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Effect of Different Milk Composition on Physico-Chemical Characteristics of Set Type Yoghurt

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MAI and TNP planned, designed and carried out the study while KJ, SI and RU analyzed the data and put the study in present form.

Key words
Yoghurt, Different milk composition, Breeds, Physiological characteristics, Set yoghurt

ABSTRACT

The gross composition of milk may affect the textural, compositional and microbiological properties of yoghurt. Sahiwal, Holstein Friesian milk procured from Dairy Animal Training and Research Center, B-block University of Veterinary and Animal Sciences, Pattoki and Nili Ravi buffalo milk procured from Nili Ravi buffalo Research Institute (BRI), Pattoki. All other ingredients purchased from Sigma Aldrich Germany through local suppliers. Milk was standardized to 15% total solids with 3.5% fat. Skim Milk Powder (SMP) was used for the standardization of the yogurt. Milk was pasteurized at 82°C for 5 minutes and cool down to 43°C and at this temperature starter culture was added. Yogurt batch incubated at 43°C for 3 to 3.5 h. During this period pH was monitored regularly and as the pH drops to 4.6, the batch was shifted to blast chilling at 1-2°C and then stored at 4°C. Sensory evaluation of all yogurt samples was carried out on a 9-point hedonic scale. All the tests were carried out on day 0, 7, 14 and 21. The collected data was investigated through ANOVA technique under complete randomized design (CRD) using SAS 9.1 software. The results showed that yoghurt made from Nili Ravi buffalo milk (T_o) showed a significant ($p \geq 0.5$) overall acceptability as compared to other treatments. Yoghurt made from Nili Ravi buffalo milk (T_o) were followed by T_3, T_4, T_1 and T_5 respectively. The Nili Ravi buffalo milk showed higher acceptability to the consumers.

INTRODUCTION

Pakistan is the 4th largest milk producing country in the globe; most of the milk is produced by cattle and Nili Ravi buffaloes, with some contribution from other milk breeds as well. Milk production in Pakistan has been increased by more than 40% in the last 10 years with a total production of 54,328 thousand tons. The Nili Ravi buffalo milk and cow milk contribution in the total milk production in Pakistan is 60.9% and 35.7%, respectively (GOP, 2018-19). Despite of gradual increase in demand of milk and milk products the dairying community of Pakistan is facing multiple problems. Globally, surplus milk is converted into numerous value-added products, but only few of these milk products are prepared in Pakistan.

Nili Ravi buffalo contributes approximately 60% of the total milk produced in Pakistan (GOP, 2018-19). The main reasons for popularity of Nili Ravi buffalo milk is due to its higher fat content (~6.5%) as well as solids-not-fat (~10.5%). The local culture of making Lassi, tea and dahi using Nili Ravi buffalo milk renders it a good choice. Nili Ravi buffalo milk is particularly rich in vitamin A and lacks in carotene. This is the reason of whiter color of Nili Ravi buffalo milk as compared to cattle milk. Nili Ravi buffalo milk is highly suitable for the manufacturing

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of large number of value-added dairy products including fermented milk products such as yoghurt, lassi and cheese (Moioli *et al*., 2006). In current industrial process of procuring the fermented products, cow milk is predominant world-wide. Variety of fermented milk products including fruit, flavored, plain yoghurt, whipped, drinking type, smoked, dried, strained and frozen products are prepared from cow milk globally. The total solids contents of cow milk are less than Nili Ravi buffalo milk therefore to have proper curd consistency of fermented products, cow's milk is generally fortified with skim milk powder (White *et al*., 2008).

Fermented milk products that are made from various milk sources, originated in the Middle East, perhaps before the Phoenician era, and spread throughout Europe. Human diet could be supplemented with fermented dairy products that can eventually provide essential nutrients vital for growth and better health (Serhan *et al*., 2016). Haj *et al*. (2007) reported that acidifying the milk through fermentation is the oldest methods of preservation of milk. Fermentation can be attained through chemical and microbiological methods. The variation in fermentation processes results in the production of various fermented dairy products such as keifr, kumiss, acidophilus milk, yoghurt etc.

