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Analysis of vegetarian preparations produced and offered in a university restaurant

Análise de preparações vegetarianas produzidas e ofertadas em um restaurante universitário

Abstract

Introduction: Knowledge on the profile, nutritional status, eating habits, and degree of customer satisfaction are essential for the collective food sector. **Objective:** To evaluate the production, waste, and satisfaction regarding vegetarian preparations at a university. **Methods:** This cross-sectional study was carried out in a university restaurant in Espírito Santo state; the one on campus A served lunch to health workers and students and the one on campus B, lunch and dinner for students from other areas. Data collection took place in eight days at the restaurant on campus A and in 20 days on campus B, comprising the measurement of food production, waste, and acceptability. **Results:** We found that the average leftover portions were 43 ± 34 on campus A and 546 ± 114 and 36 ± 42 at lunch and dinner on campus B, respectively. The average quantity of food waste per customer was equal to 29.0 ± 9.9 g on campus A and 29.1 ± 5.5 g and 18.7 ± 3.8 g at lunch and dinner on campus B, respectively. In 64.7% of the days evaluated, the quantity of food waste per capita was above the recommended. As to the acceptability of vegetarian dishes on campus A, Eggplant Parmigiana had the highest overall acceptance (84.4%) and Textured Soybean Protein with Vegetables (68.89%) the lowest. On campus B, the most accepted preparation was Kibbeh with Pumpkin (87.6%) and the least accepted, Polenta with Textured Soybean Protein (71.4%). **Conclusions:** Despite the waste, the acceptability of the preparations was satisfactory, and these indicators should be continuously monitored.

Keywords: Vegetarianism. University Restaurant. Food waste. Customer satisfaction.

Resumo

Introdução: O conhecimento do perfil, estado nutricional, hábitos alimentares e grau de satisfação dos clientes com o serviço são essenciais para o setor de alimentação coletiva. **Objetivo:** Avaliar a produção, desperdício e satisfação quanto às preparações vegetarianas em universidade. **Métodos:** Estudo transversal conduzido em um Restaurante Universitário do Espírito Santo, sendo que o do campus A servia almoço e atendia o público da área da saúde e o do campus B, almoço e jantar para os estudantes das demais áreas. A coleta de dados ocorreu em oito dias no restaurante universitário do campus A e em 20 dias no do campus B, compreendendo a mensuração da produção, desperdício e aceitabilidade de alimentos. **Resultados:** Verificou-se que a média de porções de sobra foi de 43 ± 34 no campus A e de 546 ± 114 e 36 ± 42 no almoço e jantar do campus B, respectivamente. A quantidade de restos média por cliente foi igual a $29,0 \pm 9,9$ g no campus A e $29,1 \pm 5,5$ g e $18,7 \pm 3,8$ g no almoço e jantar do campus B, respectivamente. Em 64,7% dos dias avaliados a quantidade de restos per capita estava acima do recomendado. Quanto à aceitabilidade das preparações vegetarianas no campus A, verificou-se maior e menor aceitação geral para Berinjela à Parmegiana (84,4%) e Proteína Texturizada de Soja com Legumes

(68,89%), respectivamente. No campus B, a preparação mais aceita foi Quibe com Abóbora (87,6%) e a menos aceita, Polenta com Proteína Texturizada de Soja (71,4%).

Conclusões: Apesar do desperdício, a aceitabilidade das preparações foi satisfatória, sendo necessário o monitoramento contínuo destes indicadores.

Palavras-chave: Vegetarianismo. Restaurante. Desperdício de alimentos. Satisfação do usuário.

INTRODUCTION

In the past few years, there has been an increase in the number of meals taken outside the home by the population. Data from the 2017-2018 Household Budget Survey showed that meals outside the home account for 32.8% of the expenses of Brazilians with food, while the same survey showed that in the years 2008-2009 and 2003-2004 the numbers were 31.1% and 24.1%, respectively.¹

Factors such as intense traffic in urban centers, long working hours, as well as living far from work, school, and university are among those responsible for the growth of meals taken outside the home.²

To meet this growing demand, the collective food sector offers several services to the population, including food and nutrition units and university restaurants.³ These places aim to provide balanced meals at an affordable price, considering the food and nutritional needs of their customers. To do so, the profile, nutritional status, eating habits, and the satisfaction of the customers with the service must be known.⁴

