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Research Article

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A comparative study on biochemical constituents of sweet potatoes from Orissa and Tamilnadu and its curd formation

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ABSTRACT

Sweet potato plays a significant role in tribal Indian diet. Acurd like product was prepared by fermenting boiled β-carotene and anthocyanin rich puree(16%) with different varieties of milk and starter curd. Addition of sweet potato enriched the colour, texture and nutrient status of the curd. This brings about antioxidant along with calcium and protein. Biochemical analysis of sweet potato and its physiological changes in curd formation using buffalo milk was analyzed. The production of ethanol from sweet potato using yeast and its biochemical characteristics were analyzed.

Keywords: Sweet potato, vegetable curd, starch, Fermentation

INTRODUCTION

The sweet potato, *Ipomoea batatas* L. (Lam.), is a dicotyledonous plant belonging to Convolvulaceae family. It is an extremely important crop mainly seen in tropical countries. It ranks seventh in the world from the viewpoint of total production. It is also a storehouse of many important pigments like β-carotene, anthocyanin etc which act as good antioxidants[1]. In addition to its nutritional benefits, the crop's easy adaptability to tropical climate and minimal growth requirements, make it a crop of high commercial importance[2]. Recently it has been found out that sweet potato can control blood sugar levels and insulin resistance. The World Health Food Organization has labeled it as anti-diabetic food .Studies estimated that a daily intake of 100g of orange fleshed sweet poato prevent vitamin A deficiency in children and lactating mothers.

Sweet potato is a rich source of starch. It has 30% more starch than that of rice and corn and 49% than wheat under same condition[3]. This high starch content is being judiciously utilized for the production of ethanol[4]. The demand for ethanol is being rising day by day due to its potential of being used as a substitute for gasoline[5].. The yeast *Saccharomyces* spp**.** is used for the fermentation process using sweet potato as a starch substrate. But starchy and cellulosic materials must be hydrolyzed into fermentable sugars by amylase produced using barley before they can be utilized by the yeast[6].

Some sweet potato varieties are rich in β-carotene and anthocyanin pigment. To get benefit from these naturally available antioxidants, either sweet potato can be consumed directly or can be incorporated into some other edible items[7]. One such novel idea is production of vegetable curd [8]. Curd or yoghurt is a rich source of proteins, essential vitamins, minerals etc. It is a product of lactic acid fermentation of milk and is nutritionally more beneficial than milk. Yoghurt involves the use of specific symbiotic /mixed culture of *Lactobacillus bulgaricus* and *Streptococcus thermophillus***.**. It usually consists of heterogeneous mixture of lactic acid bacteria i.e. *Lactobacillus bulgaricus***,** *Streptococcus lactis***,** *Streptococcus diaticlactis***,** *Streptococcus clemoris*, etc. Basically curd is produced due to fermentation of milk sugar lactose into lactic acid by lactic acid bacteria. This curd can be further enriched by dietary fibres, starch, minerals, vitamins and important pigments by co-fermenting it with vegetables such as sweet

potato, lemon etc[9,10]. This study aims to produce sweet potato curd with milk for its nutritive value and production of ethanol from sweet potato starch using Saccharomyces sp.

EXPERIMENTAL SECTION

Biochemical analysis of sweet potato

The βcarotene rich varieties of sweet potatoes were collected from Orissa and Tamilnadu. The milk sample and barley were collected from market. The physical parameters like dry weight and biochemical parameters such as starch by anthrone method[11], amino acid by ninhydrin method[12], and proteins by lowry's method[13].

Production of ethanol from sweet potato

The production of ethanol was carried out in sweet potato using basal growth medium for the growth of yeast. All the ingredients of basal growth medium were added one litre of distilled water and autoclaved**.** To this sterilized basal medium actively growing yeast was inoculated aseptically. It was kept in a incubator for one night at 37^{o}C. Sweet potato was used as substrate for the production of ethanol. Barley was used for production of amylase which hydrolysis of starch. *S. cerevisae* (yeast) was added to the fourth one acted as control. Fermentation was permitted to continue for 68 to 70 hours after which the samples were analysed for residual sugar content.. About 12 -18 ml of the yeast innoculum was pitched into the fermentation broth and left for incubation for 10 days at 28^{o}C. After alochol production was subjected into distillation for purification.

Preparation of sweet potato curd

The Starter culture was pepared by half litre of of milk was taken and boiled at 80-90^{o}C for 15-20 minutes. It was cooled down to about 32^{o}C. This boiled milk was inoculated with a small volume of previously prepared acid. This inoculated milk was left for incubation at 37^{o}C overnight. One litre of different cow's milk was taken and boiled for 30 minutes. It was cooled down to room temperature. Simultaneously, about 250 gms of sweet potato roots of Gouri variety (with high β-carotene and anthocyanin content) were taken and weighed. They were then boiled for 15 minutes. The boiled roots were peeled-off and washed into a puree. This sweet potato puree was weighed and added to boiled milk in required proportion so as to make the final volume upto 250 gms. In such way six experimental samples were prepared. They were left for incubation overnight at 37^{o}C.The physical parameters such as changes in pH and titrable acidity. The biochemical analysis like starch content and protein content of vegetable curd were analyzed.

