Evaluation of different quality parameters of goat milk yoghurt developed using selected lactic acid bacteria

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ABSTRACT

The present study was undertaken to develop yoghurt from goat milk and to assess its sensory, chemical, microbiological and storage quality. Three different cultures were tried and incubation temperatures viz. 30, 37 and 42°C were selected. Yoghurt was prepared using 3% mixed culture containing Streptococcus thermophilus and Lactobacillus bulgaricus NCDC 144 in the ratio of 1:1. The product was prepared in five replicates and analysed for sensory attributes such as flavor, body and texture, colour and appearance and overall acceptability on 9-point hedonic scale by a panel of five judges. Based on overall acceptability of the product, the best incubation temperature (42°C) was selected. The product prepared with optimized incubation temperature was further subjected for chemical, microbiological and storage quality. It was observed that goat milk yoghurt contains less percentage of total solids and higher titrable acidity than cow milk yoghurt. The sensory and microbiological quality of the product was evaluated on 0, 3, 6 and 9 days at refrigeration temperature (4±1°C) to assess the storage stability of the product. The sensory attributes change significantly (p<0.05) after 9th day of storage in control and developed product both. The product had total plate count of 10^6 cfu/g and decreased significantly (p<0.05) after 9th day of storage (10^4 cfu/g). The coliform and yeast and mould count were not detected, both in control and developed product throughout storage period. It may be concluded that good quality goat milk yoghurt can be prepared by using mixed culture at 3% concentration with incubation temperature of 42°C for 8 hours.

Key words: Goat milk, Dairy, Sensory, Storage, Yoghurt.

INTRODUCTION

Goat is popularly known as poor man’s cow (or mini-cow) because of its immense contribution to the poor man’s economy. In India, total goat population of 135 million contribute about 4.9 million tons of milk production (FAOSTAT, 2014). Being small-sized animals, goat can easily be managed by women and children. Feeding, milking and care of goats do not require much equipment and hard work. The goat milk is better than cow milk for the reasons like less allergenic, naturally homogenized, easier to digest due to a smaller fat globule as well as higher levels of medium chain fatty acids and it matches up to human milk better than cow milk (Cooke, 2010). Goat milk and its products like yoghurt, cheese and powder have three-fold significance in human nutrition: (1) feeding more starving and malnourished people in the developing world than from cow milk (Cooke, 2010). Goat milk and its products yoghurt has a definite therapeutic value, especially those who suffer from stomach and intestinal disorder (Nahar et al., 2007). The present study was undertaken to develop yoghurt from goat milk and to assess its sensory, chemical, microbiological and storage quality.

MATERIALS AND METHODS

The goat milk (Mehsani goat) having 3.6% fat and cow milk having 4.4% fat was obtained from Livestock Research Station (LRS), S.D.A.U., S.K.Nagar. By following the standard procedure, three different type of cultures were taken i.e. Streptococcus thermophilus, Lactobacillus bulgaricus and Streptococcus thermophilus+Lactobacillus bulgaricus culture NCDC - 144. Out of three, one best would be selected based on highest overall acceptability of product by panel of judges and it was used for further study. The selected culture was used for the preparation of yoghurt at different temperatures of incubation i.e. 30, 37 and 42°C for selection of best temperature criteria. The incubation obtained by lactic acid fermentation of prescribed milk by the action of specific lactic acid bacteria (LAB) used as starter culture. It has been demonstrated that acid milk is better to digest than normal milk. For some individuals, yoghurt has a definite therapeutic value, especially those who suffer from stomach and intestinal disorder (Nahar et al., 2007). The present study was undertaken to develop yoghurt from goat milk and to assess its sensory, chemical, microbiological and storage quality.
temperature selected for control was 42°C as found in most of the review. The samples named as Sample S₁:- Control (cow milk) at 42°C, Sample S₂:- Goat milk at 30°C, Sample S₃:- Goat milk at 37°C and Sample S₄:- Goat milk at 42°C. The product prepared in five replicates and analysed for sensory attributes such as flavor, body and texture, colour and appearance and overall acceptability on 9-point hedonic scale suggested by Nelson and Trout (1964) by a panel of five judges. The product prepared with optimized incubation temperature was further subjected for chemical, microbiological and storage stability. Total solids (T.S.) and Titratable acidity in final product was determined according to the procedure described in AOAC (1990). Total plate count (TPC), Psychrotrophic counts (PTC), Coliform counts (CC) and Yeast and Mould counts (Y and M) in the sample were enumerated following the method described by American Public Health Association (APHA,1982). Storage studies at 4±1°C had been carried out at 3 days’ interval. The selected sample was periodically drawn and was analyzed for sensory and microbial quality as described. All the experiments were conducted in replicates and the data generated on various parameters were subjected to appropriate statistical analysis.