Regarding the menu offered, nutritionists must plan meals that meet, in addition to nutritional quantity and quality, sensory, social, and cultural aspects to arouse people's interest in consuming such meals, thus giving students – who are their main customers – conditions necessary for the performance of their activities.³

Vegetarian diets entail the total or partial restriction of the consumption of products of animal origin, and can be classified into: ovo-lactovegetarian, lacto-vegetarian, ovo-vegetarian, strict vegetarian, and vegan, for those who do not use any animal derivatives in their food, although vegans do not use any product tested on animals.^{5,6}

In Brazil and in the world, the number of vegetarians has grown. A public consultation carried out by the *Instituto Brasileiro de Opinião Pública e Estatística* (IBOPE – Brazilian Institute for Public Opinion and Statistics) revealed that the number of vegetarians in Brazil increased from 8% in 2012 to 14% in 2018.^{7,8}

Regarding the acceptability of vegetarian dishes offered in university restaurants, it is considered even more difficult to fully satisfy omnivorous customers, who are generally not used to foods commonly used in vegetarian dishes in college cafeterias, such as vegetables and textured soybean protein.⁹

Another way to assess acceptability is by controlling food waste, which can be generally defined as losses that occur during the production chain, from food production to consumption, due to the disposal of food fit for consumption. Food waste has a negative impact on the economy, sustainability, and global health.¹⁰

According to Busato, Barbosa & Frares¹¹, in Brazil, the amounts of food discarded daily could feed more than 10 million Brazilians daily. Thus, waste is a factor of great relevance and in food and nutrition units it can indicate lack of quality. Therefore, it is essential to control, compare, and evaluate the procedures and the performance of the activities carried out through adequate planning.

This study evaluated the production, waste, and satisfaction regarding vegetarian preparations at a university.

MATERIALS AND METHODS

This cross-sectional study was carried out in a university restaurant linked to a public institution in Espírito Santo state, with the health campus (campus A) offering lunch only and the campus that serves the other areas (campus B) providing lunch and dinner. In total, around 3500 people are served daily in these places during lunch and dinner, with approximately 40% (1400 people) consuming the vegetarian preparations offered by the university restaurant.

Data collection took place in October and November 2019, eight days during lunch on campus A and 20 days on campus B during lunch and dinner. The collection period was longer on campus B because its restaurant serves more people. During both periods, the production, distribution, waste, and acceptability of vegetarian preparations were evaluated.

The meal production process was inspected for 20 days (eight on campus A and 12 on campus B), and the production quantified by multiplying the number of servings that a container provides by the number of containers produced. As for the distribution of vegetarian preparation and waste, data were obtained in 26 days (eight on campus A and 18 on campus B) and 17 days (six on campus A and 11 on campus B), respectively. Acceptability was investigated during 27 days, eight days on campus A and 19 days on campus B.

Food waste was evaluated considering the quantity of food left on the plate per customer through the equation:

$$\text{Food waste (g)} = \frac{\text{Total food waste (g)}}{\text{No. of customers served on the mealtime}}$$

The scale Balmak® brand, with maximum capacity of 500 kg and precision of 100 g, was used to measure all weights. The quantification and classification of food waste was carried out as recommended by Vaz,¹² considering values below 30 g per person as adequate.

From the number of vegetarian portions served on the mealtime (lunch or dinner), the percentage of distribution was estimated using the following equation:

$$\% \text{ of distribution} = \frac{\text{No. of vegetarian portions served}}{\text{No. of customers}} \times 100$$

The leftovers of vegetarian preparations, consisting of prepared food that was not served,¹² were quantified for 20 days (eight on campus A and 12 on campus B), by subtracting the number of meals produced by the number of meals served.

Regarding the acceptability of vegetarian preparations, the evaluation was carried out by approaching the customers who chose to consume the vegetarian preparation. They received a leaflet with the presentation, objective, and invitation to participate in the study and were approached by the researchers when leaving the university restaurant. At this point, doubts were clarified and detailed information about the project was provided.

