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Study Of The Microbiological Quality And Physio-Chemical Properties Of The Soft White Cheese Traditionally Produced In Wasit Province In Iraq

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Abstract

The current study was undertaken to evaluate the microbiological quality and physicochemical properties of the soft white cheese traditionally produced in different places at Wasit province in Iraq. Thirty-three different locations in major areas were subjected to this study. The samples were assembled aseptically from several cheese workstations. The averages of pH values, moisture percentage, protein content in dry weight and total protein content of cheese samples in different locations were 6.65, 71.06%, 20.29% and 8.95% respectively. The averages of total plate count, count oflactic acid bacteria, and coliform bacteria count of cheese samples in different areas were 4.05 log cycle, 3.69 log cycle, and 2.75 log cycle respectively. A significant negative correlation was recorded between the pH of the tested soft cheese samples and moisture content (-0.33). Significant differences ($p<0.001$) were found in the mean of pH values and moisture content among some locations. No significant differences ($p>0.001$) in the mean of pH values and moisture content among other locations. There were significant differences ($p<0.001$) in the means of pH values, moisture content, total plate count, count oflactic acid bacteria, and coliform bacteria count, among some locations. No significant differences ($p>0.001$) in the means of pH values, moisture content, total plate count, count of lactic acid bacteria, and coliform bacteria count among other locations. A significant positive correlation was found between total plate count and count of lactic acid bacteria (0.82), which means that most of the counted bacteria were lactic acid bacteria. A significant positive correlation was found between total plate count and coliform bacteria count (0.46). The high microbiological content found in the cheese samples, particularly coliforms reflect poor sanitary conditions during processing, a lack of cooling facilities, and the lack of heat treatment to remove undesirable microorganisms and poor health control. Divers' values of moisture content between different locations results showed that there is a lack of a standardized procedure in processing of soft white cheese production in Wasit province.

Keywords: Soft cheese, coliform bacteria, lactic acid bacteria, moisture content, protein content

Introduction

Dairy products have been an essential part of the human diet for over 8000 years and are included in several countries' official dietary guidelines. Dairy products have high nutritional factors involving protein, carbohydrates, vitamins as well as minerals such as calcium, potassium, and phosphorus. Many dietary

recommendations for dairy consumption are based on the importance of dairy products to supplying recommended calcium intakes (Rozenberget al., 2016).

Food products are subject to spoilage by undesirable microbesthroughoutharvest, production, storage, and distribution. Dairy products, becauseof their nutritional value, particularly their high protein and fat content, provide an ideal development environment for a wide range of microorganisms (Lasloand György, 2018). They have, on occasion, served as a significant vehicle of gastrointestinal infection around the world. Many enteropathogenic species have been found in milk and cheese that has been refrigerated and eaten without being heated. High levels of pathogenic microorganisms in cheese may be caused by post-pasteurization contamination, the manufacturing and handling process, equipment, and temperature abuse during transportation, and storage conditions (Araújo et al., 2002).

Food spoilage endangers human health and causes enormous economic losses. Approximately 15–25% of foodstuffs worldwide deteriorate. The type of spoilage microorganism is primarily determined by the type of dairy product. The microbiological content of a product is correlated to the manufacturing steps. Fungi and spore-forming bacteria are linked to cream cheese and processed cheese. Soft, fresh cheese spoilage is the associated withlactic acid bacteria, psychrotrophs, fungi,coliforms, and their enzymatic degradation (Lasloand György, 2018).

While traditional soft white cheese is considered healthy, it could be a good medium for infectious microbes. The risk of contamination is a problem internationally and not restricted to one area. The Food and Drug Administration (FDA) referred that some raw milk cheeses are a likely cause for health problems. Consumption of cheese contaminated with undesirable microbes was the source for 0.4% of the overall foodborne epidemics in Europe(Abdulghani and Kareem, 2019).

Because of its high moisture content (55-80%), neutral pH (6-7), and richness in carbohydrates, proteins, vitamins, and minerals, soft cheese is regarded asa perfect growth medium for many microbes, making it a good environment for microbes which can result in food poisoning and spoilage (Arslan et al., 2011).

Soft cheese is a popular food all over the world. It is typically consumed within 3-4 weeks of manufacturing in Iraq. In rural areas and remote villages, traditional unripened soft cheese is made from unpasteurized milk. Since raw milk contains around 30% of the total microbial count of undesirable microorganisms, this issue means that strict hygienic precautions must be followed in cheese production (Abdulghani and Kareem, 2019).

Therefore the aim of the study was to undertake to evaluate the microbiological quality and physiochemical properties of traditional soft cheese in Wasit province in Iraq.

Materials and Methods

Sampling plan

Soft white cheese is produced in Wasit province in Iraq by farmers using old traditional methods and as such is expected to be exposed to contamination during production or after processing. Thirty-three different locations in major areas at Wasit province were subjected to evaluate the physio-chemical and microbiological quality. The samples were assembled aseptically and were placed in an icebox from several cheese workstations. The weight of the sample was 500gm. The samples were microbiologically and chemically analysed immediately after collection on the same day. Every experiment and analysis was repeated at least three times. The presented findings are the average of three separate triplicates.

Physiochemical tests

The pH meter (model PHS-3C) was used to determine the pH value of traditional soft white cheese samples by immersing the electrode in the sample. The pH electrode was calibrated with standard buffers at pH 4.0 and pH 7.0. The moisture content of soft white cheese samples was determined according toJo et al. (2018). The dry protein content was obtained using the kjeldal method according to ISO 5893-1 (2005).

Microbiological examination of traditional soft white cheese

Sample preparation

A 25 g portion of each sample was transferred into a sterile 500 mL conical flask, diluted with 225 mL sterilized peptone water (0.1%) (Hi-Media, Mumbai, India), and rapidly shaken for 3 minutes. After 30 minutes at room temperature, the flasks were reshaken for 3 minutes (Andrews and Hammack, 2003).

