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Sustainability and waste generation in a food and nutrition unit in Goiania-GO, Brazil

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Abstract

Objectives: This study aimed to evaluate the production process of meals in a food and nutrition unit (FNU) in Goiania-GO, Brazil, focusing on waste generation and sustainable aspects. *Material and Methods:* the study was made in a FNU that serves a healthy community, between June and July 2014, during 20 working days with an average production of 159 meals/lunch. This is a quantitative and observational case study with waste weight obtained from the reception, storage, production and distribution areas (except rest intake). A survey was conducted to discover what sustainability activities had been initiated. Fresh food and cuttings were quantified to determine the correction factor and other organic and inorganic waste production. *Results:* There were important actions taken towards sustainability, like selective waste gathering. A total of 776 kg of solid waste was found, of which 568.38 kg was organic waste, 207.62 kg inorganic waste and 17.65 kg was oil. Regarding the areas with the greatest percentage of organic waste, the study shows that it was the production area (55.2%) and the distribution area (38.98%). Concerning the inorganic waste, the greatest generator was the reception area (36.95%), followed by the distribution area (35.9%). *Conclusion:* besides the environmental consciousness showed in the FNU management, it is necessary to improve the food production planning and the correct destination of the inorganic waste, to establish awareness programs and employee training, to thus improve the storage control to reach the waste reduction goal.

Key words: Solid Waste. Collective Food. Waste of Food. Environmental Management.

Introduction

The change that occurred in the lifestyle of Brazilians in recent decades, driven mainly by the inclusion of women in the labor market and by the process of urbanization, brings as a consequence the search for meals outside the home. This habit is accompanied by an industry growth of around 20% per year worldwide, highlighting the developing countries.[1,2] Therefore, this activity has resulted in major waste generation and extensive use of natural resources before the final product is generated.[3]

Because there is no specific legislation for the management of solid waste in the food sector, these are treated as non-hazardous and declared as waste Class II, according to the Brazilian Association of Technical Standards – Brazilian Standards (ABNT-NBR), due to their nature and composition similar to household waste, varying only in large generated volumes.[4]

The concept of sustainability is something that has been inserted into the culture, being a current issue that can be understood as the development of actions that meet the current needs while the future generations have the assurance that their needs will not be comprimised.[5] In the food production context, therefore, we must consider not only the production of quantitatively and qualitatively adequate food, nor only the economic and material development, but also the production system that is viable for the environment, in order to ensure and sustain the quality of human life.[6]

According to Brandão et al.,[7] it is estimated that 15% of the food produced in the food service sector is discarded. It is an amount that exceeds the amount declared as "acceptable" for waste for institutional catering, considering that within the realm of the unit (FNU) more food is produced as a safety margin which should be at a maximum range of 10%.[8]

A major concern is the increase in the consumption of fried foods served in many establishments, generating oil residue used in the preparation, which damages the environment when disposed in inadequate locations.[9] It's worth adding the negative impact on public health by excessive intake, which in turn can cause chronic diseases and other illnesses arising from the use of saturated oil.[10]

Poorly discarded organic waste can cause contamination of groundwater by infiltration of manure and/or represent a large financial loss, as it could have been converted into biogas and organic fertilizer. The packaging used for shipping and storage of products protects them before consumption, but also creates problems in the post-consumption when they are not discarded in the appropriate locations.[11,12]

It is therefore vital to identify the waste generating points in the FNUs, for future decision-making and deployment methods for its control and reduction. Great importance should be given to the definition of strategies to minimize the waste generation, to support conscious use of energy and water, as well as to provide education to and monitoring of those involved in the process, with the aim of tackling the problem, turning the environmental policy into a reality and ensuring the aspect of hygienic and sanitary quality of meals.[13-15]

Faced with the increasing expansion of the food production sector, it is essential to investigate the critical points, including the factors that lead to the generation of waste and initiatives that contribute to sustainability. Thus, this study aimed to evaluate the production process of meals in a FNU, located in the city of Goiania-GO, with a focus on waste and sustainability aspects, allowing greater examination of the matter.

Material and methods

A descriptive observational study was conducted through a case study, to ensure depth of the study, more credibility of the results and integration in the context of research. According to Gil,[16] data related to behavior, when obtained through observation, tend to be more reliable than those obtained by means of reporting, and after repeated contact, the researcher has a chance of more reliable data, for his constant presence won't change the usual behavior of surveyed members.

This study aimed to identify the amount of waste generated from reception to the distribution of meals at the FNU, observing issues relating to surplus, pre-preparation techniques, control over production, as well as the identification of sustainable initiatives implemented in the management and operation of the unit.

