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EFFECT OF DIFFERENT CONCENTRATIONS OF CHERRY AND ORANGE SYRUP ON MICROBIOLOGICAL AND SENSORY PROPERTIES OF CAMEL MILK

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Abstract
The effect of different concentrations (5, 10, and 15 %) of orange and cherry syrup with on the bacteriological and sensory properties of camel milk was studied. Sensory evaluation results revealed that the samples with 10% orange syrup obtained the highest scores; and the second high score was referred to samples with 15% cherry syrups which were significantly different from other samples.(P< 0.05 was considered significant.) Milk with 5% cherry syrup obtained lower scores in comparison with control. Bacteriological results showed changes in total counts (cfu/ml) in camel milk samples containing different concentrations of cherry and orange syrup. The total counts in orange and cherry fortified camel milk was decreased by concentrating the syrups; so that it was (310, 240, 160) and (730, 680, 490 cfu/ml) in samples with 5, 10 and 15% of cherry and orange syrups, respectively. Whereas, no changes in the yeast and mold counts were observed at all concentration of pasteurized camel milk (control milk and fruit milk) and were zero. Using the syrups in camel milk enhanced the flavor acceptability and also it leads to decreasing in microbial total counts; which could be beneficial in preservation of the product. Accordingly, orange and cherry syrups could be used in production of fruit fortified camel milk.

Keywords: cherry, sensory properties, fortified camel milk.

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1.INTRODUCTION

There is a direct relationship between nourishment and health. Using nutritious foods will help to increase life expectancy and resistance to many diseases. Camel milk is different from other ruminant milk, it is low in cholesterol, sugar and protein but high in minerals (sodium, potassium, iron, copper, zinc and magnesium), vitamins A, B2, C and E; it also contains a high concentration of insulin and milk solids in addition to nutriments such as lactoferin, immunoglobulins, antimicrobial agents and so one (Akhundov et.al, 1972; Cilla et.al, 2011; García-Nebot et.al, 2010a; Moros et.al, 2005; Romero et.al, 2012; Zulueta et.al, 2007). It has no allergic properties and can be consumed by lactase-deficient individuals, as well as those with a weakened immune system. In fact, this milk is believed to have medicinal properties. In India camel milk is used therapeutically against Dropsy, Jaundice, problems of the Spleen, Tuberculosis, Asthma, Anemia, and Piles (Blando et.al, 2004; AOAC, 1990). Camel milk has proven beneficial in the treatment of tuberculosis (Blando et.al, 2004). Patients with chronic hepatitis had improved liver function after being treated with camel milk and its fermented products (Chandra et.al, 1992). In fact, camel milk was as effective as ass milk and superior to treatment with only medication or a diet consisting of cow milk protein. The camel milk works as a laxative on people unaccustomed to drinking this milk (Eberhard et.al, 1940; Hashim et.al, 2009). Camel milk is given to the sick, the elderly and the very young because of the belief that it is not only healthier, but also works especially well in bone formation because of high level of calcium (more than cow milk) (GAST et.al, 1969; HASHIM et.al, 2009). The milk is said to be of such strength, and to have such health-giving properties, that all the bacteria are driven from the body.

Orange is a good source of vitamin C, it was also observed that orange juice resulted in an increase in the free and total acidity in the stomach and helped in better digestion of proteins (Knoess et.al, 1979).

Cherry is rich in antioxidants and contain potent phyto-nutrients including anthocyanins (plant pigments) and melatonin, which may help aid with sleep. Studies suggest that cherries may reduce inflammation (Larmond et.al, 1977; Rao et.al, 1970), and ease the pain of arthritis and gout, protection against heart disease and certain cancers (Sharmanov et.al, 1978). Cherries were also suggested to reduce the risk of diabetes and insulin resistance syndrome as well as aid in the treatment and possible prevention of memory loss (Steel et.al, 1996).

Some research has been conducted communicating fruits effect on sensory and microbial properties of dairy products which are different from our study (Callon et.al, 2005; Do Espírito Santo et.al, 2012; Gangadharan et.al, 2011; Hashim et.al, 2009; Hetherington et.al, 1991; Jaramillo et.al, 2009). The objective of this study was to determine the effects of different concentration of fruit syrup on the microbial and sensory properties of fruit fortified camel milk

2. MATERIAL AND METHODS

2.1. Materials

Cherry and orange syrup used in this study were pasteurized commercial products from Sanich Company, Iran. The compositions of the cherry and orange syrup according to manufacturer's data were, Natural cherry concentrate, Sugar, Water, Citric acid (E330) and Natural orange concentrate, Sugar, Water, Citric Acid (E330), Ascorbic Acid (Vitamin C) E330, Beta- carotene (Vitamin A) 160a, Pectin (E440) and orange flavor respectively. Camel milk used in this study was obtained from Aghghala city, Anbar-oloumvillage. The composition of the camel milk as determined by (13) that included, Water 86.5%, Ts 13.5%, (Fat 4.4%, Ash .9%, Lactose 4.3% and Protein 3.9%), pH equal to 6.6 and titratable acidity 15D.

