

Consumer perceptions of the Nutrition Facts table and front-of-pack nutrition rating systems

Teri E. Emrich, Ying Qi, Julio E. Mendoza, Wendy Lou, Joanna E. Cohen, and Mary R. L'Abbé

Abstract: Preferences for, and consumer friendliness of, front-of-pack (FOP) nutrition rating systems have not been studied in a Canadian population, and studies comparing systems that are accompanied by mandatory labelling, such as Canada's Nutrition Facts table (NfT), are lacking. The purpose of this study was to evaluate 4 FOP systems relative to the NfT with respect to consumer friendliness and their influence on perceptions of the healthiness and nutrient content of food. Canadian consumers ($n = 3029$) participating in an online survey were randomized to score the consumer friendliness of 1 of 5 FOP conditions with or without an NfT and to score the healthiness and nutrient content of 2 foods using the provided label(s). The mean differences in scores were evaluated with analysis of covariance (ANCOVA) controlling for age, gender, and education, with Tukey–Kramer adjustments for multiple comparisons. The NfT received the highest scores of consumer friendliness with respect to liking, helpfulness, credibility, and influence on purchase decisions ($p < 0.05$); however, consumers still supported the implementation of a single, standardized FOP system, with the nutrient-specific systems (a “Traffic Light” and a Nutrition Facts FOP system) being preferred and scored as more consumer friendly than the summary indicator systems. Without the NfT, consumer ratings of the healthiness and calorie and nutrient content differed by FOP system. With the NfT present, consumers rated the healthiness and calorie and nutrient content similarly, except for those who saw the Traffic Light; their ratings were influenced by the Traffic Light's colours. The introduction of a single, standard, nutrient-specific FOP system to supplement the mandatory NfT should be considered by Canadian policy makers.

Key words: nutrition labelling, front-of-pack nutrition rating systems and symbols, surveys.

Résumé : Les préférences de la population canadienne en matière d'étiquetage sur le devant de l'emballage (« FOP ») et la facilité d'utilisation du système d'évaluation de la valeur nutritive n'ont pas fait l'objet d'études; en outre, il n'y a pas d'études comparatives des systèmes d'évaluation de la valeur nutritive accompagnés de la présentation du tableau canadien de la valeur nutritive (« NfT ») conformément à la loi. Cette étude se propose d'évaluer quatre FOP par rapport au NfT selon leur facilité d'utilisation et leur influence sur la perception de l'aspect santé et du contenu nutritif de l'aliment. Dans une enquête en ligne, on demande à 3029 consommateurs canadiens d'évaluer aléatoirement une des cinq FOP accompagnées ou non du NfT et d'évaluer l'aspect santé et le contenu nutritif de deux aliments d'après l'étiquette présentée. On compare les différences moyennes des résultats par une analyse de covariance prenant en compte l'âge, le genre et la scolarité et en appliquant la méthode de Tukey–Kramer pour des comparaisons multiples. Le NfT reçoit la plus haute cote sur le plan de la facilité d'utilisation (affinité, utilité, crédibilité) et de son influence sur la décision d'acheter ($p < 0,05$); toutefois, les consommateurs sont en faveur de la mise en place d'un seul système normalisé de FOP, mais préfèrent le système spécifique aux nutriments (par « feu de circulation » et valeur nutritive sur le FOP) et le trouvent plus facile d'utilisation que le système présentant un résumé. Sans le NfT, les évaluations des consommateurs de l'aspect santé et du contenu énergétique et nutritif diffèrent selon la FOP. Avec le NfT, les consommateurs évaluent de façon similaire l'aspect santé et le contenu énergétique et nutritif sauf ceux qui ont vu le feu de circulation. Leur évaluation est influencée par la couleur des « feux de circulation ». Les responsables des orientations politiques devraient songer à mettre en place un seul système normalisé de FOP spécifique aux nutriments en plus du NfT obligatoire. [Traduit par la Rédaction]

Mots-clés : étiquetage alimentaire, système d'évaluation nutritive sur l'étiquette du devant de l'emballage, enquêtes.

Introduction

Front-of-pack (FOP) nutrition rating systems and symbols provide simplified information to consumers on the nutritional characteristics of food products (Committee on Examination of Front-of-Package Nutrition Rating Systems and Symbols, Institute of Medicine (IOM) 2010). Since being introduced in the United States

and Sweden in the late 1980s, FOP systems have proliferated, with numerous symbols developed by governments, expert groups, health organizations, food manufacturers, and retailers currently in use (European Food Information Council (EUFIC) 2013; IOM 2010). We recently found that 19% of foods in a database of Canadian packaged food labels carried 1 or more FOP systems (Schermel et al. 2013). Four general types were found: nutrient-

Received 30 June 2013. Accepted 12 September 2013.

T.E. Emrich and M.R. L'Abbé. Department of Nutritional Sciences, FitzGerald Building, University of Toronto, 150 College Street, Toronto, ON M5S 3E2, Canada.

