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Effect of strength of citric acid solution on the preparation of paneer from goat milk

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Abstract

The present study was conducted on goat milk paneer using citric acid solution as a coagulant to estimate the effect of strength of citric acid solution in term of quantity of coagulant used and quantity of whey received during preparation of goat milk paneer and on sensory quality (General appearance, Taste and flavour, Body and texture and Overall acceptability) and yield of goat milk paneer. Different strength of citric acid solution as a coagulant for preparation of paneer from a goat milk were used like S₁ (1%), S₂ (2%) and S₃ (3%). The statistical analysis of data revealed that the mean value of quantity of citric acid solution for S₃ and S₂ were differed significantly ($p < 0.05$) with S₁. The values of quantity of whey received and yield for S₁, S₂ and S₃ were non-significant to each other. The score of general appearance for S₁ treatment was significantly ($p < 0.05$) higher than S₃ but non-significant to S₂ treatment. The mean values for taste and flavor and overall acceptability of S₁ treatment significantly ($p < 0.05$) higher than S₂ and S₃ treatments. The score of body and texture for S₁ treatment was significantly ($p < 0.05$) higher than S₃ but non-significant to S₂ treatment. Strength of citric acid 1 percent was found to be best suited, because it resulted in good quality goat milk paneer.

Keywords: Goat milk, citric acid, paneer, yield, sensory quality

1. Introduction

Livestock sector plays an important role in India economy. Goats are important part of livestock industry and play a crucial role in the socio-economic structure of marginal farmers in India. India possess 148.88 million goats and is ranked second in the world in terms of goat population (Basic Animal Husbandry Statistics, 2019) [6]. Total milk production in India is 187.7 million tone and goat milk contribution is 3 percent of total milk production in India (Basic Animal Husbandry Statistics, 2019) [6]. Goat milk has been recommended as an ideal substitute for cow and human milk (Zenebe *et al.*, 2014) [11]. Goat milk can be used to prepare a wide variety of dairy products as paneer, cheese, butter, ice-cream, butter milk, condensed milk, yoghurt, flavoured milk, sweets and candy (Fazilah *et al.*, 2018) [5]. The growing consumer interest in goat's milk and its dairy products is related to the nutritional benefits offered by these products (Clark & Gacia, 2017) [4]. Good quality paneer is characterized by a marble white color, sweetish, mildly acidic taste, nutty flavour, spongy body and closely knit smooth texture (Patel, 1991) [8]. Several coagulants for preparation of paneer have been tried namely lemon juice, citric acid, tartaric acid, lactic acid, malic acid, hydrochloric acid, phosphoric acid, acetic acid, fermented milk, sour/ cultured whey, yoghurt and lactic cultures. The present research work was carried out as an attempt to utilize goat milk for the preparation of paneer, a value added product. In order to estimate the effect of strength of citric acid as a coagulant in term of quantity of coagulant used and quantity of whey received during preparation of goat milk paneer and on sensory quality and yield of goat milk paneer, different strength of citric acid solution are used for its preparation and better suited level of citric acid solution is selected for paneer preparation from goat milk.

2. Materials and Methods

2.1 Procurement of milk: Goat milk was procured from livestock research station, Bojunda, Chittorgarh and standardized to 5 percent fat for preparation of paneer.

2.2 Preparation of paneer: Different strength of citric acid solution were used as coagulant like S₁ (1%), S₂ (2%) and S₃ (3%) to preparation of paneer. The product was prepared by the process suggested by Sachadeva and Singh (1988) [9].

The standardized goat milk was added with 0.10 percent calcium chloride and heated to 90 °C than subsequently cooled to 85 °C and add citric acid solution as coagulant slowly with continuous agitation till clear whey separated out. The curd was left for 5-10 minutes in the whey and then drained through muslin cloth and pressed in a hoof at 2-3 kg/cm² pressure. Paneer block was dipped in chilled water for 5-10 minute and packaged in pre-sterilized LDPE pouches and stored at 5 °C.

2.3 Yield of goat milk paneer: The yield of goat milk paneer obtained was weighed and recorded as per cent yield of the milk used for preparation of goat milk paneer in each treatment.

2.4 Sensory analysis of paneer: The paneer prepared under different treatments during the course of the investigation was subjected to the sensory evaluation by a panel of five judges from the Department of Livestock Products Technology and Department of Veterinary Public Health by using the procedure described in IS 6273(Part II) (1971) [7]. The product was judged for different quality attributes by 9 point Hedonic scale (Amerine *et al.*, 1967) [1] with suitable modifications.

2.5 Statistical analysis: Data were statistically analyzed by using the method described by Snedecor and Cochran (1989) [10].

3. Results and Discussion

To study the effect of different strength of citric acid solution, paneer was prepared from goat milk added with 0.1 percent calcium chloride using different strength of citric acid

solution as coagulant at 85 °C coagulation temperature.

3.1 Effect of different strength of citric acid solution on various parameters like the quantity of citric acid solution used and quantity of whey received during preparation of paneer and yield of goat milk paneer.

