Evaluation of the Temperature of Distribution and Analysis of Critical Control Points on a self-Service Restaurant of the City of Guanambi – BA

Avaliação da Temperatura de Distribuição e Análise de Pontos Críticos de Controle em um Restaurante *Self-Service* da Cidade de Guanambi – BA

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Abstract

Compliance with health legislation is important to ensure food safety in food production. The objective was to evaluate the time and temperature of distribution of hot and cold preparations, as well as to identify the critical control points of the stages of preparation of chicken salpicão, in a self-service restaurant in the city of Guanambi - BA. To evaluate the temperature of distribution, two hot preparations (whole rice and white) and a cold (mayonnaise salad) were selected, served daily in the restaurant. The measurements were taken with the aid of a thermometer, for 120 minutes, with an interval of one hour. Monitoring of the time and temperature were also evaluated in each operation (cooking, cooling and distribution) of chicken salpicão production, with subsequent identification of critical control points. It was found that the mayonnaise salad reached the cooling counter with a temperature above 10 ° C. Although it has been observed a reduction of this during the exposure time, the same was above as recommended by the legislation (up to 10ºC / 4 hours exposure). The white and whole rice presented adequate temperatures at the beginning of the distribution, 61ºC and 66ºC, respectively, with subsequent reduction of these. The cooking, cooling, mixing and distribution stages of chicken salpicão production were identified as critical control points because they present potential health risks to consumers when not properly performed. It is necessary an efficient monitoring and inspection by the responsible organs, in order to obtain the adequacy of the temperature of the foods offered to the consumers.
Keywords: Collective Feeding. Monitoring. Food Supply.

Resumo

O cumprimento às legislações sanitárias é importante para garantir a segurança alimentar na produção de alimentos. Objetivou-se avaliar o tempo e a temperatura de distribuição de preparações quentes e frias, bem como identificar os pontos críticos de controle das etapas de preparo do salpicão de frango, em um restaurante self-service da cidade de Guanambi – BA. Para avaliar a temperatura de distribuição foram selecionadas duas preparações quentes (arroz integral e branco) e uma fria (salada de maionese), servidas diariamente no restaurante. As medições foram feitas com o auxílio de um termômetro, durante 120 minutos, com intervalo de uma hora. Avaliou-se também o monitoramento do tempo e temperatura em cada operação (cocção, resfriamento e distribuição) da produção de salpicão de frango, com posterior identificação dos pontos críticos de controle. Verificou-se que a salada de maionese chegava ao balcão de refrigeração com temperatura acima de 10°C. Embora tenha sido observada uma redução desta durante o tempo de exposição, a mesma encontra-se acima do preconizado pela legislação (até 10°C/4 horas de exposição). O arroz branco e integral apresentaram temperaturas adequadas no início da distribuição, 61 ºC e 66 ºC, respectivamente, com posterior redução destas. As etapas de cocção, resfriamento, mistura e distribuição, da produção de salpicão de frango, foram identificadas como pontos críticos de controle por apresentarem riscos potenciais à saúde do consumidor quando não realizadas adequadamente. Faz-se necessário um acompanhamento e fiscalização eficiente por parte dos órgãos responsáveis, a fim de se obter a adequação da temperatura dos alimentos ofertados aos consumidores.

Palavras-chave: Alimentação Coletiva. Monitoramento. Abastecimento de Alimentos.

1 Introduction

The commercialization of food is becoming increasingly a market in ascension, since the convenience of *self-service* restaurants becomes a viable and routin option[1]. According to the Brazilian Institute of Geography and Statistics - IBGE[2], it is estimated that the Brazilians spend on average 25% of their income eating out.

According to the Brazilian Association of Collective Meals[3], it is evaluated that the market for collective meals in the year of 2016 has provided 11 million meals daily, moving 16.9 billion reais per year, in addition to offering directly 180 thousand jobs and a daily volume of 5.8 billion tons of food, which represents the governments a recipe of two billion reais per year between taxes and contributions.

Before the increasing appreciation of the sector, competitiveness and the requirement of the consumer regarding the health and nutritional quality of foods, it is important that the establishments, especially at restaurants with self-service distribution, adopt hygienic-sanitary measures in the whole production process of meals in order to avoid situations that might favor the contamination of food[4], from the implementation of good manufacturing practice laid

down in Resolution RDC No. 216, September 15th, 2004[5], which ensures the supply of meals within the legal standards.

The compliance with the Sanitary Legislation in force is critical to ensure food safety in food production, aiming to obtain information of important stages in the assessment of the conditions of preparation and distribution[6]. In this context, the monitoring and recording of the temperature distribution, in food services, can prevent cases of food toxinfections[7].

