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Quality characteristics of yoghurt made from various blends of camel's and cow's milk

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Abstract:

Milk and its products are of high nutritional value and are of great importance in human nutrition. In Sultanate of Oman, cow's milk is normally used in the production of various dairy products. However, in Salalah and the surrounding area camel milk is more used than cow's milk. The aim of this study is to enhance the utilization of camel milk for the production of yoghurt from blends of camel and cow's milk. Three types of yoghurts were made from 100% cow's milk and blends of camel and cow's milk in the proportion of, 15: 85% and 30: 70% of camel's and cow's milk, respectively. Milk as well as their products were subjected to chemical, microbiological and sensory evaluation analyses using standard methods. The results obtained showed very slight difference between the chemical

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composition of camel's and cow's milk. The contents of the chemical components of the last two blends of camels and cow's milk were almost identical. On the other hand, the microbial analysis showed that the camel and cow's milk were free from Coliform bacteria. However, it was found that very small numbers of Coliform bacteria were found in the milk blends at the levels of 0.8 x10 and 0.9×10for the samples of 30: 70% and 15: 85%. Camels and cow's milk blends, respectively. The total bacteria count in the cows and camels milk were 0.3 ×10² and 0.1×10² respectively, while it was 0.5 ×10² and 0.8 ×10² in the camel's and cow's milk blends of 15: 85 % and 30: 70% respectively. The results also indicated the presence of very small numbers of yeasts and molds in all the milk samples. It was found to be 0.3 × 10, 0.2 × 10 , 0.4 × 10 and 0.1×10² in the camel's and cow`s blends of 30: 70% and 15:85% respectively. The acidity of the various types of yoghurts i.e. type A (blends of 30:70 %); type B (15: 85%) and type C (0:100%) camels to cow's milk was the same in the fresh product 1.05% However, it progressively increased with the increase of storage period at a 6° C , where it reached after 10 days of storage 1.1 % in type A yoghurt; 1.07% % in type B yoghurt and 1.11 % in type C yoghurt with a concomitant decrease in the pH values. There was also a progressive decrease in the protein and total solids contents and a progressive increase in the fat contents of all the types of yoghurts with the increase in the storage period for all the types of yoghurts. The sensory evaluation results indicated that the 100% cow's milk yoghurt (type C yoghurt) scored the highest overall acceptability and that type B yoghurt (15: 85% camels / cow's milk scored the second best overall acceptability. It is recommended that camel`s milk utilization enhancement to be explored by its incorporation in yoghurt manufacture.

Key words: Quality characteristics; yoghurt; camel's; cow's milk; food processing.

INTRODUCTION

The Sultanate of Oman is located between latitudes 16' 40N and 26' 200N and longitude 51' E and 50' 40E. According to the

Ministry of Agriculture, the number of different livestock (in thousands) in the Sultanate was 326.240 cows, 1685.420 goats, 380.990 sheep and 127.010 camels were in the year 2009. In respect of local production of poultry meat, table eggs and fresh milk, it is evident that fresh milk production has rising trend from 2007 (47.63 thousand tons) to 2009 (49.57 thousand tons) (MOA, 2009). Milk is defined as the lacteal secretion obtained by the complete milking of one or more mammalian animals. It is highly valued because it is an important source of many of the nutrients essential for the proper development and maintenance of the human body. Facts show milk as the healthiest drink (WWW.dairyfarmingtoday.org). Cows are the main source for the milk supplies; they produce 90% of the world total supply of milk (AOAD, 1983). Milk and milk products have been used as important food for man since before the dawn of civilization. From historical experience, they have long been regarded as the best cornerstone to build nourishing diets. Primitive people had little reason to be concerned with protein foods when they had milk in their diets. They had to be concerned with preservation of milk in its various forms (Carls, 1978). Camel milk is obtained from camels. This type of milk is much more common than other types of milk in native camel habitats, which are usually very hot and dry. Unlike many other animals, camels can withstand very dry climates with little water. Some studies suggest that camel milk is also healthier than the regular cow`s milk common in the west. Although it is somewhat common in Middle Eastern countries, this type of milk is rare in countries like the United States (Wise, 2011). Yoghurt is a cultured dairy product .The process of making yoghurt involves culturing cream of milk with live and active bacterial cultures which prepared by adding bacteria directly to the milk (Enda, 1998). Several factors are crucial for successful yoghurt making, which include: good sterile technique, proper sterilization and cooling of the milk ensure

good results; proper incubation temperature (50°C) and protection of the starter from contamination. The objective of this work was to process of yoghurt by using cow`s, camel`s milk and mixed milk (cow and camel) for manufacturing yoghurt and to Assess of the chemical, microbiological and sensory quality of manufactured yoghurt as well as to study the effect of refrigerated storage on the shelf life of the manufactured yoghurt.

