

Evaluation of nutrients in the formulated milk shakes with powdered leaves of *Ipomoea batatas*

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Abstract

Ipomoea batatas (Sweet Potato) leaves provide a dietary source of vitamins, minerals, antioxidants, dietary fiber, and essential fatty acids. Bioactive compounds contained in this vegetable play a role in health promotion by improving immune function, reducing oxidative stress and free radical damage, reducing cardiovascular disease risk and suppressing cancer cell growth. Currently, sweet potato leaves are consumed primarily in the islands of the Pacific Ocean and in Asian and African countries and there is limited consumption in the United States. In the present study the nutritional characteristics and bioactive compounds present within sweet potato leaves have been assessed. They have potential cardio protective and chemo preventive advantages and hence consumption of this vegetable should be advocated. It is suggested that the incorporation of the leaves of sweet potato in different food preparation could enhance the health. Hence in the present study, three standardized recipes such as an Apple milk shake, Banana milk shake and Sapota milk shake were selected and incorporated with four different concentrations such as 2%, 4%, 6% and 8% of powdered Sweet potato leaves separately. The nutrient content of the formulated milk shakes was evaluated.

Key words: Powdered leaves of Sweet Potato, milkshake, standardization, incorporation, consumer acceptability.

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INTRODUCTION

The sweet potato (*Ipomoea batatas*) is a dicotyledonous plant and belongs to the family Convolvulaceae. The large, starchy, sweet-tasting, tuberous roots are important root vegetables. The family includes fifty genera and more than thousands species of Convolvulaceae. *Ipomoea batatas* is the only crop plant of major importance. The genus *Ipomoea*, with approximately 500 to 600 species, comprises the largest number of species within Convolvulaceae. This family is dominated by twining or climbing woody or herbaceous stem that often have heart-shaped leaves and funnel-shaped flowers. Sweet potato tops are able to survive adverse conditions and also serve as an additional leafy green vegetable. The sweet potato tops are tender, glabrous and purplish. Generally those who eat sweet potato tops prefer the top four inches of tips including both stem and leaves (Antia, 2006).

India, characterized by variety of natural climates and seasons, has a number of edible green leafy vegetables (GLVs), some of which are locally grown and consumed. Greens are affluent sources of

micronutrients like iron, calcium, phosphorus, vitamin C, beta-carotene and folic acid. Apart from common green leafy vegetables like spinach, amaranthus, fenugreek, cabbage, etc., many types of underexploited green leafy vegetables are available seasonally. However very limited information is available regarding their nutritional status. Sweet potato (*Ipomoea batatas* Lam.), grown in tropical and subtropical regions, is a root crop. Asia and Africa produce 95% of the total world output. It is grown and consumed mostly in developing countries, and it is the world's fifth largest food crop. It contains abundant nutritional substances and could become an important food resource to solve the problem of food shortages caused by desertification and population growth (Ishiguro, 2004). It has been reported that the plant based foods contain significant amounts of micronutrients which provide desirable health benefits (Chang, 2010). This plant could potentially be used for alleviating iron deficiency base anaemia.

Sweet potato leaves have been used for numerous oxidative stress associated diseases such as cancer, allergy, aging, HIV and cardiovascular problems. Along with the tubers of sweet potato, the leaves are also edible. Besides its delicious taste it is aromatic with some bitter taste. The

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leaves are consumed and cooked. It is a great source of antioxidant, Vitamin C, A, thiamin, riboflavin, niacin and folic acid. In comparison to other leafy greens, it possesses more dietary fiber and nutrients. Sweet potato leaves are cooked as a vegetable in many parts of the world. they are rich in vitamin B, beta carotene, iron, calcium, zinc and protein, and the crop is more tolerant of diseases, pests and high moisture than many other leafy vegetables grown in the tropics (Woolfe,1992).

Polyphenolics, among them anthocyanins and phenolic acids such as caffeic, moncaffeoylquinic depending on the varieties and growing conditions, sweet potato leaves are comparable to spinach in nutrient content. the average mineral and vitamin content includes 117mg calcium, 1.8 mg iron, 3.5 mg carotene, 7.2mg vitamin C, 1.6 mg vitamin E and 0.56 mg vitamin K/100 g fresh weight of leaves. Levels of iron, calcium and carotene are rich in the top, compared with other major vegetables. Sweet potato leaves are also rich in vitamin B, beta carotene, iron, calcium, zinc and protein. Studies have shown that sweet potato leaves contain as many vitamins, minerals and other nutrients as spinach (Yosimoto, 2006). Sweet potato leaves are the excellent source of antioxidative (chlorogenic), dicaffeoylquinic and tricaffeoylquinic acids are superior when compared to other commercial vegetables (Ishiguro, 2004). Ascorbic acid (AA), known as vitamin C, has exerted the activity in preventing in IMA- induced cause of DNA damage (Mahmood, 1993).

