



Contents lists available at ScienceDirect

Appetite

journal homepage: [www.elsevier.com/locate/appet](http://www.elsevier.com/locate/appet)

## The effect of new purchase criteria on food procurement for the Brazilian school feeding program



Panmela Soares <sup>a, b, \*</sup>, M. Carmen Davó-Blanes <sup>a, c</sup>, Suellen Secchi Martinelli <sup>b, d</sup>,  
Leonardo Melgarejo <sup>e</sup>, Suzi Barletto Cavalli <sup>b, f</sup>

<sup>a</sup> Public Health Research Group, University of Alicante (Universidad de Alicante), Edificio de Ciencias Sociales, Campus San Vicente del Raspeig, Ap. 99, C.P. 03080, Alicante, Spain

<sup>b</sup> Nutrition in Foodservice Research Centre, Federal University of Santa Catarina, Brazil

<sup>c</sup> Department of Community Nursing, Preventive Medicine and Public Health and History of Science, University of Alicante, Campus San Vicente del Raspeig, Ap. 99, C.P. 03080, Alicante, Spain

<sup>d</sup> Nutrition Post-Graduate Program, Federal University of Santa Catarina, Campus Universitário Trindade, Centro de Ciências da Saúde, Departamento de Nutrição, Florianópolis, SC, 88040-900, Brazil

<sup>e</sup> Gaúcha Association for the Protection of the Natural Environment (AGAPAN), Av Osvaldo Aranha, 440 sala, 304 – Bairro Bom Fim, Porto Alegre, RS, 90, 035-190, Brazil

<sup>f</sup> Nutrition Department, Nutrition Post-Graduate Program, Federal University of Santa Catarina, Campus Universitário Trindade, Centro de Ciências da Saúde, Departamento de Nutrição, Florianópolis, SC, 88040-900, Brazil

### ARTICLE INFO

#### Article history:

Received 27 July 2016

Received in revised form

10 October 2016

Accepted 13 October 2016

Available online 15 October 2016

#### Keywords:

Public policies

School feeding

Health promotion

### ABSTRACT

**Objective:** To explore the effect of the school feeding program purchase criteria on the quantity, variety and origin of food products acquired for school meals in a municipality in Brazil.

**Method:** Analysis of purchase lists for two years prior and two years after implementation of the purchase criteria (2010). The origin (family farms (FF)/other providers (OP)) and nutritional characteristics (recommended/controlled) of food products were studied, registering annual varieties (n) and daily quantities (kg/day); contrast of proportions was applied.

**Results:** The acquisition of recommended products increased, and the quantity of controlled products decreased ( $p = 0.005$ ). Purchase of legumes and vegetables ( $p < 0.05$ ) increased and high sugar foods decreased ( $p = 0.02$ ). The majority of food products in 2010 and 2011 were acquired from OP (64% and 61%), although FF provided the greatest proportion of legumes and vegetables. Ten new varieties of recommended products were incorporated, 9 of which were acquired from FF.

**Conclusion:** The criteria of direct purchase from family farms resulted in an increase in the variety and quantity of healthy foods in the schools in the municipality.

© 2016 Elsevier Ltd. All rights reserved.

### 1. Introduction

It is estimated that 35% of adults worldwide are overweight (WHO, 2011) and that one in nine people has insufficient access to food (FAO, IFAD, & WFP, 2015). Considering the school as a strategic space for health promotion (WHO, 2004, 2013), and in order to confront this double burden of poor nutrition, policies are being developed to influence the availability and nutritional quality of

school feeding programs (SFP). In this context, initiatives have been put forward that limit the supply of food with poor nutritional quality, and those with high levels of salt, sugar and fats (Cummings et al., 2014; Robles, Wood, Kimmons, & Kuo, 2013) and promote the offering of healthy foods through direct purchase of produce from local farms to supply the SFP (Ballesteros, 2015; Nicholson, Turner, Schneider, Chriqui, & Chaloupka, 2014; PAA Africa, 2013; Sidaner, Balaban, & Burlandy, 2013; WFP, 2013; WHO, 2004). Thus, the SFP becomes a strategic action, not only to promote healthy foods at school, but also to provide opportunity for local farms. The direct purchase of food products guarantees predictable, structured markets for the farms in the region, promoting the economy and local development (Rosset, 2011), food sovereignty and the right of countries to control food production, and to guarantee population

\* Corresponding author. Nutrition in Foodservice Research Centre, Federal University of Santa Catarina, Brazil.

E-mail addresses: [panmela\\_soares@yahoo.com.br](mailto:panmela_soares@yahoo.com.br) (P. Soares), [mdavo@ua.es](mailto:mdavo@ua.es) (M.C. Davó-Blanes), [suellen.smartinnelli@gmail.com](mailto:suellen.smartinnelli@gmail.com) (S.S. Martinelli), [melgarejo.leonardo@gmail.com](mailto:melgarejo.leonardo@gmail.com) (L. Melgarejo), [sbcavalli@gmail.com](mailto:sbcavalli@gmail.com) (S.B. Cavalli).

access to sufficient, varied and nutritious foods (Via Campesina, 1996).

School Feeding Programs are present in different countries and feed approximately 368 million children daily worldwide (WFP, 2013). In the case of Brazil, the National School Feeding Program (NSFP) is responsible for providing free meals to over 40 million students (FNDE, 2014). When it began in the 1950's, the program had the objective of addressing undernourishment. The current diet of most Brazilians is of low nutritional quality. The daily intake of vegetables and fruit is lower than recommended levels, and the intake of unhealthy foods is higher than recommended (IBGE, 2011). This situation, together with the increase in overweight among children ages 5 to 9 (IBGE, 2010), has become a new challenge for the NSFP.

