CIAGRO 2022
09 a 10 de Junho | Tendências e estratégias para a agroindústria do futuro

DIAGNÓSTICO DAS BOAS PRÁTICAS DE FABRICAÇÃO (BPF) EM ESTABELECIMENTOS PRODUTORES DE QUEIJO COALHO ARTESANAL NO SERTÃO SERGIPANO

DIAGNÓSTICO DE BUENAS PRÁCTICAS DE FABRICACIÓN (BPM) EN ESTABLECIMIENTOS PRODUCTORES DE QUESO COALHO ARTESANAL EN SERTÃO SERGIPANO

DIAGNOSIS OF GOOD MANUFACTURING PRACTICES (GMP) IN ARTISANAL COALHO CHEESE PRODUCING ESTABLISHMENTS FROM SERTÃO SERGIPANO

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DOI: https://doi.org/10.31692/IIICIAGRO.0221

ABSTRACT

The territory of Alto Sertão plays a role of extreme social and economic importance for Sergipe, as it is an important region that produces milk and its derivatives, with emphasis on artisanal Coalho cheese. However, when this food is not obtained under adequate conditions of Good Manufacturing Practices (GMP), undesirable microorganisms may multiply, which may reflect negatively on the product's final quality, in addition to possible risks to the consumer's health. In this context, this study aimed to diagnose GMPs in establishments producing artisanal coalho cheese in Alto Sertão Sergipano. First, a survey was carried out in partnership with the municipal secretaries of Agriculture of possible cheese factories in the cities of Alto Sertão Sergipano, being chosen five establishments in four cities with the most representative in the production of artisanal Coalho cheese from Alto Sertão Sergipano (Canindé do São Francisco, Gararu, Monte Alegre and Nossa Senhora da Glória). Then, a checklist adapted from ANVISA, 2002, was applied in person, totaling 20 establishments producing artisanal coalho cheese. From the results obtained, it was possible to verify that most cheese factories, regardless of the city surveyed, were not in compliance with the recommendations recommended by current legislation, especially concerning the hygienic and sanitary conditions of the facilities, transport of raw materials, storage of the cheese and lack of training and technical assistance, in addition to failures or absence of GMP.

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KEYWORDS: Hygienic-sanitary habits, checklist, GMP, artisanal Coalho cheese.

INTRODUCTION

As a crucial producing milk and dairy products region, the territory of Alto Sertão Sergipano plays a role of extreme social and economic importance for Sergipe.

Among the relevant products from the dairy sector in Alto Sertão Sergipano, the artisan Coalho cheese stands out. The producing units of this food matrix in that region have recently sought the implementation of Good Manufacturing Practices (GMP), aiming to meet the current legislation and ensure the sanitary hygienic quality of the cheese produced. However, although the production of artisan Coalho cheese plays an essential role in the economy of Alto Sertão Sergipano, for small producers, in particular, it is correct to state that there has been a decrease in the number of cheese factories nowadays compared to previous years in the region.

The decrease in the number of cheese factories in Alto Sertão Sergipano occurred, among other reasons, due to the operation of increased inspection in mid-2016, by the Federal and State Public Ministry in a process called Integrated Preventive of Triple Divisa (FPI). During this operation, numerous cheese plants in the region had to be closed due to inadequate hygiene or precarious production situation for the non-implementation of GMP, a mandatory requirement for the food-producing sectors by the current legislation in Brazil.

Given the mentioned aspects, this study aimed to identify and diagnose the adequacy of GMP in artisanal Coalho cheese-producing establishments from Sertão Sergipano, looking forward to supporting the importance of GMP by assuring the marketing of a safe product offered to the consumer that meets the requirements of the current legislation.

THEORETICAL FOUNDATION

General aspects of Alto Sertão Sergipano

The milk production chain presents itself as an economic activity of paramount importance for the national economy, bringing Brazil up to third place among the largest milk producers in the world (SORIO, 2018).