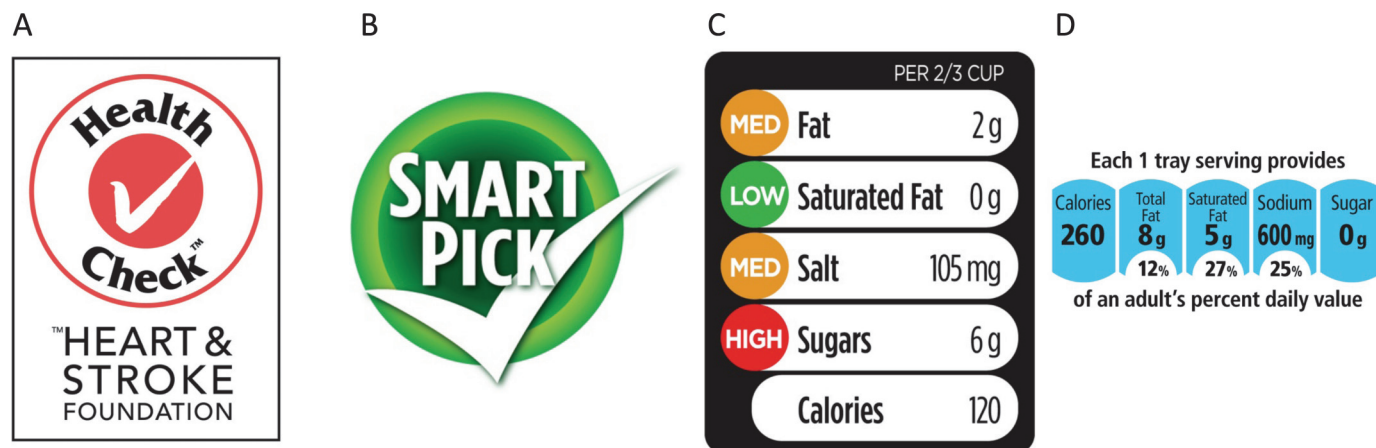
Y. Qi and W. Lou. Dalla Lana School of Public Health, University of Toronto, 155 College Street, Toronto, ON M5T 3M7, Canada.

J.E. Mendoza. Department of Food, Agricultural and Resource Economics, J.D. MacLachlan Building, University of Guelph, Guelph, ON N1G 2W1, Canada.

J.E. Cohen. Department of Health, Behavior and Society, Johns Hopkins Bloomberg School of Public Health, 2213 McElderry Street, Baltimore, MD 21205, USA.

Corresponding author: Mary R. L'Abbé (e-mail: mary.labbe@utoronto.ca).

Fig. 1. Front-of-pack (FOP) nutrition rating systems evaluated in the randomized mock package experiment. Summary indicator systems: (A) Health Check, a nonprofit-developed system (The Health Check logo, Health Check word mark, and the Heart and Stroke Foundation word mark are trademarks of the Heart and Stroke Foundation of Canada used under license), and (B) Smart Pick, modelled after a manufacturer-sponsored system. Nutrient-specific systems: (C) The Multiple Traffic Light, an interpretive system, and (D) The Nutrition Facts-based FOP system, an information-based system. B, C, and D were created by On Brand Design under contract with Dr. Mary L'Abbé at the Department of Nutritional Sciences, University of Toronto. In the fifth FOP condition, participants were exposed to mock packages without an FOP system. Participants were randomized to evaluate an assigned FOP system with or without a Nutrition Facts table, for a total of 10 treatment groups.



specific systems that show the amount per serving of select nutrients or use symbols based on the criteria used to make nutrient content or health claims on food packages; summary indicator systems that use a single symbol or score to provide summary information about the nutritional quality of a product; food group information systems that indicate the presence of a food group or food ingredient; or hybrid systems that combine characteristics of 2 or more of the preceding systems (IOM 2010).

The proliferation of FOP systems has led to concerns that they may be confusing and misleading to consumers because of their inconsistent appearance, application, and underlying nutrient criteria, and this has prompted expert groups to call for a single, standardized FOP system for use on all prepackaged food (IOM 2011; The Standing Committee on Health 2007). However, consumer attitudes toward the adoption of a single, standardized FOP system have not been evaluated. Furthermore, only a limited number of studies have examined consumer preferences for different FOP systems and FOP systems' overall consumer friendliness with respect to liking, helpfulness, credibility and trustworthiness, and understanding (Hawley et al. 2013). Most studies have identified a preference for nutrient-specific systems, specifically Traffic Lights, over summary indicator systems (Berning et al. 2008; Feunekes et al. 2008; Gorton et al. 2008; Maubach and Hoek 2010; Moser et al. 2010; Signal et al. 2007). However, results vary by country and ethnic group, suggesting a need for country-specific studies (Feunekes et al. 2008; Gorton et al. 2008; Moser et al. 2010; Signal et al. 2007). In Canada, where Traffic Lights are not in use and summary indicator systems are the predominant FOP style (Schermel et al. 2013), the consumer friendliness of different FOP systems has not been tested. Moreover, although in most jurisdictions (including Canada) FOP systems usually appear in conjunction with either a mandatory or a voluntary nutrition label on food packages, the consumer friendliness of FOP systems has been tested only relative to the standard nutrition label in a single study (Gorton et al. 2008); the consumer friendliness of different FOP systems has not been tested in situations with or without the standard nutrition label, such as the Nutrition Facts table (NfT) used in Canada.

To use FOP systems to guide the selection of foods, consumers must understand them. This understanding can be (i) substantial understanding (ability to interpret the label correctly to identify healthier foods) or (ii) conceptual understanding (general under-

standing of the concept behind an FOP system) (Grunert et al. 2010a, 2010b). With respect to substantial understanding, several studies have found that consumers are able to use FOP systems to identify the healthier of 2 products (Hawley et al. 2013), whereas a more limited number of studies have found that consumers perceived the same product as healthier when it carried an FOP system than when it did not (Andrews et al. 2011; Steenhuis et al. 2010). The latter studies suggest the potentially misleading nature of FOP systems; however, it is unclear whether this effect occurs across a range of product categories and different FOP system types, such as nonprofit compared with manufacturer-developed systems, or information-based compared with interpretive systems. Conceptual understanding of FOP systems has been less studied. A 2010 study of a nutrient-specific system in 6 European countries found low levels of conceptual understanding, with substantial variation among countries (Grunert et al. 2010a); conceptual understanding of other FOP systems has not been tested.

