STUDIES ON QUALITY OF YOGHURT PREPARED FROM BLEND OF GOAT AND COW MILK

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ABSTRACT
Goat milk with 25, 50, 75 per cent level were used to mix with cow milk for preparation of yoghurt. Significant increase in fat, protein, ash and acidity percentage was observed in different blends whereas, SNF, lactose and curd tension(g) were decreased as goat milk proportion increased from 25 to 100 per cent in yoghurt. The yoghurt prepared from the blend of goat milk and cow milk in proportion of 25:75 was found acceptable resulting in to better quality product. While the quality of yoghurt prepared from combination of 50:50, 75:25 and 100:00 was acceptable. The preparation of yoghurt from the blend of goat milk and cow milk helps for utilization of goat milk to fetch better price to the milk producers.

Key words : Yoghurt, Blend-goat-cow-milk, Quality.

INTRODUCTION
Caprine milk has advantages over bovine milk as baby food because it imparts greater resistance against diseases and it has very little allergic reaction to human body. It also reduces the cream line because fat content of goat milk is so finely divided in the milk. (Tyagi and Prasad, 1989).

Use of goat milk for preparation of various dairy products is an age old practice throughout the world. In fact, some of the products are exclusively prepared from goat milk, for instance cheeses in Europe and Kefir in Russia. A very limited research work has been done on its utilization for Indian dairy products. It is reported that it is not possible to produce acceptable quality product from goat milk without process alterations (Bhosale and Yadav, 2003). Considering these facts in mind present investigation was planned to manufacture yoghurt from the blend of goat milk and cow milk.

MATERIALS AND METHODS
Collection of milk samples : Fresh samples of cow milk were obtained from dairy farm of

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Dr. Punjabrao Deshmukh Krishi Vidyapeeth, Akola (Maharashtra) and goat milk samples were obtained from the National Agricultural technology project (NATP), department of Animal Nutrition, Post Graduate Institute, PDKV, Akola, Maharashtra.

Chemical analysis of milk : Milk samples were analysed for fat, SNF and acidity using standard procedure given in BIS (1981).

The experiment was planned to study the acceptable blending of goat milk with cow milk for manufacture of blended yoghurt. Following acceptable blends of yoghurt were selected for experimental trials.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Goats milk (%)</th>
<th>Cow milk (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>T₂</td>
<td>75</td>
<td>25</td>
</tr>
<tr>
<td>T₃</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>T₄</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>T₅</td>
<td>0</td>
<td>100</td>
</tr>
</tbody>
</table>

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Experimental yoghurt samples were prepared as per the method of Aradhana Gupta and Prasad, (2000) with slight modifications.

Flow chart for preparation of yoghurt

Milk  ↓
Filtration  ↓
Testing of milk  ↓
Heat treatment (85-90°C for 15 min.)
Cooling at 37-42°C  ↓
Inoculation with yoghurt culture @ 1%
(1:1 ratio v/v) (str. Thermiphillus and Lacto bulgaricus)  ↓
Filling of container  ↓
Incubation (37 to 42°C for 6 to 8 hrs)  ↓
Storage (6±2°C)

Chemical analysis of yoghurt samples: yoghurt samples prepared from different treatment combinations were analysed for the fat, protein, lactose, SNF, acidity and ash content using standard procedures given in BIS (1981).

Curd tension of the experimental yoghurt samples were determined with slight modification in dimension of the ‘H’ shaped knives as per the procedure given by Rao et al. (1964).

Sensory evaluation of yoghurt: The sensory quality of yoghurt samples was evaluated by a panel of judges using 9 point hedonic scale as prescribed by Nelson and Trout (1964).

Statistical analysis of data: The experiment was laid out in randomized block design with five replication and experimental data was analysed as per the methods of Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

Chemical analysis of goat milk and cow milk: It is observed from the Table 1 that the average fat content of goat and cow whole milk was 4.21 and 3.82 per cent, respectively. The solids not fat (SNF) and acidity of goat and cow milk were 8.17, 8.50 and 0.15, 0.14 per cent respectively.

Sensory evaluation of yoghurt: The sensory attributes of yoghurt prepared from the blend of goat milk and cow milk combinations (T1, T2, T3, T4 and T5) are shown in Table 2.

Colour and appearance: It is observed from Table 2 that yoghurt prepared from goat milk and its blending in different levels with cow milk was liked very much on the basis of its colour and appearance score. However, the appearance score was 8.80 for yoghurt prepared from goat milk (T1), whereas, 8.60, 8.44, 8.32 and 8.20 scores for blends of goat milk with 25 per cent cow milk (T2), 50 per cent cow milk (T3), 75 per cent cow milk (T4) and 100 per cent milk (T5), respectively.

