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Effect of Different Levels of *Paneer* Whey on Sensory attributes of Milk Bread

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ABSTRACT

The aim of the study was to undertaken the effect of addition of five different percentages (control (0%), 25%, 50%, 75% and 100%) of paneer whey on sensory attributes of milk bread. The sensory scores assigned for crust color varied significantly for treatments T1, T2 and T5 and there was no significant difference between the treatments T3 and T4 and found statistically equal in effect. The scores assigned to symmetry of shape of milk breads did not widely differ among the treatments and the statistical difference among the treatments was non-significant, indicating that addition of paneer whey did not affect the symmetry of shape for milk bread. The sample with 100 per cent paneer whey (T5) scored highest (4.06) and lowest score (3.50) was recorded for 50 per cent paneer whey treatment (T3). The average values recorded for aroma ranges between 9.84 ± 0.19 and 10.61 ± 0.52 out of maximum score twelve. The means for total scores of milk breads ranged between 84.18 ± 2.09 and 86.83 ± 2.57.The lowest score (84.18) was recorded for T3 (75pw:25w) and highest score (86.83) was given to control (T1).

Key words: *Paneer whey, Milk bread, Sensory attributes, Total Score*

INTRODUCTION

Whey is the serum or watery part of the milk that separates from the curd in the manufacturing process of chakka, channa, cheese and paneer. It is rich in degradable materials and exerts a high oxygen demand. Data says that, about 2.5 million tones of milk is being processed in nearly 200 dairy plants in India and processing of 1 litre of milk generates about 8 to 10 litres of whey water depending upon the type of products manufactures[15]. Whey contains more than half of the total solids present in the whole milk. Whey is the largest by-product of the world dairy industry, generated during the manufacturing of cheese, paneer, chhana, chakka, casein, etc. It has been estimated that the biological oxygen demand (BOD) of whey ranges from 38,000 to 46,000 ppm[11].

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Therefore, the disposal of whey is a costly proposition. Several methods have been suggested for efficient disposal of whey. Whey has been very efficiently utilized in the production of whey powder, whey paste, lactose and lactic acid, ice-cream mix, milk biscuits, cheese spreads, infant food formulations, vinegar production, soft and alcoholic beverages etc. But still the potential of whey has not been fully exploited Thus utilization of whey through economical processes at cottage level is the demand of the day.

The bakery industry in India is one of the largest segments of the food processing industry accounting for an annual turnover of nearly Rs. 3000 Crores. The production of bakery products is estimated at around 5 million tonnes in the year 2004-05. India is the second largest producer of biscuits after USA. Bread and biscuits account approximately for 85% of the total bakery products produced in the country[17] and other major products are rusks, soup sticks, buns, cakes, pizza bread, etc. The share of the organized sector is estimated to be around 45 per cent and the industry is growing at a healthy rate of 10-11 per cent[17]. There is immense potential for the utilization of whey solids in the production of variety of bakery products.

In India the traditional and organized bakery industry has grown considerably over the recent decade. These businesses are run on small and medium scales and these processors are constantly on the lookout for newer products, cost reduction and value addition. The use of whey solids in the appropriate manner is likely to provide low cost solids to the bakers besides resulting in newer/high nutritional value products. Therefore, the present study was undertaken to utilize *paneer* whey in the preparation milk bread and to study its effect on sensory properties.

MATERIAL AND METHODS

A composite sample of fresh *paneer* whey was obtained from the Department of Dairy Technology and used during the research work. The whey was prepared using citric acid of commercial grade @ one per cent as a coagulant. The whey collected was clarified and separated twice at 40 ± 5°C using power operated centrifugal separator and filtered through double layered muslin cloth. The *paneer* whey obtained was used in place of water for dough making at four different levels viz., 25, 50, 75 and 100 per cent. Refined wheat flour, sugar, hydrogenated fat, salt, baker's yeast, vanilla essence were procured from local market of Pusad, M.S., India.

