The nutritional and sensory quality of protein preparations in school food and nutrition units: an evaluation using the ansq method

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Abstract

Food and Nutrition Units aim to provide balanced meals within dietary and hygienic standards. However, one should also consider the sensory aspects of preparation because these characteristics can influence the attitude of the messmate, drawing him or not for ingestion. This study aimed to assess the dimensions of sensory and nutritional quality of protein preparations in school. The study was conducted in two school units in Rio de Janeiro, with the application of the theoretical model Assessment of Nutritional and Sensory Quality. The main procedures that could compromise the nutritional and sensory quality of the preparations were: (a) lack of standardization in per capita preparations; (b) lack of photographic records at all stages; (c) failure to keep the right temperature in the sensory context, at receiving, storing and thawing; (d) deficiency in the quality control of the oil used in frying; and (f) not conducting satisfaction surveys with messmates. It was possible to identify that both units may present improvements in the production process, in order to contribute to the nutritional and sensory quality of food. Corrective actions should be taken by local nutritionists, as well as awareness of the team should be held.

Key words: Food Service. Collective Feeding. Food Quality. School Feeding.

Introduction

Habits and behaviors, including food, are built in childhood, when choices relating to the amount of food, mealtimes and environment begin. Thus, school food service has a key role insofar the adoption of intervention strategies aimed at promoting the consumption of healthy foods and the restricted intake of high caloric foods may contribute to consolidate healthier food practices with respect to the foods nutritional aspects.[1]

The Food and Nutrition Units (FNU), under the technical responsibility of a nutritionist, respond for the production of meals in the school environment. A FNU has the purpose of providing balanced meals, in compliance with dietary and hygiene standards, as well as to please users with the services offered.[2,3] However, it is important to consider the sensory aspects of preparations, which contribute to influence the consumers' acceptance because it is known that our senses, sight, touch, taste, and smell act on what we eat, contributing to the food choices, in the same way that culture shapes food selection by "imposing standards that prescribe, forbid or allow what to eat".[4]

Debates on food and eating are therefore gaining space in the nutrition science, once it is known that "Food is a nutritional act, eating is a social act, because it consists of attitudes associated with traditions and customs, protocols, behaviors, and situations."[5] However, in this work it is emphasized the nutritional and sensory quality dimensions, as referred by Proença et al.[6]

The Assessment of Nutritional and Sensory Quality Assessment (ANSQ) system developed by Riekes,[7] as an example for meat preparations and presented by Proença et al.,[6] aims to provide the nutritional and sensorial quality of the meals offered in foodservice establishments.

Such theoretical model of control of the production process aimed at the monitoring of the nutritional and sensorial quality was developed from the principles of the Hazard Analysis and Critical Control Points (HACCP) system, widely consolidated and recognized worldwide. The HACCP emphasizes the nutritional and sensory dangers that may impact the quality of the preparations.

Studies have been conducted to complement the ANSQ concept. Borjes, Cavalli & Proença[8] presented a classification of vegetables used in the production process of commercial and collective meals, correlating the nutritional and sensory characteristics and processing techniques. Fernandes, Dutra & Proença[9] addressed a reflection on the nutritional and sensory criteria of preparations made of black and red beans in the composition of the ANSQ's module "Beans", and defined criteria for the nutritional and sensory quality of these preparations. However, there are few studies that use this system in FNUs to contribute to the nutritional and sensory quality assurance of preparations and/or use it as an evaluation tool of these characteristics.

Considering the importance of the nutritional and sensory aspects as well as the influence of good nutrition in childhood and in food choices, we decided to evaluate the nutritional and sensory quality dimensions of protein preparations in schools and indicate corrective actions when necessary.

Method

The study considered the methodological criteria of descriptive research by means of a case study in two school FNUs located in the city of Rio de Janeiro (FNU 1 and FNU 2). The selection of the FNUs was made by convenience and intentionally, because these units have curricular internship activities and until then no studies addressing the qualitative assessment of nutritional and sensory aspects of meals had been done. Both are private schools, offering average standard menus, one is self-managed and the other outsourced, and both have the Good Practices Manual described and implemented.

FNU 1 serves an average of 700 meals/day (lunch), while FNU 2 an average of 400 meals (lunch) using the cafeteria mixed system. Both serve a heterogeneous clientele consisting of students from preschool to high school, teachers and personnel of maintenance, cleaning and school administration and other employees (secretaries, directors, receptionists).

The menu is planned by a nutritionist and consists of the following preparations:

- FNU 1: two protein preparations, one garnish, three kinds of rice (parboiled, white and whole-grain rice), two kinds of beans (one of them can be replaced by soup), six kinds of salads, two kinds of fruit juices and, as dessert, fruit or pastry.