Total plate count

Using plate count agar (Hi-Media, Mumbai, India), the total plate count was obtained using the pour plate technique as described in the FDA's Bacteriological and Analytical Manual (Maturin and Peeler, 2001). (pH 7.0). For each dilution, triplicate plates were incubated for 48 hours at 35° C.

Lactic acid bacteria count and confirmation

Using MRS agar (Hi-Media, Mumbai, India), the Lactic acid bacteria count was determined by the pour plate technique (pH 6.5). For each dilution, triplicate plates were incubated for 48 hours at 35° C. A direct microscopic examination, catalase test and motility were used to validate the presence of representative colonies from MRS plates (Lotfy et al., 2018).

Coliform Count

The coliform count was determined using a pour plate method with an overlay of violet red bile agar (Hi-Media, Mumbai, India) (pH 7.4). For each dilution, triplicate plates were incubated for 24 hours at 35° C. A direct microscopic examination gas production, and oxidase test was done to confirm the presumptive coliform test (Hitchins, 1992).

Statistical analysis

Data were analyzed using the analysis of variance procedures. All statistical analyses were performed using the Gemstat software. Significant differences were determined using Duncan's test ($p<0.001$).

Results and Discussion

pH determination

Cheese was prepared after the growth of natural lactic acid bacteria. Fig. 1 shows the pH values for different locations in major areas in Wasit province. Observations were made immediately after reaching the samples of cheese to the laboratory. The pH values of cheese samples in different areas ranged between 5.29 and 7.64 with an average of 6.65.

There were significant differences ($p<0.001$) in the average of pH between the samples of soft cheese at some locations. There were no significant differences ($p>0.001$) between the average of the pH of the samples collected from other sites (Figure 1).

Haddad and Yamani (2017) found that the pH of soft cheese in major governorates of Jordan ranged between 4.9 and 6.5 with an average of 6.0. Abdulghani and Kareem (2018) referred that the pH of soft

cheese sold in the Salahuddin governorate ranged from 5.10-6.40. Vrdoljak et al. (2016) displayed that the pH of soft cheese range ranged from 5.8-6.5. Our results are consistent with the results above.

A significant negative correlation was recorded between the pH of the tested soft cheese samples and moisture content (-0.33). At high microbial growth, it is expected that a lot of microbial population depleting oxygen, this leads to a decrease in the oxidation reduction potential (Eh), and therefore many other bacteria can grow and work to reduce some compounds that act as final electron acceptors and produce reducing compounds that can result in a decrease in pH. Also, the producers of traditionally soft cheese didn't use the mold during ripening process (Adams and Moss, 2008).

Overall, these results show that the pH of tested samples is slightly lower than the pH of milk (pH of buffalo milk is 6.81 while pH of cow milk is 6.76) (Johansson et al., 2019). The slight decrease in values of samples cheese in comparison with raw milk (buffalo and cow milk) is due to the high protein content of cheese (high buffer capacity). The ability of a food to resist pH fluctuations is referred to as its buffering capacity. Foods with low buffering capacity will experience fastpH shifts as a result of alkaline or acidic compounds created by bacteria as they grow (FDA, 2001).Generally, the microorganisms can grow and multiply only during the limited range of pH, most of them prefer to live in a neutral environment around pH 7(6-8). Staphylococcal enterotoxins are unaffected by low pH and heat conditions that kill S. aureus bacteria. The Staphylococcal enterotoxins are resistant to proteolytic enzymes as well, consequently Staphylococcal enterotoxins remain active in the digestive tract after ingestion (Argudín et al., 2010).

Moisture content

Fig. 2 displays the moisture content of the samples of soft cheese were collected from different sites in Wasit province. Tests were made directly after reaching the samples of cheese to the laboratory. The moisture percentage of cheese samples in different areas ranged between 61.33% and 78.00% with an average of 71.06%.

There were significant differences ($p<0.001$) in the average of moisture content between the samples of soft cheese at some locations. There were no significant differences ($p>0.001$) between the average of the samples collected from other sites (Figure 2).

Haddad and Yamani (2017) reported that the moisture content of soft cheese in major governorates of Jordan ranged between 39.5 and 74.5 with an average of 56.5. Abdulghani and Kareem (2018) stated that the moisture content of soft cheese sold in the Salahuddin governorate ranged between 50.10-60.70%. Al-Manhal (2013) demonstrated that the moisture content of soft cheese ranged between 55.33-69.85%. Our results are in agreement with the results above.