MATERIALS AND METHODS

Materials

Fresh camel milk was collected from Suhil farm in the mountain (Salalah, Sultanate of Oman) and fresh cow milk was collected from Sahanot farm in Salalah during the last of November, then the samples were refrigerated to suppress microbial growth. Chemical and microbiological analysis were conducted on milk samples (cow milk , camel milk, 30% camel milk +70% cow milk, 15% camel milk +85%cow milk) and yoghurt samples one by pure cow`s milk and the other two samples using different ratios of cow`s milk and camel milk. The chemical and microbiological analysis for yoghurt samples were conducted after one day of the manufacture, after five days and after ten days. The used glassware and other materials were sterilized by dry and wet sterilization. The hot sterilization was done by oven at 148˚C for 3 hours, while wet sterilization was carried out in an autoclave at 121˚C for 15 minutes. Violed red bile agar and plate count agar microbiological media were obtained from Oxoid Ltd (UK) and wort agar was obtained from Lab M limited (UK). All used microbiological media were prepared according to the manufactures instructions. In addition, other materials were used in the manufacture of yoghurt such as stabilizer, skimmed milk powder and culture.

Methods

Microbiological media

Plate count agar (PCA), violet red bile agar (VRBA) and potato dextrose agar (PDA) were used as a standard preparation for media.

Titratable acidity and pH

For acidity, 10 ml of each sample was pipette into a 100 ml conical flask, one ml phenolphthalein were then added, titration was carried out using 0.1 N NaOH until a faint pink color was obtained. pH values were determined by pH meter after calibrating it by buffer solution at pH 7.0 and temperature 25˚C.

Protein content

Protein content was determined according to Kjeladahel method described by (AOAC, 1990). Tow grams of each samples were placed in digestion flask (500 ml), KSO_4 was added to it. Then 25 ml of concentrated sulfuric acid was added and the content was heated at 35˚C in fume cupboard until a clear solution was obtained (2-3 hours) and left to cool before those antidumping granuleswas added. The digested samples were poured in a volumetric flask (100 ml) and diluted to 100 ml with distilled water. Five ml were distilled using 10 ml of 40% NaOH; 25 ml of boric acid with drops of methyl red were placed in a conical flask. Distillation of the reaction mixture liberated ammonia and reacted with boric acid, changing the color from red to light greenish blue. Excess alkali was then titrated using 0.1 N hydrochloric acid, until color changed to light purple. The titration reading was reported. The protein content was determined by multiplying the percentage nitrogen by empirical factor 6.36; as follow:

$$N\% = \text{Volume of HCl} \times N \times 14 \times \frac{dilution\ factors}{1000 \times weight\ of\ sample} \times 100$$

Protein % = N% ×6.63 N = Normality of HCl

Total soluble solids content

The total soluble solids percentage was determined according to the modified method of AOAC, (1990). Three grams of each sample were weight into a dry clean crucible dish, and then heated on a water bath for 10 – 15 min. The dish was placed in an oven at 70˚C overnight, and then cooled in desicator and weight quickly.

Fat content

A rapid volumetric as described by Foley and Murphy, (1974) was used for determination of fat content of different samples. Ten ml of concentrated sulfuric acid was poured in abutyrometer tube. Then 10.94 ml of mixed milk was added slowly at the sides, followed by 1.0 ml of fat – free amyl alcohol, which was also added slowly at the sides, the tube was closed with especial metal and rubber stoppers and the content thoroughly and immediately centrifuged at 1100 rpm for 10 min .The tube was then transferred to a water bath at 65˚C for 3 min for complete fat suspension. The percentage of fat was determined directly from butyrometer neck.

