FOOD FOR COLLECTIVES
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Impact of a campaign against food waste in a university restaurant

Impacto de uma campanha contra desperdício de alimentos em um restaurante universitário

Abstract

Introduction: Food waste in Food Services occurs throughout the whole production process. Reject and food leftover index (FLI) are some of the ways to quantify it. *Objective*: This study aimed to evaluate the impact of a campaign against food waste, conducted in an university restaurant, about the weight of food rejects and FLI for lunch and dinner. *Methods:* The campaign targeting the restaurant's clientele took place in April 2019, with awareness activities against food waste. Data on the weight of distributed preparations and food rejects were collected for FLI calculation, in the months before and after the food and environmental education actions of the campaign. The data obtained for food rejects weight and FLI were subjected to descriptive statistics and mean comparison, considering p-value ≤ 0,05. *Results*: At lunch, the campaign did not lead to statistically significant changes in the weight of food rejects and FLI. However, at dinner there was a statistically significant reduction (p = 0.02) in food waste after the campaign, with an average reduction of 8 kg in the rejected produced, and in FLI ($p \leq 0{,}001$), with an average reduction of 1.8% in the index. *Conclusion*: It was found that the specific awareness-raising actions developed impacted the behavior of diners and reduced food waste.

Keywords: Food waste. Collective feeding. Food and Nutritional Education. Food services.

Resumo

Introdução: O desperdício de alimentos em Unidades de Alimentação e Nutrição ocorre em todo o processo produtivo, e uma das formas de quantificá-lo é através do rejeito e índice de resto-ingesta (IR). *Objetivo*: Este estudo objetivou avaliar o impacto de uma campanha contra o desperdício de alimentos, realizada em um restaurante universitário, sobre o peso do rejeito e IR das refeições, almoço e jantar. *Método*: A campanha, junto à clientela do restaurante, ocorreu em abril de 2019, com atividades de sensibilização contra o desperdício de alimentos. Foram coletados dados de peso de preparações distribuídas e do rejeito alimentar, para o cálculo do IR, nos meses anterior e posterior às ações de educação alimentar e ambiental da campanha. Os dados obtidos de peso do rejeito e IR foram submetidos à estatística descritiva e de comparação de médias, considerando *p*-valor ≤ 0,05. *Resultados*: Na refeição almoço, a campanha não levou a mudanças estatisticamente significativas sobre o peso do rejeito e do IR. No jantar, entretanto, houve redução estatística significativa (p = 0,02), após a campanha, no rejeito alimentar, com redução média de 8 Kg no rejeito produzido, e no IR ($p \leq 0{,}001$), com redução média de 1,8% no índice. *Conclusão*: Verificou-se que as ações pontuais de sensibilização desenvolvidas impactaram o comportamento do comensal e reduziram o desperdício de alimentos.

Palavras-chave: Desperdício de alimentos. Alimentação coletiva. Educação Alimentar e Nutricional. Serviços de alimentação.

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INTRODUCTION

It is estimated that one-third of the food produced annually worldwide for human consumption is lost or wasted.[1] Food loss is defined as the decrease in the edible mass of food during production, harvest, and processing stages. When this loss occurs at the end of the human food chain, it is termed waste and is related to the behavior of retailers and consumers.[2]

The United Nations, through the "Sustainable Development Goals" included in the "2030 Agenda for Sustainable Development", proposes that sustainable production and consumption patterns be ensured by 2030 (Goal 12). One of the ways in which this goal is to be achieved includes halving the per capita global food waste at the retail and consumer levels.[3]

Food waste at the consumer level is associated with a combination of external, personal, and behavioral factors, all influenced by cultural issues.[4] In the context of Food and Nutrition Units (FNUs), one of the main issues is the generation and disposal of organic waste associated with food waste. This topic has mobilized the scientific community and unit managers aiming to minimize waste and the economic and environmental damages associated with it.[5]

Food waste in FNUs can occur throughout the production process, from receipt to distribution. Organic waste associated with waste includes (1) parts of the food that do not need to be removed but are removed during pre-preparation or preparation stages;[4] (2) leftovers from distributed preparations that were not consumed and need to be discarded, called dirty leftovers or scraps; [4,6,7] and (3) leftovers (or parts) of the meal left by the diner on the plate, referred to as food rejects or ingestion leftovers.[4,7] In this work, we will use the following terms: "Scraps" for the foods that were displayed on the distribution counter and "Ingestion leftovers" for what remains on the diner's plate and is wasted.

