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Utilisation of Beetroot Extract as Colouring Agent in Lassi

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ABSTRACT

Colour is the first characteristic to be noticed and is one of the main ways of visually assessing a food before it is consumed. Colour provides an indication of the expected taste of food; hence food colors are used extensively. In the dairy industry, most of the colouring agents used are artificial in nature which are reported to cause harmful effects when consumed in higher doses. Beetroot is a vegetable and its juice and extracts are used as food colorant, which is natural and safe. Present study was conducted to investigate the effect of beetroot extract on colour and sensory quality of lassi. After addition of beetroot extract, it was found that the sensory score of beetroot lassi was higher than control lassi (without added colour). Sensory score and pH of beetroot lassi decreased during storage at refrigeration temperature. It was concluded that addition of beetroot extract gave good colour and appearance to the lassi and there was no adverse effect on body and texture, flavor and overall acceptability of lassi.

Key word: *Beetroot extract, Lassi, Sensory properties, Colour, Shelf Life*

INTRODUCTION

The first impression of a food is usually visual and major part of our willingness to accept a food depends upon its colour. The characteristic colour of raw food is due to the natural pigments present in the plant and animal materials. Sometime synthetic colours are added in the preparation of food. But synthetic colours are harmful to consumer, especially those used in food[10]. In comparison to synthetic colour, the natural colouring agents are far from this harmful effect and in addition they may also act as a health beneficial agents to consumer. Beetroot is commonly used as a vegetable. But beetroot juice and extracts are also used as traditional medicine, food colorant and additive to cosmetics[5,12]. In many dairy products, beverages, candies and meat products, red beetroot extract is widely used as a natural colorant[1,2,8]. Gasztonyi *et al.*[3] reported the major red-violet pigments (betanin, isobetanin, betanidin and isobetanidin) and the major yellow components (vulgaxanthin I and vulgaxanthin II) in five red beet varieties (Bonel, Nero, Favorit, Rubin and Detroit).

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Beetroot predominately contains pigments called betalains, which are composed of betacyanins and betaxanthins[9], and a number of phenolic compounds. Wootton-Beard [15] reported that beetroot juice contains a high level of antioxidants. Present study was conducted to investigate the effect of beetroot extract on colour and sensory quality of lassi.

MATERIALS AND METHODS

Extraction of beetroot: Beetroots were cleaned with potable water and peeled using a peeler. They were then shredded into small shreds using an SS shredder. About 80 g of the shredded beetroot was taken in a grinder and added with 20 ml acidic solution (0.2 g citric acid + 0.1 g ascorbic acid was dissolved in 100 ml pasteurized water), ground for 4-5 min and the pulp taken in a muslin cloth, pressed manually and the extract collected in a separate container. This beetroot colour extract (BCE) was used in preparation of beetroot lassi.

Preparation of beetroot lassi: Cow milk was filtered and standardized to 1.8 – 2 % fat and 9 - 9.2 % SNF by using skim milk powder and potable water. Granular sugar @ 14 % was added and mixed properly. The milk was homogenized at 60°C and then heated at 90°C/5min and cooled to 40°C. BCE @ 1, 2, 3, 4 and 5 ml per 500 ml of milk as well as starter culture @ 1.5 – 2 % were added and mixed properly. The milk was incubated at 37°C for 8 hours to reach the pH of 4.5 – 4.6. The curd was broken by agitation, mixed thoroughly to form lassi which was then cooled to 7 to 8°C. Lassi was packaged in low density polyethylene (LDPE) pouches and stored at refrigeration condition.

Sensory evaluation: The organoleptic quality of lassi samples was evaluated by a panel of judges on 9 point hedonic scale where a score of 9 represented 'like extremely' and score of 1 represented 'dislike extremely'[7]. The samples for evaluation were coded appropriately. The evaluation was carried out in the sensory evaluation room under proper lighting. The parameters judged were: colour and appearance, flavour, body & texture and overall acceptability. The judges were chosen from staff and students of the Department based on interest, liking for h eproduct and availability for sensory evaluation.