Yogurt is a coagulated milk, mostly obtained by the action of two bacteria, which are *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus* (Trachoo, 2002). Yogurt is made of milk, considered as a complete food. It is mostly consumed by infants or elder people. It contains all nutrition required by the people, along with this also contain live microbes (Ayar *et al*., 2006).

Yoghurt having health benefits like enhancing lactose digestion by maldigesters, protection against gastrointestinal upsets, lowering the risk of cancer, improving immune response, decreasing the blood cholesterol, calcium and iron, helping the body to assimilate protein, diarrhoea protection, longevity and control. It also helps in maintenance of GIT (gastrointestinal) microflora as well (Andronoiu *et al*., 2011; Vahedi *et al*., 2008; Iwalokun and Shittu, 2007; Foda *et al*., 2007; Aly *et al*., 2004). Other health benefits of yoghurt include improvement in the bowel movement, enhancement of GIT (gastrointestinal) function, consumption of different constituents in the GIT. These are most likely due to the action of gut microflora and also improving immune response (Adolfsson *et al*., 2004). Consumers (children, young and aged person) mostly demand novel product with the formulation of nutrition in plain yoghurt.

MATERIALS AND METHODS

Experimental site

The research was carried out in postgraduate laboratory of Department of Dairy Technology and Central Laboratory Complex (CLC), Ravi campus, University of Veterinary and Animal Sciences, Pattoki, District Kasur, Pakistan.

Procurement of milk

Sahiwal, Holstein Friesian (HF) milk was procured from Dairy Animal Training and Research Center, B-block University of Veterinary and Animal Sciences, Pattoki and Nili Ravi Nili Ravi buffalo milk procured from Buffalo Research Institute (BRI), Pattoki. All other ingredients were purchased from Sigma Aldrich Germany through local suppliers. The experiment and analysis of the samples were carried out in the Department of Dairy Technology and CLC, A-Block, University of Veterinary and Animal Sciences, Pattoki.

Procurement of ingredients

Starter culture, *Streptococcus thermophilus and Lactobacillus delbrueckii ssp. bulgaricus*, was purchased from Danisco, Sweden through local suppliers. All other ingredients (stabilizers) were procured from local market, Lahore.

Preparation of starter culture

The freeze-dried culture was propagated by inoculation into fresh milk which was heated at 90°C for 3 minutes. The inoculated milk incubated at 45°C until pH 4.6 is reached and then Stored overnight at 4°C.

Preparation of yogurt

Standardized milk was used having 15% total solids and 3.5% fat. Skim Milk Powder (SMP) was used for the standardization of the yogurt. Milk was pasteurized at 82ºC for 5 minutes and cool down to 43ºC and at this temperature starter culture was added. Yogurt batch incubated at 43ºC for 3 to 3.5 h. During this period pH was monitored regularly and as the pH drops to 4.6, the batch was shifted to blast chilling at 1-2ºC and then stored at 4ºC.

Experimental design

A total of 6 treatments were prepared and 100% Nili Ravi buffalo milk yogurt was used as control (T_o). T_1 was prepared from Sahiwal milk (100%), T_2 was prepared from 100% Holstein Friesian milk, T_3 was prepared from 50% Nili Ravi and 50% Sahiwal milk, T_4 was prepared from 50% Nili Ravi and 50% Holstein Friesian milk while

T_5 was prepared from 50% Sahiwal and 50% Holstein Friesian milk. Yogurt was stored at 4ºC for three weeks and analyzed at day 0, 7, 14 and 21.

Physico-chemical determination

Physico-chemical characteristics of all the treatments were carried out for protein, total solids, fat content, pH and titratable acidity according to the standard methods of Association of Analytical Chemists (AOAC, 1999).

Textural properties

Textural properties of all the treatments were determined for the following parameters.