RESULTS AND DISCUSSION

Based on the sensory evaluation the overall acceptability was given for Streptococcus thermophilus, Lactobacillus bulgaricus and Streptococcus thermophilus and Lactobacillus bulgaricus culture NCDC – 144 were 7.5±0.2, 7.8±0.3 and 8.1±0.2 respectively. The Streptococcus thermophilus and lactobacillus bulgaricus culture NCDC – 144 culture in the ratio of 1:1 was adjusted as best by panel of judges and used for the further study. The starter culture selected for the preparation of goat milk yoghurt was Streptococcus thermophilus and lactobacillus bulgaricus mix culture NCDC 144 in the ratio of 1:1 that give the synergistic effect of both strains in the production of good flavor and development of acidity. Aggarwal (1974), Bozanic et al. (2001) and De vuysta et al. (2003) have also prepared goat milk yoghurt with good flavor and keeping quality by using a similar type of starter culture.

Sensory Evaluation: All the sensory attributes of the yoghurt i.e. flavor, body and texture, colour & appearance and overall acceptability assumes an important position. The sensory scores obtained during the sensory analysis were presented in Table 1.

It is evident from the table that the flavor scores of the sample S₃ was similar to control S₀ at 5 % level of significance, however the score decreased and was lower than that of the control. The score of the sample S₄ was significantly (p<0.05) lower than those of the samples S₁ and S₂ and in case of sample S₅ it further decreased. Sample S₅ and S₆ were significantly (p<0.05) different from S₀ and S₁ samples. There was no significant difference between S₁ and S₂. It indicated that the incubation temperature of 42°C as evidenced by high flavor score was accepted by the panel (Table 1). However, temperature of 30 and 37°C was not acceptable by the panel of judges. The increased flavor score may have attributed to the growth of starter culture at 42°C as the culture is thermophilic in nature. The characteristic flavor of yoghurt is due to production of lactic acid, acetaldehyde and other carbonyl compounds during fermentation of lactose by yoghurt culture (Pette and Lolkeme, 1950). Similar result has been reported by Baltadjeva et al. (1989) in the preparation of Bulgarian yoghurt with good flavor and keeping quality. The results obtained in the present study were in agreement with the study conducted by Abou-dawood et al. (1993) and Bozanic et al. (2001) who reported increasing flavor by the effect of starter culture. Sanna et al. (2005) reported the selected Streptococcus thermophilus and Lactobacillus bulgaricus mix culture resulted in yoghurt with a good organoleptic features. The flavor of goat milk yoghurt at 42°C was slightly lower than that of control and it may be due to a specific and typical flavor of the goat milk. The result obtained was also similar to Palanidorai et al. (2009) and Vargas et al. (2008). Broadway and Biju (1998) reported that flavor has been recognized as a key attribute to the yoghurt and the typical flavor of goat milk products should be controlled at the dairy plant level.