The results obtained in present investigation were in agreement with the results reported by Patil (1982) who observed that appearance of goat milk curd was better due to bright shiny colour and smooth body without whey separation. Singh et al. (1992) reported that goat milk yoghurt is white in colour because it is devoid of carotenoid pigment.

Flavour: It is observed that average flavour score was 8.04 for yoghurt prepared from goat milk (T1) whereas, 8.12, 8.32, 8.56 and 8.76 scores treatments T2, T3, T4 and T5 respectively.
It is further revealed that there was significant increase in the score of flavour with the increased level of cow milk with goat milk from 25 to 100 per cent. Hence, addition of cow milk seems to be advantageous to decrease the intensity of goatish flavour in the product. All these treatments differ significantly from each other.

The results obtained in the present investigation were in the agreement with the results reported by Morgan and Gaborit (2001) who observed that the unique sensorial properties of goat milk product, which is characterized by a specific and typical “goaty flavour”. This specific flavour may be undesirable in milk for direct consumption. Broadway and Biju (1998) who reported that flavour has been recognized as a key attribute to the yoghurt and the typical flavour of goat milk products should be controlled at the dairy plant level.

**Body and texture**: The average body and texture score for cow milk yoghurt (T₅) was 8.80 whereas, average score for blending of cow milk with 25 per cent goat milk (T₄) 50 per cent goat milk (T₃) 75 per cent goat milk (T₂) and 100 per cent goat milk (T₁) were 8.60, 8.36, 8.12 and 8.00 respectively.

It showed that by addition of cow milk from 25, 50, 75 and 100 per cent in goat milk there was increase in score of body and texture of yoghurt, as body and texture of yoghurt depends upon total solids content in the milk. This means the cow milk yoghurt was firm and had compact body while the goat milk yoghurt was having slight loose body and texture.

The yoghurt prepared from 25 per cent goat milk blended with 75 per cent cow milk (T₄) produced firm and compact body with glossy textural surface which was at par with 100 per cent cow milk yoghurt (T₅).

Manjunath et al. (1982) observed that plain yoghurt from goat milk had a slightly loose body due to higher minerals content. Lowestein et al. (1978) reported that goat milk yoghurt shows smooth body and Aggrawal (1974) reported that the consumers had no difficulty to distinguishing cow milk yoghurt from goat milk yoghurt in respect of smooth body and sharp flavour.

Broadway and Biju (1998) reported that the yoghurt prepared from mixture of cow milk and goat milk had a firm and consistent body and texture as compare to plain goat and cow milk yoghurt samples and lowest score of plain goat milk yoghurt as it resulted in soft body and weak gel like texture.

**Acidity**: Average acidity scores of yoghurt samples were 8.36, 8.48, 8.68 and 8.80 for T₁, T₂, T₃, T₄ and T₅ treatments, respectively.

Goat milk yoghurt (T₁) obtained lowest score score of acidity as compare to all other treatments studied. The yoghurt prepared from cow milk was having acceptable acidity level of 0.80 per cent L.A. and goat milk yoghurt had 0.85 per cent acidity. It is noticed that increase in proportion of cow milk there was increase in acidity score of yoghurt.

The results of present investigation are in agreement with the results of the Loewestein et al. (1978) who reported that goat milk yoghurt showed

| Table 2. Effect of different levels of goat and cow milk on sensory quality of yoghurt. |
|---|---|---|---|---|---|
| Treatment | Colour appearance | Flavour | Body and texture | Acidity | Overall acceptability |
| T₁ | 8.80 | 8.04 | 8.00 | 8.28 | 8.40 |
| T₂ | 8.60 | 8.12 | 8.12 | 8.36 | 8.52 |
| T₃ | 8.44 | 8.32 | 8.36 | 8.48 | 8.68 |
| T₄ | 8.32 | 8.56 | 8.60 | 8.68 | 8.76 |
| T₅ | 8.20 | 8.76 | 8.80 | 8.80 | 8.94 |
| 'F' Test | Sig | Sig | Sig | Sig | Sig |
| SE ± | 0.039 | 0.065 | 0.065 | 0.363 | 0.0591 |
| CD at 5% | 0.116 | 0.196 | 0.196 | 0.109 | 0.177 |
more rapid development of lactic acid as compared to cow milk yoghurt.

**Overall acceptability** : It is seen from Table 2 that the overall acceptability of the yoghurt exhibited a trend observed under the earlier parameters. It is observed from the data that the control treatment (T5) was significantly superior with a score of 8.94. This was followed by T4, T3, T2 and T1 valued 8.76, 8.68, 8.52 and 8.41, respectively. Overall acceptability of yoghurt in T3 (50:50) and T4 (25:75) was at par.

