

Effect of implementation of a University Restaurant on the diet of students in a Brazilian public university

Efeito da implementação do Restaurante Universitário na alimentação de estudantes de uma universidade pública brasileira

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Abstract *Dietary practices of college students were compared before and after implementation of the University Restaurant (UR) and examined according to frequency of UR use. A natural experiment was conducted with students (n = 1131) of a Brazilian public university using a validated self-completed and identified questionnaire that inquired information on practices of substituting lunch and/or dinner with a snack (≥ 5 days/week) and on regular consumption of foods that were markers of a healthy or unhealthy diet. At the second time point, UR use by students was also assessed based on their attendance to it. Changes in food practices were examined by determining differences in proportions between the two assessments. The analysis of the association between UR use and each dietary practice was carried out using multiple logistic regression models. An association was observed between greater UR use and higher frequency of regular consumption of beans, vegetables, raw vegetables, cooked vegetables and fruit and lower frequency of regular consumption of French fries and/or fried snacks. The UR proved to be an environment that facilitated the adoption of healthy dietary practices and promoted improvement in the diets of the students who were more assiduous to the restaurant.*

Key words *Food consumption, Food habits, Universities, Collective Feeding*

Resumo *Práticas alimentares de universitários foram comparadas antes e após implementação do Restaurante Universitário (RU) e examinadas segundo a assiduidade ao RU. Experimento natural foi conduzido com estudantes (n = 1.131) de uma universidade pública utilizando questionário validado autopreenchido e identificado que abarcou as práticas de substituir o almoço e/ou jantar por lanche (≥ 5 dias/semana) e o consumo regular de alimentos marcadores de alimentação saudável e não saudável. No segundo momento, foi examinada a adesão dos estudantes ao RU por meio de sua assiduidade a ele. A variação das práticas alimentares foi examinada pela diferença entre proporções obtidas nos dois momentos de avaliação. A análise da associação entre a assiduidade ao RU e cada uma das práticas alimentares regulares foi feita por meio de modelos de regressão logística múltipla. Observou-se associação entre maior assiduidade ao RU e maior frequência de consumo regular de feijão, hortaliças, hortaliças cruas, hortaliças cozidas e frutas e menor frequência de consumo regular de batata frita e/ou salgados fritos. A implementação do RU se constituiu como um espaço facilitador da adoção de práticas alimentares saudáveis e promoveu a melhoria da alimentação dos estudantes com maior assiduidade a ele.*

Palavras-chave *Consumo de alimentos, Hábitos alimentares, Universidades, Alimentação coletiva*

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Introduction

The organizational food environment, characterized by schools, universities, workplaces, among others, constitutes a strategic setting for promoting a healthy diet, since it has a strong influence on the dietary behaviors of the individuals frequenting this environment¹⁻³. Among these food environments, the university campus warrants special attention given that while at university students acquire eating habits that can persist into adult life, thereby representing a unique opportunity for promoting a healthy diet⁴⁻⁷.

However, studies suggest that, in many cases, the campus food environment discourages healthy eating and/or encourages unhealthy dietary practices owing to the low nutritional quality of the foods sold in these settings⁸⁻¹¹. Research also suggests that college students adopt inadequate dietary practices, characterized by skipping meals, high intake of ultra-processed foods and low intake of fruit and vegetable¹²⁻¹⁵. Few studies exist investigating the association between campus food environments and dietary practices of individuals exposed to them or analyzing the impact of changes to this environment on the dietary practices of this group^{5-7,10}. In addition, we found no previous studies addressing the impact of changes in the campus food environment after implementation of a University Restaurant (UR).

In Brazil, University Restaurants, implemented within Federal higher education institutions in the 1950s and significantly expanded in the 1970s¹⁶, represent an initiative consistent with national policies on food and nutrition¹⁷, health promotion¹⁸, food and nutrition security¹⁹ and affirmative action²⁰, contributing to the creation of favorable environments for the adoption of healthy dietary practices by individuals with access to these environments.

