



Nutritional value of child-targeted food products: results from the Food Quality Observatory

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Abstract

Objective: To characterise the nutritional quality of food products targeted to children, we aimed: (1) to determine if the nutritional composition of child-targeted food products is different from those for the general population and (2) to verify differences in the nutrient content of child-targeted food products between three selected food categories.

Design: The present study is part of the work conducted by the Food Quality Observatory, created in 2016 in the province of Quebec (Canada). Ready-to-eat (RTE) breakfast cereals (*n* 331), granola bars (*n* 310) and yoghurts and dairy desserts (*n* 380) were the food categories analysed.

Setting: Nutritional values and all packaging information were obtained by purchasing every product available in supermarkets, grocery stores and specialty grocery stores. Free sugars were manually differentiated from total sugars for each product. Products were classified according to two targeted consumer groups: children or general population.

Results: The nutrient profile of RTE breakfast cereals, granola bars and yoghurts and dairy desserts targeted to children differed from that of products intended at the general population. Child-targeted RTE breakfast cereals had the least favourable nutritional composition, with significantly higher content of carbohydrates, total sugars, free sugars and Na compared with breakfast cereals for the general population as well as child-targeted granola bars and yoghurts and dairy desserts. All child-targeted products analysed contained free sugars.

Conclusions: The current study supports the relevance to further regulate marketing to children on food product packages to ensure that such marketing is not present on food products with poor nutritional quality.

Keywords
Food marketing
Children
Food product package
Nutritional quality
Food supply
Nutritional value

Several studies have demonstrated associations between the diet and health status of individuals, which strengthens concerns about the nutritional quality of the food we consume everyday^(1,2). Meanwhile, studies also showed that the food environment can influence individual food choices^(3,4), which is particularly true for children's dietary intakes, since food promotion is one important environmental determinant⁽⁵⁾.

Data from the 2015 Canadian Community Health Survey suggest that sugars and Na consumption is particularly high among children aged 1 to 18 years⁽⁶⁾. Their sugar intake represents a quarter of total energy intake and is significantly higher than adults⁽⁶⁾. However, that represents only the amount of total sugars. Total sugars include free, added,

or naturally present sugars, and the distinction between the types of sugars is important for taking into account their different association with health⁽⁷⁾. Naturally occurring sugars are those present in fruits, vegetables and dairy products in their natural state. Added and free sugars are the sugars added to foods, and they both differ by the inclusion of fruit juices in the latter^(7,8). Compared with total and added sugars, free sugars appear to be more relevant to consider since dietary sources of free sugars are more consistently associated with the risk of increased energy intake, weight gain, diabetes and dental caries⁽⁷⁾.

Children represent a vulnerable group, since their preferences can be easily influenced by food and beverage marketing^(9–13). This is an important concern that has been

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highlighted in the recent Canada's Food Guide⁽¹⁴⁾. Indeed, studies show that most food products marketed to children are unhealthy, namely high in sugars, fats and/or Na⁽¹⁵⁻¹⁹⁾. In the province of Quebec, commercial advertising intended for children under the age of 13 is prohibited by The Consumer Protection Act⁽²⁰⁾, but there are three exceptions not covered by this law: advertising in a children's magazine, advertising about a children's show and exceptions relating to the display, container, packaging and label⁽²¹⁾. It is then possible for food companies to target children by using pictures on their product labels. Child-targeted product packaging is therefore a powerful marketing technique widely used to reach children's attention⁽²²⁾.

The current study aimed to characterise the nutritional quality of food products targeted to children and available in the Quebec food supply. Ready-to-eat (RTE) breakfast cereals, granola bars and yoghurts and dairy desserts were the food categories selected for conducting the analyses, since they are part of the food categories most likely to be marketed to children⁽²³⁾. More specifically, this characterisation aimed: (1) to determine if the nutritional composition of child-targeted food products is different from those for the general population; and (2) to verify differences in the nutrient content of child-targeted food products between the three selected food categories. We also included comparisons of free sugars content in the analyses. Our hypothesis is that the nutritional composition of child-targeted food products is different from those for the general population, with a lower nutritional quality that is mainly explained by a higher content of free sugars in such products.

