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EVALUACIÓN DE LA CADENA DE FRÍO EN LA COMERCIALIZACIÓN DE QUESO CRIOLLO EN EL CANTÓN LOMAS DE SARGENTILLO

EVALUATION OF THE COLD CHAIN IN THE MARKETING OF CREOLE CHEESE IN THE LOMAS DE SARGENTILLO CANTON

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RESUMEN: A nivel mundial el queso gracias a su gran nivel nutritivo se ha convertido en uno de los alimentos más consumidos. Su composición se basa en proteínas, grasas combinado con su sabor y textura lo convierten en alimento de alto consumo, su conservación está estrechamente ligado a la cadena de frío que constituye un factor fundamental en la calidad de los productos lácteos. El objetivo de este estudio fue evaluar la cadena de frío mediante el monitoreo de la temperatura de quesos criollos durante su comercialización en el cantón Lomas de Sargentillo. Se seleccionaron cinco locales comerciales mediante un muestreo aleatorio estratificado, evaluando los productos durante un periodo de 21 días. Se tomaron mediciones de temperatura y pH en los días 1, 7, 14 y 21, con el uso de un datalogger para realizar un registro continuo de la temperatura en equipos de almacenamiento, de igual manera se utilizó un termómetro digital para registrar la temperatura interior del producto, en este caso el queso. Además, se tomaron cinco muestras de queso para analizar los parámetros fisicoquímicos y bromatológicos (humedad, grasa y proteína). Los análisis microbiológicos incluyeron la detección de *Salmonella spp.*, *Enterobacteriaceae* se obtuvo un promedio de 3.9x105UFC, *Escherichia coli* se obtuvo un promedio de 3.16x102UFC, *Staphylococcus aureus* se obtuvo un promedio de 4.6x103 UFC y *Listeria monocytogenes* en ausencia. Los resultados, evaluados conforme a la norma (1), evidenciaron incumplimiento en los parámetros de *Enterobacteriaceae*, *E. coli* y *Staphylococcus aureus*, mientras que se cumplió con los criterios establecidos para *Listeria monocytogenes* y *Salmonella spp.* Se concluye que las deficiencias en la cadena de frío influyen de manera significativa en la calidad microbiológica, fisicoquímica y bromatológica de los quesos criollos durante su comercialización.

Palabras clave: *cadena de frío, microbiológica, queso criollo, temperatura, físico-químicos.*

ABSTRACT: Globally, cheese, thanks to its high nutritional value, has become one of the most consumed foods. Its composition, based on proteins and fats, combined with its flavor and texture, makes it a widely consumed food. Its preservation is closely linked to the cold chain, which is a fundamental factor in the quality of dairy products. The objective of this study was to evaluate the cold chain by monitoring the temperature of local cheeses during their sale in the Lomas de Sargentillo canton. Five commercial establishments were selected using stratified random sampling, and the products were

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Febrero 2026

evaluated over a period of 21 days. Temperature and pH measurements were taken on days 1, 7, 14, and 21, using a data logger to continuously record the temperature in storage equipment. A digital thermometer was also used to record the internal temperature of the product, in this case, the cheese. In addition, five cheese samples were taken to analyze the physicochemical and bromatological parameters (moisture, fat, and protein). Microbiological analyses included the detection of Salmonella spp., Enterobacteriaceae (average of 3.9 x 10^5 CFU), Escherichia coli (average of 3.16 x 10^2 CFU), Staphylococcus aureus (average of 4.6 x 10^3 CFU), and Listeria monocytogenes (absence). The results, evaluated according to standard (1), showed non-compliance with the parameters for Enterobacteriaceae, E. coli, and Staphylococcus aureus, while the established criteria were met for Listeria monocytogenes and Salmonella spp. It is concluded that deficiencies in the cold chain significantly influence the microbiological, physicochemical, and bromatological quality of local cheeses during their commercialization.