In 2011, the University of the State of Rio de Janeiro (UERJ) experienced the implementation of a UR within its main campus (Maracanã), providing healthy food (lunch and dinner) at subsidized prices for students. This initiative was joined to the food environment already set up, which was characterized by the presence of different commercial outlets with low availability of healthy foods and wide range of snacks, confectionery and sugar-sweetened beverages. Thus, the implementation of the UR represented an opportunity to investigate food-related issues in the university setting.

The objective of the present study was to compare the dietary practices of students of the

UERJ before and after the implementation of the UR and to examine the differences in these practices according to UR use.

Methods

Study population and design

A natural experiment was conducted with historical control (status of individuals' exposed to the UR prior to its implementation) in a population of students enrolled in the first semester of 2011 on 31 undergraduate courses offered by the 24 academic units of the Maracanã campus and that continued frequenting the university during the second academic semester of 2012. For this, a census was carried out with the universe of these students.

Characterization of the University Restaurant (UR)

The UR was implemented in November 2011, operating from Monday to Friday, from 11am to 2pm (lunch) and from 5pm to 8pm (dinner), serving an average of 3,100 meals daily, comprising 1,900 lunches and 1,200 dinners at subsidized prices for all students and with concession discounts for quota students (enrolled in the university via admissions exam under the quota system based on racial and social criteria)²¹. At the time of the study, the price of meals was US\$ 3.47 (equivalent to R\$ 5.31) for teaching staff and technical-administrative staff, US\$ 1.96 (R\$ 3.00) for non-quota students (enrolled at the university via the regular admission system) and US\$ 1.31 (R\$ 2.00) for quota students. The Brazilian Real currency was converted into US dollars using *Purchasing Power Parity* (PPP 2012: US\$ 1.00 = R\$ 1.53 at time of study)²².

The daily menu was structured as follows: starter: comprising three types of salad; main protein dish or equivalent option; garnish: combining with the main dish, predominantly based on vegetables; side dish: white rice, whole-grain rice and beans; desserts: fruit daily with one sweet dessert option on two days of the week; and beverages: fruit juice with or without sugar, coffee and tea, with or without sugar, filtered water. The menu was prepared using only fresh or minimally processed foods, cooking ingredients and processed foods, with no ultra-processed foods²³.

Questionnaire

The data collection instrument consisted of a self-completed and identified questionnaire that was completed before and after the implementation of the UR, allowing comparison, at the individual level, of students' diets. It was devised based on validated instruments used in risk factor surveillance systems for Brazilian adolescents²⁴ and Brazilian adults²⁵. It was previously tested with nutrition students who were enrolled in the university in the second semester of 2010 ($n = 50$) and no changes were required in the content and in the form.

The information included in the questionnaire were related to the identification and characterization of the students as well as to their eating habits (covering food routines and consumption of certain foods), as described by Perez et al.¹⁵. For the second data collection, the questionnaire included questions on use of the UR, as detailed in the item on variables and indicators. The dietary routines considered at baseline were: having lunch and/or dinner and substituting lunch and/or dinner with a snack. At the second data collection, besides information on having lunch, dinner and substituting lunch and/or dinner with a snack, routines of UR use were also surveyed.

Food consumption, in both data collections, was assessed based on foods considered markers of a healthy diet (MHD) and markers of an unhealthy diet (MUD), as described in "variables and indicators". These were chosen based on nutritional recommendations for a healthy diet^{26,27} and also on evidence suggesting an association of these variables with risk and protective factors for non-communicable chronic diseases²⁶⁻²⁹.

Data collection

Data collection took place between August 2011 and March 2013 in a two-stage process. The first stage was prior to implementation of the UR, between August and October 2011, with 36 days of effective data collection. The second stage took place after implementation of the UR, between December 2012 and March 2013, with 40 days of effective data collection. This second stage did not occur exactly one year after implementation of the UR, as originally planned by the coordinators of the study, owing to a strike at the university from June to September 2012, followed by the academic break. Therefore, the collection was carried out after full resumption

of activities of the 2012-second academic semester, which extended from 5th November 2012 to 13th March 2013.

