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Availability and Price of Food Products with and without Trans Fatty Acids in Food Stores around Elementary Schools in Low- and Medium-Income Neighborhoods

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Availability and Price of Food Products with and without Trans Fatty Acids in Food Stores around Elementary Schools in Low- and Medium-Income Neighborhoods

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The purpose of this exploratory, descriptive, and cross-sectional study was to investigate the relationship between the price and availability of food products with and without trans fatty acids in food stores near elementary schools located in low- and medium-income neighborhoods of a Brazilian city. The supply of products containing trans fatty acids was higher in both regions, and these products were also cheaper. It is noteworthy that this availability may influence food choices and, consequently, the health status of children and adolescents, since this population is more likely to buy less-healthy foods when these are more available, accessible, and financially attractive.

KEYWORDS *access to foods, child and adolescent, cost of foods, nutrition labeling, processed foods, trans fatty acids*

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The dietary structure and food habits of children and adolescents of many countries have been changing. Eating out more frequently is one of the significant changes that have occurred to the eating patterns of this young public, which results in greater consumption of processed foods, fast foods, and sugary beverages (Linda and Popkin 2005). These changes have been associated with increased prevalences of childhood and adolescent overweight and obesity (Popkin 2002; Andrade, Pereira, and Sichieri 2003).

In this context, children and adolescents with improper dietary habits are more vulnerable to chronic diseases in adulthood, such as diabetes, dyslipidemia, and hypertension (World Health Organization [WHO] 2000; Lobsteint, Baur, and Uauy 2004; Fowler-Brown and Kahwati 2004; Haslam and James 2005).

Today, it is widely known that a high-fat diet, especially one rich in trans fats, is a risk factor for chronic diseases (Costa, Bressan, and Sabarens 2006). Processed foods are the main source of trans fats (Martin, Matshushita, and Souza 2004).

In 2004, the World Health Organization (WHO) launched the Global Strategy on Diet, Physical Activity, and Health. One of its goals was to completely eliminate trans fats from processed foods. The reason for concern was the increased consumption of trans fats, since they have been shown again and again to negatively impact human health (WHO 2004). In 2003, the Brazilian government published Resolution RDC no. 360, which determined that trans fats content be printed on food labels. This allowed the Brazilian population to have an idea of how much trans fats they were consuming. Another resolution, Resolution RDC no. 359, determined that the amount of trans fats by serving also had to be printed on the label. However, foods with ≤ 0.2 g of trans fats per serving can claim to have “zero trans fats” since the resolution considers this amount insignificant (Brazil Ministry of Health 2003a, 2003b). Since products that contain ≤ 0.2 g of trans fats can make zero trans fats claims, the only way to verify their presence is by checking the ingredients list. In this case, one cannot be entirely sure if one’s diet contains trans fats.

According to Drewnowski and Darmon (2005a), price, accessibility, and availability are the determinants of the foods children and adolescents consume. Studies have shown that children and adolescents have increasing participation in food choices (McNeal 2000; Olivares, Yáñez, and Díaz 2003; Ozgen 2003). A Brazilian study done with elementary students in Florianópolis, a city located in the Southern region of the country, has shown that sweets, chips, ice creams, and cookies are the children’s main expenses (Fiates, Amboni, and Teixeira 2008). Sutherland and colleagues (2006) made similar findings while assessing the foods bought by Australian children. Access to these foods usually occurs near schools because of nearby grocery and convenience stores (Zenk and Powell 2008).

However, Jetter and Cassady (2006) emphasize that in the United States of America, large grocery stores are not found in poor regions. These regions usually have smaller grocery stores with a smaller variety of food items, especially of healthy foods, such as high-fiber and low-fat foods. Hence, people living in lower-income areas have less access to more nutritious foods.

The cost of healthier foods may be another limiting factor for their consumption by children and adolescents living in poorer regions. A study that investigated the relationship between diet quality and cost found that diet cost decreases as its energy, sugar, and fat contents increase (Drewnoswski and Darmon 2005b). This likely occurs because high-sugar and high-fat foods are cheaper and easier to produce, process, transport, and store than more-perishable foods (Drewnoswski 2004).

Studies relating trans fat content and price are scarce and such studies have not yet been done in Brazil. Therefore, the objective of the present study was to investigate the relationship between the price and availability of food products with and without trans fatty acids in food stores near elementary schools located in low- and medium-income neighborhoods in Brazil.