Brazil's milk production is concentrated in the southern states, followed by the Southeast, Midwest, and Northeast. The Northeast Region of Brazil receives incredible notoriety due to high milk production in all states, having most of its products manufactured by

small properties from family farming, demonstrating the importance of this activity within the economic and social sphere (SORIO, 2018).

In the State of Sergipe, dairy activity stands out in Alto Sertão region. The territory of Alto Sertão Sergipano is located in the northwest of Sergipe's State, corresponding to the Sergipe microregion of Sertão do São Francisco. According to the data collected from Brazilian Institute of Geography and Statistics - IBGE (BRASIL, 2019), it is estimated that the total population of the territory is approximately 150,000 inhabitants distributed in a geographical area of 4,900,686 km². This region comprehend seven cities: Canindé de São Francisco, Garau, Monte Alegre, Nossa Senhora da Glória, Nossa Senhora de Lourdes, Poço Redondo e Porto da Folha (MENEZES, 2009).

The economy of this region is mainly based on agriculture and livestock, with an emphasis on the production of corn and milk. These two raw materials have great relevance to the region's economic development, especially dairy farming, as it is the region that concentrates the largest dairy basin in the state (MENEZES, 2009).

Among the cities of Alto Sertão Sergipano with elevated milk production and derivatives stand out the cities of Nossa Senhora da Glória, Poço Redondo, Porto da Folha, Gararu, Canindé do São Francisco, Monte Alegre and Nossa Senhora de Lurdes (Table 1) (FRAGA et al., 2016).

Table 1 – Milk production in different cities of Alto Sertão Sergipano.

Municipalities	**Milk Production**	
	1000 L	**/ Value (R$ 1,000 BRA)**
Nossa Senhora da Glória	50,248	60,297
Poço Redondo	41,992	50,390
Porto da Folha	38,299	45,959
Gararu	26,006	31,208
Canindé de São Francisco	23,348	28,017
Monte Alegre de Sergipe	19,757	23,708
Nossa Senhora de Lourdes	12,814	15,377

Source: adapted from IBGE – Municipal Livestock Research (2016).

Besides having an essential prominence in milk production in Sergipe, the supra-mentioned cities have significant representativity in dairy products production, especially artisanal cheese (FRAGA et al., 2016; SORIO, 2018). In Table 2, it is possible to verify the number of cheese factories in the cities of Alto Sertão Sergipano.

Table 2 - Main producing establishments of artisanal Coalho cheese in Alto Sertão Sergipano.

Municipalities	Number of cheese factories by year		
	2003	2010	2020
Canindé	01	05	17
Gararu	18	26	23
Monte Alegre	05	03	05
N.S. da Glória	27	26	43
N.S. Lourdes	06	12	02
Poço Redondo	08	07	01
Porto da Folha	15	23	03
TOTAL	80	102	94

Fonte: Adapted from EMDAGRO (2020).

Coalho cheese

Artisanal Coalho cheese is the product made with whole milk, being fresh, raw, or with simple heat treatment, on a small scale of production, which uses few physical structures, elaborated by traditional methods, with binding and territorial, regional or cultural valorization that give it identity, linking to the territory of origin, according to Technical Identity and Quality Regulation (TIQR) established for each type and variety, being allowed to acquire milk from nearby rural properties, since that they meet all relevant sanitary standards (SERGIPE, 2019).

In the northeast region of Brazil, Coalho cheese has relevant prominence among typical regional products with high production and commercialization, being considered a specific cultural product, tasted by consumers in many ways, whether in natural form, in preparations, baked, fried or used as an ingredient in northeastern cuisine (BARROS et al., 2019).

Artisanal Coalho cheese has its manufacturing process based on different stages, being a viable activity to be developed by medium and small producers once it is generally a simple process without high investments, with relatively fast financial return due to its marketing demand (PEREZ, 2005).

Although it is variable among producers, the processing steps of artisan Coalho cheese basically comprehend the following steps: milk reception, pasteurization, curd addition, coagulation, curd cutting, cooking, salting, shaping, pressing, turning, maturation and packing.