For both data collections, students who had joined the university in the first semester of 2011 and that agreed to take part in the study, filled out the questionnaire at the beginning of classes of different disciplines. Only students who had taken part at baseline participated in the second data collection. Time taken to complete the questionnaire ranged from 10 to 15 (mean: 12) minutes at baseline and from 20 to 30 (mean: 25) minutes for at the second data collection. Trained fieldworkers visited each course up to 15 (mean: 5.3) times at baseline and up to 30 (mean: 8.7) times on the second data collection, at different times and in different disciplines, in order to gather data on as many students as possible.

Variables and indicators

The following sociodemographic variables were assessed to characterize the group studied: sex, age, university admission way (quota/non-quota), living arrangements regarding shared abode, maternal educational level and ownership of the following goods and services: fixed telephone, computer, home internet access, bathroom in the home. UR use by the students was determined by examining the number of days the student went to the UR during the seven days leading up to the data collection (zero to five days).

With regard to food consumption, 10 foods, food groups or culinary preparations, were analyzed for the seven days preceding the study, consumed inside and/or outside the university environment: 1) beans; 2) vegetables in general (excluding root vegetables and tubers); 3) cooked vegetables (excluding root vegetables and tubers); 4) raw vegetables; 5) fresh fruit; 6) French fries (not counting "packet" chips) and/or fried snacks; 7) hamburger and/or processed meats; 8) biscuits and/or "packet" salted snacks (including "packet" potato chips); 9) confectionery (desserts, sweets, chocolates, chewing gum, lollipops etc.); and 10) sugar-sweetened beverages, excluding milk-based and yoghurt drinks and including soft drinks, juices or other fruit beverages, ice tea, natural guarana, other teas, coffee, flavored waters, isotonic and soy based drinks. The first five items were considered MHD and the last five, MUD.

The dietary routines were measured by determining the frequency, during the seven days prior to data collection, of having lunch, dinner

(markers of healthy dietary routine – MHDR) and of substituting lunch and/or dinner with a snack (markers of an unhealthy routine – MUDR). Lunch and dinner were defined as meals containing, for example, rice with beans and/or meat and salad and/or cooked vegetables; soup; spaghetti, among others; sandwich-based meals were not counted.

Based on the weekly frequency of consumption of each of the foods or food groups or preparations selected, an indicator was derived expressing the proportion of students that regularly consumed (on at least five out of the seven days preceding data collection) each of the selected foods. Similar indicators were devised for dietary routines.

An assiduity variable was created to assess students' use of the UR based on the number of days on which the student frequented the UR during the seven days leading up to data collection. The following categories were devised: non-user (did not go to the UR), occasional user (frequented the UR on one or two days) and frequent user (frequented the UR on three to five days) during the week preceding data collection.

Data analysis

Variation in consumption of MHD and MUD foods as well as in MHDR and MUDR was analyzed based on the difference in proportions obtained before and after implementing the UR. The statistical significance of differences in proportions was examined by comparing the confidence intervals (95%) of the estimates obtained.

The analysis of the association between assiduity to the UR (independent variable) and each of the regular dietary practices (≥ 5 days in the week) (dependent variables) was carried out using bivariate analysis and multiple logistic regression models. The models yielded adjusted odds ratios and their respective 95% confidence intervals. In these models, sex and age group of the students were considered as covariates. Previous studies have found these variables to be associated with the dietary patterns of students³⁰, adolescents^{31,32}, young adults³³, and adolescents and adults³⁴.

Data entry by independent digitizers and double data entry validation were done using the Microsoft Excel® 2007 software application. All data analysis was performed using the *Statistical Package for the Social Sciences* (SPSS) version 21.0 software application.

Ethical aspects

The Ethics Committee of the Dean's Office of Post-graduation and Research of the UERJ, approved the present study. The study included students that signed the Free and Informed Consent Form.

