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Development of Carrot Extract Incorporated Synbiotic Lassi

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A B S T R A C T

Lassi is a popular fermented product consumed mostly in northern India during summer as refreshing drink. The present study was carried out with incorporation of carrot extract as 5, 10, 15 and 20 per cent levels and represented as T1, T2, T3 and T4, respectively. Among these levels, 15 per cent level of addition was found to be acceptable by sensory panel (9 point hedonic scale) and was used for the production of synbiotic lassi with *Lactobacillus casei* (NCDC 298). The prepared synbiotic lassi was subjected to physicochemical and microbial analysis with control and probiotic lassi. The prepared synbiotic lassi with carrot extract showed good microbial quality and better probiotic viability than the control and probiotic lassi. It is concluded that synbiotic lassi incorporated with 15 per cent carrot extract is best in overall acceptability, microbial quality with recommended levels of probiotic viability.

Introduction

Milk is a wholesome food and contains all nutrients required for normal functioning of the body. It can be processed into products like fermented and non-fermented classes. The fermented milk products include dahi, yoghurt, lassi, buttermilk, cheese etc. Out of these lassi is a ready-to-serve fermented dairy product which has a creamy consistency, sweetish rich aroma and a mild acidic flavour, which makes the product refreshingly palatable. Carrot is an important source of dietary carotenoids and also rich in beta carotene, ascorbic acid and tocopheral. It has several functional components and significant health promoting properties. It is an important source of natural antioxidants and anti-cancer activity (Sharma *et al.*, 2012). The pectin content of carrot, which contains oligosaccharides, act as a potent prebiotic Gopalan *et al.*, (1989). Dahl containing *L. casein* was found to stimulate the non-specific immune response in mice than the mice fed with other diets Jain *et al.*, (2008).

Materials and Methods

The good quality milk obtained from Livestock Farm Complex, VCRI, Namakkal,

which is used for this study. Carrot juice was extracted by juice extractor. This extracted juice and *Lactobacillus casei* (NCDC-298) obtained from National Collection of Dairy Cultures (NCDC), Division of Dairy Microbiology, National Dairy Research Institute, Karnal was used for this study. The experimental design was presented at Table 1.

Preparation of synbiotic lassi

The obtained milk was standardized as 3 per cent fat and 8.5 per cent SNF and it was preheated to 60^0 C and homogenized. The homogenized milk was pasteurized (80^0 C for 10 minutes) with different levels of carrot extract (5, 10, 15 and 20 per cent) and the milk was cooled to 40 ^{0} C and the starter culture was added at 1 per cent level. This mixture was incubated at 37 ^{0} C for 4 hrs. After that the set curd was blended with 12 per cent sugar syrup which is prepared with 0.8 per cent fresh rose petals as flavoring agent. The prepared lassi was stored at 4^0 C.

Sensory evaluation

The quality of lassi was evaluated by the panelists on the basis of 9- point hedonic scale where 9 indicate extremely like and 1 extremely dislike (Amerine *et al.*, 1965).

The sensory characteristics of the treatment lassi with carrot extract at different levels were assessed by using the score card which contains parameters includes colour and appearance, flavor, body and texture and overall acceptability. The selected level was used for further studies.

Physico-chemical, Microbial and Statistical analysis

The pH and acidity of lassi was estimated by using a digital pH meter and procedure described in IS: SP: 18 (Part XI)-1981, respectively. The different microbial parameters of lassi, such as standard plate count, coliform count, probiotic viability count and yeast and mould count was done by adopting standard procedure according to Bergey's manual of systematic bacteriology Kandler and Weiss, (1986). The obtained data of all studies were analysed by one way Analysis of Variance using SPSS (version 20.0).

