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Sanitary hygiene conditions, structural and operating in Units of Food and Nutrition

Condições higiênico-sanitárias, estruturais e de funcionamento de Unidades de Alimentação e Nutrição

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ABSTRACT

The study aimed to evaluate hygiene and sanitary conditions as well as structural and operational aspects in food and nutrition facilities and to identify possible factors associated with unsatisfactory conditions. In order to achieve this, the study used data obtained from auditing processes developed at food suppliers based in Rio Grande do Sul. The sample consisted of 148 auditing processes between July 2014 and June 2015. Regarding the results, low overall scores and high frequency of unsatisfactory hygienic conditions were observed in almost all research modules. As for the aspects investigated, it was found that longer operating time and better conditions of the facilities and buildings were associated ($p<0.05$) with better overall scores for the largest part of this module. Considering the results presented, it is clear that the institutional foodservices evaluated generally displayed unfavorable sanitary conditions, a fact that may compromise the safety of food prepared in these places. Thus, auditing plays in important role in making the conditions of these places more suited to proper levels as they pinpoint the non-conformities and provide information that can be used to implement improvements, which directly contribute to the prevention of cases of foodborne diseases.

KEYWORDS: Food Services; Food Hygiene; Quality Control; Nutrition and Public Health; Sanitary Surveillance

RESUMO

O estudo teve como objetivo avaliar as condições higiênico-sanitárias, estruturais e de funcionamento de Unidades de Alimentação e Nutrição (UAN) e identificar possíveis fatores associados às condições insatisfatórias. Para isso, foram utilizados dados de auditorias, pertencentes a uma concessionária de refeições coletivas, instalada no Rio Grande do Sul. A amostra foi composta por avaliações de 148 UAN, distribuídas em todas as regiões do Estado gaúcho, entre julho de 2014 e junho de 2015. Em relação aos resultados, baixas pontuações gerais e altas frequências de condições insatisfatórias foram observadas em praticamente todos os módulos de investigação. Quanto aos aspectos considerados, identificou-se que maior tempo de funcionamento e melhores condições de instalações e edificações estiveram associados ($p < 0,05$) a pontuações médias mais elevadas, na maior parte dos módulos avaliados. Diante dos resultados encontrados, percebe-se que as UAN apresentaram condições higiênico-sanitárias desfavoráveis, fato este que pode comprometer a segurança dos alimentos preparados nestes locais. Assim, auditorias auxiliam no processo de adequação das condições nestes estabelecimentos, uma vez que apontam as inconformidades, fornecendo informações que podem auxiliar na realização de ações de melhorias, as quais contribuem na prevenção das ocorrências de Doenças Transmitidas por Alimentos.

PALAVRAS-CHAVE: Serviços de Alimentação; Higiene dos Alimentos; Controle de Qualidade; Nutrição em Saúde Pública; Vigilância sanitária

INTRODUCTION

Food and Nutrition Units (FNUs) are structures belonging to the public food sector, usually located in companies, serving specific clientele, whose purpose is to manage the production of meals, while maintaining hygiene and sanitary standards in food storage, production and distribution for consumption. Thus, they contribute to the maintenance or recovery of the health of the public[1].

The concern with the sanitary and nutritional quality of foods makes establishments seek to stand out by improving the quality of the offered products and services. The control of hygiene and sanitary conditions where food is prepared is a critical point, since contamination from different sources can be introduced in the various preparation stages[2]. Thus, food safety is a major concern and carrying out measures to prevent contamination of meals at different production stages is necessary, since foodborne diseases propagate very rapidly and with high pathogenicity[3].

Foodborne diseases are clinical occurrences resulting from the consumption of food that may be contaminated with toxins from pathogenic microorganisms, chemical substances, harmful objects, or containing naturally toxic elements; that is, diseases that occur from the intake of chemicals, biological or physical hazards in food[4]. Studies point out that storage during preparations in inadequate temperatures and poor hygiene of the area are the main causes of foodborne diseases. They are associated with a significant incidence of pathologies, contributing to the increase of morbidity and mortality rates in the human population, representing part of the high health costs in the global economy[5,6].