METHOD

This is an exploratory, descriptive, and cross-sectional study. Data were collected in June and August of 2009, in the city of Florianópolis, Santa Catarina, Brazil.

Description of the Study Area

Two neighborhoods with a similar number of inhabitants but distinct socioeconomic levels were chosen. Both neighborhoods were in the city of Florianópolis, located in the Southern region of Brazil. Only neighborhoods with public elementary schools were eligible. The living conditions and social class of a region are determined by the following indicators: (1) living conditions, (2) education level, (3) income, and (4) basic sanitation (Vasconcelos 2008), as shown in table 1. According to the Brazilian census (Instituto Brasileiro de Geografia e Estatística 2000), in neighborhood A, the mean number of individuals per household was higher, education level was lower, income was lower, and water supply and basic sanitation were worse than those of neighborhood B. This shows that neighborhood B had a more favorable socioeconomic profile, with better indicators. Hence, neighborhood A was mostly occupied by low-income individuals, and neighborhood B was mostly occupied by middle-class individuals.

Data were collected where the greatest amounts of foods were sold within a 500-meter radius of the public elementary school of each

TABLE 1 Sociodemographic Indicators of Neighborhoods A and B in Florianópolis, SC, Brazil, 2009

Indicators	Neighborhood A	Neighborhood B
Population ^a	12673	11790
Mean number of dwellers per household	4	3
Education level		
% Illiterate or up to one year of formal education	6	2
% 1 to 10 years of formal education	81	27
% >10 years of formal education	12	71
Monthly nominal salary of the heads of the family		
% No income or up to 50% of the minimum salary	9.5	1.8
% 50% to 500% of the minimum salary	63	24.2
% 5 to 10 minimum salaries	19.5	28
% 10 minimum salaries or more	8	46
Basic sanitation		
% Sewer	14	38
% Septic tank	52	59
% Rudimentary septic tank or hole or river or lake without a bathroom or toilet	34	3
Piped water		
% Connected to the water supply network	38	82
% Well or spring water	62	1
% Others	—	17

Source: IBGE 2000.

^aProjection for 2009 made by the Municipal Health Department of Florianópolis.

neighborhood. According to the literature, children and adolescents consume food products that are available in their environment (Morland, Roux, and Wing 2006; Sharkey 2009; McKinnon et al. 2009).

Data collection was formally authorized by the management of each establishment once the objectives and methods of the study were explained and the anonymity of the establishments was guaranteed.

Food Products

The studied food products were those that, according to the literature, are the children's and adolescents' favorites, mostly because they are easy to purchase and consume (Morland et al. 2006; Sharkey 2009; McKinnon et al. 2009). The food groups analyzed in this study were:

- Candy: hard candy, chewy candy, toffee, gelatin, and gumdrops.
- Cereal bars: with or without chocolate.
- Beverages: milk and soy drinks of various flavors.
- Cookies: plain and sandwich cookies.
- Crackers: plain and sandwich crackers.
- Chocolates: milk, dark, white and variations.

- Sweets made with peanuts, coconut, milk, rice or guava, and ready-to-eat cakes.
- Snacks: chips, salty peanuts, nuts and almonds.

Instrument for Data Collection

A form was developed for collecting the data printed on the labels of the studied food products, such as weight and serving size (in grams or milliliters), price (in *reais*/R\$), ingredients containing trans fats in the ingredients list, and claims of zero trans fatty acids.

According to the Danish Nutrition Council (2003) and Hissanaga (2009), substances that likely contain trans fats are: (1) partially hydrogenated fat, (2) partially hydrogenated vegetable fat, (3) hydrogenated vegetable fat, (4) partially hydrogenated vegetable oil, (5) hydrogenated vegetable oil, (6) hydrogenated oil, and (7) partially hydrogenated and/or interesterified fat. Since hydrogenated fat, vegetable fat, and margarine may also contain trans fats, these items were also included in the study to avoid excluding food products that may have this isomer.

Data Collection

All food products in the abovementioned groups found in the establishments were analyzed. The data were collected by trained dieticians and nutrition students.

A magnifying glass of the brand Maped Blister $3 \times D = 500$ mm was used to facilitate data collection.