This research sought to examine many of these research gaps, to

- (i) Identify consumers' preferred FOP system for use on packaged foods based on self-reported preferences and measures of consumer friendliness (including conceptual understanding);
- (ii) Determine how different FOP systems, with or without the NfT, influence consumers' perceptions of the healthiness of different types of prepackaged foods;
- (iii) Determine consumers' attitudes towards the use and regulation of FOP systems.

Materials and methods

Participants

The study was conducted together with the Canadian Consumer Monitor (CCM) panel (AFMNet Consumer Monitor 2010). The CCM is a nationally representative panel of Canadian consumers between the ages of 20 and 69 years who complete on-line surveys related to food and nutrition every 8 to 10 weeks (Arcand et al. 2013; Wong et al. 2013). The CCM panel was recruited between March 2010 and January 2011; 31 223 individuals were contacted via email to join the panel, and 6665 completed the baseline questionnaire. The current study was conducted in July and August 2011. Consent forms were sent to each participant's

email when he or she joined the panel, and a link to the consent form was provided at the start of every survey. Ethics approval was received from both the University of Toronto and the University of Guelph research ethics boards.

Survey design and procedure

For the mock package experiment, each CCM participant was assigned randomly to 1 of the 5 test FOP systems (Fig. 1). The Health Check and Smart Pick symbols were chosen to be representative of summary indicator systems. The former represented a third-party nonprofit health foundation symbol; the latter was designed for this study to be representative of manufacturer-developed symbols (such as Kraft's Sensible Solutions or Pepsi's Smart Spot). The Multiple Traffic Light and the Nutrition Facts FOP system were chosen to be representative of nutrient-specific systems: the former, an interpretive system; the latter, an information-based system. Participants were further randomized to view their assigned FOP system with or without an NfT, for a total of 10 different treatment conditions. The no-NfT condition was designed to simulate what consumers see on store shelves if they choose not to turn over the package to view the mandatory NfT. Each participant viewed his or her assigned FOP system–NfT condition on the mock packages of both a frozen meal and a breakfast cereal. These categories were chosen because they are believed to be familiar to most participants, minimizing the potentially confounding effect of participants learning about a new product (Roe et al. 1999).

For each treatment condition, dependent variables were measured on a 5-point Likert-type scale. The consumer-friendliness measures of liking, helpfulness, credibility, understanding, and influence on purchase intention were evaluated for each FOP system. Participants in the no-FOP system–no-NfT condition were not asked to respond to the consumer friendliness measures, whereas participants in the no-FOP system–with-NfT condition were asked to respond to the consumer friendliness measures in relation to the NfT. Additionally, all respondents were asked to rate their perceptions of the healthiness, as well as the calorie and nutrient content, of both the frozen meal and the breakfast cereal. The consumer friendliness and perceived healthiness measures were modelled after those used by Feunekes et al. (2008) to test the effectiveness of different FOP nutrition labelling formats in Europe.

Conceptual understanding of each of the FOP systems was further assessed by asking consumers to rate, on a 5-point Likert-type scale, a series of statements describing the FOP systems (e.g., “This symbol is a guide to whether or not the food contains a little or a lot of a certain nutrient”, “This symbol indicates that the food meets a certain nutritional standard”, etc., with anchors 1 (“does not describe at all”) and 5 (“describes completely”).

Finally, panelists completed additional questions about their preferences regarding the regulation and use of FOP systems by food manufacturers in Canada. Respondents' demographic variables (age, gender, education, province, income) were collected during the recruitment process and the first survey and were merged with this survey data. The survey was translated, face validated by nutrition-labelling professionals, reviewed by a plain-language expert, and pilot tested with an online consumer panel from Guelph, Ontario, prior to being administered to the CCM panel (Emrich et al. 2012).

Statistical analyses

All data analyses were carried out using SAS version 9.3 (SAS Institute, Cary, N.C., USA). Data are presented as means (\pm SD) for continuous variables and count followed by percentage for categorical variables. Analysis of covariance (ANCOVA) was conducted to compare the mean rating differences in consumer friendliness, healthiness measures, calorie and nutrient content of the products, and the importance of including calorie counts and different

Table 1. Demographic characteristics of survey respondents ($n = 3029$).

Characteristics	CCM	
	No.	%
Gender		
Male	1049	34.6
Female	1980	65.4
Age (y)		
20–29	208	6.9
30–39	491	16.2
40–49	756	25.0
50–59	889	29.3
60–69	685	22.6
Education		
Less than high school	32	1.1
High school	537	17.7
Trade school	276	9.1
College	1039	34.3
University	1145	37.7
Province		
Alberta	332	11.0
British Columbia	488	16.1
Manitoba	189	6.2
New Brunswick	75	2.5
Newfoundland	58	1.9
Nova Scotia	167	5.5
Ontario	1078	35.6
Prince Edward Island	66	2.2
Quebec	404	13.3
Saskatchewan	172	5.7
Income		
Less than \$25 000	182	6.0
\$25 000–49 999	438	14.5
\$50 000–74 999	460	15.3
\$75 000–99 999	411	13.6
\$100 000–124 999	317	10.5
\$125 000–149 999	177	5.8
\$150 000–174 999	145	4.8
\$175 000–199 999	83	2.7
\$200 000+	115	3.8
Not provided	701	23.1

Note: CCM, Canadian Consumer Monitor.

nutrients in the FOP systems. The Tukey–Kramer method was used for multiple comparisons adjustment throughout the study. The mean ratings of statements describing the FOP systems were compared using ANCOVA with control of variables for age, gender, and education. For all the analyses, $p < 0.05$ was considered as statistically significant unless stated otherwise.