The choice of the subject matter took place from pre-defined characteristics: formality of management; a healthy community that used the service; technical supervision of a nutritionist; willingness of managers and owners to participate in the study; and easy insertion of the researcher in the work place without any interference with the flow of employees and customers.

The study was conducted in a FNU that adheres to self-management under the technical supervision of a nutritionist, and serves employees of administrative and operational positions. The unit provides an average of 159 meals a day/lunch, with a menu classified as average standard, with two protein dish options, three types of salads (always considered at least one leafy vegetable), two side dishes (rice and beans), and a type of

garnish. The distribution system is centralized, and the distribution is done through self-service with the portioning of the protein plate.

It was not necessary do get the approval of the ethics committee before conducting the survey, as the study didn't involve work that involves any kind of intervention with humans. However, a cover letter explaining the project was previously sent to the nutritionist responsible for FNU, which guaranteed confidentiality of the company's name and of the return of the results.

Food and work security within a FNU extends to all events that may interfere with the continuity anywhere in the production process, which may involve environmental, chemical, biological, physical or mechanical hazards that lead to losses in production and/or the productivity of the employees.[17] Because it is a waste weighing task, the research had met the food and labor safety standards for risk prevention.

Data Collection

The quantification was conducted by use waste generated in the area of reception from raw materials, the areas of storage, pre-preparation and preparation, as well as distribution.

Research in the FNU was developed in June and July 2014, with visits from Monday to Friday, for four consecutive weeks, totaling twenty (20) visits.

Identification of actions that contribute to sustainability

By means of a questionnaire answered by the nutritionist of the unit, actions that contribute to sustainability were identified. The questionnaire followed the model used by the Center for Research in Dining Productions of the Federal University of Santa Catarina.[18]

In order to give credibility to the questions contained in the questionnaire, the researcher assumed the role of systematic observer, who showed efficiency in the planning, the main sources of waste and the understanding of the difficulties encountered to sustainable management.

Gil,[16] states that when the researcher decides the modality of systematic observation, he knows which aspects are significant for achieving the intended objectives and he searches for meaning regarding the relationship between the facts and possible explanations.

Classification and quantification of waste generated

The residues were classified into organic and inorganic, according to the ABNT-NBR,[4] including the frying oil. To quantify residues, a scale from the brand Filizola was used, with a maximum capacity of 15 kg and a sensitivity of 0.05g. The residues were obtained from the areas of reception, storage, production and distribution.

In the reception area, the packaging of products arriving for storage were observed and quantified, as well as those that were already taken to this place for a pre-cleaning before storage.

In storage the expiration dates were checked for the genres of stock at room temperature, and perishable foods. Their integrity was also verified, in order to ensure waste control of raw materials.

In the production area, waste generated in the pre-preparation and preparation were observed and quantified, such as peels and seeds of fruit and vegetables; oil; plastic, glass or tin packaging, used for food protection; stored food leftovers that had been discarded; disposable wipes and paper towels, which are widely used in this area for hygiene of equipment and for drying hands.

In the distribution area (cafeteria), the dirty leftovers were observed and quantified (only the food from the distribution counter that weren't served) as well as the disposable utensils used during distribution like glasses, cutlery, gloves and napkins. For this area the samples that are collected and stored daily were also quantified, which are discarded after a period of 72 hours.

Understanding the factors that lead to the generation of waste in the production process

Forms were used for the evaluation of administrative activities and technical/operational activities. The evaluated criteria were classified as "compliant" (C) or "non-compliant" (NC). When it was 'NC' this was justified in the space dedicated to comments.

To understand the factors that lead to the generation of waste in the FNU, observations were made between the technical and administrative activities: if the criteria for selecting suppliers include those who sell their products in returnable packaging; and the efficiency in production planning, if menu takes the eating habits of the customers into account, if there is determination of the number of meals, per capita, and finally, if the amount to be produced is consistent.

In the technical/operational activities, the executions of pre-preparation and preparation were observed, with an emphasis on applied techniques and training frequency of employees. To calculate the correction factor (CF) of vegetables and fruits of this study the fresh food (gross weight) were weighed. After removal of the cuttings they were weighed again (net weight).[19]

Analysis and interpretation of data

The questionnaire about sustainability initiatives were transcribed and categorized as positive or negative, in order to give meaning to the descriptive process. Systematic observations were used to confirm existing evidence in the literature on the theme under discussion.

