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EFFECT OF CAMEL MILK ON MICROBIOLOGICAL AND CHEMICAL QUALITY OF SOFT CHEESE

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ABSTRACT

Soft cheese made from buffaloes milk mixed with camel milk at different concentrations (90, 80, 70, 60 %) and (10, 20, 30, 40 %) respectively, the soft cheese (control and their treatments) were stored for 60 days at 4^0C. The chemical composition, microbiological and organoleptic properties were determined for all soft cheese samples during storage periods (fresh, 30, 45 and 60 days). The chemical compositions results showed that the values of total solids, fat, total protein and ash were increased with increasing the amount of camel milk, while salt was decreased during storage periods. The microbiological results revealed that camel raw milk was contained $13X\ 10^6$, $12X\ 10^4$, $13X10^2$, $1X10^4$ and $3X10^3$ cfu/ ml for total bacterial count (T.B.C), total coliform (T.C.), faecal coliform (F.C.), total fungi (T.F.) and lactic acid bacteria (L.A.B) respectively. Yeasts *E. coli, Listeria monocytogenes Staph. aureus* and *Salmonella* were not detected in raw camel milk. Buffaloes' milk were contained $8X10^5$, $3X10^4$, $6X10^2$, $4X10^4$ and $1X10^2$ cfu/ml for T.B.C, T.C, F.C, T.F and L.A.B respectively, *E. coli, Staph aureus, L. monocytogenes* and *Campylobacter* were detected while yeasts and *Salmonella* not detected. The different concentrations (20, 30, 40 %) of camel milk induced completely elimination of *E. coli, Staph. aureus, L. monocytogenes* and fungi after 30 days of refrigerator (4°C) storage while concentration of 10 % camel milk induced completely elimination of *Staph. aureus* and fungi after 60 days of refrigerator storage. On the other hand 100 % buffaloes milk cheese as a control was contaminated with *E. coli, Staph aureus* and *L. monocytogenes* during storage periods, total fungi was increased during storage periods with presence of different types of fungi especially after 60 days of refrigerator (4°C) storage.

INTRODUCTION

Milk is the most important product obtained from camel milk being a complete food, helps to provide a nutritious and balanced diet to nomadic desert people under harsh conditions. Cheese was difficult to make from Camel milk under natural condition, but success was achieved when pH of milk was lowered and calcium chloride was added prior to rennet addition , that is because of differences in availability of K-casein, camel milk has more large casein micelles than does caw milk, which may relate to poor rennetability of camel milk (Haider, *et al.,* 2004). It's also due to its low total solids contents. Its suitability for cheese making decreases significantly in the hot season, when camel milk production is influenced by water and feed availability, as under water shortage conditions camel milk contains abnormally low milk solids and its cheese processing ability is poor. Camel milk is used therapeutically against dropsy, jaundice, problems of the spleen, tuberculosis, asthma, anemia and piles (Rao *et al.,* 1970). Patients with

chronic hepatitis had improved liver function after being treated with camel milk (Sharmanov, *et al.,* 1978). The camel milk works also as a laxative on people unaccustomed to drinking this milk (Rao *et al.,* 1970).

Raw milk may contain microorganisms pathogenic for man and their source may lie either within or outside the udder. Pathogenic bacteria may present in raw milk as a direct consequence of udder disease. Among the organisms commonly producing mastitis is *Escherichia coli* and it is pathogenic bacteria (Sinell, 1973).Contamination of raw milk by pathogenic bacteria from source external to the udder may be caused by *Salmonella* strains, which produce many outbreaks of enteritis (Robinson, *et al.,* 1979). *Listeria monocytogenes*, Shiga toxin producing *E. coli* (STEC) and serotypes of Salmonella are considered as important food-borne pathogens (Olsen *et al.,* 1995). Cheese made from 100% camel milk lower yield and lower component recovery than cheese made from caw milk (Mehaia and Qassim 1993). Camel milk also has germicidal property, which is of great important due to the prescence of lactic acid producing *Lactobacillus* and *Streptococci. Lactobacillus acidophilus* strains showed inhibitory effect towards *Salmonella typhi*, *Staph aureus, E. coli, Proteus vulgaris* and *Yersinia enterocolitica*. Camel milk has the ability to inhibit the growth of pathogenic microorganisms because it contains number of enzymes with anti-bacterial and anti-viral properties these are : Lactoferrin which prevents microbial growth in the gut, Lacto peroxides that suppresses gram-negative bacteria and most effective in raw milk during the first 4 days, peptidogly can recognition protein (PGRP) that broad anti-microbial activity, stimulates the immune system, N-acetyl-glucoseaminidase (NAGase) antiviral activity, Lysozym which inhabits the growth of bacteria and has effective influence on the storage camel milk and immunoglobulin's these possed several trails which give them tremendous advantage over conventional antibodies (Werney, 2003). Microorganisms may gain access to cheese during process; handling and distribution since milk provide a high nutritive, favorable media for the growth and multiplication of such organisms. Many food poisoning outbreaks may be due to using milk from diseased animals with infection of bacterial origin or manufacturing in contaminated places or from the workers themselves. Ingestion of certain microorganisms can be detrimental human health (UNEP, 1992).