Results

Participants

Three thousand twenty-nine respondents (65% women) completed the survey and were included in the analysis. Demographic characteristics of respondents are shown in Table 1. There were no significant differences in the 10 conditions with respect to gender, age, or education among the participants. The sample was older and better educated than the general Canadian population.

Consumer friendliness of FOP systems

Mean scores of consumer friendliness differed by FOP system and by NfT (with the exception of understanding, which did not differ by NfT) (Table 2). The NfT–no-FOP system label combination received significantly higher mean scores on liking, helpfulness, credibility, and influence on purchase decisions than all the FOP system–NfT combinations, except for the Nutrition Facts FOP system–no-NfT combination, which received similar scores for lik-

Table 2. Mean scores of consumer friendliness by FOP system and Nft* (*n* = 3029).

Variables	FOP system					ANCOVA†		
	No system‡ (<i>n</i> = 600)	Summary indicator systems		Nutrient-specific systems		FOP system	Nft	FOP×Nft
		Health Check (<i>n</i> = 642)	Smart Pick (<i>n</i> = 572)	Traffic Light (<i>n</i> = 588)	Nutrition facts-based FOP system (<i>n</i> = 627)			
Frozen meal								
Liking§								
No Nft	NA	3.2de	3.0ef	3.5c	3.9ab	<0.0001	<0.0001	0.0535
Nft	4.1a	2.7fg	2.5g	3.4cd	3.7bc			
Helpfulness								
No Nft	NA	3.2d	2.7e	3.6bc	4.1a	<0.0001	<0.0001	0.9561
Nft	4.3a	2.8e	2.4f	3.3cd	3.8b			
Credibility¶								
No Nft	NA	3.1c	2.4d	3.2c	3.7ab	<0.0001	<0.0001	0.1086
Nft	4.0a	2.7d	2.1e	3.0c	3.6b			
Understanding**								
No Nft	NA	3.9cd	3.6e	4.4a	4.3ab	<0.0001	0.0537	0.5808
Nft	4.1bc	3.8de	3.6de	4.3ab	4.2ab			
Influence on purchase decisions††								
No Nft	NA	2.7ef	2.3gh	3.1cd	3.7b	<0.0001	0.0001	0.5327
Nft	4.2a	2.4fg	2.1h	3.0de	3.4bc			
Breakfast cereal								
Liking§								
No Nft	NA	3.1d	2.9de	3.5c	3.9ab	<0.0001	0.0017	0.6880
Nft	4.1a	3.0de	2.7e	3.4c	3.7bc			
Helpfulness								
No Nft	NA	3.0d	2.6ef	3.6c	4.0b	<0.0001	0.0020	0.5117
Nft	4.3a	2.9de	2.5f	3.5c	3.8bc			
Credibility¶								
No Nft	NA	3.1cd	2.5e	3.3c	3.8b	<0.0001	0.0182	0.6566
Nft	4.1a	2.9d	2.4e	3.2cd	3.7b			
Understanding**								
No Nft	NA	3.8b	3.6b	4.4a	4.3a	<0.0001	0.5831	0.7284
Nft	4.2a	3.8b	3.6b	4.4a	4.3a			
Influence on purchase decisions††								
No Nft	NA	2.6d	2.4de	3.2c	3.6b	<0.0001	0.0127	0.8258
Nft	4.2a	2.5de	2.2e	3.2c	3.5bc			

Note: FOP, front-of-pack; Nft, Nutrition Facts table; FOP×Nft, the significance of the interaction between FOP and Nft on consumers ratings of consumer friendliness on the 5-point Likert scale; ANCOVA, analysis of covariance; NA, not applicable.

*Values that do not share lowercase letters are significantly different from each other using LSMeans multiple comparison with Tukey–Kramer adjustments (*p* < 0.05).

†Models controlled for gender, age, and education.

‡Respondents randomized to view no FOP system and no Nft were not asked to complete consumer friendliness measures; respondents randomized to view no FOP system with an Nft completed consumer friendliness measures with reference to the Nft.

§Question: “How much do you like the [FOP system] on this food?” Anchors: 1 = “do not like at all”, 5 = “like a lot”.

||Question: “How helpful is the [FOP system] in helping you choose a healthier food?” Anchors: 1 = “not very helpful”, 5 = “extremely helpful”.

¶Question: “How credible is the [FOP system] to you?” Anchors: 1 = “not at all credible”, 5 = “extremely credible”.

**Question: “How difficult is it for you to understand the [FOP system]?” Anchors: 1 = “very difficult”, 5 = “very easy”.

††Question: “Would the [FOP system] influence your decision to buy this food?” Anchors: 1 = “not at all”, 5 = “extremely”.

ing (on both the frozen meal and the breakfast cereal) as well as helpfulness and credibility (on the frozen meal only). The 2 nutrient-specific systems (with or without the Nft) received significantly higher scores on understanding than did the 2 summary indicator systems (with or without the Nft) on both the frozen meal and the breakfast cereal. In addition, the 2 nutrient-specific systems (with or without the Nft) received higher scores on liking, helpfulness, credibility, and influence on purchase decisions than did Health Check (with the Nft) and Smart Pick (with or without the Nft) (*p* < 0.05).

Effect of Nft on consumer friendliness of FOP systems

Pairwise comparison between the frozen meals with or without the Nft showed that consumers found the summary indicator systems (Health Check and Smart Pick) more helpful, credible, and likeable when they were shown without the Nft (*p* < 0.05) (Table 2). In addition, the Nutrition Facts FOP system was given

significantly higher scores on helpfulness when shown without the Nft. However, no significant differences in consumer friendliness scores were seen between the FOP system pairs (FOP system with and without Nft) on the breakfast cereal (Table 2).