Quantitative data were recorded on forms designed in Microsoft Office Excel software, version 2013, in order to create a database. These were analyzed using descriptive statistics, with percentage calculation and daily, weekly and monthly arithmetic averages, for the quantity of generated waste.

Results

Chart 1 describes the positive and negative aspects of sustainability initiatives found in the evaluated FNU.

Chart 1. Positive and negative aspects of sustainability actions of a FNU in the city of Goiania-GO, 2014.

	POSITIVE ASPECTS	NEGATIVE ASPECTS
General Characteristics of the FNU		- Insufficient number of employees
General characterization of equipment, utensils and installations	- Existence of processor and manual peeler for vegetables - Preventive maintenance of equipment - Predominantly fluorescent lamps	- Do not have a dishwasher - Manually operated faucets
General characteristics of environmental sustainability practices in the FNU	- Nutritionist with training on environmental sustainability - Selective collection of organic and inorganic waste - Organic waste sent for animal feed supplement - Separated recyclable waste and transported by the municipality - Suitable destination for oil residue	- Doesn't have environmental certification -Staff without training on environmental sustainability - Doesn't have an alternative source of electricity - Unit without program on energy waste
Specific features of environmental sustainability in the production process of the meals in the FNU	- Planning menus considering regional and seasonal foods - Raw materials checked upon receipt - Defrost at room temperature with control and monitoring of surface temperature (to reach 3-4 °C, continued thaw under refrigeration) - Predominance of cooking techniques that generate minimal oil residue - Waste monitoring of food for customers - Reuse of clean leftovers	- Lack of preparation datasheet (PDS) - Less importance to the choice criteria for suppliers to GM without food options - Doesn't use organic products and/or family farming - Use of environmental hygiene products and household appliances online - Vegetable Receipt in natura - Vegetable Storage at room temperature - Doesn't perform monitoring per capita and of CF

To better understand the generation of waste in pre-preparation, the mean and standard deviation (SD) of the CF found, the SF values described in the literature as well as the determination of the percentage of most used fruits and vegetables in the FNU are described in Table 1.[19,20]

Table 1. Correction Factor and % of use of fruits and vegetables of the most used foods in the FNU. Goiânia-GO, 2014.

FOOD	Use Frequency	CF observed Average/SD	CF literature	% use (Kg) Average/SD
Pineapple	9	1,96 ± 0,52	1,89	53,7 ± 9,78
Zucchini	3	1,61 ± 0,005	1,33-1,38	62,29 ± 0,16
Chard	6	2,5 ± 1,54	1,54-1,66	49,96 ± 16,40
Lettuce	17	1,91 ± 0,62	1,09-1,33	57,25 ± 16,66
Banana	3	1,24 ± 0,26	1,51	83,67 ± 15,17
Potatoe	3	1,18 ± 0,04	1,06	85,26 ± 3,13
Eggplant	2	1,14 ± 0,02	1,04-1,08	87,35 ± 1,89
Beet root	3	1,17 ± 0,05	1,61-1,88	85,71 ± 3,42
Onion	20	1,18 ± 0,06	1,03-2,44	85,21 ± 4,04
Carrot	9	1,19 ± 0,07	1,17	82,98 ± 4,03
Parsley	12	1,4 ± 0,06	1,1	71,1 ± 2,81
Chayote	4	1,2 ± 0,06	1,47	83,48 ± 4,1
Cabbage	5	1,3 ± 0,14	1,60-2,22	77,42 ± 7,75
Gilo	2	1,18 ± 0,02	1,09	85,1 ± 1,86
Orange	3	1,7 ± 0,26	1,39-2,13	60,12 ± 8,35
Watermelon	3	1,95 ± 0,43	2,17	53,65 ± 10,3
Melon	5	1,81 ± 0,42	1,04	57,64 ± 10,77
Tangerine	2	1,48 ± 0,08	1,30-1,43	67,98 ± 3,44
Green corn	3	2,29 ± 0,17	2,63	45,48 ± 1,22
Cucumber	3	1,06 ± 0,02	1,42	94,75 ± 1,82
Purple cabbage	2	1,8 ± 0,6	1,72	62,5 ± 20,84
Green cabbage	6	1,6 ± 0,30	1,72	64,60 ±14,18
Tomato	20	1,12 ± 0,04	1,25	89,86 ± 3,34
Green beans	2	1,14 ± 0,03	1,41	87,62 ± 2,46

In Table 2 the total amount, the daily average and the percentage of organic, inorganic and oil waste produced in the UAN four weeks are depicted.