The hygiene, sanitary, structural and operating conditions of food production areas, as well as the way in which food is handled, may directly affect their microbiological quality[7].

In this regard, strategies that can assess, in all aspects, the conditions of these environments are necessary. A widely-used tool in the area of public foodservices is the checklist, which allows for a preliminary assessment of the conditions of an establishment, diagnosing nonconforming items and outlining corrective actions in order to fit the requirements and reduce the risks that may compromise the food and diners' health[8]. Therefore, adopting a step-by-step control program makes it possible to analyze and evaluate food preparation throughout the whole process, from receiving the raw material to the final product[9]; thus auditing is a management method used to evaluate the improvement actions related to a quality system. This process constructively assists in the resolution and prevention of problems, in which, through these audits, data are collected so that corrective actions can be taken, guaranteeing the continuous improvement of the institution[10,11].

Considering the relevance of the topic, and the lack of studies involving the characterization of FNUs in Rio Grande do Sul, and factors related to sanitary inadequacies, especially with regard to the chosen methodological design and the high number of analyzed Units, this study aimed to evaluate the hygiene, sanitary, structural and operating conditions of 148 institutional foodservices and to identify which factors were associated with unsatisfactory conditions, through data collected from auditing by a food supplier, in Rio Grande do Sul.

METHOD

Study design and sample process

This was an observational study with a cross-sectional design with secondary information obtained from the database of a private foodservice company in the State of Rio Grande do Sul.

The study consisted of the auditing of 148 institutional foodservices in all regions of the State of Rio Grande do Sul from July 2014 to June 2015.

Data collection

Information was collected from a database built with the application of a self-assessment tool by the food supplier that was also responsible for auditing the FNUs.

The evaluation tool had 152 items, separated into nine modules, namely, receiving and storing goods (M1); organizing and cleaning the kitchen (M2); organizing and cleaning the restaurant (M3); facility conditions (M4); production and manipulation process (M5); distribution and service (M6); labor relations (M7); documentation and legislation (M8); and facility and building conditions (M9), the latter being the client's responsibility. The legislations that guided the the evaluation tool were RDC No. 216/04[12] and RDC No. 275/02[13] of the National Health Surveillance Agency, Ordinance No. 78/09 of the Health Secretariat of Rio Grande do Sul[14]. All evaluated items were classified according to the criteria: "conforming", "nonconforming" and "not observed".

An external auditor applied the data collection instrument in the FNUs once, during business hours, on a visit to the restaurant without prior notice. The person in charge of the establishment followed up after the audit, to understand the noted nonconformities. Each audit lasted an average of eight hours and, finally, all items were tabulated in a spreadsheet in Excel, along with the observations describing the nonconformities.

Thus, each audit generated individual scores for modules and the overall score (weighted mean for all nine modules).

As exposure variables, through the records of the food suppliers, the following information was collected for each FNU: population of the city where it was located (variable collected and analyzed in a continuous and categorized form, taking into account the mean value in £196,739 inhabitants and ^{3} 196,740 inhabitants), operating time (in continuous years and categorized the tertile values of < 5 years; between 5 and 10 years; > 10 years), availability of meals – serves lunch, dinner and supper (categorized as yes/no), total meals served daily (collected continuously and categorized the tertile values of £ 84; between 85 and 177; ^{3} 178), presence of a nutritionist acting as site supervisor (categorized as yes/no) and conditions of facilities and buildings (unsatisfactory/satisfactory). The categorizations for continuous variables followed criteria presented in the analysis of median values or of the 25th and 75th percentile.

Statistical analysis

After capturing the auditing results, items that were not related to the hygiene, sanitary, structural and operating conditions were excluded, such as items of decoration, taste and consistency of the preparations, filling out of a timecard and team assistance.

