EFFECT OF DIFFERENT LEVELS OF LACTIC ACID ON THE PHYSICO-CHEMICAL AND SENSORY ATTRIBUTES OF BUFFALO MILK PANEER

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ABSTRACT

A study was conducted to determine the influence of different amount of lactic acid viz. 0.2, 0.4 and 0.6 per cent (w/v) on the physico-chemical and sensory attributes of buffalo milk paneer. Study revealed that the incorporation of lactic acid at the rate of 0.2 per cent brought about a significant (P<0.05) improvement in yield, moisture and protein content, total solid recovery, flavour, body and texture and overall acceptability of the product as compared to the product prepared with 0.6 per cent coagulant. However, a significant decline in the former product was noticed with respect to fat, ash, total solids and titratable acidity. Paneer samples prepared by the incorporation of lactic acid at 0.2 and 0.4 per cent were statistically at par for protein, total solid recovery, body and texture and overall acceptability. No significant (P>0.05) differences were observed in lactose content, pH value and colour and appearance among all the samples. Based on significantly (P<0.05) higher sensory scores, incorporation of lactic acid at the rate of 0.2 per cent w/v was adjudged best for the preparation of buffalo milk paneer.

INTRODUCTION

Paneer is a heat and acid coagulated indigenous milk product mainly consisting of milk solids obtained by coagulating the casein with the help of citric, lactic or tartaric acid from which part of moisture has been removed by pressing.

In India, paneer production has been largely confined to the non organized sector of the dairy industry. An estimated one per cent of the country’s total milk production is converted into paneer. Its annual production is estimated at 1,50,000 tones (Aneja et al. 2002). Though the technology of paneer manufacturing process and handling is quite simple but still out of reach of the majority of the persons. Keeping in mind the future increased demand for paneer the following study was undertaken to optimize the amount of lactic acid incorporation for production of paneer with better recovery and sensory profile.

MATERIAL AND METHODS

Buffalo milk paneer was prepared by following the procedure of Bhattacharya et al. (1971) with slight modifications. The standardized milk (6% fat) sample was divided into three groups. Milk sample from each group was held at 82°C for 5 minutes. Afterward the milk samples were cooled to 70°C. One per cent lactic acid solution was then added to the milk samples at the rate of 0.2, 0.4 and 0.6 per cent (w/v), respectively in the three groups and the milk samples were kept on continuous agitation till clear whey (yellowish-greenish colour) separated out. The curd was left to settle down for 10 minutes without agitation. The curd was collected and filled in hoops (15x15x7.5 cm) lined with muslin cloth. Pressure was applied on the top of the hoop by placing a weight of 5 kg for 15 minutes. Afterward, the pressed blocks of curd were removed from the hoop and immersed in chilled water and placed on wooden planks for 10-15 minutes to allow loose water to drip down.

Physico-chemical properties of the paneer samples were determined by the standard methods of Association of Analytical Chemists (AOAC, 1980). Sensory evaluation of the products was done by an experienced panel using 9 point hedonic scale, wherein 9 denoted extremely desirable and 1 extremely undesirable. Data were subjected to statistical analysis

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(Snedecor and Cochran, 1989) for analysis of variance and critical difference for comparing the means and to find out the effect of treatment.

RESULTS AND DISCUSSION

Physico-chemical properties: On studying the effect of levels of lactic acid incorporation, it was observed that the average yield at all the three levels was significantly (P<0.05) different from one another (Table 1). The maximum yield was recorded in paneer made from milk coagulated with 0.2% lactic acid while with 0.6 per cent lactic acid, it was minimum. The decrease in the yield with increase in the quantity of lactic acid is attributed to the decrease in recovery of total solids and retention of less moisture in the coagulum. Moisture content of the paneer samples decreased with increase in the level of lactic acid. The paneer obtained from milk coagulated with 0.2 per cent lactic acid exhibited maximum moisture content and it was significantly (P<0.05) higher than the samples prepared with 0.4 and 0.6 per cent coagulant, respectively. However, the later two samples were statistically at par with each other. So it may be said that the amount of lactic acid above 0.2 per cent had an adverse effect on the moisture content of paneer. Decrease in the moisture content of paneer samples with increase in the level of lactic acid may be attributed to the shrinkage of coagulated solids and subsequently more expulsion of whey from the coagulum resulting in low moisture.

The average fat content of paneer samples prepared from milk coagulated with lactic acid at three different levels were significantly (P<0.05) different among themselves. The maximum fat content was found in paneer samples coagulated with 0.6 per cent lactic acid while the minimum in paneer samples made with 0.2 per cent coagulant. Increase in the fat content of paneer samples with increase in the quantity of lactic acid is due to expulsion of more whey from the coagulum at higher levels of lactic acid, resulting in increased fat content per unit mass of paneer. Similar trend in fat content has also been reported by Rao et al. (1984). The highest protein content was recorded in paneer sample obtained from milk coagulated with 0.2 per cent lactic acid and it was significantly (P<0.05) different from paneer samples prepared from milk coagulated with 0.6 per cent coagulum. So it is clear that there was a negative correlation between level of lactic acid and protein content of paneer.