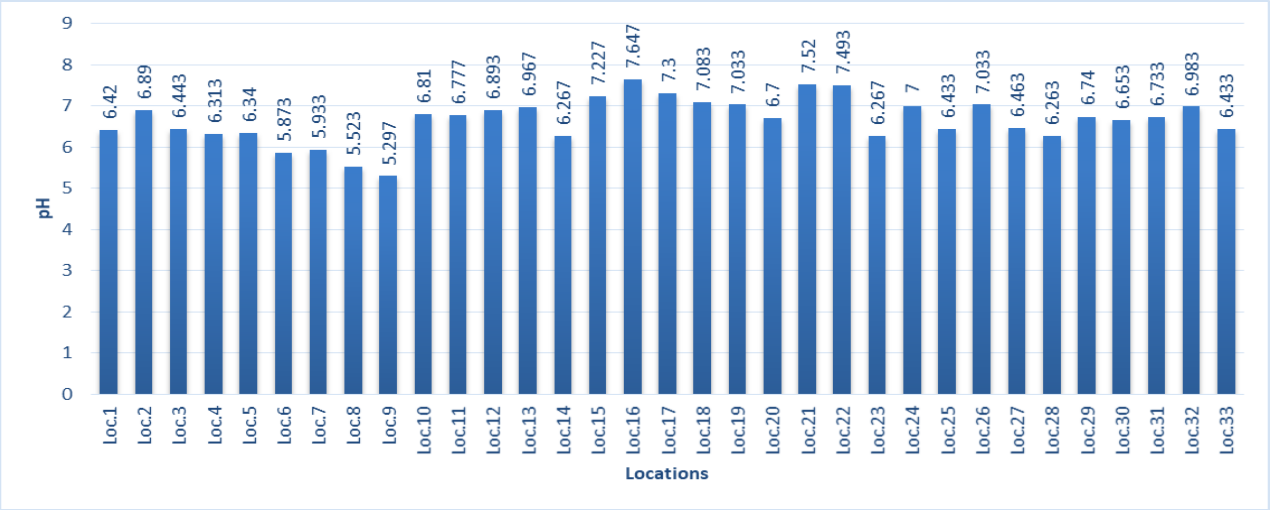


Figure 1 pH values of cheese samples from different locations

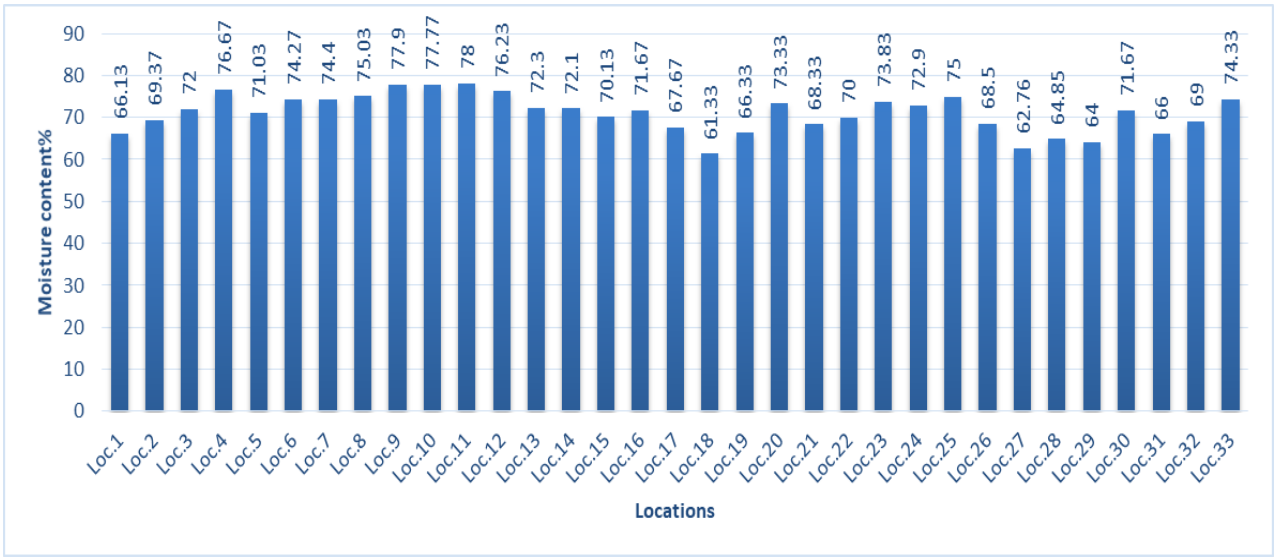


Figure 2 the moisture content of cheese samples from different locations

The moisture content of the food system is considered the most important intrinsic factor that influences microbial growth as well as pH and oxidation reduction potential where all the metabolic activity in the cell requires free water. Controlling the moisture content of foods is one of the oldest preservation techniques (FDA, 2012). The average of moisture content for soft cheese under study is approximately 71.06%. Therefore, we expect the soft cheese samples encouragement environment for the growth of many types of microorganisms especially pathogenic bacteria because all microorganisms prefer the high moisture content of the environment. Therefore, soft cheese with a high percentage of moisture encourages the growth of spoilage and disease-causing microorganisms if it is mishandled.

Lactic acid production has many effects like helping increasethe actions and decreasing the cheese's moisture content, which impacts whey secretion from the curd of milk after cheese making (Stojiljkovic,

2018).

Protein content

Fig. 3 displays the protein content in dry weight of samples of soft cheese were collected from different sites in Al-Kut city while Fig. 4 displays the total protein content. Tests were made directly after reaching the samples of cheese to the laboratory.

The protein percentage in dry weight of cheese samples in different areas ranged between 14.20% and 35.81% with an average of 20.29% while the total protein percentage of cheese samples in different areas had a range between 3.94% and 8.95%. The average of total protein was 5.93%.

Significant differences ($p<0.001$) were found in the average of protein content between the samples of soft cheese at some locations. There were no significant differences ($p>0.001$) between the average of the samples collected from other sites (Figures 3 and 4).

Salih et al. (2012) found that the protein content in dry weight of white cheese samples that were collected from local Sudanese markets ranged from 18.28% to 21.89%, with an average of 20.12%.

Figure 3 the protein content in dry weight of cheese samples from different locations

Figure 4 the total protein content of cheese samples from different locations

Mustafa et al. (2013) reported the protein content in dry weight ranging from 14.17% to 15.73%, with an average value of 14.57% in white cheese produced at household level in level in Sudan's White Nile State's Dueim Area. Al-Manhal (2013) demonstrated that the protein content in dry weight of local soft cheese that was sold in the markets of Basra city in Al-Ashar, Al-Qarna, Abu-Alkhaseeb and 5mil during September 2012 ranged between 13.51 and 21.01. Our results correspond with these results.

