Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.7634

ISSN: 2582 – 2845

Ind. J. Pure App. Biosci. (2019) *7*(4), 231-237

Research Article

Indian Journal of Pure & Applied Biosciences

Screening of Optimized Carrot Pulp Concentration for Development of Vitamin a Fortified *Lassi*

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Received: 10.07.2019 | Revised: 16.08.2019 | Accepted: 23.08.2019

ABSTRACT

In the present investigation, fortification of lassi with carrot pulp was aimed to enrich the product with vitamin A. The physico-chemical composition of end product was observed as fat content 2.48-2.37, acidity 0.42-0.51 (as per cent lactic acid), total sugars 13.64-16.21 and TSS 14.00 to 15.43 per cent, respectively. The fat content of lassi samples decreased with increase in level of carrot pulp while parameters like acidity, viscosity, fiber content, total sugars, and TSS increased with increase in the level carrot pulp. The overall acceptability for sensory score for lassi prepared using 10 per cent carrot pulp was highest i.e. liked very much. The mean lactic acid count count was found to increase with increasing pulp from 8.50 to 8.68 log cfu/ml. However, the lassi samples were free from yeast & mold and coliforms.

Keywords: *Dahi, Lassi, Carrot pulp, Fortification, Vitamin A.*

INTRODUCTION

Fermentation with pride takes its position as the basic food preservation technique employed by man from time honoured. Its documentation has been well established in human nutrition. Old Vedic and ayurvedic literature have number of references available on fermented milk (*dahi*, *dahi* with sugar, "chhash", butter milk obtained by churning curd). "Chhach" has been known as an efficacious tool for almost all diseases. *Lassi* is very popular ready to serve fermented milk beverage and many a times it is also mentioned with the name "chhach" by technocrats in literature. It has been used as a refreshing beverage from time immemorial in India, especially in western Northern and Central religions. It is usually prepared by stirring whole curd with addition of sugar or salt, a small amount of cold water to make the product flowable. The product is popular not only because of its refreshing and delicious taste, but also due to its nutritive and therapeutic benefits and thirst quenching quality (Momin, 2009).

Cite this article: Kaur, I., Chawla, R., SivaKumar, S., Goel, N., & Mishra, S. K. (2019). Screening of Optimized Carrot Pulp Concentration for Development of Vitamin a Fortified *Lassi*, *Ind. J. Pure App. Biosci. 7*(4), 231-237. doi: http://dx.doi.org/10.18782/2320-7051.7634

In human nutrition carrot (*Dascus carota* L.) is one of the more commonly used vegetables. It is broadly accepted and easily obtainable vegetable, which is rich in β carotene, ascorbic acid, tocopherol and classified as vitaminized food (Hashimoto & Nagayama, 2004). All age groups can consume functional and healthy dairy products which are fortified with carrot. As carrot is affordable in cost as well, it serves as fruitful method for dairy fortification and also imparts an attractive color to the dairy product (Bandyopadhyay et al., 2007). Balanced food can be obtained by combination of carrot pulp and *lassi*. Also, carrots are good source of carbohydrate, calcium, phosphorous, potassium, iron, magnesium, copper, manganese and sulphur. It is an excellent source of vitamin A, B_1, B_2, C, E, thiamin, folic acid and riboflavin however lack protein and fat. Carrot prevents vitamin A deficiency; besides it prevents cancer and other diet related human diseases. It reduces the enzymes that promote the conversation of precarcinogens to carcinogens. On the other hand, *lassi* is rich in protein and fat but is deficient in iron and vitamin C. Combining carrot pulp with *lassi* can produce a nutritionally rich food. It also enhances the immune system, protect against stroke, high blood pressure, osteoporosis, cataracts, arthritis, heart disease, bronchial asthma and urinary tract infections (Beom et al., (1998), Sun et al., (2001), Seo Yu, (2003).

Therefore, it was planned to study the effect of addition of carrot pulp on sensory, chemical and microbial status of *lassi*.