Results and Discussion

Sensory qualities of lassi containing different levels of carrot extract

The mean (n=6) sensory scores of lassi containing different levels carrot extract (5, 10, 15 and 20 per cent) are presented in Table 2. At 15 per cent level of incorporation the sensory quality of the lassi was highest compared to other levels in the sensory characteristics viz. colour and appearance, flavour, consistency and overall acceptability. Sharp carrot flavour was noticed at the 20 per cent level of incorporation which was objectionable. The statistical analysis showed that there was significant ($P<0.05$) difference between different level of inclusion in the sensory characteristics like colour and appearance, flavour, consistency and overall acceptability. Hence, 15 per cent level of addition was selected for further studies. Srishti *et al.,* (2017) reported a lower level (10 per cent) of inclusion of carrot extract to score higher sensory points. This may be due to variation in the quality of the carrot extract which in turn depends on the variety of carrot and yield of the juice.

Physico chemical analysis of synbiotic lassi

pH

The mean (n=6) pH of control, probiotic and lassi milk inoculated with *L.,casei* containing

15 per cent carrot extract during 4 h of incubation is presented in Table 3. The reduction in pH was observed with advancement of incubation time. Among all the treatments pH of synbiotic lassi milk containing added carrot extract showed lowest pH of 4.28 ± 0.02 at the end of 4 h of incubation, from the initial pH of 6.54 ± 0.01. There was a significant (P<0.05) difference in pH between control, probiotic and synbiotic lassi milk during incubation.

Table.1 Experimental design for selection level of carrot extract

Treatment	Toned milk (ml)	Butter (g)	SMP** (g)	Sugar Syrup (ml)	Carrot extract (ml)	Flavour%	Probiotics*%
Control	880.00	-	-	120	-	0.8	**Dahi culture**
Probiotic lassi	880.00	-	-	120	-	0.8	1
T_1	722.10	29.88	78.02	120	50	0.8	1
T_2	680.16	26.52	73.32	120	100	0.8	1
T_3	637.00	25.00	68.00	120	150	0.8	1
T_4	593.00	23.12	63.92	120	200	0.8	1

***L. casei*(NCDC 298) **SMP-Skimmed milk powder

Table.2 Sensory qualities of lassi containing different levels of carrot extract

Levels of Carrot extract (%)	Sensory characteristics			
	Colour and appearance	Flavour	Body and texture (consistency)	Overall acceptability
Control	8.50^{b} ± 0.17	8.82^{a} ± 0.02	8.78^{b} ± 0.02	8.82^{a}± 0.02
5	8.47^{b}± 0.14	7.36^{e}± 0.15	8.39^{e}± 0.14	7.45^{d}± 0.06
10	8.49^{b}± 0.21	7.85^{c}± 0.08	8.64^{d}± 0.25	7.91^{c}± 0.10
15	8.80^{a} ± 0.07	8.15^{b}± 0.07	8.86^{a}± 0.19	8.73^{b}± 0.08
20	8.97^{a} ± 0.01	7.75^{d}± 0.01	8.71^{c} ± 0.01	7.00^{e}± 0.01

Means (±SE) bearing different lowercase superscripts between column differ significantly (P<0.05)

Table.3 Physicochemical analysis of synbiotic lassi

Time (hr)	Control lassi		Probiotic lassi		Lassi with carrot extract	
	pH	Acidity	pH	Acidity	pH	Acidity
0	6.42^{Ab}± 0.01	0.14^{Ec} ± 0.01	6.41^{Ab}± 0.01	0.15^{Eb}± 0.01	6.54^{Aa}± 0.01	0.14^{Ec}± 0.01
1	5.91^{Ba} ± 0.01	0.25^{Dd} ± 0.03	5.88^{Bb} ± 0.01	0.29^{Dc} ± 0.03	5.71^{Bc} ± 0.01	0.32^{Db} ± 0.02
2	5.75^{Ca} ± 0.01	0.33^{Cc}± 0.02	5.65^{Cb} ± 0.01	0.38^{Cb}± 0.02	5.31^{Cd} ± 0.01	0.42^{Ca}± 0.02
3	5.14^{Da} ± 0.01	0.42^{Bd}± 0.01	4.71^{Db} ± 0.01	0.63^{Bc}± 0.01	4.51^{Dd} ± 0.01	0.70^{Ba}± 0.02
4	4.50^{Ea} ± 0.01	0.71^{Ad}± 0.01	4.43^{Eb} ± 0.01	0.84^{Ac}± 0.01	4.28^{Ed} ± 0.02	0.92^{Aa}± 0.01