Although the milk pasteurization step may be observed as one of the steps in manufacturing artisan curd cheese, it is estimated that 85% of Coalho cheese manufacture is made with fresh raw material (raw milk). However, in the State of Sergipe, there is legislation under Law number 8,523 of 2019, which establishes, among other guidelines, that the

production and marketing of artisanal cheeses (traditional and innovation) can be performed with raw milk since it is produced in hygienic conditions, covering herd management, milking procedures and milk transportation to the artisanal cheese.

Moreover, the legislation attests that production units must participate in the Mastitis Control Program with exams for detection of clinical and subclinical mastitis, as well as the implementation of Good Practices in Dairy Production Programs (SERGIPE, 2019).

Implementation of GMP in the agroindustry of Coalho cheese

Coalho cheese industries, especially the artisanal one, has been seeking, in latest years, the implementation of GMP, with the objective of before the requirements of legislation that decrees the obligation of this tool in establishments that are responsible for manipulation, preparation, storage, distribution, transportation and exposure to food sales (BRASIL, 2004).

According to this Technical Regulation, GMP must be included in various industry sectors such as facilities hygiene, supply, and equipment, waste treatment, supply hygiene, equipment and maintenance, water quality, raw material quality, control of plagues and vectors (CUNHA et al., 2012).

It is essential to mention that, back in 2003, the Brazilian Health Regulatory Agency (Anvisa) approved the Technical Regulation of Good Practice for Food Services, establishing the General Program for Sanitation Standard Operating Procedures (SSOPs) to be used in milk establishments and derivatives that operate under Federal Inspection regime, as a preliminary and essential stage of food safety (BRASIL, 2003).

In addition, in 2019, the Legislative Assembly of the State of Sergipe approved Law Number 8,523, which has norms on producing and marketing artisanal cheese (traditional and innovation). That law defines, among other guidelines, that artisanal cheeses can be prepared with whole milk (fresh, raw, or with simple heat treatment on a small production scale) and elaborated through traditional methods. According to this legislation, producers can acquire milk from nearby rural properties as long as they meet sanitary standards, being necessary the GMP in all production stages (SERGIPE, 2019).

It is essential to state that Coalho cheese production steps are performed through intense product handling throughout the manufacturing process. Being extremely important that manipulators implement and execute the actions established by the GMP manual (DUARTE et al., 2005).

In this context, studies that enable to diagnose of the implementation of GMP in sectors of artisanal Coalho cheese in Alto Sertão Sergipano might favor and sensitize the different actors involved within the production process of this food, thus favoring obtaining a safer product for those consumers, more competitive in the market and line with the requirements of current legislation.

METHODOLOGY

Local of execution

The survey was conducted from April to July 2021 with 20 artisanal Coalho cheese producers in the four most representative cities of Alto Sertão Sergipano for production of artisanal cheese: Canindé de São Francisco, Gararu, Nossa Senhora da Glória, and Monte Alegre de Sergipe, in partnership with the Secretaries of Agriculture from the above municipalities, which assisted with the survey of possible establishments.

Survey

The study was conducted through the face-to-face application of a structured questionnaire (survey type) adapted from the RDC Number 275 checklist (2002) of the Brazilian Health Regulatory Agency (ANVISA) (BRASIL, 20002), in five cheese factories in four cities from Alto Sertão Sergipano, with a total of 20 producers of artisanal Coalho cheese. The survey involved questions regarding hygienic-sanitary conditions of the whole cheese factories, such as equipment, supply, buildings, facilities, production, and food transportation.

RESULTS AND DISCUSSION

The surveys were applied to different artisanal Coalho cheese producers in four cities from Alto Sertão Sergipano, who agreed to participate in this study and signed the Free Consent Form. Out of the 20 producers interviewed, regardless of the city surveyed, it was observed that 60% (n = 12) were male and 40% (n = 8) were female.