In response to this situation, and following international recommendations (WHO, 2004), NSFP guidelines have been modified to promote both healthy eating at school and local family farm production. Since 2010 regulations have included criteria for food procurement for the NSFP. The purchase of products with a high level of sodium, sugar and saturated and trans fats was restricted, and the provision of low nutrition drinks was prohibited. It was recommended that at least three portions of fruit and vegetables be included weekly in school menus. Furthermore, the requirements of the program mandated the provision of the NSFP with products purchased directly from local family farmers, prioritizing organic production and the most vulnerable producers, such as land reform settlers or indigenous, among others (Brasil, 2009a, 2009b). Although this requirement was applied during the development of the NSFP, the effect of the purchase criteria on the foods provided in school feeding programs is unknown. The objective of this study is to explore the effect of purchase criteria included in the School Feeding Program (SFP) on the quantity, variety and origin of the foods used to prepare school meals in a municipality of Santa Catarina (Southern Brazil).

## 2. Methodology

A quantitative content analysis was carried out of purchase lists developed to supply food for school meals in a Brazilian municipality. Lists were studied from two years prior to (2008 and 2009) and two years after (2010 and 2011) the implementation of criteria established for the purchase of food products.

Data collection was carried out in 2011 in a medium sized municipality of the state of Santa Catarina, in the South of Brazil, selected because it is included in the 47% of Brazilian municipal areas whose education networks incorporate (since 2010) criteria established by the federal government for the direct purchase of food products from family farms (Saraiva et al., 2013). This municipality includes approximately 50 public schools for infant and primary education and 5700 students. The rural population is over 4000 people, 17% of which are family farmers who can participate in government programs to strengthen family agriculture.

In order to obtain the purchase lists, telephone and in-person contact was made with the nutritionist of the Municipal Education Council, who is responsible for the planning and supervision of school feeding for all of the public education network of the city. Purchase lists included information related to quantity, characteristics and origin (family farms-preferably coming from the same federal area as the school- or other providers) of the food products supplied annually to the program during the 200 days of the school year.

For the content analysis of the purchase lists, a previously designed protocol was used that contained the purchase criteria of the NSFP. The quantities (kg) and varieties (n) of food products were studied, categorized by location of origin; family farms (FF) or other

providers (OP), form of production; organic or conventional, and nutritional characteristics; recommended (healthy foods) or controlled (unhealthy foods, with elevated quantities of sodium, sugar, and saturated and trans fats). Also, recommended and controlled products were divided into 10 and 11 subcategories, respectively (Martinelli, Soares, Fabri, Veiros, & Cavalli, 2016). Box 1 presents the foods included in each category and subcategory. The categorization of food products was carried out by two researchers simultaneously and independently. The differences in categorization that came up during the process were discussed by the research team and a consensus was reached.

### Box 1

Categories and subcategories of recommended and controlled food products.

Recommended Foods	
1. Fruit	Natural fruits; juices without added sugar, conservatives or other added ingredients
2. Low-carbohydrate vegetables	Vegetables with up to 10% carbohydrate content
3. High-carbohydrate vegetables	Vegetables with over 10% carbohydrate content
4. Spices and complementary vegetables	Vegetables used in small quantities (ex: garlic, oregano, basil)
5. Cereals, breads, doughs, flours and yeasts	Breakfast cereals without sugar, breads, pastas, rice, flour, corn flour, yucca flour and yeast
6. Whole foods	Unrefined foods from group 5
7. Low-fat meats and eggs	Meats with less than 50% of calories from fat
8. Legumes	Legumes in their natural form
9. Milk and milk derivatives with low levels of saturated fats	Milk in its natural form, white cheeses, natural yogurt, dried milk without added sugar
10. Condiments used in small quantities (Ex: vinegar)	Condiments low in salt (ex: olive oil, vinegar, balsamic vinegar)
Controlled Foods	
1. Meats, cheeses and sauces with high levels of sodium and/or saturated fats	Meats with over 50% of calories from fat, yellow cheeses, processes sauces and cream-based sauces, butter, margarine, mayonnaise and/or hydrogenated fats
2. High-sugar foods	Industrial foods with sugar (fruity sweets, marmalades, breakfast cereals with sugar, cookies, cakes, chocolates)
3. Cookies and salty products	Salty crackers, tostadas and industrial appetizers
4. Semi-prepared or ready-to-eat foods	Prepared foods- cooked or pre-cooked- that need no added ingredients
5. Concentrated, powdered or dehydrated foods	Mixes for preparing reconstituted foods (ex: soup powders, biscuit mixes)
6. Canned or conserved products	Canned foods and conserves
7. Drinks with low nutritional content	Soft drinks and industrial juices
8. Drinks with toasted or milled cereals or infused drinks	Tea and coffee
9. Fats	Soy, sunflower, canola and corn oils
10. Sugar	White and brown sugar, crystal or refined
11. Salt	Marine salt, course and fine

Source: Adapted from (Martinelli et al., 2016).

After the information collection, product unit measures were standardized in kilograms. Purchased units and product weight were considered as they appeared in the purchase lists (Ex: 500 g package of pasta; 900 ml container of yogurt). In the case of vegetable units (Ex: one head of lettuce, one bunch of parsley), kilo conversion was carried out in reference to table weights for the food commercialization of the Central Supply Center of Rio Grande do Sul (CEASA-RS, 2014).