Means (±SE) bearing different lowercase superscripts between column differ significantly (P<0.05)
Means (±SE) bearing different uppercase superscripts between row differ significantly (P<0.05)

Table.4 Microbial analysis of synbiotic lassi

Treatment	Viable count	Total viable bacterial count	Yeast and mould Count	Coliform count
Control	$8.15^{b} \pm 0.01$	$7.54^{b} \pm 0.01$	2.43 ± 0.06	-
Probiotic lassi	$8.17^{b} \pm 0.04$	$7.58^{b} \pm 0.01$	2.47 ± 0.06	-
Lassi with carrot extract	$9.34^{a} \pm 0.01$	$8.65^{a} \pm 0.01$	2.41 ± 0.04	-

Means (±SE) bearing different lowercase superscripts between column differ significantly (P<0.05)

Significantly higher rate of reduction in pH was observed in carrot extract added lassi milk. Similar findings are reported by Sharma *et al.,* (2016) that synbiotic lassi with 5 per cent honey to have a pH 4.55 on day 0 to 3.96 and 3.93 on 2nd and 4th weeks of storage, respectively.

Titrable acidity

The mean (n=6) titratable acidity of control, probiotic and lassi milk inoculated with *L.,casei* containing 15 per cent carrot extract during 4 h of incubation is presented in Table 2. The acidity of lassi milk increased with advancement of incubation time. The carrot (0.92 ± 0.01) added synbiotic lassi milk showed highest acidity than control (0.71 ± 0.01) and probiotic lassi (0.84 ± 0.01).There was a significant (P<0.05) difference in titratable acidity between control, probiotic and synbiotic lassi milk during incubation. Significant (P<0.05) increase in titratable acidity was observed in carrot extract added lassi milk with advancement of incubation time.

Significant (P<0.05) increase in the titratable acidity was noticed with addition of prebiotics to milk during incubation compared to control and probiotic treatments. This may be attributed to bacterial growth promoting effect of prebiotics containing sugars and oligosaccharides. Similarly Srishti *et al.,* (2017) observed titratable acidity of prepared lassi to increase with increase in the level of addition of carrot juice.

Microbial analysis of synbiotic lassi

Microbial analysis like Viable count, Total viable bacterial count, Coliform count and Yeast and mould count were presented in Table 4. In that the viable count was highest (9.34 ± 0.01) in carrot added synbiotic lassi compared to others.

Viability of probiotic organism in the lassi was significantly higher in the synbiotic lassi compared to the probiotic lassi containing no added prebiotic substances. Carrot extract was found to support the growth and viability of both *L. casei* and *S. thermophilus* compared to honey and *Aloe vera* extract. This may be attributed to the in-vitro growth promoting potential of the prebiotic substances (Goderska*et al.,* 2007). Carrot extract contains carrot concentrated protein which has anti- crystallization properties (Zhang *et al.,* 2007). The total viable bacterial count was highest (8.65 ± 0.01) in carrot added lassi compared to control and probiotic lassi.

The count was increased by the addition of prebiotics and maintained its viability high compared to probiotic and control lassi. These findings are close agreement with Srishti *et al.,* (2017) reported decrease in the count with increase in the addition of carrot juice beyond 20 per cent in lassi. The coliform count was absent in all the samples. There was no significant difference in the yeast and mould count of control, probiotic and carrot added synbiotic lassi.

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