Gel firmness

Gel firmness of yogurt was determined at 4-6ºC by penetration measurements (Texture Analyzer, LFRA-4500, Brookfield, Inc., USA) equipped with a 4.5 kg load cell. The apparatus was adjusted to the following conditions: cylindrical probe (38mm in diameter); penetration speed 1mm/s; penetration distance 30mm into surface. The peak force measured in grams (Aly *et al*., 2004).

Monitoring of viscosity during yogurt manufacturing

Yogurt viscosity was measured by using Brookfield viscometer model BM type. Three readings from every sample taken and an average value was recorded. The readings taken at 10ºC, which is the temperature at which the yogurt is most likely to be consumed. The spindle speed adjusted keeping in view to the thickness level of the sampled yogurt. In this experiment, the standard combination used, speed 12 (revolutions/second) and spindle number 4. To calculate the final viscosity in centipoises, a factor of 500 is taken to multiply the obtained figure.

Monitoring of pH during yogurt manufacturing

The milk pH during the process of gelatin was recorded on regular basis by immersing the glass electrode of the pH meter (H19020 microprocessor bench pH meter; Hanna Instruments, Woonsocket, RI, USA) in the milk. The pH meter standardized with buffers at 45°C before use.

Syneresis

Syneresis measured according to the method described by Aly *et al*., (2004). Yogurt mix (25g) weighed in a centrifuge tube and the samples was then be reared together and the set gels were then be stored at 4ºC for 24 h. Samples of yogurt weighed and centrifuged for 10 min at 3500xg and at 4ºC. The whey extracted from the sample of yogurt de-caned off and the rest of the yogurt reweighed. The WHC is defined as weight (g) of the remaining (or drained) yogurt out of the total weight (100g) of the yogurt (before centrifugation).

Water holding capacity

The water-holding capacity of yogurt was determined according to the technique recommended by Aly *et al*. (2004). 20g of a sample of yogurt (Y) centrifuged at 1250 x g for 10 min at 4°C. The whey that is extracted (W) removed and weighed. The water-holding capacity (WHC, $g.kg^{-1}$) calculated as:

$$WHC = (Y - W) / Y \times 1000$$

Sensory evaluation

Sensory evaluation of all yogurt samples was carried out on a 9-point hedonic scale by a panel of 10 semi trained judges. Sensory evaluation was carried out on day 0, 7, 14 and 21.

Statistical analysis

The collected data under investigation was analyzed through ANOVA technique under complete randomized design (CRD) using SAS 9.1 software. Duncan multiple range (DMR) test applied to find the difference between means. The data obtained in triplicates and each treatment was also triplicated.

RESULTS

Physico-chemical properties

Highest protein, total solids (TS) and fat content were recorded at day 1st and gradual reduction was observed with the passage of storage period as shown in Table I. The maximum protein (p<0.001) contents were obtained in 1st day and the least in 21st day. Fat and protein largely affected by microbes. During storage fat and protein decreases as microbial action increases. Table II shows pH and acidity of yoghurt at different storage days prepared from different milk sources.

Textural properties

The microstructure and the rheological properties of set yogurts are considerably critical to product quality and shelf life. Syneresis, serum release from the gel matrix, is regarded as a technological defect in set yogurts. Serum release, known as syneresis, is considered as one of the most important parameters indicating the quality of yogurt during storage. Gel firmness, viscosity, syneresis and water holding capacity of yoghurt at different storage days prepared from different sources of milk are shown in Table III. The results showed that gel firmness increases with storage period and highest firmness was observed in at day 21 of storage period in all the treatments. It was also observed that Highest firmness was observed in T_0 (100%) Nili Ravi buffalo milk followed by T_1 and T_5.

Table I. Protein (%) total solids (%) and fat (%) of yoghurt at different storage days prepared from different milk sources.