Keywords: *cold chain, microbiological, creole cheese, temperature, physical-chemical*

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INTRODUCTION

Ecuador is a country characterized by its diversity in the elaboration of food products, within which natural and processed foods are included. Both types require adequate methods of preservation that permit maintaining their quality, which is determined by factors such as the degree of freshness, the appearance, the flavor, and the coloration. Throughout history diverse procedures of conservation have been developed, among which refrigeration, the use of salts, nitrites, and other traditional and technological methods stand out. Nevertheless, in the production of foods such as meats, dairy products, and their derivatives, it proves indispensable to maintain an adequate cold chain in order to conserve their properties and guarantee that they are apt for human consumption (2).

The dairy products that present a high risk of food intoxication or that possess a short shelf life must be subjected to a rigorous control of temperature, with the aim of assuring the correct functioning of the cold chain. This control permits preserving the safety and quality of the foods during their elaboration, transport, and storage. Currently, the consumers seek products that contribute greater nutritional benefits, which depends directly on the quality of the raw material, the process of elaboration, the transport, and the conditions of storage. An inadequate management in any of these stages can compromise the integrity of the consumer and generate risks for public health (3).

The market of the cheeses is ample at the worldwide level and represents a great responsibility for the producers, since the principal objective is to offer to the consumer a fresh, nutritious, and quality product. There exist different types of cheeses, among them the fresh or soft cheeses and the mature or hard cheeses, each one with specific characteristics. One of the fundamental aspects in the elaboration of the cheese is the

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Febrero 2026

adequate management of the coagulation of the casein, principal protein of the milk. The interaction of this protein varies according to the type of cheese, the content of salt, the pH, the chemical composition of the milk, and the environmental conditions during the process of elaboration, factors that influence directly in the texture, the flavor, and the final quality of the product (4).

Cheese is one of the most consumed foods owing to its elevated content of proteins, fats, as well as by its sensory properties such as the flavor and the texture. However, owing to its composition, it is susceptible to suffer alterations in its quality, especially when an adequate cold chain is not maintained. Among the principal changes that can present themselves are found variations in the odor, color, and texture, generally associated to an inadequate management during the production or commercialization. In many cases, the artisanal producers do not count with appropriate norms of hygiene nor with the necessary equipment to guarantee a safe process. In addition, a great part of these producers has not received training on good manufacturing practices, which increments the risk of contamination by pathogenic bacteria and can affect gravely the health of the consumer (5).

The cold chain comprises a set of operations destined to conserve the shelf life and the nutrients of the cheese, avoiding fluctuations of temperature that can affect its quality. This chain must be maintained in a continuous manner during all the stages of the productive process, from the elaboration until the sale of the final product. The adequate control of the temperature is fundamental to guarantee the food safety and the quality of the cheese. Nevertheless, the maintenance of the cold chain does not depend solely on the producers and merchants, but also on the final consumer, who must conserve the product in adequate conditions until its consumption. The rupture of the cold chain in any of these stages provokes the deterioration of the product, loss of nutrients, and alterations in its sensory characteristics (6).

In the artisanal elaboration of the cheese, independently of the canton where it is produced, the raw material utilized frequently does not comply with the standards established by the standard (1), corresponding to fresh non-ripened cheeses. In many cases, these products are elaborated with non-pasteurized milk, coagulants of diverse nature are employed, and variable times of fermentation and maturation are managed. These conditions generate a wide diversity of flavors and textures that, on occasions, result disagreeable for the consumer. Likewise, the bad practices of elaboration and manipulation affect negatively the quality of the product, diminish its acceptance in the market, and increase the risk of infections or food intoxications, which can present themselves in an isolated form or give rise to outbreaks of greater magnitude (7), (8).

Lomas de Sargentillo, being a canton that is found in the central part of the province of Guayas and being a site of passage for many tourists, has become a propitious sector so that its inhabitants dedicate themselves to activities such as commerce and alimentation; from there that currently the commercialization of creole cheese in this cantonal head is found widely diffused; although it is necessary to evaluate if at the moment of the commercialization all the processes of assurance of the quality of the product are complied with, otherwise the product would represent a constant threat for the consumer (9).

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Febrero 2026

Fresh cheese has elevated percentages of moisture which makes necessary that it be controlled with temperatures between 2 °C and 4 °C, which is not complied with in an adequate manner in the elaboration and management of the artisanal creole cheese, which produces alterations in the same favoring the growth of microorganisms such as Staphylococcus aureus and Escherichia coli, principal responsible for acute food intoxications.