The yoghurt prepared from combination of 25:75 and 50:50 (goat milk : cow milk) showed non-significant difference in overall acceptability of yoghurt.

The overall acceptability of the product may be looked upon as a comprehensive exhibition of the respective characters of colour and appearance, flavour, body and texture and finally the taste of the product. It is worthwhile to mention that a drop in the acceptability of the product was experienced might be due to the enhancement in the level of acidity and the goaty flavour in the final product.

The lowest score for T1 clearly indicated that goat milk yoghurt without blending of cow milk was shown least overall acceptability by the panel of the judges and whatever the scores offered might have been due to the slightly goaty flavour of goat milk to the product. The significant difference in overall acceptability of T4 treatment with respective combination of 25 per cent goat milk and 75 per cent cow milk produced acceptable quality yoghurt. Hence, the goat milk to the extent of 25 per cent blending in cow milk could be recommended for the manufacture of yoghurt. At this level, the goaty flavour disappeared which was at par with the control (T5) treatment and the sufficient result into an acceptable product which also might be of significant enhancement of the nutritional status of this particular product.

It was interesting to note from the observation recorded on the effect for overall acceptability of yoghurt was of statistically significant (P < 0.05). The control treatment (T5) resulted in the highest score at 8.94 followed by T4 being at 8.76 were of second in order and lowest score in T1 treatment due to goaty flavour and more acidity in goat milk yoghurt.

As overall acceptability depends upon the score of flavour, body and texture of the product and lactic acidity. All these attributes increased with increasing the level of cow milk percentage with goat milk used for preparation of yoghurt. But the rich appearance of the goat milk yoghurt might be on account of higher content of fat and protein in milk as compared to cow milk.

The yoghurt prepared from blending of goat milk and cow milk had a firm and consistent body and texture which is comparable to cow milk yoghurt in T3 and T4.

**Chemical quality** : It is revealed from Table 3 that the fat content of the yoghurt differed significantly (P < 0.05) with the treatment combinations. It is seen from the data that mean fat content was highest in T1 (4.10%) followed by T2, T3, T4 and T5 (control) valued at 4.00, 3.94, 3.82 and 3.76 per cent, respectively.

The fat content of the product were mainly governed by the fat content of milk. The highest value of fat in case of goat milk (4.21%) was related to the level of fat in yoghurt (4.10%). The second higher value was that of T2 being at 4.00 per cent of fat in yoghurt which contained 75 per cent cow milk. The fat content of T3, T4 and T5 were at par. The typical flavour of yoghurt could be accomplished due to fat content.

Aggrawal (1974) reported that yoghurt from goat milk containing 4.2 per cent fat was indistinguishable from cow milk yoghurt made by same procedure.

It is observed from the Table 3 that SNF content of yoghurt showed significant differences. However, the highest numerical value of 8.72 per cent was noticed in the control (T5) treatment. This was followed by T4, T3, T2 and T1 valued at 8.67, 8.56, 8.47 and 8.39 per cent, respectively and the lowest value was recorded for T1 treatment. This is due to SNF content in the milk.
Shrinivasan and Anantkrishan (1964) observed that SNF content was in the range of 8.00 to 8.5 per cent in the dahi and Kehagias and Dalles (1986) observed that solids contents 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.

It was revealed that (Table 3) the protein content of the yoghurt differed significantly among the treatments. The highest protein content was observed in T1 sample valued at 3.74 per cent which was followed by T2, T3 and T4 treatments being at 3.69, 3.63 and 3.56.

The increase in protein content in yoghurt was mainly due to increased level of goat milk for its manufacture. It is worthwhile to mention that the increase of milk proteins due to goat milk addition of considered as positive attribute as it provides protein to human body.

Goat milk proteins are more digestible than cow milk proteins as it forms softer and more fragile curd in stomach when acidified. As a result proteolytic enzyme can break it down easily into smaller units and help in the treatment of peptic ulcers and infantile or adult cases of pyloric stenosis.

The values of lactose content of experimental samples of yoghurt are shown in Table 3. It is revealed from the data that as the level of cow milk percentage increased with goat milk for preparation of yoghurt there was significant increase in lactose content of yoghurt. This might be due to the fact that cow milk contains more lactose than goat milk.

De (1980) denoted lactose content in the range of 4.6 to 4.2 per cent in Dehi. Sindhu et al. (2000) and Ingle and Joglekar (1972) also observed that in the manufacture of dahi there were appreciable decrease in lactose, from 4.886 to 3.559 per cent. Goodenough and Kleyh (1976) reported that the lactose content of yoghurt mix was 8.50 and decreased during fermentation to 7.75.