Results

Of the total 1508 enrollers in the first semester of 2011 (official figures from the UERJ), 1336 were included in the first stage. At the time of the second data collection, 128 of those studying at baseline were no longer attending the university. Thus, from the 1208 who were eligible for the study 1131 were effectively studied (Figure 1). Most of the were female (56.4%), lived with the family (88.0%), had a fixed telephone, computer and home internet access (over 90.0% for each service), had mother with at least complete secondary level education (71.7%); around half (50.6%) of them were aged 19 years or younger and had at least two bathrooms in the home (50.3%) (data not shown).

Examination of the frequency of regular consumption (≥ 5 days/week) of selected foods before and after implementation of the UR revealed improvement in students' diets, with an increase in the proportion of students consuming vegetables (from 42.3% to 49.2%) and raw vegetables (from 25.6% to 34.9%) and a decrease in the proportion consuming French fries and/or fried snacks (from 14.7% to 4.9%), hamburger and/or processed meats (from 22.0% to 14.6%), biscuits and/or "packet" salted snacks (from 35.7% to 22.2%), confectionery (from 38.8% to 26.7%) and sugar-sweetened beverages (from 63.2% to 53.5%) (Table 1). However, it should be noted that the decrease in proportion of students that regularly consumed MUD, except for French fries and/or fried snacks, and that replaced dinner with snacks occurred independently of UR use, as it can be seen comparing the numbers observed for no users of RU (Tables 2 and 3) with those before RU implementation (Tables 1 and 4).

Comparison of food consumption according to assiduity to UR (raw analysis) revealed a greater proportion of students that regularly consumed beans, vegetables and raw vegetables among frequent UR users. After adjusting for confounding factors, higher assiduity to UR was found to be associated with greater frequen-

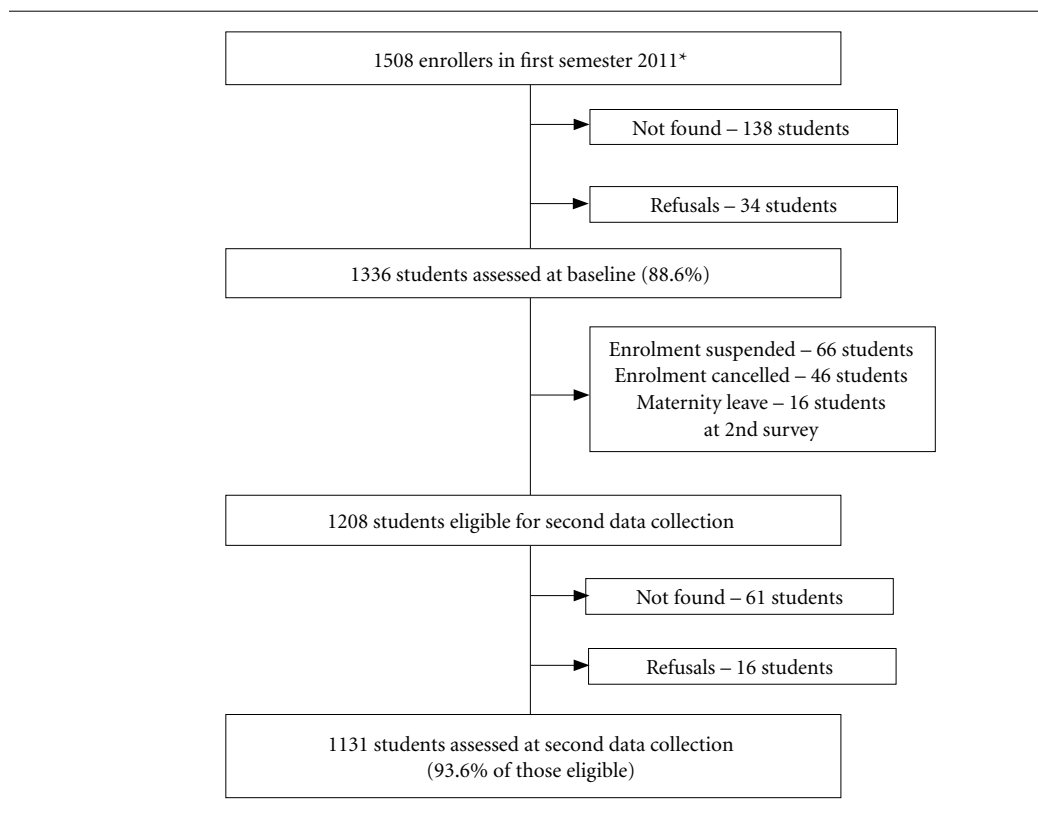


Figure 1. Flow chart of participation in study assessing the impact of implementation of the University Restaurant on diets of students from the University of the State of Rio de Janeiro. Students enrolled in the first semester of 2011 at the University of the State of Rio de Janeiro. Rio de Janeiro, Brazil, 2011-2012/13.

