



Research Article

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## Phytochemical and antinutritional constituents of sweet potato

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### ABSTRACT

Sweet potato (*Ipomoea batatas* (L.) Lam.) is the major industrial crop in Tamil nadu which are rich in antioxidants and lot of therapeutic application. The phytochemical components such as alkaloids, saponin, tannins, steroids, anthocyanins, flavonoids and anthroquinones were extracted using different solvents namely ethylacetate, methanol, chloroform and acetone. Specific antinutrients are extracted more in methanol and ethyl acetate solvents other than ethanolic extract. The oxalate and trypsin inhibitors were highly observed in sweet potato. Phytate was found to be 35 mg/100g of sweet potato. Cyanogenic glycosides and phlobatanins were absent in sweet potato and coumarin was extracted in sweet potato.

**Keywords:** sweet potato, cassava, antinutrients, phytochemicals

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### INTRODUCTION

Sweet potato (*Ipomoea batatas* (L.) Lam.) has played an important role as an energy and a phytochemical source in human nutrition and animal feeding. Ethnopharmacological data show that Sweet potato leaves have been effectively used in herbal medicine to treat inflammatory infections and oral diseases. This tuberous root is a rich source of carbohydrates, dietary fiber, vitamin A (as  $\beta$ -carotene), vitamin B<sub>6</sub>, vitamin C, manganese, copper, potassium, and iron. Recently, studies on sweet potato have focused on its antioxidant capacities due to the increased content of phenols, flavonoids,  $\beta$ -carotene, anthocyanins, and caffeoylquinic acid derivatives[1,2,3]. Other reports have reported its medicinal use, specifically its antidiabetic and antiviral properties[4,5]

### EXPERIMENTAL SECTION

Sweet potato and cassava leaves were collected from the field. 500g of dried form of sweet potato leaves and cassava leaves were pulverized using a electric blender. The aqueous extract of sweet potato tuber and cassava samples were prepared by soaking 100g in 200ml of different solvents namely acetone, chloroform, methanol and ethylacetate. The extraction was performed for a period of 24 hours. The crude extract was subjected to centrifugation at 10,000 rpm and supernatant was used to analyze the anti-nutritive content of tuber.

#### *Test for alkaloids*

The extract was dissolved in 2N Hydrochloric acid. The mixture was filtered and the filtrate was divided into three equal portions. First portion was mixed with a few drops of Mayer's reagent to form cream precipitate. Second portion was treated with equal amount of Dragondroff reagent to get orange precipitate and final portion was mixed

with equal amount of Wagner's reagent to form a brown precipitate. All the three tests confirmed the presence of alkaloids [6].

*Test for saponins*

About 0.5ml of extract was mixed with distilled water and shaken well vigorously. Frothing was indicated the evidence of saponins

*Test for tannins*

0.5 ml of extract was dissolved in 10ml of distilled water and filtered. To the filtrate, 0.1% ferric chloride was added drop by drop to get brownish green or black .

*Test for steroids*

To the 2ml of extract and 2ml of acetic anhydride, 2ml of sulphuric acid was added. The Appearance of green color indicates the presence of steroids.

*Test for flavonoids*

2ml of extract was treated with 1.5 ml of 50% methanol solution and heated. To this solution magnesium and few drops of concentrated hydrochloric acid were added. The red color was observed for flavonoids and orange for flavones [7].

*Test for anthocyanin*

1 ml of filtrate was mixed with 5ml of dilute hydrochloric acid. The appearance of pale pink color shows the presence of anthocyanin.

*Test for anthraquinones*

0.5 ml of extract was dissolved in 5ml of chloroform and shaken well for 5 minutes. The extract was filtered. To this filtrate, added equal volume of 10% ammonia solution. A pink violet or red color in ammonical layer indicates the presence of anthraquinones[8].

*Test for phenolic flavonoids*

1 ml of filtrate was mixed with 2ml of 10% lead acetate to form brown color which confirmed the presence of phenolic flavonoids.

