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RESEARCH PAPER

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Evaluation of yoghurt prepared from different combinations of goat milk and sheep milk

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ABSTRACT

The present investigation was undertaken to utilize goat milk with sheep milk for preparation of yoghurt and to obtain value added product. The goat milk and sheep milk were used in the proportions of 100:00 (T_1), 75:25 (T_2), 50:50 (T_3), 25:75 (T_4) and 00:100 (T_5) for yoghurt preparation. Sheep milk in 25, 50, 75 per cent level were used as blending with goat milk for preparation of yoghurt and it significantly affected the fat, protein, SNF and ash percentage whereas lactose and acidity decreased from 25 to 100 per cent sheep milk in yoghurt. The yoghurt prepared from goat milk blended with sheep milk in proportion of 25:75 was of good quality. At this level, the goaty flavour disappeared while yoghurt prepared from combination of 100:00, 75:25 and 50:50 showed goaty flavour hence, acceptablity was less. As the levels of sheep milk increased with goat milk, the overall acceptability of yoghurt was increased. The cost of production of yoghurt was increased but there was reasonable increase in nutrients due to blending of sheep milk with goat milk.

KEY WORDS : Cow milk, Goat milk, Sheep milk, Yogurt, Sensory evaluation

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INTRODUCTION

Yoghurt may be defined as the solid, custard like fermented milk product made from fortified high solids milk using a symbiotic mixture of *Streptococcus salaivarius* subsp. *thermophillus* and *Lactobacillus delbrueckii* subsp. *bulgaricus* as starter. It was reported that the per capita consumption of yoghurt (in kg) in some leading countries was Bulgaria 42.2 kg, Swedan 29.1 kg, Israel 22.1 kg, Switzerland 16.9 kg, Norway 15.3 kg and France 15.2 kg (Anonymous, 1990).

Yoghurt is found nutritious over milk due to higher concentration, better digestibility and adsorption of fat, lactose protein and minerals. Therapeutic properties of yoghurt may be attributed to elaboration of bacteriocin like compounds and microbes in the starter culture which exhibit antagonism against undesirable flora (Sarkar and Mishra, 2002).

Caprine milk has advantages over bovine milk as baby food because it imparts greater resistance against disease and is less likely to being about allergic reaction to some milk factors of mixing of goat milk to sheep milk is desirable from immunology stand point. Sheep milk contains higher per cent of fat (6.5 to 8) and protein (4 to 6) in comparison to buffalo milk. Sheep milk is also richer in total solids, minerals and lactose than cow milk, so it is ideal for cheese and yoghurt making.

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MATERIALS AND METHODS

The freeze dried yoghurt cultures, *Lactobacillus bulgaricus* and *Streptococcus thermophillus* was obtained from National Cultures Collection Unit, National Dairy Research Institute, Karnal. During the investigation the cultures were maintained in 10 ml sterile skim milk media in culture tubes. The cultures were grown by inoculating them in tubes and then keeping the tubes at 37^0c temperature in incubator. After coagulation the cultures were stored in the refrigerator at 6 ± 2^0C and were renewed alternate day.

Fresh goat milk was obtained from NATP Project, Department of Animal Nutrition, PGIVAS, Akola and sheep milk was obtained from Cattle Breeding Farm, Borgaon manju. The milk was strained through clean muslin cloth in stainless steel pot.

The goat milk and sheep milk were taken as per treatment. The milks were properly mixed for preparing different combinations as goat milk and sheep milk in the proportions of 100:00 (T_1), 75:25 (T_2), 50:50 (T_3), 25:75 (T_4) and 00:100 (T_5) for yoghurt preparation. The milk was heated 85^{0}C to 90^{0}C for about 15 minutes and mixed thoroughly and cooled to incubation temperature of 37 – 42^{0}C. The milk was inoculated by one per cent of *Lactobacillus bulgaricus* and *Streptococcus thermophillus* in 1:1 proportion so as to get firm solid curd within 6 – 8 hours. Clean and sterilep paper cups of 100 ml or containers of 250 ml size were filled with inoculated milk and covered with sterilized butter paper. Each cup was numbered by marker and then incubated at 37 to 42^{0}C for 6 – 8 hours. Yoghurt samples, after setting of yoghurt transferred to refrigerator (6 ± 2^{0}C) and stored till judging and chemical analysis.

Sensory evaluation of yoghurt:

The quality of yoghurt was evaluated by offering the samples to the panel of five judges. The sample of each treatment was offered to same panel of judges for organoleptic evaluation. *i.e.* appearance, flavour, body and texture, over all acceptability. For organoleptic evaluation of yoghurt, 9 point "Hedonic scale" was used as prescribed by Nelson and Trout (1964).