It is seen from the table that body and texture of the sample S₀ was at par with control S₀ at 5 % level of significance, however the score was lower than that of control there was no significance difference (p<0.05) was observed between sample S₁ and sample S₂. The body and texture score for sample S₅ and sample S₆ did not vary significantly and that were significantly (p<0.05) different from the sample S₁ and S₂ and scored lower than S₀ and S₁ (Table 1). 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 firm body and texture of cow milk yoghurt

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Flavor (Mean ± SE)</th>
<th>Body &amp; Texture</th>
<th>Colour &amp; Appearance</th>
<th>Overall Acceptability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample S₀</td>
<td>8.60 ± 0.24*</td>
<td>8.80 ± 0.20*</td>
<td>8.20 ± 0.20*</td>
<td>8.80 ± 0.20*</td>
</tr>
<tr>
<td>Sample S₁</td>
<td>6.20 ± 0.20*</td>
<td>5.60 ± 0.24*</td>
<td>5.80 ± 0.20*</td>
<td>6.20 ± 0.37*</td>
</tr>
<tr>
<td>Sample S₂</td>
<td>6.40 ± 0.40*</td>
<td>6.00 ± 0.31*</td>
<td>6.60 ± 0.24*</td>
<td>6.40 ± 0.24*</td>
</tr>
<tr>
<td>Sample S₃</td>
<td>8.40 ± 0.24*</td>
<td>8.20 ± 0.20*</td>
<td>8.80 ± 0.20*</td>
<td>8.40 ± 0.24*</td>
</tr>
</tbody>
</table>

* Superscripts are to be read column wise for mean comparison.
* Mean with similar superscripts in column do not differ significantly (p<0.05)
was due to higher total solids content of cow milk compared to goat milk. Texture of yoghurt was also dependent on the coagulation activity of starter culture (De vuysta et al., 2003). Isanga and Zhang (2008) stated that during yoghurt manufacturing, the thermal processing of milk (90–95°C / 5 min) denatures whey proteins which consist of alpha lactalbumin and beta lactoglobulin. The denatured whey proteins interact with casein micelles by coating on their surface (Mathur et al., 1999). The denatured whey proteins have a good water binding ability, so enhance the thickness of the curd. Manjunath et al. (1982) observed that plain yoghurt from goat milk had a slightly loose body due to higher minerals content. Lowenstein et al. (1978) reported that goat milk yoghurt showed smooth body and Aggrawal (1974) reported that the consumers had no difficulty in distinguishing cow milk yoghurt from goat milk yoghurt in respect of smooth body and sharp flavor. Cho-Ah-Ying et al. (1990) concluded that the temperature of incubation had significantly affected the texture of yoghurt.

As observed from the Table 1, the score for colour and appearance of Sample S₂ was higher than the sample S₀. However, there were no significant (p<0.05) changes between Sample S₀ when compared to control (Sample S₀) with respect to colour and appearance of the yoghurt. The sample S₀ and S₂ were significantly (p<0.05) different from each other and that of S₀ and S₃. The colour and appearance depends upon the carotene content. The cow milk having higher carotene content than goat milk so yoghurt from cow milk had yellowish white appearance while the goat milk yoghurt had pure white appearance. Aggarwal (1974) was also reported that goat milk yoghurt is whiter than cow milk yoghurt. Good quality yoghurt has a gel like coagulation and with porcelain like surface without wheying off. It has natural milk colour and fresh appearance (Ranganadham and Gupta, 1987). The lower appearance of sample S₀ and S₃ was due to unapparent coagulation, loose body and lower gel formation. Bano et al. (2011) was also found similar result that goat milk yoghurt prepared by incubation at 43°C having a good colour and appearance. Shekhar et al. (2012) concluded that heat treatment to boiling temperature increase the appearance of dahi. However, formulation 100% goat milk was scored as whiter and creamier. The later is one of the most important parameters for consumer preference in dairy products (Duboc and Mollet, 2001). Vargas et al. (2008) reported that whiteness and creaminess of the yoghurt increased significantly (p<0.05) when more goat milk was added.

For any food to be commercially successful, its overall acceptability by the consumers is the most important and decisive attribute. It is evident from the Table 1 that the scores of the sample S₂ was similar to control S₀ at 5 % level of significance, however it was slightly less than that of S₃ which indicates no significant decrease in the overall acceptability of the product except some statistically ignorable drop. The overall acceptability of sample S₁ and S₃ was remarkably lower than the control and S₂ indicating that the sample incubation temperature of 30 and 37°C were not desirable for preparation of yoghurt. The overall acceptability of yoghurt was determined on the basis of the average score obtained for different sensory attributes viz., colour and appearance, flavor and body and texture. Similar result was also reported by Palanidori et al. (2009) at incubation temperature of 38°C. Abou-dawood et al. (1993) observed that yoghurt prepared from goat milk had total organoleptic score ranging from 75-95%. Seelee et al. (2009) reported that 43°C incubation temperature had better sensory characteristics.

