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Chemical evaluation of sweet potato (*Ipomoea batatas*) [L.] Lam) varieties

Parul Maurya, Sadhna Singh, Anjali Chaudhary and Mridula Pandey

Abstract
The present study was conducted to explore the chemical composition of different sweet potato varieties. All the varieties were subjected to different treatment like blanching and un blanching then sun and oven drying for preparation of sweet potato powder. The powder prepared by directly peeling, grating and oven drying of variety CIP-4+40127 was found to be best with respect to sensory attributes and maximum flour recovery. The chemical composition of sweet potato variety revealed significant difference between the varieties for crude protein, crude fat, crude fibre and total ash contents. The mean carbohydrate content of different varieties ranged from 85±4.01 to 87±4.36 percent where as energy value ranged from 361±10.88 to 364±15.5 Kcal per 100 gram. The calcium, phosphorus and beta carotene contents of different varieties ranged from 136±3.46 to 146±3.23 mg per 100 gram, 151±6.51 to 156±2.91 mg par 100 g 6.04 to14.25 micro gram per 100 g.

Keywords: Sweet potato, blanching, UN blanching, chemical composition

Introduction
Sweet potato is traditionally considered as hardly crop. It is rich in carbohydrates, vitamins and minerals and can provide more edible energy per 100 per day than wheat, rice or cassava. It's a short-season crop that reliably produces food on marginal and degraded land with little to no work and little or no outside input. Sweet potato is one of the most vital and under-utilized crops on the planet. It is typically characterized to as subsistence, food security, or famine relief crop, but its usefulness in under developed nations have expanded significantly (Salunkhe, 1999) [15]. Different scientists (Owori, 2007) [14] and (Ahmed, 2010) [1] have reported that sweet potato is an important source of carbohydrates. In the form of simple carbose and dietary fibers, this has an important role in energy deficiencies. Apart from carbohydrates, sweet potato is a good source of vitamin A compared to other roots and tubers (Up to 4000 I.U. per100 g of fresh tubers, depending on the variety). Its Vitamin C content (38 mg per 100 gram) is also remarkable (Bell, 2000) [2]. It also contains vitamin E, B1, B2 and Folic acid. It is rich in minerals essential for proper functioning of the body such as zinc and calcium (32 percent). The Purple fleshed sweet potato varieties have anthocyanin upto 348 mg per 100 g and have good antioxidant properties (Xu, 2015) [17]. Research on nutraceuitical properties of purple fleshed sweet potatoes indicate that anthocyanin from sweet potatoes exhibit strong radical scavenging activity, anti-nutagenic activity and significantly reduced high blood pressure and liver injury in rats (Yong H. W., 2019) [18]. Other physiological function include anti-inflammatory activity, anti-microbial activity, ultraviolet light protection and reduction in memory impairment effects and cancer (Lim S, 2013) [10].

Materials and Methods
The study was conducted in the department of Food Science and Nutrition, College of Community Science, Acharya Narendra Dev University of Agriculture& Technology, Kumarganj Ayodhya, during the year 2020-21 to 2021-22. Three varieties of sweet potato (*Ipomoea batatas* Lam.) namely CIP- 440127 (V_1), ST-14 (V_2), PRDF-I-2 (V_3) were used in the present study. The sweet potato varieties were collected from the Participatory Rural Development Foundation (PRDF) 59, Canal Road, Shivpur- Shahbazganj, P.O. Jungle Salikram, Gorakhpur (U.P.). (Email: prdf2008@gmail.com, Website: www.prdf-agri.com). The collected sweet potato varieties were washed and used for flour preparation of sweet potato powder were determined.

Preparation of sweet potato powder

Fresh sweet potato tubers were washed thoroughly to remove dust and dirt, then peeled manually with stainless steel kitchen knife and grated using a greater. Each variety was subjected to different pre-treatments. All the three varieties namely CIP-440127, ST-14 and PRDF-I-2 of sweet potatoes were then blanched/un blanched and then dried in oven/ sun and ground to make powder. Among the six methods used for sweet potato powder preparation.