* Official figures from the UERJ.

cy of regular consumption of beans, vegetables, raw vegetables, cooked vegetables and fruit and with lower frequency of regular consumption of French fries and/or fried snacks for the group of students (Table 2).

With regard to regular dietary routines (≥ 5 days/week) practiced before and after implementation of the UR, a reduction in the proportion of students substituting dinner with snacks was evident (from 24.7% to 19.2%) (Table 4). Comparison of these routines according to assiduity to UR use (raw and adjusted analysis), showed a lower proportion of students substituting dinner with snacks, although these differences did not reach statistical significance (Table 3).

Discussion

The findings of the present study revealed an improvement in students' dietary practices (decrease in proportion of students substituting

dinner with a snack and in regularly consuming each MUD, and increase in proportion of students consuming vegetables and raw vegetables) after implementation of the UR. Higher assiduity to UR was found to be associated with greater proportion of students that regularly consumed beans, vegetables, raw vegetables, cooked vegetables and fruit and with lower proportion of regular consumption of French fries and/or fried snacks. Nevertheless, even among the most frequent users of the UR, regular consumption of the MHD foods ranged from 33.4% (fruits) to 63.4% (beans), being below the desired level²⁵, since only 1/3 of students regularly consumed fruit, just under half regularly consumed vegetables and approximately 2/3 regularly consumed beans.

The consumption of foods MUD, which should be avoided²⁷, was high, especially sugar-sweetened beverages (51.3%), confectionery (22.5%) and biscuits and/or "packet" salted

Table 1. Frequency (%) of regular consumption (≥ 5 days in week) of foods markers of healthy and unhealthy diet before and after implementation of the University Restaurant (UR). Enrollers in the first semester of 2011 at the University of the State of Rio de Janeiro. Rio de Janeiro, Brazil, 2011-2012/2013.

Consumption of foods markers of healthy and unhealthy diet	Regular practice (≥ 5 days/week)			
	Before (%)	[95%CI] ^f	After (%)	[95%CI] ^f
Beans (n = 1131)	55.3	[52.4-58.2]	50.1	[47.2-53.0]
Vegetables ^a (n = 1131)	42.3	[39.4-45.2]	49.2	[46.3-52.2]
Raw vegetables (n = 1131)	25.6	[23.2-28.2]	34.9	[32.2-37.7]
Cooked vegetables ^a (n = 1131)	21.2	[18.9-23.7]	23.7	[21.3-26.2]
Fruit (n = 1129)	23.9	[21.5-26.5]	27.9	[25.3-30.5]
French fries and/or fried snacks ^b (n = 1131)	14.7	[12.7-16.8]	4.9	[3.7-6.2]
Hamburger and/or processed meats (n = 1131)	22.0	[19.7-24.5]	14.6	[12.6-16.7]
Biscuits and/or "packet" salted snacks ^c (n = 1128)	35.7	[33.0-38.6]	22.2	[19.8-24.7]
Confectionery ^d (n = 1128)	38.8	[36.0-41.7]	26.7	[24.2-29.3]
Sugar-sweetened beverages ^e (n = 1129)	63.2	[60.3-65.9]	53.5	[50.6-56.4]

^aExcluding root vegetables and tubers. ^bExcluding "packet" potato chips. ^cIncluding "packet" potato chips. ^dDesserts, sweets, chocolates, chewing gum, lollipops etc. ^eSoft drinks, juices or other fruit beverages, ice tea, natural guarana, other teas, coffee, flavored waters, isotonic and soy based drinks, excluding milk-based and yoghurt drinks. ^fThe statistical significance of differences in proportions was examined by comparing the confidence intervals (95%) of the estimates obtained.