MATERIALS AND METHODS

Starter culture

Mesophilic mixed strain *dahi* culture NCDC-167 was procured from National Collection of Dairy Cultures (NCDC) of Dairy Microbiology Division, National Dairy Research Institute, (NDRI) Karnal.

Culture maintenance and propagation

Starter culture procured from the NCDC was maintained in sterilized skim milk for propagation. The fresh skim milk (100 ml) was taken into 250 ml conical flasks and plugged with non-absorbent cotton plugs. The flasks were transferred in autoclave and sterilized at 15 psi pressure for 15 min. The culture was propagated by inoculating sterilized skim milk @ 2% level, in laminar air flow chamber (Make-NSW INDIA Model). Thereafter, the flasks were incubated at 37°C for 5 hours and stored at 5-7℃. The sub-culturing was done at regular intervals to maintain culture activity.

Preparation of carrot pulp

Punjab Carrot Red variety of carrots were purchased from local market of Ludhiana. Carrot roots were washed thoroughly, and both ends were removed, peeled further using a sharp knife and cut longitudinally into halves. These halves were blanched in hot water (90℃/3-5 minutes) for five minutes to inactivate pectinase and peroxidase enzymes, in addition to tenderization of carrot tissues. These halves were blended in a food processor (Make- Inalsa, Maxie plus Model) to obtain pulp.

Preparation of carrot pulp *lassi*

Carrot *lassi* was prepared by obtaining standardized milk from Experimental Dairy plant of College of Dairy Science and Technology, GADVASU, Ludhiana. Standardized milk was heated at 90℃ for 5-10 minutes, and cooled to 37℃. Starter culture NCDC 167, was inoculated @ 2 per cent and allowed to set. *Dahi* was incubated at 37℃ for 6 hours till the acidity approached 0.7- 0.8%. Further, prepared *dahi* was broken and pasteurized sugar solution (@10%) and carrot pulp as per treatment was added in different ratios (5%, 7.5%, 10% and 12.5%) along with process of blending. After blending, product was served to semi trained panelists and sensory evaluation was performed.

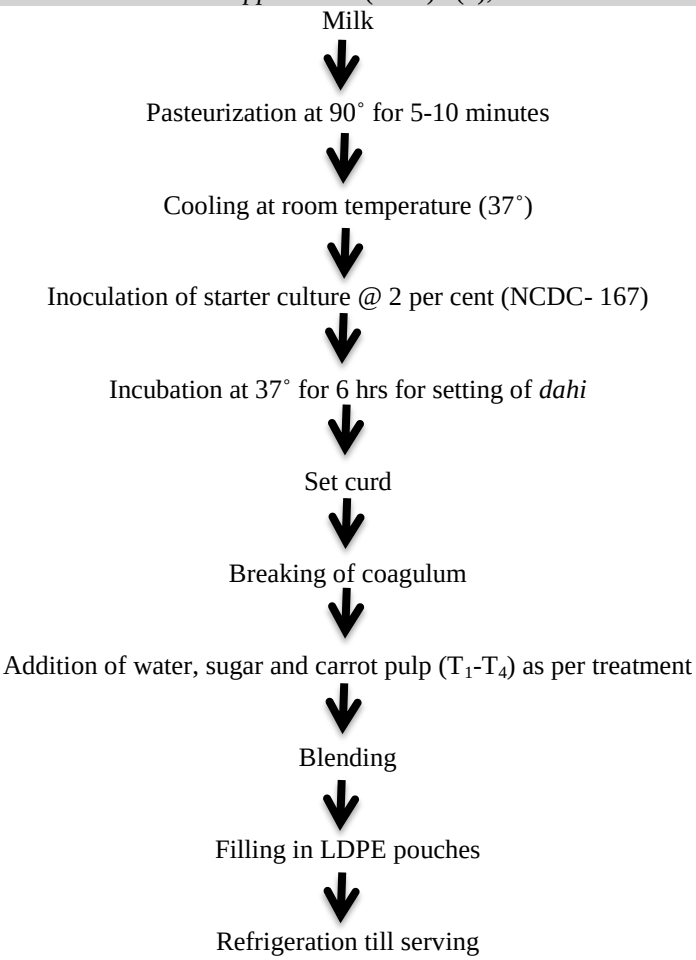

Fig. 1: Flow diagram for preparation of carrot *lassi*

Treatment details: The following concentrations of carrot pulp were used.