Conceptual understanding

With respect to conceptual understanding, when presented with a list of possible descriptors of the Nft or their FOP system, consumers scored the correct descriptions of the concept behind the Nft or specific FOP system the highest (Table 3). More than 70% of consumers randomly assigned to either the Nft or the Nutrition Facts FOP system believed that their respective labels could be used to compare foods both within (e.g., cereal to cereal) and across (e.g., cereal to crackers) food categories. Seventy-one percent of consumers in the Traffic Light group believed that it could help them compare foods within a food category. Fewer than 50% of the consumers in the Health Check or Smart Pick groups

Table 3. Mean scores of statements describing the Nutrition Facts table and FOP systems.

FOP system	Statements rated most descriptive of each FOP system	Mean score*
Nutrition Facts table	The Nutrition Facts table is a guide to whether or not the food contains a little or a lot of a certain nutrient.	4.0
	The Nutrition Facts table is a guide to the amount of different nutrients in a food.	3.8
Health Check	The Nutrition Facts table is a guide to the amount of nutrients a person should eat in a day.	2.9
	This symbol indicates that the food meets a certain nutritional standard.	3.5
Smart Pick	This symbol indicates that the food is healthy or good for me.	3.1
	This symbol indicates that the food is more nutritious than other similar foods.	2.9
	This symbol indicates that the food meets a certain nutritional standard.	2.8
Traffic Light	This symbol indicates that the food is healthy or good for me.	2.7
	This symbol indicates that the food is more nutritious than other similar foods.	2.7
	This symbol is a guide to whether or not the food contains a little or a lot of a certain nutrient.	3.5
Nutrition Facts FOP system	This symbol is a guide to the amount of different nutrients in a food.	3.0
	This symbol indicates that the food is healthy or good for me.	2.7
	This symbol is a guide to whether or not the food contains a little or a lot of a certain nutrient.	3.6
	This symbol is a guide to the amount of different nutrients in a food.	3.1
	This symbol indicates that the food is healthy or good for me.	2.8

Note: Bolded statements are the correct descriptions of the FOP system of interest. FOP, front-of-pack.

*Anchors: 1 = "Does not describe at all"; 5 = "Describes completely".

believed these FOP systems could be used to compare foods within or across food categories.

Effect of FOP system on perceived overall healthiness and nutrient content

Mean scores of healthiness and nutrient content differed by NfT and FOP system (Table 4). With respect to the frozen meal, consumers who saw the NfT, regardless of FOP system, gave similar scores on healthiness and on calorie, fat, saturated fat, trans fat, fibre, and sugar content. However, consumers who saw the Traffic Light and an NfT scored the frozen meal significantly lower in sodium than did all the other FOP system–NfT groups.

When there was no NfT, consumers in the Health Check group scored the frozen meal as significantly healthier than did the 2 nutrient-specific system groups and the no-FOP system group. In addition, the Health Check group scored the meal lower in saturated and trans fat than did all the other FOP system groups, but higher in sugar than did the nutrient-specific system and no-FOP system groups. Consumers in the Health Check and Smart Pick groups without the NfT scored the frozen meal as healthier, lower in saturated fat and sodium, and higher in fibre, but also higher in calories and sugar, when compared with the same FOP system with the NfT. In addition, consumers in the Health Check–no-NfT group rated the frozen meal as lower in fat and trans fat than did the Health Check–NfT group.

With respect to the breakfast cereals, consumers who saw the NfT with no FOP system, Health Check, Smart Pick, or Nutrition Facts FOP system scored the cereal similarly with respect to healthiness and calorie, fat, saturated fat, trans fat, sodium, fibre, and sugar content (Table 4). However, consumers who saw the Traffic Light scored the cereal lower with respect to healthiness and higher with respect to fat and sugar content than did all other FOP system–NfT groups ($p < 0.05$). The Traffic Light group also scored the cereal higher in sodium than did consumers who saw no FOP system or a summary indicator system ($p < 0.05$). On the other hand, when the NfT was absent, a number of differences in product ratings among the different FOP systems were seen. Consumers with the Nutrition Facts FOP system perceived the cereal as significantly healthier than did consumers who saw the same cereal with no FOP system or Traffic Light. In addition, consumers who saw the Nutrition Facts FOP system scored the cereal as lower in fat and sugar than did all other FOP system groups, and lower in sodium than did all other FOP system groups except for the Health Check group. Consumers scored the cereal as lower in calories and saturated fat when they saw a nutrient-specific system than

did all other FOP system groups ($p < 0.05$). Finally, consumers who saw either 1 of the summary indicator systems or no FOP system, without the NfT, scored the cereal as significantly higher in calories and all 7 nutrients than did consumers exposed to the same FOP system with the NfT. Meanwhile, consumers who saw the Traffic Light scored the cereal lower in trans fat, sodium, and sugar when the NfT was present than when it was absent ($p < 0.05$).

Consumer preferences for FOP systems

The majority of participants (86%) believed that there should be either a single mandatory or a single voluntary FOP system used by all manufacturers, and most (68%) believed that a single FOP system should be used on all food packages, not just on healthy products or on products chosen at the manufacturer's discretion. Participants were split as to who should be responsible for overseeing the use of FOP systems, with 44% and 35% supporting oversight by the government and the nonprofit sector, respectively; only 14% favoured oversight by manufacturers or industry associations. With respect to the importance of including calories and 11 different nutrients in the FOP system, participants rated, on average, all nutrients as at least somewhat important (mean rating >3.8 out of 5). Sodium, trans fat, saturated fat, and sugar received the highest mean ratings of importance for inclusion in an FOP system. When asked directly which FOP system they preferred (Health Check, Smart Pick, Traffic Light, or Nutrition Facts FOP system), 53% preferred the Traffic Light and 30% preferred the Nutrition Facts FOP system.