Descriptive statistics were first conducted through the central tendency (mean and median) and the dispersion measures (standard deviation, 75th and 25th percentile, maximum and minimum values) for continuous variables, and through the distribution for categorical frequencies.

Subsequently, scores were estimated for each module, considering the total number of items in the module to be equal to 100% and calculating the score that the "conforming" items represented. Thus, each audit could receive a score between 0 and 100 points, for each evaluated module.

The outcome, hygiene, sanitary, structural and operating conditions were also evaluated in a dichotomous, satisfactory and unsatisfactory manner, which, in order to obtain a positive classification, they needed to achieve a result equal to or greater than the 75th percentile, since the median value (50%) did not guarantee adequate conditions, in accordance with RDC No. 216/04[12], RDC Nº. 275/02[13] and Ordinance No. 78/09[14].

For the means comparison and possible identifications of significant differences, the Student t-test and ANOVA were applied. A significance level of 5% ($p < 0.05$) was used for all analyses to identify significant differences between the investigated characteristics. The construction of the final database and the statistical analyses were performed through the SPSS Statistic Data 20 program (Statistical Package for Social Sciences – Chicago, IL, 2008).

Ethical aspects

The Research Ethics Committee evaluated and approved the study project, according to Resolution No. 466/12 of the National Health Council, under Opinion No. 1,324,384 and CAAE: 50654815.2.0000.5668. The concessionaire responsible for the database containing information from the audits, through the signing of a letter of consent, provided the necessary data to carry out the study.

RESULTS

Table 1 shows the descriptive results by modules, and overall. The average score for the set of nine modules was 65.5 points. The standard deviations with high values characterize a very heterogeneous set of results, observed by the extreme values in the maximal scores (100 points) and minimum scores (0 points). Individually, the modules with higher and lower average scores were, respectively, 4 (facility conditions with 81.5 points) and 1 (reception and storage of goods with 54.9 points). Distribution and service (M6) and labor relations (M7) had scores slightly higher than 70 points. Organizing and cleaning the kitchen (M2), documentation and legislation (M8), and facilities and buildings (M9) had scores between 56 and 58 points, below the median value.

The satisfactory evaluation frequency, by modules and overall, is represented in the Figure. All modules showed high percentages of unsatisfactory evaluation, except for module 6 (distribution and service), which showed 55.4% of FNUs with a satisfactory classification. It is also worth noting the overall score for all modules, with only 25% satisfaction with conforming observations.

Table 2 shows the main characteristics of the general aspects of the investigated FNUs, as well as the frequency distribution. Operating time of less than five years, low presence of nutritionists and unsatisfactory facilities and buildings were the variables with the most significant results.

Table 3 shows the overall score averages, and for each module in relation to the characteristics observed in the FNU.

Regarding the location, the units in more populated cities had better averages in the conforming score, with statistical significance for module 2 (organizing and cleaning the kitchen), module 3 (organizing and cleaning the restaurant), 4 (facility conditions), 5 (production and manipulation process), and module 9 (facilities and buildings) and overall score (Table 3) ($p < 0.05$).

The association between the FNU's operating time and the score average showed similar behavior in all evaluated modules, in which the longer the FNU had been operating, the higher the mean conforming score. Modules 2 (organizing and cleaning the kitchen) and 5 (production and manipulation process) and overall score (Table 3)

Table 1. Measures of central tendency and dispersion, in relation to scoring, by modules, in the 148 FNUs. RS, 2016.