RESULTS AND DISCUSSION

Sweet potato, *Ipomoea batatas* L.(Lam.), is a dicotyledonous tuber crop.The sweet potatoes were collected from Orissa and Tamilnadu. Various biochemical analysis were carried out to judge certain characteristics of the sweet potatoes. Gouri had a pale orange colour root while Kalinga had a yellowish colour. The pale orange colour is due to the presence of β-carotene and.anthocyanin. The dry weight of sweet potatoes were Gouri(19%), Kalinga(26%), Krishna(12%)and amudhu(18%)were observed. This low dry matter content is due to high moisture content .The average dry matter content is 30% but varies widely depending on location, climate, day length, soil type etc[14].

Analysis of starch content

Sweet potato tuber is highly rich in starch. It has 30% more starch content than rice and corn and 49 % more starch than wheat (Wang, 1984). This high starch makes it a highly beneficial crop in ethanol production to meet the world fuel crisis. With reference to results in Table1, highest starch content was found in Kalinga (19.2 %) followed by Krishna (18.3 %), amudhu (11.5 %). Lowest starch content was recorded in Gouri (15. 2 %).The starch content of sweet potato ranges from 7 % to 22 % .[15].

Analysis of protein content

The maximum protein content was recorded in Gouri i.e. 1.92 % followed by Amudhu (1.88 %). Lowest protein content was recorded in Kalinga i.e. (1.04 %)(Table1). Variation in total protein content within cultivars was studied by several groups. One group Purcell et al., 1978[16] found that variation was slightly less and another (Bradbury et al., 1985b[14} that it was as great among roots of same plant as between plants. It was also shown that total protein varied by genotype, environment and interaction of genotype and environment ($p < 0.01$) [17].

Analysis of Amino acid content

The highest free amino acid content was recorded in Kalinga (0.17 %). Krishna had the lowest recorded amino acid content (0.12 %). Amudhu (0.16%) and Gouri (0.14 %) had intermediate values for amino acid contents the tuber can be converted into other edible items like sweet potato curd(Table1).

Characteristics of Sweet potato curd

Sweet potato curd was prepared by co-fermenting sweet potato with milk. Then it was judged for its biochemical characteristics and suitability.pH is known to be a very important parameter in determining the flavour and consistency of fermented food products. Milk based fermented products like curd and yoghurt are considered best for consumption at pH 4-4.5.With reference to results in Table2, after inoculation and incubation for 18 hours, the pH values of sweet potato curd were reduced to 3.48-3.61. Lowering of pH occurred due to accumulation of Lactic acid. However the variation in pH with varying sweet potato concentration (0-20%) was not much significant. The decrease in pH in lactic acid fermentation is due to accumulation of organic acids (Titrable acids).It was found that titrable acidity of sweet potato after 18 hours incubation varied between 1.20-1.5 %.The reasons behind this was higher sweet potato percentage apparently inhibited bacterial growth and conversion of sugars into acids[18]. Even addition of sweet potato increased the total solid content, buffering capacity and osmotic pressure, which also contributed to the inhibition of bacterial growth.

The starch content of sweet potato curd after 18 hours of fermentation varied from 0-3.2 % . This starch content was found to increase proportionally with the increasing sweet potato concentration in curd. Even though some starch might have been broken down to sugars due to α-amylase activity of lactic acid bacteria, the curd still had appreciable amount of sweet potato starch (0.75-3.5 %) which acted as a carbohydrate source as well as a stabilizer. The protein content of the sweet potato curd was found to be varying between (16-16.3%).The protein content of sweet potato curd was high and it did not depend on the varying sweet potato concentrations (Table2).

Table 1 Biochemical analysis of sweet potato

Variety	Starch(%)	Protein(%)	Aminoacid(%)
Gouri	15.2	1.92	0.14
Krishna	18.3	1.81	0.12
Amudhu	17.5	1.88	0/16
Kalinga	19.2	1.04	0.17

Table 2 Physical and biochemical change in sweet curd

% of Sweet potato with curd	Ph	Acidity	Protein(%)	Starch(g%)
0	3.50	1.5	16.01	0.00
4	3.35	1.4	16.03	0.78
8	3.45	1.43	16.10	1.00
12	3.51	1.22	16.09	1.50
16	3.55	1.32	16.13	2.60
20	3.61	1.30	16.25	3.20

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CONCLUSION

The experiment was conducted by taking four varieties of sweet potato from Orissa and Tamilnadu depending on morphological characteristics and consumers preference initially. Then biochemical analysis of the sweet potato were carried out and their dry weight, starch, protein and amino acid content were determined. On the basis of these biochemical analysis the suitable variety was chosen for ethanol production and sweet potato curd production.

It was found out that Kalinga with high starch content (19. 2 %) was suitable for ethanol production and Gouri with high β-carotene content was suitable for vegetable curd production. The curd produced was analyzed for its pH, titrable acidity, starch, total sugar and protein content. Ethanol was produced by taking blanched roots and inoculating it with yeast. Fermentation was carried out for 14 days to produce ethanol which was confirmed by the formation of yellow precipitate. It was found that addition of sweet potato increased the total sugar and starch content and kept the bacterial growth in control thus maintaining favorable taste and flavor.

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