Any food becomes susceptible to different contaminating agents even more so if it does not have a control of the temperature. For which the control of the cold chain becomes indispensable; at the same time the lack of knowledge of Good Manufacturing Practices of places that elaborate and commercialize this product do not count with equipment such as refrigerators, since they are artisanal enterprises, which would help to improve the conservation in the cold chain and the quality, in order to guarantee the health of the consumer because from this will depend the growth of the small and medium enterprises (10).

At the present time there does not exist a statistic that reveals with exactitude everything about the commerce that is dedicated to the sale of artisanal cheese in the canton Lomas de Sargentillo; in addition neither is specific information possessed on how many locales dedicate themselves to these activities and count with an adequate management in the conservation of the foods in cold. This investigation was realized with the purpose of evaluating the cold chain by means of the monitoring of the temperature of the creole cheeses in the commercialization of the canton Lomas de Sargentillo assuring the conservation of the product (11).

MATERIALS AND METHODS

Experimental design

For the present investigation the locales where creole cheeses are commercialized located in the cantonal head of the canton Lomas de Sargentillo were taken into account, the same which for effects of the investigation were grouped in the following manner: neighborhood stores, industrial stores, supply centers, stall in the market, and distributors.

Once the strata were defined, the simple random sampling was applied in each group or stratum with the aim of determining the sample (12).

Table 1. Proportional stratified random sampling.

Stratum	Probability	Number of locales	Relative frequency	Number sampled
1	Industrial stores	3	0.07	1*
2	Supply centers	7	0.16	1*
3	Neighborhood stores	30	0.67	2
4	Stall in the market	5	0.11	1
Total		**45**	**1.00**	**5**

*0.07 of 5 = 1; 0.16 of 7 = 1

Table 2. Proportional stratified random sampling in locales of creole cheese.

Stratum	Probability	No. locales	Rel. freq.	No. sampled	Selected locales
1	Industrial stores	3	0.07	1*	LC05
2	Supply centers	7	0.16	1*	LC03
3	Neighborhood stores	30	0.67	2	LC01, LC04
4	Stall in the market	5	0.11	1	LC02
Total		**45**	**1.00**	**5**	

*0.07 of 5 = 1; 0.16 of 7 = 1

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Considering that dairy products demand care in relation to the cold chain, a data logger was placed in the commercial establishments of the canton Lomas de Sargentillo with the aim of controlling the temperature of the places of storage.

Subsequently the discretionary and non-probabilistic type sampling was realized; before realizing the analysis the asepsis of the place, hands, equipment that were utilized was safeguarded; for the management of the samples 454 grams of cheese were taken into consideration; each sample was coded with the initials of each store; finally the sampling by quartering was realized. An analysis of temperature, pH, and moisture was realized during day 1, day 7, day 14, and day 21, by triplicate, and the determinations of content of fat and protein were realized in a single repetition together with the microbiological analysis (13).

Control of temperature (data logger and thermometer)

A control of the sample was realized by the measurement of the temperature with data logger, which measured the temperature in real time in programmed periods of time every 10 min during 21 days in the five locales of sale. The determination of temperature of the cheeses was realized with a thermometer, during the days 7, 14, and 21.

Determination of moisture

The analysis of moisture was realized by means of the method of desiccation in the hot-air oven.

Determination of the hydrogen potential (pH)

The analysis of the sample of the product was determined by means of the potentiometer method to measure the pH.

Determination of Enterobacteriaceae

A microbiological control was realized in the creole cheese by means of the method of count in plate by pour plating; the dilutions were realized in peptone water; dilutions were realized for subsequent plating and incubation; after 24 h the count of colony-forming units was realized.

Determination of Listeria monocytogenes

For the count of Listeria monocytogenes a plating on petrifilm in different dilutions was realized and subsequent process of incubation at 37 °C ± 1 °C during 24 h; subsequently the count was realized.

Determination of Staphylococcus aureus

A microbiological control of the sample was realized by the method of plate by surface spreading for the detection and count of Staphylococcus aureus.

Determination of Escherichia coli

A microbiological control of the sample was effected by plating on Petrifilm for the detection and count of Escherichia coli subsequent to the 24 to 48 hours at 35 °C.