The aim of this study was to evaluate the chemical and microbiological quality of cheese processed of mixed buffaloes' milk with camel milk in relation of storage periods.

MATERIALS AND METHODS

Materials:

Buffaloes' milk was obtained from plant of Food Technology Research Institute, Agricultural Research Center, Giza, Egypt. Fresh camel milk was obtained from local market. Rennet enzyme was obtained from Chr. Hansen laboratories, Copenhagen, Denmark. Salt (NaCl) was obtained from local market, Giza.

Methods

Soft cheese manufacture:

The soft cheese manufacture was done according to the method applied by **Fahmi and Shrara (1950)** modified by El-Safty *et al.,*(1983). Camel milk was used as different ratios during manufacturing (10, 20, 30 and 40 %). The chemical and microbiological analysis were determined in soft cheese at different periods (fresh, 30, 45, 60 days).

Chemical analysis:

Total solids, fat, total protein, ash, and salt of the obtained cheese were determined according to the method described by (A.O.A.C. 2006).

Microbiological analysis:

* Total bacterial count was carried out according to Berrang *et al.,* (2001).
* Total coliform and faecal coliform counts were carried out according to **Mercuri and Cox (1979).**
* Total yeasts and Molds counts were carried out according to NMKL(1999).
* Lactic acid bacterial count was carried out according to Badis *et al.,* (2004).
* Isolation of *E. coli* was carried out according to Collins *et al., (*1998). *E. coli* colonies are green metallic sheen on Eosin Methylene blue (EMB)agar medium.
* Isolation of *Salmonella* was carried out according to Ellis *et al.,* (1976). The suspected colonies were sub cultured on nutrient agar slope and incubated at 37^0C for 24 hr.
* *Salmonella* and *E. coli* identification attempts were made using the criteria described by Kreig and Holt (1984), using the following tests: growth on TSI, urea, indole, M.R, V.P and sugar fermentation. Serological tests of the suspected *Salmonella* strain was carried out according to Kauffmann (1973).
* Isolation of *Staphylococcus aureus* was carried out according to Gouda (2002). The isolation of *Staph aureus* based on appears as black, convex, shiny colonies surrounded by a yellow zone on Vojel Johnson agar medium.
* Isolation of *Campylobacter* was carried out according to Oosterom et al., (1983). The isolation of *Campylobacter* based on appearance grey, moist, flat and spreading colonies on *Campylobacter* blood free selective agar medium.
* Isolation of *Listeria monocytogenes* was carried out according to USDA-FSIS(1989). the isolation of *Listeria* based on appearance dew-drop-like, dark brown or black colonies with brown halo on palcam agar medium.
* Isolation and identification of fungi: The fungal isolates were purified using hyphal tip techniques Riker and Riker, (1936), and then identified according to their morphological, macroscopically characters by using different media, Czapek yeast autolysate agar medium (CYA) for purification and identification of *Penicillium spp*., Czapek agar (CZ) medium for identification of *Aspergillus spp.*, potato sucrose agar (PSA) medium for identification of *Fusarium* as described by **Jens** *et al.,* **(1991)**

and confirmed by Fungal Taxonomy Dept. Plant Pathology Institute ARC, Giza, Egypt.