Sample S₃ was adjudged as the best by sensory panel, was selected as final product. The finally selected product with incubation temperature of 42°C was studied further to inspect its suitability in terms of chemical, microbiological and storage quality in comparison to the control.

**Chemical evaluation:** The chemical composition of control and final developed product averaged over three replications is given in Table 2.

It is clear from the data given in Table 2 that there were some differences in chemical composition of control and final developed product. Control product recorded more total solid (13.4 ± 0.90) as compared to final developed product (12.1 ± 0.15). It is due to the chemical composition of milk used as a raw material for the preparation of yoghurt. As the starter culture used is not having much effect on total solids, thus there was not much change was observed with respect to total solids of milk and yoghurt but the minor change observed as in table was due to moisture loss during heat treatment of raw milk prior to preparation of yoghurt. This is due to the composition of milk used for the preparation of yoghurt. Similar result was also found by Manjunath and Abraham (1986). Arora et al. (2013) reported that total solids percentage of cow milk is higher than goat milk. This result was also in agreement with the result of Nahar et al. (2007); they reported that total solids percentage of goat milk yoghurt was lower than cow milk yoghurt. Ehirim and Onyeneke (2013) reported that cow milk yoghurt having higher total solids percentage than cow and goat milk blend. Eissa et al. (2010) was also prepared the cow milk yoghurt and goat milk yoghurt with 13.2% and 12.8% total solids, respectively.

**Table 2:** Chemical composition of cow milk yoghurt (control) and goat milk yoghurt

<table>
<thead>
<tr>
<th>Quality Attributes</th>
<th>Control</th>
<th>Final Product</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S₀</td>
<td>S₂</td>
</tr>
<tr>
<td>Total Solid (%)</td>
<td>13.4 ± 0.90</td>
<td>12.1 ± 0.15</td>
</tr>
<tr>
<td>Titratable Acidity (°L.A.)</td>
<td>0.81 ± 0.03</td>
<td>0.98 ± 0.03</td>
</tr>
</tbody>
</table>
Titratable acidity of the developed products (Table 2) was more than the titratable acidity of the raw material used and it was due to activity of starter culture and production of lactic acid by the starter culture. It was also found that titratable acidity of experimental sample was higher than that of control. The production of acidity in the yoghurt preparation is due to activity of starter culture in the production of lactic acid in the milk. Manjunath and Abraham (1986) reported that goat milk yoghurt showed an increased rate of lactic acid production than cow milk yoghurt. The result was in agreement with the result of Eissa et al. (2010).

The microbiological quality evaluation of the product involved the enumeration of Total Plate Count, Coliform Count and Yeast and Mould Count and all are expressed in cfu/g of the control and developed product. On microbial analysis, it was found that both the experimental product and control contain the total plate count value of 10² cfu/g. This was due to the viability of starter culture organism. Udayvir et al. (2003) reported standard plate count of dahi in the value of 10² cfu/g. Sakore et al. (2007) prepared dahi with 10² cfu/g and suggested that for getting maximum therapeutic value, the fermented milk product should contain population of viable cells of probiotic culture more than 10⁶ cfu/g at the time of consumption. Ehirim and Onyeneke (2013) and Nahar et al. (2007) was also observed the similar result as in our experiment. Seele et al. (2009) also found the total viable count in 10⁶ cfu/g value.

The coliform count and yeast and mould count was found to be nil in the experimental product and control both as indicated in Table 3. Nahar et al. (2007) stated that the presence of coliform organisms in dahi as a result of contamination during its production and handling may cause public health problems. The possible sources of contamination of product are uncleaned hands of the manufactures, poor quality water used in the manufacturing process and exposure of the product to open air during setting of curd. Ehirim and Onyeneke (2013) were observed similar results as in present study. Sakore et al. (2007) was reported the coliform count in dahi in value of 2-4 cfu/g. However, it was reported that coliforms, if present, in yoghurt could survive a maximum of 3 days (Dardashti et al., 2001). Yeast and mould count could be attributed to contamination from air and the carryover culture used for yoghurt production. Nahar et al. (2007) was also reported nil value for yeast count in yoghurt. Ehirim and Onyeneke (2013) were reported the yeast and mould count around 2.75 cfu/g.