Chemical parameters:

Fat content of yoghurt was done as per the procedure given in IS:1224 (1958). Protein content was determined as per ISI, Hand book of Food analysis SP:18 (Part-IX):1981. The procedure used for estimation of lactose was as per SP: 18 (Part XI) 1981. SNF percentage was determined as per IS: 1479 (Part II):1961. Acidity percentage was estimated as per IS: 1479 (Part-I):1960.

Curd tension :

Curd tension of yoghurt samples was determined by using the 'H' shape knives that were used with little variation in the dimension of 'H' shape knives.

Statistical analysis:

The data obtained was analyzed by using Randomized Block Design.

RESULTS AND DISCUSSION

The experimental findings of the present study have been presented in the following sub heads:

Sensory evaluation of yoghurt:

Sensory evaluation of yoghurt was done by offering the product to a panel of judges. The judges were asked to put the score in hedonic scale indicating from dislike with 1 score to extremely like with 9 score value.

Appearance:

Appearance score of sheep milk yoghurt in treatment T_5 was superior than T_1, T_2, T_3 and T_4 and similarly, treatment T_4 was superior over T_3, T_2 and T_1 treatments. Appearance of sheep milk yoghurt might be an account of higher content of fat and protein in milk as compared to goat milk. Domagala (2008) observed that the highest shear stress was found for sheep milk yoghurt with the lowest value for goat milk yoghurt, and yoghurt from sheep milk was characterized by the highest apparent viscosity, whereas goat milk yoghurt had the lowest value.

Flavour:

Flavour score for cow milk yoghurt in treatment T_5 was superior over treatment T_4, T_3, T_2 and T_1 similarly treatment T_4 was superior over T_3, T_2 and T_1 whereas T_2 was at par with T_1 treatment.

Body and texture;

Increase in sheep milk per cent increased the score for body and texture of yoghurt. The yoghurt prepared from 25 per cent goat milk and 75 per cent sheep milk (T_4) produced firm and compact body with smooth texture which was at par with 100 per cent sheep milk yoghurt (T_5).

Overall acceptability:

There was an increase in sensory score of yoghurt with increased level of sheep milk with decreased level of goat milk. Yoghurt prepared from goat milk T_1 treatment *i.e.* 100 per cent goat milk was not good in sensory characteristics and scored lowest overall acceptability (7.78 out of 9 points) indicated that the product was "liked moderately". There was an overall increase in sensory score of yoghurt if when the sheep milk proportion was increased with goat milk, and sheep milk yoghurt showed highest score (8.92 out of 9 points) indicated that the product was "liked extremely". Similarly T_4 combination *i.e.* 25:75 goat and sheep milk scored (8.80 out of 9 points) indicated that the product was "like very much". The results of present investigation are in agreement with Domagala (2008).He observed that goat milk yoghurt in comparison to cow and sheep milk yoghurts was less

Table 1 : Effect of sheep milk blending with goat milk on sensory evaluation of yoghurt

Treatments (GM:SM)	Mean values of scores obtained for five replications(Out of 9 marks)			
	Appearance	Flavour	Body and texture	Overall acceptability
T_1 (100:00)	7.20	8.02	7.90	7.78
T_2 (75:25)	7.42	8.12	8.08	8.16
T_3 (50:50)	7.56	8.32	8.36	8.40
T_4 (25:75)	8.06	8.58	8.6	8.80
T_5 (00:100)	8.525	8.82	8.8	8.92
'F' test	Sig.	Sig.	Sig.	Sig.
SE (m)±	0.087	0.050	0.048	0.121
CD at 5%	0.244	0.173	0.135	0.342

acceptable sensorially, because of its looser and weaker consistency.

Chemical analysis of yoghurt

Fat content in yoghurt :

It is observed from the Table 2 that the fat content of the yoghurt varied significantly with the treatment combination. It is seen from the data that mean fat content was highest in T_5 (6.88%) followed by T_4, T_3, T_2 and T_1 (control) valued 6.40, 5.58, 4.46 and 4.32 per cent, respectively. The present findings are supported by the observations of Fadela *et al.* (2009) who observed that fat content of yoghurt prepared from sheep milk was higher than cow and goat milk yoghurt. Laxminarayana (1980) discussed there was no appreciable change in the milk fat 3.5 – 7 per cent during lactic fermentation.

Protein content in yoghurt:

It is revealed from Table 2 that the protein content of the yoghurt differed significantly among the treatments. The highest protein content was observed in T_5 treatment valued at 4.45 per cent which was followed by T_4, T_3 and T_2 treatments being at 4.10, 3.86 and 3.76 respectively. The present findings are supported with the result of Krishna Gopala *et al.* (1982) who reported that there was slight increase in protein content from 4.23 to 4.45 in the final product whereas Shankar and Laxminarayan (1974) observed that mix culture increased protein content to an appreciable extent.