* Extraction and quantification of aflatoxin M1 (AFM1): the method used to extract AFM1 from cheese was carried out according to the method described by Dragacci *et al.,* (1995).

Sensory evaluation:

The cheese was organolepticaly assessed by 10 trained panelists for flavor (50), body and texture (35), appearance a color (15) according to Nelson and Trout (1965) where the total score was 100 degrees.

RESULTS AND DISCUSSION

Milk and soft cheese composition:

Mean composition of milk used to manufacturing cheese is shown in Table (1). The buffaloes' milk had total solids (T.S.) content of 15.60 %. The fat and protein contents were 6.0 % and 4.0 % respectively. the same table shows that the camel milk had mean total solids content of 11.07 %. The mean fat and protein contents were 3.10 % and 3.11 % respectively. The mixtures of buffaloes' milk and camel milk show that the T.S., Fat and protein decreased with increasing the percentage of camel milk , but ash increased with increasing the percentage of camel milk .

Table (1): Chemical compositions of buffalo milk, camel milk and mixed buffaloes and camel milks cheese.

Type of analysis / Type of milk	T.S (%)	Fat(%)	Protein(%)	Ash(%)
Buffaloes milk	15.60	6.00	4.00	0.80
Camel milk	11.07	3.10	3.11	0.90
90 B.M+10% C.M	15.15	5.70	3.90	0.81
80 B.M+ 20% C.M	14.71	5.40	3.80	0.82
70 B.M+30% C.M	14.28	5.20	3.73	0.83
60 B.M+40% C.M	13.85	4.80	3.62	0.84

T. S. Total solids
C.M : camel milk B.M: buffalo milk

The composition of white soft cheese made from buffaloes' milk and its mixed with camel milk were shown in table (2), the results showed that the total solids, fat and protein contents decreased with increasing the camel milk percentage. Whilst, ash slightly increased with camel milk increased, during storage period.. The salt content results of soft cheese slightly decreased during storage period. This may be due to the loss of moisture during storage. The results are in agreement with those stated by Mehaia and Qassim(1993), Hassanein (2003) and Haider *et al,* (2004**).**

Table (2): Chemical compositions of buffalos soft cheese (control) and mixed buffaloes and camel milks cheese.

Cheese Samples	T.S %.	Fat %	Protein %	Salt %	Ash %
Fresh					
Control	46.70	21.60	14.40	2.61	2.70
90 B.M+10% C.M	45.33	20.50	14.03	2.70	2.80
80 B.M+ 20% C.M	44.03	19.50	13.90	2.63	2.90
70 B.M+30% C.M	42.81	18.70	13.43	2.68	3.00
60 B.M+40% C.M	41.24	17.50	13.10	2.66	3.10
30 days					
Control	47.30	22.00	14.71	2.55	2.75
90 B.M+10% C.M	46.31	21.00	14.65	2.65	2.87
80 B.M+ 20% C.M	44.92	20.00	14.17	2.58	2.86
70 B.M+30% C.M	43.66	19.10	13.72	2.63	3.10
60 B.M+40% C.M	42.11	18.20	13.40	2.60	3.21
45 days					
Control	48.05	22.70	15.01	2.50	2.81
90 B.M+10% C.M	47.24	22.10	14.94	2.60	2.98
80 B.M+ 20% C.M	45.58	20.70	14.45	2.53	3.31
70 B.M+30% C.M	44.27	19.60	13.95	2.58	3.28
60 B.M+40% C.M	42.89	18.50	13.67	2.55	3.36
60 days					
Control	48.83	23.50	15..31	2.43	2.91
90 B.M+10% C.M	47.12	22.30	15.24	2.53	3.10
80 B.M+ 20% C.M	45.23	21.10	14.74	2.48	3.38
70 B.M+30% C.M	43.95	20.00	14.23	2.52	3.39
60 B.M+40% C.M	42.80	19.30	13.94	2.49	3.43

T. S. Total solids C.M : camel milk B.M: buffalo milk

Microbiological determinations:

The data recorded in Table (3) clearly showed that camel raw milk contained $13X10^6$, $12X10^4$, $13X10^2$ and $1X10^4$ cfu / ml for T.B.C , T.C., F.C. and T.F respectively, and given positive for *E. coli , L. monocytogenes* and *Campylobacter* , while was negative for yeasts , *staph aureus* and *Salmonella*. Also, buffalo raw milk contained $8X10^5$, $3X10^4$, $6X10^2$ and $4X10^4$ cfu /ml for T.B.C. , T.C. , F.C. and T.F. respectively *E. coli , Staph aureus , L. monocytogenes* and *Campylobacter* were detected, whereas yeasts and *Salmonella* were undetected. These results are in agreement with those recoded by several investigations who observed that camels raw milk samples contained $1.8X\ 10^5$ total bacterial count, 6.8X 10 total coliform and 4.1X10 yeast cfu/ml. All samples were negative for *Salmonella spp*. and *Listeria monocytogenes*, positive for *Staph aureus* and *Escherichia coli* (Omar and Eltinay, 2008). The presence of *Staph aureus* in camels milk indicated contamination from the skin, mouth or the nose of the food handler (FAO, 1992). Contamination of raw milk by pathogenic bacteria from source external

to the udder may be caused by *Salmonella* strains (Robinson *et al.,* 1979). *Salmonella spp., E. coli* and *L. monocytogenes* were isolated from camel milk by (Alall *et al.,* 2012). Milk in general and camel milk specifically significant interferences in the recovery of *L. monocytogenes, Salmonella spp*. and *E. coli* may occur (De Boer., 1998). Lore *et al.,* (2005) found that the total lactic acid bacteria were6.8 $\log_{10}$ cfu/ml of camel milk The mean log count per ml camel milk for aerobic total count and moulds and yeasts were 5, 2.7 and 1.9 respectively. Coliform and faecal group were found in 45.5 and 12% respectively of samples, while *staph aureus* and *Salmonella* were detected in 70 and 24 % respectively of samples (El-Zine and Al- Turki, 2007). *Salmonella* is one of the most etiologic agents responsible for several outbreaks associated with the consumption of raw milk and milk products (De Buyser *et al.,* 2001). Total bacterial counts, coliform, lactic acid bacteria, *E. coli, Staph aureus* and yeast-mold ($\log_{10}$ cfu/ml) levels in the buffalo milk samples were detected as 6.36 , 5.74 , 1.10 , 2.46 and 2.63 respectively (Zeki, *et al.,* 2013). In another study carried out in China, TBC, L.A.B, yeast-mold, coliform, *E. coli* and *Staph. aureus* ($\log_{10}$ cfu/ml) level in 120 buffalo milk samples were determined as 5.59, 4.62, 1.79, 2.42, 1.53 and 1.68 respectively (Han, *et al.,* 2007). As in study on raw buffalo milk samples, TBC, *E. coli* and yeast levels ($\log_{10}$ cfu/ml) were determined between $3.4X10^5$ - $4X10^7$, 2X10 - $1.7X10^4$ and $2.7X\ 10^2$ - $1.7X10^4$ respectively (Braun and preuss,2007). Coroian *et al.,* (2010) reported mean coliform bacteria, Yeast-mold and aerobe mesophile general creature levels in 42 Romanian buffalo milk samples as 4.96 ± 0.45/ml, 633.47 ± 0.01/g and 4.46 ± $0.11X10^5$ /ml respectively ..

Table (4) shows that a higher decrease in the microbial count of processing cheese in 40% camel milk where counts varied from $9X10^6$ to $2X10^6$, $2X10^6$ to $2X10^5$, $3X10^5$ to $3X10^4$, $4X10^4$ to $7X10^3$ and $2X10^6$ to $11X10^3$ cfu/g for T.B.C., T.C., F.C., yeasts and T.F. respectively, and induce completely eliminated of *L. monocytogenes* beginning of addition 20 until 40 % - camel milk comparing to processing fresh cheese. Aflatoxin M1 did not detected in buffalo and camel milk.