The majority of bacteria use amino acids as a source of energy and nitrogen. Peptides and more complicated proteins can be metabolized by some bacteria. Other nitrogen sources include urea, ammonia, creatinine, and methylamines (FDA, 2001). In general, almost all organisms will utilize simple compounds such as amino acids before attacking more complex compounds such as high molecular weight proteins. The same is true for carbohydrates and fatty acids (Jay, 1998).

Microbial analysis

Results of the microbiological analysis of the samples of soft white cheese obtained from 33 different locations are presentedin the logarithmic cycle in Table 1. Observations were made immediately after reaching the samples of cheese to the laboratory.

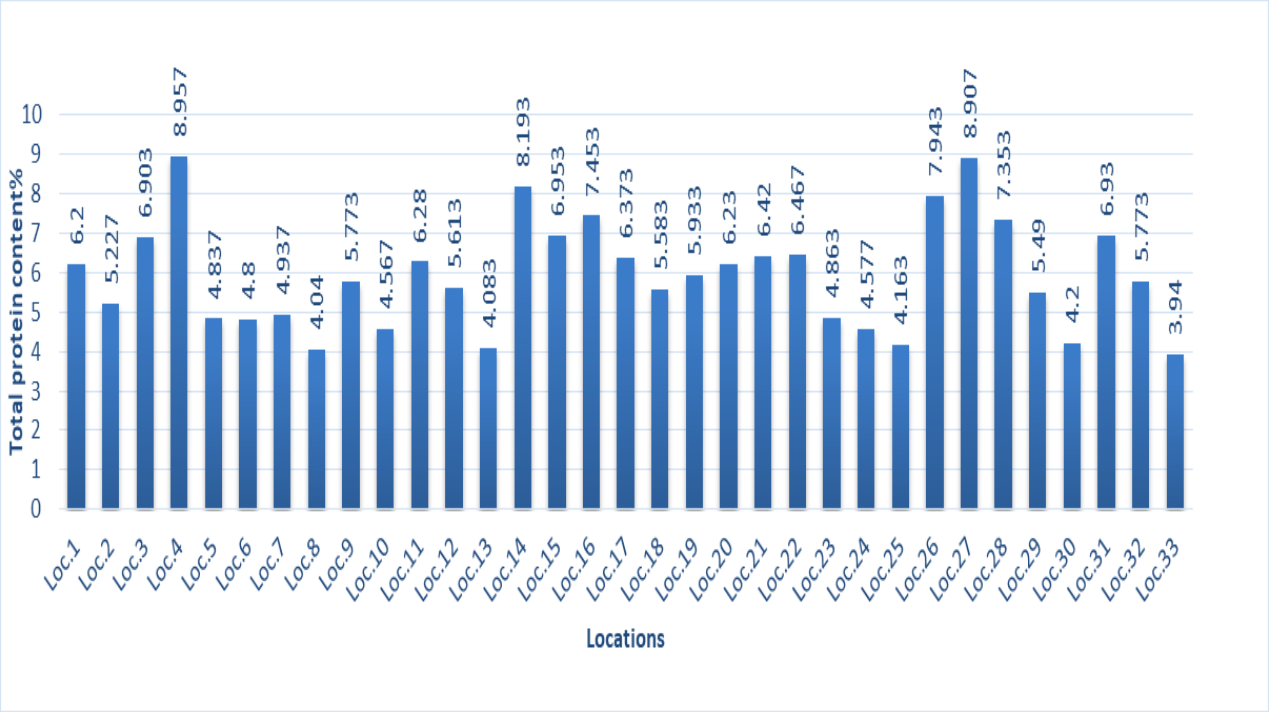


Table 1 Results of microbial analysis of cheese samples collected from different locations

Location	Total Plate Count	Coliform Count	Lactic Acid Bacteria Count
Loc.1	3.888 ± 0.014 ^{kl}	3.567 ± 0.030 ^{ef}	3.595 ± 0.016 ^{jklmn}
Loc.2	3.897± 0.005 ^{kl}	0	3.763 ± 0.007 ^{hijk}
Loc.3	5.345±0.014 ^{b}	2.441 ±0.04 ^{k}	5.124 ± 0.038 ^{b}
Loc.4	5.431 ±0.016 ^{a}	3.874 ±0.029 ^{cd}	5.384 ± 0.011 ^{a}
Loc.5	3.554±0.054 ^{p}	2.3 ±0.043 ^{lk}	3.221± 0.040 ^{qr}
Loc.6	3.435±0.039 ^{r}	2.175 ±0.114 ^{l}	3.008 ± 0.092 st