Table 2. Amount of organic, inorganic and oil waste of four weeks, generated in the FNU. Goiânia-GO, 2014.

WEEK	Organic (Kg)	Daily Average (Kg)	%	Inorganic (Kg)	Daily Average (Kg)	%	Oil (Kg)	Daily Average (Kg)	%
WEEK 1	100,48	20,10	17,68	41,16	8,23	21,67	6,42	1,28	36,37
WEEK 2	173,82	34,76	30,58	48,2	9,64	25,37	5,80	1,16	32,86
WEEK 3	156,51	31,30	27,54	58,03	11,61	30,55	1,58	0,32	8,95
WEEK 4	137,57	27,51	24,20	42,59	8,52	22,42	3,86	0,77	21,87
TOTAL	568,38	-	100	189,97	-	100	17,65	-	100

Table 3 allows you to view which area of FNU was responsible for the largest volume of organic and inorganic waste produced when conducting the lunch meal during four weeks.

Table 3. Amount of organic and inorganic waste generated per area at the FNU. Goiânia-GO, 2014.

GENERATING AREA	Organic waste (Kg)	%	Inorganic waste (kg)	%
RECEPTION	13,85	2,43	70,19	36,95
STORAGE	19,27	3,39	0	0
PRODUCTION	313,73	55,20	51,60	27,16
DISTRIBUTION	221,53	38,98	68,18	35,89
TOTAL	568,38	100	189,97	100

For knowledge about the volume and composition of the waste produced by this activity that generates such intense impacts on the environment, in Table 4 the different types of waste generated in the FNU are classified and quantified, as well as its percentage in relation to total waste produced in the period of research and their final destinations.

Table 4. Classification, quantification, percentage and the final destination of waste generated in the FNU in the city of Goiania-GO, 2014.

TYPE OF RESIDUE	Total generated (Kg)	%	Final destination
Cuttings and discarded food	568,38	73,24	Animal Feed
Disposibles	53,07	6,84	Landfill
Paper/cardboard	52,07	6,71	Recycling
Plastic	36,09	4,65	Recycling
Cooking oil	17,65	2,27	Re-use
Expanded polystyrene (isopor®)	13,32	1,72	Landfill
Wood	13,10	1,69	Re-use
Glass	7,98	1,03	Landfill
Cans	6,10	0,79	Landfill
Other*	4,68	0,60	Landfill
Tetra Pack Boxes	3,56	0,46	Landfill
Total	776	100	-

* **Other**: disposable cloths, coffee filter, paper towels, gloves

Discussion

Chart 1 shows that in the studied FNU many actions that contribute to the preservation of the environment are already well established, as waste management initiatives could be identified. The dominance of cooking techniques aimed at reducing the oil residue and the finding the appropriate destination when the generation does occur was diagnosed. Worth mentioning among the positive aspects: the selective collection of organic and inorganic waste; reuse of clean leftovers and nutritionist training about environmental sustainability.

According to the National Policy on Solid Waste (PNRS),[21] it is the responsibility of producers and the government, to dispose and manage solid waste throughout the product life-cycle. To this end, the aim, among a number of principles and objectives of this policy, is to reduce the impact on the environment and natural resources, the protection of public health, as well as to encourage the adoption of sustainable patterns of production and consumption of goods and services.

For Barthichoto et al.,[22] the separation of organic from inorganic waste facilitates recycling, because in this way the recyclable material has greater potential for reuse, as it remains cleaner. When conducting a study with 32 FNUs from different types of services located in a municipality of São Paulo, Barthichoto et al.[22] found that only 25% (n=8) did selective collection, from these FNUs, 87.5% (n=7) separated cans, plastic, paper, metal and organic waste, and 12.5% (n=1) only did the separation of recyclable solid waste from organic waste. However, much remains to be done at the FNU in question, so that the goal of minimizing the generation of waste and the use of natural resources is achieved. Highlighted as negative aspects: the administrative technical activities, such as lack of a preparation datasheet (PDS) which involves monitoring *per capita* (PC) and the correction factor (CF); as well as characteristics of sustainability, such as lack of alternatives for electricity and the use of manually operated faucets.

The standardization of processes through production planning with the adoption of PDS, creating routines and operating procedures, the preference for equipment that consumes less water and the development of awareness programs to avoid waste are highlighted as rational actions towards sustainable development. All damage caused by waste go beyond the financial context, because they interfere with people's health and the environment when waste is disposed in an inadequate way.[22,23]

Veiros and Proença,[5] when discussing the relationship between sustainability and growth in the number of production units of meals, highlight that after a good menu planning and procurement of raw materials with respect to regional habits and encouraging local production, the definition and adequate and standardized implementation of pre-preparation and preparation techniques are seen as basic goals for achieving sustainable production. So we can say that the PDS is an indispensable and complementary tool of sustainable food production process.

