

# Temperature and exposure time of preparations distributed at lunch in a hospital Food and Nutrition Unit

## Temperatura e tempo de exposição de preparações distribuídas no almoço de uma Unidade de Alimentação e Nutrição hospitalar

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### ABSTRACT

A substantial number of people eat their meals away from home, in food and nutrition units (hereafter, FNU), so controlling the production of these meals is important to avoid cases of foodborne illness. Therefore, the observation of the binomial time and temperature of preparations is essential for the provision of safe food. Thereby, this study aimed to evaluate the temperature and the exposure time of preparations served in the cafeteria of a hospital FNU, located in the city of Maceio-AL, during lunchtime. To this end, a descriptive, cross-sectional study, was carried out, in which the temperatures of the preparations served and their exposure time at the beginning and at the end of the distribution were evaluated. A digital penetration thermometer was used. The temperatures obtained were compared to the values recommended by the Brazilian legislation in force. The data obtained were analyzed descriptively. 180 preparations were evaluated. The raw salad and the cooked salad had average initial and final temperatures above the recommended by the legislation. The desserts had average temperatures within the desirable range. The main dishes (meat) and side dishes (rice and beans) reached adequate average temperatures. The garnishments had a lower-than-expected average starting temperature and an adequate average final temperature. Vegetarian options for main dishes had inadequate temperature averages. It was concluded that most of the preparations had adequate temperature during distribution, however, some inadequacies were observed. Thus, the implementation of temperature control measures is indispensable at FNU.

**Keywords:** Collective food. Food safety. Temperature.

### RESUMO

Grande número de pessoas realiza suas refeições fora de casa, em unidades de alimentação e nutrição (doravante, UAN), sendo assim, é importante o controle da produção dessas refeições para evitar casos de doença veiculadas por alimentos. Portanto a observação do binômio tempo e de temperatura das preparações é fundamental para a oferta de um alimento seguro. Dessa forma, este estudo teve por objetivo avaliar a temperatura e o tempo de exposição das preparações servidas no refeitório de uma UAN hospitalar, localizada na cidade de Maceió -AL, durante o horário de almoço. Para isso, realizou-se um estudo descritivo, transversal, em que foram avaliadas as temperaturas das preparações servidas e o tempo de exposição dessas no início e ao final da distribuição. Utilizou-se termômetro digital de penetração. As temperaturas obtidas foram comparadas aos valores preconizados pela legislação vigente no Brasil. Os dados obtidos foram analisados de forma descritiva. Foram avaliadas 180 preparações. A salada crua e a salada cozida apresentaram as temperaturas médias iniciais e finais acima daquelas preconizadas pela legislação. As sobremesas obtiveram médias de temperatura dentro do desejável. Os pratos principais (carnes) e os acompanhamentos (arroz e feijão) atingiram temperaturas médias adequadas. As guarnições apresentaram temperatura média inicial abaixo do esperado e temperatura média final adequada. As opções vegetarianas do prato principal obtiveram médias de temperatura inadequadas. Conclui-se que a maior parte das preparações possuía temperatura adequada durante a distribuição, no entanto algumas inadequações foram observadas. Com isso, a implantação de medidas de controle da temperatura é indispensável na UAN.

**Palavras-chave:** Alimentação coletiva. Inocuidade dos alimentos. Temperatura.

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Received: December 30<sup>th</sup>, 2022.  
Accepted: May 12<sup>th</sup>, 2023.  
Published: July 17<sup>th</sup>, 2023.



## INTRODUCTION

Food and nutrition units (FNU) are responsible for a substantial part of the population's meals, since more and more people are eating out of their homes (Conzatti, Adami & Fassina, 2015). Data from the Brazilian Association of Collective Meal Companies indicate that in the year 2021 the collective food market provided 35.5 million meals/day (ABERC, 2022). Therefore, it is important to look carefully at the preparations produced in FNU, so that they are microbiologically safe and free from contamination (Silva, Boni & Schindwein, 2019), preventing or minimizing the risk of developing foodborne diseases - hereafter, FBDs (Pereira & Lemos, 2021).

