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Effect of custard apple pulp on physico-chemical properties of rabri

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Abstract
Rabri was prepared from cow milk with constant level of sugar (6 percent by weight of rabri) and different levels of custard apple pulp (0, 5, 10, 15 and 20 percent by weight of rabri). On an average custard apple pulp rabri of treatments T_1, T_2, T_3, T_4 and T_5 contained moisture 43.22, 44.73, 46.24, 47.75 and 49.28 percent, fat 14.84, 14.19, 13.47, 12.85 and 12.17 percent, protein 9.49, 9.14, 8.75, 8.36 and 7.98 percent, ash 1.99, 1.91, 1.86, 1.76 and 1.71 percent, total solids 56.78, 55.27, 53.76, 52.25 and 50.72 percent, total sugar 12.53, 12.75, 12.98, 13.25 and 13.48 percent, titrable acidity 0.19, 0.25, 0.32, 0.39 and 0.44 percent L.A., pH 6.31, 6.12, 5.90, 5.75 and 5.52 respectively.

Keywords: Rabri, custard apple pulp, physico-chemical, moisture, etc.

Introduction
It is concentrated and sweetened whole milk product containing several layers of clotted cream. The basic methodology denotes use of fresh cream milk, it is heated in boiling pan. A thin layer of clotted cream forms on surface of milk this is then clotted from time to time using a wooden stick. These layers of clotted cream are placed one over the other. This process is continued till 1/6th of original milk is left. Sugar 5 to 6% by weight of original milk volume is added. Fruits like grapes, apples, custard apples, etc. could be utilized for the preparation of fruit rabri. In addition, the color and flavor of rabri is improved by incorporation of fruit pulp (Kerawala and Sidappa, 1963) [6].

Materials and Methods
The present research was undertaken on the topic entitled "Studies on preparation of rabri using Custard apple (*Annona squamosa*) pulp". The research was conducted in the Department of Animal Husbandry and Dairy Science, Dr. P. D. K. V., Akola, during the year 2024-25.

Materials
The whole, clean, fresh cow milk was obtained from market. Custard apple pulp and sugar were obtained from local market. Different equipment used viz., *karahi*, *khunti*, stainless steel trays, mixer grinder were available in the department.

Methods
The rabri with different combinations was prepared by addition of custard apple pulp in proportions of 0, 5, 10, 15 and 20% of custard apple pulp in rabri.
The preparation process of rabri was illustrated through a schematic flow diagram by Aneja (1997) [1], which outlines the steps involved in creating this traditional dessert

Procedure for preparation rabri

Milk
↓
Filtration
↓
Heat at simmering temperature (85-90°C)
↓
Fan the surface to facilitate skin formation
↓
Break skin with wooden stick and place on cooler part of *karahi*
↓
Reduce volume to 1/3rd
↓
Add sugar @ 6% of original volume of milk
↓
Immerse the layers of skin in sweetened condensed milk
↓
Heat gently for a while
↓
Cool to room temperature
↓
Add custard apple pulp as per treatment
↓
Store at refrigerated condition (0-4°C)

Results and Discussion

Chemical composition of Custard apple pulp rabri

The custard apple pulp rabri prepared under various treatments was subjected to analyze properties viz., moisture, fat, protein, ash, titrable acidity, total sugar, pH, and total solids.

Moisture content

It was observed that average moisture content in T_1, T_2, T_3, T_4 and T_5 was 43.22, 44.73, 46.24, 47.75 and 49.28 percent, respectively. Basically, all the treatments showed the significant difference for moisture content due to custard apple pulp. As custard apple pulp increased in rabri, the moisture content in rabri also increasd. This might be due to high moisture content in custard apple pulp. The maximum moisture was observed in treatment T_5 (49.28%) whereas, minimum moisture obtained in treatment T_1 (43.22%). Gupta *et al*., (2016) [4] prepared rabri with different combination of sugar and found moisture content from 46.45 to 37.58. Khaskheli *et al*. (2008) [7] evaluated rabri samples purchased from 25 dairy shops from which 2 samples each were selected i.e. 50 samples of rabri purchased and observed variation in moisture content from 24.33 to 38.85. Moisture content of custard apple rabri was increased as compared to control rabri, due to higher moisture content of custard apple pulp.