Data on food rejects are used to calculate the food leftover index or ingestion leftover index (ILI), which is defined as the percentage ratio between the weight of the meal rejected by the diner and the weight of the distributed preparations.[5] This index has been used as a tool to quantify waste in FNUs.[6,8-10]

Among the main factors identified as influencers in the increase of the ingestion leftover index in FNUs are: inadequate menu planning and meal volume production, frequent repetition of preparations, poor presentation or appearance of served foods, preparations incompatible with diners' eating habits, incorrect portioning, and the use of inappropriate utensils.[11-13]

An assessment regarding food waste in FNUs showed that Brazilian university restaurants exhibit ingestion leftover indexes and leftovers above acceptable levels.[14] In this context, prevention has been considered the best strategy against waste. The creation of awareness campaigns emphasizing the importance of reducing food waste can directly influence diner behavior and assist in waste reduction.[4,15-19]

Since 2015, the University Restaurant (RU) of the Federal University of Rio Grande do Norte (UFRN) has been conducting annual awareness campaigns aimed at reducing food waste among diners, employing various methodologies. The objective of this study was to analyze the effects of the awareness campaign against food waste conducted by the clientele at the UFRN RU in the year 2019.

METHODS

Study design

This is an observational, quantitative, and descriptive study conducted at the RU using data on food rejects from the clientele collected before and after an awareness campaign against food waste, led by

production nutritionists and interns. The campaign took place in April 2019, considering data on the ingestion leftover index between March and May 2019, for lunch and dinner meals.

Characterization of the FNU

The RU serves approximately 2,500 lunches and 1,400 dinners daily, catering to students, faculty, and administrative staff of the institution. The service provided is self-service with portioning of the main course and dessert based on a predefined portion size.

The menu varies according to the meal, with lunch typically consisting of an appetizer (raw/cooked salad or roots/tubers), main course (beef/pork, chicken, fish, or vegetarian option), side dishes (rice, beans, and farofa/couscous/gravy), dessert (sweet or fruit), and juice. Dinner comprises an appetizer (soups, porridges, or cornmeal pudding), main course (beef, chicken, or vegetarian option), side dish (rice/pasta/couscous and bread), dessert (only fruit), and beverage (juice or coffee with or without milk).

Awareness Campaigns

The campaigns to raise awareness occur annually at the RU and began due to the need to reduce food waste by diners. The methodological resources used in the 2019 campaign included:

• Real-time weighing of ingestion leftovers left on diners' plates during both lunch and dinner by staff in the dishwashing and sanitation area. As diners returned their plates for cleaning, the ingestion leftovers were discarded into a trash bin placed over a platform scale. The scale display was mounted on the external wall of this area, facing the dining hall, allowing diners to see in real-time the weight of waste generated from food rejects. Disposable materials, bones, and fruit peels were discarded in separate containers with the assistance of staff (Figure 1 - Supplementary material)

•Portable scale available for weighing the ingestion leftovers on each diner's plate at the moment the plate was left in the dishwashing and sanitation area.(Figure 2 - Supplementary material)

• Questionnaire application to users who wasted their meal (visually identified at the restaurant exit by those whose plates had ingestion leftovers), who were approached by the nutrition intern. They were invited to quantify the waste and asked about the motivation that led to the waste. (Figure 3 - Supplementary material)

• Exhibition for tasting, in the cafeteria, of recipes prepared with usually discarded parts of vegetables and fruits (Figures 4, 5, and 6 - Supplementary Material).