Discussion

Overall, we found that the NfT was more consumer friendly than were FOP systems with respect to liking, helpfulness, credibility, and influence on purchase decisions. This is an encouraging finding given the widespread use of standardized nutrition labels such as the NfT on food packages in Canada and internationally (EUFIC 2013). However, our findings are in contrast to those of the only other study to compare a mandatory nutrition label with different FOP systems; Gorton et al. (2008) found that more consumers "liked" or "really liked" Traffic Lights than they did a mandatory nutrition label. The high ratings of the NfT along the dimensions of consumer friendliness studied here are perhaps a result of the widespread use of this mandatory label by Canadian consumers; 71% of Canadians report looking for the NfT when reading food labels, whereas only 23% report looking for "healthy–better choice" symbols or logos, such as FOP systems

Table 4. Mean healthiness, calorie, and nutrient content scores of a frozen meal and a breakfast cereal by NfT and FOP system*.

Characteristics and FOP systems	Frozen meal			Breakfast cereal		
	No NfT	NfT	<i>p</i> [†] (NfT×FOP)	No NfT	NfT	<i>p</i> [†] (NfT×FOP)
Healthiness[‡]			<0.0001			0.0028
No FOP system	2.5cd	2.3d		3.4cd	3.8a	
Health Check	3.2a	2.4cd		3.4bcd	3.9a	
Smart Pick	3.0ab	2.4cd		3.6ac	3.8a	
Traffic Light	2.7bc	2.5cd		3.2d	3.4cd	
Nutrition Facts FOP system	2.4cd	2.3d		3.7ab	3.7ab	
Calories[§]			<0.0001			0.0028
No FOP system	4.0a	3.1c		3.4a	2.2b	
Health Check	3.6b	3.0cd		3.3a	2.1b	
Smart Pick	3.6b	2.9cd		3.3a	2.1b	
Traffic Light	2.8d	2.9cd		2.2b	2.3b	
Nutrition Facts FOP system	2.9c	3.1c		2.1b	2.2b	
Fat[§]			<0.0001			<0.0001
No FOP system	3.7a	3.4ab		2.5a	1.7d	
Health Check	2.9e	3.2bcd		2.2bc	1.7d	
Smart Pick	3.2bcd	3.3bc		2.4ab	1.6d	
Traffic Light	3.0d	3.2bcd		2.2bc	2.1c	
Nutrition Facts FOP system	3.0c	3.3bcd		1.7d	1.8d	
Saturated fat[§]			<0.0001			<0.0001
No FOP system	3.5c	3.9a		2.2a	1.2bc	
Health Check	2.4e	3.7abc		2.0a	1.2c	
Smart Pick	2.8d	3.9ab		2.2a	1.2c	
Traffic Light	3.1d	3.6bc		1.4b	1.3bc	
Nutrition Facts FOP system	3.7abc	3.8abc		1.3bc	1.3bc	
Trans fat[§]			0.0001			<0.0001
No FOP system	3.2a	2.9ab		2.0ab	1.2d	
Health Check	2.2c	2.7b		1.8bc	1.2d	
Smart Pick	2.7ab	2.9ab		2.1a	1.2d	
Traffic Light	2.7abc	2.7b		1.8abc	1.3d	
Nutrition Facts FOP system	3.0ab	2.9ab		1.7c	1.3d	
Sodium[§]			<0.0001			<0.0001
No FOP system	4.3a	4.4a		3.0a	2.1de	
Health Check	3.2c	4.3a		2.6bc	2.0e	
Smart Pick	3.7b	4.4a		2.8ab	2.1de	
Traffic Light	3.3c	3.8b		2.9ab	2.5c	
Nutrition Facts FOP system	4.4a	4.3a		2.5c	2.3cd	
Fibre[§]			<0.0001			0.0036
No FOP system	2.2b	2.2b		3.8ab	2.4c	
Health Check	2.6a	2.2b		3.8ab	2.3c	
Smart Pick	2.6a	2.2b		3.9a	2.4c	
Traffic Light	2.1b	2.1b		3.5ab	2.4c	
Nutrition Facts FOP system	2.0b	2.1b		3.4b	2.4c	
Sugar[§]			<0.0001			<0.0001
No FOP system	3.1a	1.4c		3.9a	2.7c	
Health Check	2.8ab	1.5c		3.6ab	2.7c	
Smart Pick	2.7b	1.4c		3.6ab	2.7c	
Traffic Light	1.4c	1.4c		3.7a	3.4b	
Nutrition Facts FOP system	1.2c	1.4c		2.7c	2.8c	

Note: NfT, Nutrition Facts table; FOP, front-of-pack; FOP×NfT, the significance of the interaction between NfT and FOP on consumer ratings of product healthiness and nutrient content.

*Values that do not share letters are significantly different from each other using least-squared means multiple comparison with Tukey–Kramer adjustment ($p < 0.05$).

[†]*p* value for interaction of FOP system and NfT; model controlled gender, age, and education.

[‡]Question: “How healthy is this food for you?” Anchors: 1 = “not at all healthy”, 5 = “very healthy”.

[§]Question: “Please indicate if this food has a little or a lot of the following nutrient” Anchors: 1 = “a little”, 5 = “a lot”.

(Canadian Council of Food and Nutrition 2008). We also found a consumer preference for nutrient-specific over summary indicator systems, consistent with the findings of other studies (Berning et al. 2008; Feunekes et al. 2008; Gorton et al. 2008). With respect to consumer friendliness measures, in the majority of FOP system–NfT comparisons, the 2 nutrient-specific systems (the Nutrition Facts FOP system and the Traffic Lights) were scored higher than were the 2 summary indicator systems (Health Check and Smart Pick) with respect to liking, helpfulness, understanding, and influence on purchase decisions, and the Nutrition Facts FOP

system was scored as significantly more credible than all other FOP systems.