Fat content

The average fat content in custard apple pulp rabri was 14.84, 14.19, 13.47, 12.85 and 12.17 percent for treatments T_1, T_2, T_3, T_4 and T_5 respectively. It was also observed that maximum fat content was observed in T_1 (14.84) and minimum fat content observed in T_5 (12.17). The fat content of rabri was significantly influenced by the addition of custard apple pulp in rabri. As the custard apple pulp level increased the fat content of rabri decreased significantly. Jadhav *et al*. (2002) [5] recorded the fat content in different combination of sapota rabri as 19.00 to18.17 percent fat. Pawar (2003) [8] recorded the fat content in rabri by adding mango pulp at 2, 4, 6 and 8% at initial weight of buffalo milk i.e. 18.07 to 15.02 percent. The fat content in the rabri samples prepared and studied in this investigation varied but comparable with the result of De (1980) [2] and Gayen and Pal, (1991) [3] as they reported fat content of rabri as 13.2 to 21.5%.

Protein content

The protein content was 9.49, 9.14, 8.75, 8.36 and 7.98 percent respectively. The differences were statistically significant among the various treatments in rabri preparation. It was observed that as the level of custard apple pulp increased, the protein content of the product was decreased. This might be due to lower protein content in custard apple pulp. Therefore, treatment T_1 (9.49) had high amount of proteins as compared to T_5 (7.98). It was observed that the level of custard apple pulp in the blend increased there was decrease in the protein content of rabri. This might be due to less protein content in custard apple pulp as compared to rabri. Pawar (2003) [8] recorded the protein content in rabri blended with mango pulp at 2, 4, 6 and 8% at initial weight of buffalo milk had 11.03 to 9.8 percent protein. Jadhav *et al*. (2002) [5] recorded the protein content in different combination of sapota pulp i.e 10, 20 and 30 percent in milk shake had protein content from 10.03 to 8.7 percent .The protein content of rabri prepared and studied in this investigation varied but compared with result of De (1980) [2] and Gayen and Pal. (1991) [3] recorded protein content in rabri as 10.27-13.23.

Ash content

The data obtained indicates that the ash content of rabri in treatments T_1, T_2, T_3, T_4 and T_5 was 1.99, 1.91, 1.86, 1.76 and 1.71 percent respectively. As the custard apple pulp level increased the ash content of the product was decreased. The ash content of custard apple *rabri* decreased with increase in proportion of custard apple pulp in the *rabri* because ash content in custard apple pulp is lower. Pawar (2003) [8] recorded the ash content in *rabri* with addition of mango pulp at 2,4,6 and 8% at initial weight of buffalo milk was 2.8 to 2.3 percent. Jadhav *et al*. (2002) [5] recorded the ash content in different combination of sapota milk shake at 10, 20 and 30 percent of pulp and has 2.7 to 2.3 percent. The ash content in the rabri samples prepared and studied in this investigation varies but comparable with result of De (1980) [2] and Gayen and Pal. (1991) [3] recorded the ash contain of rabri as 3.00 percent.

Titrable acidity content

Titrable acidity of treatments T_1 to T_5 were recorded as 0.19, 0.25, 0.32, 0.39 and 0.44 percent respectively. As the custard apple pulp increased in rabri, the acidity in rabri was increasing continuously. Highest titrable acidity was observed in treatment T_5 (0.44%) whereas, lowest in treatment T_1 (0.19%). Increase in acidity might be due to increase in the level of custard apple pulp added in rabri preparation. Pawar *et al*. (2011) [9] studied the Mango pulp incorporated into rabri with addition mango pulp at 2,4,6 and 8% at initial weight of buffalo milk and best 6% treatment and found that the acidity 0.30%.