T1= 5% concentration of carrot pulp on *lassi* basis

T2= 7.5% concentration of carrot pulp on *lassi* basis

T3= 10% concentration of carrot pulp on *lassi* basis

T4= 12.5% concentration of carrot pulp on *lassi* basis

Sensory evaluation:

Sensory evaluation was carried out by presenting approximately 50 ml of *lassi* samples to seven trained panelists, selected from the faculty of Dairy Technology Division. Nine-point hedonic scale was employed to carry out the evaluation of samples with slight modification (Amerine et al., 1965 & Shone, 1979) and total of five different attributes were generated pertaining to parameters which were colour and appearance, consistency, sweetness, flavour and overall acceptability covering each and every parameter of *lassi.* The nine-point hedonic scale includes various scales of grading i.e. liked extremely (9), liked very much (8), liked moderately (7), liked slightly (6), neither liked nor disliked (5), disliked slightly (4), disliked moderately (3), disliked very much (2), disliked extremely (1) (Lawless & Heymann 1998).

Chemical analysis of *lassi*:

The *lassi* samples were analyzed for chemical parameters by adopting standard procedure given below. Fat was determined by Gerber method (IS: SP 18 (Part XI) (1981). Acidity of *lassi* samples was determined as per procedure stated AOAC (AOAC, 1995). Total sugar of *lassi* samples was determined as per procedure of Lane and Eynon method, (1923) modified by Ranganna (1977). The total soluble solids (TSS) of the *lassi* was calculated in terms of ˚ Brix by using a hand refractometer. Fibre content of dry sample was determined by using AOAC method (1995). Colour of *lassi* samples were measured using Colour Flex Colorimeter (Hunterlab, Reston, Virginia) supplied along with the universal software

Easy Match QC (version 4.62) and the results were expressed in terms of CIE-LAB system. Data was received through the software in terms of values for L* (lightness, 0 (black) to 100 (white)); a* (redness, +60 (red) to -60 (green)) and b* (yellowness, +60 (yellow) to -60 (blue))[6]. Viscosity of samples were measured at 15 ±1°C using a rotational viscometer (Model LV DV2T, Brookfield Engineering, Inc., USA) equipped with spindle model LV(04)64. Before measurements, *lassi* samples were gently stirred with a spatula for homogeneity. Samples were sheared at 100 rpm for 3 minutes and five readings were recorded at the interval of 30 seconds and the apparent viscosity was recorded in centipoise (cP). Readings recorded after 30 seconds of shearing were taken for average viscosity calculation.

Microbial analysis of *lassi*:

All treatment samples of *lassi* along with a control sample were analyzed for different microbial activity such as lactic acid bacteria count, yeast and mould count and coliform count.

Statistical design:

The data of the samples obtained from various experiments were statistically analyzed by Analysis of Variance using statistical software SPSS 16 (IBM) for Windows Evaluation Version. A probability level of ($p \leq 0.05$) was used for testing the statistical significance of all experimental data.

RESULTS AND DISCUSSION

The results of the present study as well as relevant discussions have been presented under following sub heads and Table 1 to 3. The different levels 0% (control), 5%, 7.5%, 10% and 12.5% carrot pulp was used for *lassi* formulation.