Storage study: The storage study of final developed product and control were conducted at refrigeration temperature (4±1°C). The products were analysed for sensory and microbiological quality intermittently for 3 days and the results found were shown as under.

It is seen from the Table 4 that the score for flavor of S₀ and S₃ was significantly different at 5% level of significance from each other at 0, 3, 6 and 9 days of storage. The flavor score of sample S₀ was not significantly (p>0.05) differ up to 3 days of storage, above which the score was decreased significantly at 6th and 9th day of storage. Similar trend was observed for the flavor score of sample S₃ where the score at 0 day was significantly (p<0.05) higher than at 9th day. During the entire storage period the flavor score of S₀ was better than that of control S₀. The flavor of both control and goat milk yoghurt was acceptable up to 9th day of storage. This may be due to production of lactic acid during storage. The decrease in flavor may also correlate to the proteolytic activity of bacteria and the production of higher acidity (Abrahamsen, 1978). Loss of flavor is attributed to fat and protein degradation (Mottar et al., 1979). Hanif et al. (2012) was also reported similar result of decrease in flavor score with increase in storage time. The results are in agreement with the findings of Eissa et al. (2010); Farooq and Haque (1992); Salwa et al. (2003) found the decrease in flavor of yoghurt during storage.

Body and texture: It is evident from the Table 5 that the score of S₀ was higher at 0 day and significantly (p<0.05) different from 3rd, 6th and 9th day. Moreover, the score at 3rd and 6th day was not significantly (p>0.05) different but it was higher than at 9th day. Similar results were also found in

<table>
<thead>
<tr>
<th>Table 3: Microbial evaluation of goat milk and cow milk yoghurts</th>
<th>Control (S₀) (cfu/g)</th>
<th>Final Product(S₃) (cfu/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Plate Count</td>
<td>2.1 x 10⁶</td>
<td>1.7 x 10⁶</td>
</tr>
<tr>
<td>Yeast and Mould Count</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>Coliform Count</td>
<td>Nil</td>
<td>Nil</td>
</tr>
</tbody>
</table>

Note: Mean ± SE with different superscript in a row wise differ significantly (p<0.05).

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Storage days</th>
<th>3</th>
<th>6</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>So</td>
<td>7.883 ± 0.075⁵</td>
<td>7.820 ± 0.075⁵</td>
<td>7.550 ± 0.075⁵</td>
<td>7.167 ± 0.075⁵</td>
</tr>
<tr>
<td>S₃</td>
<td>8.233 ± 0.065⁵</td>
<td>8.167 ± 0.065⁵</td>
<td>7.900 ± 0.065⁵</td>
<td>7.383 ± 0.065⁵</td>
</tr>
</tbody>
</table>

Note: So- control; S₃- final product
Table 5: Effect of storage on body and texture score of yoghurt

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Storage days</th>
<th>0</th>
<th>3</th>
<th>6</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>So</td>
<td>8.267 ± 0.069&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.983 ± 0.069&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7.900 ± 0.069&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7.683 ± 0.069&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>S&lt;sub&gt;y&lt;/sub&gt;</td>
<td>7.583 ± 0.079&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.450 ± 0.079&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.367 ± 0.079&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>7.183 ± 0.079&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
</tbody>
</table>

Note: Mean ± SE with different superscripts in a row wise differ significantly (p<0.05).

S<sub>y</sub> and score at 0 day was significantly higher than at 9<sup>th</sup> day and the score at 0, 3<sup>rd</sup> and 6<sup>th</sup> day was not significantly different (p<0.05).