- FNU 2: two or three protein preparations (depending on the main course), two garnishes, two kinds of rice (white and whole-grain), black bean, pasta, plain "farofa", spicy toast, three kinds of salad, two kinds of juice, one fruit and one dessert.

The application of the theoretical model of ANSQ for purposes of evaluation of the nutritional and sensory characteristics of meat preparations was conducted in April, May and June 2011, when the production process of two beef preparations, two chicken preparations, and one fish preparation were observed in each FNU. Thus, it was considered a phase of assessment of the characteristics of the FNU and then the aspects directly related to the operational processes.[6,7] The system implementation stages, consisting of a detailed description of the preparation, construction of the preparation flow chart and a descriptive chart highlighting the stages, hazards, criteria, monitoring procedures, corrective actions, and records were not accomplished, once it was not the goal of this study.

The assessment of the FNUs characteristics considered aspects such as the number of meals produced, the distribution of the staff to meet the production demand, as well as the staff's qualification, the physical area and equipment, and how the information system is structured. The *Basic Guidelines for the Assessment of the Characteristics of a Meals Producing Unit* described by Proença et al..[6] were used.

For the assessment of the FNU's production process, forms were used to collect and record data for the implementation of the ANSQ described by Proença et al..[6] The forms help collect data for the evaluation of the procedures adopted in each stage of the production process, with information on the sensory characteristics and temperature at receiving, storage time, thawing temperature, standardized meat cuts, removal of apparent fats, standard amount of salt addition, use of mechanical, chemical and enzymatic means to tenderize meats, use of herbs, spices and other ingredients indicated to the kind of preparation, cooking time and temperature binomial, temperature control and quality of frying oil, and evaluation of the preparation by tasting it.

Results and discussion

An aspect that should be considered is the difficulty in applying the forms described by the authors[6,7] with respect to the criteria of temperature and time in the preparation stage. Although the indicators are specified, the sensory criteria may be different according to the restaurant's users, as well as the temperatures used may vary according to the equipment used. This limitation is also pointed out by Riekes.[7]

As a result, the criteria of observation in each stage were the same as those defined by Riekes[7] and Proença et al.[6], except for the indicator of the time and temperature binominal in the cooking stage (Chart 1).

Chart 1 – Time and temperature criteria for the classification of meats doneness in the preparation phase. Rio de Janeiro, RJ, 2011.

Classification	Temperature	Time
Grilled – Medium*	Between 60º.C and 70º.C	60 seconds
Grilled – Well done *	Between 70º.C and 80º.C	120 seconds
Grilled – Very well done*	Between 80º.C and 95º.C	>120 seconds
Roast – Medium	70º.C	-
Roast – Well cooked	76º.C	-

Source: Riekes, 2004; Proença e col (2005).

* For steaks with thickness not exceeding 1cm in electric grill at 180º.C

Characteristics of the Food and Nutrition Units (FNU)

In order to make the meals of the menu, both FNUs have appropriate equipment to perform the diverse dietary techniques of preparation. However, FNU 2 does not have the adequate number of equipment for the preparation of the menu, and occasionally there are delays in the distribution of the meals, because of overload in some equipment, for example the steak grill.

The FNUs have an operational staff sufficient to meet quantitatively the demand of services, with 11 employees in FNU 1 and 21 in FNU 2. The teams attend training courses oriented to the production of safe food every six months. The FNUs often organize training sections on hygiene and sanitation control [10,11], and topics such as dietary techniques, nutritional aspects, dishes decoration, etc., are not prioritized.

The existence of documented routines relating to the hygiene and sanitation control was identified (Standard Operational Procedures and Best Practices Manual). However, regarding the standard procedures for the execution of the menu, it was observed that in FNU 1 technical guidance sheets (TGS) were being developed and gradually implemented, while in FNU 2 the TGSs were all ready. But in both units oral communication, in loco, between nutritionist and the staff was more frequent.

TGS is an operational support management tool in which costs are calculated, handling methods are described, and the nutritional value of the preparation is also calculated. [12] The TGS delivers a nutritionally balanced menu and contributes to the assurance of standardized preparations. So, the use of TGS is of paramount importance, because it helps the nutritionist's assignment of promoting the employees' development and the consumers' good health, once it allows to identify the total energy value and the nutrients contained in each preparation. [3,12] Therefore, nutritionists and the staff should discuss how the preparations must be made and collaborate in the definition of purchase orders and daily requisitions, thus avoiding food shortages or surpluses.