The occurrence of Foodborne diseases [8] has been increasing significantly on a global level and temperature is one of the main environmental factors that influence the microbial growth. The conditions of time and temperature distribution of food to the public must be carefully monitored, especially the frozen ones, once the exposure for prolonged periods at high temperature enables a rapid increase in microbial rate, representing a risk to consumer health[9].

Regarding the sanitary quality of meals in establishments intended for collective feeding, the implementation of the Hazard Analysis and Critical Control Points (HACCP) is an important tool in the control of time and temperature, by presenting as philosophy the prevention, rationality and specificity for control of risks that the food can offer[10].

In this context, the objective was to evaluate the binomial time and temperature of distribution of preparations such as whole rice, white rice and mayonnaise salad, as well as to identify identify the critical control points of the stages of preparation of chicken salpicão, in a self-service restaurant in the city of Guanambi - BA.

2 Material and Methods

The experiment was conducted in a self-service restaurant, characterized by receiving clients from different socioeconomic levels, the city of Guanambi- BA during the period from August to September 2014. It was initially made a proposal to the owner of the establishment, elucidating the research objectives and ensuring the fulfillment of ethical parameters, commitment to privacy and non-identification of the property researched.

The research was conducted in two moments. In the first stage two hot preparations were selected (white and whole rice) and a cold preparation (mayonnaise salad), served daily in the restaurant, these being evaluated for binomial time and distribution temperature. The monitoring was performed at the moment in which the hot and cold preparations were exposed in heating and freezing counters, respectively, during two business days of the week.

The measurements were performed with the aid of a digital thermometer type skewer, brand Minipa, with a range from -50 to +300 °C, this being inserted into the geometric center of the food, for approximately 10 seconds or until stabilization of temperature. The reading occurred for three hours (120 minutes), with an interval of one hour, registering the data into a spreadsheet for monitoring, for later analysis.

At each measurement the sanitization of the thermometer was performed with non-recyclable paper towel moistened in alcohol 70%, in order to avoid cross-contamination.

The results were analyzed according to recommended temperatures by Resolution RDC No. 216, dated from September 15th, 2004 being considered adequate when temperature was above 60°C for conservation hot and below 10 °C for frozen foods[5].

The second stage of the experiment was performed from the evaluation of the production of chicken salpicão, through the elaboration of a processing flowchart. The analysis consisted of checking the production operations and monitoring of the binomial time and temperature (as described in the first step) of specific steps of this process. The monitoring was performed during a normal flow commensal customer, observing precautions relating to the work area, kitchenware and hygiene of food handlers. It was evaluated carefully the possibility of contamination of salad by monitoring the time and temperature in each operation (cooking, cooling and distribution). Critical control points (CCP's) were subsequently identified, from the processing flowchart drawn, and proposed the critical limits for them, as well as the procedure for monitoring and corrective actions.

The results obtained were evaluated by means of frequency analysis, using the software Microsoft Excel 2010®, version for Windows 8 and confronted with legislation in force[5]. It was made available to the owner of the establishment, after analysis of the results, reports with the results and the actions to be taken to improve the quality of services.

3 Results and Discussion

According to the results obtained, it was observed that the temperatures of distribution, in relation to the exposure time, ranged between 18 and 22°C for the mayonnaise salad (Figure 1).

Figure 1 - Temperature distribution of mayonnaise salad as a function of exposure time in a self-service restaurant type from Guanambi- BA, 2014.
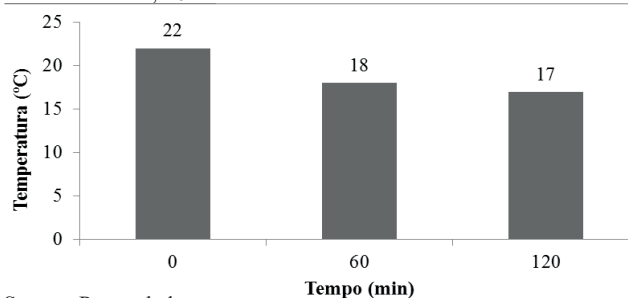
Source: Research data.

In accordance with the RDC No. 216[5], cold preparations should remain exposed in cooling counters for a period of four hours at a maximum temperature of 10 °C for two hours, for temperatures between 10 and 21 °C, recommending the replacement of meals with temperature above 10 °C in up to two hours. While temperatures above 21 °C, the food should

be immediately discarded.

It was found that the preparation came to the cooling counter with high temperatures (above 10 °C). Although a reduction in temperature at the time of exposure was observed, the same is above the recommended by the legislation. Mayonnaise-based foods become potentially dangerous in the absence of rigorous control of temperature, representing a risk to the health of the consumer due to the possible presence of *Salmonella spp*[11] being recommended maximum storage temperature of 4 °C and time of exposure risk at a temperature not exceeding 30 minutes[5].