The average daily quantity (kg/day) of foods present in purchase lists for each food group was calculated, in order to determine the effect of purchase criteria on the quantity of foods acquired. The total quantity of foods present in purchase lists was calculated (kg/year) grouped into “recommended” and “controlled” foods- and divided by the 200 school days. Later, the proportion corresponding to each food group was calculated, with respect to the average daily total. A contrast of proportions between the study years was carried out to identify differences between daily quantities of acquired foods, using 2008 as the reference year.

In order to explore the effect of the purchase criteria on the origin of food products, daily quantities (kg/day) acquired in 2010 and 2011 were stratified by origin, FF or OP. The proportion supplied by family agriculture and the proportion supplied by other providers was calculated for each food group. In order to identify changes in the proportions of foods acquired from FF and OP, a contrast of proportions was carried out between 2010 and 2011. Data referring to 2008 and 2009 were not stratified by origin given that foods were not purchased from family farms.

Finally, in order to identify the effect in terms of food variety, evolution and origin of foods were explored in the purchase lists during the study period. The annual food variety was calculated (n), as the sum of the different food items included in the purchase lists for each year. Later, the variation in the study period was calculated and the origin was identified (FF/OP) for the included/excluded varieties.

Statistical significance was considered as  $p < 0.05$  using the Z-test for contrast of proportions with the Stata 11.0 program. (Stata

Corp., College Station, TX, 2011).

### 3. Results

The daily averages of the foods acquired (kg/day) for each food group from 2008 to 2011 are shown in Table 1. Results show a significant increase in the quantities of recommended foods and a decrease (also significant) in controlled foods among the years studied ( $p = 0.005$ ). After 2010, although there is evidence of a gradual reduction in the quantities of fruits ( $p = 0.03$ ), there was an increase in the purchase of legumes and vegetables with high and low carbohydrate content ( $p < 0.05$ ). The foods with high sugar content decreased significantly, from 16.7% in 2008 to 12.7% in 2011 ( $p = 0.02$ ). Concentrated products, meat, cheeses and sauces with high sodium and/or saturated fat content presented similar values in all of the years analyzed. Ready-to-eat products, canned goods and drinks with low nutritional value were not present in purchase lists.

The proportion of quantities of foods supplied by family farms and other providers for each food group for 2010 and 2011 are presented in Fig. 1. The total quantities of foods acquired from other providers (64% and 61%) are greater than those acquired from family farms (36% and 39%) in both years, and there are no important variations during the study period. In the category of recommended foods, although the majority are acquired from OP, there is a significant increase in the proportion of foods acquired from FF (39% in 2010 and 45% in 2011,  $p = 0.03$ ), which is concentrated in the group that includes grains, breads, doughs and flours (15% in 2010 and 27% in 2011,  $p = 0.02$ ). Furthermore, family farms provide the total quantity of legumes and the largest proportion of vegetables (with high carbohydrate content (70% and 78%) and with low carbohydrate content (60% and 66%)).

Controlled foods did not register significant variation in the study period, and the greatest proportion was acquired from OP, with the exception of high sugar foods, the majority of which were acquired from FF (64% in 2010 and 60% in 2011).

**Table 1**  
Daily average procured food products, in kg/day, by food group from 2008 to 2011.

Food group	2008 <sup>a</sup>		2009		2010		2011		2009 P	2010 P	2011 P
	N = 777		N = 708		N = 810		N = 857				
	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)			
<b>Total recommended food products</b>	<b>481</b>	<b>(61.9)</b>	<b>429</b>	<b>(60.6)</b>	<b>528</b>	<b>(65.2)</b>	<b>587</b>	<b>(68.5)</b>	<b>0.6</b>	<b>0.2</b>	<b>0.005</b>
Fruit	201	(25.9)	158	(22.3)	159	(19.6)	144	(16.8)	0.1	0.003	<0.001
Low-carbohydrate vegetables	60	(7.7)	53	(7.5)	97	(12.0)	117	(13.7)	0.9	0.005	<0.001
High-carbohydrate vegetables	18	(2.3)	16	(2.3)	55	(6.8)	78	(9.1)	0.9	<0.001	<0.001
Spices and complementary vegetables	1	(0.1)	1	(0.1)	2	(0.3)	2	(0.2)	0.9	0.6	0.6
Cereals, breads, doughs, flours and yeasts	114	(14.7)	100	(14.1)	107	(13.2)	126	(14.7)	0.8	0.4	0.9
Whole foods	0	(0)	0	(0)	0	(0)	0	(0)	–	–	–
Low-fat meats and eggs	36	(4.6)	46	(6.5)	46	(5.7)	57	(6.7)	0.1	0.3	0.08
Legumes	1	(0.1)	3	(0.4)	8	(1.0)	12	(1.4)	0.3	0.02	0.004
Milk and milk derivatives with low levels of saturated fats	48	(6.2)	50	(7.1)	52	(6.4)	49	(5.7)	0.5	0.8	0.7
Condiments used in small quantities (Ex: vinegar)	2	(0.3)	2	(0.3)	2	(0.2)	2	(0.2)	0.9	1.0	0.9
<b>Total controlled food products</b>	<b>296</b>	<b>(38.1)</b>	<b>279</b>	<b>(39.4)</b>	<b>282</b>	<b>(34.8)</b>	<b>270</b>	<b>(31.5)</b>	<b>0.6</b>	<b>0.2</b>	<b>0.005</b>
Meats, cheeses and sauces with high levels of sodium and/or saturated fats	56	(7.2)	52	(7.3)	56	(6.9)	58	(6.7)	0.9	0.8	0.7
High-sugar foods	130	(16.7)	127	(17.9)	125	(15.4)	109	(12.7)	0.5	0.5	0.02
Cookies and salty products	14	(1.8)	8	(1.1)	8	(1.0)	8	(0.9)	0.3	0.2	0.1
Semi-prepared or ready-to-eat foods	0	(0)	0	(0)	0	(0)	0	(0)	–	–	–
Concentrated, powdered or dehydrated foods	57	(7.4)	55	(7.8)	56.0	(6.9)	58	(6.8)	0.8	0.7	0.6
Canned or conserved products	0	(0)	0	(0)	0	(0)	0	(0)	–	–	–
Drinks with low nutritional content	0	(0)	0	(0)	0	(0)	0	(0)	–	–	–
Drinks with toasted or milled cereals or infused drinks	1	(0.1)	1	(0.1)	1	(0.1)	1	(0.1)	0.9	1.0	0.9
Fats	11	(1.4)	11	(1.6)	11	(1.4)	11	(1.3)	0.8	0.9	0.8
Sugar	23	(3.0)	21	(3.0)	21	(2.6)	21	(2.5)	1.0	0.7	0.5
Salt	4	(0.5)	4	(0.6)	4	(0.5)	4	(0.5)	0.9	1.0	0.8