*Test for ascorbic acid*

0.1 ml of brominated sample extract was added with 2.9 ml of distilled water. 1 ml of 2% DNPH reagent and 1-2 drops of thiourea were added and incubated at 37°C for 3 hours . The Red osazone crystals were dissolved in 7 ml of 80% sulphuric acid and kept for 5 minutes. The red color indicate the presence of ascorbic acid

*Test for cardiac glycosides*

0.2 g of extract was dissolved in 1 ml of glacial acetic acid containing 1 drop of 1% ferric chloride solution. This was then under layered with 1ml of concentrated sulphuric acid. A brown colored ring was interfaced which showed a characteristic nature of cardiac glycosides.

*Test for tri-terphenoids*

To the 5 ml of the extract, 2ml of chloroform was added. Concentrated sulphuric acid was added along the sides of the test tubes. Reddish brown ring was observed between the two layers.

*Test for coumain*

Fluorescence was detected by the UV test (365 nm) for ethyl acetate extract of sweet potato which indicated the presence of coumarins.

The cyanogenic glycosides was determined by alkaline pictrate method of Oke(1969). 5g of dried samples of these leaves were weighed and dissolved in 50 ml of distilled water in corked conical flasks. The mixtures were allowed to stay overnight and then filtered. To 1ml of sample was taken in a test tube added 4ml of alkaline pictrate and heated in a waterbath for 15 minutes. The absorbance of color intensity was measured at 490nm in a spectrophotometer compared with standard cyanide solution[9].

Trypsin inhibitor present in tubers were analyzed by methodology of kakade et.al(1971).0.2 g of sample was taken in a screw cap centrifuge tube dissolved with 0.1 M phosphate buffer and centrifuged at 5000 rpm for 5 min and filtered through Whatman No 42 filter paper. The volume of the filtrate was made upto 2ml with phosphate buffer. The test tubes were kept in a water bath at 37° C.2ml of casein was added and incubated for 20 min. The reaction was stopped by adding 6ml of TCA solution. TCA solution served as a blank. The absorbance was read in spectrophotometer at 280nm and its concentration can be calculated using standard trypsin[10].

2 g of sweet potato and cassava leaves samples were weighed and soaked in 100 ml of 2% hydrochloric acid for 3 hours and then filtered through a double layer thick filter papers. 50 ml of each filtrate was made upto 150ml with distilled water.10 ml of ammonium thiocyanate solution was added as indicator. Each solution was titrated against standard iron chloride solution which contain 0.001 95 g of iron per ml. The end point was slightly brownish yellow ether conthich persists for 5min.The phytate in cassava and Chinese potato were calculated[11].

For tannin aanalysis.400 mg of samples were placed into two conical flasks. 40 ml of diethyl ether containing 1%acetic acid was added and centrifuged to remove the pigments. To precipitate was dissolved in20ml of 70% acetone. The flasks were sealed with cotton plug covered with aluminium foil, then kept in a shaker for 2 hours. Each content in then flask was filtered through whatman filerpaper.0.5 ml o the filtrate was made upto 1ml with distilled water.0.5 ml o folin ciocalteau reagent was added and mixed with 2.5 ml of 20% sodium carbonate solution was added and mixed. The mixtures were kept for 40 min at room temperature. The absorbance was measured by spectrophotometer using tannins as standard[11]

1 g of sample was dissolved in 190ml of distilled water. 10 ml of 6 M hydrochloric acid and warmed in water bath at 90° C for 4 hours and subjected to centrifugation at a speed of 2000 rpm for 5 min. The supernatant was diluted and evaporated. The brown precipitate was filtered off and titrated with ammonia solution until salmon pink color of methyl orange changed to faint yellow. The solutions were heated at 90° C and the oxalate was precipitated with 10 ml of 5% calcium chloride solution. The solutions were allowed to stand overnight then centrifuged. Each precipitate was washed with 25% sulphuric acid , diluted to 125 ml and warmed at 90°C. It was titrated against 0.05 M potassium permanganate[9].