Modules	Mean (SD)	Median	P75*	P25*	Maximum	Minimum
Receiving/storing of goods (M1)	54.9 (15.4)	57.2	71.5	42.9	100	14.3
Organizing and cleaning the kitchen (M2)	56.9 (19.3)	60	73.3	44.2	96.7	3.3
Organizing and cleaning the restaurant (M3)	64.7 (15.0)	64.3	76.2	54.7	97.6	28.6
Facilities conditions (M4)	81.5 (13.9)	87.5	87.5	75	100	25
Production and manipulation process (M5)	66.8 (17.2)	70	80	60	100	20
Distribution and service (M6)	75.3 (29.4)	100	100	50	100	0
Labor relations (M7)	73.4 (25.8)	66.7	100	66.7	100	0
Documentation and legislation (M8)	58.3 (22.2)	60	80	40	90	10
Facilities and buildings (M9)	57.5 (26.0)	62.5	75	37.5	100	0
Overall Score (OS)	65.5 (12.7)	66.9	75.6	58	97.5	29.6

M: module; SD: Standard deviation; *Percentile 75 and 25.

showed higher average scores in the categories with greater years of FNU operation, being statistically significant ($p < 0.05$).

Those FNUs that did not serve dinner and supper showed higher averages in all modules of the auditing; these values were significant in modules 3 (organizing and cleaning the restaurant) and 5 (production and manipulation process) and overall score (Table 3).

The number of meals served daily showed no behavior pattern and only module 8 (documentation and legislation) showed a difference between averages ($p < 0.05$), in which the more meals that were served, the higher the average score.

Regarding the presence of nutritionists, there were no significant associations between their presence or absence and the averages of scores of the evaluated aspects in the FNU.

Finally, in relation to the variable facilities and buildings, those FNUs established in places with satisfactory classification showed higher averages for all modules, with module 3 (organizing and cleaning the restaurant) and the overall score (Table 3) showing statistically significant differences ($p < 0.05$).

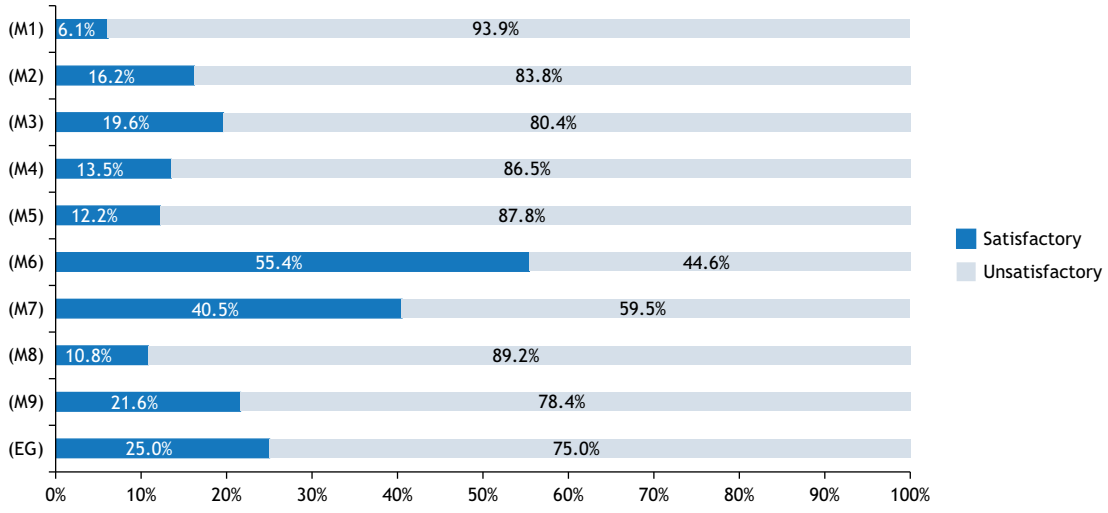
DISCUSSION

In relation to the instrument used to evaluate hygiene, sanitary, structural and operating conditions, evaluation tools that follow a checklist adapted from the legislation have increasingly been used[12-14]. These tools measure, in steps, the environment from storage to handling, and to the final product disposal. Thus, they provide a diagnosis, enabling the development of actions that help in the resolution of possible nonconformities. Spinelli et al.[15], in a study conducted in commercial restaurants in the central and southern regions of São Paulo city, also used their own checklist, adapted from DRC No. 216, of September 15, 2004[12], to evaluate and compare the good practices of these establishments.