2.2. Preparation of Fruit Camel Milk

Raw camel milk pasteurized at 72Ċ for 15 second, and three concentrations of cherry and orange syrup (5, 10 and 15%) were used in this study. Fruit syrups were added to pasteurized camel milk under sterile conditions and followed by stirring with a sterile spoon until homogenous. Serial dilutions were made from samples and used for microbiological and sensory assays. Also a control batch (without any syrup) was considered.

2.3. Microbiological Assay

The microbial growth was examined by diluting the samples in sterile Distilled water and plating in Plate count agar (Mirmedia, Mp-2602, Iran) for total counts, samples were plated in Manitol salt agar (micro media, Mm0213, ref, Hungary) for Staph. aureus counts, in VRBA (micro media, Mm0114, Ref, Hungary) for Entrobacteriaceae counts and in YGC agar (Mirmedia, Mfd, Iran) for yeast and mold counts. Plates were incubated at 37 ◦C for 48 h for bacteria and at 30 ◦C for 5 d for yeast and mold counts.

2.4. Sensory Evaluation

Panelists were selected based on interest, time available, and a liking forCamel milk (n = 6). Six University students were selected; 3female and 3 male aged 20 to 27 years. During training, panelists discussed terms and attributes and learned to consistently use the scale. Panelists evaluated each treatment within each experiment in duplicate. All the samples were Organoleptically rated for appearance, taste, flavor, texture and overall acceptability by a panel of 5 judges using the 5-point hedonic scale (Hetherington et.al, 1991). The data obtained in the research was subjected to statistical analysis as described.

3. Statistical Analysis

All analyses were performed using STATA 10 software (StataCorp, College Station, Texas

77845 USA). Data was presented as Median (Q1 –Q3) for ordinal evaluations. Ordinal logistic regressions were used to compare and investigate the relationship of appearance, taste, flavor, viscosity and total acceptability with formulations. A reference category of formulation has been defined for each run of the analysis and other formulations were compared to this formulation. P< 0.05 was considered as significant.

4. RESULTS AND DISCUSSION

4.1. Microbiological Assay

These results indicate changes in total counts (cfu/ml) in camel milks containing different concentrations of cherry and orange syrup.

The changes in the Total counts in milks were significantly different between all concentrations for orange and cherry fortified camel milks. The total counts in orange and cherry fortified camel milk was decreased by concentrating the syrups; so that it was (310, 240, 160) and (730, 680, 490 cfu/ml) in samples with 5, 10 and 15% of cherry and orange syrups, respectively. orange milk had high total count in comparison with cherry milk whereas, no changes were observed in the yeast and mold counts at all concentration of pasteurized camel milk (control and fruit milk) they remained constant. (Fig.1) Also, in this survey the number of enrtobacteriacea were counted, so that, the number, in both raw and pasteurized milk was zero. Also the number of S.Thermophilusin raw and pasteurized milk was 62 and 0(CFU/ml) respectively. The total count for orange fortified camel milk exceeds 730 (CFU/ml). But because of the pasteurization treatment, they may not necessarily pose a hazard to the health of the consumer (pasteurization are known a treatment which destroy all spoilages and hazardous microorganisms).

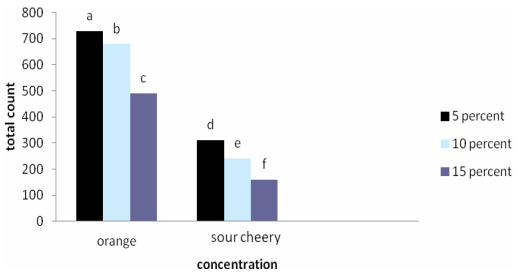

Fig. 1. Microbial analysis of different flavored milks

4.2. Appearance

The appearance values are displayed in table1 as a function of frequency of the panelists that assigned a particular score. Scores of all flavored milks were 3 and above on a scale of 1 to 5, indicating desirable appearance.

Appearance values of all flavored milks at the end of formulation were comparable which agreed with the lack of differences observed in the values present in table 1.

Table 1. Results of sensory appearance

Appearance	Coef.	Std. Err.	Z	P>z
5% Cherry	-.5059145	.4367204	-1.16	0.247
10% Cherry	-.3772392	.4328565	-0.87	0.383
15% Cherry	-.1856413	.422934	-0.44	0.661
5% Orange	-.1793004	.4179452	-0.43	0.668
10% Orange	.6963003	.4239583	1.64	0.101
15% Orange	-.125278	.4199878	-0.30	0.765

Table 2. Result of sensory taste

Taste	Coef.	Std. Err.	Z	P>z
5% Cherry	-.3892768	.4163709	-0.93	0.350
10% Cherry	-.2433961	.4025641	-0.60	0.545
15% Cherry	.2802697	.4009399	0.70	0.485
5% Orange	-.1680235	.4002935	-0.42	0.675
10% Orange	.8510416	.4168785	2.04	**0.041**
15% Orange	-.0070885	.403094	-0.02	0.986