Data Treatment and Analysis

The grocery stores were classified according to the number of aisles. A grocery with only one aisle was considered very small; one with two to five aisles was considered a minimarket; and one with six or more aisles was considered a supermarket (Tester et al. 2010).

The information in the forms was transcribed to a Microsoft Excel (2003) structured spreadsheet and reviewed at the end of the process by two individuals. Food products were considered to have trans fats if they contained ingredients that may contain trans fats. Product weights were standardized to 100 g or 100 ml, if liquid, to ease comparisons.

The software Epiinfo version 3.5.1 (chi-square) and SPSS version 17.0 (Student's *t*-test) were used for the statistical analyses. Confidence level was set at 95%. The products were compared according to presence or absence of trans fats by establishment or not and by food group. The differences between the mean prices of the products were also verified.

FINDINGS

Neighborhood A, mostly occupied by low-income individuals, had a mini-market, and neighborhood B, mostly occupied by middle-class individuals, had a supermarket.

Figure 1 shows the food groups separated by presence or absence of trans fats. More than 80% of the cookies and savory snacks sold in these grocery stores contained trans fats, as well as 50% of the cereal bars and chocolates. On the other hand, more than 50% of the candies, beverages, sweets and snacks did not contain trans fats in their composition.

The differences between the mean prices of food products with and without trans fats by food group according to establishment and regardless of establishment (intra-establishment) are presented in table 2.

Table 3 shows the bivariate statistical analysis of availability and mean price of the food products with and without trans fats according to establishment and regardless of establishment (intra-establishment).

A total of 694 food products were analyzed, of which 67.7% were sold at the supermarket in neighborhood B. The proportions of food products containing trans fats found in the groceries of neighborhoods A and B were 73% and 66.6%, respectively. This difference was not statistically significant ($p = .078$).

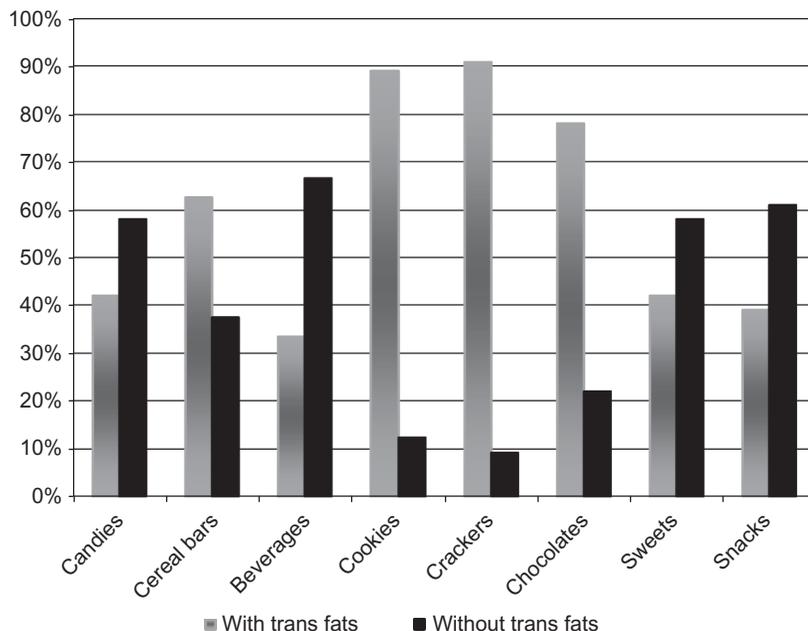


FIGURE 1 Percentage distribution of the food groups according to trans fat content, regardless of establishment in Florianópolis, SC, Brazil, 2009.

TABLE 2 Mean Price (R\$) and Standard Deviation (SD) of the Prices of Food Products with and without Trans Fats by Food Group, According to Establishment and Regardless of Establishment (Intra-Establishment), Florianópolis, SC, Brazil, 2009

