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Research report

## Front-of-pack symbols are not a reliable indicator of products with healthier nutrient profiles <sup>☆</sup>

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## ABSTRACT

**Background:** Front-of-pack (FOP) nutrition rating systems and symbols are a form of nutrition marketing used on food labels worldwide. In the absence of standardized criteria for their use, it is unclear if FOP symbols are being used to promote products more nutritious than products without symbols. **Objectives:** To compare the amount of calories, saturated fat, sodium, and sugar in products with FOP symbols, and different FOP symbol types, to products without symbols. **Methods:** The median calorie, saturated fat, sodium, and sugar content per reference amount of products with FOP symbols were compared to products without FOP symbols using data from the Food Label Information Program, a database of 10,487 Canadian packaged food labels. Ten food categories and 60 subcategories were analyzed. Nutrient content differences were compared using Wilcoxon rank-sum test; differences greater than 25% were deemed nutritionally relevant. **Results:** Products with FOP symbols were not uniformly lower in calories, saturated fat, sodium, and sugar per reference amount than products without these symbols in any food category and the majority of subcategories (59/60). None of the different FOP types examined were used to market products with overall better nutritional profiles than products without this type of marketing. **Conclusion:** FOP symbols are being used to market foods that are no more nutritious than foods without this type of marketing. Because FOP symbols may influence consumer perceptions of products and their purchases, it may be a useful public health strategy to set minimum nutritional standards for products using FOP symbol marketing.

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## Introduction

Worldwide, chronic diseases account for 60% of deaths, and unhealthy diet is a preventable risk factor shared by most chronic diseases (World Health Organization, 2003, 2005). To reduce chronic disease risk, the World Health Organization recommends that individuals and populations limit their intake of saturated and *trans* fat, cholesterol, and simple and added sugars, while achieving energy balance (World Health Organization, 2003, 2004). To help consumers choose foods consistent with these recommendations, the World Health Organization supports the provision of

“accurate, standardized and comprehensible information on the content of food items” on food packages (World Health Organization, 2004). Indeed, in many countries around the world, standardized, voluntary or mandatory nutrition labels are found on the back-of-pack of some, or all, pre-packaged foods (European Food Information Council, 2013). For example, Canada has required the use of a mandatory Nutrition Facts table (NFT) on most pre-packaged foods since 2007 (Government of Canada, 2003). Furthermore, voluntary claims that describe the level of a nutrient in a food or the relationship between a food and health are also permitted on products meeting prescribed conditions in many countries (Hawkes, 2004). For example, Canada’s Food and Drug Regulations allow for the voluntary use of nutrient-content claims such as “low in fat” and health claims such as “a healthy diet with adequate calcium and vitamin D, and regular physical activity, help to achieve strong bones and may reduce the risk of osteoporosis” on food labels. Besides nutrition labels and claims, a variety of front-of-pack (FOP) nutrition rating systems and symbols have been providing simplified nutrition information to consumers on the front of food packages since the 1980s (Committee on the Examination of Front-of-Package Nutrition Rating Systems and Symbols, Institute of Medicine, 2010; European Food Information Council, 2013). Standardized, voluntary FOP systems

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have been introduced in some countries (Department of Health, Food Standards Agency, Welsh Government, & The Scottish Government, 2013; Plibersek & Neumann, 2013); however, multiple FOP systems with their own unique symbols and underlying criteria can currently be found in most marketplaces (Committee on the Examination of Front-of-Package Nutrition Rating Systems and Symbols, Institute of Medicine, 2010; Hawkes, 2009; Silverglade & Ringel Heller, 2010). Within Canada, there are presently no specific regulations governing the use of FOP symbols, beyond that they may not be “false, misleading, or deceptive” (Government of Canada, 2010). Voluntary claims and FOP systems provide nutrition information beyond what is required on the nutrition label in most jurisdictions and can therefore be defined as forms of nutrition marketing (Colby, Johnson, & Hoverson, 2010).

The US Institute of Medicine has categorized FOP systems into three general types: nutrient-specific systems, summary indicator systems, and food group information systems (Committee on the Examination of Front-of-Package Nutrition Rating Systems and Symbols, Institute of Medicine, 2010). According to the Institute of Medicine, nutrient-specific systems typically either display the amount of calories and select nutrients per serving (i.e. repeat some of the information required by nutrition labels on the FOP) or use symbols based on claim criteria (i.e. ‘low in fat’ or ‘high in fibre’). Summary indicator systems provide summary information on the nutrient content of a food product using a single symbol, icon, or score and are based on nutrient thresholds or algorithms. Finally, food group information systems use symbols to convey the presence of a food group or ingredient (see Fig. 1 for examples of each type of FOP system).

Nutrition marketing has the potential to influence consumer purchases at the grocery store, which may impact consumption patterns and ultimately chronic disease risk. Consumers perceive products with summary indicator systems (such as the Heart and Stroke Foundations’ Health Check™ symbol shown in Fig. 1) as more healthful and lower in ‘negative’ nutrients (Andrews, Burton, & Kees, 2011; Reid et al., 2004; Steenhuis et al., 2010). Moreover, it has been found that FOP claims (such as the nutrient-content and health claims that form the basis of some nutrient-specific systems such as the General Mills’ Goodness Corner found in Fig. 1) exert a ‘halo’ effect whereby consumers tend to generalize the claim to the entire product, believing that the product is healthier with respect to nutritional and health elements not identified in the claim (Andrews, Netemeyer, & Burton, 1998; Roe, Levy, & Derby, 1999; Wong et al., 2013). While we are not aware of any study examining consumers’ perceptions

of products with food group information systems, it is possible that this “halo” effect may extend to such systems given their similarities with nutrient-specific systems based on claims criteria. While there is little research available examining the impact of the different FOP systems on food purchases and consumption (Hawley et al., 2012), 23% of consumers report looking for better choice slogans, symbols or logos [FOP systems] on food labels (Canadian Council of Food and Nutrition, 2008), and qualitative research has found that many consumers use FOP nutrition information more often than back-of-pack nutrition labels (Canadian Council of Food and Nutrition, 2010).