Those who expressed interest in participating in the study signed the Free and Informed Consent Form in two copies: one for the researchers and the other for the participant. After consent, the participants answered a brief questionnaire containing sociodemographic questions,

the frequency of food consumption in the university restaurant, and acceptability of the vegetarian dish offered on the day.

Vegetarian preparations whose attributes were evaluated during the research were: Zucchini with Textured Soybean Protein (TSP); Eggplant Parmigiana; Eggplant Stuffed with TSP; *Escondidinho de Cará* (a vegetarian Shepherd's pie of sorts baked with *cará*, a tuberous root) with TSP; Falafel; Oven-baked Omelet; Scrambled Eggs; Polenta with Lentils; Polenta with TSP; TSP with Vegetables; Kibbeh with Pumpkin; Vegetarian Kibbeh; *Canjiquinha* (crushed corn) pie; and Soybean Pie.

The attributes taste, aroma, texture, appearance, and general acceptance were evaluated on a 5-point Likert-type scale with scores of 1 (I disliked it very much), 2 (I disliked), 3 (I neither liked nor disliked), 4 (I liked), and 5 (I liked it very much).¹³ The acceptability index (AI) of each attribute was calculated through the equation below, with values greater than 70% having been considered satisfactory.¹⁴

$$AI (\%) = \frac{A \times 100}{B}$$

In which: A = average score obtained by the dish and B = maximum score obtained by the dish.

The average percentage of vegetarian portions served was estimated through the following equation:

$$\text{Average \% of vegetarian portions served} = \frac{\frac{\text{No. of vegetarian portions served on the day} \times 100}{\text{No. of people served on the day}}}{\text{No. of days in which the dish was served}}$$

Data were stored in the Microsoft Excel software and analyzed with the SPSS (Statistical Package for the Social Sciences) software, version 21.0. The results obtained were presented in the form of descriptive statistics with data in frequency (%), plots, mean, standard deviation, minimum, maximum, and median. We performed association tests (Chi-square) and group comparison tests. To test the normality of numerical variables, the Kolmogorov-Smirnov test was applied. For data with parametric distribution, we applied the Student's t-test and for data with non-parametric distribution, the Mann-Whitney test. For all tests, a significance level of $p < 0.05$ was adopted.

The study was approved by the ethics committee for human research of the *Universidade Federal do Espírito Santo* (Federal University of Espírito Santo) under No. 3.445.226 and CAAE 14084019.2.0000.5060.

RESULTS

Table 1 shows the results referring to the number of customers served, portions produced and served, leftovers of vegetarian preparations, and amount of food waste on the days evaluated.

Table 1. Characterization of the number of customers, vegetarian preparations, and waste according to the campus hosting the university restaurant. Vitória – ES, 2019.

Information	Campus A	Campus B	P value**
Average No. of customers ^a			
Lunch	593 ± 92	1841 ± 262	< 0.001
Dinner	-	539 ± 89	
P value*		< 0.001	
Average No. of vegetarian portions produced ^b			
Lunch	169 ± 57	546 ± 152	< 0.001
Dinner	0	215 ± 34	
P value*		< 0.001	
Average No. of vegetarian portions served ^b			
Lunch	123 ± 55	395 ± 112	< 0.001
Dinner	0	183 ± 40	
P value*		< 0.001	
Average quantity of vegetarian preparations leftovers ^a			
Lunch	43 ± 34	150 ± 114	0.016
Dinner		36 ± 42	
P value*		0.007	
Average quantity of food waste per capita (g) ^b			
Lunch	29.0 ± 9.9	29.1 ± 5.5	0.99
Dinner	-	18.7 ± 3.8	
P value*		0.18	

*Comparison between lunch and dinner on Campus B ** Comparison between lunch on campuses A e B.