Colour measurement: Colour of the samples was measured by Scanner-Adobe Photoshop method[14].

pH: pH of sample was determined by dipping the electrode of pH meter (Servewell Instruments, Bangalore) directly into the product at 27°C.

Statistical analysis:

Data obtained in the study were subjected to statistical analysis by one way ANOVA using MS-Excel package version 2007.The differences among treatments were measured at 5% level of significance.

RESULTS AND DISCUSSION

Effect of beetroot colour extract (BCE) on sensory quality of lassi: The beetroot colour extract (BCE) was added to milk before incubation period. The levels of BCE added were 1, 2, 3, 4 and 5 ml BCE per 500 ml milk. The sensory evaluation results showed that control lassi scored 7.14 which was white and on addition of 1 ml BCE scored less, 6.98 (Table-1). This is because of very light pink colour. However, as BCE concentration increased the colour and appearance score of lassi also increased. The highest score was 7.79 on addition of 4 ml BCE in 500 ml milk. Use of 5 ml BCE did not much help in enhancing colour and appearance score ($P>0.05$). As BCE level increased, the body and texture, flavor and overall acceptability scores also significantly increased. However, at the addition of 3-4 ml BCE, the increase in body and texture and flavor was not statistically significant. The overall acceptability scores were 7.27, 7.21, 7.36, 7.68, 7.82 and 7.63, respectively for lassi samples containing 0, 1, 2, 3, 4 and 5 ml BCE. This shows that BCE addition significantly enhanced the overall acceptability of lassi.

Colour and appearance, flavor and overall acceptance scores of lassi was significant (P<0.05), but on body and texture score it was not significant (P>0.05) after addition of 5 ml BCE in milk. Since maximum colour and appearance score of lassi was found at 4 ml BCE in 500 ml milk. So it was chosen for further studies (Table-1).

Stability of beetroot colour in lassi during storage at refrigeration temperature:

The colour intensity of beetroot lassi was studied during storage at refrigeration temperature. The Red (R), Green (G), Blue (B) and Luminosity (L) values were 233.2, 199.85, 190.42 and 209.9 respectively on 0 day (Table-2). Lassi being an acidic product developed a pleasant pink colour on BCE addition. On storage the proportions of R, G, B and L seemed to have changed but the changes were not statistically significant, indicating that there was no significant change in the colour of lassi during storage. Since lassi is an acidic product and temperature of storage was low, the beetroot colour showed stability for a period of 8 days. Houghton and Henry[6] reported that beetroot colour shows greatest stability at pH 4.5.

Effect of storage on pH of lassi: pH of lassi decreased during storage period. In control lassi, pH decreased from 4.60 to 4.23 towards the end of storage; whereas in beetroot lassi, pH decreased from 4.70 to 4.48 (Table-3). Decrease in pH of lassi may be due to continued fermentation. This factor helps in colour stability of beetroot lassi. George *et al.*[4], Shuwu *et al.*[11] and Sutariya and Rao[13] also reported increase in acidity of lassi during storage.

Effect of storage on sensory score of beetroot lassi at refrigeration temperature:

Colour and appearance score was 8.26 on zero day which remained the same up to 6 days indicating that the colour has not changed at all. After 6 days, the colour and appearance score decreased to 8.17 and 8.14 on 7th and 8th day respectively, which were not significantly different from the initial score. This shows that the lassi had a stable beet root colour during the storage period of 8 days. Regarding body and texture attribute, the scores were similar up to 7 days (7.97 – 7.94) and thereafter significantly decreased to 7.27 (Table-4) which may be attributed to slight whey separation caused by continued fermentation during storage. This was also reflected in flavor score which decreased to 5.67 at the end of storage. This is attributed to yeasty flavor. Similar trend was observed with overall acceptability score. The overall acceptability score decreased from an initial score of 8.23 to 5.60 at the end of storage for 8 days. Since lassi is an acidic and sweet product, yeasts and molds may grow during storage causing yeasty flavor. This was also reported by George *et al*[4]. Decrease in sensory score of lassi during storage was also reported by Sutariya and Rao[13].