In the survey of Fraga (2016), in the city of Nossa Senhora da Glória/SE, it was found that Coalho cheese factories were managed 87% by males and only 13% by females. Similar results were also demonstrated in the research of Silva et al. (2018), in the city of Jaguaribe, in the state of Ceará, where the authors found that 92% of the artisanal Coalho cheese producers were male and only 8% female. Data reported in the above studies are equalized with the data

obtained in the present research, where it was possible to show that most artisanal Coalho cheese owners were males. However, it was possible to observe the active participation of both genders.

The most significant active participation of males in artisanal Coalho cheese establishments might be related, among other reasons, to the fact that cheese production is traditionally a family action, where men have the emblematic figure in family administration and women in house administration (FRAGA, 2016).

Regarding the age of the producers from Alto Sertão Sergipano, it was possible to verify that most interviewees were between 25 and 60 years of age.

Silva et al. (2019), in the state of Ceará, found that the age group of the highest prevalence among producers was 60 to 73 years, which is divergent from those found in the present research, where the age range of the producers was 18 to 60 years, with a predominance of owners aged 18 to 46 years regardless the researched city.

The production of artisanal Coalho cheese in northeastern Brazil presents itself as a historical and cultural activity, being a tradition transmitted from generation to generation, from father to son (FRAGA, 2016), which might have favored the high percentage of young people in this activity in our research.

It is important to emphasize that most of the visited cheese producers have mentioned the use of family labor for production, possibly bringing an economic contribution to local development and, consequently, to the social reproduction of family plants of artisanal cheese in Alto Sertão Sergipano.

Out of the producers who answered the survey, it was possible to verify that, regardless of the city, 45% (n = 9) reported having no education or had at least initiated fundamental education, 35% (n = 7) had complete middle education, 15% (n = 3) had higher education. Only 5% (n = 1) had postgraduation.

In the study of Figueiredo (2018) on the importance of the degree of education for farmers in the management of rural property in the state of São Paulo, the author noted that out of the 89 producers evaluated, 36% were not literate, 38% had only attended the fundamental school, 7% had completed middle education, and only 18% had higher education.

In another study on Coalho cheese establishments in Sertão Sergipano, Meneses et al. (2009) found that around 60% of producers had a lower level of education than completed their entire school.

The lower degree of education tends to favor the difficulty of these producers to implement hygienic-sanitary measures appropriate to the cheese production process, which needs knowledge and basic understanding of, for example, aspects related to food legislation, which may influence the correct adoption of GMP, directly or indirectly affecting the quality of the final product (DEVIDES et al., 2014).

Regarding family monthly income, 50% (n = 10) of artisanal Coalho cheese producers chose not to respond to this theme. Among the remaining 50 %, it was possible to note that, regardless of the surveyed city, 30 % of respondents (n = 6) reported having a monthly income up to one minimum wage; 15% (n = 3) up to two minimum wages and only 5% (n = 1) reported having a monthly income up to four minimum wages.

In the research of Fraga (2016), about geographical indication from the perspective of Coalho cheese producers from Nossa Senhora da Gloria/SE, it was found that 9 % of producers had monthly income between R$ 4,000.00 and R$ 7,000.00, 35% in the range between R$ 7,000.00 and R$ 10,000.00 and 56% of respondents reported having a monthly payment over R$ 10,000.00.

The results mentioned are divergent from the results obtained in the present research, where approximately 90% of respondents reported having a monthly income up to two minimum wages, equivalent to R$ 2,200.00. The possible factor for the divergence between data may be linked to the amount of milk benefited, since 60% (n = 12) of the searched cheese factories had daily average milk beneficiation for production of cheese up to 2,000 liters of milk, almost five times lower than the daily beneficiation of milk for the production of Coalho cheese reported by Fraga (2016), is said that the lower milk benefit, the lower the monthly income for the Coalho cheese producer.