The results of a value of strength of citric acid solution on various parameters like the quantity of citric acid solution used and quantity of whey received during preparation of paneer and yield of goat milk paneer, are presented in Table 1. The mean values for quantity of citric acid solution (ml/L milk) used for S₁, S₂ and S₃ were 64.00±3.5, 37.33±2.03 and 28.00±1.32 respectively. The mean value of quantity of citric acid solution for S₃ and S₂ were non-significant to each other but differed significantly ($p<0.05$) with S₁. These findings are in accordance with the observation of Bandyopadhyay *et al.* (2006) [2].

The average value for quantity of whey (ml/L milk) received for S₁, S₂ and S₃ were (746.66±20.38), (730±20.08) and 677.33±12.39 respectively. The values of quantity of whey received for S₁, S₂ and S₃ were non-significant to each other but in case of S₁ found higher value than S₂ and S₃. Bandyopadhyay *et al.* (2006) [2], also reported similar findings while studying in the effect of non-conventional coagulant vis-à-vis traditional coagulant on chhana.

The average value of strength of a coagulant on yield of a paneer were non-significant to each other but declining trend in yield was found as the increase in strength of a citric acid solution. The findings are in close proximity with that of Banker *et al.* (2014) [3] who reported that increase in strength of a citric acid from 1 per cent to 3 per cent resulted in declined the yield of chhana but the differences were observed to be marginal.

Table 1: Effect of strength of citric acid solution on various parameters like the quantity of citric acid solution used and quantity of whey received during preparation of paneer and yield of goat milk paneer.

Parameter	Quantity of citric used (ml/L milk)	Quantity of whey received (ml/L milk)	Yield (%)
S ₁	64.00 a ±4.8	746.66±20.38	14.09±1.20
S ₂	37.33 b ±1.53	730.66±20.08	13.86±1.36
S ₃	28.00 b ±3.84	677.33±12.39	13.22±0.57

Each observation is a mean ± SE of three replicate experiment (n=3)

Mean in column bearing a common superscripts do not differ significantly ($p<0.05$).

S₁- 1% citric acid solution S₂- 2% citric acid solution S₃-3% citric acid solution

3.2 Effect of different strength of citric acid solution on the sensory quality of goat milk paneer

The effected of strength of a citric acid solution on sensory quality of goat milk paneer is presented in Table 2.

3.2.1 General appearance: The average value for general appearance of a treatment S₁, S₂ and S₃ were 7.53±0.07, 7.16±0.05 and 6.73±0.10 respectively. The score of appearance for S₁ treatment was significantly ($p<0.05$) higher than S₃ but non-significant to S₂ treatment.

3.2.2 Taste and flavor and Overall acceptability: The mean values for taste and flavor and overall acceptability of S₁ treatment significantly ($p<0.05$) higher than S₂ and S₃ treatments while S₂ and S₃ treatments for taste and flavor and overall acceptability were non-significant to each other.

3.2.3 Body and texture: The average value for body and texture of a treatment S₁, S₂ and S₃ were 8.13±0.13, 7.40±0.08 and 6.73±0.20 respectively. The score of body and texture for S₁ treatment was significantly ($p<0.05$) higher than S₃ but non-significant to S₂ treatment. The present findings are in close agreement with that of Bankar *et al.* (2014) [3] who reported 1 per cent citric acid solution scored maximum for all sensory attributes than 2 per cent and 3 per cent concentration of citric acid solution.

From this study, it is evident that amongst all the strength of citric acid tried 1.0 per cent citric acid solution when used as coagulant resulted in product having superior quality with respect to all the attributes studied. Hence Strength of citric acid 1 percent was found to be best suited for preparation of paneer from goat milk.

Table 2: Effect of strength of coagulant on sensory quality of goat milk paneer

Parameter	Sensory attributes			
	General Appearance	Taste and Flavor	Body and texture	Overall acceptability
S ₁	7.53 ^a ±0.07	7.46 ^a ±0.10	8.13 ^a ±0.13	7.53 ^a ±0.05
S ₂	7.16 ^{ab} ±0.05	7.00 ^b ±0.06	7.40 ^{ab} ±0.13	7.03 ^b ±0.08
S ₃	6.73 ^b ±0.10	6.93 ^b ±0.04	6.73 ^b ±0.20	6.70 ^b ±0.08

Each observation is a mean ± SE of three replicate experiment (n=3)

Mean in column bearing a common superscripts do not differ significantly ($p < 0.05$).

S₁- 1% citric acid solution S₂- 2 % citric acid solution S₃- 3% citric acid solution.

4. Conclusion

On the basis of the results obtained in the experiment, it is concluded that Quantity of whey received during preparation of paneer and yield of paneer ($P > 0.05$) were not affected by strength of citric acid solution. Quantity of coagulant used during preparation of paneer and sensory quality of paneer were significantly ($P < 0.05$) affected by strength of citric acid solution. Strength of citric acid 1 percent was found to be best suited, because it resulted in good quality goat milk paneer.

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