Methods

Data collection

The present study is part of the work conducted by the Food Quality Observatory (Observatory), created in 2016 to monitor the quality of the food supply in the province of Quebec, Canada⁽²⁴⁾. Depending on the food category, data collection took place in supermarkets, grocery stores and specialty grocery stores either from the Greater Montreal area (Quebec, Canada) (through an agreement with *Protégez-Vous*, a Quebec-based non-profit organisation specialising in consumer information and product testing) or from Quebec City and its surroundings (by the Observatory). The choice of the food categories for the present study depended on the availability of data within the Observatory at the moment the analyses were conducted (i.e. RTE breakfast cereals, sliced breads, sliced processed meats, ready-to-serve soups, frozen meals, granola bars, pasta sauces and yoghurts and dairy desserts), on the relevance of the food categories with regard to marketing to children as well as on the increased prevalence of containing free sugars in the targeted categories based

on the literature on the subject. RTE breakfast cereals (*n* 331), granola bars (*n* 310) and yoghurts and dairy desserts (*n* 380) were thus selected, for a total of *n* 1021 food items analysed. Nutritional values for RTE breakfast cereals and part of the data for yoghurts (*n* 200) were collected and shared by *Protégez-Vous* in 2016 and 2018, respectively. Data collection for granola bars (2018) and for the other part of the data for yoghurts and dairy desserts (2019) were conducted by the Observatory. Yoghurts and dairy desserts were collected in two parts explained by the fact that *Protégez-Vous* had not collected all the products of this food category (drinking yoghurt, desserts made from dairy substitutes and fresh cheese were not included). The analysis of each food categories is a long process that lasts approximately 9 months, which is why the three categories of food could not have been collected the same year. Every product available in all these food categories was purchased. Collected RTE breakfast cereals were cold breakfast cereals in individual packaging with the exclusion of multiple packages with several varieties. Collected granola bars were only those sold in boxes and not individually. For yoghurts and dairy desserts, we considered those sold in individual format; large formats were excluded. Yoghurts and dairy desserts included yoghurts, fresh cheese, dairy desserts (i.e. RTE pudding) and desserts made from dairy substitutes. Frozen desserts were excluded. Nutritional value and packaging information were entered separately in double coders in an Excel file for each food category. When discrepancies were noted between the two coders for both nutritional value and packaging information, coders then return to consult together the information on the packaging to validate the exact information. If they were still hesitating, a consensus was reached with a neutral third person (VP), which reinforced the classification validity. For the purpose of our study, the nutritional values of interest were energy (kcal), fat (g), saturated fat (g), carbohydrates (g), total sugars (g), fibres (g), proteins (g) and Na (mg).

Calculation of free sugars content

While information about nutrient content can be collected directly from the Nutrition Facts Table available on the package of each product⁽²⁵⁾, the amount of free sugars is not displayed in Canada. As we aimed to analyse further the sugar content of food products by differentiating naturally occurring sugars, free sugars or both, free sugars were manually differentiated from total sugars for each product of the three food categories. The definition of free sugars from the WHO was used: 'Free sugars include monosaccharides and disaccharides added to foods and beverages by the manufacturer, cook or consumer and sugars naturally present in honey, syrups, fruit juices and fruit juice concentrates'⁽²⁶⁾. Sugar differentiation was conducted using the step-by-step method published by Bernstein *et al.*⁽²⁷⁾ for calculating the free sugar content of foods

**Table 1** Step-wise approach for the calculation of free sugars content for RTE breakfast cereals, granola bars and yoghurts and dairy desserts (adapted from Bernstein *et al.*⁽²⁷⁾)