Sensory evaluation of *lassi* :

The sensory score for colour and appearance varied from 7.52-8.10 with increase in level of pulp concentration. However, statistical data for colour and appearance did not show any significant difference between different treatments for carrot pulp. In case of consistency and richness of carrot pulp *lassi,* highest score was obtained in 10% carrot pulp *lassi* whereas lowest in control. Carrot pulp improved the acceptability of product in terms of i.e. mouthfeel & richness of the product. This could be due to sensory preference of the panelists who liked only intermediate levels. Similar results were reported by Upadhyay in carrot juice *lassi* (Upadhyay et al., 2017). The highest sensory scores were obtained for consistency & richness, sweetness and flavour for *lassi* prepared using 10 per cent carrot pulp with the score 7.99, 8.40 and 8.80, respectively (Table 1). Data revealed that the most appreciated flavour was obtained with 10% carrot pulp *lassi,* which displayed significant differences ($p<0.05$) compared to the other samples as well. Sharp carrot flavour was noticed at the 12.5 per cent level of incorporation, which was however bit objectionable. The critical examination of data revealed 10 per cent carrot pulp showed significant difference in organoleptic characteristics (flavour, consistency & richness and overall acceptability). Upadhyay et al. (2017) reported similar observations in *lassi* prepared using carrot juice. Researchers reported that lower level (10 per cent) of inclusion of carrot extract to score higher sensory points. This might be due to fluctuation in the quality of the carrot extract which in turn was dependent on the variety of carrot and yield of the pulp.

Table 1: Sensory evaluation score of carrot *lassi* (n=7)

Sensory attributes	Concentration of pulp				
Parameters	**Control**	**5% pulp**	**7.5%pulp**	**10%pulp**	**12.5%pulp**
Color & appearance	7.52 ± 0.62^{b}	7.80 ± 0.24^{a}	7.86 ± 0.05^{a}	7.89 ± 0.57^{a}	8.10 ± 0.35^{a}
Consistency & richness	7.52 ± 0.50^{a}	7.65 ± 0.07^{a}	7.80 ± 0.27^{ab}	7.99 ± 0.22^{b}	7.60 ± 0.42^{a}
Sweetness	7.52 ± 0.50^{a}	7.60 ± 0.07^{a}	7.64 ± 0.09^{a}	8.40 ± 0.27^{b}	8.20 ± 0.00^{b}
Flavour	7.42 ± 0.43^{a}	7.60 ± 0.96^{a}	7.70 ± 0.27^{a}	8.80 ± 0.45^{b}	7.30 ± 0.27^{a}
Overall acceptability	7.42 ± 0.43^{a}	7.60 ± 0.89^{a}	7.72 ± 0.26^{a}	8.20 ± 0.45^{b}	7.70 ± 0.35^{a}

Mean ±SE

Values with different superscripts within the same row differ significantly ($p<0.05$)

Chemical evaluation of *lassi*:

The per cent physico-chemical parameters like fat, acidity, TSS, total sugars, fiber, viscosity (centiposie) and instrumental colour of different concentrations of carrot *lassi* has been compiled in Table 2. Fat content of carrot pulp fortified *lassi* ranged from 2.37- 2.48 per cent wherein the higher fat content was observed in control treatment. It was recorded that with increase in carrot pulp, per cent fat content in *lassi* showed a decreasing trend. This can be due to the increase in level of pulp which indirectly decreased the concentration of fat in final *lassi*. Similar results were also reported by Upadhyay et al. (2017) in case of carrot juice based *lassi*.

Titratable acidity showed increasing trend with increasing in carrot pulp levels. Based on the research study reported by Srishti et al. (2017) titratable acidity of prepared *lassi* increases with increase in the level of addition of carrot juice in *lassi*. Aggarwal and Prasad also noticed increase in titratable acidity with increased levels of carrot pulp and is due to fermentation of sugar and conversion of lactose to lactic acid (Agarwal & Prasad, 2013). Total sugar content ranges from 13.64 to 16.21 with increase in carrot pulp concentration. Results are in agreement with Chawla et al. (2018), in which total sugar content increased with increase in carrot powder concentration in *lassi*. Fiber content observed to lie between 1.03- 1.93 per cent with increase in carrot pulp level. Increase in carrot pulp concentration increased total solids content as expected, due to which viscosity also increased. Results obtained are in agreement with Chawla et al. (2018).