Results and Discussion

Chemical composition of sweet potato flour

In the present study chemical parameters of sweet potato powder were studied. Data regarding the moisture content of different varieties of sweet potato powder prepared by different processing methods (P) (blanched and un blanched) and different drying methods (D) (sun dried and oven dried) varied significantly table (1). The mean moisture content of CIP-440127 was the maximum (6.7±0.15%). Whereas, mean moisture content of PRDF-I-2 and ST-14 were 6.1±0.14 and 6.0±0.19 percent, respectively. Significant difference in the moisture content of blanched and UN blanched powder was found. The mean moisture content of blanched sweet potato was 6.3±0.16 whereas, mean moisture content of UN blanched sweet potato was 6.2±0.16 percent. Drying methods were found to have no significant effect on moisture content. However, interaction effects between varieties (V), method of processing (P) and drying methods (D) were found to be significant. (Hossain, 2019) [6] reported 7.14±0.01, 7.02±0.08 and 6.45±0.03 percent moisture in orange, yellow and purple varieties. (Koua, 2018) [8] reported 5.30±0.25, 6.30±0.15, 4.50±0.10, 5.75±0.45, 5.10±0.20 and 5.90±0.89 percent moisture in OSPF- WC, OSPF-PC, YSPF-WC, WSPF-WC and WSPF-PC varieties of sweet potato flour. Similar trend was also found in the present study.

The mean dry matter content of different varieties namely CIP-440127, ST-14 and PRDF-I-2 were 93.3±4.75, 93.9±4.84 and 93.8±1.49 percent, respectively. Statistically no significant effect of variety, method of processing and method of drying was observed on the dry matter content of the sweet potato. (Nogueira, 2018) [12] reported 8.72±0.07 percent moisture and 91.28 percent dry matter in sweet potato flour.

The mean protein content of sweet potato powder prepared by different methods is given in table 3. The protein content of different varieties differed significantly and ranged from 2.93±0.07 percent in CIP-440127, 2.61±0.05 percent in ST-14 and 2.59±0.09 percent in PRDF-I-2. (Hossain, 2019) [6] and (Nogueira, 2018) [12] also reported almost similar protein in orange, yellow and purple varieties.

The mean fat content of sweet potato powder prepared by different methods is given in table 4. The fat content of different varieties differed significantly and ranged from 0.83±0.01 percent in CIP-440127, 0.61±0.01 percent in ST-14 and 0.74±0.03 percent in PRDF-I-2. The fat content was significantly affected by processing method that is blanching and method of drying (sun and oven). M. B 2019 reported 0.44±0.19, 0.50±0.30, 0.55±0.46 percent fat in orange yellow and purple varieties. Ji *et al.*, (2015) [7] reported 0.72, 0.76, 0.64 and 0.56 percent fat in Jizi 01, Xinong 431, Beijing 553 and Shangshu 19 verities.

The mean fiber content of sweet potato powder prepared by different methods is illustrated in table 5. The fiber content of different varieties varied significantly and ranged from 2.11±0.08 percent in CIP-440127, 2.20±0.08 percent in ST-14, 2.31±0.11 percent in PRDF-I-2. Significant difference in the fiber content of blanched and UN blanched flour was found. The mean fiber content of blanched sweet potato was 2.15±0.09 whereas, mean fiber content of un blanched sweet potato was 2.20±0.09 percent. Drying method (D) did not significantly affect the fiber content. The fiber content was significantly affected by processing method. Interaction effect was found to be non-significant. (Hossain, 2019) [6] reported 2.1±0.00, 2.4±0.00, 2.34±0.00 percent fiber in yellow, orange and purple varieties. (Ji, 2015) [7] reported 2.35, 2.21, 1.90 and 1.85 percent fiber in Jizi 01, Xinong 431, Beijing 553 and Shangshu 19 verities which are in accordance with the present findings.

