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Physico-chemical analysis of sweet potato (*Ipomoea batatas* L.) in Bastar region of Chhattisgarh

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Abstract

The Horticultural Processing Laboratory, Krantikari Debridhur College of Horticulture and Research Station, MGUVV, Jagdalpur, Bastar (C.G.) conducted in 2024-2025. Raw sweet potatoes with physico-chemical characterization had an average weight of 135.6 g, length of 11 cm, breadth of 5.1 cm, diameter of 44.4 mm and moisture content of 78.90%. Titratable acidity (0.44%), ascorbic acid (12.00 mg/100 g), total sugars (11.58%), reducing sugars (6.28%), non-reducing sugars (5.30%), pH (6.33) and TSS (4.9 °Brix) were all included in the biochemical profile.

Keywords: Sweet potato, physico-chemical, analysis, Titratable acidity, ascorbic acid, reducing sugar, total sugar, non-reducing sugar, pH and TSS

1. Introduction

The sweet potato (*Ipomoea batatas* L.) is a member of the Convolvulaceae family, which is one of the most significant and underutilized tuber crops in the world. This crop is frequently referred to as a famine relief, food security or subsistence crop. Its applications have changed significantly in underdeveloped nations (Srivastava *et al.* 2012) [8]. Since it helps to lessen food shortages during emergencies (natural disasters or conflicts), its production and culture are vital in many nations. Mostly provided by Asian and African nations, particularly China and India, it is one of the most significant, adaptable and underutilized food crops in the world. Native to South and Central America, sweet potatoes are widely farmed in China, Nigeria, Uganda, India, Indonesia, Vietnam, the United States and the Philippines. The world's biggest producer of sweet potatoes is China. In 2023-24, sweet potatoes were produced in India on 1,11,000 hectares, yielding 1311 metric tons annum (Anonymous 2023-24) [1]. In Orisha, Kerala, Tamil Nadu, Assam and Bihar, it is predominantly farmed. Chhattisgarh developed 51.40 metric tons of sweet potatoes over an area of surrounding 4.35,000 hectares and in Bastar 89-hectare area is covered under sweet potato cultivation with the production of 15.25 metric tonnes (Anonymous 2023-24) [1]. Sweet potatoes that are grown in over 100 different countries, are a crop that is extremely important in many regions of the world. Because of its status as a primary food crop in tropical and subtropical regions, it offers urban as well as rural residents a nutritional benefit through increased production as well as consumption (Alam *et al.* 2021) [3].

2. Materials and Methods

2.1 Experimental site

Laboratory trial was carried out at Horticultural Processing Laboratory, Krantikari Debridhur College of Horticulture and Research Station (MGUVV) Jagdalpur, Bastar (C.G.)-494001.

2.2 Physical characteristics of raw sweet potato

2.2.1 Fruit shape

Fruit shapes were assessed using fruit shape desiccators.

2.2.2 Fruit length (cm)

A vernier callipers was used to measure the fruit's length (cm) from the apex to the stem end and the average result was shown.

2.2.3 Fruit width (cm)

The fruit's width (cm) at its widest point was measured using a vernier callipers and the average result was shown.

2.2.4 Fruit diameter (mm)

The fruit's diameter (mm) was measured using a vernier callipers and the average results was shown.

2.2.5 Fruit weight (kg)

Fruit weight was measured with an electronic balance and reported in kilograms (kg).

2.2.6 Moisture content (%)

Ranganna (1977) ^[6] states that the following formula was used to assess moisture content:

$$\text{Moisture content (\%)} = \frac{W1 - W2}{W1}$$

2.3 Chemical characteristics of raw jackfruit

2.3.1 Total soluble solids (°Brix)

A hand refractometer was used to assess the total soluble solids (TSS°Brix) of raw sweet potato.

2.3.2 pH

Raw sweet potato's pH was measured with the help of pH meter.

2.3.3 Titratable acidity

10 grams of the homogenized pulp was taken in a beaker, mix it well and then use phenolphthalein as an indicator to titrate the sample solution against 0.1N sodium hydroxide. The final point is indicated by a light pink appearance (Ranganna 1977) ^[6].

$$\text{Acidity} = \frac{\text{Titre} \times \text{Normality of NaOH} \times \text{volume made up} \times \text{Equivalent weight of acid} \times 100}{\text{Volume of sample taken} \times \text{Wt./Volume of sample taken} \times 1000}$$

2.3.4 Ascorbic acid

A 2-6 dichlorophenolindophenol (dye) visual titration

method slightly modified from Ranganna's (1986) ^[7] description was used to measure ascorbic acid amount.