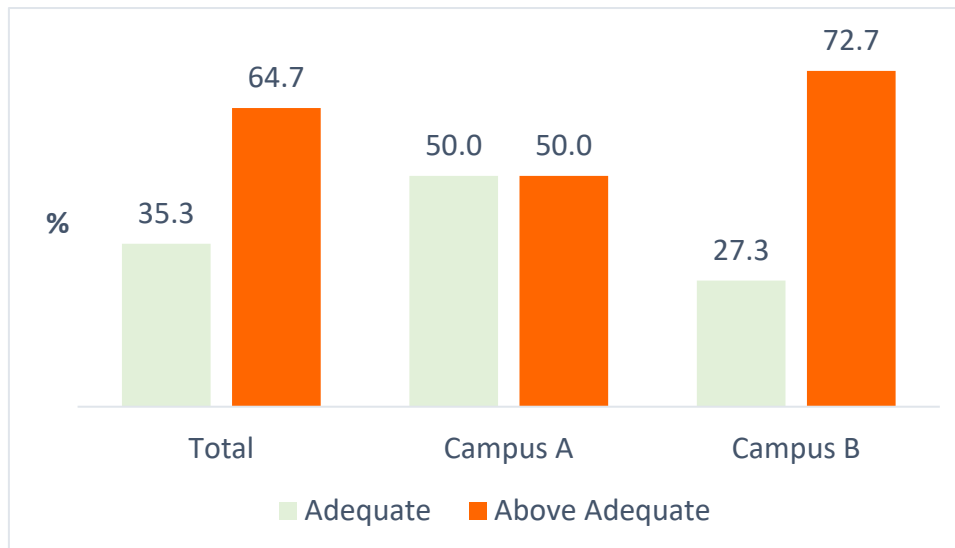
^a Mann-Whitney test, ^b Student's t test, p < 0.05.

The number of customers served at lunch on campus B was higher than that on campus A and at dinner on campus B. In view of this difference, the production of vegetarian preparations was also higher at lunch on campus B. These results may have influenced the larger quantity of clean leftovers identified on campus B, especially at lunch. We must highlight that on four of the days evaluated, the quantity of clean leftovers was equal to zero (one day of lunch on campus A, one day of lunch on campus B, and two days of dinner on campus B).

Regarding food waste per capita (in grams), we observed that on campus A the mean ± SD was 29.0 ± 9.9 g, ranging from 17.2 to 42.1 g. On campus B, the average quantity of food waste per capita at lunch was 29.1 ± 5.5 g, with results ranging from 21.4 to 34.3 g. Nevertheless, the average at dinner was higher than the others (33.2 ± 3.9 g), ranging from 27.5 to 38.2 g. There was no difference in the quantity of food waste during lunch between the two campuses (p = 0.99) and between lunch and dinner in campus B (p = 0.18).

As to the classification of the quantity of food waste per capita, we observed that Campus B presented greater inadequacy than Campus A (Figure 1), although this difference was not statistically significant ($p = 0.20$).

Figure 1. Classification of the quantity of food waste per capita, according to the Campus evaluated. Vitória – ES, 2019.



Chi-square test, $p = 0.20$.

Information related to the acceptability index and the percentage of vegetarian portions served are shown in Table 2. On Campus A, the vegetarian preparation with the highest general acceptance was Eggplant Parmigiana (84.4%), while Textured Soybean Protein (TSP) with vegetables was the least accepted (68.89%). On the other hand, on Campus B, the most accepted dish was Kibbeh with Pumpkin and the least accepted was Polenta with TSP (87.6% and 71.4%, respectively).

It is worthy of note that, on Campus A, all dishes had a general acceptance AI above 70%, except for TSP with Vegetables (68.89%), which had an AI ranked above 70% only regarding appearance. Considering all the attributes investigated (taste, aroma, texture, appearance, and general acceptance), on Campus A, the dishes vegetarian Kibbeh, Zucchini with TSP, *Escondidinho de Cará* with TSP, and Eggplant Parmigiana obtained AI above 70% in all attributes. The latter had both a greater general acceptance and a higher average percentage of portions served. On the other hand, although TSP with Vegetables had a general acceptance AI lower than the others, the dish that obtained the lowest average percentage of portions served was polenta with lentils (Table 2).

Table 2. Acceptability of the vegetarian preparations, according to the campus in which the university restaurant is located. Vitória – ES, 2019.