Treatments*	Parameters	Storage days			
		1st	7th	14th	21st
T_0	Proteins	3.90±0.19[a]	3.85±0.14[a]	3.78±0.08[a]	3.70±0.09[a]
	Total solids	15.00±0.15[a]	13.80±0.16[d]	13.72±0.15[e]	13.68±0.18[d]
	Fats	3.50±0.16[a]	3.47±0.18[b]	3.32±0.16[c]	3.24±0.19[d]
T_1	Proteins	3.20±0.14[c]	3.16±0.16[c]	3.12±0.05[c]	3.07±0.06[d]
	Total solids	15.00±0.29[a]	14.70±0.26[b]	14.55±0.25[d]	14.20±0.28[c]
	Fats	3.50±0.19[a]	3.46±0.17[b]	3.35±0.15[c]	3.39±0.16[d]
T_2	Proteins	2.70±0.18[f]	2.67±0.18[f]	2.64±0.06[f]	2.60±0.07[f]
	Total solids	15.00±0.19[a]	14.72±0.16[b]	14.50±0.18[d]	14.18±0.16[c]
	Fats	15.00±0.19[a]	14.72±0.16[b]	14.50±0.18[d]	14.18±0.16[c]
T_3	Proteins	3.50±0.15[b]	3.46±0.15[b]	3.42±0.07[b]	3.40±0.08[b]
	Total solids	15.00±0.20[a]	13.90±0.24[b]	13.73±0.05[d]	13.55±0.05[d]
	Fats	3.50±0.27[a]	3.44±0.28[b]	3.39±0.26[c]	3.35±0.28[d]
T_4	Proteins	3.30±0.17[c]	3.26±0.14[c]	3.23±0.08[c]	3.20±0.06[c]
	Total solids	15.00±0.05[a]	13.95±0.05[b]	13.82±0.23[d]	13.67±0.25[e]
	Fats	3.50±0.15[a]	3.43±0.13[b]	3.34±0.09[c]	3.31±0.08[d]
T_5	Proteins	2.90±0.18[e]	2.87±0.17[e]	2.84±0.07[e]	2.80±0.05[e]
	Total solids	15.00±0.18[a]	14.73±0.17[b]	14.45±0.15[c]	14.05±0.16[f]
	Fats	3.50±0.15[a]	3.42±0.14[b]	3.36±0.14[c]	3.29±0.11[d]

Within rows and columns, means denoted by a different letter are statistically different ($p<0.05$). *For treatments details please see section under the heading experimental design.

Table II. pH and acidity of yoghurt at different storage days prepared from different milk sources.

Treatments*	Parameter	Storage days			
		1st	7th	14th	21st
T_0	pH	4.60±0.19[a]	4.51±0.16[a]	4.38±0.18[b]	4.24±0.19[c]
	Acidity	0.89±0.18[a]	0.92±0.17[a]	0.95±0.19[a]	0.98±0.16[b]
T_1	pH	4.60±0.18[a]	4.48±0.17[a]	4.32±0.19[b]	4.21±0.14[c]
	Acidity	0.85±0.09[a]	0.88±0.08[a]	0.91±0.07[a]	0.95±0.08[b]
T_2	pH	4.60±0.27[a]	4.49±0.27[a]	4.41±0.23[b]	4.35±0.22[c]
	Acidity	0.88±0.08[a]	0.92±0.09[a]	0.94±0.05[a]	0.96±0.05[b]
T_3	pH	4.60±0.18[a]	4.47±0.17[a]	4.38±0.17[b]	4.32±0.12[c]
	Acidity	0.88±0.09[a]	0.93±0.07[a]	0.95±0.09[a]	0.97±0.06[b]
T_4	pH	4.60±0.06[a]	4.49±0.05[a]	4.37±0.05[b]	4.31±0.09[c]
	Acidity	0.86±0.05[a]	0.88±0.07[a]	0.90±0.08[a]	0.94±0.07[b]
T_5	pH	4.60±0.30[a]	4.50±0.24[a]	4.37±0.22[b]	4.30±0.25[c]
	Acidity	0.87±0.04[a]	0.90±0.04[a]	0.93±0.05[a]	0.97±0.08[b]

Rows and columns with the same letter having non-significant difference. * For treatments details please see section under the heading experimental design.