• Illustrations in the entrance area of diners and in the distribution area related to food waste and losses worldwide, and the amount of water wasted when food is not consumed and thrown away (Figures 7, 8, 9, 10, 11 and 12 - Supplementary Material).

• Tips posted on tables, about measures that diners can take to reduce waste.

• Screening of videos in the cafeteria about data regarding food losses worldwide, water and carbon footprints of food, and other recently conducted campaigns, aimed at promoting awareness about the impacts of food waste.

Waste Assessment

To assess food waste, the ingestion leftover index (ILI) was utilized, derived from quantitative data on the preparations produced in the restaurant. The ILI is expressed as the percentage relationship between

the weight of the discarded meal (ingestion leftovers) and the weight of the distributed meal, as depicted in Equation (1)[5] below:

$$(1) ILI = Weight of food leftovers x 100 \div weight of distributed meal$$

The data on the weight of the distributed meal and the ingestion leftovers were obtained through direct weighing of the preparations before being served and the ingestion leftovers from the diners' plates, respectively. The weighing did not include parts of the foods classified as inedible (bones and fruit peels). The information was recorded on the "Meal served control map" instrument (Figures 12 and 13 - Supplementary Material) used in the routine procedures of the RU to record information regarding the production and distribution of meals. For this study, data from lunch and dinner were collected for all days of the week, for the months before (March) and after (May) the campaign. The ILI values were classified as follows: 5 to 10% was considered "good"; 10 to 15% was considered "fair"; and above 15% was considered "poor".[12]

The data were tabulated and statistically analyzed using Microsoft Excel® software. The Shapiro-Wilk normality test was employed to assess the normality of the data. To test differences between continuous variables, the Student's t-test was utilized, with a significance level of 5%.

RESULTS

Table 1 illustrates the average weights of the served preparations, food rejects, and the ILI for the months preceding (March) and following (May) the campaign.

In the dinner service, there was a statistically significant decrease ($p = 0.02$) in the weight of food rejects after the campaign, with an average reduction of 8 kg of waste produced. Consequently, there was a statistically significant decrease in the ILI ($p \leq 0.001$), with an average reduction of 1.8% in the index.

At lunchtime, there was no statistically significant change in both the weight of food rejects produced and the IR. The ILI values were classified as "good" both before and after the campaign, as observed in the table.

Table 1. Weight of served preparations, weight of waste, and ingestion leftover index before and after the waste awareness campaign conducted at the University Restaurant (UFRN) in 2019. Natal, RN.

Variables	Before the campaign	After the campaign	*p- value*
Weight of served preparations (kg)[a]			
Lunch	1465 (240)	1500 (190)	*0,62*
Dinner	747 (116)	817 (195)	*0,19*
Weight of reject (kg)[a]			
Lunch	93 (28)	88 (18)	*0,58*
Dinner	50 (9,3)	42 (12)	*0,02*
Ingestion leftover index (%)[a]			
Lunch	6,4 (1,8)	5,9 (0,9)	*0,18*
Dinner	6,9 (1,5)	5,1 (1,1)	*0,001*

[a] Mean (Standard deviation).

DISCUSSION

The awareness campaign conducted in April 2019 with the diners of the UFRN RU had a satisfactory response regarding the dinner meal, with a statistically significant reduction in both food rejects and IR in the months before (March) and after (May) the campaign. These campaigns are utilized as a tool in combating waste in restaurants, having been evaluated in food service companies FNUs[18-20] and popular restaurants.[21]

In an RU, similar results to those found in our research were obtained by Borges et al.,[16] who, after an awareness campaign against waste, observed a reduction from 8.68% to 6.20% in the ILI. Other studies have demonstrated the effectiveness of awareness strategies in reducing per capita IR values in the short term.[17-19]

However, despite these results, it is important to consider that sporadic campaigns do not have a long-lasting effect, and permanent and systematic actions are necessary to maintain low ILI.[22] Knowing which preparations are associated with higher waste rates in the unit can also contribute to long-term IR reduction. Nascimento et al.[10] observed an inversely proportional relationship between the ILI and the acceptance rate of specific preparations. Therefore, reviewing preparations with low acceptance should be included as a strategy for waste reduction in FNUs.