Sweet potato leaves have been found to contain a high amount of antioxidants, making it suitable in combating inflammatory problems like asthma, arthritis, gout, etc. Also, vitamin C helps in scavenging and fighting off free radicals thus preventing premature aging and disease. Riboflavin content is higher in the leaves and mature leaves contain higher amounts of riboflavin than young leaves. Mature leaves contained 3.4 times higher vitamin B₆ than roots. (Islam, 2006)

The present investigation an attempt has been made to formulate the milk shake the leaves of *Ipomoea batatas* and to assess the acceptability and nutrient content of the formulated different milk shakes.

MATERIALS AND METHODS

Apple, banana, sapota, milk and sugar were purchased from the local market of Mannargudi in

Thiruvarur District. Sweet potato leaves were collected, air dried and powdered.

Standardization of recipe through incorporation

Three fruit milk shakes such as apple milk shake, banana milk shake and sapota milk shake recipes were prepared separately and standardized. Powdered leaves of sweet potato was incorporated in to it at the concentration of 2%, 4%, 6%, and 8%.

Assessing the consumer acceptability of standard and incorporated Fruits milk shake

The quality of food product was assessed by means of human sensory organs. The evaluation is said to be sensory evaluation or organoleptic evaluation or subjective evaluation (Srilakshmi, 2007). A standard recipe refers to a particular standard of use of certain metrics in cooking standard sizes, time, temperature, amount, etc., This rule creates uniformity for kitchen produce whether or not it is tangible or intangible (Roth, 1998).

The developed fruit milk shakes were evaluated for five hedonic scale rating

The score allotted were

Excellent	-	4
Very good	-	3
Good	-	2
Fair	-	1
Poor	-	0 by 25 consumers

The hedonic rating test was used to measure the consumer acceptability of food products and three samples were served to the consumer at one time.

Estimation of nutrient content of the standard and most acceptable sweet potato leaf powder incorporated recipes

The micro and macro nutrient contents of the sweet potato leaf powder incorporated fruit milk shakes was analysed for by using the following methods: carbohydrate -Anthrone Method, protein -Lowry's method, vitamin C -Harris and Ray method, zinc -Vogel method, calcium -Qualitative method, Iron -Harris method, potassium -Vaessen method, phenolic content -Folin method.

Preparation of Standard Apple Milk Shake

100gm of apple, 100gm of milk 10gm of sugar and 50ml of water were taken in a flask. The fruit of the apple was peeled and cut into small pieces. Then water, milk and sugar were added. The mixture was beaten well and the product was further analysed.

Table.1. Ingredients and procedure for the preparation of 5% [M1], 10%[M2], 15%[M3], and 20%[M4] of sweet potato leaves powder incorporated Apple milk shake(100ml)

S. No.	M1		M2		M3		M4	
	Ingredients	Quantity (g)	Ingredients	Quantity (g)	Ingredients	Quantity (g)	Ingredients	Quantity (g)
1	Apple	98gms	Apple	96gms	Apple	94gms	Apple	92gms
2	Milk	100ml	Milk	100ml	Milk	100ml	Milk	100ml
3	Sugar	10gms	Sugar	10gms	Sugar	10gms	Sugar	10gms
4	Water	50ml	Water	50ml	Water	50ml	Water	50ml
5	Sweet potato leaves powder	2gm	Sweet potato leaves powder	4gm	Sweet potato leaves powder	6gm	Sweet potato leaves powder	8gm

Table.2. Method of preparation and timings involved in the standardization of recipes through incorporation

S. No.	Name of the product	Preparation involved	Time in minutes
1	Apple milk shake	Grinding, Boiling and Mixing	15 minutes
2	Banana milk shake	Grinding, Boiling and Mixing	15 minutes
3	Sapota milk shake	Grinding, Boiling and Mixing	15 minutes

RESULT AND DISCUSSION

The mean score of consumer acceptability of Sweet potato leaves powder incorporated apple, banana and sapota milk shake was 12.62, 15.5 and 13.2 respectively (Table 3).