Loc.7	3.79 ±0.010 ^{m}	3.144 ±0.003 ^{h}	3.68 ± 0.071 ^{ijkl}
Loc.8	3.677 ±0.032 ^{n}	1.651 ±0.156 ^{n}	3.56 ± 0.241 ^{lmn}
Loc.9	4.332 ±0.010 ^{ef}	3.56 ±0.072 ^{ef}	3.374± 0.028 ^{opq}
Loc.10	3.915 ±0.013 ^{kl}	2.843 ±0.022 ^{i}	3.02 ± 0.0641 st
Loc.11	3.360±0.02 ^{s}	1.842 ±0.062 ^{m}	2.916 ± 0.078 ^{t}
Loc.12	4.347 ±0.013 ^{ef}	3.943 ±0.012 ^{bc}	3.455 ± 0.055 ^{nop}
Loc.13	4.024 ±0.064 ^{j}	2.83 ±0.016 ^{i}	3.159 ± 0.275 ^{rs}
Loc.14	4.348± 0.005 ^{ef}	3.143 ±0.011 ^{h}	4.212 ± 0.031 ^{dc}
Loc.15	4.371 ±0.009 ^{de}	2.315 ±0.023 ^{kl}	4.086 ± 0.081 ^{de}
Loc.16	4.333±0.010 ^{ef}	3.328 ±0.023 ^{g}	4.213± 0.068 ^{dc}
Loc.17	3.928 ±0.025 ^{k}	0	3.784 ± 0.046 ^{hi}
Loc.18	3.687 ±0.007 ^{n}	0	3.492 ± 0.071 ^{mno}
Loc.19	4.272±0.046 ^{g}	4.234 ±0.040 ^{a}	3.283 ± 0.142 ^{pqr}
Loc.20	4.372± 0.001 ^{de}	3.955 ± 0.001 ^{bc}	3.74 ± 0.013 ^{hijkl}
Loc.21	3.626±0.025 ^{o}	3.509 ±0.033 ^{f}	2.549 ± 0.064 ^{u}
Loc.22	3.508± 0.011 ^{q}	2.633 ± 0.038 ^{j}	2.36 ± 0.001 ^{v}
Loc.23	3.760 ±0.019 ^{m}	1.593±0.111 ^{n}	3.655 ± 0.039 ^{ijklm}
Loc.24	3.916±0.033 ^{kl}	2.344 ±0.53 ^{kl}	3.842 ± 0.034 ^{ghi}
Loc.25	4.030 ±0.026 ^{j}	2.278 ±0.040 ^{kl}	3.991 ± 0.011 ^{efg}
Loc.26	3.340 ±0.012 ^{s}	0	3.326± 0.004 ^{opqr}
Loc.27	4.397 ±0.008 ^{d}	4.107 ±0.018 ^{ab}	3.892 ± 0.011 ^{fgh}
Loc.28	4.196 ±0.017 ^{h}	3.944 ±0.047 ^{bc}	4.144± 0.009 ^{cde}
Loc.29	3.929 ±0.015 ^{k}	3.64 ±0.020 ^{ef}	3.776± 0.047 ^{hij}
Loc.30	3.876 ±0.020 ^{l}	3.749 ±0.054 ^{de}	3.586 ± 0.082 ^{klmn}
Loc.31	4.444 ±0.005 ^{c}	4.19 ±0.014 ^{a}	4.314 ± 0.011 ^{c}
Loc.32	4.309 ±0.011 ^{fg}	4.054 ±0.015 ^{abc}	4.279 ± 0.004 ^{c}
Loc.33	4.124 ±0.005 ^{i}	3.687 ±0.029 ^{ef}	4.064 ± 0.015 ^{def}
L.S.D 0.05	0.0434	0.1741	0.163
C.V%	0.7	3.9	2.7
P Value	<.001	<.001	<.001

Different superscript letters in the same column represent significant differences (p<0.001).

Total plate count

The total plate count of cheese samples in different areas ranged between 3.34±0.012 log CFU/g and 5.43±0.016 log CFU/g with an average of 4.05 log CFU/g.

There were significant differences (p<0.001) in the average of the total plate count between the samples of soft cheese at some locations. There were no significant differences (p>0.001) between the average of the total plate count the samples collected from other sites (Table 1). There was a significant positive correlation between the averages of total protein content of the soft cheese with the average of total plate count (0.45).

Al-Manhal (2013) demonstrated that the range of the total count of 10 soft cheese samples was 2×108 to 9×105 CFU/g. Alper and Nesrin (2013) found the total aerobic mesophilic bacteria range from 5.2 x 104 to 5.68 x 1011 CFU/g. Our results are in agreement with previous studies.

Cheese is a microbiologically complex subject due to the variety of cheesemaking processes, ripening procedures, and composition. Strains and type of nonstarter microorganisms present in cheese (coliform bacteria, Staphylococcus aureus, yeast and mold, and Salmonella) depend on their initial count in fresh milk (specially when made with unpasteurized milk), formation of biofilm on equipment and later contamination, and survival ability and competition of individual strains in cheese environment (availability of nutrients, salt, aw, pH, acidity, temperature,) (Johnson, 2001). Generally, most foods provide enough nutrients to sustain the growth of a wide variety of foodborne pathogens (FDA, 2001).

Microorganisms that grow or retain viability in cheese comply with the same set of requirements as any other food product (competition, moisture, salt, acidity / type of acid, pH, redox potential, nutrient availability, anaerobic/aerobic conditions, and temperature). The presence and survival of microorganisms, as well as the ability of the microbe to grow, determine the microflora of cheese (Johnson, 2001).

During maturation of cheese, environmental factors may change sufficiently to allow the growth of pathogens that were previously inhibited, or conditions may become even more adverse. The cheese-making environment is dynamic. As a result, the microorganisms in cheese can be regarded as a dynamic ecological system (Johnson, 2001).