In our study, in terms of the satisfactory classification of audited modules, a value equal to or greater than the 75th percentile was used, as it is believed that FNUs should constantly strive for excellence with regard to good practices and the guarantee of hygienic and sanitary conditions. In general, with the scores

Table 2. Distribution of exposure variables in relation to investigated FNUs. RS, 2016.

Variables	N	%
Population		
≤ 196.739 inhabitants	76	51.4
≥ 196.740 inhabitants	72	48.6
Time of FNU (years)		
< 5	50	42.0
5 to 10	41	34.5
> 10	28	23.5
Lunch		
Yes	148	100.0
No	0	0
Dinner		
Yes	77	52.0
No	71	48.0
Supper		
Yes	25	16.9
No	123	83.1
Total meals served/day		
≤ 84	37	25.0
85 to 177	37	25.0
≥ 178	74	50.0
Nutritionist		
Yes	86	41.9
No	62	58.1
Facilities and buildings		
Unsatisfactory	111	75.0
Satisfactory	37	25.0



OS: Overall Score
* For the "satisfactory" criterion, we used a value equal to or greater than that presented in percentile 75.

Figure. Distribution of frequency of satisfaction regarding the evaluated modules. RS, 2016.

Table 3. Score value averages, according to exposure variables in 148 Food and Nutrition Units (FNU). RS, 2016.

variables of exposure	M1		M2		M3		M4		M5		M6		M7		M8		M9		OS	
	Mean	p-value	Mean	p-value	Mean	p-value	Mean	p-value	Mean	p-value	Mean	p-value	Mean	p-value	Mean	p-value	Mean	p-value	Mean	p-value
Population		0.119*		**0.003***		**0.012***		**0.046***		**0.001***		0.485*		0.353		0.202		**0,018**		**0,003**
≤ 196.739 inhabitants	53		52.4		61.7		79.2		62.5		73.7		71.5		56.1		52,6		62,5	
≥ 196.740 inhabitants	56.9		61.6		67.9		83.8		71.4		77.9		75.5		60.7		62,7		68,6	
Time of FNU (years)		0.718*		**0.014***		0.219*		0.346*		**0.002***		0.267*		0.064		0.092		0,693		**0,012**
< 5	53.2		51.2		62.1		80		60.8		72		67.3		54		58		62,1	
5 to 10	53.7		60.1		65.2		84.1		71.7		81.7		78.1		62.2		62,5		68,8	
> 10	56.1		63.9		69		82.1		73.2		78.6		79.8		63.6		60,7		69,7	
Lunch		-		-		-		-		-		-		-		-		-		-
Yes	54.9		56.9		64.7		81.5		66.8		75.3		73.4		58.3		57,5		65,5	
No	-		-		-		-		-		-		-		-		-		-	
Dinner		0.285*		**0.018***		**0.029***		0.301*		**0.006***		0.092*		0.734		0.768		0,676		**0,043**
Yes	53.6		53.3		62.1		80.4		63.1		71.4		72.7		57.8		56,7		63,5	
No	56.4		60.8		67.5		82.8		70.9		79.6		74.9		58.9		58,5		67,7	
Supper		0.146*		0.082		**0.017***		0.252*		**0.037***		**< 0.001***		0.081		0.175		0,152		**0,004**
Yes	50.9		50		57.9		78		60		54		65.3		52.4		50,5		57,7	
No	55.8		58.3		66.1		82.2		68.2		79.7		75.1		59.5		58,9		67,1	
Total meals served/day		0.864*		0.099		0.38*		0.858*		0.126*		0.771*		0.234		**0.046**		0,926		0,995
≤ 84	54.1		61.9		67.7		81.8		71.6		74.3		67.6		51.4		58,8		65,5	
85 to 177	56		58.1		63.9		82.4		66.5		72.9		77.5		57.3		56,4		65,7	
≥ 178	54.8		53.7		63.6		80.9		64.6		77		74.3		62.3		57,4		65,4	
Nutritionist		0.836*		0.233		0.778*		0.327*		0.829*		0.686*		0.739		0.067		0,397		0,97
Yes	55.2		55.2		64.4		80.5		67.1		76.2		74		61.2		55,9		65,5	
No	54.6		59.1		65.1		82.9		66.5		74.2		72.6		54.4		59,7		65,4	
Facilities and buildings		0.236*		0.22		**< 0***		**0.001***		0.269*		0.067*		0.668		0.42		-		**< 0,001**
Unsatisfactory	54.1		54.9		62.2		79.7		65.9		73.3		72.9		57.6		-		63,2	
Satisfactory	58.1		63.9		73.9		87.9		70		82.8		75		60.9		-		73,8	