Table 2. Frequency (%) of regular consumption (≥ 5 days in week) of foods markers of healthy and unhealthy diet after implementation of the University Restaurant (UR) according to assiduity ^a to the University Restaurant (UR) and respective adjusted odds ratios and 95% CI. Enrollers in the first semester of 2011 at the University of the State of Rio de Janeiro. Rio de Janeiro, Brazil, 2012-2013.

Regular consumption of foods markers of healthy and unhealthy diet (≥ 5 days in week)	Assiduity to UR (%)			Non-user	Adjusted Odds Ratio ^g	
	Non-user [95%CI]	Occasional user [95%CI]	Frequent user [95%CI]		Non-user [95%CI]	Frequent user [95%CI]
Beans (n = 1131)	43.8 [39.7-48.0]	45.3 [39.1-51.6]	63.4 [58.2-68.4]	1	1.02 [0.752-1.403]	1.97 [1.485-2.627]
Vegetables ^b (n = 1131)	44.9 [40.8-49.1]	46.9 [40.7-53.2]	57.6 [52.4-62.8]	1	1.11 [0.819-1.513]	1.82 [1.376-2.407]
Raw vegetables (n = 1131)	28.5 [24.8-32.4]	30.5 [24.9-36.4]	48.1 [42.9-53.4]	1	1.12 [0.805-1.567]	2.41 [1.809-3.217]
Cooked vegetables ^b (n = 1131)	21.3 [17.9-24.8]	21.0 [16.2-26.4]	29.4 [24.8-34.3]	1	1.04 [0.713-1.516]	1.81 [1.318-2.508]
Fruit (n = 1129)	25.9 [22.3-29.7]	24.3 [19.2-29.9]	33.4 [28.6-38.5]	1	0.96 [0.676-1.373]	1.59 [1.177-2.157]
French fries and/or fried snacks ^c (n = 1131)	6.5 [4.6-8.7]	4.1 [2.1-7.1]	2.9 [1.5-5.0]	1	0.66 [0.319-1.367]	0.41 [0.200-0.855]
Hamburger and/or processed meats (n = 1131)	16.5 [13.5-19.7]	14.0 [10.0-18.7]	12.1 [9.0-15.8]	1	0.85 [0.555-1.318]	0.70 [0.472-1.057]
Biscuits and/or "packet" salted snacks ^d (n = 1128)	24.2 [20.7-27.9]	19.8 [15.1-25.1]	20.7 [16.7-25.2]	1	0.76 [0.527-1.116]	0.84 [0.604-1.174]
Confectionery ^e (n = 1128)	28.5 [24.8-32.4]	28.8 [23.4-34.7]	22.5 [18.3-27.1]	1	0.98 [0.703-1.389]	0.76 [0.550-1.050]
Sugar-sweetened beverages ^f (n = 1129)	52.3 [48.1-56.5]	59.3 [53.0-65.3]	51.3 [46.0-56.5]	1	1.31 [0.966-1.794]	0.95 [0.727-1.263]

^aNon-user – did not frequent UR in the week preceding data collection; occasional user: frequented UR on one or two days in the week preceding data collection; and frequent user: frequented UR on at least three days in the week preceding data collection.

^bExcluding root vegetables and tubers. ^cExcluding "packet" potato chips. ^dIncluding "packet" potato chips. ^eDesserts, sweets, chocolates, chewing gum, lollipops etc. ^fSoft drinks, juices or other fruit beverages, ice tea, natural guarana, other teas, coffee, flavored waters, isotonic and soy based drinks, excluding milk-based and yoghurt drinks. ^gThe analysis of the association between assiduity to the UR and each of the regular dietary practices was carried out using bivariate analysis and multiple logistic regression models. The models yielded adjusted odds ratios for gender and age group, considering non-user as base category and their respective 95% confidence intervals.