In addition, the COVID-19 pandemic that began in the middle of 2020 and has extended so far brought the need for social restrictions that affected the economy, leading to a decrease in purchasing power by most Brazilian consumers, especially regarding non-essential food items (PROCONSP, 2021), such as the consumption of artisanal Coalho cheese, generating less demand from consumers of this food, which may have, consequently, contributed to the less monthly income of producers from Alto Sertão Sergipano.

Regarding milk benefited in artisanal cheese factories from the four cities surveyed, it was observed that most of this milk was intended for producing artisanal Coalho cheese, with milk collection performed twice daily (Table 3).

Table 3 - Daily average milk processing for Coalho cheese production from different cities of Alto Sertão Sergipano.

	Municipalities			
Liters of milk	Canindé	Gararu	Monte Alegre	N.Sra.Glória
300 - 600L	2		1	
600 - 900L	1		1	2
900 - 1200L	1			
1200 - 1500L		1	1	
1500 - 2000L		1	1	
> 2000 L	1	3	1	3

Source: Authors (2021).

It was possible to observe that 60% (n = 12) of respondents reported having the daily average of milk benefited for the production of artisanal Coalho cheese compatible with the profile of artisanal cheese factories, for processing between 300 and 2000 liters of milk daily, thus equalizing with the definition described by Law Number. 8,523 of April 29, 2019, of the State of Sergipe, which defines as artisanal cheese factories, the place intended for the production of artisanal cheese in rural or urban property, with a maximum size of 250 m² and with beneficiation capacity up to 2000 liters of milk daily (SERGIPE, 2019).

Regarding the storage and transportation operation of fluid milk, it was possible to verify that 60% (n = 12) of respondents said they had stored this raw material is protected and isolated milk cans, away from the milking area, in a clean place with appropriate air circulation. However, 65% (n = 13) of respondents reported not performing physicochemical tests to verify the physicochemical quality of the milk. In addition, all respondents, regardless of the city surveyed, said they filtered milk before its processing, a stage that is advocated by Normative Instruction 76 of 2018 (MAPA) (BRASIL, 2018). Regarding raw milk, 80% (n = 16) of respondents said they transport the milk to produce artisanal cheese in motorcycles or even in open cars.

The legislation in force in Brazil allows the transportation of raw milk in cans to the cheese factories, as long as it does not exceed two hours after milking (BRASIL, 2018), being an essential tool for maintaining the quality and microbiological safety of the milk and its dairy products, such as the artisanal Coalho cheese.

Regarding the transportation of artisanal Coalho cheese for commercialization, 90% of respondents, regardless of the city researched, reported no use of refrigerated cars. Instead, there is the use of iced styrofoam boxes to pack the cheese to maintain the integrity of the product.

However, the practical absence of temperature control can negatively influence the quality and safety of the final product since the cold chain is basically to refrigerate the product from its production and keep it out throughout the sequence until final consumption, guaranteeing the microorganisms control and microbiological quality of this product (FLISH, 2016).

In addition, cheese should be conserved under refrigeration, in transportation, and in storage at a temperature between 10°C to 12°C to reduce the risk of contamination by microorganisms, considering that the cooling temperature decreases the multiplication of these contaminants (MIGUEL, 2006), as evidenced in the study of Dantas et al. (2013), where the authors demonstrated that Coalho cheese samples marketed in Paraíba and stored without refrigeration, generally presented higher total and thermotolerant coliform count, by the most likely number technique in comparison to the Coalho cheese samples that were stored under refrigeration.

Regarding buildings and facilities, it was possible to verify that all establishments visited and interviewed (100 %) (n = 20) were located away from dumpsters, but 60 % (n = 2) had an external area with some irregularity, for example, access roads with an absence of paving and presence of foreign objects such as bags, plastic bottles, water tank, drums, and tires.

The presence of objects in disuse or strange, as well as the presence of dust outbreaks and the absence of paving in the external environment of food-producing establishments, such as cheese houses, can be configured as a potential physical or biological danger for processing food, as the presence of this inadequacy might favor the contamination of the raw material and the final product and provide the presence of urban pests and vectors, leading to economic damage to the establishment and risks to consumer health and integrity, and contradicts the requirements advocated by the legislation (NORONHA et al., 2005).