The widespread use of the NfT by consumers in Canada may also explain the higher levels of conceptual understanding observed in relation to the NfT. Consumers gave higher scores to the correct descriptions of the NfT (≥ 3.8 out of 5) than to the correct descriptions of the FOP systems, indicating their greater understanding of the NfT. Scores for the correct descriptions of nutrient-specific FOP systems were similarly high, perhaps because of their greater similarity to the NfT than to the summary indicator systems.

However, our findings relating to consumer friendliness and conceptual understanding should be considered in relation to the composition of our sample, which was predominantly female and better educated than the average consumer. This is particularly relevant given previous research that has shown that nutrition labels are more likely to be used by women than by men, and by college-educated consumers than by those with a high school education (Blitstein and Evans 2006). Furthermore, a 2011 systematic review identified greater understanding of nutrition labels among women and consumers with higher levels of education, literacy, and numeracy; a lack of numeracy skills appeared particularly problematic in the understanding and use of nutrition labels (Campos et al. 2011). Thus, despite our finding that the NfT was superior to the FOP systems along several dimensions of consumer friendliness and conceptual understanding, other research would suggest that certain segments of the population may benefit from a more simplified presentation of nutrition information on food packages in the form of FOP systems. Moreover, CCM panelists strongly favoured the implementation of a single, standardized FOP system, either by government or a nonprofit group, despite the higher scores of consumer friendliness and conceptual understanding attributed to the NfT.

When used in conjunction with the mandatory NfT, FOP systems, with the exception of the Traffic Lights, had a limited influence on consumers' perceptions of the healthiness and calorie and nutrient content of the breakfast cereal and frozen meal used in this study. Compared with other FOP system groups that saw the NfT, consumers who saw the frozen meal with a "green" sodium Traffic Light perceived the meal as lower in sodium, whereas consumers who saw the breakfast cereal with "amber" fat and sodium and "red" sugar Traffic Lights perceived the meal as higher in fat, sodium, and sugar and as less healthy overall. Thus, it appears that consumers can correctly interpret the meaning of the Traffic Light colours and incorporate them into their evaluations of the product.

We found that, as in previous studies, FOP systems influenced consumer perceptions of product healthiness and nutrient content in the absence of a mandatory nutrition label (Andrews et al. 2011; Steenhuis et al. 2010). Andrews et al. (2011) found that a frozen dinner displaying a summary indicator system was rated as healthier overall and lower in negative nutrients than was the same frozen dinner displaying a Traffic Light nutrient-specific system, or a no-FOP system control. Similarly, we found that, when the NfT was absent, a frozen dinner with a Health Check summary indicator system was scored healthier overall and lower in saturated and trans fat than was the same frozen dinner with no FOP system or a nutrient-specific FOP system. However, a different pattern emerged when the breakfast cereal was shown without the NfT. Consumers exposed to the nutrient-specific systems scored the cereal as lower in negative nutrients, demonstrating that the influence of FOP systems differs by product type.

Finally, with respect to many nutrients, consumers who saw no FOP system or a summary indicator system, without the NfT, scored the frozen meal more favourably, but the breakfast cereal less favourably, than did consumers who saw the same FOP conditions with the NfT. This finding is of particular concern because past research has found that the presence of nutrition information on the FOP label may lead consumers to truncate their search for nutrition information (i.e., not look at the NfT) and rely exclusively on the claims made on the FOP label to evaluate products (Roe et al. 1999).

Conclusion

In summary, consumers are in favour of a single, standardized FOP symbol for use on packaged foods, despite the high levels of consumer friendliness associated with the existing mandatory nutrition label. Consumers would prefer an FOP system that

builds upon the well-liked, helpful, credible, and influential NfT, providing nutrient-specific information in the form of a Traffic Light or Nutrition Facts FOP system; however, prior to widespread implementation, such a system will need to be evaluated as suitable for consumers with lower health-literacy skills. Our findings suggest that consumers support the recommendation of the IOM that a single, standardized FOP system appear on all products, and that this should therefore be considered by Canadian policy makers.

Acknowledgements

The CCM panel was established in 2010 by Dr. Spencer Henson of the University of Guelph through funding from the Advanced Foods and Materials Network, a former Networks of Centres of Excellence, with co-investigators from across Canada. Further support for this research was obtained from the Earle W. McHenry Research Chair Award (M.R.L.) and a Canadian Institutes of Health Research (CIHR) Frederick Banting and Charles Best Canada Graduate Scholarship, a Cancer Care Ontario and CIHR training grant in Population Intervention for Chronic Disease Prevention (grant no. 53893), and the CIHR Strategic Training Program in Public Health Policy (T.E.).

