

# Food waste and consumer satisfaction with the food service of Hotel and Tourism School of Coimbra, Portugal

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## Abstract

*Introduction:* Food waste is a matter of concern in school food services. One of the causes given for its occurrence is the lack of awareness of consumers for food waste problem. *Objective:* Assess food waste of meals served at the cafeteria, the perception of consumers in relation to their own food waste and their satisfaction with the food service. *Methodology:* Lunch meals were assessed in two consecutive days. The leftovers and plate waste resulting from school lunch were weighed by meal components. It was considered that values above 10% of leftovers and plate waste were unacceptable. Other variables were assessed through a questionnaire administered to consumers. *Results and Discussion:* Most respondents were satisfied with the food service. It was found an average of 22.7% of leftovers and 12.7% of plate waste from the meals evaluated. The main dish component with highest amount of plate waste was fish (25.37%), much higher than meat (14.15%). An amount above 20% of leftovers was found for all components, except for protein source and bread. There was a dissociation between the perception of wasted food and actual plate waste. *Conclusions:* In spite of satisfaction of consumers with food service, the results of food waste found are considered unacceptable and reflect the need to improve the planning of meals and menus adequacy to consumer preferences, as well as to develop strategies to reduce meals rejection. The dissociation between perception of food waste and the amount and type of food effectively wasted justifies the intervention at the level of awareness of users of cafeteria, as a possible strategy to reduce waste.

**Key words:** Food Waste. Food Services. Consumer Satisfaction.

## Introduction

In Europe, it is estimated that about 89 million tons of foods are wasted each year throughout the food chain, from the field to the dining table, and in all stages of food production, from primary production to the end-consumers.<sup>1</sup> In the so-called developed countries, food waste (FW) is mostly concentrated in the final stages of the distribution and consumption chain.<sup>2-6</sup>

Concern about food waste has grown among organizations and governments due to its most diverse ethical, environmental, economic and health implications.<sup>1,2,7</sup> Food wastes account for high economic costs for businesses, once it results in wastage of energy, labor and equipment resources that are involved in the entire food supply chain.<sup>6</sup> In addition to the cost of non-consumed foods, food waste results in high waste management costs, such as the operational costs relating to landfills, transportation, and waste treatment and separation stations. Wasting foods also raises social issues, considering the current global financial crisis, increasing food prices and foods shortage globally.<sup>8</sup>

School, as an educational place par excellence, should include topics related to Food and Health not only in the academic curriculum but also in the meals served daily.<sup>9,10</sup> The *Escola de Hotelaria e Turismo de Coimbra (EHTC)* (Hotel and Tourism School of Coimbra), a national reference hotel and restoration education,<sup>11</sup> has the additional duty to teach FW-related topics to their students. Because the EHTC food service is part of an eco-school, it should develop tools to enable quantification of FWs, identifying the stages at which it occurs and their related costs.

Several entities, such as the Ministry of Education, the European Union and the World Health Organization,<sup>12</sup> have shown growing concern about the quality of school meals, added to the fact that in some critical situations, the school lunch constitutes the only “hot meal” of the day,<sup>9,13,14</sup> all this requires that school cafeterias play the key role in providing nutritious foods to consumers and assure the provision of balanced, appropriate meals to the various ages that they serve.<sup>9,14-16</sup>

In a food service, it is crucial to quantify and differentiate the leftovers and wastes that together constitute FW. Meal food wastes include leftovers, i.e., cooked foods that are not served, and plate wastes, foods that are served but not eaten.<sup>17</sup> If, on the one hand, assessment of leftovers has the purpose of measuring the efficacy of the meals planning,<sup>18</sup> such waste usually resulting from failures in the planning and management of the operations,<sup>17</sup> on the other hand, plate wastes depend essentially on the quality of the meal and preferences, appetite and the consumers’ attitude towards the food.<sup>17,19-21</sup>

Assessing meal services through leftovers quantification also allows determining whether the customers of the cafeteria are served with a lunch that meets their nutritional needs and what is actually consumed.<sup>13,22,23</sup>

There are diverse causes of FW in food services, among them inadequate serving sizes; poor awareness and sensitization of consumers with regard to food wastes and the importance of nutrition; difficulties of the food in considering the patrons preferences in the planning of the meals served.<sup>1</sup>

Compared to leftovers, the control of plate wastes is more difficult, once it involves the users and their relationship with the meals. High rates of plate waste (>10%) clearly indicate dissatisfaction with the meal.<sup>18</sup>

The general objective of this work was to assess food wastes of the meals served at the cafeteria of the EHTC by quantifying food scraps or leftovers and plate wastes (edible parts), and identify the reasons that led to food waste in the form of leftovers and assess the satisfaction of the users with the food service.