According to the Ministry of Health (Brazil, 2022), FBDs are diseases in which food or water act as a vehicle for the transmission of organisms harmful to health or toxic substances. It is emphasized that food contamination can occur, among other situations, when preparations are exposed for long periods to inadequate temperatures (Carvalho, Ricardo & Moraes, 2012).

The control of the microbiological and hygienic-sanitary conditions ensures that such problems are avoided and, in this perspective, the control of the temperature and the exposure time of the food to this is fundamental in this process, ensuring the quality and safety of the meals, both in storage and in distribution to the consumer (Conzatti et al., 2015).

The temperatures recommended by the current legislation, having as reference the Resolution of the National Agency for Vigilance (ANVISA) RDC No. 216/2004, of September 15, 2004, must be respected in order to minimize risks to the health of the diners and to guarantee the integrity of the food (Sousa, D. M. Pereira & Pereira, 2019). Also, proper care must be taken with the temperature of the equipment, such as the distribution counters, in order for the preparations to be kept at adequate temperatures at the time of distribution. Therefore, the CVS ordinance No. 5 of 2013 sets criteria for the distribution of prepared food and establishes that the counters must be clean, with treated and clean water, changed daily and at an adequate temperature (from 80 °C to 90 °C) (CVS Ordinance No. 5, April 9, 2013).

This way, control measures of the time/temperature binomial, together with good food handling practices, must be obeyed so that there is no microbial multiplication in the food; ensuring not only the nutritional and sensory quality of the food, but also making the meal safe from the hygienic-sanitary point of view (Nascimento, Pontes, Sousa, Morais & Queiroz, 2017).

In this context, it is important to pay attention, inside an FNU, to the exposure time and temperature of preparations. In order to do so, aiming at the benefits for the diners and for the FNU itself, strict control measures must be adopted by the FNU, which will have more credibility in the market regarding the hygienic-sanitary quality of its

preparations/ food (Correa et al., 2017; Rocha et al., 2019; Sousa et al., 2019).

In face of the aforementioned, this study aimed to evaluate the temperature and exposure time of the preparations served in the cafeteria of a hospital FNU, located in the city of Maceio-Alagoas, during lunchtime.

## MATERIALS AND METHODS

This was a descriptive, cross-sectional study, carried out in a hospital FNU in the city of Maceio-Alagoas, which in its cafeteria serves residents and employees of the hospital. The FNU has a concession-based management system, employs 63 people, and, on average, serves a total of 400 meals per day at lunchtime, of which 250 are for patients and visitors, and 150 are for employees and residents. The menu for the cafeteria is of the intermediate type and it is divided into the categories shown in Table 1.

The variable of interest in this study is the temperature of the ready-to-eat foods/ preparations. The temperatures of the preparations were measured from Monday to Friday, except on holidays, during 15 days, at the beginning, starting at 11 a. m., and in the end of the distribution, at two p. m. The data collection period covered from 11/01/2022 to 11/23/2022. The data were gathered by the nutrition trainee.

To measure the temperatures, a BMAX® TP101 digital penetration thermometer was used, whose stem was introduced into the geometric center of the food, without touching the bottom of the container, until the temperature stabilized; the thermometer was cleaned and disinfected with a sheet of paper towel dampened in 70% alcohol before and after each measurement.

The temperature readings obtained were compared with the values defined in the RDC No. 216/2004, of September 15, 2004, and CVS Ordinance 5/2013, which determine that, after cooking, preparations that are consumed hot must be submitted to a temperature higher than 60 °C for up to six hours, and the preparations that will be consumed cold need to remain in the distribution at a temperature of 10 °C for a maximum time of four hours or between 10 °C and 21 °C for a maximum time of up to two hours. Furthermore, it should be noted that the temperatures of the equipment used to store the preparations awaiting distribution (pass through) were also analyzed and shall be: hot, minimum 60 °C and cold, maximum 5 °C (CVS Ordinance No. 5, April 9, 2013).

The data were gathered in spreadsheets and they were later typed into Microsoft Excel, in which a descriptive statistical analysis was performed. The daily averages of the initial and final temperatures of the preparations served were calculated, in which, for data analysis, they were divided into the following categories: entrees, main dishes, vegetarian options, side dishes, garnishments and desserts. Fruits were excluded from the sample.

**Table 1**

Menu items description related to lunch served in the cafeteria of a hospital food service unit in Maceio-AL, 2022.