Determination of Salmonella spp.

25 grams of sample were incubated with peptone water and sodium chloride at 2% for 24 hours for the enrichment of possible cells of Salmonella; subsequently an aliquot was passed to the culture medium Rappaport and it was incubated at 43 °C during 24 hours; after incubation it was plated on selective medium S-S (Salmonella-Shigella) and

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Febrero 2026

incubated at 37 °C during 24 hours for identification of typical colonies; subsequently the suspicious colonies were plated on TSI agar incubated from 35 to 37 °C and subsequent confirmation.

Statistical analysis

The type of statistics that corresponds to this study is the inferential since estimations of the quality that the creole cheeses taken from 5 locales of stores and commercials of the canton Lomas de Sargentillo have were obtained, which were chosen at random, but taking into consideration as requirement that it be a center of commerce of select taste for all the consumers.

For the comparison of the means of the different analyses (temperature, moisture, pH, and microbiological analyses) an ANOVA with a Tukey test $p \geq 0.05$ was realized to determine significant differences.

RESULTS

Next, in Table 3 the mean values of temperature of the data logger in the course of 21 days are presented, where the temperatures of the refrigeration equipment of the creole cheeses in 5 locales on day 1, 7, 14, and 21 were taken. Upon comparing on each day the temperature of the samples of the locales, it was observed that the temperatures so that an adequate cold chain can be managed should not surpass from 2 °C to 6 °C as indicates (1). For this a control of the temperature with minimal differences that permit an adequate storage in the conservation of the creole cheese should be established.

Table 3. Mean values of temperature of the data logger.

Samples of Locales	DAY 1 (°C)	Day 7 (°C)	Day 14 (°C)	Day 21 (°C)
LC01	8.59a	7.51b	9.91a	7.27a
LC02	1.35c	2.76c	7.12bc	4.54b
LC03	5.40b	-1.41d	1.12d	0.17c
LC04	5.88ab	8.34b	8.10ab	6.15ab
LC05	7.16ab	12.38a	5.69c	4.78ab
S.E.	0.75	0.55	0.78	1.16

Means with different letter in each column differ significantly ($p < 0.05$). S.E.: Standard error of the mean.

As can be observed, in the 5 establishments there exist different fluctuations of temperature on the day until day 21, observing that in the 5 locales analyzed the cold chain is broken and even temperatures inferior to 0 °C are observed, below the range which could occasion a process of freezing of the product, differing throughout the time fluctuating above the range of temperature recommended for a product, for which it is recommended that it not exceed from 2 °C to 6 °C as indicates (1). The ranges of temperature on day 1 in the different locales fluctuated from 8.59 °C to 1.35 °C; different data were observed on day 7 with fluctuations from −1.41 °C to 12.38 °C; on day 14 the variations of temperature were with a range from 1.12 to 9.91 °C and on day 21 changes of temperature that go from 0.17 °C to 7.27 °C are evidenced, which indicates to us that there exists little control with respect to the variations of temperature of the places of storage of the creole cheeses under study.

If fluctuations in the temperature of the places of storage are evidenced, obligatorily the internal temperature of the creole cheeses will be affected as is evidenced in Table 4. Where the mean values of the internal temperature of the creole cheeses sampled from

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Vol. 4 No. 8 PP. 96-110

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Febrero 2026

5 locales of sale of this product are presented; on day 1 three locales with temperatures that differ from the recommended range are evidenced; two locales are found above what is permitted and one locale with temperatures inferior to what is exposed in (1). In similar form it happens throughout the time where it can be highlighted that LC03 and LC04 are the locales that present more variations in their internal temperature.

Table 4. Values on the temperature of the sample with thermometer.

SAMPLES OF LOCALES	Thermometer temp. DAY 1 (°C)	Thermometer temp. DAY 7 (°C)	Thermometer temp. DAY 14 (°C)	Thermometer temp. DAY 21 (°C)
LC01	8.6 °C	1.5 °C	-1.9 °C	-0.2 °C
LC02	1.8 °C	0.9 °C	3.6 °C	3.8 °C
LC03	4.5 °C	7 °C	2.9 °C	-2 °C
LC04	6.6 °C	5.9 °C	5 °C	5.3 °C
LC05	11.6 °C	10.9 °C	5.8 °C	3.7 °C

Values compiled on the temperature of the cheeses.