$$\text{Ascorbic acid (mg/100 g)} = \frac{\text{Titre value} \times \text{dye factor} \times \text{volume made up} \times 100}{\text{ml of aliquot taken for estimation} \times \text{wt./vol. of sample taken for estimation}}$$

2.3.5 Total sugar

$$\text{Total Sugar (\%)} = \frac{\text{Factor} \times \text{Dilution}}{\text{Titre} \times \text{weight of sample}} \times 100$$

To measure the total sugar, fill a 250 ml flask with a 50 ml solution of clarified sugar. Five millilitres of HCl are added and the mixture is permitted to rest at room temperature (20 °C or above) for a full 24 hours. 0.1 N NaOH is used in combination with a phenolphthalein indicator to reverse this and replenish the volume. It was titrated and the value was noted. The sugar content was all shown as a percentage.

2.3.6 Reducing sugar

Ranganna (1977) ^[6] explained how reducing sugars were estimated using Lane and Eynon's titrimetric methods.

$$\text{Reducing Sugar (\%)} = \frac{\text{Factor} \times \text{Dilution}}{\text{Titre} \times \text{weight of sample} \times 1000} \times 100$$

2.3.7 Non reducing sugar

The reducing sugar value was subtracted from the total sugar sample to determine the non-reducing sugar value

(Ranganna 1986) ^[7].

$$\text{Non-reducing sugar (\%)} = \text{Total sugar (\%)} - \text{Reducing sugar (\%)}$$

3. Results and Discussion

3.1 Physico-chemical characteristics of raw sweet potato

The quality of the final product was determined by evaluating the raw sweet potato's physical and chemical properties viz. Fruit shape, length (cm), width (cm), diameter (mm), weight (g), moisture content (%), drying time, total soluble solids (°Brix), pH, titratable acidity (%), ascorbic acid (mg/100 g), total sugar (%), reducing sugar (%) and non-reducing sugar (%) were determined and displayed in Tables 1 and 2.

3.1.1 Physical characteristics of raw sweet potato

The physical properties of a raw sweet potato are listed in Table 1. Raw sweet potatoes were found to have an veins fruit form. The average fruit weight (kg), fruit width (cm), fruit diameter (mm), fruit length (cm) and fruit moisture content (%) were 0.135 kg, 5.1 cm, 44.4 mm, 11 cm and 78.90% respectively.

Table 1: Physical characteristics of raw sweet potato

S. No.	Parameters	Average ± SD
1	Fruit Shape	Veins
2	Fruit Weight (kg)	0.135±0.66
3	Fruit Width (cm)	5.1±1.29
4	Fruit diameter (mm)	44.4±0.88
5	Fruit Length (cm)	11±1.80
6	Moisture Content (%)	78.90±1.53

3.1.2 Chemical characteristics of raw sweet potato

The fresh sweet potato's chemical characteristics are listed in Table 2. Titratable acidity (%), ascorbic acid (mg/100 g), total sugar (%), reducing sugar (%), non-reducing sugar (%), pH and TSS (°Brix) of raw sweet potato were reported at 0.44%, 12.00 mg/100 g, 11.58%, 6.28%, 5.30%, 6.33 and 4.9°Brix, respectively.

Table 2: Chemical characteristics of raw sweet potato

S. No.	Parameters	Average $\pm$ SD
1	TSS (°Brix)	4.9 $\pm$ 0.05
2	pH	6.33 $\pm$ 0.05
3	Titrateable acidity (%)	0.44 $\pm$ 0.02
4	Ascorbic acid (mg/100 g)	12.00 $\pm$ 0.86
5	Total sugar (%)	11.58 $\pm$ 0.50
6	Reducing sugar (%)	6.28 $\pm$ 0.10
7	Non-reducing sugar (%)	5.30 $\pm$ 0.48

Conclusion

Raw sweet potatoes were shown to have advantageous qualities for product development based on physico-chemical investigation. The fruit is of an appropriate size and moisture content for processing, as indicated by its average weight (0.135 kg), length (11 cm) and moisture content (78.90%). In terms of chemistry, the tubers showed a pH of 6.33, titratable acidity (0.44%), and notable amounts of ascorbic acid (12.00 mg/100 g), total sugars (11.58%), and total soluble solids (4.9°Brix), indicating high sweetness and nutritional potential. Their appropriateness for baking and confectionery items is further supported by the balance between reducing (6.28%) and non-reducing sugars (5.30%). The raw sweet potato employed in this study is of excellent quality and suitable for value-added product formulation, such as cookies and other processed food items, according to the observed physico-chemical attributes overall.

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