Steps	n*
Step 1 Given that total sugars represent the sum of naturally occurring sugar and free sugars, products that contain no total sugar (0 g), as declared in their Nutrition Facts table, therefore contain no free sugar (0 g/100 g). For example: RTE breakfast cereals made from 100 % whole wheat without any other ingredients (0 g of total sugar).	20
Step 2 For products with >0 g of total sugars that contain no free sugar ingredient† listed in the ingredient list, it is estimated that they contain no free sugar (0 g/100 g). In that case, total sugars solely represent naturally occurring sugars. For example: strawberry yoghurt with stevia extract (contain naturally occurring sugars from lactose and strawberry, but 0 g of free sugar).	32
Step 3 For products with >0 g of total sugars that contain no or minimal amounts of naturally occurring sugars, it is estimated that total sugars solely represent free sugars. Therefore, free sugars content = total sugars content. For example: RTE breakfast cereals only made from puffed rice and frosted with honey (the only source of sugars in this product is honey, total sugars therefore represent only free sugars).	16
Step 4 Products that contain both naturally occurring sugars and free sugar ingredients are compared with similar products without free sugar ingredients (from steps 1 and 2) from the same food category. The equation used to calculate free sugars at this step was:	555
$\text{Free sugars} = \frac{100 \times (\text{sugars per 100 g product unsweetened} - \text{sugars per 100 g product sweetened})}{\text{sugars per 100 g product unsweetened} - 100}$	
For example: vanilla yoghurt (10 g of total sugars per 100 g) v. unsweetened yoghurt (2 g of total sugars per 100 g)	
$\text{Free sugars per 100 g in this vanilla yogurt} = \frac{100 \times (2 - 10)}{2 - 100} = 8.16 \text{ g}$	
Step 5 Products that contain both naturally occurring and free sugars and that do not have a comparator without free sugar in the same food category were assigned a free sugars value based on a substitute value from the USDA Database for the Added Sugars Content of Selected Foods ⁽⁴⁴⁾ . For example: granola bar with fruits and nuts was assigned a free sugars value at 93.56 % of total sugars because the comparable USDA database product number 19 023 had 93.56 % of the total sugars coming from added sugars.	380
Step 6 Products that contain both naturally occurring and free sugars and that do not have a comparator in the USDA Database (Step 5) were assigned a value reflective of the proportion of total sugars coming from free sugars in products within the same food category.	0
Step 7 (new step added) If none of the preceding steps could be used to determine the free sugars content in a product, each case was discussed between the first and last authors (JGM and VP), and a joint decision was then taken. For example: free sugars value of a cherry yoghurt substitute was determined by subtracting naturally occurring sugar from cherry based on the fruit content of fruit yoghurts.	18

*Number of products for which the free sugar estimation was made at this step.

†Free sugar ingredients refer to all monosaccharides and disaccharides added to foods and beverages by the manufacturer, cook or consumer and sugars naturally present in honey, syrups, fruit juices and fruit juice concentrates⁽²⁶⁾. Monosaccharides and disaccharides represent simple sugars made up of one or two units, as opposed to complex carbohydrates which consist of three or more units and include starch and fibre.

and beverages in the Canadian food supply. Table 1 describes the steps of this algorithm.

Classification

All products have been classified separately by two different coders according to two targeted consumer groups, i.e. children or general population. A product was considered to be targeted to children by the presence of ≥ 1 of the following criteria: (1) explicitly written that it is a product for children (< 18 years) or family; (2) a packaging displaying a character, drawing, cartoon or animal attractive for children; (3) a packaging displaying a movie, program, activity, promotion or contest aimed at children; (4) a fun or particular package shape or package size adapted for children; (5)

name of the product intended for children; (6) a fun or positive theme (humour, happiness, autonomy or freedom); (7) animated foods which seem to be in motion; (8) references to magic or fantasy; (9) a note for use in the lunch box or at school^(15,28–30) and (10) a 'mom approved' mention on packaging. All other products were considered as intended for the general population. If a product was classified differently by the coders, a consensus was reached with a neutral third person, which reinforced the classification validity. While disagreement between the two separate coders was observed for twenty-eight products among the 156 classified as child-targeted products, which represent 3% of the overall sample of products (total of n 1021), the validation with a third person was estimated to be necessary for only 5% of these child-targeted products. External

validation of coding was assessed by calculating two Cohen's κ coefficients (considering limited access to the 2016 data, external validation for breakfast cereals was done using data collected in 2021). Coefficient was 0.77 for yoghurts and dairy desserts and granola bars and 0.86 for breakfast cereals which means a high level of agreement. In addition, since it is too subjective to adequately differentiate food marketing targeting children as compared with teenagers, we decided to consider as children all individuals <18 years.