Next, Table 5 is presented. Where the mean values of pH in the course of 21 days, of the five locales on day 1, 7, 14, and 21 are exposed. On day 1, a range between 5.79 to 6.43 with a relatively acid pH was observed, observing the influence of the temperature on the pH of the products, evidencing significant differences among the different locales where LC02 and LC03 reached more acid pH; consequently this tendency was observed until day 21, even cheeses that began with a less acid pH on day 21 presented a drastic decrease, for which it can be mentioned that the incidence of the temperature on this parameter is fundamental.

Table 5. Mean values of pH.

Samples of Locales	DAY 1	Day 7	Day 14	Day 21
LC01	6.18b	6.22b	6.41b	5.82a
LC02	5.79c	6.03c	6.12c	5.43b
LC03	5.82c	5.87d	6.12c	5.41b
LC04	6.38a	6.68a	6.61a	5.79a
LC05	6.43a	5.98c	5.43d	5.02c
S.E.	0.04	0.02	0.04	0.05

Means with different letter in each column differ significantly ($p < 0.05$).

In Table 6 the mean values and standard error of the moisture of the samples raised from the 5 locales during the days 1, 7, 14, and 21 are presented; as is evidenced they present different content of moisture existing significant differences among the cheeses in a range of 40.61% and reaching a maximum of moisture of 56.96% with a similar tendency throughout the time but presenting a decrease of content of moisture by processes of loss of water in the storage arriving at a content of moisture minimum of 41.59% and maximum of 53.55% on day 21.

Table 6. Mean values of moisture of the samples.

Samples of Locales	Day 1 (%)	Day 7 (%)	Day 14 (%)	Day 21 (%)
LC01	48.76ab	45.52b	50.38a	46.46b
LC02	44.77abc	42.77bc	47.05a	44.32b
LC03	50.45a	51.90a	56.96a	53.55a
LC04	40.81c	40.61c	54.34a	41.59c
LC05	44.15bc	44.63b	48.81a	45.30b
S.E.	1.32	0.63	16.23	0.47

Means with different letter in each column differ significantly ($p < 0.05$).

With respect to the content of protein and fat the results are presented in Table 7 evidencing contents that comply with the specifications in Standard (14).

ISSN: 3091-1796
Vol. 4 No. 8 PP. 96-110
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Febrero 2026

Table 7. Percentage of protein.

Samples of Locales	% Protein	% Fat in dry extract
LC01	16.72	53.54
LC02	15.63	52.36
LC03	20.45	52.90
LC04	14.43	41.14
LC05	14.09	50.30

Next, in Table 8 the results of the microbiological parameters of Salmonella spp., Enterobacteriaceae, Escherichia coli, Staphylococcus aureus, and Listeria monocytogenes are presented. The positive results can be observed where it does not comply for Enterobacteriaceae, Escherichia coli, Staphylococcus aureus, and where it can be observed that it does comply with Listeria monocytogenes (absence) and Salmonella spp. (absence) as indicates (1). These results of the presence of microorganisms are associated to the results presented in the changes of temperature linked to the rupture of the cold chain that favors the microbiological development, accelerating the growth of the same, denoting the importance of the conservation of vulnerable products and recommended to be found in controlled storage, being a critical factor the temperature that affects the microbiological stability and the safety of the food.

Table 8. Results of microbiological analysis.

Samples	Enterobacteriaceae m: 2×10^2 CFU/g	E. coli m: <10 CFU/g	S. aureus m: 10 CFU/g	L. monocytogenes m: Absence	Salmonella m: Absence
LC01	1.6×10^4	4.3×10^2	9.0×10^3	Absence	Absence
LC02	3.4×10^5	3.9×10^2	3.0×10^3	Absence	Absence
LC03	8.4×10^5	8.0×10^1	1.5×10^3	Absence	Absence
LC04	1.3×10^5	1.0×10^1	8.4×10^3	Absence	Absence
LC05	6.4×10^5	6.7×10^2	1.0×10^3	Absence	Absence