Despite evidence that consumers perceive products with FOP systems as healthier or having more favourable nutrient contents, it is presently not known if FOP systems are being used to market products with overall better nutrient compositions. Most countries allow products to carry claims (like those that form the basis of some nutrient-specific systems) without considering their overall nutrient composition (Hawkes, 2004). Furthermore, while summary indicator systems typically consider multiple nutrients in their criteria, the nutrients included and their thresholds or algorithms vary from one system to the next (Committee on the Examination of Front-of-Package Nutrition Rating Systems and Symbols, Institute of Medicine, 2010; Hawkes, 2009), and food group information systems typically only consider a single food group or ingredient and not overall nutrient content (Committee on the Examination of Front-of-Package Nutrition Rating Systems and Symbols, Institute of Medicine, 2010). Considering the weaknesses in the present voluntary FOP systems, the Institute of Medicine has suggested that to best promote health, FOP systems need to consider calories and multiple nutrients, namely saturated fat, *trans* fat, sodium, and added sugar as these nutrients are of greatest relevance to public health and chronic disease risk (Committee on Examination of Front-of-Package Nutrition Ratings Systems and Symbols (Phase II), Institute of Medicine, 2011). However, since FOP systems currently only consider selected nutrients and food components, they may be being used to market products that are no healthier in their content of the nutrients proposed by the Institute of Medicine than products without such marketing.

In the absence of standardized underlying nutrient criteria, we hypothesize that products marketed with FOP symbols will provide similar levels of calories, saturated fat, *trans* fat, sodium, and sugar to products without symbols. This study aimed to evaluate if FOP symbols are being used on foods lower in calories, saturated fat, *trans* fat, sodium, and sugar than foods without symbols. This study also



Fig. 1. Examples of different front-of-pack symbol types.

compared foods with and without different types of FOP symbols to determine which FOP types were most likely to identify products with more favourable levels of the nutrients related to health risks.

## Materials and methods

A cross-sectional comparison of the calorie, saturated and *trans* fat, sodium, and sugar content of foods with and without FOP symbols was completed using the Food Label Information Program (FLIP). As previously described by Schermel, Emrich, Arcand, Wong, and L'Abbe (2013), the FLIP is a Canadian database of food label information developed by the L'Abbe lab group at the University of Toronto. FLIP has quantified the use of nutrition marketing, such as FOP systems, nutrient content claims, and health claims, on food labels and collected information on the nutritional compositions of foods from the NfT (which includes information on calories and 13 core nutrients such as fat, carbohydrates, protein, sodium, and sugar). The FLIP was modelled after similar American food label surveys (Brandt, Moss, Ellwood, Ferguson, & Asefa, 2010; Colby et al., 2010). Data were collected in 2010–2011 and include information on 10,487 unique products. Data were sampled in the greater Toronto area and Calgary, Alberta from the four major Canadian grocery retailers that together accounted for 56% of the grocery sales in Canada (Mintel Global Market Navigator, 2010). This sampling approach ensured that most national brand products were collected as well as a wide-range of private label brand products (Schermel et al., 2013). Every product with a NfT available from national and private label brands was purchased by systematically scanning the grocery store shelves in each aisle and collecting each unique product with a NfT. Each product was purchased once and only in a single size.

FLIP data were collected for 23 pre-defined food categories and 153 subcategories, as described in Schedule M of Canada's *Food and Drug Regulations* [B.01.001] (Canadian Food Inspection Agency, 2010). Schedule M has established reference serving sizes for each subcategory and is the basis of the criteria for making nutrition and health claims. Nutrition information for each product was taken from the NfT, which provides information on the amount of calories and 13 core nutrients in a manufacturer defined serving size, and manually entered into the database. To ensure the accuracy of data entry: (1) calorie calculations based on Atwater factors were used to identify data entry errors, and any differences between calculated and recorded calories of 20% or greater were checked manually against the product label information, and (2) NfT data were sorted for outliers for each nutrient. Information from the NfT was used to derive the amount of calories and nutrients per Schedule M reference amount in order to standardize serving sizes for comparison.

Each food label was scanned for FOP systems using the definitions and categories defined by the Institute of Medicine (Committee on the Examination of Front-of-Package Nutrition Rating Systems and Symbols, Institute of Medicine, 2010). As previously described by Schermel et al. (2013), FOP systems in FLIP were independently classified by two reviewers, with any disagreements being resolved in consultation with the research team. This analysis included FOP systems that provided nutrition information beyond what is required by the NfT (i.e. nutrition marketing): nutrient-specific systems based on claim criteria, summary indicator systems, and food group information systems. Nutrient-specific systems that displayed the amount of calories and select nutrients on the FOP were excluded as they simply repeated NfT required information.

## Data analysis

This analysis focused on the 10 food categories that had the largest number of foods with FOP systems: (1) bakery products, (2) cereals and other grain products (hereafter referred to as cereals

and grains), (3) combination dishes, (4) dairy products and substitutes (dairy products), (5) fats and oils, (6) fruits and fruit juices, (7) meat, poultry, their products and substitutes (meat and poultry), (8) snacks, (9) soups, and (10) vegetables. A total of 92 subcategories were found within these 10 food categories. For example, the bakery products subcategory included subcategories such as 'bread', 'bagels, tea biscuits, scones, rolls, buns, croissants, tortillas, soft bread sticks, soft pretzels and corn bread', and 'crackers, hard bread sticks and melba toast'. Data were analyzed using SAS software (version 9.3, SAS Institute Inc., Cary, NC, 2011). The distributions of all continuous variables were first assessed and then differences in the amount of calories, saturated and *trans* fat, sodium, and sugar per reference amount of foods, with and without FOP symbols, were compared using *Wilcoxon rank-sum test*. Statistical significance level was set at  $p < 0.05$ . Differences in calorie or nutrient content per reference amount greater than 25% were deemed to be nutritionally relevant as per the *Food and Drug Regulations*' criteria for "reduced" or "lower" claims (Government of Canada, 2003). Under the *Canadian Food and Drug Regulations*, in order to carry a claim of being "reduced" or "lower" (for example "Sodium reduced" or "Lower in saturated fat"), a food must contain 25% less of the nutrient of interest per reference amount of the food than the reference amount of a similar reference food. Data are reported as median followed by interquartile range. Only statistically significant and nutritionally relevant differences are reported in the results and tables. Additional sub-group analyses were conducted by subcategory and by FOP type (nutrient-specific system based on claims criteria, summary indicator system, and food group information system).