Table (5) shows that addition of different concentrations of camel milk to processing cheese and keeping it at 4^0C for 30 days induced decreasing in T.B.C., T.C., F.C. and yeasts counts from $9X10^5$ to $2X10^5$, $9X10^4$ to $7X10^3$, $8X10^3$ to $5X10^2$ and $9X10^5$ to $3X10^4$ cfu/g respectively and completely elimination of *E. coli, Staph. aureus, L. monocytogenes* and fungi comparison with processing cheese using only buffalo milk (control).

Table (6) evidences that continuous storage of processing cheese at 4^0C for 45 days increased microbial counts but addition of different concentrations of camel milk especially 40 % concentrate paid to decreasing their load from $5X10^6$ to $3X10^5$, $9X10^5$ to $5X10^5$, $4X10^5$ to $2X10^3$ and $2X10^6$ to $7X10^5$ cfu/g for T.B.C., T.C., F.C. and yeasts respectively, whereas *E. coli, Staph. aureus, L. monocytogenes* and fungi disappeared comparison with control.

Table (7) clearly shown that 10% concentration of camel milk induced completely elimination of remained *Staph. aureus* and fungi in processing cheese after 60 days of storage at 4^0C but was ineffective toward

Campylobacter. Also T.B.C., T.C., F.C. and yeasts diminished from $10X10^7$ to $6X10^5$, $2X10^7$ to $2X10^5$, $4X10^6$ to $4X10^4$ and $9X10^5$ to $7X10^4$ cfu/g respectively, at 40% concentration of camel milk and presence of different types of fungi and duration of *E. coli, Staph. aureus* and *L. monocytogenes* in processing cheese with only buffalo milk (control) until the end storage period. All processing cheese samples were contaminated with *Campylobacter* during storage time for 60 days, These results are in agreement with Al-Majali et al.,(2007) who described the ability of camel milk to inhibit the growth of many bacterial species due to the lytic action of lysozyme and lactoferrin of camel's milk. Al-Haj and A-Kanhal (2010) reported that lysozme may cause direct lysis of bacteria. Fermented camel milk products were free from pathogenic bacteria such as *Salmonella spp., Staphylococcus aureus, Listeria monocytogenes* and *Escherichia coli* O_{157}:H_7 while the total coliform, yeasts and molds counts were less than 10 cfu/ml (Abdel Rahman et al., 2009). All examined processing cheese samples were free from aflatoxin M_1.

Moroccan traditional fermented dairy products like lben and jben showed high number of coliform, enterococci and pathogens such as *Salmonella spp., L. monocytogenes* and *Staph. aureus* (Hamama and Bayi, 1991). Camel milk provided support to the growth of *L. acidophilus* (Abu-Tarboush, 1994). Lactic acid bacteria (L.A.B) have shown to possess an inhibitory effect mostly towards Gram positive pathogens and closely related bacteria due to the bactericidal effect of protease sensitive bacteriocins (Jack et al., 1995). Still L.A.B were also able to control the growth of Gram negative pathogens including food borne pathogens by the production of organic acids and hydrogen peroxide (Ito et al., 2003). Camel milk is gaining more popularity nowadays because of its high nutritional quality and therapeutic value (Strasser et al., 2006). The inhibition of pathogenic bacteria was also observed by (Barbour, et al., 1984).The changes with age of processed cheese are influenced by four main factors: product composition, processing, packaging and storage conditions (time and temperature) (Schar and Bosset , 2002). Soft feta with palm oil (cow rennet) showed the highest contamination level of 4.11 and 3.72 log cfu/g of total viable count and *Staphylococci* respectively (Hegazy and Mahgoub, 2013).

These negative results against the occurrence of most pathogenic bacteria, might be due to the activity of protective protein (Lysozyme, Lactoferrin, Lactoperoxidase, immunoglobulm G and A) of camel's milk as reported by Barbour,et al., (1984) and El-Agamy, (1992), who found that camel milk lysozyme (LZ) was effect against *Salmonella* and that camel milk Lactoperoxidase was bacteriostatic against the Gram-positive strains, and showed bactericidal effect against Gram negative cultures.

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Sensory evaluation:

Average of organoleptic score recorded in soft cheese and its treatments with different levels of camel's milk were recorded in Table (8). The cheese flavour treatments were inferior to that made with raw milk. After 45 days of pickling improvement has been happened in the flavour and body and texture. After 60 days of pickling , flavour as well as body and texture were improved, these treatments acquired a full flavour and scored are 93 for all treatments, these points nearly from cheese made with buffaloes' milk. These results are in agreement with reported by Mehaia *et al.,* (1993).

