

Original Research Article

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Development and Quality Evaluation of Dahi Fortified with Beta Carotene Rich Sweet Potato Juice Variety *Bhu-Sona*

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ABSTRACT

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The research was conducted to prepare β -carotene rich dahi with different levels of sweet potato (SP) juice (10, 20, 30, 40 and 50%). Different physical, nutritional and sensory characteristics were analysed to assay the quality of β -carotene rich dahi. Data on different parameters were recorded and analyzed. It was found that the physical, nutritional and sensory qualities of dahi improved by addition of Sweet potato juice. Addition of SP juice increases the Protein (3.60 to 6.77g), Ash (0.71 to 3.79%) and β -carotene content (4.52 mg/100g). It also revealed that 30% Sweet potato juice addition shown superior results for Flavour, Texture, Colour as well as Overall acceptability. Enriching Dahi with β -carotene rich sweet potato juice will boost as a functional food. The finding of this research may give an overall idea about manufacturing of β -carotene rich dahi and appropriate technology of β -carotene rich dahi preparation.

Introduction

Sweet potato (*Ipomea batatas* L. Lam) is an important root crop grown in many tropical countries. Human consumption is one of the most important uses of sweet potatoes in both temperate and tropical growing areas and they

are used either fresh or processed products. In India, the roots of this crop are consumed either as fresh vegetable or as boiled or baked products in the diet of rural and tribal people (Ray and Balagopalan, 1997). These roots are rich in starch, vitamins and minerals (Woolfe, 1992). Some sweet potato varieties contain

coloured pigments-anthocyanin, β -carotene and an unidentified flavonoid. These pigments are regarded as beneficial antioxidation, anti-cancer and protection against liver injury (Yamakawa, 2000).

Sweet potato is expected to play a vital role in combating the food shortages and malnutrition that may increasingly occur as a result of population growth and pressure on land utilization (Naskar *et al.*, 2008).

Orange fleshed sweet potato (variety *Bhu-sona*) is one of the cheapest sources of β -carotene. Vitamin A is build-up by human body when it has adequate amount of its precursor β -carotene. Vitamin A deficiency is a public health problem in more than half of all countries, especially in Africa and South-East Asia hitting hardest young children and pregnant women in low income countries.

Dahi (Indian yoghurt), the products of lactic acid fermentation of milk are reported to possess several nutritional/dietary advantages over milk. The yoghurt is popular in Europe and American countries; consumption of dahi is very common among Asian people, especially in Indian sub-continent.

There are different forms of dahi such as sweet dahi, sour dahi and flavoured dahi which are customarily consumed by the people of all over the world.

Consumption of Dahi is linked with several health benefits because of their presence of lactic acid bacteria. In dahi much of the lactose in milk is converted to digestible lactic acid and serves as valuable source of protein, essential vitamins and minerals. Hence the present study was designed to manufacture β -carotene rich dahi fortified with different levels of sweet potato juice with whole milk and to compare qualities on the basis of physical, chemical and microbial parameters.

Materials and Methods

The freshly harvested sweet potato tubers of variety *Bhu-sona* was collected from the experimental farm of the Regional centre of ICAR-Central Tuber Crops Research Institute, Bhubaneswar, Odisha.

Preparation of starter culture

Half litre of cow milk (Source: Orissa Milk Federation, OMFED, Orissa) was taken and pasteurized at 80-90°C for about 10-15 minutes. Then it was cooled at room temperature, 30 \pm 2 °C. After cooling, 5 ml of previously prepared homemade dahi was inoculated into the milk. The whole mixture was kept in an incubator at 30 °C for 12 h to prepare dahi starter culture.

Preparation of sweet potato juice

200gm of the sweet potato variety *Bhu-sona* was weighed and washed properly to ward off the dirt. Then it was peeled off and was cut into cubes. Then the cubes were boiled for 15 minutes till they become tender. Then the whole mixture was allowed to cool down. After cooling, it was transferred into a grinder to make juice out of it. For each 200gm of sample, 200ml of water was used into order to make juice. After that, the juice was filtered using a muslin cloth and the extracted juice was used further in the experiment.

Preparation of plain dahi (Control) and β -carotene rich (fortified with sweet potato juice) dahi

Whole milk was pasteurized and heated to reduce about one third of its original volume. During heating milk was stirred continuously with the help of stirrer to avoid the formation of cream layer. After desired heating milk pan was taken out from heater and allowed to cool. The sweet potato juice which is previously

pasteurized was incorporated into Dahi at 10, 20, 30, 40 and 50% level in different cups except control (Hossain et.al, 2012). Sweet potato juice was added before incubation with starter culture (2%). The plastic cups were pre-washed with boiled water before use. The samples were incubated at 37 °C until the complete dahi formation (8-12 h). The dahi samples were stored at about 4 °C at refrigeration until used.

Physic-chemical analyses of β -carotene rich Sweet Potato Dahi

Data were collected for several physico-chemical (moisture, pH, protein, ash, β -carotene content, titratable acidity (TA) and lactic acid (LA) parameters, by following the standard procedures mentioned by Amerine and Ough (1980).

Sensory evaluation

The prepared β -carotene rich sweet potato dahi was subjected for sensory evaluation. Ten individuals served as panellists, were trained to evaluate dahi as per score card (Scale 1-5) developed by committee of American Dairy Science Association (USDA, 1984) to evaluate dairy product for flavour, texture, colour and acceptability (Bodyfelt *et al.*, 1988).