Regarding the type of surface used for the manufacture of artisanal Coalho cheese, it was possible to verify that 90% (n = 18) of respondents reported the use of stainless steel for equipment and utensils, which is the most recommended material in the food area, as they have flat surfaces, are resistant to high temperatures and corrosion and capable of resisting repeated cleaning and disinfection operations, avoiding sources of contamination (BRASIL, 1997).

According to Noronha et al. (2005), the equipment and utensils used in the production area at the cheese factories should be made of non-corrosive, non-porous, non-toxic, and resistant to successive washes and disinfections, preferably stainless steel. Out of the 20 properties visited, 95% reported having suitable equipment for the conservation of artisanal

Coalho cheese, whereas 85 % (n = 17) of respondents have answered they used a freezer, 10 % (n = 2) cold room, and only 5 %, (n = 1) reported to use ice styrofoam boxes for final product packaging.

Different results were reported in the research of Pereira et al. (2016), which evaluated Coalho cheese storage. The authors have found that 28.5% of the produced cheeses were stored in the freezer, and 71.5% of producers held cheese after processing in refrigerators or styrofoam boxes. The Coalho cheese cooling process consists of keeping it at low temperatures, thus making it challenging to proliferate undesirable microorganisms that can deteriorate and cause diseases to the consumer. This process is fundamental for maintaining sensory and nutritional characteristics (PAULA et al., 2009).

Regarding cleaning the facilities, equipment, or utensils, out of the 20 producers interviewed, 80% (n = 16) responded that they have sanitized those items daily. However, 70% (n = 14) of Coalho cheese producers reported not having a duly trained hygiene practice and claiming not to register the sanitation control once a single manipulator was responsible for several operations, even without adequate training.

Different results were reported in the study of Saraiva (2018), where the authors concluded that approximately 90% of artisanal cheese factories were responsible for the sanitation operation. In contrast, Pereira et al. (2016) observed the absence of a qualified employee to perform the cleaning of the facilities only. It is important to emphasize that the lack of responsibility for the hygiene process can cause ineffective hygiene of facilities, equipment, and utensils and may bring in numerous harms, including physical, biological, chemical, food, endangering consumer health (NASSU et al., 2006).

Among the producers, it was possible to attest that, regardless of the city researched, 60% (n = 12) of respondents reported using hygiene products regularized by ANVISA. However, only 30% (n = 6) performed dilution as advocated by the product label, which may impair the efficiency of the sanitation process. ANVISA must regularize the chemicals used for the hygiene of food industries. Dilutions recommended by manufacturers must be observed during the hygiene processes. Once incorrect diluted solution can lead to several problems, such as the inefficient disinfection of the environment, surfaces, utensils, and microbial resistance (STEINBACH, 2019).

Regarding the integrated control of urban pests and vectors, 80% (n = 16) of the interviewed cheese producers claimed to perform the integrated management of urban problems

and vectors in the inner area.

However, in 20% (n = 4) of the establishments, domestic animals and urban pests were present in the external environment, such as cats, dogs, and flies. Pest and vectors control is the set of measures adopted to prevent the presence of insects, rodents, and birds in the food production facilities; this control can be performed through the correct sealing of the doors, windows, ceilings, siphoned drains, with the primary objective of controlling the presence of these animals. In case of need, chemical control might be implemented, which should be done by qualified companies registered under a competent body (MEDEIROS et al., 2017).

In addition, the respondents attested to performing integrated pest control through the use of non-recommended products by the Ministry of Health, which were purchased in local supermarkets, such as SBP, Baygon, insect trapping adhesives, and beyond. It is essential to emphasize that using those products in a food production environment is not allowed, and chemical control must be performed by a company with the ability to do control registration (BRASIL, 1997). Proper control of pests and vectors is a crucial tool advocated by GMP since those elements in the food production environment might contribute to cross-contamination between products and compromise their quality and safety (FLISCH, 2016).