During the entire storage period the score for body and texture of S<sub>y</sub> was significantly lower (p<0.05) than that of control S<sub>o</sub>. Yogurt made from cow milk showed better texture than those prepared from goat milk which may be due to higher total solids in cow milk than goat milk. Mahdian and Tehrani (2007) observed significant increase in texture acceptability with increasing total solids. The improvement in body and texture with increase in total solids may be attributed to the gel firmness as a result of interaction of proteins (Mohammed et al., 2004). The results are in agreement with the findings of Hanif et al. (2012); Eissa et al. (2010); Farooq and Haque (1992); Salwa et al. (2003) found a decrease in body and texture of yogurt during storage as result of proteolysis.

**Colour and appearance:** It was observed from the Table 6 that score for colour and appearance of the sample S<sub>y</sub> at 0 days was significantly different (p<0.05) from score at 3<sup>rd</sup>, 6<sup>th</sup> and 9<sup>th</sup> day. The score at 3<sup>rd</sup> and 6<sup>th</sup> day was significantly differing. The lowest score was found at 9<sup>th</sup> day and it was in acceptable limit. The score for the sample S<sub>y</sub> was highest at 0 day and significantly different (p<0.05) from subsequent days. The score at 0, 3<sup>rd</sup> and 6<sup>th</sup> day did not differ significantly (p>0.05).

During the entire storage period the score for colour and appearance of S<sub>y</sub>, was higher (p<0.05) than that of control S<sub>o</sub> at 0, 3<sup>rd</sup> and 6<sup>th</sup> day but it was lower than S<sub>y</sub> at 9<sup>th</sup> day of storage. Farooq and Haque (1992) and Hanif et al. (2012) reported similar results and found the decrease in scores of colour and appearance of yogurt during storage. The results are in agreement with the findings of Salwa et al. (2003) reported a decrease in colour and appearance of yogurts during storage period.

**Overall acceptability:** It is evident from the result score of storage study for overall acceptability (Table 7) of sample S<sub>i</sub> was higher at 0 day and lowest at 9<sup>th</sup> day but it was in acceptable limit. The score at 0 and 3<sup>rd</sup> day was not significantly differing (p>0.05) and score at 6<sup>th</sup> and 9<sup>th</sup> day was also differing significantly (p<0.05) from each other and that of 0 and 3<sup>rd</sup> day. The score of S<sub>y</sub> was not significantly different at 0, 3<sup>rd</sup> and 6<sup>th</sup> day of storage but significantly different (p<0.05) at 9<sup>th</sup> day.

During the entire storage period the score for S<sub>y</sub> was found to be similar with S<sub>y</sub> but there was gradually decline at subsequent days and was in acceptable limit. This may be due to the breakdown of various ingredients like protein, fat and lactose etc in the product and also affected its texture and thus resulted in low acceptance. The results are in agreement with the findings of Hanif et al. (2012); Eissa et al. (2010); Farooq and Haque (1992); Salwa et al. (2003) found a decrease in overall acceptability of yogurt during storage.

**Effect of storage on microbiological quality of yoghurt**

The microbiological evaluation of samples was followed for the enumeration of total plate count, coliform count and yeast and mould count at 0, 3, 6 and 9 days with three replications and data observed were given below.

**Total plate count:** It is seen from the Table 8 that total plate count of S<sub>y</sub> at 0 day was higher and total plate count at 0, 3<sup>rd</sup> and 6<sup>th</sup> day was in range of 10<sup>4</sup> and it was acceptable. At 9<sup>th</sup> day of storage, a decline in the total plate count was observed (10<sup>4</sup>). Similar trend was also found in S<sub>y</sub>. Sakore et al. (2007) suggested that for getting maximum therapeutic value, the fermented milk product should contain population of viable cells of probiotic culture more than 10<sup>6</sup>cfu/g at the time of consumption. The result of study was in agreement with the findings of Sheikh et al. (1970). During storage, the microorganisms used lactose and oxygen in milk for their growth and for acid production (Tamime and Robinson, 1999). Ehirim and Onyeneke (2013) was reported that duration of storage played important role in the growth of lactic acid bacteria and decrease in numbers of lactic acid bacteria may be due to the accumulation of ambient lactic acid. The results of present study were also in agreement with Seelee et al. (2009), who reported that the viability of microorganisms decreased after 7 day of storage.