Group	Trans fats	Grocery store in neighborhood A			Grocery store in neighborhood B			Both grocery stores			<i>p</i> ^b
		<i>n</i>	Mean (R\$)	SD	<i>n</i>	Mean (R\$)	SD	<i>n</i>	Mean (R\$)	SD	
Candies	Yes	10	2.26	0.77	20	2.03	0.46	30	2.11	0.58	.06
	No	16	3.58	4.27	25	2.52	1.08	41	2.93	2.79	
Cereal bar	Yes	3	4.63	0.15	7	3.93	1.09	10	4.14	0.95	.25
	No	1	4.00	–	5	6.64	4.09	6	6.20	3.81	
Beverages	Yes	1	0.55	–	4	0.61	0.10	5	0.60	0.09	.84
	No	1	0.55	–	9	0.59	0.07	10	0.59	0.07	
Cookies	Yes	88	0.81	0.27	129	1.25	1.32	217	1.07	1.13	.00 ^c
	No	4	1.07	0.24	23	1.89	0.35	27	1.77	0.44	
Crackers	Yes	25	1.11	0.52	41	1.33	0.89	66	1.25	0.77	.00 ^c
	No	1	0.89	–	5	2.94	0.04	6	2.60	0.84	
Chocolates	Yes	12	3.45	0.76	66	3.38	3.07	78	3.39	2.84	.28
	No	1	5.81	–	21	4.04	2.57	22	4.12	2.53	
Sweets	Yes	17	1.89	0.73	19	2.52	1.47	36	2.22	1.18	.25
	No	20	1.52	0.69	30	2.20	1.38	50	1.93	1.19	
Snacks	Yes	8	2.07	0.88	27	2.97	1.84	35	2.77	1.70	.85
	No	16	2.33	0.63	39	3.03	0.99	55	2.83	0.95	
Total	Yes	164	1.38	1.02	313	2.04	2.06	477	1.81	1.80	.00 ^c
	No	60	2.34	2.45	157	2.73	1.80	217	2.62	2.00	

Note. Neighborhood A: mostly populated by low-income individuals; neighborhood B: predominantly inhabited by middle-class individuals; one *real* (R\$1.00) is equivalent to 1.75 dollars (US\$1.75).

^aStudent's *t*-test comparing the mean price between establishment.

^bStudent's *t*-test comparing the mean price between food with and without trans fats.

^cSignificant for a confidence level of 95%.

TABLE 3 Bivariate Analysis of the Availability and Price in *Reais* (Mean \pm Standard Deviation) of the Food Products with and without Trans Fats, According to Establishment and Regardless of Establishment (Intra-Establishment), Florianópolis, SC, Brazil, 2009

Establishment	Availability of food products			Price of the food products							
	Yes <i>N</i>	No <i>n</i>	<i>p</i> ^a	Trans fats			Trans fats			<i>df</i>	<i>SED</i>
				Yes Mean R\$	SD	No Mean R\$	SD	<i>p</i> ^b			
Grocery store in neighborhood A	164	60		1.38	1.02	2.34	2.45	<.001 ^c	468.0	0.19	
Grocery store in neighborhood B	313	157	.078	2.04	2.06	2.73	1.80	.004 ^c	66.6	0.33	
Both stores	477	217		1.81	1.80	2.62	2.00	<.001 ^c	692.0	0.15	

Note. Neighborhood A: mostly populated by low-income individuals; neighborhood B: predominantly inhabited by middle-class individuals; *SD* = standard deviation; *df* = degree of freedom; *SED* = standard error of a difference between means.

^aPearson's chi-square test.

^bStudent's *t*-test.

^cSignificant for a confidence level of 95%.

The mean price of products without trans fats was higher than that of products with trans fats in both sites. The mean price of products without trans fats in the low-income neighborhood was 69.5% higher than that with trans fats ($p = .004$). The difference in price between these two types of products in the middle-class neighborhood was 33.8% ($p < .001$).

The prices of some groups of food products presented a trend that differed from the trend above. Beverages without trans fats were 3.3% cheaper in neighborhood B. Sweets without trans fats were 21.5% cheaper in neighborhood A and 51.2% cheaper in neighborhood B. Cereal bars and crackers without trans fats were also 13.61% and 19.6% cheaper, respectively, in neighborhood A. The results of the groups' candies, cookies, chocolates, and snacks were in agreement with the mean prices found for the products with and without trans fats. These groups represent 69.2% and 72% of the food products analyzed in neighborhoods A and B, respectively.

The studied products were more expensive in neighborhood B than in the neighborhood A, regardless of trans fat content. Products with trans fats sold in neighborhood B were 47.8% more expensive than those sold in neighborhood A ($p < .001$). Products without trans fats sold in neighborhood B were 16.6% more expensive than those sold in neighborhood A ($p < .001$).