*p-value: T-test and ANOVA; Bold values are statistically significant (p < 0.05).
There are no overall results given in this table but this is discussed and referred to in the body copy - authors need to add overall scores to this table.

obtained in the nine modules evaluated, almost all of them showed an unsatisfactory result, which was also evidenced in the study by Mello et al.[16], who evaluated seven institutional foodservices operating in the city of Porto Alegre, RS, observing, in a good part of the investigated units, deficient service regarding good practices and current legislation.

In relation to M8 – documentation and legislation – a study carried out in Minas Gerais[17] evaluating good practices of a small FNU, showed a higher percentage of inadequacy in this area: in the FNU, all standard operating procedures were established, however, there was no compliance with the standard operating procedures for hygiene of facilities, equipment and utensils, and for preventive equipment maintenance, which resulted in only 53% adequacy for the item documentation.

Similarly, an investigation carried out in a military FNU, in the city of Belém[18], reported that of the 17 evaluated items in the documentation category, only 53% (n = 9) were in compliance and 47% did not conform. These values are quite different from those shown in this study, in which only 10.8% of the units have a satisfactory index in the documentation and legislation module (M8). Records are very important in an FNU as they allow the standardization of quality control and supervision[19].

As for the overall score, the "facility conditions" module (M4), with a mean of 81.5 among the investigated FNUs, stands out positively, assuming that they are producing meals in adequate physically functional environments and with equipment recommended for such activity. On the other hand, a similar result was not found in the study by Medeiros et al.[20], who evaluated the hygiene and sanitary conditions of restaurants registered in the sanitary surveillance in Santa Maria, RS, from 2006 to 2010, and observed that the furniture and utensil conditions had the highest index of inadequacy in the evaluations. According to Resolution RDC Nº. 216 of September 15, 2004[12], equipment, furniture and utensils that come in contact with food must be of materials that do not transmit toxic substances, odors, or flavors; they must be kept in a suitable state and be resistant to corrosion and repeated cleaning and disinfection procedures.

The distribution and service (M6) module showed, in the analysis of the graph, the highest frequency of satisfaction for the investigated FNUs. This result may be associated with training received by the staff regarding the necessary care for food distribution in the buffet and customer service required by the public foodservice concessionaire.

Formal education levels of workers from professional courses, training, and positive experiences in their areas, are part of the factors that contribute to the guarantee of food safety in the units that produce meals[21].

In FNUs, training programs emphasize the importance of individual and public health. Staff should be supervised and trained periodically in personal hygiene, hygienic food handling and foodborne diseases[12], which may have contributed to a higher satisfaction of the investigated FNUs.

In food distribution, waitstaff should adopt procedures that minimize the risk of contamination of prepared foods, including hand antisepsis and the use of disposable gloves, since these practices are most noticed by clients and may be an influence in determining satisfaction when consuming the food.

Regarding the users' satisfaction levels, the food concessionaire involved in this research has developed a daily satisfaction survey (electronic panel and satisfaction book), semiannual (through a proper form) in all restaurants, and monthly meetings, which bring together the restaurant staff with the aim set by the client to analyze items such as flavor, menu and services. These interventions help to document the quality of service provided by the public food concessionaire.