Dishes	AI (%)					Average % of vegetarian portions served*
	Taste	Aroma	Texture	Appearance	General acceptance	
CAMPUS A						
Vegetarian kibbeh	83.7	72.3	74.3	80.6	82.6	32.5
Soybean pie	80.0	69.2	72.1	67.5	76.2	21.0
Zucchini with textured soybean protein	71.7	74.63	79.02	90.73	80.0	15.6
Polenta with lentils	82.5	68.75	86.25	86.25	81.25	9.4
Falafel	77.4	66.96	73.04	71.74	76.52	30.8
<i>Escondidinho de cará</i> with textured soybean protein	87.3	72.73	81.82	78.18	83.64	13.4
Textured soybean protein with vegetables	62.2	61.48	68.88	77.78	68.89	13.0
Eggplant parmigiana	87.4	81.11	80.56	87.23	84.44	35.7
CAMPUS B						
Vegetarian kibbeh	84.4	76.2	77.6	81.9	83.7	32.2
Soybean pie	81.0	73.8	75.7	77.8	79.8	26.7
Polenta with lentils	80.8	72.5	76.7	76.7	79.2	13.8
Falafel	79.4	69.7	73.2	72.7	79.8	31.1
<i>Escondidinho de cará</i> with textured soybean protein	78.0	72.3	77.5	82.5	79.3	23.2
Polenta with textured soybean protein	68.4	66.1	70.7	77.0	71.4	15.5
<i>Canjiquinha</i> pie	79.7	74.1	70.8	81.6	74.7	22.3
Eggplant stuffed with textured soybean protein	82.5	78.8	76.9	85.2	81.3	32.4
Oven-baked omelet	80.4	72.8	78.7	80.8	80.4	37.2
Scrambled eggs	74.9	72.8	73.3	68.7	73.8	19.4
Kibbeh with pumpkin	89.5	78.1	82.9	85.7	87.6	29.5

*Average % of vegetarian portions served = [(No. of vegetarian portions served on the day/total of customers served)]*100/No. of days in which the dish was on the menu.

On Campus B, all dishes had a general acceptance AI above 70%. Considering the other attributes, polenta with TSP had AI values lower than 70% as to flavor (68.4%) and aroma (66.1%).

In addition, falafel obtained an AI below 70% regarding aroma (69.7%) and Scrambled Eggs had 68.7% in appearance.

Regarding the average percentage of distribution of vegetarian preparations, although TSP with Vegetables had the lowest general acceptance AI among all the dishes evaluated on Campus A, its average percentage of distribution (13%) was higher than that of Polenta with Lentils (9.4). On Campus B, Polenta with Lentils also had the lowest percentage of distribution (13.8%), although the dish Polenta with TSP, which had a general acceptance AI (71.4%) lower than that of Polenta with Lentils (79.2%), had an average percentage of distribution of 15.5%.

DISCUSSION

The results found in this study showed that the number of customers served by the university restaurant was proportional to the production, distribution, and the quantity of clean leftovers of vegetarian preparations. The quantity of food waste per capita were higher than recommended on most days evaluated, although there was no difference between campuses and between lunch and dinner on Campus B. As for the acceptability of vegetarian preparations, we observed that, although the specific index for the attributes varied, the general acceptance AI was satisfactory for most dishes. In addition, we observed that the average percentage of distribution of these dishes was not proportional to AI.

The acceptability of a dish is considered good by customers when its AI is greater than 70%.^{15,16} Thus, of the eight dishes evaluated on Campus A and 11 evaluated on Campus B, only one preparation had a general acceptance AI below 70% – Textured Soybean Protein (TSP) with Vegetables. Therefore, in general, the preparations evaluated have an acceptable AI. We must highlight that the attribute that obtained the lowest AI among the dishes was aroma, for six preparations.

In contrast to the findings of the present study, a study carried out at the *Universidade do Estado do Rio de Janeiro* (State University of Rio de Janeiro), which analyzed the relationship between the menu and waste in a university restaurant, reported that, according to the people interviewed, the most determining factor for acceptability and waste is taste.¹⁷ In contrast, texture was the biggest problem associated with a vegetable protein-based dish.¹⁸

Regarding the average percentage of distribution of the vegetarian portions served on Campus A, one notices that, although TSP with Vegetables had a lower AI than Polenta with Lentils, the average percentage of distribution of the former was lower than that of Polenta with Lentils on the day the latter was served. This may have occurred due to the options on the menu of each day, since on the day that TSP with Vegetables was the vegetarian option, the animal protein served was Rilled Pork Rack. As for the day of the Polenta with Lentils option, the animal protein dish served was Chicken Sausage. It is noteworthy that in a study by Nascimento et al.,¹⁹ carried out at a university restaurant in Espírito Santo, one of the least accepted main dishes of animal origin was pork (AI = 91%) and the most accepted was chicken (AI = 94%).