Table (8): Effect of adding camel milk to buffalo milk on organoleptic properties of processing soft cheese.

Cheese treatments	Storage period	Organoleptic properties			
		Flavor (50)	Body & Texture (35)	Appearance & color (15)	Total (100)
Control	Fresh	45	33	13	91
	30 days	46	32	13	91
	45 days	47	33	14	94
	60 days	47	33	14	94
10% C.M	Fresh	45	33	13	91
	30 days	45	32	13	90
	45 days	46	32	14	92
	60 days	47	32	14	93
20%C.M	Fresh	44	32	12	88
	30 days	44	32	12	88
	45 days	45	33	13	91
	60 days	46	33	14	93
30% C.M	Fresh	44	32	12	88
	30 days	44	32	12	88
	45 days	45	33	13	91
	60 days	46	33	14	93
40% C.M	Fresh	44	31	12	87
	30 days	45	32	12	89
	45 days	46	33	13	92
	60 days	46	33	14	93

C.M:Camel milk

Conclusion

The obtained results clearly observed that the use of camel milk at different concentrations (up to 40%) with buffaloes' milk in cheese processing and stored for 60 days at 4^0C did not show any effect on flavor when fresh and during storage period and completely eliminated of *E. coli, Staph. aureus, Salmonella, Listeria monocytogenes* and fungi.

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تأثير لبن الابل علي الجودة الميكروبيولوجية والكيميائية للجبن الطري

نعمات ابراهيم بسيوني* ، أحمد فريد عبد السلام* ، زينب محمد عبد الغني* ، عادل محمد محمد القرماني* محمد عبد المطلع عطوه* و احمد محمد حسنين **

*** المركز الاقليمي للاغذية والاعلاف**

**** معهد بحوث تكنولوجيا الاغذية - مركز البحوث الزراعية**

في هذه الدراسة تم تصنيع الجبن الطري عن طريق خليط من اللبن الجاموسي ولبن الابل بنسب خلط (٩٠،٨٠،٧٠، ٦٠ %) و(١٠ ،٢٠ ، ٣٠ ، ٤٠%) علي التوالي . تم تخزين عينات المقارنة (لبن جاموسي) والمعاملات للجبن الطري لمدة ٦٠ يوما علي درجة ٤ ° م . وقد اختبر التركيب الكيماوي و الخواص الميكروبيولوجية والصفات الحسية للجبن الناتج الطازج والمخزن لمدد ٣٠ ، ٤٥ ، ٦٠ يوما. أظهرت النتائج الكيميائية أن قيم الجوامد الكلية والدهن و البروتين الكلي وكذا الرماد قد زادت بزيادة نسبة لبن الابل في العينات ، بينما انخفضت نسب الرطوبة و الملح أثناء فترات التخزين .

كما أظهرت النتائج الميكروبيولوجية أن لبن الابل الخام احتوي ١٣ X ١٠^{٦} و ١٢ X ١٠^{٤} و ١٣ X ١٠^{٢} و ١ X ١٠^{٤} و ٣ X ١٠^{٣} خلية / مللي لكل من البكتيريا الكلية و الميكروبات القولونية الكلية و القولونية البرازية و الفطريات الكلية و بكتريا حامض اللاكتيك علي التوالي ، كما تم عزل ميكروبات الاشيرشياكولاي والليستريا مونوسيتوجينيس و الكامبيلوباكتر ولم يعزل الخمائر والاسيتافيلوكوكس اوريس و السالمونيلا. احتوي اللبن الجاموسي علي 8 X 10^5 و ٣X ١٠^{٤} و ٦ X ١٠^{٢} و ٤ X 10^4 و ١X10^2 خلية / مللي لكل من البكتيريا الكلية و الميكروبات القولونية الكلية و القولونية البرازية و الفطريات الكلية و بكتريا حامض اللاكتيك علي التوالي، كما تم عزل ميكروبات الاشيرشياكولاي و الاسيتافيلوكوكس اوريس والليستريا مونوسيتوجينيس و الكامبيلوباكتر ولم يعزل الخمائر و السالمونيلا. احدثت التركيزات المختلفة (١٠ ،٢٠ ، ٣٠ ، ٤٠%) للبن الابل تثبيط كامل لكل من الاشيرشياكولاي والاسيتافيلوكوكس اوريس والليستريا مونوسيتوجينيس والفطريات بعد ٣٠ يوم من التخزين في الثلاجة، بينما التركيز ١٠ % من لبن الابل احدث تثبيط كامل للاسيتافيلوكوكس اوريس والفطريات بعد ٦٠ يوم من التخزين المبرد علي الجانب الاخر فان الجبن المصنع من اللبن الجاموسي فقط (المقارنة) استمر تلوثها بالاشيرشياكولاي و الاسيتافيلوكوكس اوريس والليستريا مونوسيتوجينيس اثناء فترات التخزين في الثلاجة وازدادت الفطريات الكلية مع ظهور انواع مختلفة من الفطريات خصوصا بعد ٦٠ يوم من التخزين المبرد .