Lactic acid bacteria count

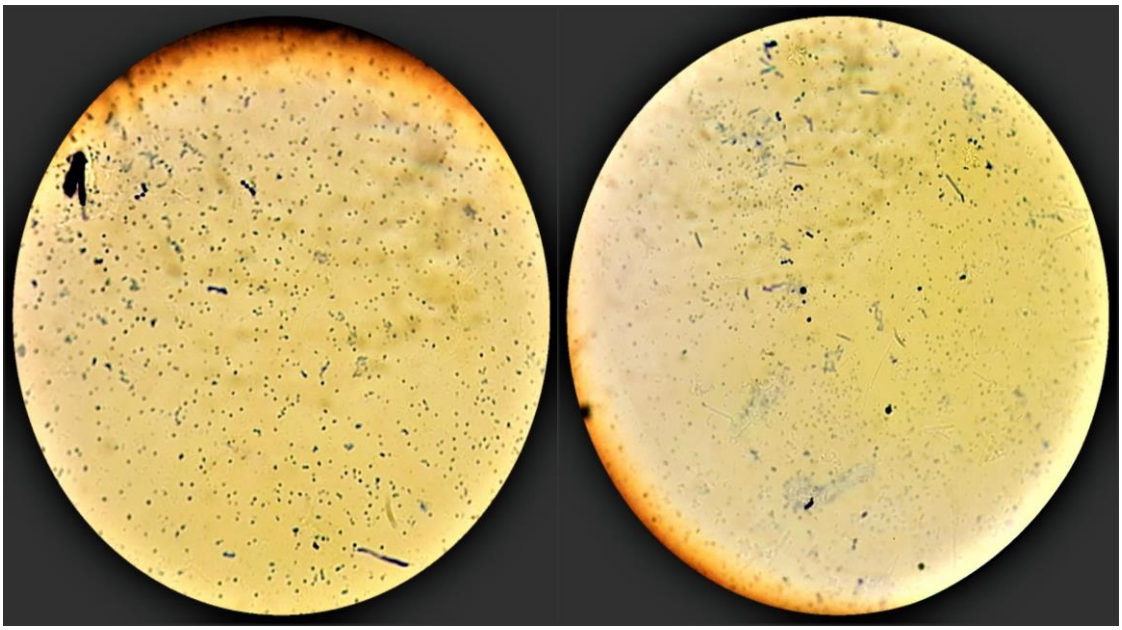
The lactic acid bacteria under the microscope seem as gram-positive, cocci, coccobacilli, or rods (Figure 5).

The lactic acid bacteria count of cheese samples in different areas ranged between 2.36±0.001 log CFU/g and 5.38±0.011 log CFU/g with an average of 3.69 log CFU/g.

There were significant differences ($p<0.001$) in the average of lactic acid bacteria count between the samples of soft cheese at some locations. There were no significant differences ($p>0.001$) between the average of the lactic acid bacteria count between the samples collected from other sites (Table 1).

There is a significant positive correlation between the total plate count and the count oflactic acid bacteria (0.82), which means that most of the counted bacteria were lactic acid bacteria. There is a significant positive correlation between the total protein content of the soft cheese with the lactic acid bacteria count (0.38). Most microorganisms need essential amino acids for growth and some starter culture bacteria are considered as non-proteolytic, consequently, the availability of the essential amino acids is considered as an essential growth factor.

Figure 5 Lactic acid bacteria isolated from cheese samples under the microscope



Stojiljkovic (2018) referred that lactic acid bacteria count in soft white cheese had a range between 2.9 x 104 and 2.04 x 108. The average of lactic acid bacterial count (LAB) of cheese samples was CFU/ml 6.5x105. Salih et al. (2012) showed that the count of lactic acid bacteria in white cheese ranged from 1.7x104 CFU/ml to 1.4 x106 CFU/ml. Our results are in agreement with previous studies.

The starter culture used in this natural fermentation is generally a poorly known mix of microflora that, while predominated by LAB, may also include other microorganisms, and its microbial load and diversity are generally changing over time. Furthermore, research aimed at characterizing traditional cheese indicate that those produced with unpasteurized milk contain a huge variety of LAB (Kongo, 2013).

LAB are considered the most significant bacterial group in dairy manufacturing because they have probiotic properties and can act as fermentative agents as starter cultures. The most vital fermentation in food production is carbohydrates conversion to lactic acid by LAB. The presence of LAB in milk fermentation results in the production of lactic acid, which is essential as a preservative agent and in the development of product flavor. The production of lactic acid serves several purposes: it aids in the providing of activities and reduces the moisture content of cheese weight, which helps in the release of whey from the curd of milk after cheesemaking. Lactic acid bacteria, on the other hand, help in cheese ripening since their enzymes are essential in obtaining the important ingredients for flavor development (Stojiljkovic, 2018).

Endogenous enzyme activity or the aerobic metabolism of lactic acid bacteria can both produce hydrogen peroxide. The reaction createsa short-lived oxidation product such as hypothiocyanate, which can inhibit gram-positive bacteria and eliminate gram-negative bacteria by disrupting their cytoplasmic membrane. In the presence of hydrogen peroxide, milk can produce antimicrobials. Lactoperoxidase, an enzyme that makes up around 0.5 percent of whey proteins and catalyzes the hydrogen peroxide oxidation of thiocyanate. Thiocyanate is found naturally in milk and may be increased by the consumption of vegetable residues such as cabbage and turnip, which are high in thiocyanate precursors (Adams and Moss, 2008).

Coliform bacteria count

The coliform bacteria under the microscope appear as Gram-negative, rod-shaped bacteria (Figure 6).

The coliform bacteria count of cheese samples in different areas ranged between zero (0) and 4.23±0.040 log CFU/g with an average of 2.75 log CFU/g.