A big part of the waste generated in FNUs is due to the reckless use of raw materials and/or the lack of reusing leftovers. The use of a PDS assists the work of the nutritionist, by giving the conditions to promote the maintenance or improvement of the nutritional status of the customers; reducing the losses by allowing PC and CF control, and a greater control of the quantities of raw materials used. Moreover, it can contribute to the satisfaction

of customers with the standard preparations. For the handlers, the PDS optimizes time and stress in the accelerated routine of the production process.[24,25]

In a study by Souza,[25] it was found that the cost of food items and the leftovers of a FNU were reduced after preparation and implementation of a PDS. Before the implementation of the PDS, the cost of food was 24.8% of the total, and after implementation of the PDS, it was reduced to 15.6%. Leftovers ranged from 34 to 35% of the total production, and after implementation of the PDS, waste was reduced to 20%. However, the study reports that good quality of raw materials used and the final product should always prevail.

Chamberlain, Kinasz & Campos,[26] in a study conducted in two FNUs, attribute the generation of organic waste from discarded leftovers to the lack of standardization of per capita, one of the items that make up the PDS. Similarly, several other studies have found the predominant cause of CF waste, the leftovers from the manufacturing and food remains, all of these factors could be modified with the implementation of the PDS.[15,22,25,27,28]

The implementation of sustainability initiatives in FNUs requires the nutritionist, in the role of manager, to engage, influence and support their development. More importantly, these initiatives can have a positive impact on the financial aspect. Considering that usually the professional inserted into a food service providing company falls under the obligation to comply with contracts that prioritize costs, sustainability can be an important management strategy. Therefore, every team has an obligation to be involved and monitoring should be constant from the economic, environmental and social point of view.[6,27]

Among the indicative operational aspects of waste generation, the CF was analyzed. As shown in Table 1, CFs found in lettuce, chard and red cabbage are relevant, coinciding with the study of Ricarte et al.,[29] in which significant waste for leafy vegetables was observed due to inadequate techniques applied in the pre-preparation.

In the studied FNU, inadequate technical pre-preparation of leafy vegetables was also identified, observing excessive amounts of cuttings that seemed unnecessary, as the foliage was in excellent condition. These vegetables were delivered to the unit three times a week, based on the menu settings and always presented excellent quality. After checking the receipt, they were stored in refrigerator for a maximum of two days.

CFs of chayote and cucumber had values lower than expected in the literature, which can be explained by the fact that, under the circumstances of the research, these foods were prepared inside their peel, removing only the seeds and inedible tips. According to Starck et al.,[30] the parts that are not generally usable for foods such as the peel, may in fact be used. Thus, if you can nutritionally enrich food, with a greater amount of fibers, vitamins and minerals, you reduce, as a consequence, the waste.

Carrots, beets and potatoes were peeled by hand with a manual tool that reduces excessive losses. This reduction, however, didn't occur for potatoes and carrots, perhaps due to the form of storage, which happens at room temperature and allows for more rapid degradation.[23] This also occurred with other vegetables and fruits in this study, that showed a CF above the values reported in the literature.

Ricarte et al.,[29] described the importance of the storage of fruits and vegetables in a refrigerator, with a recommended temperature of up to 10 °C for up to a week for these foods. In addition to the time and temperature conditions, cleaning, inventory turnover and ventilation of the food must also be observed, as the life of these foods can be increased, nutritional and sensory characteristics can be maintained and impairment losses reduced.

To avoid waste in the process of peeling and cutting, Andreatti, Bernardi & Abbud,[31] mention in their work the importance of using proper equipment, appropriate blades and trained personnel. Barros, Garcia and Almeida[28] report that employee training is a key factor in the control of loss by CF, but emphasize that it should not be seen in isolation, because the quality, temperature and characteristics of foods are highly influential factors in the loss of raw materials and profit.

CFs found in green cabbage, tomatoes and watermelon (1,6; 1,12; 1,95) respectively, are presented below the values reported in the literature, suggesting the need for a specific list of CF.

To draw up a list of CF for a FNU, Barros, Garcia and Almeida[28] reported that CFs found when using good quality food were mostly lower than the values found in the literature. According to Silverio & Oltramari,[32] each food service should create and regularly review a CF list according to the quality of raw materials purchased. This will bring greater security in the elaboration of purchases and will detect and control possible waste in pre-preparation.