Statistical analyses

Means and standard deviations were determined for energy, fat, saturated fat, carbohydrates, total sugars, free sugars, fibres, proteins and Na for all products of each food category and for products classified according to targeted customers (children or general population). To illustrate the difference between products targeted at children and those for the general population in the three food categories separately, Wilcoxon rank sum tests were used. Kruskal–Wallis tests were conducted to assess differences in products targeted at children between food categories, and the Dwass, Steel, Critchlow-Fligner procedure was used to assess the presence of significant differences. All comparisons were made per reference serving and per 100 g. According to the Canadian regulation, the reference serving used for RTE breakfast cereals was 55 g⁽³¹⁾. For both granola bars and yoghurts and dairy desserts, the reference serving used was one unit. Considering the multiple comparisons performed, Bonferroni correction was used for all statistical tests, and $P < 0.00185$ was considered statistically significant. Statistical tests were conducted using SAS Studio version 3.8.

Results

Overall, a total of 156 out of 1021 products (15%) was targeted at children. RTE breakfast cereals represent the food category with the highest number of child-targeted products ($n\ 72/331$; 22%). Granola bars and yoghurts and dairy desserts showed similar proportions of child-targeted products, with 13% ($n\ 39/310$) and 12% ($n\ 45/380$), respectively.

Table 2 shows the mean nutritional composition of each food category according to targeted consumers, for a reference serving. Compared with RTE breakfast cereals for the general population, RTE breakfast cereals targeted at children had a higher content of carbohydrates, total sugars, free sugars and Na, but a lower content of fat, saturated fat, fibres and proteins. More specifically, free sugars were twice as high and Na was 1.8 fold higher in RTE breakfast cereals marketed to children than in those for the general population. Granola bars targeted at children had a lower content than granola bars for the general population for all

Table 2 Nutritional composition of ready-to-eat (RTE) breakfast cereals, granola bars and yoghurts and dairy desserts, per reference serving

Categories	Targeted consumers	Weight (g)		Energy (kcal)		Fat (g)		Saturated fat (g)		Carbohydrates (g)		Total sugars (g)		Free sugars (g)		Fibres (g)		Proteins (g)		Na (mg)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
RTE breakfast cereals	All products ($n\ 331$)	55.0		217.8	23.2	3.9	3.6	0.9	1.3	41.4	5.6	11.4	5.6	9.2	6.2	4.7	3.1	5.3	2.2	148.4	116.7
	General population ($n\ 259$)			219.4	24.7	4.5	3.7	1.0	1.4	40.2	5.5	10.0	4.5	7.4	4.5	5.1	3.3	5.8	2.2	126.3	109.4
Granola bars	Children ($n\ 72$)			212.0	15.4	2.0*	1.8	0.4*	0.7	45.7*	3.5	16.4*	6.5	15.8*	6.8	3.1*	2.0	3.6*	1.2	227.8*	108.1
	All products ($n\ 310$)	34.5	8.3	144.2	36.8	5.3	2.8	1.5	1.0	22.3	5.2	9.5	3.6	8.7	3.1	2.4	1.5	2.9	2.3	81.3	46.4
Yoghurts and dairy desserts	General population ($n\ 271$)	35.7	8.1	150.2	34.9	5.6	2.8	1.6	1.0	22.9	5.1	10.0	3.5	9.1	3.0	2.4	1.5	3.1	2.4	85.9	46.2
	Children ($n\ 39$)	25.9	3.8	102.8*	17.8	2.8*	0.9	0.7*	0.5	18.2*	3.3	6.3*	2.4	5.9*	2.2	2.2	1.2	1.6*	0.7	49.5*	34.3
Yoghurts and dairy desserts	All products ($n\ 380$)	109.6	29.9	104.9	47.8	2.8	3.5	1.7	2.5	14.9	6.0	11.5	4.8	9.0	4.9	0.4	1.1	4.9	2.9	64.3	44.7
	General population ($n\ 335$)	111.9	29.5	107.4	47.7	2.9	3.7	1.8	2.6	15.1	5.7	11.7	4.7	9.1	4.8	0.5	1.1	5.2	2.9	66.5	45.2
Yoghurts and dairy desserts	Children ($n\ 45$)	92.8	28.0	86.8*	45.0	2.4	1.5	1.1	0.8	13.5	8.0	9.7	5.1	7.9	5.3	0.4	0.8	2.5*	1.2	47.3*	37.9

*Significantly different from general population ($P < 0.00185$) (Wilcoxon rank sum). Threshold was corrected using the Bonferroni correction (5%/27). The reference serving used for RTE breakfast cereals was 55 g while the reference serving for granola bars and yoghurts and dairy desserts was one unit.