## Results

Overall FOP symbols (excluding nutrient-specific systems that only displayed the amount of select nutrients on the FOP) were found on 17.8% of the products in the FLIP (with some products having two or more symbols). Nutrient-specific symbols based on claim criteria were found on 3.4% of the products and, as reported by Schermel et al. (2013), 7.5% of the products carried a summary indicator system, 3.5% a food group information system, and 7.0% a hybrid system that combined features of two or more of the FOP types. Of the 92 subcategories found and examined, 60 contained products with FOP symbols. *Trans* fat was excluded from the results as no difference  $>0.1$  g was observed in any category.

### *Differences between products with and without FOP symbols by food category*

Products with FOP symbols were not uniformly lower in calories, saturated fat, sodium, and sugar per reference amount than products without symbols in any food category, and in some instances were higher in one or more of these nutrients (Table 1). Products with FOP symbols were only lower in calories than products without symbols in the 'cereals and grains' category (209 versus 300 cal), while products with FOP symbols had higher calories than products without symbols in the 'soups' category (120 versus 90 cal) ( $p < 0.05$ ). In contrast, products with FOP symbols were lower in saturated fat than those without in five categories ('bakery products', 'combination dishes', 'dairy products', 'meat and poultry', and 'snacks') with differences ranging from 0.8 to 2.3 g ( $p < 0.05$ ). 'Meat and poultry' products with FOP symbols were lower in sodium than products without symbols (356 versus 522 mg) ( $p < 0.05$ ). In half of the categories ('cereals and grains', 'combination dishes', 'dairy products', 'soups', and 'vegetables'), products with FOP symbols were higher in sugar than products without, with differences as great as 6 g of sugar per reference amount ( $p < 0.05$ ). 'Cereals and grains' with FOP symbols were significantly higher in saturated fat, sodium, and sugar than 'cereals and grains' without symbols.

**Table 1**Comparison of the nutrient content per reference amount of products with and without front-of-pack nutrition rating symbols.<sup>a</sup>

Food category	FOP status	N	Calories (kcal)	Saturated fat (g)	Sodium (mg)	Sugar (g)
Bakery products	No	1254	144 [120, 183]	1.2 [0.3, 3.4]	169 [91, 250]	6 [1, 13]
	Yes	382	126 [91, 140]	0.5 [0.3, 1.3] <sup>b</sup>	148 [92, 205]	2 [1, 8] <sup>b</sup>
Cereals and other grain products	No	548	300 [164, 302]	0.2 [0.0, 0.3] <sup>b</sup>	1 [0, 57] <sup>b</sup>	2 [1, 4] <sup>b</sup>
	Yes	229	209 [156, 300] <sup>b</sup>	0.3 [0.2, 0.5]	109 [2, 200]	6 [3, 11]
Combination dishes	No	852	300 [230, 340]	3.0 [1.3, 4.7]	709 [509, 880]	4 [2, 7] <sup>b</sup>
	Yes	192	261 [212, 295]	1.5 [0.7, 2.5] <sup>b</sup>	561 [468, 660]	5 [3, 9]
Dairy products and substitutes	No	741	109 [81, 130]	3.5 [1.5, 6.0]	160 [100, 220]	1 [0, 9] <sup>b</sup>
	Yes	98	110 [84, 132]	1.5 [0.4, 3.2] <sup>b</sup>	126 [100, 210]	7 [1, 14]
Fats and oils	No	395	80 [70, 100]	1.0 [0.8, 2.0]	120 [0, 300]	0 [0, 2]
	Yes	81	70 [35, 80]	1.0 [0.3, 1.0]	135 [70, 260]	0 [0, 2]
Fruits and fruit juices	No	611	120 [100, 130]	0.0 [0.0, 0.0]	10 [0, 25] <sup>b</sup>	25 [21, 29]
	Yes	189	120 [86, 130]	0.0 [0.0, 0.0]	20 [6, 35]	25 [19, 28]
Meat, poultry, their products and substitutes	No	557	147 [90, 223]	2.9 [1.1, 4.9]	522 [425, 640]	1 [0, 1]
	Yes	86	127 [91, 154]	0.6 [0.4, 1.5] <sup>b</sup>	356 [256, 437] <sup>b</sup>	1 [0, 1]
Snacks	No	384	260 [230, 270]	1.5 [1.0, 3.0]	288 [151, 390]	2 [0, 3]
	Yes	87	214 [179, 240]	0.7 [0.0, 1.3] <sup>b</sup>	233 [74, 360]	2 [0, 4]
Soups	No	244	90 [60, 150] <sup>b</sup>	0.5 [0.0, 1.5]	740 [650, 898]	2 [1, 4] <sup>b</sup>
	Yes	90	120 [90, 150]	0.5 [0.2, 1.0]	625 [480, 650]	4 [2, 7]
Vegetables	No	489	25 [16, 40]	0.0 [0.0, 0.0]	180 [34, 290]	2 [0, 4] <sup>b</sup>
	Yes	134	30 [20, 50]	0.0 [0.0, 0.0]	71 [15, 290] <sup>b</sup>	3 [1, 5]

<sup>a</sup> Front-of-pack nutrition rating symbol nutrition marketing includes: (1) nutrient-specific symbols based on claim criteria, (2) summary indicator symbols, (3) food group information symbols, and, (4) hybrid symbols; and, excludes nutrient-specific systems that display the amount of calories and select nutrients per serving. All data are presented as median and interquartile range [Q1, Q3]. Calorie and nutrient amounts are expressed per reference amount and rounded to the number of decimal places provided in the Nutrition Facts table. Reference amounts are reference serving size amounts found in Schedule M of Canada's *Food and Drug Regulations* and are the basis of the criteria for making nutrient content and health claims in Canada.

<sup>b</sup> Statistically significant ( $p < 0.05$ ) and nutritionally relevant ( $\geq 25\%$ ) difference between products with and without a front-of-pack symbol in the amount of calories or nutrient of interest.

#### Differences between products with and without FOP symbols by food subcategory

No differences in calorie, saturated fat, sodium, and sugar content were observed between products with and without FOP symbols in half of the subcategories examined (30/60) (see Supplementary Table S1). Products with FOP symbols were higher in at least one nutritional component (calories, saturated fat, sodium, or sugar) of public health relevance than products without symbols in nine subcategories. For example 'cookies and graham wafers' with symbols had 25% more sodium than products without symbols ( $p < 0.05$ ). Products with FOP symbols were found to be lower than products without symbols in one or two nutrients for 17 subcategories ( $p < 0.05$ ), saturated fat and sodium were the nutrients most often lower. For example, 'canned meat and poultry' with FOP symbol marketing had 0.4 g of saturated fat and 241 mg of sodium compared to 1.6 g and 413 mg in products without symbols ( $p < 0.5$ ).