قام بتحكيم البحث

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Table (3): Microbial load of buffalo and camel raw milk.

Microorganism / Kind of milk	T.B.C. (cfu/ml)	T.C. (cfu/ml)	F.C. (cfu/ml)	Yeasts (cfu/ml)	T.F (cfu/ml)	L.A.B (cfu/ml)	E. coli	*Staph. aureus*	*Salmonella*	*Listeria Monocytogens*	*Campylobacter*	Identification of fungi	Aflatoxin M1(ppb)
Buffaloes' milk	**$8X10^5$**	**$3X10^4$**	**$6X10^2$**	**-**	**$4X10^4$**	**$1X10^2$**	**+**	**+**	**-**	**+**	**+**	***Aspergillus epp. Penicillium spp.***	-
Camels' milk	**$13X10^6$**	**$12X10^4$**	**$13X10^2$**	**-**	**$1X10^4$**	**$3X10^3$**	**-**	**-**	**-**	**-**	**+**	***Penicillium spp. Stemphylium.botryosum***	-

T.B.C. : Total bacterial counts. T.C. : Total coliform. F.C. : Faecal coliform. T.F. : Total Fungi. L.A.B. Lactic acid bacteria Positive : (+) Negative: (-)

Table (4): Microbial load of processing fresh cheese:

Microorganism / Kind of cheese	T.B.C. (cfu/g)	T.C. (cfu/g)	F.C. (cfu/g)	Yeasts (cfu/g)	T.F (cfu/g)	L.A.B (cfu/g)	*E. coli*	*Staph. aureus*	*Salmonella*	*Listeria monocytogenes*	*Campylobacter*	Identification of fungi	Aflatoxin M1(ppb)
Control (100% B.M)	$9X10^6$	$2X10^6$	$3x10^5$	$4X10^4$	$2X10^6$	$2X10^3$	+	+	-	+	+	*Penicillium spp. Penicillium. chrysogenum Aspergillus spp.*	-
10% C.M	$6X10^6$	$12X10^5$	$12X10^4$	$2X10^4$	$8X10^5$	$3X10^3$	+	+	-	+	+	*Fusarium spp.*	-
20% C.M	$5X10^6$	$10X10^5$	$10x10^4$	$13X10^3$	$6X10^5$	$4X10^3$	+	+	-	-	+	*Fusarium spp.*	-
30% C.M	$4X10^6$	$7X10^5$	$8X10^4$	$10x10^3$	$6X10^4$	$5X10^3$	+	+	-	-	+	*Aspergillus spp.*	-
40% C.M	$2X10^6$	$2X10^5$	$3X10^4$	$7x10^3$	$11X10^3$	$8x10^3$	+	+	-	-	+	*Penicillium spp.*	-

*** The same footnotes in Table (3). C.M :Camel milk B.M:Buffalo milk**

Table (5): Microbial load of processing cheese during storage at 4^0C for 30 days:

Microorganism / Kind of cheese	T.B.C. (cfu/g)	T.C. (cfu/g)	F.C. (cfu/g)	Yeasts (cfu/g)	T.F. (cfu/g)	L.A.B (cfu/g)	*E. coli*	*Staph. Aureus*	*Salmonella*	*Listeria monocytogenes*	*Campylobacter*	Identification of fungi	Aflatoxin M1(ppb)
Control (100% B.M))	$9X10^5$	$9X10^4$	$8X10^3$	$9x10^5$	$5x10^3$	5x10	+	+	-	+	+	*Stemphylium. botryosum Fusarium spp. Penicillium spp.*	-
10% C.M	$7x10^5$	$5X10^4$	$3x10^3$	$4x10^5$	$1x10^2$	10x10	-	+	-	-	+	*Penicillium spp.*	-
20% C.M	$4X10^5$	$11X10^3$	$7x10^2$	$2x10^5$	-	13X10	-	-	-	-	+	-	-
30% C.M	$2X10^5$	$11X10^3$	$5x10^2$	$7x10^4$	-	15X10	-	-	-	-	+	-	-
40% C.M	$2X10^5$	$7X10^3$	$5x10^2$	$3x10^4$	-	$8X10^2$	-	-	-	-	+	-	-

*** The same footnotes in Table (3). C.M :Camel milk B.M:Buffalo milk**

Table (6): Microbial load of processing cheese during storage at 4^0C for 45 days:

Microorganism / Kind of cheese	T.B.C. (cfu/g)	T.C. (cfu/g)	F.C. (cfu/g)	Yeasts (cfu/g)	T.F. (cfu/g)	L.A.B (cfu/g)	*E. coli*	*Staph. Aureus*	*Salmonella*	*Listeria monocytogenes*	*Campylobacter*	Identification of fungi	Aflatoxin M1(ppb)
Control (100% B.M)	$5X10^6$	$9X10^5$	$4X10^5$	$2x10^6$	$3x10^3$	$10x10^2$	+	+	-	+	+	*Aspergillus. flavus Penicillium. chrysogenum*	-
10% C.M	$9x10^5$	$11X10^3$	$8x10^3$	$15x10^5$	$2x10^2$	$4x10^3$	-	+	-	-	+	*Stemphylium. botryosum*	-
20% C.M	$8X10^5$	$9X10^3$	$5x10^3$	$10x10^5$	-	$4X10^3$	-	-	-	-	+	-	-
30% C.M	$6X10^5$	$6X10^3$	$2x10^3$	$10x10^5$	-	$7x10^3$	-	-	-	-	+	-	-
40% C.M	$3X10^5$	$5X10^3$	$2x10^3$	$7x10^5$	-	$9X10^3$	-	-	-	-	+	-	-

*** The same footnotes in Table (3). C.M :Camel milk B.M:Buffalo milk**

Table (7): Microbial load of processing cheese during storage at 4^0C for 60 days:

Microorganism / Kind of cheese	T.B.C. (cfu/g)	T.C. (cfu/g)	F.C. (cfu/g)	Yeasts (cfu/g)	T.F (cfu/g)	L.A.B (cfu/g)	*E. coli*	*Staph. Aureus*	*Salmonella*	*Listeria monocytogenes*	*Campylobacter*	Identification of fungi	Aflatoxin M1(ppb)
Control (100%B.M)	$10X10^7$	$2X10^7$	$4X10^6$	$9X10^5$	$4X10^3$	5X10	+	+	-	+	+	*Stemphylium. botryosum Penicillium. chrysogenum Aspergillus. flavus Fusarium spp. Penicillium. citreonigrum*	-
10% C.M	$8X10^6$	$3X10^6$	$3X10^5$	$7X10^5$	-	$3X10^2$	-	-	-	-	+	-	-
20%C.M	$3X10^6$	$8X10^5$	$9X10^4$	$4X10^5$	-	$6X10^2$	-	-	-	-	+	-	-
30%C.M	$9X10^5$	$6X10^5$	$7X10^4$	$2X10^5$	-	$8X10^2$	-	-	-	-	+	-	-
40%C.M	$6X10^5$	$2X10^5$	$4X10^4$	$7X10^4$	-	$3X10^3$	-	-	-	-	+	-	

*** The same footnotes in Table (3).**
C.M :Camel milk
B.M:Buffalo milk

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