**Table1: Anti-Nutritional constituents of Sweet potato plant**

Sl.No	Phytochemicals	Methanolic extract	Chloroform extract	Ethyl Acetate extract	Acetone extract
1.	Alkaloids	+++	+	+++	+
2	Saponins	-	-	+	-
3	Tannins	-	-	++	+
4	Steroids	-	-	+	-
5	Anthocyanines	+++	+++	++	+
6	Flavonoids	+	++	+++	+
7	Anthraquinones	-	-	++	-
8	Phenolic flavonoids	++	+	+	+
9	Ascorbic acid	++	++	+	+
10	Cardiac glycosides	-	-	-	-
11	Tri-terpenoids	+++	+++	++	+
12	Coumarin	-	-	++	-

The anti-nutritive components of `sweet potato leaves were qualitatively analyzed in Table 1 and 2. Alkaloids are a diverse group of secondary metabolites, shows antimicrobial activity by inhibiting DNA topoisomerase[12]. An indole-type alkaloid called ipomine A was found for tuberous roots of Sweet potato[13]. Alkaloids were extracted in sweet potato using different solvents.. The maximum concentration was present in methanolic extract and ethyl acetate extract. Saponins are present in plants having anticarcinogenic property[14] . Saponins were only identified in sweet potato and exist in tubers as triterpene saponins.

Tannin is one of the important secondary metabolite which reduces the risk of coronary heart diseases. Tannin was only observed in ethyl acetate extract of tubers. It was found to be highly observed in ethylacetate extract of `sweet potato. Steroids play a significant role of anti inflammatory and analgesic agents[15]. It was slightly observed only in ethylacetate extract.

Anthocyanins were found to be high in chloroform extract of sweet potato and moderately present in ethylacetate extract. Suresh et.al reported that methanol preserves the extracted anthocyanin in their original form. It should be solvent of choice for quantitation and analysis of anthocyanins. Anthocyanins are potential therapeutic role of cardiovascular diseases, cancer, AIDS, nerve disorders and behavioural disorders[16], .This can be useful in controlling oxidative stress during pregnancies.

Antraquinones were absent in all samples except very trace amount in ethyl acetate extract. However, little data have been suggested for the presence of this particular secondary metabolite in leaves of *Ipomoea* spp. There are many natural antioxidants present in different parts of plants in the form of phenolic compounds such as flavonoids, phenolic acid and tocopherols. These compounds are potential antioxidants and free radical scavengers[17]. Phenolic flavanoids and were moderately present in methanol extract of sweet potato and cassava . A higher content of phenolic acids were found in Sweet potato leaves as compared with those of major commercial leafy vegetables[18]. Flavonoids were identified in different extracts of sweet potato. But it was highly observed in ethylacetate extract. Cadiac glycosides were absent in sweet potato.

Terpenoids were found to be high in methanolic, chloroform extract and very little amount in ethylacetate extract of these tubers. Phlobatannins are rarely present in ethyl acetate extract which shows diuretic property. Ascorbic acid was found to be present more in methanolic extract and moderately observed in chloroform extract. Coumarins from *Ipomoea* spp.,were isolated and characterized two coumarins (umbelliferone and scopoletin) in aerial parts of *I. cairica* (L.) Sweet potato[19]. This compound was only found in ethylacetate extract of sweet potato.

The antinutritional constituent such as trypsin inhibitor was found to be 172 mg/100g of Sweet potato .The high amount of oxalate was observed in sweet potato (163 mg/100g) and phytate content (1.05 mg/100g). The sweet potato showed maximum amount of anthocyanin (4.4mg/100g) when compared with cassava.

### CONCLUSION

This study represents the phytochemicals and antinutrient constituents of sweet potato using different solvents namely ethyl acetate, chloroform, methanol and acetone. The maximum amount of antinutrients and phytochemicals were observed in ethylacetate extracts. Cyanogenic glycosides were absent in sweet potato and coumarin was present in sweet potato. The leaves are used as a animal feed and dumped as a manure. These leaves contain lot of antinutrients which shows medicinal property and these compounds can be used for pharma industry.

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