<sup>a</sup> Reference year.

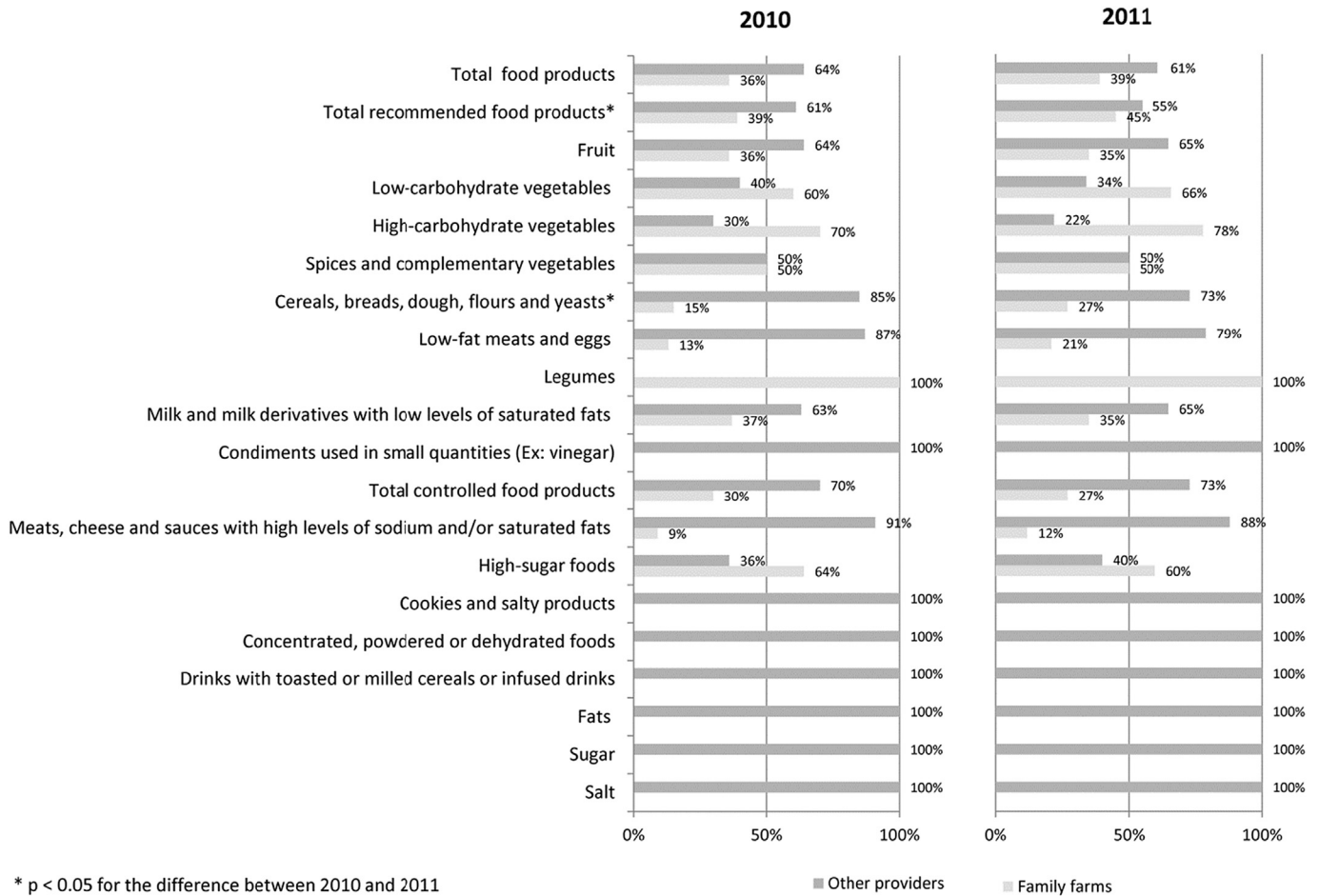


Fig. 1. Proportion of the quantities of foods procured from family farms and other providers for each food group in 2010 and 2011.