The instrumental color values like lightness (L*) value decreased with increase in concentration of carrot pulp while the redness value increased due to the pigment present in carrots. Yellowness also increased with the increase of carrot pulp and was due to the colour of carrots. Similar results were reported by Madora et al. (2016) in yoghurt fortified with carrot powder.

Table 2: Physico-chemical evaluation of carrot *lassi*

Physico chemical		**Concentration of pulp**				
Parameters		**Control**	**5%pulp**	**7.50%pulp**	**10%pulp**	**12.50%pulp**
Fat		2.48±0.03^{b}	2.45±0.03^{ab}	2.41±0.02 ^{ab}	2.40±0.10 ^{ab}	2.37±0.01^{a}
Acidity		0.42±0.35 ^{c}	0.45±0.06 ^{bc}	0.47±0.03 ^{ab}	0.50±0.06 ^{ab}	0.51±0.06 ^{a}
TSS		14.00±0.06 ^{d}	15.07±0.06^{c}	15.19±0.35^{bc}	15.23±0.35^{b}	15.43±0.35^{a}
Total sugars		13.64±0.03^{e}	14.35±0.08 ^{d}	14.86±0.02^{c}	15.06±0.02^{b}	16.21±0.02^{a}
Fiber		0.1±0.08 ^{e}	1.03±0.03^{d}	1.27±0.03 ^{c}	1.43±0.03 ^{b}	1.93±0.06^{a}
Viscosity (centipoise)		136±0.00 ^{e}	154±0.0 ^{d}	160±0.00 ^{c}	178.8±2.89 ^{b}	200±2.45^{a}
Instrumental colour	**L***	90.72±0.09 ^{e}	89.29±0.03^{d}	88.09±0.08^{c}	85.43±0.17 ^{b}	82.99±0.48^{a}
	a*	(-1.24)±0.01^{e}	0.60±0.02^{d}	2.15±0.09 ^{c}	5.82±0.15 ^{b}	8.99±0.07 ^{a}
	b*	0.06±0.01^{e}	3.05±0.01^{d}	5.29±0.17 ^{c}	10.75±0.29 ^{b}	14.85±0.07 ^{a}

Mean±SE

Values with different superscripts within the same row differ significantly ($p<0.05$)

Microbial evaluation of carrot *lassi*:

The lactic acid bacteria count, yeast and mould (log cfu/ml) and coliform of different types of *lassi* has been compiled in Table 3. The mean Lactic Acid Bacteria count (LAB) ranged from 8.53-8.68. As shown in results, lactic acid bacteria count increased with increase in level of carrot pulp. Similar results were reported by Salwa et al. (2004) in carrot yoghurt fortified with carrot juice.

The *lassi* samples were evaluated for yeast and mould count by pour plate method. It was observed that all *lassi* samples under study did not show presence of any yeast and mould growth. The presence of coliforms in milk and milk products is indicative of

unhygienic condition or practices followed during production, processing, handling and storage. Coliforms were not detected in any of the *lassi* samples, which is an indicative that the all *lassi* samples were safe for human consumption.

Table 3: Microbial evaluation of carrot *lassi*

Microbial	**Concentration of pulp**				
Parameters	**Control**	**5% pulp**	**7.5% pulp**	**10%pulp**	**12.5% pulp**
Lactic acid count (log cfu/ml)	8.50[a]	8.53 [a]	8.58 [a]	8.62 [a]	8.68 [b]
Coliforms	Nil	Nil	Nil	Nil	Nil
Yeast and mold	Nil	Nil	Nil	Nil	Nil

Values bearing different alphabets with in row vary significantly ($p<0.05$)

CONCLUSION

It can be concluded from the study that *lassi* prepared with different concentrations of carrot pulp were aimed to increase vitamin A content along with objective to achieve sensory acceptability from consumers point of view. Therefore, best acceptable *lassi* can be prepared with 10% pulp with a value 58.57µg/100g of vitamin A content in carrot *lassi*. Also, being prepared from carrots, it is purely safe for public health and can be used as vitaminized food supplement as well. The results highlighted the possibility of processing *lassi* with 10% carrot pulp being most acceptable.