Table 3. Frequency (%) of regular healthy and unhealthy dietary routines (≥ 5 days in week) after implementation of the University Restaurant (UR) according to assiduity^a to the University Restaurant (UR) and respective adjusted odds ratios and 95% CI. Enrollers in the first semester of 2011 at the University of the State of Rio de Janeiro. Rio de Janeiro, Brazil, 2012-2013.

Healthy and unhealthy regular dietary routines (≥ 5 days in week)	Assiduity to UR (%)			Adjusted odds ratio ^c		
	Non-user [95%CI]	Occasional user [95%CI]	Frequent user [95%CI]	Non-user	Occasional user [95%CI]	Frequent user [95%CI]
Lunched ^b (n = 1130)	86.3 [83.3-89.0]	83.5 [78.5-87.8]	85.0 [81.0-88.5]	1	0.82 [0.544-1.265]	0.90 [0.613-1.342]
Dined ^b (n = 1130)	60.6 [56.5-64.7]	55.6 [49.3-61.7]	63.7 [58.5-68.6]	1	0.82 [0.606-1.132]	1.07 [0.803-1.429]
Substituted lunch with snack (n = 1130)	4.6 [3.1-6.6]	4.1 [2.1-7.1]	5.2 [3.2-7.9]	1	0.83 [0.391-1.775]	1.12 [0.594-2.126]
Substituted dinner with snack (n = 1131)	20.3 [17.1-23.9]	21.8 [16.9-27.3]	15.6 [12.0-19.6]	1	1.13 [0.778-1.652]	0.83 [0.575-1.200]

^a Non-user – did not frequent UR in the week preceding data collection; occasional user: frequented UR on one or two days in the week preceding data collection; and frequent user: frequented UR on at least three days in the week preceding data collection.

^b Meal containing rice with beans and/or meat and salad and/or cooked vegetables; soup; spaghetti, among others, excluding sandwiches. ^c The analysis of the association between assiduity to the UR and each of the regular dietary practices was carried out using bivariate analysis and multiple logistic regression models. The models yielded adjusted odds ratios for gender and age group, considering non-user as base category and their respective 95% confidence intervals.

Table 4. Frequency (%) of regular healthy and unhealthy dietary routines (≥ 5 days in week) before and after implementation of the University Restaurant (UR). Enrollers in the first semester of 2011 at the University of the State of Rio de Janeiro. Rio de Janeiro, Brazil, 2011-2012/2013.

Healthy and unhealthy dietary routines	Regular practice (≥ 5 days/week)			
	Before (%)	[95%CI] ^b	After (%)	[95%CI] ^b
Lunched ^a (n = 1130)	87.0	[84.9-88.9]	85.3	[83.2-87.3]
Dined ^a (n = 1130)	58.3	[55.4-61.2]	60.5	[57.6-63.3]
Substituted lunch with snack (n = 1130)	4.5	[3.4-5.8]	4.7	[3.6-6.0]
Substituted dinner with snack (n = 1131)	24.7	[22.2-27.2]	19.2	[17.0-21.5]

^a Meal containing rice with beans and/or meat and salad and/or cooked vegetables; soup; spaghetti, among others, excluding sandwiches. ^b The statistical significance of differences in proportions was examined by comparing the confidence intervals (95%) of the estimates obtained.

snacks (20.7%). In addition, a large proportion of students routinely skipped dinner (20.3%) and/or substituted this meal with snacks (15.6%).

Regarding beans, it is interesting to compare the no significant increase in the proportion of students consuming this item (actually a reduction, but not statistically significant) before and after implementation of the UR with the findings about its consumption according to assiduity to UR. This outcome resulted from a combination

of two phenomena: a decrease in total proportion of students that regularly consumed this food among non-users and occasional users of the UR and the unchanged proportion of bean consumers among frequent users. In addition, after controlling for confounding factors there was a greater likelihood of regular consumption of beans among frequent UR users. This finding indicates that the presence of beans on the UR menu allowed the maintenance and/or resump-

tion of the consumption of a traditional food that, together with other foods such as rice and manioc flour, had lost popularity in favor of a diet rich in ultra-processed foods in Brazil³⁵⁻³⁷.