The varieties of foods present in purchase lists in 2008 and 2011 are shown in Table 2 according to origin. During the study period, 10 new recommended food products were incorporated into purchase lists and one disappeared (watermelon). Incorporations of foods acquired from family farms included vegetables with low and high carbohydrate content (lettuce, cauliflower, pumpkin and broccoli, yucca, and sweet potato), cereals (yucca flour and corn flour), spices and complementary vegetables (fresh parsley) and from other providers, (soymilk). Furthermore, there was a substitution of providers in 8 food products (banana, carrot, cabbage, beet, rice, chicken eggs, whole milk and beans) from OP to FF.

Among the controlled food products that were removed from the purchase lists of food products supplied by OP are chicken sausage and honey biscuits. Cheese and milk products came to be acquired from FF.

The rest of the food items were unchanged; given that they were acquired from OP during the study period.

Finally, there was no purchase of organic food products identified in either of the years studied.

#### 4. Discussion

This study explores the effect of the implementation of purchase criteria included in the NSFP on food procurement for school meals in a Brazilian municipality during the years after the criteria's application, in 2010 and 2011. The implementation of the law impacted the quantity, variety and origin of the foods present on

purchase lists for the period studied. Although there was no effect on the purchase of organic food products, there was a significant reduction in controlled foods and an increase in the quantity and variety of recommended foods, especially vegetables and legumes. After the application of the regulation, OP remained the principal providers of the SFP, however the incorporation of FF as suppliers of foods contributed to the production of purchase lists with healthier foods in terms of quantity and variety.

The regulations of the program promote the inclusion of organically produced foods in school meals (Brasil, 2009a). Despite the benefits of organic production for the environment (Schneider et al., 2014) and for health (Barański et al., 2014), program regulations have not contributed to incorporating these foods in the purchase lists of the studied municipality. This result is in accordance with the general tendency of Brazilian public schools, where the inclusion of organic produce in school meals is just beginning. It is important to take into account that family farmers face difficulty in obtaining the certification required to commercialize organic food products, which results in their limited supply and availability (Silva & Sousa, 2013; Soares, Martinelli, Melgarejo, Davó-Blanes, & Cavalli, 2015). This situation could limit the program's benefits for the environment and for the health of producers and consumers in the municipality.

The purchase criteria established for the NSFP (Brasil, 2009a) restrict the acquisition of food products high in sodium, sugars and saturated and *trans* fats, because they are important markers of poor nutrition (WHO, 2004). According to our study, the

**Table 2**  
Variety in foods present on purchase lists in 2008 and 2011 by origin.

Groups of food products	2008 and 2009 (n)	2010 and 2011 (n)	Change		Family farms	Other providers
			+	-		
<b>Recommended food products</b>	<b>34</b>	<b>43</b>	<b>10</b>	<b>-1</b>	<b>17</b>	<b>-9 + 1</b>
Fruit	6	5	-	-1	1 (banana)	-2 (banana and watermelon)
Low-carbohydrate vegetables	7	11	4	-	7 (lettuce, cauliflower, squash, broccoli, carrot, cabbage, beet)	-3 (carrots, cabbage, beet)
High-carbohydrate vegetables	1	3	2	-	2 (yucca and sweet potato)	-
Spices and complementary vegetables	3	4	1	-	1 (fresh parsley)	-
Cereals, breads, dough, flours and yeasts	9	11	2	-	3 (rice, yucca flower and y corn flower)	-1 (rice)
Low-fat meats and eggs	4	4	0	-	1 (chicken eggs)	-1 (chicken eggs)
Legumes	1	1	0	-	1 (beans)	-1 (beans)
Milk and milk derivatives with low levels of saturated fats	2	3	1	-	1 (whole milk)	-1 (whole milk)
						1 (soy milk)
Condiments used in small quantities (Ex: vinegar)	1	1	0	-	-	-
<b>Controlled food products</b>	<b>30</b>	<b>28</b>	<b>-</b>	<b>-2</b>	<b>2</b>	<b>-4</b>
Meats, cheese and sauces with high levels of sodium and/or saturated fats	7	6	-	-1	1 (cheese)	-2 (cheese, chicken sausage)
High-sugar foods	12	11	-	-1	1 (dairy drinks)	-2 (dairy drinks and honey cookies)
Cookies and salty products	1	1	0	-	-	-
Concentrated, powdered or dehydrated foods	6	6	0	-	-	-
Drinks with toasted or milled cereals or infused drinks	1	1	0	-	-	-
Fats	1	1	0	-	-	-
Sugar	1	1	0	-	-	-
Salt	1	1	0	-	-	-
<b>Food products supplied by OP that were unchanged</b>						
Orange, apple, papaya, onion, tomato, chayote, cabbage flower, potato, garlic, paprika, cinnamon, wheat flower, yeast, pasta, bread, minced meat, whole beef meat, chicken breast, powdered milk, vinegar, chicken mortadella, sausage, whole chicken, chicken thigh and drumstick, margarine, "Maria" biscuits, "corn starch" biscuits, crème caramel, fruit sweetener, corn cereal with chocolate, sugared corn cereal, malted chocolate biscuit, sweetened honey biscuit, soy corn biscuit, salted biscuit, soy and milk biscuit, tomato extract, flavored juices, instant cereal drinks, powdered chocolate, gelatin, shredded coconut, coffee, soy oil, sugar, salt.						