Lactose determination

The procedure of AOAC, (1980) was used for the determination of lactose. Firstly,pipetted 5 ml from each Fehling A + B in a conical flask determined the invert sugar and then 10 ml of distilled water was added, then 3 – 5 drops of methylene blue was added as an indicator. The lactose standard was titrated until the final red precipitate occurred. Fehling factor was calculated from the following equation. Fehlingfactor: the titration ×the concentration after that the lactose was determined by prepared 10 ml of yoghurt (steamed or without

treatment) in 100 ml volumetric flask. Then the volume was completed to 100 ml by adding distilled water. After that the mixture was filtered. Finally, the sample was titrated against felling solution (A + B) as before. Then the concentration of lactose was calculated from the following equation:

$$\text{Lactose \%} = \frac{\text{Fehling factor}}{\text{Concentration} \times \text{titration}} \times 100$$

Microbiological analysis

Total count of bacteria

The total plate count of microbes were enumerated by culturing them on Plate Count Agar (PCA) which dissolved in distilled boiling water, then transferred to bottle and sterilized in an autoclave (121˚C for 15 min). Then the media with culture was incubated for 24 - 48 hours at 37˚C.

Yeast and molds count

The yeast and mold strains were enumerated by culturing them onpotatodextrose agar (PDA) medium and incubating for 72 hours at 25˚C. The media was first dissolved in distilled water by boiling, transferred in 250 ml conical flasks, sterilized in an autoclave (15 Psi - 121ºC for 15 minute), and then cooled to room temperature before used.

Coliform bacteria count

One ml of each of the dilution was inoculated aseptically in triplicates of 9 ml sterilized Mac Conkey broth using the Durham tubes. The tubes were incubated at 37˚C for 48 hours. Positive tubes gave gas in the Durham tubes. Then the positive tube were sub cultured into EC broth medium and then incubated at 44.5˚ C for 24 hours to determine the faecal coliform bacteria, the tube showing any amount of gas production were considered positive. Mac Conkey broth and EC medium broth were used as a medium.

Manufacture of yoghurt

First the skimmed milk powder were added to pasteurized milk, after that pasteurized yoghurt milk at 90˚C for 10 minutes and cooled to 44˚C then culture was added after that it was packed into consumer packs immediately transferred to the incubation room, incubated at 44-46˚C for 4 hours the pH was reached 4.6 then stored in refrigerator. The samples were coded as C.

The process started with preparation milk (15% camel milk with 85% cow milk then skimmed milk powder and stabilizer were added to the milk and pasteurized yoghurt milk at 90˚C for 10 minutes after that cooled to 44˚C in this temperature the culture was added then packed and immediately incubated in the incubation room for 4 hours at 44-46˚C the pH was reached 4.55 then stored in refrigerator. The samples were coded as B.

In process of skimmed milk powder and stabilizer were added to pasteurized milk (30% camel milk with 70% cow milk), then pasteurized yoghurt milk at 90˚C for 10 minutes and cooled at 44˚C then culture added and packed into consumer packs after that immediately incubated in the incubation room for 4 hours at 44 - 46˚C (pH reached 4.56) then stored in refrigerator. The samples were coded as A. Also another two batches of yoghurt were prepared, one batch by 100% camel milk and the other batch by 50% camel milk + 50% cow milk, followed the same way the previous manufacturing but the incubation period was increased to 9 hours, at the end of the incubation period were obtained the pH 4.47 for yoghurt prepared 100% camel milk and pH 4.45 for yoghurt prepared by 50% camel milk.

Chemical and microbiological analysis of yoghurt

Chemical analysis including fat, protein, acidity, pH and solids were conducted on different samples of yoghurt stored at 6˚C

for different intervals of time (1 day, 5 days and 10 days). Microbiological analysis (coliform, total count of bacteria, yeast and mold) were conducted on different samples of yoghurt stored at 6˚C for different intervals of time (1 day, 5 days, and 10days).

Sensory evaluation of processed yoghurt

All kinds of yoghurt were displayed for sensory evaluation using 15 panelists at the second day of storage. The panelists were asked to evaluate samples by appearance, flavor, taste, texture, overall ranking and using 5 points, top mark for 5 and less marked for 1. Sensory evaluation has been done in a quiet and comfortable place. Each panelist was provided with water for rinsing. All these conditions were equalized for all tests. The samples were given codes before being tested.

Statistical analysis

All scores of the sensory evaluation were analyzed by the analysis of variance (ANOVA). To determine whether there were significant differences between means for each variable, least significant difference (LSD test) was used.