References

- AFMNet Consumer Monitor. [Online.] 2010. AFMNet Consumer Monitor Panel. Available at <http://consumermonitor.ca/>. [Accessed 1 May 2013.]
- Andrews, J.C., Burton, S., and Kees, J. 2011. Is simpler always better? Consumer evaluations of front-of-package nutrition symbols. *J. Public Policy Mark.* 30(2): 175–190. doi:10.1509/jppm.30.2.175.
- Arcand, J., Mendoza, J., Qi, Y., Henson, S., Lou, W., and L'Abbé, M.R. 2013. Results of a national survey examining Canadians' concern, actions, barriers, and support for dietary sodium reduction interventions. *Can. J. Cardiol.* 29(5): 628–631. doi:10.1016/j.cjca.2013.01.018. PMID:23489574.
- Berning, J.P., Chouinard, H.H., and McChuskey, J.J. 2008. Consumer Preferences for Detailed Versus Summary Formats of Nutrition Information on Grocery Store Shelf Labels. *Journal of Agricultural and Food Industrial Organization*, 6(1): 1–22.
- Blitstein, J.L., and Evans, W.D. 2006. Use of Nutrition Facts Panels among Adults Who Make Household Food Purchasing Decisions. *J. Nutr. Educ. Behav.* 38(6): 360–364. doi:10.1016/j.jneb.2006.02.009. PMID:17142192.
- Campos, S., Doxey, J., and Hammond, D. 2011. Nutrition labels on pre-packaged foods: a systematic review. *Public Health Nutr.* 14(8): 1496–1506. doi:10.1017/S1368980010003290. PMID:21241532.
- Canadian Council of Food and Nutrition. 2008. Tracking Nutrition Trends VII. Canadian Council of Food and Nutrition, Mississauga, Ont., Canada.
- Committee on Examination of Front-of-Package Nutrition Rating Systems and Symbol, IOM. 2010. Examination of Front-of-Package Nutrition Rating Systems and Symbols: Phase I Report. The National Academies Press, Washington, DC, USA.
- Committee on Examination of Front-of-Package Nutrition Rating Systems and Symbol, IOM. 2011. Front-of-Package Nutrition Rating Systems and Symbols: Promoting Healthier Choices. The National Academies Press, Washington, DC, USA.
- Emrich, T.E., Mendoza, J.E., and L'Abbe, M.R. 2012. Effectiveness of front-of-pack nutrition symbols: A pilot study with consumers. *Can. J. Diet Pract. Res.* 73(4): 200–203. doi:10.3148/73.4.2012.200. PMID:23217449.
- EFUIC. 2013. Global Update on Nutrition Labelling. European Food Information Council, Brussels, Belgium.
- Feunekes, G.I.J., Gortemaker, I.A., Willems, A.A., Lion, R., and van den Kommer, M. 2008. Front-of-pack nutrition labelling: Testing effectiveness of different nutrition labelling formats front-of-pack in four European countries. *Appetite*, 50(1): 57–70. doi:10.1016/j.appet.2007.05.009. PMID:17629351.
- Gorton, D., Ni Mhurchu, C., Chen, M., and Dixon, R. 2008. Nutrition labels: a survey of use, understanding and preferences among ethnically diverse shoppers in New Zealand. *Public Health Nutr.* 12(9): 1359–1365. doi:10.1017/S1368980008004059. PMID:19087382.
- Grunert, K.G., Fernández-Celemin, L., Wills, J.M., Storcksdieck Genannt Bonsmann, S., and Nureeva, L. 2010a. Use and understanding of nutrition information on food labels in six European countries. *J. Public Health.* 18(3): 261–277. PMID:21124644.
- Grunert, K.G., Wills, J.M., and Fernández-Celemin, L. 2010b. Nutrition knowledge, and use and understanding of nutrition information on food labels among consumers in the UK. *Appetite*, 55(2): 177–189. doi:10.1016/j.appet.2010.05.045. PMID:20546813.
- Hawley, K.L., Roberto, C.A., Bragg, M.A., Liu, P.J., Schwartz, M.B., and Brownell, K.D. 2013. The science of front-of-package labels. *Public Health Nutr.* 16(3): 430–439. doi:10.1017/S1368980012000754. PMID:22440538.
- Maubach, N., and Hoek, J. 2010. A qualitative study of New Zealand parents'

- views on front-of-pack nutrition labels. *Nutr. Diet.* **67**: 90–96. doi:10.1111/j.1747-0080.2010.01425.x.
- Moser, A., Hoefkens, C., Van Camp, J., and Verbeke, W. 2010. Simplified nutrient labelling: Consumers' perceptions in Germany and Belgium. *J. Consum. Prot. Food Saf.* **5**(2): 169–180.
- Roe, B., Levy, A.S., and Derby, B.M. 1999. The impact of health claims on consumer search and product evaluations outcomes: Results from FDA experimental data. *J. Public. Policy. Mark.* **18**(1): 89–105.
- Schermel, A., Emrich, T., Arcand, J., Wong, C., and L'Abbé, M. 2013. Nutrition marketing on processed food packages in Canada: 2010 food label information program. *Appl. Physiol. Nutr. Metab.* **38**: 666–672. doi:10.1139/apnm-2012-0386. PMID:23724885.
- Signal, L., Lanumata, T., Robinson, J., Tavila, A., Wilton, J., and Ni Mhurchu, C. 2007. Perceptions of New Zealand nutrition labels by Maori, Pacific and low-income shoppers. *Public Health Nutr.* **11**(7): 706–713. PMID:18167165.
- Steenhuis, I.H.M., Kroeze, W., Vyth, E.L., Valk, S., Verbauwen, R., and Seidell, J.C. 2010. The effects of using a nutrition logo on consumption and product evaluation of a sweet pastry. *Appetite*, **55**(3): 707–709. doi:10.1016/j.appet.2010.07.013. PMID:20678531.
- The Standing Committee on Health. 2007. Healthy Weights for Healthy Kids. House of Commons of Canada, Ottawa, Ont., Canada.
- Wong, C.L., Arcand, J., Mendoza, J., Henson, S.J., Qi, Y., Lou, W., and L'Abbé, M.R. 2013. Consumer attitudes and understanding of low-sodium claims on food: an analysis of healthy and hypertensive individuals. *Am. J. Clin. Nutr.* **97**(6): 1288–1298. doi:10.3945/ajcn.112.052910. PMID:23576050.