The mean ash content of sweet potato powderr prepared by different methods is given in table 6. The mean ash content of different varieties differed significantly and ranged from 1.92±0.07 percent in CIT 440 127, 1.45±0.09 percent in ST-14, 1.45±0.04 percent in PRDF-I-2. Ash content was significantly affected by processing method that is blanching and UN blanching and methods of drying i.e. (Sun and oven). Ash content was not significantly affected by drying methods. Interaction effect between varieties and processing method were found to be non-significant. However interaction effect between varieties, method of processing and drying methods (V×P×D) was found to be significant. (Koua, 2018) [8] reported 1.21±0.45, 1.28±0.85, 1.46±0.28, 1.93±0.62, 0.93±0.30 and 1.36±0.08 percent ash in OSPF- WC, OSPF-PC, YSPF-WC, WSPF-WC and WSPF-PC varieties. The ash content found in present study was on little higher side.

The mean carbohydrate content of sweet potato powder prepared by different methods is presented in table 7. The mean carbohydrate content of different varieties namely CIP-440127 ST-14 PRDF-I-2 were 85±4.01, 87±4.36 and 86±1.96 percent, respectively. Statistically no significant effect of variety (V), method of processing (P) and method of drying (D) was observed on the carbohydrate content of sweet potato. (Hossain, 2019) [6] reported 86.86±0.44, 85.80±0.61 and 85.80±0.61 percent carbohydrate in yellow orange and purple varieties. (Koua, 2018) [8] reported almost similar carbohydrate in whole sweet potato powder.

The mean energy content of sweet potato powder prepared by different methods is presented in table 8. The mean energy content of different varieties namely CIP-440127, ST-14, PRDF-I-2 were 361±10.88 Kcal, 363±6.97 Kcal and 364±15.59 Kcal, respectively. Statistically no significant effect of variety (V), method of processing (P) and method of drying (D) was observed on the energy content of sweet potato. (Koua, 2018) [8] reported 369.52±0.31, 373. 42±0.45, 371.77±o.191, 363.44±1.63, 374.08±0.56 and 372.16±0.31 kcal energy in OSPF- WC, OSPF-PC, YSPF-WC, YSPF-PC, WSPF-WC and WSPF-PC varieties.

The mean vitamin C content of sweet potato powder prepared by different methods is presented in table 9. The vitamin C and Beta-carotene content of different varieties were different. The vitamin C content of variety CIP-440127 was 21.5 mg whereas, the vitamin C content of variety ST-14 was 25.8 mg and PRDF-I-2 was 30.1 mg respectively. (Mukhopadhyay, 2011) [11] reported 24 mg per 100 g vitamin C in sweet potato tubers. The beta-carotene content of different varieties namely CIP-440127, ST-14, PRDF-I-2 were 7.12, 14.25 and 6.04. Singh *et al.*, (2014) reported 16.24, 8.01, 7.77, 8.60, 10.39 µg per 100 g beta-carotene in ST-14, CIP-440127, CIP-SWA-2,

Kamla Sundari, Sree Lanka varieties of sweet potato.

To conclude sweet potato can play a major role in satisfying the food requirements of third world countries in the coming years. Sweet potato powder could be prepared by direct peeling, grating and oven drying thenblanching and un blanching. It is rich in carbohydrate and energy and also contains good amount of vitamin C.

Table: 1 Mean Moisture content (%) of different varieties of sweet potato (*Ipomoea batatas* Lam.) powder with different treatments

Treatments	Varieties			Mean
	CIP-440127	ST-14	PRDF-I-2	
Blanched sun dried	6.2±0.17	6.1±0.17	5.9±0.19	6.1±0.17
Blanched oven dried	6.9±0.14	5.6±0.22	7.7±0.11	6.7±0.16
Mean	6.5±0.15	5.8±0.19	6.8±0.14	6.3±0.16
Un blanched sun dried	6.7±0.15	6.6±0.21	6.3±0.21	6.5±0.19
Un blanched oven dried	6.9±0.16	5.9±0.81	4.8±0.07	5.9±0.13
Mean	6.8±0.15	6.2±0.19	5.5±0.14	6.2±0.16
Total Mean	6.7±0.15	6.0±0.19	6.1±0.14	6.3±0.16
Interaction effect	SEm±		C.D. (P=0.05)	
Between varieties (V)	0.087		0.253	
Between processing method (P)	0.071		0.206	
Between method of drying (D)	0.071		NS	
V × P	0.122		0.357	
V × D	0.122		0.357	
P × D	0.100		0.292	
V × P × D	0.173		0.505	