Table 3 Nutritional composition of granola bars and yoghurts and dairy desserts, per 100 g

Categories	Targeted consumers	Energy (kcal)		Fat (g)		Saturated fat (g)		Carbohydrates (g)		Total sugars (g)		Free sugars (g)		Fibres (g)		Proteins (g)		Na (mg)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Granola bars	All products (n 310)	418.4	44.4	15.0	6.5	4.4	2.8	65.6	9.5	27.6	8.1	25.3	7.6	7.1	4.7	8.2	5.7	233.3	116.0
	General population (n 271)	421.7	45.0	15.7	6.7	4.7	2.8	65.0	9.7	28.1	8.0	25.8	7.6	6.9	4.6	8.5	5.9	239.9	113.4
Yoghurts and dairy desserts	Children (n 39)	395.7*	31.8	10.8*	3.1	2.8*	1.9	69.8	6.0	24.1	7.6	22.5	7.1	8.7*	5.1	6.5	3.7	187.3	124.5
	All products (n 380)	96.4	40.7	2.5	3.1	1.5	2.1	13.8	5.3	10.6	4.1	8.3	4.4	0.4	0.8	4.5	2.6	60.2	42.6
	General population (n 335)	97.1	42.2	2.6	3.3	1.5	2.2	13.8	5.3	10.7	4.2	8.3	4.5	0.4	0.8	4.7	2.6	61.3	43.6
	Children (n 45)	90.7	26.3	2.5	1.1	1.2	0.6	13.8	4.9	10.0	3.0	8.0	3.6	0.3	0.7	2.9*	1.3	51.7	33.3

*Significantly different from general population ($P < 0.00185$) (Wilcoxon rank sum). Threshold was corrected using the Bonferroni correction (5%/27).

nutrients analysed except fibres, for which content was similar. Finally, yoghurts and dairy desserts targeted at children were lower in energy, proteins and Na than yoghurts and dairy desserts for the general population.

Since the reference serving of granola bars and yoghurts and dairy desserts targeted to children was smaller in weight than the reference serving of products for the general population, further analyses were conducted based on a standardised weight (per 100 g) for these categories (Table 3). When compared with granola bars for the general population, granola bars targeted at children remained lower in energy, fat and saturated fat, while they were also found to be higher in fibres. Per 100 g, only proteins remained lower in yoghurts and dairy desserts targeted at children compared with those for the general population.

Table 4 compares the mean nutritional composition for a reference serving of child-targeted products in each of the three food categories analysed. Compared with granola bars and yoghurts and dairy desserts, RTE breakfast cereals had a higher content in energy, carbohydrates, total sugars, free sugars, proteins and Na and contained less saturated fat. RTE breakfast cereals were also lower in fat than granola bars. Yoghurts and dairy desserts had a lower content in fibres than RTE breakfast cereals and granola bars. Finally, granola bars had a lower protein content than the other two categories. In comparisons of child-targeted products per 100 g, RTE breakfast cereals remained higher in carbohydrates and Na than granola bars and yoghurts and dairy desserts ($P < 0.00185$). Nutritional composition of child-targeted products per 100 g according to food category is presented in Table S1 in supplemental materials.

Discussion

The current study compared the nutritional composition of food products targeted at children to those for the general population. As expected, the results showed that the nutritional composition of RTE breakfast cereals, granola bars and yoghurts and dairy desserts targeted at children differed from that of products for the general population, particularly for RTE breakfast cereals and granola bars. Analyses were conducted based on both the reference serving and 100 g, which allowed us to observe different results depending on the serving size. While analyses per 100 g are useful for comparing food products at equivalent weight, using the reference serving appears more relevant since it represents the actual amount consumed in one occasion⁽³²⁾.