Table 3. Result of sensory flavor

Flavour	Coef.	Std. Err.	Z	P>z
5% Cherry	-.0496225	.4194989	-0.12	0.906
10% Cherry	-.1265594	.4145064	-0.31	0.760
15% Cherry	.238179	.4068237	0.59	0.558
5% Orange	.2518304	.3979657	0.63	0.527
10% Orange	1.225107	.4232623	2.89	**0.004**
15% Orange	.1347649	.4081898	0.33	0.741

Table 4. Result of sensory viscosity

Viscosity	Coef.	Std. Err.	Z	P>z
5% Cherry	-.5287601	.4369051	-1.21	0.226
10% Cherry	-.3680052	.4261806	-0.86	0.388
15% Cherry	.0209857	.405713	0.05	0.959
5% Orange	-.0630078	.4134551	-0.15	0.879
10% Orange	.3534858	.4095047	0.86	0.388
15% Orange	-.2319219	.4186369	-0.55	0.580

4. 3. Taste

The taste values are displayed in table 2 as a function of frequency of the panelists that assigned a particular score. Scores of all flavored milks were 3 and above on a scale of 1 to 5, indicating desirable taste. Taste values of all flavored milks at the end of formulation were not comparable which implied significant differences observed in the table 2 values. The flavored milk with 10 % orange syrup, received the highest score compared to the other flavored milks and the control. Also the flavored milk with 15 % cherry syrup received the second high scores.

4.4. Flavor

Flavor scores are reported in table 3 as a function of frequency of the panelists that assigned a particular score. Scores of all milks were 3 and above on a scale of 1 to 5, indicating desirable flavor. Between samples, the control camel milk and cherry fortified camel milk at %5 and %10, received a score of mostly 3 and a few 4, while samples with 15% cherry and samples with 10% orange syrups, received an almost equal distribution of 4 and 5, respectively.

4.5. Viscosity

The viscosity values are displayed in table 4 as a function of frequency of the panelists that assigned a particular score. Scores of all flavored milks were 3 and above on a scale of 1 to 5, indicating desirable viscosity. Viscosity values of all flavored milks at the end of formulation were comparable which agreed with the lack of differences observed in the table 4 values.

4.6. Acceptability

The acceptability values are displayed in table 5 as a function of frequency of the panelists that assigned a particular score. Scores of all flavored milks were 3 and above on a scale of 1 to 5, indicating desirable acceptability. Acceptability values of all flavored milks at the end of formulation were comparable which agreed with the lack of differences observed in the table 4 values.

Table 5. Result of sensory acceptability

Acceptability	Coef.	Std. Err.	Z	P>z
5% Cherry	-.7161026	.459701	-1.56	0.119
10% Cherry	.1319867	.414856	0.32	0.750
15% Cherry	.5215358	.4163772	1.25	0.210
5% Orange	.077422	.4148605	0.19	0.852
10% Orange	.5825992	.4124545	1.41	0.158
15% Orange	.0262119	.4192979	0.06	0.950

L: Lower bound of 95% Confidence Interval U: Upper bound of 95% Confidence Interval

These results indicate that syrup concentration play a crucial role in formulating camel milk fortified with fruit syrup. Syrup type also had a clear effect on sensory properties. Milks containing orange received higher taste and flavor quality scores than milk with cherry syrup. Flavor intensity increased with syrup concentration, specifically for cherry flavor. Cherry fortified camel milk with %5 and %10 in comparison with %15 received low scores, whereas orange fortified camel milk with %5 and %15 in comparison with %10 had the low scores. Cherry milk with %15 and orange milk with %10 received best scores. The addition of fruit syrup with % 5 decreased camel milk off-flavor. Cherry and orange flavors were equally effective in decreasing camel milk off-flavor. Overall, orange fortified camel milk had higher acceptability in comparison to cherry fortified camel milk and orange but that was not significant.

5. CONCLUSIONS

This study recommends the use of cherry and orange syrup can be used for the manufacture of fruit camel milk. It is concluded from the present investigation that the use of cherry and orange syrups improve the sensory properties of the fortified camel milks.

Panelists gave the highest Flavor, texture, appearance and overall acceptability scores to the camel milks with 10% of orange and second 15% cherry among the camel milks with added fruit.

Hence, it is concluded that addition of 10% orange syrup and 15% cherry syrup in camel milk improves the organoleptic as well as nutrition properties of camel milk.

Furthermore, a new variety of fruit fortified camel milk particularly rich in nutritional compounds and pleasant flavor can be manufactured by using cherry and orange fruits.

Also if heat treatment is performed correctly, fortified camel milk has acceptable colony counts, but for prevention from spoilage these products need a cold chain for their storage and distribution.

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