Total sugar content

Total sugar content was increased from treatments T_1, T_2, T_3, T_4 and T_5 as 12.53, 12.75, 12.98, 13.25 and 13.48 percent respectively. Highest total sugar in treatment T_5

(13.48%) was observed, whereas, lowest one in treatment T_1 (12.53%). These differences may occur because of total sugar already present in custard apple pulp. Pawar (2003) [8] recorded the lactose content in rabri with addition of mango pulp at 2, 4, 6 and 8% at initial weight of buffalo milk and it was 16.20 to 17.03 percent. Jadhav *et al*. (2002) [5] recorded the total sugar content in different combination of sapota pulp in milk shake i.e. 10, 20 and 30 percent and has values from 16.8 to 17.4 percent. The total sugar content in the rabri samples prepared and studied in this investigation varies but comparable with result of De 1980 and Gayen and Pal, (1991) [2] noted the range of total sugar as 17.02 to 16.00%.

Total solids content

It was observed that the average total solids content of product was found to be 56.78, 55.27, 53.76, 52.25 and 50.72 percent for treatment T_1, T_2, T_3, T_4 and T_5 respectively. The highest total solids content was recorded for treatment T_1 (56.78%) and the lowest was recorded for treatment T_5 (50.72%). All treatments were significantly different from each other. It was also observed that as the addition of custard apple pulp level decreased, the total solids content of product increased with increase in moisture content. This might be due to the low total solids content of custard apple pulp. Pawar *et al*. (2011) [9] recorded the total solid content in *rabri* with addition mango pulp at 2, 4, 6 and 8% at initial weight of buffalo milk and it has 52.07 to 55.53 percent Jadhav *et al*. (2002) [5] recorded the total solid content in different combination of sapota pulp in milk shake i.e. 10, 20 and 30 percent and has values as 55.3 to 57.17 percent**.** The total solid content in the rabri samples prepared and studied in this investigation varies but comparable with result of De (1980) [2] and Gayen and Pal, (1991) [3] report the range of total solid contain of rabri was from 55.82 to 57.00%.

pH content

It was observed that the average pH content of product was found to be 6.31, 6.12, 5.90, 5.75 and 5.52 for treatment T_1, T_2, T_3, T_4 and T_5 respectively. The highest pH content was recorded for treatment T_1 (6.31) and the lowest pH content was recorded for treatment T_5 (5.52). All treatments were different from each other. It was also presented that as the addition of custard apple pulp level increased the pH content of product decreased. Saxena *et al*. (2022) [10] studied the pH content of rabri enriched with date syrup and makhana. In this rabri was prepared with date syrup replacing sugar completely. Three formulations were made varying the amount of buffalo milk and date syrup. The formulations were-T_1 (95:5), T_2 (90:10) and T_3 (85:15) (buffalo milk: date syrup) that decreased from 6.75 to 6.38. The pH of custard apple rabri decreases due to conversion of sugars to acid and further lowering the pH.

Sr. No.	Chemical constituents	T_1	T_2	T_3	T_4	T_5
1.	Moisture	43.22	44.73	46.24	47.75	49.28
2.	Fat	14.84	14.19	13.47	12.85	12.17
3.	Protein	9.49	9.14	8.75	8.36	7.98
4.	Ash	1.99	1.91	1.86	1.76	1.71
5.	Titrable acidity	0.19	0.25	0.32	0.39	0.44
6.	Total sugar	12.53	12.75	12.98	13.25	13.48
7.	Total solids	56.78	55.27	53.76	52.25	50.72
8.	pH	6.31	6.12	5.90	5.75	5.52

Conclusion

Custard apple could successfully be used in preparation of dairy product like rabri. While in chemical composition scores of control (T_1) was acceptable and liked very much but as compared to other treatment levels, T_3 with 10 percent custard apple pulp and 90% rabri gained acceptable score with like very much. Hence, it is concluded that 10 percent custard apple pulp rabri is more nutritious and cheaper for consumers.

The chemical composition of T_3 contains moisture 46.24 percent, fat 13.47 percent, proteins 8.75 percent, ash 1.86 percent, titrable acidity 0.32 percent LA, total sugar 12.98 percent,, total solids 53.76 percent and pH 5.90.

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