Regarding the origin of the used water, it was found that 85% (n = 17) of the respondents answered they used water from a public network, and 15% (n = 3) reported using water truck supply water. According to Law Number 8,523 of 2019, the water used in the units of artisanal Coalho cheese should be potable. It might have come from spring water, coated and protected cistern from the outside or artesian well, channeled from the source straightly to the water tank of the cheese factory, treated by filtration and chlorination system, then packed in a covered water tank and built adequately with the suitable material (SERGIPE, 2019).

In research conducted by Mera et al. (2020), it was observed that 20% of establishments had a water supply through the public network and 80% from artesian wells or related, in family-producing agroindustry from the Rio Grande do Sul municipalities.

Data from that research are divergent from the survey conducted in Alto Sertão Sergipano, as 85% of cheese factories used water from the public network. Drinking water has great importance to the food industry, as it directly influences the quality of the product. It is considered drinking water that meets the physicochemical and microbiological standards of current legislation, which in Brazil is governed by Ordinance Number. 2,914 of 2011 of the Ministry of Health. In addition, it is mandatory in Brazil that companies responsible for

manufacturing food must have an available and abundant supply of drinking water, with proper pressure and convenient temperature, an appropriate water distribution system, and adequate protection against contamination (BRASIL, 1997).

Although most cheeses interviewed used treated water, it was found that only 45% of establishments performed some laboratory analysis to verify the physicochemical and microbiological quality of the water. The use of poor-quality water in food-producing establishments can cause contamination and proliferation of microorganisms in different food matrices, such as artisanal Coalho cheese, affecting its hygienic-sanitary quality, as water can be an agent of contaminating microorganisms, leading to economic losses to the producing establishment, as well as the possibility of negatively affecting consumers health (OLIVEIRA, 2011).

Of the interviewed producers, 70% (n = 15) claimed to store the water to be used for artisanal Coalho cheese production in polyethylene boxes or cement cisterns, all with a lid and no apparent presence of cracks.

Regarding water reservoirs hygiene, 50% (n = 10) of the total Coalho cheese producers have attested they perform this step every six months under controlled sanitation registration. The other 50% (n = 10) are certified to perform sanitation procedures of reservoirs once a year. Food industries have a maximum time to complete the cleaning of water tanks, which should be done each six months or whenever necessary, so there is no risk of water contamination (SERGIPE, 2019). In addition, water can be contaminated in storage reservoirs, where the lack of regular cleaning and water tanks/cisterns disinfection are among the most frequent factors related to this contamination. (SIQUEIRA et al., 2010).

Regarding self-care related to manipulators, it was possible to find that, despite the city research, 55% (n = 11) of respondents attested they wear work uniforms or light color clothes proper to the production area. Divergent results were reported by Oliveira et al. (2018) by evaluating manipulators at artisanal cheese factories in Sertão Paraíba when the authors found that 90% of them did not use uniforms. Manipulators working in any food sector must have personal hygiene at all production stages, including clean uniforms, proper shoes, and fully covered hair to avoid food contamination (BRASIL, 1997).

Regarding hygienic-sanitary habits, it was possible to verify that most respondents wash their hands before cheese handling and preparation or after any production interruption, except for the city of Canindé, where 40% (n = 2) of the interviewees do wash their hands frequently.

The low percentage of respondents who have reported sanitizing their hands frequently at cheese factories located in Canindé/SE might be related, among other reasons, due to the total absence of guidance posters towards hand hygiene. In addition, it was possible to verify that only 35% (n = 7) of the visited cheese factories had signs in appropriate places with guidelines on the correct form of handwashing, except for the city of Nossa Senhora da Glória/SE, where the producing establishments of artisanal Coalho cheese showed the most significant percentage of illustrative posters, which probably positively affected the correct rate of respondents regarding hand washing.