## Methodology

Data collection of this observational and descriptive cross-sectional study was performed at the cafeteria of the Hotel and Tourism School of Coimbra (EHTC), which belongs to the Portugal Tourism schools network, after being authorized by the directors of the institution, in two consecutive days, in the 2013/2014 school year. The assessed days were chosen randomly from the academic week.

Quantification of food wastes was performed by weighing the meals components. An UWE calibrated scale (100 kg maximum; 1kg minimum; 30 g precision) was used to weigh the total of foods produced, leftovers and plate wastes.

At the end of the meal, the users of the cafeteria responded to a directly administered questionnaire (N=151) about their perception towards the foods that they wasted and an evaluation of their satisfaction with the meals served.

The meals consist of soup, main dish with meat/fish, side dish of carbohydrates and vegetables, dessert and bread. Leftovers were weighed at the end of the service using the aggregate selective weighing method.

The method used in weighing consists of weighing aggregate foods, per type of foods, before serving and after the meals serving, after removing all non-edible wastes. Leftovers of non-consumed foods by all individuals are separated into different receptacles, according to the type of food. An average waste value per type of food and per meal is determined by dividing the total waste found by the number of individuals who consumed the meal.<sup>24</sup>

For each collection day, we calculated the adhesion rate (AR) to the school lunch, i.e. the ratio between the students that ate at the cafeteria and the total number of students that could have eaten lunch that day at school.<sup>21</sup>

### Methodology used in the waste measurement

From the weight of the receptacles containing prepared foods was subtracted the weight of the empty receptacles, thus obtaining the weight of the foods produced.<sup>25</sup> As students finished eating, the plates were taken for selection of the wastes, where each plate component was separated into a plastic garbage bag and weighed after that. The garbage bags weight was not considered. With the purpose of obtaining only the edible portion of the protein dish component (meat and fish) and fruit wastes, the percentages of the edible portion, as described in the Table of Foods Composition,<sup>26</sup> were used.

To quantify the food leftovers in percent (%), the following formula was used:<sup>6</sup>

- % Leftovers =  $\text{weight of food leftovers} \times 100 \div \text{weight of the meal produced}$

The values were also quantified according to the wastes ratio (WR), which translates in percentage the ratio between the plate wastes (edible portion) and the amount of foods served, according to the following formula:<sup>6</sup>

- % Plate wastes =  $\text{weight of plate wastes} \times 100 \div \text{weight of the meal served}$

## Methodology used to calculate portion size/serving size/portioning

Calculation of the portion to meet the different nutritional needs according to age was based on the daily energy intake recommended by the United States Department of Agriculture, 2005,<sup>27</sup> considering the distribution of the energy value in different meals, as proposed by the United States Department of Health and Human Services and United States Department of Agriculture, 2005,<sup>28</sup> and by the Institute of Medicine, 2009.<sup>29</sup> We considered 30% of the total daily energy (TEV) for lunch.

For the distribution of TEV in macronutrients, we considered the recommendations proposed by the World Health Organization, 2003.<sup>30</sup> We used the percentages of 15% for proteins, 30% for fats and 55% for carbohydrates.

Using the average food macronutrient values, as proposed by the *Tabela Clássica de Equivalentes*,<sup>31</sup> (Classic Equivalents Table), we obtained the amount of foods recommended for the lunch meal. We considered 80g of potatoes and 100g of raw vegetables used in the soup and the intake of one piece of fruit by each user of the cafeteria and one piece of bread (25g).

## Results

The cafeteria of the EHTC is of common use by the employees and students, but most of the patrons consist of students (90.6%). Among the respondents, 59.9% usually have lunch more than three times a week at this cafeteria.

The highest adhesion rate found was of 78.3% at the day when the protein component was meat and 36.6% at the day when the protein source was fish.