implementation of the regulation contributed to a significant reduction in the overall presence of these food products, categorized as "controlled", in the purchase lists of the municipal schools. Similar results were obtained in two counties in the United States after implementation of a series of nutritional recommendations regarding the supply of healthy foods for schools (Cummings et al., 2014). However, in the analysis by groups of controlled food products carried out in this study, this decrease was only significant for foods with high levels of sugar. During the study period, the purchase of foods high in fats (almost 60 kg/day) and concentrated products (more than 50 kg/day) remained constant. This result agrees with the great majority of municipalities in Brazil, given that these products continue to be present on school menus (CECANE-UFRGS, 2011). The NSFP purchase criteria do not restrict the quantity of controlled foods, rather they limit the use of funds for their purchase (to a maximum of 30% of the budget) (Brasil, 2009a). In this sense, the program managers' difficulty in identifying food products with high levels of sodium, sugars and fats and the low cost of processed foods could explain the limited impact of the purchase criteria on the reduction in controlled foods. Taking into account the high consumption of unhealthy foods among school pupils (IBGE, 2011), other strategies should be recommended that are directed towards program managers and contribute to limiting the availability of controlled foods in schools.

Following the overall tendency of promoting healthy school feeding in schools (WHO, 2004, 2013), the Brazilian program recommends offering fruits and vegetables at least three times per week (Brasil, 2009b). As in a previous study (Sidaner et al., 2013), the increase in these foods registered on purchase lists of our study, in particular vegetables and legumes, suggests a positive effect of the legislation on the nutritional quality of recommended foods in school feeding in the studied case. The nutritional characteristics of

vegetables and legumes are associated with the prevention of chronic diseases and are used as an evaluation parameter of a healthy diet (Aune et al., 2012; Carter, Gray, Troughton, Khunti, & Davies, 2010; WHO, 2004). Given that the largest proportion of these foods was obtained from FF, the incorporation of FF in the program seems to explain the increase observed. In fact, according to a study carried out in São Paulo (Brazil), vegetables were a predominant part of purchases from FF (Gonçalves, Cunha, Stedefeldt, & Rosso, 2015). In this sense, incorporating FF into the program could be an effective strategy for increasing the supply and consumption of vegetables in schools.

It should be noted, however, the tendency shown by fruits in our study. While 30% of Brazilian municipalities did not include fruit in school feeding programs (CECANE-UFRGS, 2011), fruits were present on the purchase lists of the studied municipality during all of the years analyzed, with a gradual decrease. This result differs from studies that related the local procurement of foods with an increase in the offer of fruits in school feeding programs (Nicholson et al., 2014; Sidaner et al., 2013). However, it agrees with the decreased in the offering of fruits observed in other Brazilian municipal areas (82 – Rio de Janeiro and São Paulo) after initiating purchases from family farms (Gonçalves et al., 2015). It should be mentioned that fruit crops require long production periods. This could explain the low participation of FF in supplying these foods, given the difficulty in responding to the increased demand for fruit during the study period. Also, other macroeconomic factors, such as the decrease in production due to climate and/or the increase in the price of food products, could influence the decrease in the purchase of fruit.

The purchase criteria introduced in the program aim to promote the purchase of local products (Brasil, 2009b). Our results show that the directives included in the NSFP gave greater prominence to FF just a year after their application. However, other providers

remained more prominent overall in supply of food products to the schools in the municipality. In fact, in 2010 47% of municipalities in the country had invested an average of 23% of their budgets in the purchase and incorporation of foods from FF in feeding programs (Saraiva et al., 2013). These results suggest that the program directives have a favorable impact on creating markets for FF. Considering that change processes require time and the period analyzed by this study occurs immediately after the application of the purchase criteria, replicating the study during a greater time period could help determine more precisely the reach of the criteria in promoting purchasing proximity.

In agreement with other study results, among foods purchased from FF- with the exception of dairy products-basic/staple recommended products were predominant (Amorim, Rosso, & Bandoni, 2016; CECANE-UFRGS, 2011), and new varieties in vegetables and cereals were incorporated. The protagonism of FF in the production of basic/staple foods for the internal market (Soto-Baquero, Rodríguez, & Falconi, 2007) could explain this situation. Furthermore, with proximity of purchase, the distance and transport time— from production to consumption—is reduced, favoring the availability of fresh and whole foods (Cavalli et al., 2014). On the other hand, foods produced in the region are seasonal and their availability varies with the seasons (Brasil, 2009a; Soares et al., 2015), which results in greater variety in the food supply for school feeding programs. In this way, the incorporation of purchase criteria of proximity could support an improvement in the quality of the food supply in the studied schools. In addition, a reduction in transport time could also reduce food waste, which would result in economic and environmental benefits for the municipality. Thus, program directives would contribute to strengthening family agriculture in the region. Similar to other Brazilian municipalities (Amorim et al., 2016), the difficulties faced by FF in selling processed foods (Triches & Schneider, 2010; Wittman & Blesh, 2015) did not hamper their supplying this food type to the SFP. However, in order for distribution of these foods not to result in less healthy menus, FF should consider reducing the sugar, sodium and fats in processed foods.

The benefits identified through the implementation of proximity related purchase criteria could be compromised by the lack of public funding for infrastructure necessary for FF to produce and distribute their products (such as central distribution centers and/or roadways in rural areas) (Wittman & Blesh, 2015).