Products with FOP symbols were lower in three of the nutritional components analyzed in six subcategories. For example, 'coffee cakes, donuts, Danishes, sweet rolls, sweet quick-type breads and muffins' with FOP symbols had less calories (133 versus 217 cal), saturated fat (0.8 versus 2.2 g), and sugar (10 versus 17 g) than products without symbols ( $p < 0.05$ ) (Supplementary Table S1). Only 'meat and poultry with sauce' with FOP symbol marketing was lower in all four nutritional components compared to products without symbols: calories (134 versus 266 cal), saturated fat (0.5 versus 4.2 g), sodium (442 versus 782 mg), and sugar (1 versus 4 g) ( $p < 0.05$ ).

#### Comparison of different FOP symbol types

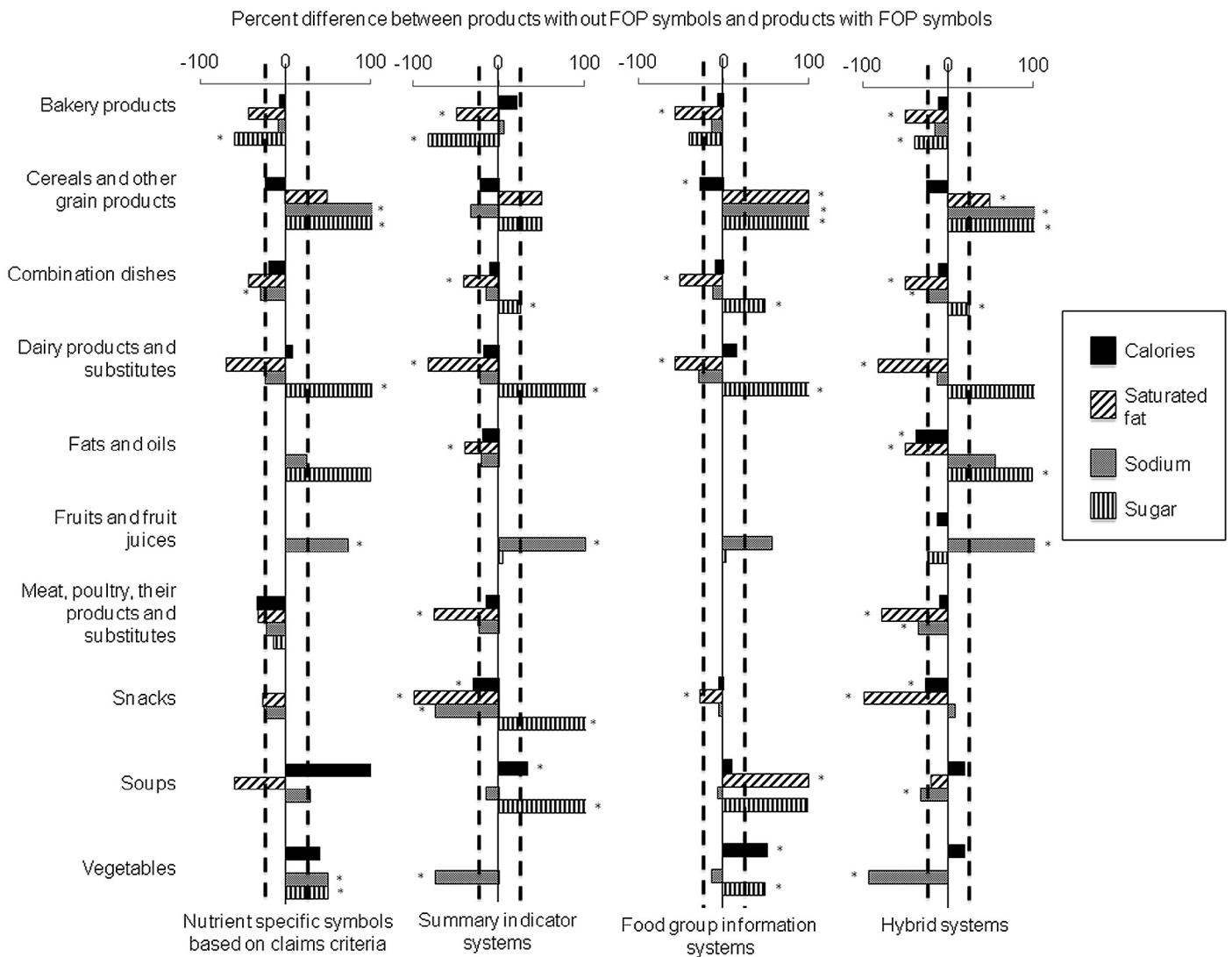
None of the different FOP types examined was used to market products with overall better nutritional profiles than products without this type of marketing (Fig. 2). Although there were cases of individual nutrient levels being improved, overall products with and without FOP symbols had similar nutritional compositions, regardless of symbol type. The largest numbers of significant differences were observed between products with and without

hybrid or summary indicator symbols ( $p < 0.05$ ). However, no food category with either of these FOP types was lower in all four nutritional components than products without symbols. For example, while 'soups' with summary indicator symbols contained less calories, saturated fat, and sodium than 'soups' without symbols (by 74 cal, 1.5 g, and 214 mg, respectively), they were higher in sugar by 14 g ( $p < 0.05$ ).

#### Discussion

The present study found that, while FOP symbols were being used as nutrition marketing on 17.8% of all products, these symbols were not being used to market products that were overall lower in calories, saturated fat, sodium, and sugar than their counterparts without FOP symbols, and in some instances were higher in one or more of these nutrients. These findings are consistent with those of Colby et al. (2010), who found that nutrition marketing in the form of food company symbols [FOP systems] were being used to market products high in saturated fat, sodium, or sugar. Further, from this analysis it is clear that none of the different FOP types are promoting healthier food choices when multiple nutrients are examined, despite certain FOP types, such as summary indicator systems, considering multiple nutrients in their criteria. Thus, when grocery shoppers are comparing similar products, choosing the product with FOP symbol marketing is no guarantee of a selection consistent with a diet that reduces chronic disease risk. For example, although consumers may perceive 'combination dishes' with summary indicator symbols as healthier and lower in negative nutrients (Andrews et al., 2011; Reid et al., 2004), we found that compared to products without symbols, 'combination dishes' with symbols were lower in saturated fat and sodium, but higher in sugar, and similar in calorie content.