Preparations	Item description
Entree	Type A vegetable salad, preferably raw Type B vegetable salad (raw OR baked OR boiled OR sauteed) Type C vegetable salad (raw OR baked OR boiled OR sauteed)
Side dishes	Type 1 rice (white OR parboiled AND brown) Carioquinha OR mulatinho OR black beans (with pumpkin, okra, maxixe, jerked beef) OR Green OR macassar OR black beans
Main dish	Prime quality beef AND optional OR Prime quality pork AND optional OR Prime quality poultry meat AND optional OR Prime quality fish meat (filet or steak) AND optional OR All-in-one feijoada AND optional OR Shellfish OR liver AND optional
Garnishments	Pasta (various cut types: farfalle, spaghetti, tagliatelle and pene) AND Flour (cassava, corn, wheat, soybean) OR Root/tuberous and type B vegetables (sweet potatoes, yellow potatoes; cassava, yellow carrots, cará, yam, winter squash AND their preparations (purée or cream) OR Savory pies OR soufflé OR Other flour-based preparations (pancakes, and so forth)
Complements	Fruit AND Fruit jam OR Paste-like candy with cheese OR Pudding (milk or fruit or bread) OR Ice cream OR gelatin OR mousse OR Sweet Pie Natural fruit juice or industrialized fruit pulp

Source: The authors.

## RESULTS AND DISCUSSION

The data referring to the temperature measurement of 180 preparations were evaluated for 15 days. In the hospital FNU, two to three tubs of each preparation were prepared per day, with the exception of main dishes, which corresponded to four tubs of each option and, in the case of vegetarian options, there were no refills.

The cafeteria was open daily with one tub of each preparation exposed on the distribution counter and the others (replacements) remained in a refrigerated pass through (cold preparations) and heated (hot preparations). Therefore, although the total operating time of the cafeteria corresponded to three hours, it did not correspond to the exposure time of the preparations, since, throughout the hours, replacements were made, on average, from thirty minutes to one hour after the beginning of the cafeteria opening, except for the vegetarian options (boiled eggs and textured soy protein), which remained exposed during the entire operation of the cafeteria, without replacements during the fifteen days of data collection. It can be seen that these vegetarian options remain during the entire distribution period at an inadequate temperature, offering risk to the consumer, since they are more prone to the proliferation of microorganisms. Still, it is noteworthy that the CVS Ordinance 5/2013 determines that foods/

preparations kept below 60 °C should be consumed within 60 minutes, which did not occur with the vegetarian preparations, which were exposed for three hours. At the distribution counter, the cold dishes were placed on a refrigerated counter and the hot dishes were placed in tubs on a heated counter, except for the vegetarian options, which were exposed on the edges of the counter at room temperature. This way of exposing the vegetarian options makes it exceed the exposure time limit of one hour, as aforementioned.

Table 2 shows the initial and final averages for the salads, the main dishes (meats), the vegetarian options, the side dishes, the garnishes, and the desserts.

A type of raw salad and a type of cooked salad that should be served cold (boiled or stewed vegetables) were served daily as entrees at the unit; these were exposed still hot on the refrigerated counter, so they did not reach the proper temperature. As for raw salad, with an average exposure time of one hour, it is noted that the initial and final average temperatures are above the recommended by the CVS Ordinance 5/2013 and this offer risk to users of the FNU. A similar result was found by Tonini, Silva, Moura e Gatti (2018), they found an average salad temperature of 22.6 °C when evaluating the average temperature of salads in a self service buffet restaurant.

**Table 2**

Temperature averages of the preparations served in the cafeteria of a hospital food service unit in Maceio-AL, 2022.

	Average initial temperature (°C)	Average final temperature (°C)	Target temperature <sup>1</sup> (°C)
Entree (raw salads)	23.6	21.4	10 – 21
Entree (cooked salads)	40.8	30.4	10 – 21
Main dishes	63.0	68.0	60
Vegetarian options	52.0	43.7	60
Side Meals	60.5	64.7	60
Garnishments	56.4	62.9	60
Desserts	11.3	8.6	10 – 21

Source: The authors.

Note. <sup>1</sup>RDC No. 216/2004 and CVS Ordinance 5/2013.