In interpreting these results, it should be noted that the researchers used as their data source the purchase lists developed by the municipal program managers, which could suppose certain limitations (since this was secondary data). However, this source of information was constructed homogeneously in different years of the study period and permits comparison of data to explore the effect of purchase criteria included in the NSFP. On the other hand, although the study is focused only on one municipality—which makes extrapolation and generalization of results difficult—the proposed methodology permits exploring the effect, unknown until now, of the application of purchase criteria on quantity, variety and origin of the food products acquired. This information is important taking into account that, despite the short time period since legislative implementation and the organizational difficulties involved in change processes, changes have been identified in the acquisition of food products that can affect nutrition in schools. Given that this process is just beginning, this information can support decision making to strengthen or introduce modifications in the program.

Offering healthy foods does not guarantee their consumption among pupils, thus the purchase criteria for food products should be supported by educational interventions. However, the availability of these products is a necessary point of departure to

support healthy feeding in schools. In this sense, although the purchase criteria of the feeding program were not effective in reducing products with high levels of salt and fats, the criteria of direct purchase from family farms introduced beneficial changes in school feeding in the municipality, increasing the quantity and variety of healthy foods in the purchase lists of the studied period. It is necessary to develop strategies to deter the reduction in the purchase of fruit and to support incorporation of organic produce in school feeding programs.

### Ethical approval

This article does not contain any studies with human participants or animals performed by any of the authors. The authors declare no conflicts of interest.

### Author disclosure statement

No competing financial interests exist.

### Contributions to authorship

P. Soares developed the study. SS Martinelli and P. Soares gathered information. P Soares and MC Davó-Blanes wrote the first draft of the manuscript. All of the authors were involved in interpretation of results and contributed ideas, revised drafts and approved the final version.

### Acknowledgments

We wish to thank José Fernández Sáez for his contribution in the quantitative analysis as well as Diana Gil-González, PHD, Pablo Caballero, PHD, and Román-Umaña for reading and commenting on the manuscript. The authors would like to give thanks to school food managers for providing study data and to the CAPES Foundation (Ministry of Education of Brazil) for the doctoral scholarship provided to Panmela Soares (grant number: 1015-13-3). This article is a product of her education in the Doctorate Program in Health Sciences of the University of Alicante and will be used as part of the material presented in her thesis in a collection of articles.

### References

- Amorim, A. L. B. d., Rosso, V. V. d., & Bandoni, D. H. (2016). Acquisition of family farm foods for school meals: Analysis of public procurements within rural family farming published by the cities of São Paulo state. *Revista de Nutrição*, 29, 297–306.
- Aune, D., Chan, D. S. M., Vieira, A. R., Navarro Rosenblatt, D. A., Vieira, R., Greenwood, D. C., et al. (2012). Fruits, vegetables and breast cancer risk: A systematic review and meta-analysis of prospective studies. *Breast Cancer Research and Treatment*, 134, 479–493.
- Ballesteros, C. (2015). Buenas prácticas para la implementación de mecanismos de compras públicas directas y locales a la agricultura familiar para la alimentación escolar Documento de trabajo. In *Implementación de un modelo de compras públicas a la agricultura familiar campesina para los programas de alimentación Escolar en El Salvador, Nicaragua, Honduras y Paraguay Proyecto TCP/RLA/3406*. Santiago de Chile: Organización de las Naciones Unidas para la Alimentación y la Agricultura.
- Barański, M., Średnicka-Tober, D., Volakakis, N., Seal, C., Sanderson, R., Stewart, G. B., et al. (2014). Higher antioxidant and lower cadmium concentrations and lower incidence of pesticide residues in organically grown crops: A systematic literature review and meta-analyses. *British Journal of Nutrition*, 112, 794–811.
- Brasil. (2009a). *Fundo Nacional de Desenvolvimento da Educação. Resolução nº 38, 16 de julho de 2009. Dispõe sobre o atendimento da alimentação escolar aos alunos da educação básica no Programa Nacional de Alimentação Escolar*. Brasília: Diário Oficial da União.
- Brasil. (2009b). *Lei nº 11.947 de 16 de junho de 2009. Dispõe sobre o atendimento da alimentação escolar e do Programa Dinheiro Direto na Escola aos alunos da educação básica; e dá outras providências*. Brasília: Diário Oficial da União.
- Carter, P., Gray, L. J., Troughton, J., Khunti, K., & Davies, M. J. (2010). Fruit and vegetable intake and incidence of type 2 diabetes mellitus: Systematic review