There was a gradual decrease in the lactose content of paneer samples with increase in the level of lactic acid. However, no significant (P>0.05) differences were observed among the treatments. Decrease in lactose content with increase in the level of coagulant can be explained on the basis that lactose being water soluble remains in the whey during the process of coagulation. So paneer samples which retain higher amount of whey or in turn the moisture, contained higher lactose content. The average ash content in all three samples was significantly (P<0.05) different from one another. The minimum ash content was recorded in paneer samples made from milk coagulated with 0.2% lactic acid. A significant increase in ash content was noticed with each increase in the level of coagulant. Thus it is apparent that there was a direct relationship between ash content and level of lactic acid. Dwivedi (1999) also reported an increase in the ash content with increase in the level of coagulant.

The total solid content of paneer samples increased progressively with increase in the level of lactic acid incorporation. The maximum value was recorded in paneer samples prepared from milk coagulated with 0.6 per cent lactic acid and it was significantly (P<0.05) higher than samples prepared with 0.2 per cent coagulant but statistically similar with samples prepared with 0.4 per cent lactic acid. So it is clear from the above finding that there was an inverse relationship between total solids and moisture content of the paneer samples. A decline in the
total solid recovery was observed with increase in the amount of lactic acid incorporation for preparation of paneer. The maximum value was observed in paneer samples prepared from milk coagulated with 0.2 per cent lactic acid and it was significantly (P<0.05) higher from samples coagulated with 0.4 and 0.6 per cent lactic acid, respectively. However, the later two samples were statistically at par with respect to total solid recovery.

The titratable acidity of paneer samples at the three different levels of lactic acid incorporation was significantly (P<0.05) different from one another. The maximum value of acidity was recorded in paneer samples prepared from milk coagulated with 0.6 per cent lactic acid while minimum in paneer samples with 0.2 per cent lactic acid. Thus it is obvious from the observations that the titratable acidity in paneer samples increased with increase in the level of lactic acid. It may be only due to the higher concentration of lactic acid in whey retained in paneer. These results are corroborating the results of Rao et al. (1984) and Dwivedi (1999). No significant (P>0.05) difference was observed among the pH of paneer samples prepared by the incorporation of lactic acid at three different levels. Generally the pH decreases with the increase in titratable acidity, contrary to this no such interaction was observed in the present study. This could be explained by the fact that pH is a measure of hydrogen-ion concentration and the weak acids or organic acids do not ionize completely. Simultaneously, on measuring titratable acidity, the amount of acid that is capable of reacting with a known amount of base is determined, hence the discrepancy (Jay, 1987).

**Sensory attributes :** The scores for colour and appearance in paneer samples prepared by the incorporation of lactic acid at three different levels were non significantly (P>0.05) different (Table 2). These results are in harmony with Singh (1998) and Dwivedi (1999). The highest flavour score was observed in case of paneer samples prepared from milk coagulated with 0.2 per cent lactic acid. A significant (P<0.05) decrease in flavour scores was noticed with increase in the amount of lactic acid utilized for preparation of paneer. An increase in the intensity of sourness with increase in amount of lactic acid was also noticed which contributed a significant role in decreasing the flavour score. The present study is in full agreement with Singh (1998) who observed deterioration in flavour scores with increase in the concentration of coagulant. Rao et al. (1984) reported deterioration in flavour of paneer when they used above 0.3 per cent citric acid.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Levels of lactic acid incorporation (%)</th>
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<tbody>
<tr>
<td></td>
<td>0.2</td>
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<tr>
<td>Yield (%)</td>
<td>19.36±0.208a</td>
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<tr>
<td>Moisture (%)</td>
<td>53.40±0.488a</td>
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<tr>
<td>Fat (%)</td>
<td>24.72±0.166a</td>
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<tr>
<td>Protein (%)</td>
<td>15.90±0.424a</td>
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<tr>
<td>Lactose (%)</td>
<td>2.70±0.104</td>
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<tr>
<td>Ash (%)</td>
<td>2.15±0.073a</td>
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<tr>
<td>Total solids (%)</td>
<td>46.52±0.506a</td>
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<tr>
<td>Total solid recovery (%)</td>
<td>60.05±0.946a</td>
</tr>
<tr>
<td>Titratable acidity (%)</td>
<td>0.26±0.024a</td>
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<tr>
<td>pH</td>
<td>6.38±0.085</td>
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*Mean±SE with different superscripts in a row differ significantly (P<0.05).

n=6 for each treatment
acid for coagulating the milk due to the higher acid content in the product.

The scores for body and texture decreased gradually with increase in the amount of lactic acid incorporation. Score for body and texture of paneer samples with 0.2 and 0.4 per cent lactic acid were significantly \( (P<0.05) \) higher than paneer samples with 0.6 per cent lactic acid. An increase in the hardness of the product was also felt with increase in the level of coagulant above 0.2\%.

The scores for body and texture of paneer samples decreased with increase in the level of lactic acid. The highest score was noticed in sample prepared with 0.2 per cent lactic acid and it was significantly \( (P<0.05) \) higher than samples with 0.6\% lactic acid but statistically at par with samples coagulated with 0.4\% lactic acid. Higher scores for overall acceptability of paneer samples with 0.2\% lactic acid could be due to higher rating of these samples with respect to flavour, body and texture. So we can say that an increase in amount of coagulant above 0.2\% had an adverse effect on the overall suitability of paneer. The present study is in accordance with Chawla et al. (1987) who reported that 1.95 gm lactic acid is sufficient to obtain paneer from 1 kg milk with better recovery and sensory profile.

Hence on the basis of above findings we can conclude that 0.2 per cent lactic acid (w/v) can be successfully utilized for the preparation of buffalo milk paneer with better yield, protein content, total solid recovery, flavour, body and texture and overall acceptability of the product as compared to higher level of coagulant.

### REFERENCES