RTE breakfast cereals stand out from granola bars or yoghurts and dairy desserts as they displayed more information that may be appealing to children. They were identified as the food category with the most child-targeted food products, which is similar to what has been observed

Table 4 Nutritional composition of child-targeted products according to food category, per reference serving

Categories	Weight (g)		Energy (kcal)		Fat (g)		Saturated fat (g)		Carbohydrates (g)		Total sugars (g)		Free sugars (g)		Fibres (g)		Proteins (g)		Na (mg)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
RTE breakfast cereals (n 72)	55.0		212.0 ^a	15.4	2.0 ^a	1.8	0.4 ^a	0.7	45.7 ^a	3.5	16.4 ^a	6.5	15.8 ^a	6.8	3.1 ^a	2.0	3.6 ^a	1.2	227.8 ^a	108.1
Granola bars (n 39)	25.9	3.8	102.8 ^b	17.8	2.8 ^b	0.9	0.7 ^b	0.5	18.2 ^b	3.3	6.3 ^b	2.4	5.9 ^b	2.2	2.2 ^a	1.2	1.6 ^b	0.7	49.5 ^b	34.3
Yoghurts and dairy desserts (n 45)	92.8	28.0	86.8 ^b	45.0	2.4 ^{ab}	1.5	1.1 ^b	0.8	13.5 ^b	8.0	9.7 ^b	5.1	7.9 ^b	5.3	0.4 ^b	0.8	2.5 ^c	1.2	47.3 ^b	37.9

RTE, ready-to-eat.
 The reference serving used for RTE breakfast cereals was 55 g, while the reference serving for granola bars and yoghurts and dairy desserts was one unit.
^{a,b,c}Mean values within a column with unlike superscript letters are significantly different ($P < 0.00185$) (Dwass, Steel, Critchlow-Figner). Threshold was corrected using the Bonferroni correction (5%/27).

on another Canadian study⁽³³⁾. In comparison with food products for the general population, RTE breakfast cereals targeted to children also had the least favourable nutritional composition, which is again consistent with previous studies^(28,34,35). Several studies focusing on sugar content have also shown that RTE breakfast cereals advertised to children were higher in total sugars than those that did not^(19,28,34-37). However, these studies had not calculated the amount of free sugars as we did, although one study analysed the list of ingredients. The current found that none of the RTE breakfast cereals intended to children were without added sugar, while 9% of those not intended for children were without added sugar⁽³⁴⁾. We also observed that no child-targeted RTE breakfast cereals were without free sugar, compared with 11% of those for the general population. The number of products without free sugar according to targeted consumer for each food category is presented in supplemental materials (see online supplemental Table S2).

On the other hand, granola bars targeted at children showed a more positive nutrient profile than those for general population. For yoghurts and dairy desserts, few differences were observed between products targeted at children and those for the general population. As opposed to RTE breakfast cereals, very few studies have previously investigated the nutritional composition of granola bars and yoghurts and dairy desserts targeted at children, which limits comparisons. Our results are nevertheless contrasting with a study that analysed cereal bars and yoghurts, since granola bars targeting children were described as having a higher content of saturated fat and Na than those not targeting children⁽¹⁵⁾. In another study, yoghurts and drinking yoghurts intended to children were found to be higher in total sugars per 100 g, but not dairy desserts⁽³⁸⁾. Our results showed no difference in total sugars between children-targeted products and products for the general population, but the analyses were performed for all yoghurts and dairy desserts grouped together, and not separated by types. The main concern highlighted for child-targeted yoghurts and dairy desserts is their lower content in proteins considering that they are part of protein foods of Canada's Food Guide⁽¹⁴⁾. This observation cannot be explained by the smaller serving unit of children-targeted products, as they remained lower in proteins on a per 100 g basis as well.

When specifically comparing child-targeted products across the three food categories, RTE breakfast cereals remained the most problematic food category. Garcia *et al.* also compared products targeted at children from different food categories on a per 100 g basis and found that RTE breakfast cereals had the highest content in carbohydrates and Na, while granola bars had the highest content in fats⁽³⁹⁾. Such finding is of concern given the popularity of RTE breakfast cereals in children.