In the studied FNU, tomatoes, when served in slices or cubes, suffered great loss of edible parts; however, when served as a type of vinaigrette, there was no CF, which may have influenced the calculation of the average, as for this preparation the entirety was being used during the cutting with a manual processor.

As for green cabbage, there are large losses of edible parts in the pre-preparation, even with the use of hand tools to facilitate cutting and improvement in the use. In this line of thought, which seeks economy and sustainability, it is suggested that team training with a focus on full use of food is conducted.

Watermelon is a fruit that is used in the unit only in its harvest period for economic reasons as well as sensory characteristics. Thus, there was maximum benefit, hence the CF value found was lower than the literature suggests. It may be that literature provides a high CF due to seasonal issues, which again reinforces the need for a separate CF list for the unit, because literature can serve as a direction, but can't be used year-round as a fixed parameter .

According to Barros, Garcia and Almeida,[28] waste of edible parts of food is seen as an important factor when running a FNU, because it characterizes lack of proper handling techniques, excess purchases and impaired nutritional quality of foods. The use of CF monitoring can help control costs, given that purchases are planned based on the forecast of losses.

The number of employees incompatible with the number of produced meals brings wrong-doings in the realization of the pre-preparation, and may influence the CF, as there is an estimated time for the fulfillment of the task. It is noteworthy that the use of manual equipment for peeling, combined with the reduced number of employees, can leverage the trend towards greater removal of edible parts of the food.[33]

Therefore, minimizing the generation of waste in the pre-preparation can be achieved through employee training, verification and analysis of the storage room, equipment and utensils used, skills of the handlers and exact sequence of preparation, which can be achieved using patterning tools. The choice criteria of the supplier should be given importance, as major influences occur, which can make the losses suffered in food vary widely, depending on the degree of maturity, quality and crop. Avoiding waste reduces costs, reduces social and environmental impacts and can increase profit.[24,34]

From the data shown in table 2, we can see reduced amounts of organic waste in the first week in relation to others. This may have been due to an unforeseen change in the handler of salads, who didn't receive training for this position, making it necessary to resort to using less elaborate preparations and a smaller variety of vegetable. In the second week this value increased, coinciding with the new replacement of the handler of salads and the preparation of dishes with more variety; decreasing in sequential weeks after adaptation of the employee.

Cavalli & Salay[35] report that employee turnover and constant absences are difficult issues when managing a FNU and can effectively contribute to the unsatisfactory development of the production process, as well as to the instability of food security. The level of information of employees, training and training focused on the area of operation is of paramount importance to ensure the quality of food served.

Moreover, to Colares & Freitas,[36] the objectives of a FNU are achieved only when the team works in a system of cooperation. The work should be organized, separating the experienced knowledge per employee (such as domestic culinary practices) and examine what is actually required to fulfill their tasks, with the right to state their ability to create, analyze, make decisions and propose experiences with respect to labor and other member employees.

The present study demonstrates the lack of training of handlers as a cause of waste that occurs in the pre-preparation and that increases the leftovers from produced and not-served meals. The leftovers in the distribution counter can be related to sensory characteristics presented in the dishes because they didn't always keep the color and/or desirable food textures, due to lack of adequate dietary techniques.

Vicente et al.[37] reinforce, in their work, that planning and execution of training inherent to the role of food handlers are the most advisable and effective means to transfer knowledge and encourage changes in attitudes. Several other studies report that the practices of employees improve after training. However, training for quality management requires costs and food area professionals for its implementation.

The growing evidence of inorganic residues in the third week of study may be related to the receipt of dry stock goods, which takes place every fortnight, as well as the extensive use of disposables. Thus, there is a need to review the criteria for choosing suppliers, giving preference to those who market their products in returnable packaging or make use of the smallest possible amount of packaging. It is known that the use of disposables enables greater health and safety, and its use is indispensable in various stages of the production and distribution cycle. However, to avoid waste and excessive disposal, it is necessary that their use happen in a rational manner.[33]

According to Kinasz & Werle,[33] the use of disposables is increasing due to their diversification and is justified by the practicality, economy and convenience. It brings greater hygiene security for users, responding to specific legislation that every day become stricter about good practices aimed at hygienic-sanitary control. However, its use should occur rationally, avoiding waste and environmental problems. Also according to the study, the authors point out that the bags and plastic cups take 200-500 years to decompose in landfills and dumps.