RESULTS AND DISCUSSIONS

Chemical composition of camel`s and cow`s milk

The chemical composition of cow`s and camel`s milk are presented in Table1. The average pH at room temperature, of camel`s milk 6.96, was higher than that of cow`s milk 6.58, and also was higher than that of the blend containing 30% camel`s milk and 70% cow`s milk 6.74 and higher than that blend containing 15% camel`s milk and 85% cow`s milk 6.76. However cow`s milk pH (6.58) was approximately similar to the values reported by Paul and Southgate,(1979) and Salih, (2010), who reported a values of (6.6) and (6.4±0.17), respectively. The

camel`s milk pH value (6.96) was higher than that reported by Farah, (1993) who reported a value of 6.6 in camel`s milk.

The titrable acidity of camel`s milk (0.15%) was higher than that of cow`s milk (0.14%) and lower compared to that of 30% camel`s milk/70% cow`s milk (0.17%) and 15% camel`s milk/ 85% cow`s milk (0.16%), and it was similar to the value reported by Elamin and Wilcox ,(1990) who gave a value of (0.15%) in camel`s milk, cow`s milk acidity lower than that reported by Paul and Southgate, (1979) which was (0.2%) in cow`s milk, also lower than that reported by Salih, (2010) who found a value of (0.16±0.01 %) in cow`s milk. Table 1, alsoshowed that the camel`s milk had a lower content of protein (2.87%) than cow`s milk (2.91%) , 30% camel`s milk 70% cow`s milk (2.91%) and 15% camel`s milk /85% cow`s milk (2.89%), the protein content of camel`s milk was higher than that reported by Elamin and Wilcox ,(1990) who reported a value of (2.8%) in camel`s milk, and cow`s milk protein was lower than those reported by Paul and Southgate ,(1979) and Salih, (2010) for cow`s milk who found a value of (3.3%) and (3.47±0.18 %), respectively. The fresh camel`s milk had a higher content of fat (3.76%) compared to that of cow`s milk (3.50%), and also higher than that reported by Elamin and Wilcox, (1990) who gave a value 3.2% in camel`s milk and had lower content compared with that of 30% camel`s milk/ 70% cow`s milk (3.87%) and 15% camel`s milk / 85% cow`s milk (3.87%). Cow`s milk fat was lower than that reported by Salih, (2010) who found a value of (4.20±0.21 %) in cow`s milk.

Table 1. Some Quality Characteristics of Camel`s, Cow`s and blends of Camel`s and Cow`s Milk (%):

Milk Sample / Component	Camel milk	Cow milk	30% Camel milk 70% Cow milk	15% Camel milk 85% Cow milk
pH	6.96±0.11	6.58±0.07	6.74±0.05	6.76±0.11
Acidity	0.153±0.13	0.144±0.02	0.171±0.11	0.162±0.19
Protein	2.87±0.09	2.91±0.11	2.91±0.12	2.89±0.10
Fat	3.76±0.12	3.50±0.15	3.87±0.14	3.87±0.07
Totalsolids	12.25±0.15	12.1±0.12	12.48±0.09	12.45±0.11
Lactose	4.30±0.08	4.36±0.13	4.37±0.12	4.34±0.08

The total solids content of cow`s milk (12.1%) was lower compared with that of camel`s milk (12.25%), 30% camel`s milk/ 70% cow`s milk (12.48%) and 15%camel`s milk /85% cow`s milk (12.45%) (Table 1) and these values were lower than those reported by Tekinisk, (1956) and Salih, (2010) for cow`s milk (12.8%), (13.30±0.20 %), respectively and higher than that reported by Elamin and Wilcox,(1990) for camel`s milk 11%.

The lactose content of camel`s milk (4.30%) was lower compared with that of the other types of milk, cow`s milk (4.36%), 30% camel`s milk/ 70% cow`s milk (4.37%) and 15% camel`s milk/ 85% cow`s milk (4.34%). (Table 1), and was higher than that reported by Elamin and Wilcox, (1990) who reported 4.2% of camel`s milk. Cow`s milk had a lower content of lactose compared with that reported by Salih, (2010) who gave a value of (4.65±0.28 %) in cow`s milk.