The finding that FOP symbols are not being used to promote products with lower levels of all the nutritional components of public health concern is worrisome because of the 'halo' effect associated with FOP nutrition information (Andrews et al., 1998; Roe et al., 1999). Although a nutrient-specific or food group information symbol may only state that a product is 'low in fat' or a 'source of whole



**Fig. 2.** Difference in calorie, saturated fat, sodium, and sugar content per reference amount between products with and without front-of-pack symbols by symbol type. \*Statistically significant ( $p < 0.05$ ) and nutritionally relevant ( $\geq 25\%$ ) difference in calorie or nutrient content per reference amount between products with and without FOP symbol. Products without FOP symbols were the reference. Negative percentages indicate instances and amounts where products with FOP symbols were lower in calories or nutrients than the reference. Positive percentages indicate instances and amounts where products with FOP symbols were higher in calories or nutrients than the reference. The dashed line represents a 25% difference in calorie or nutrient content.

grains', because of the 'halo' effect, consumers may infer that a product is also lower in calories, saturated fat, sodium, and sugar based on this information when it is not actually the case. For example, we found that foods carrying summary indicator symbols based on claims criteria were, for the most part, equal or higher than foods without these symbols in calories, saturated fat, sodium, and sugar and thus were not a good guide to selecting products as part of a diet that reduces the risk of chronic disease. Although FOP symbols have been found to impact less the consumers' perceptions of product healthiness and nutrient content when used in conjunction with the NfT (Emrich et al., 2014), FOP nutrition information often leads consumers to truncate their search for information and skip reading the standardized nutrition label (Roe et al., 1999). These results suggest that requiring products to meet comprehensive minimum standards with respect to their calorie, saturated fat, sodium, and sugar before being able to use a FOP symbol may be a useful public health strategy to ensure that these symbols are being used to market products consistent with a health promoting diet. Indeed, the Institute of Medicine has proposed that prior to qualifying for a FOP symbol, products should meet a

minimum standard with respect to saturated and *trans* fat, sodium, and added sugar content (Committee on Examination of Front-of-Package Nutrition Ratings Systems and Symbols (Phase II), Institute of Medicine, 2011).

One of the proposed benefits of FOP systems is that they may stimulate manufacturers to reformulate existing products in order to qualify to carry a FOP symbol (Committee on the Examination of Front-of-Package Nutrition Rating Systems and Symbols, Institute of Medicine, 2010). Research has found that FOP symbols developed by non-profits have led participating manufacturers to reformulate products, changing their content of one or more nutrients, in order to qualify for a symbol (Dummer, 2012; Vyth, Steenhuis, Roodenburg, Brug, & Seidell, 2010; Williams, McMahon, & Boustead, 2003; Young & Swinburn, 2002). However, we found that overall products with FOP symbols had similar levels of calories, saturated fat, sodium, and sugar to products without symbols, regardless of FOP type. This suggests that manufacturers wanting to use FOP symbol marketing in the present unstandardized marketplace would have no impetus to reformulate their products to lower their levels of calories and nutrients of public health concern

as, in general, the criteria associated with the different FOP systems are so diverse that many products can qualify for one without reformulation.

### Limitations

There are a few limitations to this study, including the somewhat subjective nature of identifying FOP symbols on food packages in the FLIP. However, every attempt has been made to minimize any subjectivity by using pre-established definitions and two independent raters to identify FOP symbols. Another limitation is the comparison of foods at the category level. Categories contain a variety of foods and comparison of products with and without symbols may not always be a true comparison of like products. We have attempted to increase the likelihood of fair comparison by conducting detailed analysis at the subcategory level where similar products are grouped. Finally, nutrient content information was derived from the food label rather than chemical analysis; however, a 2011 Canadian study found the values reported in the NfT to be a reliable indicator of the actual nutrient content as determined through chemical analysis, at least for saturated and *trans* fat (Pantazaopoulos et al., 2011).

### Conclusions

Although lower levels of either calories or one or more nutrients of public health concern were identified in products with FOP symbols in some product categories and subcategories, in general, the results of this study demonstrated that the calorie, saturated fat, sodium, and sugar content of products being marketed with FOP symbols are no better than products without FOP marketing, regardless of the FOP type, in a marketplace without standardized FOP labelling. This suggests that such symbols are being applied more as a marketing feature in the interest of selling products than promoting healthier food choices. If nutrition marketing influences consumer perceptions of product healthiness and nutrient content, and ultimately their product purchases, the results of this study suggest that minimum standards should be established regarding the content of nutrients of public health significance for products with FOP symbols. This will help ensure that consumers relying solely on FOP symbols to guide their selection of healthier products, as part of a diet that reduces chronic disease risk, are not being misled. Furthermore, the establishment of minimum standards for products to carry FOP symbols would incentivize manufacturers to reformulate their products to lower the content of nutrients of public health significance, should they want to use this form of nutrition marketing.

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### Appendix: Supplementary material

Supplementary data to this article can be found online at [doi:10.1016/j.appet.2014.09.017](https://doi.org/10.1016/j.appet.2014.09.017).

**Supplementary Data Table: Comparison of the nutrient content per reference amount of products with and without front-of-pack nutrition rating symbol nutrition marketing by product subcategory\***