Table III. Gel firmness, viscosity, syneresis and water holding capacity (WHC) of yoghurt at different storage days prepared from different milk sources.

Treatments*	Parameters	Storage days			
		1st	7th	14th	21st
T_0	Gel firmness	72.00±0.29a	70.00±0.32a	69.00±0.30a	65.00±0.32b
	Viscosity	4342.00±0.38a	4330.00±0.38a	6230.00±0.33a	4900.00±0.35b
	Syneresis	35.00±0.28d	37.00±0.26c	37.00±0.25c	39.00±0.27d
	WHC	60.00±0.26a	58.90±0.25a	58.69±0.27a	58.86±0.27b
T_1	Gel firmness	69.00±0.29a	67.50±0.28a	66.00±0.28b	62.00±0.29d
	Viscosity	3921.00±0.36a	3955.00±0.37a	5380.00±0.34a	4233.00±0.33c
	Syneresis	36.50±0.26c	38.50±0.28b	37.00±0.29c	35.50±0.23e
	WHC	57.50±0.23c	56.95±0.22c	56.35±0.26c	55.43±0.21c
T_2	Gel firmness	64.00±0.28b	62.50±0.25b	60.50±0.27c	57.00±0.25e
	Viscosity	3350.00±0.35a	3356.50±0.36a	4430.00±0.37a	4155.00±0.36d
	Syneresis	39.00±0.28b	41.50±0.24a	43.00±0.27a	42.50±0.29b
	WHC	52.50±0.21d	51.00±0.28d	51.50±0.25d	51.00±0.26e
T_3	Gel firmness	66.00±0.32b	65.00±0.31b	63.00±0.33d	59.00±0.35c
	Viscosity	3500.00±0.35a	3480.00±0.36a	4530.00±0.38a	3966.00±0.32e
	Syneresis	38.00±0.26b	40.11±0.21a	42.00±0.26a	41.00±0.27b
	WHC	55.00±0.24c	54.00±0.25c	53.00±0.26c	52.00±0.25d
T_4	Gel firmness	62.00±0.29c	60.00±0.28c	58.00±0.24e	55.00±0.26f
	Viscosity	3200.00±0.29a	3133.00±0.34a	4330.00±0.36a	3544.00±0.38f
	Syneresis	40.00±0.29a	40.19±0.27a	42.00±0.26a	44.00±0.23a
	WHC	50.00±0.28e	49.77±0.24e	48.66±0.27e	46.00±0.26f
T_5	Gel firmness	67.00±0.12b	65.00±0.15b	63.50±0.18d	60.00±0.17c
	Viscosity	3771.00±0.35a	3631.50±0.37a	5280.00±0.31a	3422.00±0.36g
	Syneresis	37.50±0.27c	40.00±0.26a	38.00±0.24b	37.00±0.25c
	WHC	55.00±0.23c	51.95±0.22d	48.85±0.26e	40.43±0.25f

Rows and Columns with the same letter having non-significant difference. * For treatments details please see section under the heading experimental design.

Sensory properties

Sensory properties such as appearance, texture, taste, smell are shown in Table IV. Table V shows the overall acceptability of different milk sources.

DISCUSSION

Physico-chemical properties

Reduction in protein may be due to proteolysis activity as lactic acid bacteria hydrolyze milk protein and produces amino groups (Unal and Akalin, 2012). These results are in line with literature, lactose converted into galactose to glucose and decreasing lactose contents, so TS was decreased in all the treatments with storage period. Another study showed that some amino groups make interaction with lactose so same trend was observed in decreasing TS contents. Ca, P and Mg decreased as storage period increased.