Operational process for meat preparations

Standardized meat cuts

In both FNUs, meat was properly cut, i.e., transversally to the fibers, during the days of assessment. However, standard definition of the servings size occurred during distribution, and not in the pre-preparation stage. In the pre-preparation stage the meats are portioned in different sizes in FNU 1, servings are put into different containers, the smallest portions being served to the preschoolers, and the largest to the older students and employees. In FNU 2, because of the

availability of different distribution counters for the children from the first through the sixth grade and the others, meat servings are separate and the smallest portions are served to the preschoolers.

Non-standardized cuts and preparations cause difficulty in maintaining a quality standard[13], once it jeopardizes the definition of the preparation's nutritional information and cost, and may cause dissatisfaction of consumers with the preparations presentation.[7] So, it is advisable to adopt standardized servings during pre-preparation, even if different counters or containers are used for different ages when serving. Definition of the size of servings should be made trying to match the reference nutritional value that is appropriate to the age and the size of the servings expected by the users. Based on this definition, the employee in charge of pre-preparation would be able to perform this activity properly, and photographic records can be used as a support tool.

Temperature

Monitoring the foods temperature throughout the production chain is of paramount importance, not only to control microbial growth but also to determine the consistency and texture of the preparation. It was observed inadequate temperature in some stages of the production process in both FNUs.

In the receiving stage, fish and beef were delivered and received, in the days of assessment, outside the temperature range considered safe. In FNU1, the temperature at receiving is not routinely checked. Sometimes the temperature is measured after the supplier has left the unit, which does not allow returning the product at the time in case of any non-conformity. However, when an inadequate temperature is identified, the supplier is immediately communicated and the product is exchanged later. In FNU 2, although the operational staff is adequate in quantitative terms, i.e., total number of employees, there was not a stock clerk or an employee trained for the function, to receive the goods, which compromises the quality of the work performed. An administrative clerk performed the stock clerk's duties.

Riekes[7] points to the need of and adequate and effective control of temperature, as well as a sensory evaluation of the goods on receipt, as the first step of the quality control process, thus preventing problems of difficult solution.

At storage, only FNU 2 presented nonconformities. There is not sufficient equipment to maintain the storage temperature due to lack of space. As a result, in this FNU the meats are delivered in the same day that they will be consumed. However, the meats that require pre-preparation the day before are kept in a vertical freezer, and it was observed that this equipment couldn't hold the temperature below 5ºC.[14]

Meats thawing must be done at a temperature below 5ºC [14], which was not observed in the FNUs, and sometimes thawing was done using hot water. Although this procedure is not usual in the FNUs, it occurred in one of the days of assessment. The frozen meat was not removed from the fridge at the proper time to allow full thawing. In FNU 2, as mentioned before, there is not enough equipment and physical area to perform a safe thawing. This practice puts the food at risk, because temperature has a significant influence on the meat quality, not only microbiologically, but also regarding the nutritional and sensory aspects, due to the loss of some exudates and liquids that carry hydro-soluble proteins and juices that impart flavor to the preparation.[7]

In the preparation stage, the time and temperature binomial used in most cooking techniques was appropriate in both FNUs, i.e., the meat was cooked to golden brown and medium doneness. The times defined by the authors to describe the grilled meats as *medium rare, well done* and *very well done* (chart 1) were lower than those used in this study. On average, twice as much time was used in relation to these indicators. For roasts, the time adopted in this study was higher than the recommended one. However, despite the "roast chicken" preparation (FNU 2) had not been cooked as described by Proença[6] – "roast in preheated oven at 180°C, keep temperature around 200°C at the beginning of cooking and adjust to 150°C to obtain a light golden color" –, there was no loss in terms of appearance and texture, which shows the importance of every food service establish its quality criteria.

So, we suggest that every FNU first experiments the criteria indicated by the authors to determine its applicability of such criteria, and, if necessary, redefine them.

Removal of apparent fat

Removal of apparent fat is a procedure performed properly in both FNUs, thus reducing the ingestion of saturated fatty acids that cause blood cholesterol to rise.

Salt

The FNUs do not use salt detector to check the amount of salt existing in a preparation. The FNU 2 has a standardized amount of salt prescribed in the TGS, but it is not used because the TGSs are not available to the employees. Thus, the FNUs assess the salinity of the preparations by tasting them at the end of cooking.

The assessment of salt by tasting the preparation, although it is a common practice in the sector, many times is not the most appropriate method. According to Riekes,[7] there may be different

opinions, because subjective feelings and tastes are involved in the evaluation, which underlines the importance of an instrument to assess the amount of salt when in doubt.