DISCUSSION

In this present investigation the identification of the distinct points of sales and distribution of creole cheeses in the canton Lomas de Sargentillo was developed; once the strata were defined they were grouped in neighborhood stores, industrial stores, supply centers, market stalls, and distributors totaling 45 points of sales; then the stratified random sampling was applied which permitted us to identify the total of 5 locales completely at random; in this investigation according to (15), the data found are completely different since they realized this study with the purpose of exploring the factors that influence in the purchase of fresh cheeses of cow and of goat. The population was represented by a proposal according to the selection of the domiciles distributed in seven parishes of the municipality Iribarren of the state Lara, Venezuela. Where a stratified random sample of 598 domiciles was selected; each place was coded and analyzed; obtained the results the consumers have greater preference for the cheeses of cow (80.4%); the average of weekly purchase of cheese of cow is 1 to 1.5 kg (54%), and the cheese of goat is of 0.5 to 1 kg fortnightly. The stores are the preferred places for the purchase of cheese of cow (23.7%), and the specialized cheese dairies in cheese of goat (34.7%). The proximity of these centers of distribution to their homes is the principal reason of their selection. The little salty flavor and the medium texture are the principal attributes of purchase for the cheeses of cow, while the cheeses of goat they prefer without salt and of more loose texture.

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Febrero 2026

According to (16), it was determined in this investigation how the cold chain and the microbiological quality are altered in the fresh cheeses commercialized in a market of the province of Guayas and artisanal cheese production in the province of Chimborazo; the deficiency in the management of the temperatures that affect considerably their physicochemical, compositional, and microbiological properties was evidenced; it is necessary to maintain an ideal control of the temperature in the cold chain from when the product is created until it arrives at the consumer in order to prevent the propagation of prejudicial microorganisms and the production of toxins in the cheese in order to guarantee the quality of our product during the entire procedure. Thus at a determined moment the aspects of manipulation do not compromise some risk of health upon ingesting the product; for that reason it is crucial to maintain the control of the refrigeration equipment 2 °C to 8 °C, in order to avoid any damage and avoid that the cold chain be broken in any dairy product. The data of this investigation on the cold chain in the creole cheeses of Canton Lomas de Sargentillo are completely different from the data of the previous results; it can be appreciated how there exists a rupture of the temperature in LC02 having a minimum temperature of 1.6 °C as was evidenced on day 1, 7, and 14 continues with the same tendency with respect to the temperature in LC02 in comparison with the temperature of day 21 the temperatures are very low; these are not optimal conditions of temperature that a product should be conserved, and its maximum temperature is of 28.4 °C the LC02 where it presents a greater temperature outside the range established 2 °C to 6 °C as indicates (1), at determined times; LC03 has a minimum temperature of −4.0 °C, presents temperatures inferior to 0 °C, is below the range which could occasion a process of freezing of the product; its maximum temperature is of 32.4 °C the LC03 presents a greater temperature outside the range established.

In this investigation it was determined that the moisture in the cheeses of the canton Lomas de Sargentillo have a range of the minimum 40.61% in LC04 of day 7, reaching a 92.19% of maximum moisture in LC03 of day 14; this is an indicative of when a lower quantity is obtained in several of the locales it means the loss of the cold chain; also the pH was determined with a range of (5.02–6.68), in fat with (41.14%–53.54%) and protein (14.09%–20.45%); the results of the investigation do not concur with those of (17), the ranges for their physicochemical parameters were pH (4.84–6.07), moisture (42.71%–66.66%), fat (12%–32%), protein (16.81%–26.62%). The results of this investigation in the artisanal fresh cheese in the city of Toluca, establish the necessity of improving the policies of hygiene by the authorities, in order to promote a good manipulation of the product causing a great impact on the health of the consumers.