Microbiological composition of milk

The microbiological characteristics of fresh camel`s milk, cow`s milk, 30% camel milk/70% cow milk and 15% camel milk /85% cow milk are presented in Table 2. The coliform count in sample 3 (30% camel`s milk/ 70% cow`s milk) and sample 4 (15% camel`s milk/ 85% cow`s milk) was (0.8×10^1) and (0.9×10^1) cfu/ml, respectively, and the microbiological analyses revealed absences of coliform in camel`s and cow`s milk. The total count of bacteria of camel`s milk ($0.1\times10^2$ cfu/ml) was less than that of cow`s milk (0.3×10^2 cfu/ml), 30% camel`s milk/ 70% cow`s milk (0.8×10^2 cfu/ml) and 15% camel`s milk/ 85% cow`s milk (0.5×10^2 cfu/ml). Table 2.illustrated also that the yeast and molds count in camel`s milk cow`s milk, sample 3 (30% camel`s milk /70% cow`s milk) and sample 4 (15% camel`s milk / 85% cow`s milk) were (0.3×10^1), (0.2×10^1), (0.4×10^1) and (0.1×10^2) cfu/ml, respectively (Table 2).

Table 2. Microbiological analysis of milk (cfu/ml)

Parameter	Camel's milk	Cow`s milk	30% Camel`s milk 70% Cow`s milk	15% Camel`s milk 85% Cow`s milk
Coliform	Nil	Nil	0.8×10^{1}	0.9×10^{1}
Total count of bacteria	0.1×10^{2}	0.3×10^{2}	0.8×10^{2}	0.5×10^{2}
Yeast and Molds	0.3×10^{1}	0.2×10^{1}	0.4×10^{1}	0.1×10^{2}

Chemical Composition of Yoghurt

The chemical composition of yoghurt is presented in Table 3. The average pH was gradually decreased during fermentation when yoghurt was processed, this reduction was clear in the three types of yoghurt A (yoghurt prepared by 30% camel`s milk/70% cow`s milk), B (yoghurt prepared by 15% camel`s milk/85% cow`s milk) and C (yoghurt prepared by 100% cow`s milk). The reduction in pH was greater in yoghurt type A, B, C after 1 day of storage, the reduction in pH continued until the fifth day of storage in yoghurt type B and type C. However, after 10 days of storage the reduction in pH was continued in yoghurt type A and type B and there was no change in yoghurt type C. On the other hand, the titrable acidity increased by fermentation of yoghurt. The increase in acidity in the three types of yoghurt (A, B, C) were similar (1.05 %) after 1 day of refrigerated storage (6°C). The increase in acidity was continued until the fifth day of storage in yoghurt type A (1.07%), B (1.06%) and C (1.06%). However, after 10 days of storage the increase in acidity was continued in the three yoghurt types A (1.10%), B (1.07%) and C (1.11%). Figure 1 describes the relationship between pH and titrable acidity during fermentation of yoghurt type A and yoghurt type B, which indicated decrease of pH and increase of acidity. On the other hand, Fig 1. describe the relationship between pH and titrable acidity during fermentation of yoghurt prepared by 100% cow`s milk (type C), this Fig revealed decrease in pH until the fifth day of storage, after that the pH was constant, the Fig also indicated the increase of acidity especially after 10 days of storage.

Table 3. Some quality characteristics of various types of yoghurts (%).

Parameter	Storage Period (Days)								
	One			Five			Ten		
	A	B	C	A	B	C	A	B	C
pH	4.4	4.5	4.4	4.4	4.4	4.3	4.3	4.3	4.3
Acidity	1.05	1.05	1.05	1.07	1.06	1.06	1.10	1.07	1.11
Total Soluble Solids (T.S.S)	15.83	15.72	15.64	15.74	15.67	15.55	15.44	15.56	15.39
Protein	4.66	4.79	4.66	4.59	4.59	4.47	4.53	4.47	4.47
Fat	3.30	3.24	3.36	3.43	3.34	3.41	3.62	3.58	3.48

A: Yoghurt prepared by 30% camel milk / 70% cow milk; B: Yoghurt prepared by 15% camel milk / 85% cow milk; C: Yoghurt prepared by 100 % cow milk.