Acidity decreases towards the storage period as shown in Tables III and V. It may be due to the microbial action. As *Streptococcus thermophilus* and *Lactobacillus bulgaricus* are the major source of decreasing acidity and conversion of lactose to lactic acid as well. She said that there was slight increase in the acidity of yoghurt during storage period. Acidity decreases from 0.9 to 1.7% during the storage of commercial yoghurt. This was due to the microbial action and non-availability of blast chiller room. They reported that there was not storage effect on TS and SNF of yoghurt, and these values decreased as storage period prolongs. This might be due to the relation between lactose, amino acid and other components. This all happens due the microbial action and different chemical reactions.

Table IV. Appearance, texture, taste and smell of yoghurt at different storage days prepared from different milk sources.

Treatments*	Parameters	Storage days			
		1st	7th	14th	21st
T_0	Appearance	8.37±0.33^{a}	8.33±0.33^{a}	7.99±0.17^{a}	7.33±0.33^{b}
	Texture	8.50±0.29^{a}	8.42±0.30^{a}	8.17±0.17^{a}	7.80±0.33^{b}
	Taste	8.67±0.33^{a}	8.33±0.33^{a}	8.25±0.17^{a}	7.92±0.33^{b}
	Smell	7.50±0.29	7.83±0.44	8.00±0.35	8.50±0.29
T_1	Appearance	8.17±0.23^{a}	7.83±0.33^{a}	8.16±0.08^{a}	7.00±0.29^{b}
	Texture	8.17±0.22^{a}	8.04±0.29^{a}	7.83±0.22^{a}	7.55±0.33^{c}
	Taste	8.25±0.25^{a}	7.92±0.30^{a}	7.88±0.18^{a}	7.66±0.25^{b}
	Smell	7.17±0.36	7.58±0.36	7.58±0.08	8.21±0.18
T_2	Appearance	8.13±0.29^{a}	7.83±0.33^{a}	7.95±0.17^{a}	6.33±0.44^{d}
	Texture	7.58±0.17^{b}	7.42±0.22^{b}	7.40±0.36^{b}	7.29±0.33^{e}
	Taste	7.50±0.14^{d}	7.38±0.22^{d}	7.44±0.19^{d}	7.10±0.23^{e}
	Smell	6.50±0.52	7.17±0.30	6.96±0.21	7.63±0.13
T_3	Appearance	8.10±0.26^{a}	7.95±0.33^{a}	8.02±0.00^{a}	6.67±0.33^{c}
	Texture	7.83±0.17^{b}	7.67±0.33^{b}	7.62±0.29^{b}	7.44±0.33^{d}
	Taste	7.83±0.17^{c}	7.50±0.29^{c}	7.45±0.25^{c}	6.67±0.17^{f}
	Smell	6.83±0.44	7.33±0.33	7.17±0.17	7.92±0.08
T_4	Appearance	8.24±0.36^{a}	8.05±0.33^{a}	8.06±0.33^{a}	6.00±0.58^{e}
	Texture	7.33±0.17^{b}	7.17±0.17^{b}	7.15±0.44^{b}	7.05±0.33^{f}
	Taste	7.17±0.17^{e}	7.25±0.14^{e}	7.21±0.14^{e}	6.42±0.30^{g}
	Smell	6.17±0.60	7.00±0.29	6.75±0.25	7.33±0.17
T_5	Appearance	8.22±0.31^{a}	8.12±0.33^{a}	8.08±0.08^{a}	6.67±0.44^{c}
	Texture	7.92±0.22^{b}	7.79±0.15^{b}	7.75±0.29^{b}	7.41±0.33^{d}
	Taste	7.92±0.22^{b}	7.79±0.23^{b}	7.69±0.15^{b}	6.38±0.31^{g}
	Smell	6.83±0.44	7.42±0.30	7.38±0.13	7.92±0.22

Rows and Columns with the same letter having non-significant difference. * For treatments details please see section under the heading experimental design.