Food category	Subcategory	FOP status	N	Calories [kcal]	Saturated fat [g]	Sodium[mg]	Sugar [g]
<b>Bakery Products</b>	Bread, excluding sweet quick, type rolls	No	147	127 [119, 135]	0.3 [0.0, 0.4]	234 [185, 264]	1 [0, 2]†
		Yes	36	122 [118, 129]	0.3 [0.3, 0.5]	211 [179, 263]	2 [1, 2]
	Bagels, tea biscuits, scones, rolls, buns, croissants, tortillas, soft bread sticks, soft pretzels and corn bread	No	179	147 [138, 162]	0.3 [0.2, 0.7]	266 [213, 324]	2 [1, 3]
		Yes	48	146 [138, 154]	0.3 [0.1, 0.5]	217 [192, 256]	2 [1, 3]
	Brownies	No	19	181 [160, 189]	2.3 [1.6, 4.2]	100 [76, 126]	15 [13, 16]
		Yes	2	146 [133, 158]	1.6 [1.1, 2.1]	113 [111, 116]	15 [14, 15]
	Cake [heavy weight]	No	47	438 [388, 463]	12.5 [8.8, 15.0]	263 [225, 330]	33 [28, 39]
		Yes	2	210 [210, 210]†	2.0 [2.0, 2.0]†	195 [190, 200]	18 [18, 18]†
	Cake [medium weight]	No	25	307 [288, 320]	2.7 [1.9, 10.1]	216 [107, 320]	22 [17, 36]
		Yes	2	191 [145, 237]†	2.8 [2.6, 3.0]	238 [237, 238]	20 [14, 27]
	Coffee cakes, donuts, Danishes, sweet rolls, sweet quick, type breads and muffins	No	82	217 [195, 236]	2.2 [1.5, 5.4]	216 [177, 249]	17 [14, 23]
		Yes	7	155 [147, 173]†	0.8 [0.8, 2.0]†	165 [141, 220]	10 [9, 18]†
	Cookies with or without coating or filling; graham wafers	No	231	144 [139, 155]	3.2 [1.5, 4.1]	83 [55, 110]†	10 [8, 12]
		Yes	63	133 [130, 140]	1.4 [0.7, 2.0]†	104 [75, 150]	8 [7, 9]†
Crackers, hard bread sticks and melba toast	No	140	90 [86, 95]	0.4 [0.2, 1.3]	130 [100, 169]	1 [0, 2]	
	Yes	98	90 [82, 95]	0.5 [0.3, 1.1]	153 [110, 189]	1 [0, 1]	
Dry breads, matzo, and rusks	No	10	110 [100, 126]	0.1 [0.0, 0.5]	177 [92, 252]	1 [0, 2]	

Food category	Subcategory	FOP status	N	Calories [kcal]	Saturated fat [g]	Sodium[mg]	Sugar [g]
		Yes	13	130 [120, 130]	0.4 [0.3, 0.5]	170 [120, 200]	2 [1, 2]
	Ice cream cones	No	1	19 [19, 19]	0.0 [0.0, 0.0]	8 [8, 8]	0 [0, 0]
		Yes	1	21 [21, 21]	0.0 [0.0, 0.0]	8 [8, 8]	1 [1, 1]
	Croutons	No	39	35 [30, 35]	0.0 [0.0, 0.1]	65 [55, 80]	0 [0, 0]
		Yes	14	30 [28, 30]	0.0 [0.0, 0.5]	65 [33, 85]	0 [0, 1]
	French toast, pancakes, and waffles	No	40	203 [193, 220]	1.1 [0.7, 1.6]	405 [361, 461]	6 [4, 8]
		Yes	12	190 [167, 225]	0.7 [0.3, 1.6]	401 [296, 481]	6 [4, 6]
	Grain, based bars with filling or partial or full coating	No	67	171 [160, 183]	2.3 [1.3, 3.2]	94 [65, 152]	14 [11, 15]
		Yes	26	160 [141, 167]	1.5 [0.5, 1.9]†	98 [92, 131]	13 [9, 14]
	Grain, based bars, without filling or coating	No	55	127 [118, 129]	0.5 [0.4, 0.7]	85 [69, 98]	9 [8, 10]
		Yes	30	120 [111, 129]	0.5 [0.4, 1.1]	79 [60, 99]	9 [7, 10]
	Rice cakes and corn cakes	No	39	64 [60, 64]	0.2 [0.0, 0.3]	136 [59, 192]	1 [1, 1]
		Yes	23	68 [64, 68]	0.2 [0.0, 0.3]	143 [56, 204]	1 [0, 4]
	Pies, tarts, cobblers, turnovers, other pastries	No	90	331 [300, 380]	7.5 [6.1, 7.9]	204 [180, 259]	19 [17, 27]
		Yes	4	158 [149, 171]†	0.0 [0.0, 0.5]†	270 [156, 270]	13 [10, 17]†
	Pie crust	No	12	143 [129, 150]	3.1 [2.3, 3.7]	107 [96, 142]	0 [0, 2]
		Yes	1	133 [133, 133]	1.7 [1.7, 1.7]	100 [100, 100]	1.7 [1.7, 1.7]
<b>Cereals and other grain products</b>	Hot breakfast cereals, such as oatmeal, or cream of wheat	No	23	150 [149, 158]	0.4 [0.3, 0.4]	183 [115, 243]	12 [8, 13]
		Yes	34	156 [150, 158]	0.4 [0.3, 0.5]	173 [111, 219]	8 [0, 11]†
	Ready-to-eat breakfast cereals, puffed and coated, flaked, extruded, without fruit or nuts, very high fibre cereals	No	47	116 [111, 120]	0.0 [0.0, 0.3]†	130 [125, 200]	7 [4, 10]
		Yes	38	113 [110, 120]	0.2 [0.1, 0.3]	168 [140, 214]	6 [4, 10]



Food category	Subcategory	FOP status	N	Calories [kcal]	Saturated fat [g]	Sodium[mg]	Sugar [g]	
	Ready-to-eat breakfast cereals, fruit and nut type, granola	No	63	212 [200, 226]	0.4 [0.2, 1.4]	135 [50, 220]	11 [9, 14]	
		Yes	82	214 [202, 220]	0.4 [0.2, 0.6]	145 [50, 238]	11 [9, 14]	
	Bran and wheat germ	No	1	50 [50, 50]	0.1 [0.1, 0.1]	0 [0, 0]	0 [0, 0]	
		Yes	1	35 [35, 35]	0.0 [0.0, 0.0]	0 [0, 0]	0 [0, 0]	
	Grains, such as rice or barley	No	73	160 [160, 162]	0.0 [0.0, 0.2]	0 [0, 1]	0 [0, 0]	
		Yes	12	165 [160, 185]	0.1 [0.0, 0.3]	3 [0, 13]	0 [0, 0]	
	Pastas without sauce	No	322	300 [300, 307]	0.2 [0.0, 0.3]†	0 [0, 2]†	2 [1, 3]†	
		Yes	61	310 [310, 310]	0.3 [0.3, 0.5]	2 [0, 2]	3 [2, 3]	
	Stuffing	No	13	167 [144, 208]	1.3 [1.3, 3.1]	557 [485, 613]	3 [2, 3]	
		Yes	1	167 [167, 167]	1.3 [1.3, 1.3]	359 [359, 359]	2 [2, 2]	
	<b>Combination dishes</b>	Measureable with a cup, such as casserole, hash, macaroni and cheese with or without meat, pot pie, spaghetti with sauce, stir fry, meat and poultry casserole, baked and refried beans, wieners and beans, meat chilli, chilli with beans, creamed chipped beef, beef or poultry ravioli in sauce, beef stroganoff, poultry a la king, Brunswick stew, goulash, stew, ragout or poutine	No	442	316 [264, 350]	2.2 [0.8, 3.7]	820 [666, 940]	5 [2, 8]
			Yes	129	275 [242, 301]	1.3 [0.6, 2.5]†	580 [528, 700]†	6 [4, 10]
		Not measureable with a cup, such as burritos, egg rolls, enchiladas, pizza, pizza rolls, sausage rolls, pastry rolls, cabbage rolls, quiche,	No	310	306 [251, 345]	4.5 [3.1, 6.0]	644 [524, 799]	4 [2, 6]
			Yes	59	195 [148, 272]†	1.9 [1.2, 2.7]†	468 [325, 558]†	4 [3, 6]