With regard to the methodological differences between this study and other intervention studies conducted in the organizational environment in terms of intervention design, outcomes studied and methods of analysis, in general, the findings reported here corroborate results of other studies aimed at promoting healthy diet in organizational environments such as schools^{38,39}, workplaces⁴⁰⁻⁴³ and universities^{5-7,10}. In these previous investigations, different strategies were employed such as reducing price^{6,10,40,43}, providing vouchers for the purchase of certain foods³⁹, improving the quality of fruit and vegetables offered at the cafeteria combined with educational activities⁴², cooking workshops encouraging the consumption of fruit and vegetables with educational activities⁴¹, increasing the availability of healthy foods in establishments that sold foods^{6,10,38,39,42}, using information-based approaches including total calories of each food and/or product, indicating low fat foods, and nutritional composition of foods and preparations^{5-7,10,39,40}. In all of the cited studies, it was observed an increase in the consumption of foods that were markers of a healthy diet (with emphasis on fruit and vegetables) and/or a reduction in the consumption of foods markers of an unhealthy diet (such as sugar-sweetened beverages, savory biscuits, sweet biscuits and confectionery). Studies combining strategies (e.g. price and educational action^{6,10,39,43}, quality of foods and educational action)⁴², attained even better outcomes.

According to Caspi *et al.*⁴³, access to food is achieved through five dimensions: availability, physical accessibility, affordability, acceptability and convenience. Analysis of the UR, in the form it was implemented, as a new facility introduced into the university environment, revealed that the restaurant encompassed all the dimensions outlined above, namely: (a) availability of fresh or minimally processed foods and culinary preparations made based on these foods in the meals offered daily to users (offering raw vegetables at the beginning of the meal serving counter separately from other preparations to encourage consumption; pre-cut fresh fruit (e.g. watermelon, papaya, honeydew melon in slices), with the aim of facilitating and encouraging their consumption; cooked vegetables; whole-grain rice; beans without the addition of meats and processed meats;

protein-based preparations made without frying or using artificial condiments; and presence of olive oil instead of ultra-processed sauces for salad); (b) physical access was guaranteed, with the UR strategically located in close proximity to the central building of the campus, where most of the courses took place; (c) price was subsidized for students; (d) preparations served were considered varied and good quality by students participating in the study (data not shown); and (e) opening times/days of the UR suited the routine of students at the university (although the waiting time to have the meal was cited by various students as a factor limiting access).

With regard to the methodological aspects, a limitation of the study was the non-randomization when allocating exposed and non-exposed individuals^{44,45}. The following procedures were adopted to compensate for this: assessment of the same individual before and after (historical control) and analysis according to assiduity to UR (non-user, occasional user and frequent user) with control of confounding variables (sex and age group). On the other hand, given that it provides effectiveness rather than efficacy assessment, this type of study has the benefit of external validity⁴⁶, allowing the results obtained to be generalized to other populations and settings, provided these are similar to the context studied. Furthermore, there is growing recognition that natural experiments may be more suitable than controlled trials for assessing interventions and program in the sphere of public health⁴⁷.

It should also be pointed out that conducting natural experiments, as well as controlled experiments, has inherent problems such as loss to follow-up⁴⁴. A strength of the present study lies in the fact that substantial coverage of the group studied at baseline, and attending the university at second data collection, was achieved (93.6%).

The findings of this study show that the UR constituted an environment which facilitated the adoption of healthy dietary practices and promoted an improvement in the diets of students frequenting the restaurant. Therefore, it can be concluded that the UR, in the form implemented, is congruent with the concept of promoting healthy food and contributed to consolidating food and nutrition security and to guaranteeing the human right to adequate food. These results reiterate the importance of recognizing the university food environment as strategic and of investing in this environment to render it healthier.

Collaborations

PMP Perez and IRR Castro contributed to the study design, supervision of fieldwork, in database analysis and writing of the manuscript. DS Canella participated in database analysis and revised the manuscript. AS Franco participated in the supervision of fieldwork and revised the manuscript.

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