If such device is not available, in addition to the authors' recommendations to have a group of evaluators tasting the preparations, to which salt would be gradually added, will indicate whether the TGSs should be available to the employees and ensure that the prescribed amount of salt will be observed, thus meeting the nutritional recommendations. Or yet, while TGSs are not used, a daily amount of salt may be specified by the nutritionist, based on nutritional recommendations, to be available to the staff and used in the diverse preparations.

Use of meat tenderizer

In FNU 1, Na UAN 1, although they use cuts of tender meat (tenderloin) they use commercial meat softeners because of the demand of users for tender meats. However, it is recommended that in addition to information to users, the softeners should be in an amount sufficient to make the tougher beef cuts more tender, such as chuck steak, flank steak.[7] And natural softeners, such as pineapple juice, papaya or marinades, as used in FNU 2, are also recommended.

Photographic records

Photographic records are not used as a current practice in both FNUs. This could be reference for the standardized servings of raw beef cuts and final preparations.

Oil

Overheated oils contain degradation products and polar compounds (polymers, dimers, free fatty acids, oxidized fatty acids). Oils with high contents of polar compounds cause irritation of the gastrointestinal tract, diarrhea, reduced growth, and in some cases death of animals in laboratories. [15]

Knowing the damages caused by oils with signs of saturation, control of such oils must be made in foodservices. In FNU 1, the quality control of frying oil is made by means of colorimetric strips to measure free fatty acids (FFA) concentration. But still, the oil was not discarded when the test indicated 2% FFA concentration, because the sensory characteristics of the food (breaded fish fillet), according to sensory evaluation, were not compromised. It is important to combine the use of strips with sensory analysis, but still some caution is required because, according to Riekes,[7] the colorimetric strips had 2% FFA concentration even when the frying oil was visibly

saturated, which makes us question the safety of these strips and reinforce the need to associate both measurements, as performed in FNU 1.

FNU 2 performs quality control by observing the sensory characteristics (color, odor, viscosity, smoke point, foaming, and the food appearance), and the frying oil is discarded when any alternation is observed.

Assembly and distribution

The addition of decorative effects for a better presentation of preparations and well-arranged foods in appropriate displays or utensils are used by both FNUs when assembling the dishes, and they also monitor the foods presentation throughout distribution.

Special care in serving well-presented preparations is considered important because they can awake feelings of esthetic nature that may be appealing, inviting the consumer to taste the meal and have extra pleasure when eating it.

Leftovers

The control of the amount of prepared, but not consumed foods is performed in both FNUs, in order to redefine the size of servings of the preparations, and also the nutritionists perform sensory evaluation of the meals. In both units, however, there is no control of the meals served, evaluation of the meals yields by the operational staff, formal degustation of the preparations, and evaluation of the users' satisfaction.

Regarding the use of additional elements, such as dressings or sauces, both FNUs use low caloric elements in their preparations and also use colorful elements with contrasting colors, but even so it was observed that in FNU 1 that melted butter was used in the preparation of the grilled steak to prevent food from looking dry.

Conclusion

The guidelines described in the ANSQ system for assessment of the sensory and nutritional characteristics of meat preparations proved to be an appropriate tool. Based on the information analysis, it was possible to identify aspects that can be improved in both FNUs.

Meat receiving, storage and thawing are steps of the production process that can be considered critical control points (CCP), once temperature inadequacies were found in these

stages compromising the sensory and nutritional aspects and as well as the hygiene and sanitary aspects. The cooking stage can also be considered a CCP due to the need of a better control on the use of salt and frying oil.

Based on the results found, the following corrective actions are suggested: a) improve the menu's planning to reduce equipment overload; implement and/or use technical sheets for a more efficient, rapid and standardized process; b) provide training to the meat handler and implement photographic records to standardize servings; select and train a stock clerk (FNU 2); d) implement and supervise the monitoring systems to control the time and temperature binominal further to the hygiene and sanitary requirements with specification of the binomial to assure nutritional and sensorial quality; e) define standard amount of salt specified in the technical sheets and taste meals with different amounts of salt; f) use of natural meat softeners (marinades, pineapple or papaya) only in tough meats (FNU 1); g) use of colorimetric strips to determine FFA concentration associated with assessment of oil characteristics, discarding it whenever recommended; h) promote degustation regularly and formally; perform evaluation of users' satisfaction.

It is worth noting that some of the above are not usual procedures in the FNUs, and in some situations these are related to external factors of difficult management by the nutritionist, such as inadequacies of equipment and supplier. But it is vital to identify them in order that corrective actions be developed and implemented for the process continuous improvement.

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