Most of the products (69%) contained ingredients with trans fats in the ingredients list, regardless of establishment. Moreover, products without trans fats were 44.8% more expensive than those with trans fats ($p < .001$). The only groups with products without trans fats that were effectively cheaper were sweets and beverages, with a difference of 15% and 1.7%, respectively.

DISCUSSION

The limitation of this study was the use of information listed on the label to determine if trans fats were present in the studied food products without testing them in a laboratory. However, the study considered that the label consists of the only information available to consumers. The manufacturer must guarantee its accuracy and be lawful. Other limitations to be considered involve the number of food products and store size. The results could be different if other groceries were included. A final limitation that should be pointed out is that the study analyzed the relative price of the foods and not the absolute price. This is because there was great variation in package weight.

The minimarket was located right next to the public elementary school in the low-income neighborhood. Food variety and supply in this grocery was smaller than those of the other one in the middle-class neighborhood, which was a supermarket. Many authors agree that minimarkets offer a smaller variety and quantity of foods, as well as a smaller variety of healthy foods. They are found mainly in low socioeconomic areas (Morland,

Wing, and Roux 2002; Jetter and Cassady 2006; Latham and Moffat 2007; Renzaho 2008).

However, despite the different supplies of foods between the two groceries, their quality did not differ. The number of products with trans fats sold in both establishments was greater and proportionally similar. This is reason for concern, since children and adolescents are more likely to buy less-healthy foods when these are more readily accessible (Gosliner et al. 2011).

The results of the present study also show that products without trans fats are more expensive than those with trans fats in both groceries. Therefore, foods without trans fats were less abundant and more expensive in both regions. This confirms the hypothesis of the study: the availability and price of products for children and adolescents may be associated with their trans fats contents. Only beverages and sweets did not present this association but the difference in price between beverages with and without trans fats was of only one cent.

In London, Mooney (1990) found that more nutritious products are more expensive. In the United States, healthier foods are from 17% to 19% more expensive than less-healthy foods (Jetter and Cassady 2006).

Although the products with trans fats were more expensive in neighborhood B than in neighborhood A, the difference between the mean price of the products with and without trans fats was greater in neighborhood A, the poorer region. However, this difference was not statistically significant ($p = .755$).

The authors Mooney (1990) and Ellaway and Macintyre (2000) also found that less-healthy foods were cheaper and healthier foods were more expensive in lower-income areas than in middle-class areas. Hollington and colleagues (1995) repeated Mooney's study and found that less-healthy foods were 5% cheaper and healthier foods were 1.5% more expensive in poorer areas.

However, despite the differences between the two regions, it is necessary to point out that products with trans fats in both groceries were not only more abundant but also cheaper. This finding is relevant since children and adolescents usually analyze flavor and price when deciding what to buy, regardless of socioeconomic status, and spend on average four dollars per week, especially on chips, sweets, ice creams, cookies, and cakes (Surtherland et al. 2006).

The percentage of trans fats in cookies, crackers, chocolates, and cereal bars was also higher. The results of this study are in agreement with the scientific literature (Martin et al. 2004) since these products are listed as the main sources of trans fats, along with ice creams, cakes, margarines, breads, and fast foods. These results enforce the need of developing more effective strategies to reduce, and especially, to eliminate, trans fats from foods.

With respect to strategies that aim to improve nutrition through more accessible food prices, French and colleagues (2001) examined the price and

effect of promotions on sales of low-fat snacks sold by vending machines in 12 workplaces and 12 schools in Minnesota. The prices of the low-fat products were reduced by 10%, 25%, and 50%, and, in consequence, sales increased 9%, 39%, and 93%, respectively. This study showed that price reductions can be an effective intervention strategy for promoting consumption of more nutritious foods.

CONCLUSION

This study evidenced that the trans fats content of the food products commonly purchased by children and adolescents was associated with price and availability, in both neighborhoods. Thus, cheaper products contained trans fats and were more readily available than products without trans fats, promoting the consumption of less nutritious foods by children and adolescents.

More studies are necessary for assessing the foods available near schools in regions of different socioeconomic profiles in Brazil, as well as studies that assess the difference in prices of the foods in these regions, especially absolute prices.

Finally, to reduce consumption of trans fats and, consequently, improve the population's health, the Brazilian legislation needs to be changed to meet the WHO's recommendation of eliminating trans fats from processed foods. Public policies that actions for the improvement of quality, price, and access are also necessary.

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