The high percentage of cheese manipulators in Alto Sertão Sergipano who do not often wash their hands might be related, but not exclusively, to the low degree of education, which makes it challenging to adopt hygienic practices, besides their lack of knowledge about the importance of the technique, since it is the principal measure to reduce risks of contamination by microorganisms and increase the cheese quality (ELIAS et al., 2008).

Within this context, the hygiene of the manipulator's hands happens to be indispensable when it comes to food safety since they have straight contact with the cheese daily, from production to the moment of commercialization, becoming a host of pathogenic agents for food disease when failures and errors get into the hygiene process (RIBEIRO, 2017).

In addition, the cleaning of the manipulator's hands should always be performed under running water, with neutral detergent and subsequent drying, by using a disposable paper towel and alcohol 70 or proper sanitizer to contribute to a reduction of the possible microorganisms on the hands of those responsible for food handling (MEDEIROS et al., 2017), highlighting that this operation must be performed whenever necessary.

In research developed by Oliveira et al. (2018) on a diagnosis of hygienic-sanitary conditions of Coalho cheese manufacturing process in Sertão Paraibano, the authors reported that most manipulators (90%) did not perform the correct handwashing, as well as the lack of guiding posters about it or any other hygiene habits. Among the microorganisms commonly found in the hands of manipulators, the significant prevalence refers to *Staphylococcus aureus*, thermotolerant and total coliforms, and *Escherichia coli* (TEIXEIRA et al., 2015).

Regarding the health status of manipulators, 70% (n = 14) of respondents, regardless of the city surveyed, have attested that they did not present any disease. In comparison, 80% (n = 16) have informed that they did not periodically perform any clinical or laboratory examinations. In addition, 100% (n = 20) of respondents have reported not having records that

could guarantee their health.

Similar results were reported by Pereira et al. (2016) on the evaluation of GMP at artisanal cheese factories in São Rafael, the state of Rio Grande do Norte. The authors concluded that only 21% of producers presented compliance with periodic examinations and registration of performed exams.

Observance of the health status of manipulators should be performed periodically through laboratory tests and records, which is fundamental to assure they do not route contamination to ensure the production process's safety (BRASIL, 2004). In addition, food manipulators that had injuries and symptoms of diseases that might compromise the sanitary-hygienic quality of the foods must be removed from their duties while not fully recovered (BRASIL, 2004).

All visited properties [100% (n = 20)] claimed to have Personal Protective Equipment (PPE), but only 60% (n = 12) of the interviewees have confirmed wearing the PPEs. PPE is Personal Protective Equipment for mandatory use for food manipulators, as they are essential for minimizing the risks of work accidents and ensuring safety and protection against contaminants in the food processing steps (NORONHA et al., 2005).

Oliveira et al. (2018) have found that 90% of cheese producers did not use PPEs. In contrast, in a survey conducted by Saraiva (2018), it was found that 45% of cheese manipulators reported using PPEs.

Both results found by Oliveira et al. (2018) and Saraiva (2010) are divergent from the data found in our research since 60% of our respondents have reported wearing PPEs.

The high percentage of manipulators who do not wear PPEs along different production stages of Coalho cheese assayed in Alto Sertão Sergipano might be related, but not exclusively, to the lack of technical assistance and training on the obligation of PPE usage to those responsible for the manipulation of the cheeses at the factories, since most cheese factories demonstrated not to have technical assistance in the region.

CONCLUSION

Considering the obtained results, it was possible to verify that most of the cheese factories from Alto Sertão Sergipano presented some non-compliance with the guidelines advocated by the GMP, especially regarding the hygienic-sanitary conditions of manipulators,

facilities, or buildings, besides the inadequate transportation of the raw material and the final product.

Observed non-adequations may be linked, but not limited to the low level of education of producers added to the lack of technical assistance and government public policies.

In addition, it is suggested that the most significant participation of governmental entities aiming the raising awareness among producers through lectures, technical assistance, and training courses related to GMP enables the reduction of inadequacies found, thus favoring the production and marketing of an artisanal Coalho cheese that meets the requirements of the current legislation and be safe for the consumers.

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