The length of time the FNU had been in operation was associated with the modules organizing and cleaning the kitchen, production and manipulation process and general results. This may be explained by the constant performance of the concessionaire in conducting training related to good practices for the teams, as we observed, in these modules, that the longer the FNU's operating time, the better the results.

However, those FNUs that only had a lunch service obtained better results in relation to hygiene and sanitary conditions. This may be because of the supervisor's full monitoring of that period, which may not occur when the units have dinner and supper services, if the leadership does not monitor them daily, leaving the teams without supervision, thus interfering with the results.

Regarding the involvement of nutritionists, even if no significant associations were found between the presence of these workers in the FNUs and better hygiene and sanitary conditions and operating conditions, monitoring by these professionals is indispensable in these environments, as it is up to the nutritionist to organize the work team, the materials and the financial resources, from the planning to the production of meals with high quality standards, in nutritional, sensorial and microbiological aspects[14].

According to Resolution nº. 380/2005[22] of the Federal Council of Nutritionists, which provides the definition of the nutritionist's areas of action and attributions, the nutritionist is responsible for planning, organizing, guiding, supervising and evaluating the food and nutrition services at institutional foodservices. Some of the mandatory activities are those that relate to good food manufacturing practices, such as selection of suppliers, food origin, purchasing, receiving and storing food; supervision of prepreparation, preparation, distribution and transportation of meals; implementation of standard operating procedures and food quality control methods; supervision of the hygiene activities of environments, vehicles of food transportation, equipment and utensils; preparation and implementation of the Manual of Good Practices and Standard Operating Procedures.

In FNUs, food may be more susceptible to various risks of contamination by microorganisms associated with handling and improper procedures during processing and distribution. Thus, industrial restaurants need greater control of hygiene and

sanitary conditions, since flaws associated with the processes that cause outbreaks of foodborne diseases can directly interfere with the diners' health[23].

The environment in which the meals are produced may have a high risk of occurrence of foodborne disease when good practices are not applied. This data can be seen in the information provided by the Ministry of Health[24], which states that the number of outbreaks and foodborne diseases cases from 2000 to 2015, at a national level, had an average of 693 outbreaks involving approximately 13,500 patients per year. Although 15.4% of foodborne disease outbreaks occur in restaurants and bakeries, foodborne diseases that occur in residences reached 38.4%.

As a limiting factor in this study, it is important to highlight the use of secondary data from a concessionary company, which made it impossible to monitor the collection of information. Other characteristics related to the FNUs, not explored in this study, could help further the discussion and understanding of the results.

This study may add to the knowledge on the subject, considering the low number of investigations that address the hygiene, sanitary, structural and operational conditions of FNUs and associated aspects. Finally, we suggest the development of new studies that approach the subject to build greater safety-based knowledge.

This study contributed to a better characterization and understanding of hygiene, sanitary, structural and operating conditions in an FNU sample from the State of Rio Grande do Sul. The results of the investigation allow the elaboration of a detailed scenario, to serve as one of the means for future planning of preventive actions or reorganization.

FINAL REMARKS

Given the results, the evaluated industrial FNUs, in general, have unfavorable environments for hygiene, sanitary, structural and operational conditions in relation to the criteria used in this study. This fact compromises the food safety prepared in these places as well as the health of the diners. The public food concessionaire could develop a plan of action for the nonconformities found in each of the restaurants as a way to remedy the irregularities and act with more technical rigor in the execution of the procedures of good practices.

Auditing quality helps in the evaluation process and adjustment of the conditions in these establishments, since it points out these nonconformities and makes possible the accomplishment of actions of improvements. However, this is a process that depends fundamentally on the management of each unit, which must act vigorously in the pursuit of excellence regarding the legislation requirements, making improvements in the working conditions and in the procedures adopted by the team.

Finally, the work carried out in the FNU is not only limited to producing meals, but also to ensuring health through a safe and qualified environment and food handling process.

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Conflict of Interest

The authors report no conflict of interest with peers and institutions, political or financial in this study.