Textural properties

Undoubtedly, the tendency to exhibit syneresis also depends on the changing in pH, which affects the gel structure, which is a casein micelle network containing heat-denatured whey proteins bound to the surface of the casein micellesIn milk, the integrity of casein micelles is controlled by a localized balance between hydrophobic interaction and electrostatic repulsion (Horne, 1998; Lucey, 2002). As the pH of milk decreases during fermentation, the CCP within casein micelles is solubilized, especially at pH<6.0, and it is completed by pH~5.0, which leads to the partial rearrangement of the internal structure of casein micelle (Lucey, 2002). As the pH of milk approaches the isoelectric point (i.e., pH< 5.0), electrostatic repulsion decreases, which facilitates enhanced casein–casein attractions due to increased hydrophobic interactions. These factors increase bond formation/strength and thus increase gel stiffness. Continuing to grow the lactic acid bacteria and also to produce lactic acid through the storage is responsible for the reduction in the pH.

Viscosity of the yoghurt increased with storage period in all the treatments and highest viscosity was observed in T_0 followed by T_1 and T_5. The viscosity may be related with gel firmness. Syneresis of the samples and control is shown in Table III. It is evident that syneresis increased with the passage of time in all the treatments including control. In Table III, it is shown that water holding capacity was decreased up to storage period of 14 days and decreased on 21 days. Highest water holding capacity was observed in T_0 followed by T_1 and T_5. As considered by many researchers syneresis is one of the most important parameters indicating the quality of yogurt during storage and consumer satisfaction (Shakerian *et al*., 2015).

Sensory properties

Appearance of yoghurt is increased with storage period in all the treatments. Appearance of yoghurt made from 100% Nili Ravi buffalo milk was higher throughout the storage period as compared to other treatments followed by T_1 and T_5, respectively. Similarly, texture was also increased with the passage of storage in all the treatments. Higher texture was observed in T_1 and T_5, respectively. Score for smell was also found increased in all the treatments throughout storage period in all the treatments. Highest score was found in T_o followed by T_1 and T_5. Overall acceptability is shown in Table V which shows that overall acceptability of yoghurt made from different combination of milk sources was found increased with the passage of storage period. Overall acceptability of T_o was higher followed by T_1 and T_5.

Table V. Overall acceptability of yoghurt at different storage days prepared from different milk sources.

Treat-ments*	Storage days			
	1st	7th	14th	21st
T_0	8.61±0.31^a	8.36±0.22^a	7.61±0.15^b	7.33±0.33^c
T_1	8.20±0.26^a	7.93±0.24^b	7.27±0.13^c	6.94±0.28^e
T_2	7.42±0.21^c	7.21±0.23^c	6.61±0.10^e	6.07±0.32^g
T_3	7.78±0.22^b	7.50±0.25^d	6.92±0.13^e	6.56±0.24^f
T_4	7.06±0.20^d	6.92±0.21^e	6.31±0.07^f	5.58±0.39^h
T_5	7.83±0.26^b	7.64±0.20^b	6.96±0.11^e	6.46±0.36^f

Rows and Columns with the same letter having non-significant difference. * For treatments details please see section under the heading experimental design.

CONCLUSION

Yoghurt made from different sources of milk showed that using 100% Nili Ravi buffalo milk has good physico-chemical, textural and sensory properties as compared to yoghurt made from other sources of milk or mixed milk. The results in comparison shows that highest score was observed in T_o (100% Nili Ravi buffalo milk) followed by T_3 (50% Nili Ravi buffalo and 50% Sahiwal Cow milk), T_4 (50:50 of Nili Ravi buffalo and Friesian), T_1 (100% Sahiwal milk), T_5 (50:50 of Sahiwal and Friesian) and T_2 respectively. Blends of cow and Nili Ravi buffalo milk have also good effects on overall performances and result of yoghurt.

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Ethical certificate

As no animal were used or trialed for this research work, so ethical certificate was not applicable.

Statement of conflict of interest

The authors have declared no conflict of interest.

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