According to Seixas[12], the inclusion of mayonnaise in the food preparation can exert influence on the microbial development, by presenting in its composition ingredients such as oil, vinegar and eggs. Although the egg (white) presents unfavorable pH (9.0 - 10.0) and compounds (lysozyme) potentially capable of inhibiting and/or destroying microorganisms, even according to Seixas[12], in function of its nutritional properties acts as a culture medium, allied to the lack of hygiene of food handlers of the product puts at risk the health of the consumer.

Oliveira *et al.*[13] found similar results when evaluating the temperatures of preparations served in self-service restaurants of hipercentro of Belo Horizonte - MG. Whereas Pignata *et al.*[14], observed values between 3.5 and 6.3 °C by analysing the temperature distribution of mayonnaise salad in a restaurant in Una - BA.

Concerning the hot preparations, it was observed that the white and whole rice came to the heating counterat appropriate temperatures and over time of distribution, there was a reduction of the same (Figure 2). It was also found that both preparations showed lower values to 75ºC, desirable characteristic, once that foods with temperature above this value begin to lose exudate and, consequently, nutritional value[15].

Figure 2 - Temperature of distribution of hot dishes (whole and white rice) as a function of exposure time in a self-service restaurant type from Guanambi- BA, 2014.
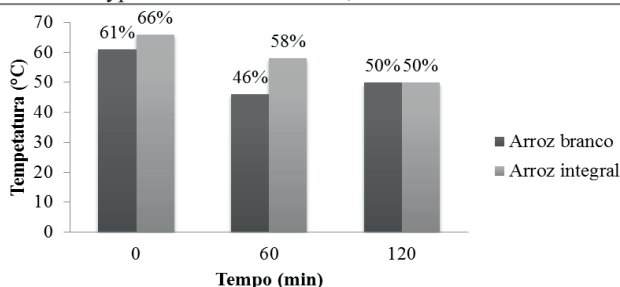
Source: Research data.

According to DRC no. 2165, for hot conservation,foods should be subjected to a temperature above 60 ºC to remain exposed for a maximum period of 6 hours, while hot dishes with temperatures below 60 °C, the recommended time of exposure is a maximum of 3 hours. It was observed in this study that the food analyzed were tat distribution counter for

3 hours and 30 minutes.

Santos and Bassi[16] found a rate of non-compliances of 87.5% in temperature distribution of rice served in units of food and nutrition in the city of São Paulo - SP. According to Pignata *et al.*[17], the use of heat in food conservation aims to promote the microbiological quality, to satisfactory levels. Thus, if the food remains exposed in a given time period at inappropriate room temperature, the environment becomes favorable to the bacteria development.

The temperature of hot preparations, such as rice, becomes important to guarantee product quality and consequent safety to consumer health. Cereals, particularly rice, presents a potential source of contamination by *Bacillus cereus*, responsible for the emetic syndrome. The deficiency of cooking temperature during the preparation of this cereal, associated to inadequate temperatures of distribution hinders the spread of heat, and the chances of destruction of the spores of this organism, which in favorable conditions, will germinate favoring the rapid multiplication of resulting vegetative cells[18].

Based on the elaboration of the flowchart of the steps of salpicão processing it was possible to observe the critical control points present in each phase of the process, which were identified in steps of cooking, cooling, mixing and distribution.

It was considered the step of cooking a CCP, since the time of exposure of foods to inappropriate temperatures directly influences the development of pathogenic microorganisms. According to the Normative Instruction no. 4, December 15th, 2014[19], the heat treatment must be sufficient to ensure that all parts of the food reaches a minimum temperature of 70 ºC for 15 minutes, emphasizing that lower temperatures can be adopted since the control of the binomial time and temperature ensures the hygienic-sanitary quality of foods.

It was found that the establishment examined does not comply with the relevant standards for the temperature and time of cooking, observing values below 70 °C for 10 minutes (Table 1), since it does not make use of this practice during the preparation of the meals served daily. As a preventative measure, it was suggested to those responsible for this step the use of a thermometer to measure the geometric center of the food, adopting temperatures higher than the observed, otherwise reheat food until it reaches 70 ºC with maintainance of the same for a period of 15 minutes.

Table 1 - Averages of cooking temperatures, cooling and distribution of the chicken salpicão served in a restaurant type self-service from Guanambi - BA, 2014.

Step	Temperature (°C)	Coefficient of variation (%)
Cooking	58 ± 3.1	5.3
Cooling	22 ± 1.6	7.3
Distribution	20 ± 1.8	9.0

Source: Research data.

One of the main causes of the occurrence of food toxinfections is related to the deficiency of control of time and

temperature in the processes of cooking, cooling, processing and storage of food[20]. Therefore, the cooling was considered a critical control point because it is a step in that it is possible to reach temperatures capable of inhibiting the action of pathogenic microorganisms.

