a single nutrient and as such may serve to relay information out of context of the food’s nutritional profile (e.g. low sodium messaging on products high in added sugar). Furthermore, the wide range of FOP references, and specifically the coexistence of multiple unregulated references, often drawing on different and conflicting nutrient criteria, could pose considerable challenges to consumers wishing to compare the nutritional value of similar products. Some of the unregulated material identified in Study 4 could be interpreted to indicate a need for more regulated references to relay important nutritional information for product attributes otherwise not available to the consumer, and perhaps also, to facilitate the simultaneous communication of multiple nutrition attributes in a more user-friendly manner. The IOM and the Canadian Standing Senate Committee on Social Affairs, Science and Technology, recognizing these shortcomings inherent to the current framework of discretionary FOP labelling, have called for a standardized nutrition labelling system to provide more visible and interpretive guidance on a limited number of key ‘negative’ ingredients.\textsuperscript{79, 83, 84}  

However, in the context of a discretionary system of FOP labelling, it is conceivable that the provision of more standardized FOP material would cluster in ways similar to those observed in the foregoing studies. The analysis presented in Studies 1 and 3, specifically, revealed highly processed products and those of transnational (‘Big Food’) manufacturers to predominantly display regulated, negative references, which relay similar information to that which would be presented in a recommended standardized, albeit composite, system. Transnational brands were more likely than others to display third-party derived FOP systems and at greater frequency than their own proprietarily developed labels, suggesting there could be similar use of a standardized government-developed system if it were to be implemented. Indeed, previous work suggests larger firms are better positioned to incur the costs associated with formulating products so they score favourably on these labels.\textsuperscript{148} Furthermore, analyses from Study 3 that indicated private retailer brands used FOP labels primarily on their premium products lines, as opposed to their discount offerings, points to the use of FOP material to appeal to specific shoppers. This raises
considerable concerns about the potential for a standardized, but still discretionary system to reach all consumers.

More recently, Health Canada has proposed mandatory FOP labels for products that exceed a predetermined threshold for sodium, sugars or saturated fat. The mandatory nature of such labelling is intended to provide an even playing field for manufacturers, to better direct consumer choice and encourage reformulation of these nutrients of concern. Although few jurisdictions have implemented mandatory warning labels, there is evidence to suggest these requirements have motivated substantial product reformulation where they are in use. The introduction of ‘high salt’ labels in Finland, for instance, resulted in a 20-25% reduction in salt content of foods. References such as these, which warn consumers of excess levels of a particular constituent, were not observed in our dataset. This is to be expected since manufacturers would have little incentive to voluntarily declare negative information about their products. While it is unclear how Health Canada’s proposed mandatory labelling would affect the presence and nature of the FOP material characterized in this thesis, it is conceivable that warning labels may stimulate manufacturers to display other nutrition promotion material to counter these labels and perhaps distract consumers. Indeed, following the implementation of the UK’s regulated traffic light system, which includes warnings of high nutrient levels (i.e., red lights), the industry sponsored Guideline Daily Amounts system, which provides non-interpretive nutrition information, saw widespread and exponential adoption. At the same time, products not required to display warning labels may aim to compete with those who are by highlighting the absence of such nutrients to minimize. In any case, in the context of a regulatory environment that continues to permit the discretionary display of FOP material, mandatory warning labels for particular nutrients of concern will do little to standardize the nutritional information consumers are currently exposed to on the FOP, and this policy could even inadvertently exacerbate the current information clutter.

The research presented in this thesis also has considerable implications for clinical practice. Clinicians should be cautious in recommending patients navigate their food selection based on FOP nutrition references. The fact that we observed both regulated and unregulated references strategically placed on certain product categories indicates that this practice is more about marketing than nutritional guidance. The density of nutritional promotion observed on highly processed foods runs in contrast to nutritional messaging encouraging consumption of minimally processed foods. Recommendations to adopt FOP labelling in food selection may also be of
limited utility for price-conscious patients given the lack of references observed on products of discount or generic brands. While some FOP material may provide nutrition information otherwise not available to consumers, the breadth of unregulated material, much of which conveyed information for which regulated options exist, raises questions about the nutritional quality of products bearing such labelling. Consumers cannot be expected to differentiate between references which are regulated and those which are not. Our findings from Study 4, taken in tandem with those gathered throughout the rest of this thesis, suggest there may be value in advising consumers against the use of FOP references to guide food purchases.

A standardized system of FOP labelling that would be applied universally to all products could mitigate the limitations of the current practice of FOP labelling both by reducing the information clutter present in the food retail environment and by creating an even playing field for food selection. Such a system of labelling, however, has yet to be successfully implemented elsewhere, although proposals are in place.⁷⁰, ¹⁶¹ Failing this, perhaps more aggressive regulatory intervention is necessary to better support healthy food purchasing. The removal of all FOP material, for instance, has been suggested as an alternative⁷⁸ to optimizing nutritional guidance. As consumers are already armed with the mandatory NFt, strengthening this nutritional information, with corresponding consumer education to optimize its utility and promote the nutritional benefits of unpackaged, unprocessed foods may be a better way to support consumer healthy food choices.

8.5 Conclusions

The work presented in this thesis represents a novel exploration into the practice of discretionary FOP labelling in Canada and has identified determinants of its display across three axes, considering both the extent and nature of the nutritional messaging on display to consumers. It has further elucidated one specific domain of this practice through an examination of unregulated nutrition labelling.

The strategic distribution of FOP nutrition references observed on highly processed, innovative products and those manufactured by transnational brands, in addition to the myriad of unregulated text found on these products, lends empirical weight to arguments this practice of FOP labelling functions primarily as a marketing tool.⁷⁸, ¹⁴⁹ As such, this work also calls into
question the utility of FOP references to direct consumers towards healthy food choices. In the context of evolving discussions of how best to mitigate the burden of diet related diseases,\textsuperscript{2, 5, 7, 84} this work serves to inform the continued policy debate and points to the need for a more effective regulatory framework for nutrition communication to better support consumers to navigate the increasingly complex Canadian food environment.
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