**Coliform count:** The coliforms were not detected during the entire period of storage either in control or final product.

Table 6: Effect of storage on colour and appearance of yoghurt

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Storage days</th>
<th>0</th>
<th>3</th>
<th>6</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>S&lt;sub&gt;y&lt;/sub&gt;</td>
<td>7.750 ± 0.073&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.983 ± 0.069&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7.900 ± 0.069&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7.683 ± 0.069&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>S&lt;sub&gt;y&lt;/sub&gt;</td>
<td>8.067 ± 0.059&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.450 ± 0.079&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.367 ± 0.079&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>7.183 ± 0.079&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
</tbody>
</table>

Note: Mean ± SE with different superscripts in a row wise differ significantly (p<0.05).
It was due to maintenance of hygienic condition during processing and storage. The results were in agreement with Ehirim and Onyeneke (2013). Sakore et al. (2007) reported the coliform counts in products were in the range of 0 to 7 cfu/g. Eissa et al. (2010) reported absence of coliform count in yoghurt after 5 days of storage.

Yeast and mould count: The Yeast and Mould count were also not detected during the entire period of storage in either control or final product. It was also due to maintenance of hygienic condition during processing and storage. The result was in agreement with Nahar et al. (2007). Ehirim and Onyeneke (2013) reported 2-3 cfu/g of yeast and mould in yoghurt.

CONCLUSION

Finally, it was concluded that the goat milk yoghurt prepared with use of Streptococcus thermophilus and lactobacillus bulgaricus NCDC-144 in the ratio of 1:1 as a starter culture and incubated at 42°C temperature was having a better sensory acceptability. Goat milk yoghurt has a lower total solids percentage and higher titrable acidity than cow milk yoghurt. Goat milk yoghurt has been acceptable up to 6 day of storage period. It was unacceptable at 9th day of storage.

REFERENCES


Table 7: Effect of storage on overall acceptability of yoghurt

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Storage days</th>
<th>0</th>
<th>3</th>
<th>6</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>S₀</td>
<td>7.967 ± 0.047ₚ</td>
<td>7.850 ± 0.047ₚ</td>
<td>7.683 ± 0.047ₚ</td>
<td>7.150 ± 0.047ₚ</td>
<td></td>
</tr>
<tr>
<td>S₁</td>
<td>7.783 ± 0.080ₚ</td>
<td>7.650 ± 0.080ₚ</td>
<td>7.567 ± 0.080ₚ</td>
<td>7.250 ± 0.080ₚ</td>
<td></td>
</tr>
</tbody>
</table>

Note: Mean ± SE with different superscripts in a row wise differ significantly (p<0.05).

Table 8: Effect of storage on microbial quality of yoghurt

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Storage days</th>
<th>0</th>
<th>3</th>
<th>6</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>S₀</td>
<td>2.1±0.20 x 10⁶</td>
<td>1.8±0.26 x 10⁶</td>
<td>1.45±0.17 x 10⁶</td>
<td>2.23±0.32 x10⁴</td>
<td></td>
</tr>
<tr>
<td>S₁</td>
<td>1.7±0.16 x 10⁶</td>
<td>1.6±0.2 x 10⁶</td>
<td>1.37±0.20 x 10⁶</td>
<td>1.82±0.30 x10⁴</td>
<td></td>
</tr>
</tbody>
</table>

It was due to maintenance of hygienic condition during processing and storage. The results were in agreement with Ehirim and Onyeneke (2013) was reported 2-3 cfu/g of yeast and mould in yoghurt.

CONCLUSION

Finally, it was concluded that the goat milk yoghurt prepared with use of Streptococcus thermophilus and lactobacillus bulgaricus NCDC-144 in the ratio of 1:1 as a starter culture and incubated at 42°C temperature was having a better sensory acceptability. Goat milk yoghurt has a lower total solids percentage and higher titrable acidity than cow milk yoghurt. Goat milk yoghurt has been acceptable up to 6 day of storage period. It was unacceptable at 9th day of storage.