As for the cooked salads served cold, these were exposed still warm on the refrigerated counter, therefore, they did not reach the appropriate temperature. These salads were prepared at a time very close to the distribution time, on average, one hour before the start of the meal. As such, it did not go through the cooling process recommended in the RDC 216/ 2004, in which the temperature of the food/preparation should be reduced from 60 °C to 10 °C within two hours.

Thus, such preparation should, thus, be produced earlier. B. L. D. S. Nascimento, Leal e Nascimento (2022) also verified inadequate temperatures in cooked salads served by a commercial FNU in the state of Bahia, in which the average temperature was around 42.9 °C. Accordingly, the aforementioned authors point out that the volume of the tubs should also be observed so that cooling is achieved completely (Nascimento et al., 2022). This observation is also valid for the present study, since smaller volumes of preparations in the tubs can lead to faster cooling. A further important factor that favors the adequacy of the temperature of the cooked salad is that its pre-preparation must be started the day before. In this way, the preparation is kept longer under proper refrigeration (Silva & Melo, 2020).

The desserts had average temperatures within the desirable range (11.3 °C and 8.6 °C), since the exposure time, as well as for the salads and the other hot dishes served, did not exceed the time limit recommended by the CVS Ordinance No. 5/ 2013 (CVS Ordinance No. 5, April 9, 2013), given that it had a large clientele and, consequently, the preparations needed to be replenished throughout the operating hours of the cafeteria. Still, other studies bring similar results to those presented here for preparations served cold (Marinho et al., 2009; Carvalho et al., 2012; Monteiro et al., 2014; Conzatti et al., 2015).

The main dishes (meat) and side dishes (rice and beans) reached appropriate initial and final average temperatures, according to the CVS 5/2013 Ordinance. The garnishes, on the other hand, had average starting temperatures below expectations, but adequate final

temperatures. A justification for this was the fact that right, after the end of the process, these preparations remained at room temperature for a few minutes before being stored in the pass through, which was close to the distribution start time, and the preparations that were left for final replenishment stayed longer in pass through consequently raising the temperature.

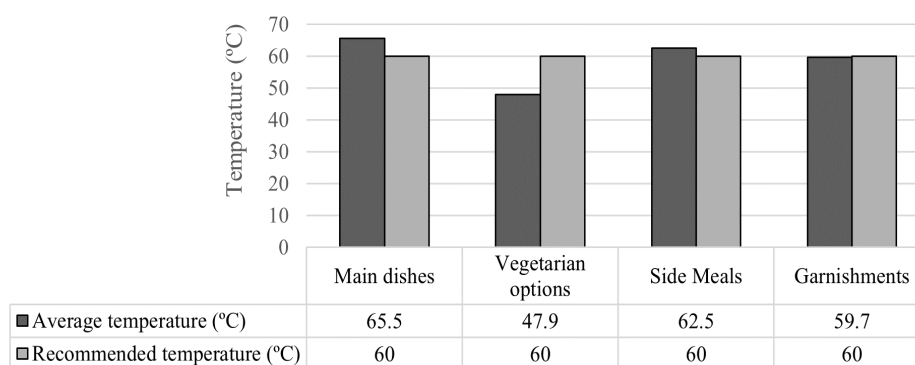
The vegetarian options (textured soy protein and boiled egg) did not have adequate temperature averages, due to the incorrect exposure of these foods on the counter, as mentioned above. It is noteworthy that, during the three hours of operation, the tubs with these preparations remained on the edge of the counter, without receiving the required heat to maintain the temperature, which occurred due to lack of space on the thermal counter. In other studies, similar results to these were found, however, for side dishes and garnishments (Nascimento et al., 2017; Tonini et al., 2018). These observations indicate that there should be more rigidity in following the good practices in FNUs, especially regarding the moment of food distribution, so that the adequate temperatures of the preparations are reached, but, in addition, the exposure time of the preparations should be monitored.