The oil produced in the first week shows a higher value in comparison to the following weeks, due to the frying done during two days of this week. In the other weeks, frying was avoided, but generation of oil took place in greasy meat preparations that, when cooking, produced the residue, which was incorporated in the quantification. This situation refers once again to the need for training in dietetics technique.

The target unit recommends on their menu the kind of preparations that don't require frying, but when it occurred, this oil was stored in gallons until they were full, to then be donated for the production of soap. This measure reduces impact on the environment, to avoid the improper disposal as well as government and population spending concerning health.[38]

During the study period, a total of 17,65kg of oil was found for an average of 159 meals/day. Despite the small amount of fried foods, this result is superior to those found in the study of Lopes & Fonseca,[39] who advocate for preparations without frying and observed a generation of 30 kg of oil per month to the average production of 1,875 meals/day. This demonstrates that the use of fatty meats increased the total oil produced in the studied FNU, making it necessary to purchase leaner meats and apply pre-preparation techniques to withdraw any excess apparent fat.

The waste from the remains of degraded raw material and cuttings are the main cause of environmental impacts due to the manure produced in the decomposition of matter, which causes proliferation of microorganisms, contamination by heavy metals and other substances that harm the environment when its final destination is inadequate.[22] This way, it can have serious health, economic and social consequences, which directly influences the quality of life and future of the planet, through contamination of water resources and soil.[40]

In the present study, an average of 179g of organic waste/person/day was produced during the lunch production. The amount found corresponds with the leftovers from the distribution counter, cutting and degraded raw materials, and is close to that reported by Spinelli & Cale, [27] who quantified the waste from leftovers and waste produced at lunch and dinner from a FNU for a week and found the value of 199,5g/person/day. Comparing the findings, there is an indication of excessive production of organic waste in the studied FNU, since the organic waste quantified was generated only at lunchtime.

Other studies investigating the generation of waste in food production encountered prevalence of organic waste compared to inorganic waste.[15] Against the backdrop, it is essential to take control measures including the reduction of costs and waste, and to seek advances in social responsibility and environmental awareness.[12]

One of the alternatives to mitigate the environmental impact is the reduction at the source. To generate a minimum of organic waste in the production process, a viable alternative proposed is the use pre-processed foods. The cost can seem higher, but if we evaluate the benefits, such as reduction of organic waste and water consumption, we see that the practice is advantageous because all residues are concentrated only in the processing unit, which may have greater ease in sending them along for composting due to the volume. Another advantage that can be gained is the improved use of the physical space, as it

reduces the storage area and uses the processing area for another purpose. Another advantage is the reduction of labor and time optimization in the production industry.[41]

The area most responsible for the generation of organic waste in this study was the production area with 55.2%, followed by the distribution area, 38.98%, as can be seen in Table 3. The sum of these exceeds the findings of Spinelli and Cale,[27] who, when assessing the waste from a FNU, found higher waste generation in the production area (77.10% of total waste), including the disposal of non-edible parts of food and food produced and not distributed.

A study by Lafuente Jr.[42] found that the solid residue classified as food, coming from the area of production and return, made up 54% of all solid waste produced on the property. This demonstrates the need for intervention measures and for the development of strategies for minimization of waste generated in the studied FNU.

As shown in Table 4, from the total solid waste produced (776Kg) in the FNU in this study, 568.38 kg (73.24%) is sent for animal feed supplementation, 88,77Kg (11.44%) are sent to landfills in the city, 88,15Kg (11.36%) are referred to collection by the city hall for recycling and 30,73Kg (3.96%) are reusable. These values express a good reduction of the amount of waste deposited in the landfill, when compared to the study of Spinelli & Cale,[27] who found 1077,48Kg (87.82%) of waste generated in the production of an average of 520 daily meals for lunch and dinner of a FNU was sent to landfills.

It is noteworthy that the leftovers are associated with deficiencies in planning, such as inaccuracy in determining the number of meals, lack of a PDS, types of utensils used in distribution and disobedience to the eating habits of customers, or excess production.[22] The occurrence of excessive CF is related to the technique used by employees, as well as the utensils and equipment used in the pre-preparation.[28]

However, once the organic waste is generated, it is necessary to adopt solutions that alter environment the least. Thus, the reuse of these foods in animal feed or compost is a feasible alternative in favor of sustainability.[39]

When seeking to contribute to the protection of the environment, a management plan in the policy on solid waste proposed by Colares & Figueredo[43] (re-education, reduction at the source, re-use and recycling) becomes essential to achieve the ultimate goal. It is a task that requires a lot of commitment and promotion of awareness of the entire team of a FNU, so that all activities related to the supply of food is considered sustainable.[6] Thus, the professional nutritionist in food production management is challenged to insert in his FNU a waste management plan. This is not a hype; it is a matter of ecological awareness in favor of health, human survival and economy.[44]