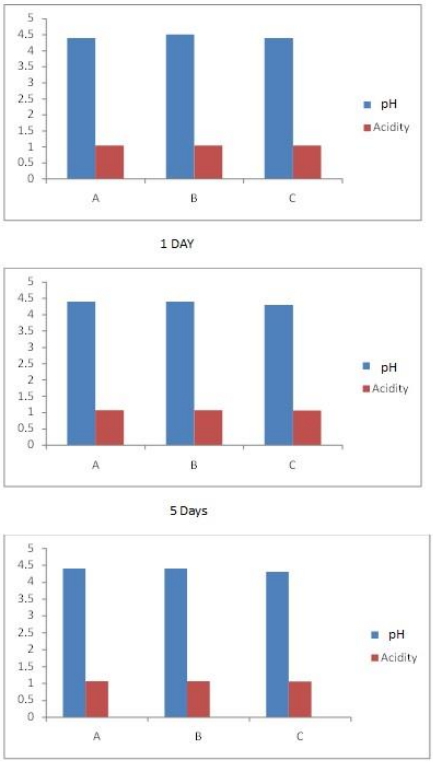

Fig. 1 Relationship between pH and titrable acidity during fermentation of yoghurt

The protein content of yoghurt type B (4.79%) was higher if compared with yoghurt type A (4.66%) and type C (4.66%), these values decreased until fifth day of storage (A (4.59%), B (4.59%), C (4.47%), after 10 days of storage the reduction in

protein continued in yoghurt type A (4.53%) and type B (4.47%) and there was no change in yoghurt type C (4.47%).

Table 3. also showed that the fat content of yoghurt type C (3.36%) was higher than that of yoghurt type A (3.30) and type B (3.24%), fat content were increased in the three types of yoghurt A (3.43%), B (3.34%) and C (3.41%) until 5th day of storage. However, after 10 days of storage the increased in fat content was continued in the three yoghurt types A (3.62%) , B (3.58%) and C (3.48%) .

Microbiological analysis of yoghurt

Table 4, showed the microbiological characteristics of yoghurt during storage at 6°C for 1, 5 and 10 days. The coliform bacteria count was higher in yoghurt prepared from a blend of 15% camel`s milk and 85% cow`s milk designated as yoghurt type B (4.0×10^2 c.f.u/g) than that in yoghurt prepared from a blend of 30% camel`s milk and 70% cow`s milk designated as yoghurt type A (0.8×10^1c.f.u/g) and yoghurt prepared by 100% cow`s milk designated as yoghurt type C (0.5×10^1 c.f.u/g) and decreased after 5 days of storage in yoghurt type B (2.4×10^2 c.f.u/g) and there were no change in yoghurt type A(0.8×10^1c.f.u/g) and C (0.5×10^1 c.f.u/g). However, after 10 days no change observed in coliform count in yoghurt type C (0.5×10^1 c.f.u/g) but there was decrease in yoghurt type B (0.7×10^1 c.f.u/g) and increase in yoghurt type A (2.2×10^1 c.f.u/g).

Table 4. Microbiological analysis of various types of yoghurt (cfu/g)

Parameter	Storage Period (Days)								
	One			Five			Ten		
	A	B	C	A	B	C	A	B	C
Coliforms	0.8×10^1	4.0×10^2	0.5×10^1	0.8×10^1	2.4×10^2	0.5×10^1	2.2×10^1	0.7×10^1	0.5×10^1
Total count of bacteria	1.8×10^3	1.8×10^4	5.5×10^2	4.0×10^2	1.7×10^4	1.2×10^2	4.6×10^2	6.0×10^4	1.3×10^2
Yeast and Molds	0.4×10^1	3.0×10^2	0.7×10^1	0.4×10^1	0.9×10^1	0.7×10^1	1.0×10^3	5.0×10^2	0.7×10^1

A: Yoghurt prepared by 30% camel milk /70% cow Milk; B: Yoghurt prepared by 15%camel milk / 85% cow milk C: Yoghurt prepared by 100% cow milk

The total count of bacteria of yoghurt type B (1.8×10^4 cfu/g) was more to that of yoghurt type A (1.8×10^3 cfu/g) and yoghurt type C (5.5×10^2 cfu/g) after 1 day of storage , and after 5 days of storage the total count of bacteria was decreased in yoghurt type A (4.0×10^2 cfu/g), yoghurt type B (1.7×10^4 cfu/g) and yoghurt type C (1.2×10^2 cfu/g), after 10 days of storage the total count of bacteria were increased in the three types of yoghurt , type A (4.6×10^2cfu/g), type B (6.0×10^4cfu/g) and type C (1.3×10^2 c.f.u/g) .