A total of 151 questionnaires were administered to individuals aged 14 to 52 years, and 57% of the responses were given by male individuals. In one of the days of assessment, the protein dish was meat (day 1) and in the other day it was fish (day 2), and a great difference was observed in the number of meals served in the two days (188 meat portions and 88 fish portions).

## Users' satisfaction with the meals service

- 83.2% of the respondents agree with the meals time schedule, and 84.4% consider the meals environment pleasing;
- 78.3% of the users responded that they are pleased/satisfied with the foods available at the menu, and 80.1% that the foods are adequate to their religious beliefs;
- 4.0% of the respondents consider important the inclusion of a vegetarian option in the menu. Regarding the quality and quantity of the foods served, 78.3% of the individuals consider the foods of good quality and 77.5% that the amount of foods served was sufficient; 76% of the individuals consider the menu varied; 68.1% consider that the meals offered at the school cafeteria are often, or always, healthy;
- 82.8% of the respondents consider the serving staff pleasant and considerate, and 87.6% consider that they are often, or always, neat and clean. With regard to the cleaning and preservation conditions of the utensils used in the meals service, 49% of the respondents reported that sometimes the dishware or cutlery are worn and/or dirty.

## Food waste in the food service

The leftovers average value was of 22.7% and plate wastes (edible items), of 12.7% in both days of assessment. The meal component with a larger amount of waste was fish (protein dish), corresponding to 25.37%, much higher than the meat dish (14.15%). An average value over 20% of leftovers was found for all food components, except for the protein component and bread.

Table 1 shows the average rates (percent) of leftovers found, per food component and per day of assessment.

**Table 1.** Percentage of leftovers per meal component. Coimbra, 2014.

| Meal component     | Day 1 (%) | Day 2 (%) | Leftovers, avg. (%) |
|--------------------|-----------|-----------|---------------------|
| Soup               | 16.95     | 27.37     | 22.16               |
| Protein dish       | 13.62     | 23.40     | 18.51               |
| Carbohydrates dish | 5.20      | 45.00     | 25.10               |
| Vegetables         | 12.11     | 31.40     | 21.76               |
| Bread              | 0         | 38.60     | 19.30               |
| Fruit              | 31.45     | 46.70     | 39.08               |

Table 2 shows the average percentages of plate wastes found, per meal and day assessed.

**Table 2.** Percentage of plate wastes per meal component. Coimbra, 2014.

| Meal component    | Day 1 (%) | Day 2 (%) | Plate wastes, avg. (%) |
|-------------------|-----------|-----------|------------------------|
| Soup              | 8         | 14.35     | 11.18                  |
| Protein dish      | 14.15     | 25.37     | 19.76                  |
| Carbohydrate dish | 22.22     | 15.38     | 18.80                  |
| Vegetables        | 11.21     | 12.5      | 11.86                  |
| Bread             | 12.5      | 7.31      | 9.91                   |
| Fruit             | 1.19      | 3.08      | 2.14                   |

### Average *per capita* consumption (values of edible portion)

The average portion served per meal component, compared with the recommended averages required to meet the needs and nutritional requirements of the age group served, are smaller for all meal components, except for the “protein dish”.

**Table 3.** Average amount of foods served and respective recommended values, per meal component. Coimbra, 2014.

| Meal component    | Average amount served (g) | Average recommended amount (g) |
|-------------------|---------------------------|--------------------------------|
| Soup              | 150                       | 200                            |
| Protein dish      | 190                       | 120                            |
| Carbohydrate dish | 160                       | 120                            |
| Bread             | 19.5                      | 25                             |
| Vegetables        | 30                        | 50                             |
| Fruit             | 90                        | 100                            |

### Consumers perception of waste

Amongst the respondents, 56.7% reported that they usually leave uneaten food on the plate and indicate the “carbohydrates dish” as the most wasted component (34.2%).

Contrarily to the users’ perception, the “protein” component was actually the most wasted food (19.8%). Despite the waste value found, only 23.5% of the respondents stated that the frequency with which they leave uneaten foods on the plate is over than, or equal to, several times in the week, and 78.3% indicate that, when they are finished with the meal, they leave an entirely, or almost, empty plate. They mentioned that the serving size was not excessive, despite the average amount of the protein component that was effectively served is quite larger than the recommended portion and the plate waste was high.

When asked about the reasons why foods are left on the plate, the main reasons given are related to taste expectations, mentioning that the meal was not as tasty as expected (30.4%), the preferences and tastes in relation to the menu, stating that they did not like the menu (24.2%), and that the serving size on the plate was too large (15.2%).