Food category	Subcategory	FOP status	N	Calories [kcal]	Saturated fat [g]	Sodium[mg]	Sugar [g]
	sandwiches, crackers and meat or poultry lunch-type packages, gyros, burger on a bun, frank on a bun, calzones, tacos, pockets stuffed with meat, lasagna ,chicken cordon bleu, stuffed vegetables with meat or poultry, shish kabobs, empanadas, fajitas, souvlaki, meat pie or tourtiere						
	Hors d'oeuvres	No	100	125 [96, 150]	2.1 [0.6, 3.8]	214 [188, 251]	1 [1, 2]†
		Yes	4	88 [88, 88]†	0.1 [0.1, 0.2]†	156 [148, 177]†	2 [2, 2]
<b>Dairy products and substitutes</b>	Cheese, including cream cheese and cheese spread	No	348	100 [86, 120]	5.0 [3.8, 6.0]	200 [160, 230]	0 [0, 1]
		Yes	32	86 [65, 90]	3.5 [2.4, 3.6]†	210 [200, 240]	0 [0, 1]
	Cottage cheese	No	14	100 [100, 110]	1.0 [0.5, 1.5]	420 [305, 540]	6 [5, 6]
		Yes	9	111 [100, 122]	0.6 [0.6, 0.6]	299 [277, 300]†	9 [5, 11]
	Cheese used as an ingredient, such as dry cottage cheese or ricotta cheese	No	9	86 [80, 100]	4.0 [2.4, 4.7]	71 [70, 71]	2 [2, 2]
		Yes	1	50 [50, 50]	1.5 [1.5, 1.5]	70 [70, 70]	2 [2, 2]
	Quark, fresh cheese and fresh dairy desserts	No	62	286 [265, 300]	13.3 [11.7, 15.0]	900 [464, 1000]	0 [0, 0]
		Yes	1	214 [214, 214]	7.1 [7.1, 7.1]	393 [393, 393]	4 [4, 4]
	Cream and cream substitute	No	22	30 [20, 50]	1.0 [0.4, 3.0]	7.5 [5.0, 10.0]	1 [0, 3]
		Yes	1	50 [50, 50]	3.0 [3.0, 3.0]	0 [0, 0]	0 [0, 0]
	Milk, evaporated or condensed	No	16	20 [15, 60]	0.5 [0.2, 0.8]	16 [15, 20]	1 [1, 11]
		Yes	1	65 [65, 65]	1.0 [1.0, 1.0]	18 [18, 18]	11 [11, 11]
Plant-based beverages, milk,	No	138	130 [100, 160]	1.0 [0.3, 2.5]	120 [100, 140]	12 [10, 19]	

Food category	Subcategory	FOP status	N	Calories [kcal]	Saturated fat [g]	Sodium[mg]	Sugar [g]
	buttermilk and milk-based drinks, such as chocolate milk	Yes	27	130 [110, 188]	0.6 [0.4, 2.5]	120 [110, 135]	12 [10, 29]
	Yogurt	No	69	140 [110, 158]	1.8 [0.1, 2.5]	93 [85, 105]	21 [9, 23]
		Yes	26	125 [84, 158]	0.5 [0.0, 1.8]†	97 [88, 108]	20 [7, 23]
<b>Fats and oils</b>	Butter, margarine, shortening, lard	No	72	70 [70, 70]	2.5 [1.5, 5.0]	60 [0, 70]	0 [0, 0]
		Yes	19	70 [70, 70]	1.0 [1.0, 1.0]†	70 [60, 70]	0 [0, 0]
	Vegetable oil	No	97	80 [80, 80]	1.3 [1.0, 1.5]	0 [0, 0]	0 [0, 0]
		Yes	8	80 [80, 80]	1.0 [0.8, 1.0]	0 [0, 0]	0 [0, 0]
	Dressing for salad	No	196	100 [60, 120]	1.0 [0.6, 2.0]	300 [240, 360]	2 [1, 4]
		Yes	32	60 [30, 90]†	0.8 [0.0, 1.0]	280 [245, 320]	2 [2, 4]
	Mayonnaise, sandwich spread and mayonnaise-type dressing	No	19	60 [40, 100]	0.5 [0.5, 1.0]	115 [90, 130]	1 [0, 2]
		Yes	20	48 [30, 50]	0.5 [0.3, 1.0]	130 [115, 140]	1 [0, 2]
	Oil, spray type	No	11	4 [4, 4]†	0.0 [0.0, 0.0]	0 [0, 0]	0 [0, 0]
		Yes	2	5 [5, 5]	0.0 [0.0, 0.0]	0 [0, 0]	0 [0, 0]
<b>Fruit and fruit juices</b>	Fruit, fresh, canned or frozen, except those listed as separate item	No	118	96 [84, 108]	0.0 [0.0, 0.0]	10 [0, 18]	18 [16, 23]
		Yes	50	84 [64, 108]	0.0 [0.0, 0.0]	0 [0, 12]†	17 [12, 22]
	Dried fruit, such as raisins, dates or figs	No	62	120 [110, 130]	0.0 [0.0, 0.0]	0 [0, 5]	23 [15, 26]
		Yes	7	140 [140, 160]	0.0 [0.0, 0.0]	0 [0, 140]	26 [20, 26]
	Juices, nectars and fruit drinks represented for use as substitutes for fruit juices	No	422	120 [110, 130]	0.0 [0.0, 0.0]	13 [5, 25]†	26 [23, 30]
		Yes	132	120 [110, 140]	0.0 [0.0, 0.0]	25 [19, 35]	26 [22, 29]
<b>Meat, poultry,</b>	Luncheon meats; pate,	No	99	60 [55, 85]	0.5 [0.3, 1.3]	523 [480, 600]	1 [0, 1]