REFERENCES

Agarwal, S., & Prasad, R. (2013). Effect of Stabilizer on Sensory Characteristics and Microbial Analysis of Low-fat Frozen Yoghurt Incoporated with Carrot Pulp, *International Journal of Agriculture and Food Science Technology 4*(8), 797-806.

Amerine, M. A., Roessler, E. B., Ough, C. S., & Enol, Vitic, A. J. (1965). Acids and the Acid Taste. I, The Effect of pH and Titratable Acidity, *American Journal of Enology and viticulture 16*(1), 29-37.

AOAC, (1995). Official methods of analysis. 19thEdn, Association of Official Analytical Chemists, Washington DC.

Bandyopadhyay, M., Chakraborty, R., & Raychaudhur, S.S. (2007). Role of carrot on shelf stability of dairy dessert (rasogolla) during refrigerated storage, *Journal of Food Processing and Preservation 31*, 714–35.

Beom, J., Young, S., & Myung, H. (1998). Antioxidants activity of vegetable and blends in iron catalyzed model system, *Journal of Food Science and Nutrition 3*, 309-314.

Bindu, J., Ravishankar, C. N., & Gopal, T. K. S. (2007). Evaluation of ready to eat black clam (*Villorita cyprinoids*) product in indigenous retort pouches, *Journal of Food Engineering 78*(3), 995-1000.

Chawla, R., Sivakumar, S., & Mishra, S.K. (2018). Fortification of *lassi* with vitamin A using natural vegetable powders, *International Journal of Chemical Studies 6*(2), 2631-35.

Hashimoto, T., & Nagayama, T. (2004). Chemical composition of ready to eat fresh carrot, *J. Food Hyg. Soc. Japan, 39*, 324-328.

IS: SP 18 (Part XI) (1981). Handbook of Food Analysis. Part XI, Dairy Products. Bureau of Indian Standards. Manak Bhavan, New Delhi.

Lane, J.H., & Eynon, L. (1923). Determination of reducing sugars by means of Fehling's solution with methylene blue as internal indicator, *J. Soc. Chem. Ind. Trans*., *42*, 32-37.

Lawless, H.T., & Heymann, H. (1998). Sensory Evaluation of Food: Principles and Practices. New York: Chapman & Hall 406-29.

Madora, E. P., Takalani, T. K., & Mashau, M. E. (2016). Physicochemical, microbiological and sensory properties of low fat yoghurt fortified with carrot powder, *International Journal of Agriculture and Biological Engineering 9*(1), 118-24.

Momin, J. K. (2009). Effects of medicinal herbs on lactic acid bacteria and their use in preparation of probiotic *lassi*, Master of Science (Dairying) In Dairy Microbiology.

Ranganna, S. (1977). Proximate constituents, Handbook of qnalysis and quality control for fruit and vegetable products, 1-26.

Salwa, A.A., Galal, E.A., & Neimat, A.E. (2004). Carrot yoghurt: Sensory, Chemical, Microbiological properties and consumer acceptance, *Pakistan J. Of Nutri*. *3*(6), 322-30.

Seo, A., & Yu, M. (2003). Toxigenic fungi and mycotoxins. In: hand book of industrial mycology (Andrea, Z ed.) Academic Press London, 233-246.

Shone, A. K. (1979). Notes on marula. Bull. 58, Dept. of Forestry, Pretoria, Republic of South Africa.

Srishti, U., Parimita, & Prafull, K., (2017). Preparation of carrot *lassi*, *Pharma Innov J 6*(8), 302-05.

Sun, M.S., Mihyang, K., & Song, J.B. (2001). Cytotoxicity and quinine reductase induced effects of Daucas carrot leaf extracts on human cancer cells, *Kor. J. Food Sci 30*, 86-91.

Upadhyay, S., Parimita, & Kumar, P. (2017). Preparation of carrot *lassi*, *The Pharma Innovation Journal 6*(8), 302-05.