Table.3. Mean Score of incorporated Apple, Banana and Sapota milk shake

S. No.	Name of the Product	Over all acceptability
1	Apple milk shake	12.62
2	Banana milk shake	15.5
3	Sapota milk shake	13.2

The mean score of appearance of the sweet potato leaves powder incorporated Banana milk shake was 3.2, 3.08, 3.24 and 3.8 respectively. The mean score of colour of the sweet potato leaves powder incorporated banana milk shake was 3.24, 3.2, 3.3, 3.84 respectively. The mean score of flavour of the sweet potato leaves powder incorporated Banana milk shake was 3.28, 3.4, 3.8 and 3.9 respectively. The mean score of taste of the sweet potato leaves powder incorporated Banana milk

Table.4. Comparative view on consumer acceptability of M1, M2, M3 and M4 incorporated in Banana milk shake

Criteria	Appearance	Colour	Flavour	Taste	Overall acceptability
M1 incorporated Banana milk shake	3.2	3.24	3.28	3.32	13.04
M2 incorporated Banana milk shake	3.08	3.2	3.4	3.9	13.58
M3 incorporated Banana milk shake	3.24	3.3	3.8	3.8	14.14
M4 incorporated Banana milk shake	3.8	3.84	3.9	3.9	15.5

shake was 3.32, 3.9, 3.8 and 3.9 respectively. The mean score of over all acceptability of the sweet potato leaves powder incorporated Banana milk shake was 13.04, 13.58, 14.14 and 15.5 respectively (Table 5).

The analysis of the nutrient content of the M1,M2,M3 and M4 incorporated banana milk shake showed that Carbohydrate ,Protein,Vitamin C ,Calcium,Iron,Zinc and Pottassium were relatively high in the M4 incorporated banana Milk Shake i.e.,9.2,0.8,72, 92,0.78,0.49,94.2 and 34.6 respectively (Table 5, Fig.1)

Thus the sweet potato leaves powder incorporated in the apple milkshake, banana milk shake and sapota milkshakes were found to be acceptable in terms of appearance, colour, flavour and taste. The sweet potato leaves powder incorporated banana milkshake showed relatively good colour appearance, flavour and taste at 2%, 4%, 6%, and 8% level of incorporation when compared to other milk shakes . The sweet potato

Table.5. Nutrient content of the most acceptable M4 incorporated Banana milk shake (100ml)

Criteria	Carbohydrate	Protein	Vitamin C	Calcium	Iron	Zinc	Potassium	Polyphenols
M1 incorporated sweet potato milk shake	8.1	0.59	54	80	0.6	0.36	920	25.5
M2 incorporated sweet potato milk shake	8.4	0.68	61	84	0.7	0.41	928	27.8
M3 incorporated sweet potato milk shake	8.9	0.72	67	89	0.7	0.45	937	30.2
M4 incorporated sweet potato milk shake	9.2	0.8	72	92	0.8	0.49	942	34.6

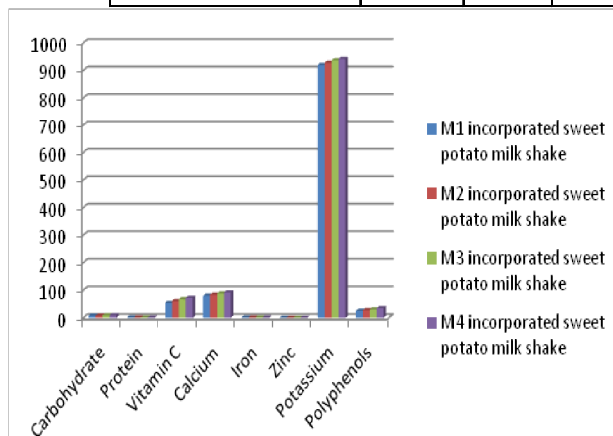


Fig.1. Nutrient status the milk shakes incorporated with the powdered leaves of sweet potato

leaves powder incorporated banana milkshake with 8% level of incorporation scored higher consumer acceptability. The present study reveals that varieties of recipe could be prepared by incorporating the sweet potato leaves powder. The sweet potato leaves powder incorporation did not have any adverse effect on quality attributes like appearance, colour, flavour and taste of the products.

It has been reported that all the plant based foods contain significant amount of micronutrients, which could provide health benefits (Chang, 2010). It has also been reported that the leaves of sweet potato contain nutrition substances and hence they could be used as food supplement (Ishiguro, 2004). The nutrients such as iron, calcium, phosphorous, vitamin C, beta carotene, etc., could synergistically enhance the nutrient content when supplemented with milk shakes of different fruits. It is evident from the investigation that carbohydrate, protein, vitamin C, calcium, zinc, iron, potassium, etc increased, when the powder of the leaves of sweet potato was incorporated with the banana milk shake.

Though all the fruits have rich nutrients the fruits of banana are easily soluble due to relatively low fibre content and also enhance the consistency, taste and flavour. Hence the leaves of sweet potato could be used effectively in the preparation of banana milk

shake, which could potentially enhance the nutrient quality of the milk shakes.

Hence it is concluded that the developed sweet potato leaves incorporated banana milk shake was more favourably accepted than apple and sapota milk shakes.

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