The yeast and molds count were higher in yoghurt type B (3.0×10^2 cfu/g) compared with yoghurt type A (0.4×10^1 cfu/g) and type C (0.7×10^1 cfu /g), after 5 days of storage yeast and molds count were decreased in yoghurt type B (0.9×10^1 cfu/g) and there were no change in yoghurt A (0.4×10^1cfu/g) and type C (0.7×10^1) , after 10 days the number of yeast and molds were increased in yoghurt type A (1.0×10^2 cfu/g) and type B (5.0×10^2 cfu/g) and there was no change in yoghurt type C (0.7×10^1 cfu/g) .

Sensory evaluation

Sensory evaluation was conducted for the three types of yoghurt A (yoghurt prepared by 30% camel`s milk / 70% cow`s milk), B (yoghurt prepared by 15% camel`s milk/ 85% cow`s milk) and C (yoghurt prepared by 100 cow`s milk) by 15 panelists has included Rating on appearance, flavor, taste, texture, and overall ranking and got the following results: The appearance of cow`s milk yoghurt (C) had the highest scores compared to A and B , with no significant difference between sample A and B and there is no significant difference between sample B and C but there is significant difference between sample A and C. (Table 5). Also the flavor of cow`s milk yoghurt (C) had the highest scores compared to other samples A and B, with significant difference between sample A, B and C. For taste and texture there was no significant difference between

sample B and C but there was significant difference between sample A and other samples and sample C had the highest scores compared to A and C. However, the panelists showed that the most acceptable yoghurt samples were the yoghurt made from 100% cow`s milk. Statistically, significant variations ($P \leq 0.05$) were observed in overall acceptability scores between yoghurt samples.

Table 5. Mean score for sensory evaluation of the three types of yoghurt.

Samples	Quality attribute				
	Appearance	Flavor	Taste	Texture	Overall acceptability
A	2.20	2.07	1.87	1.93	2.07
B	3.07	3.07	3.13	3.07	3.0
C	4.0	4.07	3.87	3.80	4.20

Means are based on a point scale (1 is poor, 2 is unacceptable, 3 is acceptable,4 is good and 5 is excellent); A = Yoghurt prepared by 30% camel`s milk/ 70% cow`s milk; B = Yoghurt prepared by 15% camel`s milk/ 85% cow`s milk;C = Yoghurt prepared by 100% cow`s milk.

CONCLUSION

In the present study, three types of yoghurt were prepared from camel`s and cow`s milk using different ratios, the first type prepared by 30% camel`s milk / 70% cow`s milk, second type prepared by 15% camel`s milk / 85% cow`s milk and third type 100% cow`s milk. Before preparation of yoghurt, the milk samples were subjected to chemical and microbiological analysis. Most of the chemical compounds of milk fairly close with and there are some differences of increase or decrease, microbiological analysis revealed some of pathogenic bacteria like total bacteria count and coliform bacteria, also revealed very few numbers of yeast and molds. Chemical analysis of the types of yoghurt gave comparable results either for microbial analysis showed the presence of small numbers of coliform, total bacteria count, yeast and molds. The manufactured yoghurt samples showed high nutritive value, especially

yoghurt that containsa greater proportion of camel milk, where that camel milk given him greater nutritional value. That opens the door widely to for using camel`s milk in preparation of yoghurt in dairy plants in Oman, since camels are important for milk production especially in Dhofar state. It is known that most of people avoid consumption of camel`s milk and camel`s milk products due to its characteristics flavor, using of cow`s milk with camel`s milk in prepare yoghurt improved the flavor and texture of yoghurt. Generally, the manufactured yoghurt samples that contain camel`s milk got to accept less by panelists compared with cow`s milk yoghurt and it is due to strength cow`s milk yoghurt best and perhaps that people not familiar with camel milk products and flavor. There are a recommendations such as: Addition of flavoring compounds in the manufacture of camel`s milk products, due to the unacceptable flavor of camel`s milk, addition of compounds to improve the texture of yoghurt prepared by camel`s milk to increase acceptance, more research is recommended on the use of camel`s milk in manufacture of yoghurt as well as encourage dairy industries to utilize camel`s milk in production of milk products.

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