The ash content of yoghurt was 0.81, 0.78, 0.75, 0.73 and 0.71 per cent in the treatment combinations T1, T2, T3, T4 and T5, respectively which indicated that with the increased levels of goat milk with cow milk, there was significant (P < 0.05) increase in the ash content of yoghurt. The highest ash content was recorded in the treatment T1 (0.81%) and the significantly lower ash content T 5 (0.71). This might be due to the lower ash content in cow milk than goat milk.

From the nutritional point of view, it is worthwhile to mention that yoghurt could supply considerable quantity of mineral matter. As the minerals particularly calcium and phosphorus are essential for the growth of bone and teeth of the growing children.

The average acidity (Table 3) was 0.85 per cent goat milk yoghurt (T1) while experimental product samples i.e. blending of goat milk with cow milk in different proportions in T2, T3, T4 and control (T5) were containing 0.84, 0.82, 0.81 and 0.80 per cent L.A., respectively.

Treatment T1 showed significantly higher acidity over T2, T3, T4 and T5 treatments. Each treatment differed significantly (P < 0.05) from each other whereas, T4 treatment was at par with T5 treatment.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Fat (%)</th>
<th>SNF (%)</th>
<th>Protein (%)</th>
<th>Lactose (%)</th>
<th>Ash (%)</th>
<th>Acidity (%)</th>
<th>Curd tension (gms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>4.10</td>
<td>8.39</td>
<td>3.74</td>
<td>4.36</td>
<td>0.81</td>
<td>0.85</td>
<td>21.20</td>
</tr>
<tr>
<td>T2</td>
<td>4.00</td>
<td>8.47</td>
<td>3.69</td>
<td>4.48</td>
<td>0.78</td>
<td>0.84</td>
<td>22.20</td>
</tr>
<tr>
<td>T3</td>
<td>3.94</td>
<td>8.56</td>
<td>3.63</td>
<td>4.58</td>
<td>0.75</td>
<td>0.82</td>
<td>23.80</td>
</tr>
<tr>
<td>T4</td>
<td>3.82</td>
<td>8.67</td>
<td>3.56</td>
<td>4.70</td>
<td>0.73</td>
<td>0.81</td>
<td>25.40</td>
</tr>
<tr>
<td>T5</td>
<td>3.76</td>
<td>8.72</td>
<td>3.50</td>
<td>4.80</td>
<td>0.71</td>
<td>0.80</td>
<td>26.00</td>
</tr>
</tbody>
</table>

'S' Test

| SE ±     | 0.015   | 0.0093  | 0.0056      | 0.0039      | 0.0047  | 0.0016      | 0.251             |
| CD at 5%  | 0.045   | 0.028   | 0.0168      | 0.0117      | 0.0140  | 0.0049      | 0.753             |

Table 3. Effect of different levels of goat and cow milk on chemical quality of yoghurt.
The results revealed that increased blend of cow milk with goat milk for preparation of yoghurt; there was significant decrease in acidity of yoghurt.

Kehagia and Dalles (1986) observed that goat milk yoghurt had higher acidity than cow milk yoghurt. Broadway and Biju (1998) reported that the acidity percentage in yoghurt from goat and cow milk combination at 50:50 combination ranged from 0.67 to 0.78 acid production.

Curd tension: The observations on curd tension of yoghurt at different levels of goat milk blended with cow milk are presented in Table 3.

It is seen that average curd tension was 21.20g for yoghurt prepared from goat milk (T1) whereas, 22.20g, 23.80g, 25.40g and 26.00g for blending of goat milk with cow milk treatments T2, T3, T4 and control (T5) treatments, respectively.

The curd tension was lowest in T1 (21.20g) and highest in the control (T5) treatment (26.00g) which was significantly more over T4, T3 and T2 whereas T4 treatment was at par with control (T5) treatment.

The results obtained in the present investigation are in agreement with Jairam et al. (1980) they reported that the curd tension might be attributed to the composition of milk and smaller size of fat globules in goat milk. Ingredients of milk which directly affected the curd tension were stage of lactation and pH value. Patil (1982) observed that curd tension of goat milk curd was lower 21.42g than that of cow milk curd 26.37g. Chawala and Balachandran (1994) observed that curd tension increased with the increase in SNF content, being highest curd tension of 45.5g was observed with the increase in SNF content, being highest curd tension of 45.5g was observed in curd having 15 per cent SNF.

From the above study, it is conclude that better quality yoghurt could be prepared from blend of 25% goat milk and 75% cow milk.

REFERENCES