Results and Discussion

Physical characteristics of β -carotene rich sweet potato (SP) dahi

The changes in pH, Titrable acidity and Lactic acid content of sweet potato dahi depicted in Table 1. The pH is a critical factor in developing satisfactory flavour and consistency of dahi. The optimum pH of milk-based product like yoghurt is reported to be at 4.0-4.5 (Varnam and Sutherland, 1994). In our investigation, the pH ranges from 3.98

(Control sample)-4.20 (T₅). As concentration of sweet potato (SP) % in dahi increased the pH of sample get increased. It might be due to addition of sweet potato juice in dahi samples.

Titrable acidity (TA) measured in terms of g LA.100g⁻¹ of sweet potato dahi did not show significant variations irrespective of the concentration of sweet potato juice. Similarly, Lactic acid of sweet potato dahi varied from 0.60 to 0.72. However, it is reported that percentage of titrable acidity decreased with increased levels of sweet potato, sugars and fermentation time in case of preparation of sweet potato yoghurt (Collins *et al.*, 1991).

Proximate composition of β -carotene rich sweet potato (SP) dahi

As the amount of sweet potato increased in preparation of dahi, the moisture content decreased. The amount (dry weight basis) of this component was affected because sweet potato contained higher amount of solids than milk. The similar results were found by Ray *et al.*, 2005. The protein and ash content varies from 3.60g to 6.67g and 0.71% to 3.79% respectively. The slight increase in protein and ash content might be due to increased level of sweet potato percentage in the product.

The β -carotene contents of sweet potato dahi were expressed as mg.100g⁻¹. With increase in sweet potato concentration in dahi, the concentration of β -carotene in sweet potato dahi increased proportionally.

The similar results are good agreement with Venkatraman *et al.*, 2018. The β -carotene is considered to be precursor of Vitamin A; this attribute has an additive beneficial impact on sweet potato dahi. The fat and total solids ranged from 4.12g to 4.52g and 25.31% to 25.69% respectively. The fat content in the dahi samples were slightly decreased from T₁ to T₅ samples (Table 2).

Table.1 Physical characteristics of β -carotene rich sweet potato (SP) dahi

S.P (%) in dahi	pH	Titration acidity (g/100 g dahi)	Lactic acid (g/100 g dahi)
Control	3.98±0.068	1.21±0.024	0.72±0.035
T ₁	4.03±0.038	1.35±0.029	0.69±0.016
T ₂	4.05±0.066	1.31±0.057	0.66±0.033
T ₃	4.09±0.073	1.28±0.012	0.63±0.012
T ₄	4.12±0.032	1.23±0.020	0.62±0.028
T ₅	4.20±0.032	1.22±0.028	0.60±0.036

±Standard deviation

Table.2 Proximate composition of β -carotene rich sweet potato (SP) dahi

S.P (%) in dahi	Parameters					
	Moisture (%)	Protein (g)	Ash (%)	β -carotene (mg/100gm)	Fat (g)	Total solids (%)
Control	74.05±0.020	3.60±0.029	0.71±0.012	Nil	4.52±0.029	25.49±0.029
T ₁	75.74±0.098	5.22±0.041	3.21±0.024	1.82±0.050	4.27±0.061	25.31±0.038
T ₂	75.02±0.054	5.82±0.041	3.41±0.024	2.56±0.049	4.21±0.043	25.45±0.063
T ₃	74.22±0.021	5.98±0.026	3.54±0.020	3.21±0.024	4.16±0.024	25.47±0.035
T ₄	73.10±0.053	6.14±0.024	3.67±0.038	3.85±0.032	4.13±0.032	25.69±0.069
T ₅	73.03±0.024	6.77±0.040	3.79±0.032	4.52±0.028	4.12±0.028	25.48±0.035

±Standard deviation

Table.3 Sensory scores (Scale of 1-5) of β -carotene rich sweet potato (SP) dahi

S.P (%) in dahi	Attributes			
	Flavour	Texture	Colour	Acceptability
Control	2.63±0.024	3.67±0.032	2.88±0.024	3.27±0.021
T ₁	2.18±0.016	2.11±0.024	3.14±0.028	2.95±0.020
T ₂	3.12±0.016	3.70±0.038	3.14±0.020	3.45±0.049
T ₃	4.21±0.065	3.77±0.020	3.22±0.016	3.63±0.024
T ₄	3.00±0.041	2.87±0.030	2.74±0.037	3.20±0.032
T ₅	2.15±0.012	2.13±0.032	2.05±0.033	2.55±0.041

±Standard deviation

Sensory evaluation of β -carotene rich sweet potato (SP) dahi

Ten member consumer panel evaluated the dahi samples consisting of 10% to 50% of sweet potato-milk mixture (Table 3). The panel used the score card developed by a committee of American Dairy Science

Association (USDA, 1984) to evaluate flavour, colour, appearance etc. In our study, four attributes (flavour, texture, colour and acceptability) were selected to evaluate sweet potato dahi. A mean score of 4.21 (scale of 1-5) indicated flavour was rated relatively high. The mean score of 3.9 for texture and 3.22 score for colour indicated sweet potato to

produce favourable effects. Similarly, a mean score of 3.63 was attributed for acceptability of sweet potato dahi. However, the consumer panel preferred the colour, flavour, texture and acceptability of the sweet potato dahi with 20 and 30% sweet potato juice that scored >3 (scale 1-5).

In conclusion, sweet potato dahi was prepared by fermenting a mixture of milk and β -carotene rich sweet potato (*variety Bhu-Sona*) juice. Sweet potato provided minerals, β -carotene and protein, which also functioned as a thickener and stabilizer. There was no any measure constraint in preparing sweet potato dahi unlike bean curd or soya curd. Moreover, dahi is a regular component of daily diet of many people in Indian Sub-continent. Enriching dahi with β -carotene rich sweet potato will boost the former as a functional food.

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