On Campus B, the repetition of the menu may also have influenced the outcome, since Polenta with TSP had a lower AI but a higher average percentage of distribution than Polenta with Lentils, both offered at lunch. When Polenta with TSP was on the menu, the animal protein offered was Chicken *Fricassee*, while on the Polenta with Lentils day, regular kibbeh was offered as an

option. Chicken *Fricassee* was served three times for lunch during our evaluation, while Kibbeh was served only once. Therefore, it would be interesting to rethink the menus, replacing repetitive preparations, in addition to ascertaining the preferences of the customers in order to increase acceptability.²⁰

Regarding leftovers, although the average quantity was unsatisfactory, in four of the days evaluated the values were equal to zero. The excess of clean leftovers is a common problem in food and nutrition units,²¹ since it is usually related to a well-defined production process in which the containers, yield, and number of customers are controlled, in addition to issues involving infrastructure and eating behavior of the customers.²² Nevertheless, when kept in adequate hygienic-sanitary conditions that comply with the legislation, the clean leftovers can be used in the next meal.²¹

Regarding the quantity of food waste per capita, the results are similar to those of the study by Nascimento et al.¹⁹ carried out in a university restaurant of the *Instituto Federal do Espírito Santo* (Federal Institute of Espírito Santo) – Santa Tereza Campus, in which rest-of-ingestion (RI)/customer values between 27 and 40 g per person were found. Borges et al.²³, while evaluating the RI of a university restaurant in Minas Gerais state, found an average RI/customer of 37.8 g, which is close to the results found in this study. On the other hand, the evaluation of food waste in a university restaurant in Piauí state revealed an average RI/customer of 167.6 g, a value well above that found in this study.²⁴

In this context, it is worth mentioning that the RI left by the customer can be influenced by several factors such as, the quality of the meal, temperature of the dish, the person's appetite, serving size, climate, etc.²⁶ Although the ideal RI per person is less than 15 g, Vaz¹² considers values between 15 and 45 g per customer as acceptable. Therefore, it is necessary for food and nutrition units to quantify the indicators of waste for a certain period and establish their own parameters regarding RI.²⁵

The values above those recommended in the literature reflect the importance of knowing the factors responsible for this waste in food services, such as being aware of the dishes that do not please the customers in order to adapt the preparation method to improve acceptance, in addition to standardizing and guiding the proper portioning of the dishes. Food waste is the focus of global discussion and the creation of public policies, as it reaches about 1.3 billion tons per year.²⁶ In Brazil, one of the main factors responsible for this waste is the lack of social awareness about the amounts of waste produced that could have been reused.²

CONCLUSION

In view of the results obtained, we identified high food waste in the university restaurant evaluated. Thus, there is a need for continuous monitoring of production and waste, aiming at controlling the process, reducing costs for the food services, and benefiting the environment.

Although satisfactory general acceptance values were found for most vegetarian preparations, many of them had lower acceptability indices for specific attributes. Periodic assessment of the acceptability of dishes by customers is essential to plan adequate menus and identify food preferences.

In addition, the results of this evaluation may improve the service provided by food and nutrition units and, consequently, contribute to diminishing waste by reducing production and increasing the sensory quality of the dishes for better acceptance by the customers. Our findings may also contribute by steering corrective measures in food services and may work as a subsidy for intervention proposals and for future studies focused on this subject, in particular the evaluation of satisfaction regarding vegetarian preparations, since there is a lack of studies in this area.

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Contributors

Fonseca JFA, Marques MA and Silva DA, contributed to the study design, to the collection, analysis, and interpretation of data, to the writing of the manuscript, and to the final review and approval of the manuscript for submission; Campagnaro LB and Santos LN contributed to the study design and to the collection, analysis, and interpretation of data. Pereira LR and Martinez OGE contributed to data collection, analysis, and interpretation

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