Table 1: Effect of addition of BCE as colouring agent on the sensory scores of lassi

ml BCE per 500 ml milk	Colour and appearance	Body and texture	Flavor	Overall acceptability
Control lassi	7.14^{ab}±0.64	7.61^{a}±0.44	7.49^{a}±0.52	7.27^{a}±0.54
1	6.98^{a}±0.78	7.57^{a}±0.40	7.55^{a}±0.41	7.21^{a}±0.59
2	7.26^{b}±0.59	7.59^{a}±0.43	7.61^{ab}±0.38	7.36^{a}±0.52
3	7.67^{c}±0.36	7.62^{a}±0.40	7.73^{ab}±0.36	7.68^{b}±0.53
4	7.79^{c}±0.43	7.70^{a}±0.38	7.75^{b}±0.33	7.82^{b}±0.38
5	7.64^{c}±0.50	7.56^{a}±0.35	7.61^{ab}±0.35	7.63^{b}±0.32

Note: BCE - beetroot colour extract; all scores on 9 – point Hedonic scale; scores with different superscripts in a column are significantly different from each other (p<0.05).

Table 2: Effect of storage on colour parameters* of BCE added lassi# at refrigeration temperature

Days	Luminosity	Red	Green	Blue
0	209.90[a]±11.1	233.2[a]±13.5	199.85[a]±10.5	190.42[a]±8.7
2	210.86[a] ±7.3	237.81[a]±6.2	200.87 [a]±7.7	191.73[a]±9.0
4	216.29[a] ±5.2	243.92[a]±7.2	206.16[a]±4.8	196.00[a]±4.7
6	216.50[a] ±7.6	243.14[a]±6.9	206.84[a]±7.9	196.54[a]±8.3
7	217.00[a] ±5.3	244.68[a]±6.5	207.08[a]±5.5	197.03[a]±5.9
8	216.30[a]±10.6	244.55[a]±11.4	208.45[a]±11.8	196.42[a]±12.0

Note: BCE - beetroot colour extract * Measured under RGBL mode on a scale of 0-255; values with different superscripts in a column are significantly different from each other ($p<0.05$); # lassi added with 4 ml BCE (beetroot colour extract) per 500 ml milk

Table-3: Effect of storage on pH of lassi# at refrigeration temperature

Days	Control lassi	Beetroot lassi
0	4.60	4.70
2	4.59	4.69
4	4.58	4.69
6	4.48	4.54
7	4.46	4.54
8	4.23	4.48

Note: # Lassi added with 4 ml BCE (beetroot colour extract) per 500 ml milk

Table 4: Effect of storage on sensory score of BCE added lassi# at refrigeration temperature

Days	Colour and appearance	Body and texture	Flavor	Overall acceptability
0	8.26[a]±0.35	7.97 [b]±0.29	7.99 [c]±0.29	8.23 [c] ±0.34
2	8.26[a]±0.35	7.97 [b]±0.29	7.99 [c] ±0.29	8.23 [c] ±0.34
4	8.26[a]±0.36	7.94 [b] ±0.31	7.96 [c] ±0.30	8.18 [c] ±0.34
6	8.26[a]±0.35	7.94 [b] ±0.31	7.53 [b] ±0.15	7.51[b]±0.16
7	8.17 [a]±0.34	7.94 [b] ±0.31	7.53 [b] ±0.15	7.51[b]±0.16
8	8.14[a]±0.35	7.27 [a] ±0.23	5.67[a]±0.75	5.60 [a] ±0.71

Note: BCE - beetroot colour extract; all scores on 9 – point Hedonic scale; scores with different superscripts in a column are significantly different from each other ($p<0.05$); # lassi added with 4 ml BCE (beetroot colour extract) per 500 ml milk

CONCLUSION

It was concluded that the BCE addition gave good colour and appearance to the lassi as well as there was no adverse effect on body and texture, flavor and overall acceptability of lassi. The colour showed stability during the period of shelf life of the dairy product at refrigeration temperature.

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