In accordance with RDC No. 2165, at this stage the food temperature should be reduced from 60 to 10ºC for approximately two hours and should be kept under refrigeration at temperatures below 5 ºC, enough to minimize the risk of cross-contamination and microbial multiplication. This recommendation was not complied by the restaurant researched, observing the average value of 22 ºC (Table 1).

Also, it was found that the cooling temperature of chicken salpicão has increased risk of physical and microbiological contamination, due to having occurred at room temperature without protective cover. A similar result was observed by Bosco and Téo[21], upon assessing the hazards and critical control points in the production of mayonnaise salad with potatoes in commercial restaurants of the city of Toledo - PR.

From the results obtained in this step, it was recommended to the responsible of the kitchen to reduce the cooling temperature and measure the same with the help of a thermometer, keeping the food properly stored. As corrective action, according to Bosco and Téo[21], it is required to accelerate the cooling with the aid of an ice bath, or store in the freezer, or still keep the dish only for two hours in the distribution step.

The person responsible for food handling must have minimum knowledge on good manufacturing practices, hygienic preparation of food, food contaminants and toxinfections, without prejudice to cases where there is legal provision for technical responsibility[5]. In this sense, the step of mixture was considered a CCP due to excessive handling of the product during the preparation.

The manipulation of food and the contact with other utensils, as well as the inclusion of *in natura* ingredients to the mix enables the contamination by pathogenic microorganisms[22]. According to Seixas *et al.*[12], in self-service restaurants microbiological contamination usually arises from improper handling and distribution, being many the pathogens that cause diseases, most commonly *Staphylococcus aureus*.

Many individuals are nasal carriers of *Staphylococcus aureus*, or feature this microorganism on the skin. In case they work with the food manipulation they become important sources of contamination, and potential cause of food poisoning[23], stressing the importance of the use of individual protection equipment to guarantee the quality of the food and food safety.

For not having been evaluated, the count of those microorganisms in the hands of food handlers involved in the salpicão preparation, it is not possible to predict the existence of such contamination. However, the employees were instructed regarding the probable contamination, by being present in the mucous membranes and respiratory apparatus of man, as well

as the adoption of good manufacturing practices throughout handling of food, including mixing, it is recommended to control the manipulation and the temperature of exposure, and the product ready to be kept under refrigeration after performing the same.

In relation to the temperature distribution, it was observed that the product ready came to the heating counter with an average temperature of 20 °C (Table 1), remaining exposed during 3 hours and 30 minutes, above the maximum time required by the legislation in these conditions, should not exceed two hours of exposure when the temperature is between 10 and 21 ºC[5]. For these characteristics, it was assigned to the stage of distribution with a critical control point, because during this phase it can promote the development of pathogenic microorganisms and their spored forms[24].

The data obtained in the present study corroborate with the ones observed by Alves and Ueno[25], to evaluate the temperature in the distribution of cold food served in self-service restaurants in the municipality of Taubaté - SP, being verified the temperature above 21 ºC. In these conditions, the authors observed a count of *Staphylococcus* coagulase positive of 9.85×10^4 CFU/g, above the limit recommended by the legislation (10^3 CFU/g).

Medeiros *et al.*[22] upon assessing the perception on the hygiene of food handlers in the university cafeteria, observed that the cross-contamination and consequent contamination of food stems from the serious distortion between a possible knowledge about correct hygienic-sanitary practices in the work environment, and improper habits of the food handler.

The exposure time is an important factor in respect to food-borne diseases, since the microorganisms can develop in conditions of appropriate substrate, temperature and time, to levels considered hazardous[26,27]. Thus, it was suggested that those responsible for the activity to adopt the practice of food monitoring at the beginning of the distribution and 1/3 before the end of the same, as well as carry out the disposal of the product, if the same does not satisfy the criteria of time and temperature recommended by current legislation[5].

4 Conclusion

Hot preparations reached the exposure counter with appropriate temperatures, but it was not maintained until the end of the distribution. Whereas the cold food went to cooling counter with temperature above the minimum permitted by legislation, remaining exposed for 3 hours and 30 minutes.

The results of this study demonstrate that salpicão is not being adequately prepared for the processes of cooking, cooling, mixing and distribution, as foreseen in the Brazilian legislation. Due to being a public interest subject, it is necessary an efficient monitoring and inspection by the responsible organs, in order to obtain the adequacy of the foods temperature offered to the consumers.

The control of the binomial temperature and time represents an effective tool in ensuring food security, since,

when controlled correctly can inhibit or even destroy microorganisms present in food. Thus, from the analysis of other preparations and the control of temperature and time of exposure, the restaurant analyzed can guarantee security with the harmlessness of preparations.

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