The importance of reducing waste extends beyond financial losses. The cost of food waste in an FNU can also be estimated through food rejects. Costa et al.[6] observed a daily average of R$ 572.59 (five hundred and seventy-two Brazilian reais and fifty-nine cents), equivalent to 80.44 kg of wasted food in an RU in northern Brazil. A similar study was conducted at the UFRN RU in 2015. At that time, the estimated average daily cost of waste was R$ 1,770.80 (one thousand, seven hundred and seventy Brazilian reais and eighty cents), corresponding to an average of 142.55 kg of food.[23]

Although the analysis of the average cost of waste was not the focus of this study, it is important to consider that, in light of these results, the reduction in average values of rejects after the campaign was a positive aspect. We suggest the development of further studies to analyze such an impact.

Although the disposal of these waste materials is the responsibility of the FNUs, combating waste should be a priority. Food originally intended for human consumption that is removed from the food chain, even if directed towards non-food use, is considered loss or waste.[2] In this regard, meal production services should implement strategies to minimize food waste, ensuring that the planning, production, and distribution stages of meals adhere to principles of health and sustainability.[24]

Some strategies can be employed in FNUs to combat waste, such as conducting awareness interventions against food waste among diners, routine menu evaluation, use of specific indicators for the unit, and training or capacity-building of staff in issues related to safe food handling and sustainability.[4,11,13]

CONCLUSION

The awareness campaign against food waste impacted diner behavior, but continuous evaluations should be conducted, and sporadic waste reduction activities should be replaced by routine strategies. It is essential to understand previous behaviors and attitudes that result in waste, seeking solutions for prevention, as well as identifying preparations associated with higher waste rates and adjusting or replacing them on the menu.

Actions such as menu evaluation, food, nutrition, and environmental education activities should be implemented and maintained in FNUs, along with further studies on this topic focused on sustainability, aimed at reducing the environmental impact generated by food losses and waste

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Contributors

Barros ANAB contributed to the analysis and interpretation of data, drafting of the study, final revision, and manuscript approval for submission; Medeiros SV contributed to the conception and design of the study, analysis and interpretation of data, final revision, and manuscript approval for submission; Oliveira Neta RS, Pitombeira GCR, Nascimento DSM, Carvalho HHM, and Mendes MM contributed to the conception and design of the study, final revision, and manuscript approval for submission; Pinheiro DD, Lima TL, Macêdo MAB, and Guedes RB contributed to the conception and design of the study.

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SUPPLEMENTARY MATERIAL

Impact of a campaign against food waste in a University Restaurant

Figure 1. Photographic register of the scale display showing users, in real-time, the weight of food waste generated during the meal.

The poster says "Keep an eye on it! Watch real-time food waste during this meal.

Figure 2. Photographic register of the portable scale provided for weighing food waste on the diner's plate, at the moment the plate was left in the dish return and sanitization area.

The post reads “Weigh here what's left on your plate today.”

Figure 3. Photographic register of a diner participating in weighing their food waste during the meal. Users who wasted their meal (visually identified upon leaving the restaurant as those whose plates had food waste) were approached by the nutrition intern, invited to quantify the waste, and questioned about the motivation behind it.

Figure 4. Photographic record of the display in the cafeteria showcasing recipes prepared with usually discarded parts of vegetables, greens, and fruits. The display booth was titled 'Gourmet Waste'.

Figure 5. Photographic record of diners participating in activities at the 'Gourmet Waste' booth. Users were invited by the interns to taste the served preparations and try to identify the foods used in their preparation. They were then provided with the recipe instructions and informed about the nutritional and environmental importance of using usually discarded parts of vegetables, greens, and fruits.

Figure 6. Photographic register of the exhibition of the 'pineapple peel sweet' preparation at the 'Gourmet Waste' booth. Other served preparations included banana peel sweet, banana peel *paçoca*, and gratin with chayote peel.