Method for Milk Bread Making

The milk bread was prepared by following "Straight dough process", AACC[1]. During each replication, 1500 g refined wheat flour was taken and divided into five lots of 300 g each to apply five different treatments.

Control (T1) = 100 per cent water

T2 = 75 per cent water + 25 per cent *paneer* whey

T3 = 50 per cent water + 50 per cent *paneer* whey

T4 = 25 per cent water + 75 per cent *paneer* whey

T5 = 100 per cent *paneer* whey

Each treatment was replicated five times.

For making the dough, 1500 g cleaned refined wheat flour was taken in the trough along with all the dry ingredients and mixed uniformly followed by addition of molten fat. The mixture was then divided into five lots for five different treatments. The dried mix was thoroughly blended together with the various proportions of whey and water as shown in the Table 2 using food processor for 10 minutes for formation of dough. The proofing of dough obtained from each treatment was done in two steps. The baking of the proofed dough in G.I moulds was done at 230 ± 5°C for 30 ± 2 min to achieve light brown color of the crust. After baking the milk bread samples were taken out from baking oven and allowed to cool at ambient temperature for 30 ± 2 minutes in the mould itself. The cooled milk bread samples were taken out in the stainless steel tray for further studies.

Sensory evaluation of milk bread

The sensory evaluation of fresh milk bread samples was done by panel of 6 judges using 100 point score card (KS 172:2009). During each replication, samples from five different treatments were judged for color of crust, symmetry of shape, crust characteristics, grain/texture, color of crumb, aroma, taste / chewability. The scores were ascertained for each factor and expressed numerically.

Statistical analysis

All the data obtained during the different types of analysis was recorded and statistically analyzed using Completely Randomized Design as described by Snedecor and Cochran[18]. In all 25 samples were studied using following combinations of water and paneer whey.

RESULTS AND DISCUSSION

Sensory evaluation may be defined as a method that scientifically measures, evokes, analyzes and interprets responses to products through smell, sight, taste, touch, and hearing[19]. The sensory evaluation of milk bread prepared with the incorporation of different *paneer* whey levels was carried out to evaluate the external and internal sensory parameters by a panel of six judges using a 100 point score card (KS 172:2009). Results are presented in Table 1.

Color of crust

The crust color of bread is very important parameter in judging the quality of the product. The golden brown color of bread crust is liked by the consumers and imparts good product appeal. The maximum score allotted for this parameter was 5. The sensory score assigned for crust color varied significantly for treatments T1, T2 and T5 and there was no significant difference between the treatments T3 and T4 and they have statistically equal effect. The highest score (4.51) was observed for treatment T2 having 25 per cent *paneer* whey and lowest score (3.58) was recorded for treatment T3 which had 50 per cent *paneer* whey. During the present study it was observed that the addition of whey darkened the bread crust color and the darkness of the crust increased with increase in the level of *paneer* whey.

The darker color may be attributed to Maillard reaction between reducing sugars, phenolic compounds and proteins during baking process as reported by Raidi and Klein[16] and Dhingra and Jood[4]. The Maillard reaction occurs when most foods are heated and results in reactions that promote the browning of cookies, bread, and other baked products. Whey proteins contain a high amount of the amino acid lysine[22]. which is typically the most reactive amino acid with regard to the Maillard reaction[3].

Symmetry of shape

The scores assigned to symmetry of shape of milk breads did not widely differ among the treatments and the statistical difference among the treatments is non-significant. This indicated that addition of *paneer* whey did not affect the symmetry of shape for milk bread. Table 1 revealed that scores for symmetry of shape varied from 3.63 ± 0.35 to 4.11 ± 0.17 out of maximum score allotted five. The score for symmetry of shape was highest (4.11) for 100 per cent *paneer* whey (T5) and lowest (3.65) was recorded for 75 per cent *paneer* whey (T4). Symmetry of shape is important in deciding the characteristics like uneven top, low ends and shrunken sides of the bread.