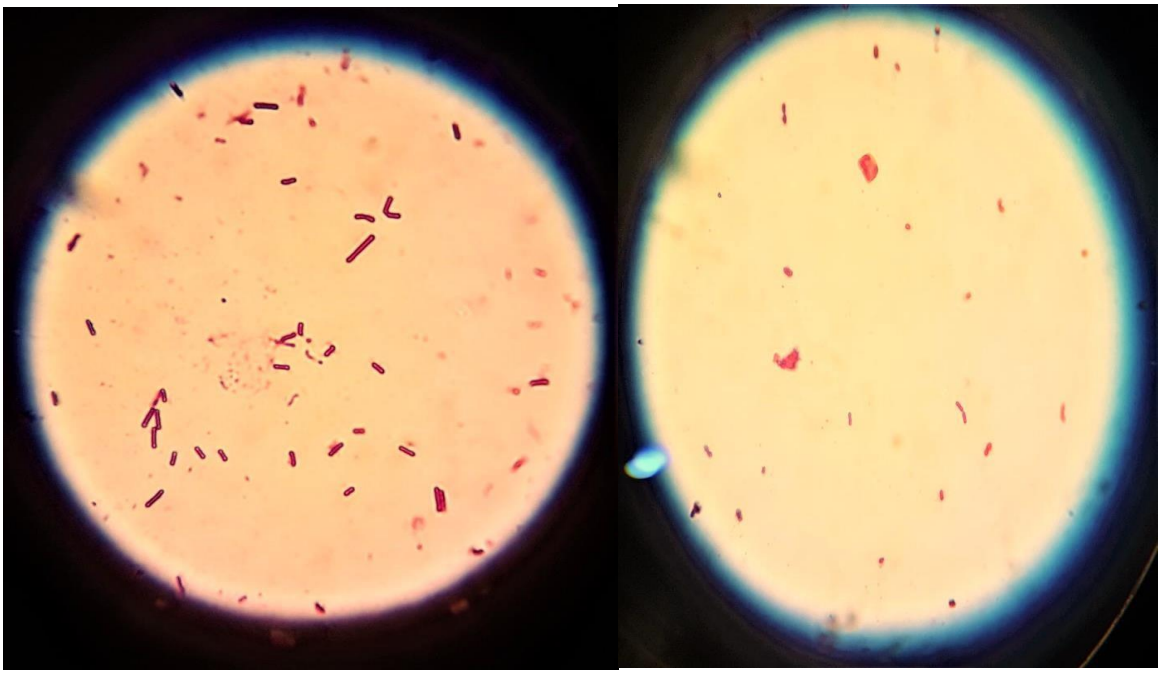


Figure 6 Coliform bacteria isolated from cheese samples under the microscope.

There were significant differences ($p<0.001$) in the average of coliform bacteria count between the samples of soft cheese at some locations. There were no significant differences ($p>0.001$) between the average of the coliform bacteria count between the samples collected from other sites (table 1).

Coliform bacteria were detected in 29 out of the 33 locations (87.87%) examined under study. Table 1 shows that 4 out of 33locations (12.12%) were not detected by coliform bacteria. Seventeen out of 33 locations (51.51%) showed coliform bacteria counts that are higher than the Iraqi Quality Standards which is 103 CFU/g (Microbiological Limits in Food IQS: 2270/5). These results are also higher than Indian and Egyptian microbiological standards for soft cheese. Indian standards for coliform bacteria are absent in 0.1 g while Egyptian standards for coliform bacteria are 10 per g (ES: 1008/11/2005 and FSSAI: 2011).

Al-Manhal (2013) demonstrated that the coliform count of 10 soft cheese samples ranged from 3×102 to 8×103 CFU/g. Yunis et al. (2013) demonstrated that the coliform count of aushari cheese samples ranged from 6 × 102 to 83 × 103. Our results are in agreement with previous studies.

Martin et al. (2016) referred that coliform bacteria are heat-labile, in soft cheese, the presence of coliforms and other Gram-negative bacteria indicates either postpasteurization contamination of the product or the use of raw milk without heat treatment in cheese-making or mishandling. And they added that several coliform bacteria found in pasteurized fluid milk products are psychrotolerant, meaning they can grow to large numbers at low temperatures.

Many factors affect the presence and survival of pathogens in cheese: properties of the pathogen, such as acid, salt, and heat tolerances, the number originally present, and their physiological condition influence their ability to survive the process of cheese-making. The steps used in the cheese-making process affect survival of pathogens as well. The temperatures employed in storage and processing, acid production by starter organisms, addition of salt, and other inhibitors and the curing process are important parameters (Roberts et al, 2005).

EPEC (Enteropathogenic E. coli) causes gastroenteritis in humans and other animals. E. coli does not grow well during the cheesemaking process in general. Although low pH and salt are inhibiting, E. coli can grow and survive the cheese-making process if starter activity is inhibited. It would be expected that surface ripened soft cheese made from raw milk would be particularly high-risk products for infection with coliform bacteria especially EPEC such as E. coli O157:H7 (Roberts et al, 2005).

A significant positive correlation was found between total plate count and coliform bacteria count (0.46). In general, the higher of the total number of microorganisms in soft cheese, there is an opportunity of the presence of coliform bacteria. The presence of coliform bacteria in traditional soft cheese is considered a negative indicator of the possibility of contamination of soft cheese with pathogenic intestinal bacteria.

Conclusion

The microbiological quality and constituents of milk have an important role in the properties of the cheese produced from it. Generally, traditionally soft cheese is not prepared in a sterilized environment and poor hygiene practice. Consequently, contaminating microorganisms will inevitably be found in cheese. It is unavoidable that they will produce a problem with cheese.The results of the research, especially with regard to the variation in the level of moisture between different production sites also showed that there is a lack of a standardized procedure in processing soft white cheese production in Wasit province.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

REFERENCES

Abdulghani, A. H., & Kareem, A. A. (2019). Levels of Some Microbial Contaminants in Domestic Soft Cheese in Governorate of Salahuddin, Iraq. Tikrit Journal for Agricultural Sciences -41 ,(3)18 ,مجلة تكريت للعلوم الزراعية 48.

Adams, M. R., & Moss, M. O. (2008). Chapter 3 Factors Affecting the Growth & Survival of Micro-organisms in Foods. In Food Microbiology (3) (pp. 20-62). The Royal Society of Chemistry. https://doi.org/10.1039/9781847557940-00020

Al-Manhal, A. J. A. (2013). Study of Microbial, Chemical content of Iraqi White Soft Cheese in Basrah Markets. Basrah Journal of Agricultural Sciences, 26(2), 100-109.

Alper, S., &Nesrin, C. (2013). Bacterial contamination in fresh white cheeses sold in bazaars Canakkale, Turkey. International Food Research Journal, 20(3).

Andrews, W. H., & Hammack, T. S. (2003). BAM: Food sampling/preparation of sample homogenate. Food and Drug Administration, Rockville.