When asked about the three most important items for the meal acceptance, the main features that they pointed out were taste (30.5%), variety (13.7%) and seasoning (13.2%).

## Discussion

With the aim to perceive whether the protein component of the meals influences the number of meals served, we calculated the AR in both days of assessment. The AR was clearly higher on the day that meat was served, which can be an indicator of the consumers' preference for such protein component.

Considering the preference diversity and the students' appetite variations, some FW is inevitable. However, when FW is overly high or persistent, it may indicate service failure or inefficiency, lead to unnecessary costs and consumers' dissatisfaction,<sup>20</sup> and the possible causes of such situation must be investigated.

In any food service, assessment of leftovers must be a regular procedure, once it allows measuring the efficiency of the foods preparation and service planning.<sup>17,32</sup> According to Vaz, leftovers values up to 3% are acceptable.<sup>6</sup> However, the author states that each food service must set its reference values, based on its specificities.<sup>6</sup> Thus, an acceptable leftovers limit must be defined and attained by all employees of school cafeterias.<sup>33</sup>

In the present study, the average leftovers found was of 22.7%, which is considered unacceptable and above the threshold value suggested in the literature.<sup>19,33</sup> In Portugal, according to a study conducted by Campos et al.<sup>34</sup> in primary schools of the 2nd and 3rd cycle and secondary schools in the north of the country, the leftovers value was of 7%, much lower than that found in this work.

Regarding the diverse plate components, the carbohydrate dish was the one that presented the highest leftovers percentage, which are likely associated with the difficulty that the kitchen staff has in quantifying raw food. On the other hand, the percentage of meat/fish leftovers is lower, which can be justified by the fact that raw quantification of this food is easier (e.g., one fillet per person). Regarding plate wastes, there are several causes, such as inadequate serving sizes and difficulty of the food service staff in considering the consumers' preferences.<sup>1</sup>

A WR of 12.7%, as found in this study, is considered unacceptable according to various classifications, such as that proposed by Aragão (designed to healthy adults), which suggests 10% as the maximum acceptable level.<sup>35</sup>

Taking into account that WR allows food services to assess processing/handling failures and integration with consumers, the goal is that WR be as close as possible to zero.<sup>17,36</sup> The value obtained in this work, although considered unacceptable, are lower than the ones found by other authors, such as Campos et al.,<sup>34</sup> who found a WR of 31% in a school environment, and Ferreira et al.,<sup>37</sup> who found a WR of 24% in an university environment.

Regarding the main protein component on the plate, fish has a higher WR compared to meat, which is in agreement with the values found by other authors.<sup>38-40</sup> The day that the protein dish served was fish, the WR was high, but the carbohydrate and bread waste was lower when compared to the day in which meat was served, which may indicate that the individuals are compensating for uneaten fish.

The fact that the individuals refused, on average, 12.7% of the meal, may indicate that they are not taking advantage of all nutritional benefits provided by the lunch, especially because the nutrients contained in the portion served already are below the recommended values. Studies show that children who eat less food during lunch are the ones who spend more money out of school in less nutritious foods such as snacks or soft drinks with high salt and/or sugar contents.<sup>9,13,16</sup> The same is believed to happen with young people and adults.

Leftovers are also dependent on preferences, appetite and attitude of consumers towards the food; when the food is not appealing to the consumer, the amount of leftovers is larger.<sup>17,21,41</sup> Therefore, dishes with high WR should be reconsidered or changed in the menus served.

As FWs may result from inadequate serving sizes,<sup>17</sup> portioning standardization, suitable to the provision of the nutritional needs of the population served, become a priority.

Taking into account that consumers' satisfaction and preferences are very much important for the food service and influenced by diverse factors, they should be assessed regularly.<sup>22,42</sup>

## Conclusion

Despite the satisfaction with the meal services, the amount of leftovers and plate wastes found in this study are considered unacceptable for being above the maximum limits and show the need for better planning of the meals, aiming to reduce leftovers. There is also the need for adapting the menus to the consumers' preferences and development of strategies to improve meals acceptance.

The existent dissociation between the consumers' perception of food waste and the amount and type of foods effectively wasted points to the need for an intervention in the users' awareness of the cafeteria as a strategy to reduce wastes.

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