Crust characteristics

The mean statistical results for scores assigned to crust character of milk breads made from different levels of *paneer* whey are described in Table 1. The result indicates that different treatments have a non-significant effect on the scores for crust characteristics. The sample with 100 per cent *paneer* whey (T5) scored highest (4.06) and lowest (3.50) was recorded for sample having 50 per cent *paneer* whey (T3). The crust character is generally referred to thick crust, tough crust, hard crust or brittle crust and an acceptable crust should be thick and tough. The whey protein plays a vital role in the improvement of texture, color and enhancement of sensory attributes of bakery items[12,10,23]. The addition of *paneer* whey might have improved the crust characteristics

of the milk bread and accordingly T5 (4.06) was found superior over all other treatments.

Grain/ Texture

The grain of bread is the exposed cell structure of crumb when a loaf of bread is sliced[9]. The organized structure of cell gives the information about the loaf volume of the breads[7]. The scores assigned by the panelists for grain/texture of milk breads obtained from different levels of *paneer* whey are presented in Table 1. The sensory scores noted for different treatments ranged from 21.16 ± 0.63 to 21.83 ± 0.84 out of maximum score twenty five. The statistical analysis revealed that the difference among the treatments is non-significant and all the treatments are statistically at par. The lowest score (21.16) was assigned to milk bread with 50 per cent *paneer* whey (T3) and highest score (21.83) was assigned to control (T1). Grain structure of bread made from *paneer* whey was characterized by thick network walls Takano *et al.*[20]. The results obtained in present study are in line with Tarar[21], who mentioned that different acidulants imparted prominent effect on grain texture of the bread. During the present study it was observed that with the increase in *paneer* whey level, the stiffness of dough was increased.

Color of crumb

A soft creamy white crumb color is preferred in white breads. However in some geographic areas; a bright white color to an off-white color is also preferred for bread crumb. The maximum score allotted to this parameter is 23. It is evident from the Table 1 that the scores assigned to crumb color ranged from 20.61 ± 0.46 to 20.91 ± 0.67. The statistical difference between the various treatments was found non-significant indicating that all the treatments are statistically equal in effect. The highest score (20.91) was assigned to milk bread prepared from 100 per cent *paneer* whey (T5) , whereas the lowest score (20.61) was given to milk bread made from 50 per cent *paneer* whey (T3). During the study, an increase in creamish color was recorded as the level of *paneer* whey increased. This noted results are supported by Divya[5] who found that bread obtained from the dough incorporated with concentrated *paneer* whey (26% TS) was yellowish and possessed a firm and "crumbly" crumb which was least accepted. Whereas, the bread prepared from concentrated *paneer* whey (15% TS) received acceptable sensory quality and high overall acceptance.

Aroma

The values recorded for aroma ranges between 9.84 ± 0.19 and 10.61 ± 0.52 out of maximum score twelve (Table 1). All the treatments were statistically non-significant ($p<0.05$) and found equal in effect. It can be seen from the Table 1 that the highest score (10.61) was observed for control (100w:0pw) and the lowest score (9.84) was recorded for T4 (75pw:25w). There was decrease in aroma score with increase in volume of *paneer* whey in milk breads. This reveals that increasing the quantum of whey may be imparting its aroma to milk bread but the effect was non-recognizable by the panel of judges. The results are in line with those observed by Asghar[2] and Pastuszka *et al.*[13].

Taste / chewability

The taste is the main criteria, which makes the product to be liked or disliked by the consumer. The average score of five replications as given by the panel of judges to the taste of milk breads was ranging from 21.50 ± 0.44 to 22.14 ± 0.69 out of maximum score twenty five. The statistical difference among the treatments was non-significant and all the treatments are statistically equal. The lowest score (21.50) was assigned to the milk bread prepared from 75 % *paneer* whey (T4) and the highest score (22.14) was allotted to control (T1).The results obtained by Tarar[21]. showed that taste of breads was affected significantly with the use of acidulants and their salts in bread. In the present study, whey testing 0.38 per cent acidity was used. This acidity of *paneer* whey might have been masked by other ingredients used in the preparation of milk breads.