Araújo, V., Pagliares, V., Queiroz, M., & Freitas-Almeida, A. (2002). Occurrence of Staphylococcus and enteropathogens in soft cheese commercialized in the city of Rio de Janeiro, Brazil. Journal of Applied Microbiology, 92(6), 1172-1177.

Argudín, M. Á., Mendoza, M. C., &Rodicio, M. R. (2010). Food poisoning and Staphylococcus aureus enterotoxins. Toxins, 2(7), 1751-1773.

Arslan, S., Eyi, A., &Özdemir, F. (2011). Spoilage potentials and antimicrobial resistance of Pseudomonas spp. isolated from cheeses. Journal of Dairy Science, 94(12), 5851-5856.

Egyptian Standards, Soft Cheese, ES:1008/11/2005, Egyptian Organization for Standardization and Quality, Arab Republic of Egypt.

Fernandes, R. (2009). Microbiology handbook: dairy products. Royal Society of Chemistry.

Food and Drug Administration. (2001). Evaluation and definition of potentially hazardous foods, chapter 3: Factors that influence microbial growth.

Food Safety and Standards Authority of India, Biological Hazards, FSSAI/2011, F.No.2-15015/30/2010 dated 1st August, 2011 and its last amendments in 2015), Ministry of Healthand Family Welfare, India.

Haddad, M., & Yamani, M. (2017). Microbiological quality of soft white cheese produced traditionally in Jordan. J Food Process Technol, 8(12), 706-712.

Hitchins, A. (1992). Coliforms-Escherichia coli and its toxins. Compendium of methods for the microbiological examination of foods, 325-369.

International Organization for Standardization (ISO) 5893-1 (2005). Animal Feeding Stuffs: Determination of Nitrogen Content and Calculation of Crude Protein Content-part 1: Kjeldahl method. International Organization for Standardization.

Jay, J. M. (1998). Intrinsic and extrinsic parameters of foods that affect microbial growth. In Modern food microbiology (pp. 38-66). Springer.

Jo, Y., Benoist, D. M., Ameerally, A., & Drake, M. A. (2018). Sensory and chemical properties of Gouda cheese. Journal of Dairy Science, 101(3), 1967-1989. https://doi.org/https://doi.org/10.3168/jds.2017-13637

Johansson, M., Lundh, Å., Sivananthawerl, T., &SvennerstenSjaunja, K. (2019). Composition and Coagulation Properties of Buffalo Milk Produced Under Swedish Conditions; Changes Taking Place During the First Weeks of Lactation.

Johnson, M. E. (2001). Cheese products. FOOD SCIENCE AND TECHNOLOGY-NEW YORK-MARCEL DEKKER-, 345-384.

Kongo, J. M. (2013). Lactic Acid Bacteria: R. BoD–Books on Demand.

Laslo, E., & György, É. (2018). Evaluation of the microbiological quality of some dairy products. Acta Universitatis Sapientiae, Alimentaria, 11, 27-44.

Lotfy, M. F., Aita, O., Hassan, E. A., &Elsayed, A. A. (2018). Applied study of microbiological hazards in raw milk soft white cheese in Egypt. Arab Universities Journal of Agricultural Sciences, 26(2), 657-666.

Martin, N. H., Trmčić, A., Hsieh, T.-H., Boor, K. J., &Wiedmann, M. (2016). The evolving role of coliforms as indicators of unhygienic processing conditions in dairy foods. Frontiers in microbiology, 7, 1549.

Maturin, L., & Peeler, J. (2001). BAM: Aerobic plate count. US Food and Drug Administration: Silver Spring, MD, USA.

Microbiological Limits in Food IQS: 2270/5, Central Organization for Standardization and Quality Control, Ministry of Planning, Republic of Iraq, 2006.

Mustafa, W., Sulieman, A., Abdelgadir, W., &Elkhalifa, E. (2013). Chemical composition of the white cheese produced at household level in Dueim area, White Nile State, Sudan. Journal of Food Nutrition Disorder, 2, 2-5.

Roberts, T. A., Cordier, J. L., Gram, L., Tompkin, R. B., Pitt, J. I., Gorris, L. G. M., & Swanson, K. M. J. (Eds.). (2005). Micro-organisms in foods 6: microbial ecology of food commodities. London, UK: Springer US.

Rozenberg, S., Body, J.-J., Bruyère, O., Bergmann, P., Brandi, M. L., Cooper, C., Devogelaer, J.-P., Gielen, E., Goemaere, S., Kaufman, J.-M., Rizzoli, R., &Reginster, J.-Y. (2016). Effects of Dairy Products Consumption on Health: Benefits and Beliefs—A Commentary from the Belgian Bone Club and the European Society for Clinical and Economic Aspects of Osteoporosis, Osteoarthritis and Musculoskeletal Diseases. Calcified tissue international, 98(1), 1-17. https://doi.org/10.1007/s00223-015-0062-x

Salih, Z. A., Sulieman, A. M. E., Elkhalifa, E. A., & Ali, A. O. (2012). Chemical and microbiological characteristics of white cheese (Jibna-beida) produced in Sudan. Food and Public Health, 2(6), 259-264.

Stojiljkovic, J. (2018). The Count of Lactic Acid Bacteria in White Cheese. Agriculture, Forestry and Fisheries, 7, 143-149.

Vrdoljak, J., Dobranić, V., Filipović, I., &Zdolec, N. (2016). Microbiological quality of soft, semi-hard and hard cheeses during the shelf-life. Mac. Vet. Rev, 39(1), 59-64.

Yunis, A. M., Abdullah, K. S., & Mohammed, H. S. (2013). Production of Semi Like Aushari Cheese by using Probiotic Bacteria and Compare it with some Native Species to some Areas in Northern Iraq. Tikrit Journal for Agricultural Sciences, 13(1).