Lactose content in yoghurt:

It is noticed from the Table 2 that the lactose content of the yoghurt varied significantly with the treatment combination. It is seen from the data that mean lactose content was highest in T_1 (4.45%) followed by T_2, T_3, T_4 and T_5 valued 4.42, 4.41, 4.38 and 4.31 per cent, respectively. Lactose content in yoghurt decreased in treatments T_1 to T_5, with increase in sheep milk per cent .This is due to the less lactose in sheep milk than that of goat milk.

SNF content in yoghurt:

It is visualized from Table 2 that SNF content of T_5 treatment was highest 11.55 per cent. This was followed by T_4, T_3, T_2 and T_1 valued at 10.64, 9.76, 8.77 and 8.38 per cent, respectively. Kehagias and Dalles (1986) observed solids content from 12.8 to 12.4 per cent and from 15.7 to 20.2 per cent for the yoghurt from cow and sheep milk, respectively. These results may be sustained with the above cited figure.

Acidity of yoghurt;

It is revealed from Table 2 that highest acidity was

Table 2 : Effect of goat milk and it's blending with sheep milk on the physico –chemical attributes of yoghurt

Treatments (GM:SM)	Mean values of five replications in per cent.					
	Fat	Protein	Lactose	SNF	Acidity	Curd tension
T_1 (100:00)	4.32	3.74	4.45	8.38	0.85	21.2
T_2 (75:25)	4.46	3.76	4.42	8.77	0.84	24.8
T_3 (50:50)	5.58	3.86	4.41	9.76	0.82	28.4
T_4 (25:75)	6.40	4.10	4.38	10.64	0.81	32.4
T_5 (00:100)	6.88	4.45	4.31	11.55	0.796	34.6
'F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
SE (m)±	0.186	0.058	0.024	0.169	0.0010	0.572
CD at 5%	0.523	0.165	0.940	0.474	0.0038	1.608

Table 3 : Estimated cost structure of one litre yoghurt production from goat milk, sheep milk and blended milk

Sr. No.	Particulars	Treatments				
		T_1	T_2	T_3	T_4	T_5
1.	Quantity of milk used in ml					
	Goat milk(ml)	1000	750	500	250	00
	Sheep milk(ml)	000	250	500	750	1000
2.	Cost of milk in Rs./lit.					
	Goat milk Rs.16					
	Sheep milk Rs.20	16	17	18	19	20
3.	Total cost of production of yoghurt in Rs. with containers/lit.	22.00	23.0	24.00	25.0	26.00
4.	Total cost of production of yoghurt in Rs.with containers/100 ml	2.20	2.30	2.40	2.50	2.60
5.	Total cost of production of yoghurt in Rs.without containers/lit.	20.00	21.0	22.00	23.0	24.00
6.	Total cost of production of yoghurt in Rs.without containers/100 ml	2.00	2.10	2.20	2.30	2.40

0.85 per cent for goat milk yoghurt (T_1) while for blending of goat milk with sheep milk in different proportions in treatments T_2, T_3, T_4 and control (T_5) were containing 0.84, 0.82, 0.81 and 0.796 per cent, respectively. Treatment T_1 showed significantly higher acidity over T_2, T_3 T_4 and T_5 treatments. The results obtained in the present investigation are in agreement with the Domagala (2008). Yoghurt from goat milk had a higher acidity (pH = 4.43) in comparison to the acidity of cow milk yoghurt (pH = 4.58) and sheep milk yoghurt (pH = 4.69).

Curd tension in yoghurt:

It is noticed from Table 2 that average curd tension (g) was 21.2 g. for yoghurt prepared from goat milk (T_1) whereas 24.8, 28.4,32.4 and 34.6 for blending of sheep milk in treatments T_2, T_3, T_4 and T_5, respectively. Curd tension of sheep milk yoghurt (T_5) was highest (34.6), which is significantly more over T_4, T_3, T_2 and T_1. The high curd tension in sheep milk yoghurt is due to the large fat globules and high amount of SNF present in sheep milk.

Cost structure of yoghurt:

High cost of production is required for yoghurt prepared from sheep milk than that of blended milks and goat milk yoghurt. The cost of production of 1 litre yoghurt from goat milk with container was Rs.22.00 and without container was Rs.20.00, while the cost of production of yoghurt from sheep milk as Rs.26.00 with container and that of without container was Rs.24.00.

Increase in the proportions of sheep milk for blending with goat milk proportionately increased the cost of production. The cost of production of 100 ml yoghurt with container from goat milk was Rs.2.20 and that of sheep milk was Rs.2.60 and without container was Rs.2.00 and 2.40.

Conclusion:

Fat, protein, SNF and ash content in yoghurt prepared from blending of sheep milk with goat milk were higher as compared to yoghurt prepared from goat milk alone. Yoghurt prepared from blending of 75 per cent sheep milk with 25 per cent goat milk was of good quality with reasonable prices. Hence, the goat milk to the extent of 25 per cent in sheep milk is recommended for the preparation of yoghurt.

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