- and meta-analysis. *BMJ (Online)*, 341, 543.
- Cavalli, S. B., Melgarejo, L., Soares, P., Martinelli, S. S., Fabri, R. K., Ebone, M. v., et al. (2014). Planejamento e operacionalização do fornecimento de vegetais e frutas pelo Programa de Aquisição de Alimentos para a alimentação escolar. In J. V. Q. Cunha, A. R. Pinto, R. M. Bichir, & R. F. S. Paula (Eds.), *Avaliação de políticas públicas: Reflexões acadêmicas sobre o desenvolvimento social e o combate à fome (Vol. Segurança alimentar e nutricional)*. Brasília: Ministério do Desenvolvimento Social e Combate à Fome. Secretaria de Avaliação e Gestão da Informação.
- CEASA-RS. (2014). *Tabela de referencia de pesos para a comercialização de produtos hortigranjeiros*. Rio Grande do Sul, Porto Alegre, Brasil: Centrais de Abastecimento do Rio Grande do Sul.
- CECANE-UFRGS. (2011). *Composição nutricional da alimentação escolar no Brasil: Uma análise a partir de uma amostra de cardápios - 2011 (resumo executivo)*. Brasília: Fundo Nacional de Desenvolvimento da Educação.
- Cummings, P. L., Welch, S. B., Mason, M., Burbage, L., Kwon, S., & Kuo, T. (2014). Nutrient content of school meals before and after implementation of nutrition recommendations in five school districts across two U.S. counties. *Preventive Medicine*, 67(Suppl 1), S21–S27.
- FAO, IFAD, & WFP. (2015). In *The state of food insecurity in the World: Meeting the 2015 international hunger targets: Taking stock of uneven progress*. Roma: Food and Agriculture Organization of the United Nations.
- FNDE (2014). Histórico. <<http://www.fnde.gov.br/programas/alimentacao-escolar/alimentacao-escolar-historico>>. Accessed 29.09.16.
- Gonçalves, H. V. B., Cunha, D. T. d., Stedefeldt, E., & Rosso, V. V. d (2015). Family farming products on menus in school feeding: A partnership for promoting healthy eating. *Ciência Rural*, 45, 2267–2273.
- IBGE. (2010). *Antropometria e estado nutricional de crianças, adolescentes e adultos no Brasil: Pesquisa de Orçamentos Familiares 2008-2009*. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística.
- IBGE. (2011). *Pesquisa de Orçamentos Familiares 2008-2009: Análise do Consumo Alimentar Pessoal no Brasil*. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística.
- Martinelli, S. S., Soares, P., Fabri, R. K., Veiros, M. B., & Cavalli, S. B. (2016). Qualidade da alimentação escolar: método para avaliação da Aquisição de Gêneros Alimentícios (AGA). In C. R. P. A. TEO, & R. M. TRICHES (Eds.), *Alimentação escolar: construindo interfaces entre saúde, educação e desenvolvimento*. Chapecó, SC: Argos.
- Nicholson, L., Turner, L., Schneider, L., Chriqui, J., & Chaloupka, F. (2014). State farm-to-school laws influence the availability of fruits and vegetables in school lunches at US public elementary schools. *Journal of School Health*, 84, 310–316.
- PAA Africa. (2013). *Purchase from africans for Africa* Accessed 22.10.15 <http://paa-africa.org/>.
- Robles, B., Wood, M., Kimmons, J., & Kuo, T. (2013). Comparison of nutrition standards and other recommended procurement practices for improving institutional food offerings in Los Angeles county, 2010–2012. *Advances in Nutrition*, 4, 191–202.
- Rosset, P. (2011). Preventing hunger: Change economic policy. *Nature*, 479, 472–473.
- Saraiva, E. B., Silva, A. P. F., Sousa, A. A., Cerqueira, G. F., Chagas, C. M. d. S., & Toral, N. (2013). Panorama da compra de alimentos da agricultura familiar para o Programa Nacional de Alimentação Escolar. *Ciência & Saúde Coletiva*, 18, 927–935.
- Schneider, M. K., Lüscher, G., Jeanneret, P., Arndorfer, M., Ammari, Y., Bailey, D., et al. (2014). Gains to species diversity in organically farmed fields are not propagated at the farm level. *Nature communications*, 5.
- Sidaner, E., Balaban, D., & Burlandy, L. (2013). The Brazilian school feeding programme: An example of an integrated programme in support of food and nutrition security. *Public Health Nutrition*, 16, 989–994.
- Silva, A. P. F., & Sousa, A. A. (2013). Alimentos orgânicos da agricultura familiar no Programa Nacional de alimentação Escolar do Estado de Santa Catarina, Brasil. *Revista de Nutrição*, 26, 701–714.
- Soares, P., Martinelli, S. S., Melgarejo, L., Davó-Blanes, M. C., & Cavalli, S. B. (2015). Potencialidades e dificuldades para o abastecimento da alimentação escolar mediante a aquisição de alimentos da agricultura familiar em um município brasileiro. *Ciência & Saúde Coletiva*, 20, 1891–1900.
- Soto-Baquero, F., Rodríguez F, M., & Falconi, C. (2007). Políticas para la agricultura familiar en América Latina y el Caribe – Resumen ejecutivo. Santiago, Chile Organización de las Naciones Unidas para la Alimentación y la Agricultura, Banco Interamericano de Desarrollo.
- Triches, R. M., & Schneider, S. (2010). Alimentação escolar e agricultura familiar: reconectando o consumo à produção. *Saúde e Sociedade*, 19, 13.
- Via Campesina. (1996). *The right to produce and access to land* (Roma: Via Campesina).
- WFP. (2013). *State of school feeding worldwide*. Rome: World Food Programme.
- WHO (2004). *Global Strategy on Diet, Physical Activity and Health*. Geneva: World Health Organization. Eighth plenary meeting, Committee A, third report.
- WHO. (2011). *Global status report on noncommunicable diseases 2010. Description of the global burden of NCDs, their risk factors and determinants*. Geneva: World Health Organization.
- WHO. (2013). *Global action plan for the prevention and control of noncommunicable diseases - 2013-2020*. Geneva: World Health Organization.
- Wittman, H., & Blesh, J. (2015). Food sovereignty and fome Zero: Connecting public food procurement programmes to sustainable rural development in Brazil. *Journal of Agrarian Change*.