Having a waste management plan in a FNU has a social significance that goes beyond the responsibility as a generator. The unit becomes a reference in environmentally consciousness with the capacity of encouraging the creation of cooperatives that create jobs and economic emancipation, integrating in society a portion of individuals living in exclusion.[9,12]

In a larger plan, the professional manager of the FNU can request the system standardized by the International Organization for Standardization (ISO). The ISO 14001 establishes standards for the registration of the Environmental Management System (EMS), as well as the issuance of quality certification. ISO 14004 sets out guidelines that assist in the implementation and improvement of the EMS, providing ordination and consistency through resources, responsibility assignments and evaluation of practices, procedures and processes.[14]

The final management of waste generated in the FNUs is important not only to meet the environmental standards of production, but also to ensure the appearance of sanitary quality of the meals.[15] It is therefore valid to implement programs and quality systems, even with no enforcement of environmental laws.[14] The control of hygienic-sanitary conditions in a FNU should start with the implementation, effectiveness and periodic review of the *Good Practice Handbook and the Standardized Operational Procedures*.[44]

We know it's the responsibility of the generator to properly separate and package the waste. Given the above, a discussion was opened about the responsibility for the final destination, considering that many municipalities haven't yet joined the PNRS, even after the expiration of the period (2nd August 2014) established for the implementation of the environmentally suitable final destination was to be achieved.[21]

According to the Panorama of Solid Waste in Brazil organized by the Brazilian Association of Public Cleaning Companies and Special Waste (ABRELPE),[45] about 60% of Brazilian municipalities continue to keep the waste in open dumps. About 70% of the waste collected in the Midwest (Goias, Mato Grosso, Mato Grosso do Sul and the Federal District) is still disposed off improperly. The region has dumps and controlled landfills that don't have a set of protection systems for the environment and people's health in place, and the landfill are little different from the dumps themselves.

The research of the ABRELPE[45] shows an increase of 4.7% in the residue collected and a 3.6% increase in the generation of solid waste for the Midwest Region when compared to the previous year. The region total 467 municipalities, of which only 33.8% (n=158) have some kind of selective collection initiative. The same survey reports a concentration of solid waste in the state of Goiás totaling an average of 0,955Kg/inhab./day; calculated indices based on the total population of each city.

Conclusion

From the verification proposal for sustainability initiatives, it was concluded that the management of the FNU in question has environmental awareness, since many initiatives have already been taken, but much remains to be done.

It's necessary to have more control over the generation of organic waste, as it can be observed that the predominant factors were the waste generated in the pre-preparation of food and the leftovers. Moreover, the choice criteria of suppliers must be revised in order to minimize the amount of packaging generated. There should also be a reassessment as to the use of disposable utensils that are being sent to the landfill.

It was observed that indicators of solid waste generation are highly relevant and modifiable. The high production of organic waste can be avoided with measures aimed at minimizing, like the training of handlers, credits usage in the preparation that include CF control, per capita, standardization of preparations, among other advantages that reduce the identified waste in the areas of production and distribution, represented by the cuttings and scraps.

It is worth mentioning the importance of applying appropriate dietary techniques for a better presentation of the dishes served, which consequently minimizes the amount of leftovers. Following dietary techniques, it is worth considering the removal of visible fat from meats before their preparation, which reduces the generation of oil and the impact on public health, as there is great concern in the management of a FNU to adopt the use of preparations that don't require the use of oil or grease.

In storage, adequate temperatures of vegetables and fruits must be obeyed to reduce food discarded by deterioration; moreover, the quantity of equipment in the production of the FNU needs to be verified.

Upon receipt, we observed an excellent quality of the raw materials delivered by suppliers, but only a few products are delivered in returnable containers. It is necessary to inspect the disposal of packaging glass, cans and tetra pack boxes, because these could be sent for recycling like cardboard and plastic already are.

Therefore, it is necessary that the management responsible for the FNU became further aware of their role in sustainability, implementing awareness programs, quality and training systems of the officials involved, so that the practices of reduction, reuse and recycling of waste don't remain only on paper and can be part of everyday life. The effort is valid, but we must carry forward the challenge of educating.

As the FNU is embedded in a company, it is important to extend the proposed sustainable initiatives to the whole company, so that this isn't an isolated attitude of the unit.

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