Food category	Subcategory	FOP status	N	Calories [kcal]	Saturated fat [g]	Sodium[mg]	Sugar [g]
<b>their products and substitutes</b>	sandwich spread, potted meat food product; taco fillings; meat pie fillings and cretons	Yes	9	62 [57, 69]	0.2 [0.2, 0.3]†	314 [256, 322]†	0 [0, 1]
	Sausage products	No	118	148 [127, 173]	4.4 [3.0, 5.5]	528 [468, 602]	1 [0, 1]
		Yes	6	85 [81, 99]†	1.3 [1.1, 1.8]†	412 [338, 587]	1 [1, 2]
	Cuts of meat and poultry without sauce, and ready-to-cook cuts, with or without breading or batter, including marinated, tenderized and injected cuts	No	34	240 [200, 259]	3.0 [1.3, 4.0]	568 [450, 750]	0 [0, 1]
		Yes	13	150 [125, 170]†	0.5 [0.4, 1.0]†	169 [106, 450]†	0 [0, 1]
	Patties, cutlettes, chopettes, steakettes, meatballs, sausage meat and ground meat, with or without breading or batter	No	109	210 [160, 242]	4.2 [1.6, 7.0]	414 [311, 560]	0 [0, 1]
		Yes	35	150 [120, 171]†	1.5 [0.6, 3.5]†	375 [301, 410]	1 [0, 2]
	Cured meat products	No	32	98 [70, 126]	2.0 [1.0, 2.9]	539 [476, 789]	1 [0, 1]
		Yes	1	91 [91, 91]	0.8 [0.8, 0.8]	501 [501, 501]	0 [0, 0]
	Canned meat and poultry	No	25	74 [63, 85]	1.6 [1.1, 1.9]	413 [370, 487]	0 [0, 0]
		Yes	6	69 [68, 70]	0.4 [0.2, 1.0]†	241 [167, 328]†	0 [0, 0]
	Meat and poultry with sauce, such as meat in barbecue sauce or turkey with gravy, but excluding combination dishes	No	90	266 [210, 300]	4.2 [2.1, 5.6]	782 [605, 1092]	4 [1, 11]
		Yes	16	134 [123, 145]†	0.5 [0.4, 0.6]†	442 [355, 475]†	1 [0, 2]†
	<b>Snacks</b>	Chips, pretzels, popcorn, extruded snacks, grain-based snack mixes and fruit-based snacks, such as fruit chips	No	297	250 [227, 268]	1.5 [1.0, 2.0]	330 [240, 425]
Yes			78	205 [176, 238]	0.7 [0.0, 1.0]†	261 [74, 360]	2 [0, 9]
Nuts or seeds for use as snacks		No	79	288 [240, 320]	3.5 [2.5, 5.0]	75 [10, 170]	3 [2, 13]

Food category	Subcategory	FOP status	N	Calories [kcal]	Saturated fat [g]	Sodium[mg]	Sugar [g]
		Yes	9	311 [310, 311]	4.5 [4.4, 5.0]	156 [40, 156]	2 [2, 3]
<b>Soups</b>	Soups	No	244	90 [60, 150] †	0.5 [0.0, 1.5]	740 [650, 898]	2 [1, 4] †
		Yes	90	120 [90, 150]	0.5 [0.2, 1.0]	625 [480, 650]	4 [2, 7]
<b>Vegetables</b>	Vegetables without sauce	No	250	30 [25, 50]	0.0 [0.0, 0.0]	170 [20, 270]	2 [1, 4]
		Yes	84	35 [23, 50]	0.0 [0.0, 0.0]	65 [13, 290]	3 [1, 4]
	Vegetables with sauce	No	25	35 [21, 45]	0.0 [0.0, 0.0]	680 [486, 760]	1 [0, 4]
		Yes	2	48 [35, 60]	0.0 [0.0, 0.0]	175 [0, 350]	4 [2, 6]
	Lettuce and sprouts	No	27	13 [10, 15]	0.0 [0.0, 0.0]	20 [13, 47]	1 [0, 1]
		Yes	17	15 [11, 15]	0.0 [0.0, 0.0]	15 [11, 34]	1 [0, 2]
	Vegetable juice and vegetable drink	No	25	60 [50, 60]	0.0 [0.0, 0.0]	640 [350, 640]	10 [8, 10]
		Yes	16	50 [50, 60]	0.0 [0.0, 0.0]	415 [133, 565] †	8 [6, 9]
	Olives	No	46	20 [18, 25]	0.3 [0.2, 0.4]	237 [176, 280]	0 [0, 0]
		Yes	1	17 [17, 17]	0.0 [0.0, 0.0]	131 [131, 131]	0 [0, 0]
	Vegetable pastes, such as tomato paste	No	7	20 [20, 35]	0.0 [0.0, 0.0]	20 [20, 30]	3 [3, 5]
		Yes	4	23 [20, 25]	0.0 [0.0, 0.0]	150 [20, 290]	3 [3, 3]
	Vegetable sauce or puree, such as tomato sauce or tomato puree	No	6	24 [15, 30]	0.0 [0.0, 0.0]	200 [10, 250]	3 [2, 3]
		Yes	10	29 [24, 30]	0.0 [0.0, 0.0]	200 [20, 226]	3 [3, 3]

\*Front-of-pack nutrition rating symbol nutrition marketing includes: 1) nutrient-specific symbols based on claim criteria, 2) summary indicator symbols, 3) food group information symbols, and, 4) hybrid symbols; and, excludes nutrient-specific systems that display the amount of calories and select nutrients per serving. All data are presented as Median and Interquartile range [Q1, Q3]. Calorie and nutrient amounts are expressed per reference amount rounded to the number of decimal places provided in the Nutrition Facts table.

Reference amounts are reference serving size amounts found in Schedule M of Canada's Food and Drug Regulations and are the basis of the criteria for making nutrient content and health claims in Canada.

† Statistically significant ( $p < 0.05$ ) and nutritionally relevant ( $\geq 25\%$ ) difference between products with and without a front-of-pack symbol in the amount of calories or nutrient of interest.