All food categories analysed contained free sugars contributing to most of the total sugars. Although naturally occurring sugars are present in dairy products (lactose),



it represented only a little part of total sugars of yoghurts and dairy desserts. WHO recommends an intake of free sugars <10% of total energy intake, ideally a maximum of 5%⁽²⁶⁾. In our study, based on a child aged 8 years whose estimated energy requirements per day are 1500 kcal (depending on levels of physical activity)⁽⁴⁰⁾, the amount of free sugars that would be consumed based on a reference serving would represent 4% of total daily energy intake for RTE breakfast cereals, 1.6% for granola bars and 2% for yoghurts and dairy desserts. Considering the fact that children will not eat only one of these foods throughout the day, but that they will also consume other foods, that will probably increase their daily intake of free sugars and the WHO recommendation (ideally 5%) will be easily reached.

The number of products intended to children found in our study is similar to numbers found in other Canadian studies. Potvin Kent *et al.*⁽³⁴⁾ found that 19.8% RTE breakfast cereals were intended to children, while Mulligan *et al.*⁽³³⁾, using the data of the University of Toronto Food Label Information Program providing nutritional information for 15 342 packaged products, found that 18.8% RTE breakfast cereals were intended to children, compared with 21.8% in the current study. Mulligan *et al.* also observed that 14.6% yoghurts and dairy desserts and 10.2% granola bars were intended to children compared with 11.8% and 12.6%, respectively, in our study. These similar percentages of child-targeted products observed in studies carried out in the Canadian food supply suggest that our classification seems to be adequate.

Considering the influence of food marketing targeted at children, our findings support the relevance to further regulate its presence on food products packages. It could be useful to establish nutritional criteria to be met by child-targeted food products, or to restrict the use of marketing to children to 'healthier' foods. Children are more likely to make healthier choices if marketing intended to them only appears on healthy food^(41,42). Our results show that many products intended to children in the selected food categories currently on the market need to be improved, especially child-targeted RTE breakfast cereals. They could be improved by lowering their free sugars and Na contents and by increasing their fibres content. Harris *et al.*⁽⁴³⁾ observed that children like low-sugared breakfast cereals, and that they consume them when they are offered. While children were allowed to add sugar when eating breakfast cereals low in sugar, they did not add more sugar than the total amount originally found in high sugar breakfast cereals⁽⁴³⁾. This suggests that a reduction in sugar content would therefore be possible and accepted by children.

The current study has several strengths: calculation of free sugars content, the extra care taken to classify food products and analysis of nutritional content per reference serving and per 100 g. Also, not only a sample, but the total-ity of RTE breakfast cereals, granola bars and yoghurts and

dairy desserts available at the time of data collection in the food supply of Quebec City or Montreal City was purchased. The current study also has limitations. We have not covered all food products targeted at children available on the market, as the study was limited to three food categories. For the calculation of free sugars, some steps (steps 5 and 7) involved a certain degree of subjectivity, which could affect the estimation obtained. For example, choosing an appropriate comparator product in the USDA database in step 5. However, a same person followed similar pattern for all food categories selected and beyond the estimates made by one and the same person, we relied on a published estimation methodology, specific to the Canadian food supply⁽²⁷⁾. The data collections were not carried out at the same time, with RTE breakfast cereals purchased in 2016, granola bars in 2018 and yoghurts and dairy desserts in two parts, in 2018 and 2019. Data collections at different years may have had an impact on the comparison of the nutritional composition of child-targeted products from the different food categories since those that were purchased later may have had the opportunity to improve their nutrients content. However, a comparison of the nutritional value of child-targeted products in Canada over time showed no nutritional improvement of products in 2017 compared with products from 2009⁽²²⁾.

In conclusion, our findings showed that the nutritional composition of child-targeted food products differed from products for the general population. RTE breakfast cereals targeted at children are of poor nutritional quality and need to be improved. The presence of marketing to children on food products packaging should be regulated to ensure that it minimise attraction of children to food products with poor nutritional quality.

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Supplementary material

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