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Figure 7. Photographic register of the exhibition, in the meal distribution area, of the amount of water wasted, in liters, for each kilogram of food wasted. This served both for users to visualize the amount of water wasted per rejected food, and to sensitize them to environmental and sustainability issues, such as water footprint.

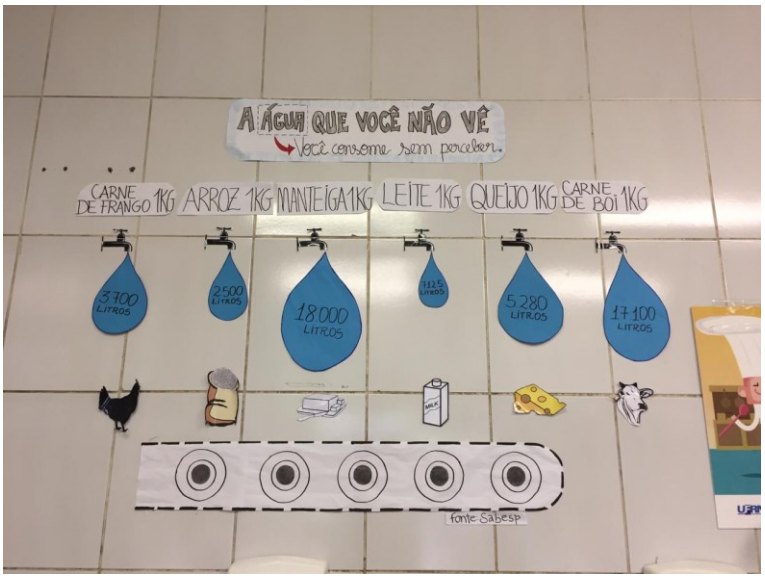

Figure 8. Photographic register of an illustration posted on the cafeteria walls to remind users of the importance of only putting the amount of food they would consume on their plate, thus avoiding waste.

Figure 9. Photographic register of the meal distribution area during the campaign against food waste at the FNU. In the image, it is possible to see in the background an illustration about food waste worldwide and, on the meal distribution counter, a sign sensitizing against food waste.

Figure 10. Photographic records of the signs sensitizing against food waste displayed on the meal distribution counters.

Figure 11. Frontal view of the meal served control map utilized at the University Restaurant

RU UFRN

CONTROL MAP OF THE SERVED MEAL - CENTRAL

TYPE:_____ **FORECAST:** Total:_____ Total w/o veg.:_____ **DATE:**___/___/___ **DAY:** _____

YIELD	PREPARATION*	PRODUCED QUANTITY (SENT) Nº PANS	CLEAN SURPLUS Nº PANS	LEFTOVERS Nº PANS
	FORECAST:_____ VEGETARIAN LINE			
YIELD	PREPARATION*	PRODUCED QUANTITY (SENT) Nº PANS	CLEAN SURPLUS Nº PANS	LEFTOVERS Nº PANS

NOTES AND INCIDENTS:

_____

_____

_____

_____

TRASH WEIGHT (Container with lid: 5kg):_____

INTERN/ NUTRITIONIST: _____

1**Order of preparations: Salad, main course, side dishes, beverage, and dessert / Soup or porridge or *mungunzá*, main course, side dishes, bread, beverage, dessert.

2**Order of preparations: Salad, main course, side dishes, beverage, and dessert / Soup or porridge or *mungunzá*, main course, side dishes, bread, beverage, dessert.

Figure 12. Back view of the meal served control map utilized at the University Restaurant.

RU UFRN

CONTROL MAP OF THE SERVED MEAL - CENTRAL

TIME AND TEMPERATURE CONTROL Turn on the Counters 10 minutes before receiving the preparations																					
3 Measurements: Lunch (10:40 / 12:10 / 13:20) and Dinner (17:10 / 18:00 / 18:50)																					
	Line 1			Line 2			Line 3			Line 4			Line 5			Line 6			HOT PASS-THROUGH		
Collection Times →	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
PREPARATION:																					
Salads:	Cold counter 1			Cold counter 2															COLD PASS-THROUGH		