As for the equipment, the thermal counter had an average temperature of 65 °C; the hot pass through was 74.4 °C, however, it was out of operation for six days during the period of data collection, thereby being a limitation for the present study, and the cold one was 11.8 °C, which was inadequate according to CVS 5/2013 (CVS Ordinance No. 5, of April 09, 2013.), which designates for this hot equipment a minimum of 60 °C and a maximum of 5 °C for cold. Therefore, the importance of equipment maintenance is emphasized in all production stages, which must follow a strict temperature and maintenance control, in order to guarantee the quality and safety of the food (Wiethölter & Fassina, 2017).

Figures 1 and 2 show the average temperature of all the hot and cold preparations, confirming that, in most of the preparations, the temperatures are adequate taking into account the exposure time mentioned above.

**Figure 1**

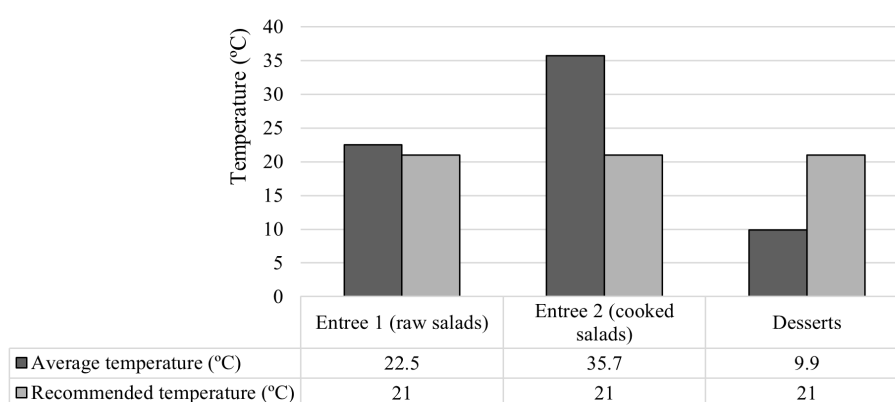
Average temperature of hot preparations served in the cafeteria of a hospital Food Service Unit in Maceio-AL, 2022.



Source: The authors.

**Figure 2**

Average temperature of cold preparations served in the cafeteria of a hospital food service unit in Maceio-AL, 2022.



Source: The authors.

As shown in Figure 1, the average temperature of the garnishes and vegetarian options did not meet the recommended temperature. However, the average temperature of the garnishes was adequate when the exposure time was analyzed, since even though the temperature was below 60 °C the exposure time did not exceed 60 minutes. For the vegetarian options, the same cannot be said. In Figure 2, which deals with the average temperatures of the preparations served cold, the average temperatures of salads (raw and cooked) did not match the expected range, that should be from 10 °C to 21 °C for a maximum of two hours, an interval considered safe (CVS Ordinance No. 5, April 9, 2013). This result only reaffirms what was presented in Table 2.

Regarding the non-compliance of the temperatures according to the legislation, some studies indicate several causes for inadequacies in the temperatures, which also apply to this study, such as Pinheiro (2010), which study demonstrates that the possible time that food remains in the vat of stainless steel before distribution and the absence of cooking up to the proper temperature are problems that bring possible health risks of the diner. Also, Penedo, Jesus, Silva, Monteiro e Ribeiro (2015) presented the lack of qualified staff, malfunctioning equipment and problems

in physical space as the main causes of failures in the control of time and temperature.

Based on the present data, it was verified the importance of controlling the temperature of both the equipment and the preparations served in FNU, considering that the concern with this aspect can guarantee, together with other attributes, the quality of the final meal offered to the consumer (Conzatti et al., 2015).

This study presented as a limitation the fact that the evaluation was performed on a relatively short number of days and it excluded holidays, although the production of meals was reduced for these days. However, the temperature measurements were performed by the nutrition trainee, following proper methods already available in the scientific literature, being this aspect was a strong point of the study.

## CONCLUSION

Given these considerations, it can be concluded that most of the preparations had an adequate temperature during distribution. However, the meals regarding the vegetarian option of the main course had temperatures outside the required standard by the legislation. This problem could be solved with the adequate exposure

conditions in the counters, ensuring that the food is safe according to the hygienic-sanitary standpoint. Thus, it is important that the FNU staff be aware of the time-temperature binomial in order to minimize the risk of

FBDs, but also to implement good practice measures focusing on this issue in the different stages of the meal production process, especially in the maintenance (waiting for distribution) and distribution stages.

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