According to (18), it determined a diagnosis about the biological hazards in fresh cheeses elaborated in artisanal form that are offered to the consumer in supermarkets and warehouses in order to carry out this study; initially several visits were made to the different establishments with the aim of observing the greater influence of the product to the public; it was taken of reference for the taking of sample, sanitary registers, operating license; the parameters obtained in the microbiological tests of the results of the count of Staphylococcus aureus (5.07 ± 0.06 Log10 CFU/g) of the plant were superior for Enterobacteria (4.33 ± 0.06 Log10 CFU/g), coliforms (4.27 ± 0.03 Log10 CFU/g) and Escherichia coli (4.03 ± 0.03 Log10 CFU/g), are outside the parameters of quality in the standard demanded by the ministry of health; in Listeria monocytogenes there exists

ISSN: 3091-1796
Vol. 4 No. 8 PP. 96-110
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Febrero 2026

(Absence), and Salmonella spp. there exists (Absence); this is due to that it had a rupture in the cold chain. In this investigation different values were obtained with respect to the microbiological results that were realized to 5 locales of creole cheeses; the results of Enterobacteriaceae can be observed that it does not comply with respect to (8.4×10^5 CFU/g), Escherichia coli does not comply with respect to (8.0×10^1 CFU/g), Staphylococcus aureus does not comply with respect to (9.0×10^3 CFU/g), and where it is observed in Listeria monocytogenes it does comply (Absence), and Salmonella spp. it does comply (Absence) with respect to (1); this means that the cold chain is already affecting the microbiological load; in the major part of these establishments they do not count with all the characteristics of quality, since they put at risk the health and the well-being of the community.

According to (19), in its cited study Microbiological analysis of fresh cheeses Guayaquil Listeria and Salmonella the presence of these microorganisms in foods of great consumption such as the cheese represents an alert on the systems of management of safety in these foods. Despite the high demand of this product in the city of Guayaquil, records of incidence by intoxication of fresh cheeses are not available. The results obtained where it is managed to evidence the presence of Salmonella spp., in a 13.71% of the cheeses analyzed; for the case of Listeria, the presence was managed to be detected in a 52.94% of the cheeses analyzed. The results of the author previously cited, have data completely different from this study with respect to microbiological parameters analyzed in the locales of sale of creole cheese in the canton Lomas de Sargentillo, where there exist the absence of Listeria and Salmonella spp. With these studies it is managed to leave in evidence the safety of the fresh cheeses that are of greater demand, which permits discovering the risk to which the consumer is exposed. For that reason, it is fundamental to consider the microbiological parameters established by the alimentary regulations in order to guarantee the quality of the foods in benefit of the persons upon consuming a product.

CONCLUSIONS

In the present investigation the rupture of the cold chain in 5 locales of sale of creole cheese was evidenced affecting directly the bromatological, sensory, and bromatological quality, where fluctuations of temperature in the 21 days of the study were evidenced registering temperatures outside the permitted range, both above the limits and inferior which influences directly in the parameters such as the pH, moisture, fat, protein and favors the microbiological proliferation.

Although the parameters of fat and protein complied with what is established in the regulations, an elevated load of the microbiological count of Enterobacteriaceae, Escherichia coli, and Staphylococcus aureus was evidenced; these results presented themselves in the 5 locales analyzed from day 1, which confirms that there exists a deficient control of the chain of temperature during the storage and its commercialization. Being able to conclude that the continuous control of the cold chain is important in order to guarantee the safety, stability, and shelf life of the creole cheese.

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REFERENCES

1. INEN. NTE INEN 1528 Requisito de norma general para quesos frescos no madurados. Técnico. Quito: Instituto Ecuatoriano de Normalización, Alimentos; 2012.

2. Barrera Naranjo, Calvo Martinez S. Evaluación técnica de la cadena de frío en la producción de carne bovina en Colombia. https://repository.uamerica.edu.co/bitstream/20.500.11839/6904/1/4131653-2018-2-IM.pdf. 2018 Aug; 1(1).

3. Carranco Ortiz B, Rodríguez Cabascango R. Incidencia del contenido de grasa de la leche de vaca, dosis del probiótico (Lactobacillus casei - 01) y temperatura de inoculación del cultivo en la elaboración de queso fresco. 1st ed. Tene ÁES, editor. Ibarra: UNIVERSIDAD TÉCNICA DEL NORTE; 2015.

4. Antezana Vásquez I. Efecto de la hidrólisis enzimática de la lactosa en el perfil de textura de queso fresco normal y bajo en grasa. Lima: Universidad Nacional Agraria La Molina; 2015.

5. Montes Cano G. Determinación de coliformes totales y Escherichia coli en quesos artesanales expendidos en la ciudad de Guayaquil. 1st ed. Guayaquil: Universidad de Guayaquil; 2019.