Total score

It can be observed from the Table 1, that the statistical difference between all the treatments is non-significant for total scores of milk breads. The maximum score allotted was 100 for deciding the total score. The mean

recorded ranged between 84.18 ± 2.09 and 86.83 ± 2.57. The lowest score (84.18) was recorded for 75 % *paneer* whey incorporated milk bread sample (T4) and highest score (86.83) was given to control (T1). The sample closest to control (T1) was T2 (25pw:75w) which scored 86.56 ± 1.37. It can be seen from Table 1, that the judges showed slight diminishing trend for the acceptability of milk bread with the increase in proportion of *paneer* whey. However all the treatments were found to be statistically at par with each other. It shows that panel of judges have accepted the replacement of water with *paneer* whey at 25-100 per cent level for preparation of milk bread.

Thus, utilization of *paneer* whey in place of water for making milk bread at cottage level is an alternate, attractive option for whey utilization and economic outlet for *paneer* whey consumption under Indian conditions. This will help to improve nutritive status of milk bread, fetch additional income and also solve the pollution problem caused by *paneer* whey which is otherwise drained.

Various changes recorded during the sensory evaluation of milk bread are in agreement with Poonam[14], Divya[5], Jarita and Kulkarni[8]. and also with Ghosh *et al.*[6], who observed similar results for chhana podo: a baked milk based traditional product.

Table 1: Effect of different levels of *paneer* whey on sensory scores and acceptability of milk bread

Sr. No	Treatments	Color of crust (5)	Symmetry of shape (5)	Crust characteristics (5)	Grain / Texture (25)	Color of crumb (23)	Aroma (12)	Taste/chewability (25)	Total Score (100)
11	Control(T1)	3.66±0.23^{c}	3.91±0.42^{a}	3.96±0.19^{a}	21.83±0.84^{a}	20.68±0.78^{a}	10.61±0.52^{a}	22.14±0.69^{a}	86.83±2.57^{a}
22	T2	4.51±0.11^{a}	3.96±0.38^{a}	3.81±0.35^{a}	21.35±0.60^{a}	20.64±0.39^{a}	10.45±0.37^{a}	21.88±0.53^{a}	86.56±1.37^{a}
33	T3	3.58±0.23^{c}	3.85±0.43^{a}	3.50±0.31^{a}	21.16±0.63^{a}	20.61±0.46^{a}	10.15±0.40^{a}	21.88±0.62^{a}	84.73±2.25^{a}
44	T4	3.59±0.35^{c}	3.63±0.35^{a}	3.65±0.23^{a}	21.16±0.76^{a}	20.78±0.58^{a}	9.84±0.19^{a}	21.50±0.44^{a}	84.18±2.09^{a}
55	T5	4.11±0.14^{b}	4.11±0.17^{a}	4.06±0.30^{a}	21.71±0.68^{a}	20.91±0.67^{a}	10.28±0.33^{a}	21.73±0.38^{a}	85.91±2.96^{a}

Mean in a row with similar superscript are not significantly different at α=0.05

Values are the Means ± SD and n=5 for each group

CONCLUSIONS

The sensory evaluation of milk bread prepared from different treatments was done by a panel of six judges using a 100 point score card and the results revealed that the sensory scores assigned for crust color varied significantly for treatments T1, T2 and T5 and there was no significant difference between the treatments T3 and T4 and found statistically equal in effect.

The means for total scores of milk breads ranged between 84.18 ± 2.09 and 86.83 ± 2.57.The lowest score (84.18) was recorded for T3 (75pw:25w) and highest score (86.83) was given to control (T1). The difference was statistically non-significant. It shows that panel of judges have accepted the replacement of water with paneer whey at 25-100 per cent level for preparation of milk bread. Thus it can be inferred that paneer whey up to 100 per cent level can be used effectively for replacement of water in the production of milk bread. Replacement of water with paneer whey not only improves the nutritional attributes of milk breads. Thus, utilization of paneer whey instead of water for making milk bread is an alternate, attractive option and economic outlet for utilization of paneer whey at cottage level under Indian conditions.

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