6. Álvarez Ocas A, Coronado Chugnas E, Suárez Vázquez C, Terrones Marín L, Vallejos Terrones M. La Cadena de Frío del queso fresco. 1st ed. Bustamante JHP, editor. Cajamarca: Universidad Nacional de Cajamarca; 2019.

7. Cedeño Tapia MA. Calidad del queso fresco en diferentes lugares de procedencias y lugares de comercialización en Quevedo. 1st ed. Rodríguez WM, editor. Quevedo: Universidad Técnica Estatal de Quevedo; 2015.

8. Moreano Terán. Evaluación de la calidad microbiológica en quesos frescos de producción artesanal expendidos en el mercado cerrado Latacunga. Ciencia y Desarrollo Social. 2021 Jul; 3(6).

9. Aguilar Hernández E. Prevalencia de cepas de Staphylococcus aureus resistentes a antibióticos en muestras de queso blanco fresco expendidas en el municipio Guaicaipuro - Estado Miranda. 1st ed. Gamero BA, editor. Guaicaipuro: Universidad Central de Caracas Venezuela; 2017.

10. Restrepo Niño. Cadenas de frío: lácteos. 1st ed. Uniandes, editor. Bogotá: Uniandes; 2015.

11. Ocampo AM. Revistaialimentos. [Online].; 2018. Available from: https://www.revistaialimentos.com/blog/trs-partes/4-factores-de-exito-en-la-refrigeracion-de-lacteos/.

12. Marchal. Estadística aplicadas a los negocios y a la economía. México: Miembro de la cámara nacional de la industria Editorial Mexicana. 15th ed. Chacón JM, editor. Mexico D. F.: McGRAW-HILL/INTERAMERICANA EDITORES, S.A. DE C.V.; 2018.

13. Lizarzaburu Luna NP, Díaz Sihuenta J, Salinas Maldonado T, Sacha Donayre S, Castro Vera CJ, Clavijo Sánchez A. Determinación de la humedad y solidos totales en muestras de queso fresco. Callao; 2021.

14. INEN. NTE INEN 64. Determinación de contenido de grasas. Técnico. Quito: Instituto Ecuatoriano de Normalización, Alimentos; 1973. Report No.: INEN 64.

ISSN:
3091-1796
Vol. 4 No. 8 PP. 96-110

DOI:
https://doi.org/10.56519/abv9ea41
Febrero 2026

15. Arlenis, Muñoz, Araque, Quijada, Segovia E. Quesos frescos bovino y caprino. Hábitos de compra. Scielo. 2019 Mar; 28(1).

16. Baque López, Chugchilán Veintimilla. Evaluación de la calidad microbiológica de quesos frescos comercializados en un mercado de la provincia del Guayas y producidos en una quesera artesanal de la provincia de Chimborazo. 1st ed. ESPOCH, editor. Riobamba: ESPOCH; 2019.

17. Díaz Galindo P. Detección de staphylococcus aureus ORSA/MRSA en quesos frescos artesanales comercializados en mercados populares en el valle de Toluca. 1st ed. México UAdEd, editor. Toluca: Universidad Autónoma del Estado de México; 2016.

18. Chacon Zarate L, Villamizar Cancelado A, Villamizar Cancelado S. Análisis de peligros microbiológicos en tres tipos de queso hilado que se expenden en la ciudad de Bucaramanga. 1st ed. Gomez S, editor. Bucaramanga: Universidad Nacional Abierta y a Distancia “UNAD”; 2019.

19. Plaza Ibarra A. Análisis microbiológico en quesos frescos que se expenden en supermercados de la ciudad de Guayaquil, determinando la presencia o ausencia de listeria y salmonella. Trabajo final para la obtención del título: Ing. en Alimentos. 1st ed. Espol, editor. Guayaquil: Espol; 2013.

20. INEN. NTE INEN ISO 8968-1. Determinación de contenido de nitrógeno método de KJELDAHL y cálculo de la proteína bruta. Técnico. Quito: Instituto Ecuatoriano de Normalización, Alimentos; 2015. Report No.: NTE INEN ISO 8968-1.