*All values are on dry matter basis

Table 2: Mean Dry matter content (%) of different varieties of sweet potato (*Ipomoea batatas* Lam.) powder with different treatments

Treatments	Varieties			Mean
	CIP-440127	ST-14	PRDF-I-2	
Blanched sun dried	93.8±4.99	93.9±3.54	94.1±1.56	93.9±3.36
Blanched oven dried	93.1±4.52	94.4±6.15	92.3±1.43	93.3±4.03
Mean	93.5±4.75	94.2±4.84	93.2±1.49	93.6±3.70
Un blanched sun dried	93.3±4.99	93.4±5.84	93.7±1.79	93.5±4.21
Un blanched oven dried	92.9±4.51	94.1±3.85	95.2±1.20	94.1±3.18
Mean	93.1±4.75	93.8±4.84	94.5±1.49	93.8±3.70
Total Mean	93.3±4.75	93.9±4.84	93.8±1.49	93.7±3.70
Interaction effect	SEm±		C.D. (P=0.05)	
Between varieties (V)	2.116		NS	
Between processing method (P)	1.727		NS	
Between method of drying (D)	1.727		NS	
V × P	2.992		NS	
V × D	2.992		NS	
P × D	2.443		NS	
V × P × D	4.231		NS	

Table 3: Mean Crude Protein content (%) of different varieties of sweet potato (*Ipomoea batatas* Lam.) powder with different treatments

Treatments	Varieties			Mean
	CIP-440127	ST-14	PRDF-I-2	
Blanched sun dried	2.88±0.12	2.75±0.05	2.43±0.10	2.69±0.08
Blanched oven dried	2.88±0.05	2.56±0.06	2.58±0.09	2.67±0.07
Mean	2.88±0.07	2.31±0.05	2.51±0.09	2.56±0.07
Un blanched sun dried	2.96±0.09	2.59±0.06	2.75±0.04	2.76±0.06
Un blanched oven dried	2.99±0.04	2.78±0.05	2.58±0.14	2.78±0.08
Mean	2.98±0.07	2.69±0.05	2.67±0.09	2.78±0.07
Total mean	2.93±0.07	2.61±0.05	2.59±0.09	2.71±0.07
Interaction effect	SEm±		C.D. (P=0.05)	
Between varieties (V)	0.042		0.122	
Between processing method (P)	0.034		NS	

Between method of drying (D)	0.034	NS
V × P	0.059	NS
V × D	0.059	NS
P × D	0.048	NS
V × P × D	0.083	0.243

*All values are on dry matter basis

Table 4: Mean Crude Fat content (%) of different varieties of sweet potato (*Ipomoea batatas* Lam.) powder with different treatments

Treatments	Varieties			Mean
	CIP-440127	ST-14	PRDF-I-2	
Blanched sun dried	0.74±0.01	0.42±0.01	0.63±0.02	0.59±0.02
Blanched oven dried	0.75±0.01	0.52±0.01	0.65±0.03	0.64±0.02
Mean	0.74±0.01	0.47±0.01	0.64±0.03	0.62±0.02
Un blanched sun dried	0.96±0.01	0.74±0.01	0.85±0.01	0.85±0.01
Un blanched oven dried	0.86±0.01	0.74±0.01	0.84±0.05	0.81±0.02
Mean	0.91±0.01	0.74±0.01	0.84±0.03	0.83±0.02
Total Mean	0.83±0.01	0.61±0.01	0.74±0.03	0.72±0.02
Interaction effect	SEm±		C.D. (P=0.05)	
Between varieties (V)	0.011		0.032	
Between processing method (P)	0.009		0.026	
Between method of drying (D)	0.009		NS	
V × P	0.015		0.045	
V × D	0.015		0.045	
P × D	0.013		0.037	
V × P × D	0.022		NS	

*All values are on dry matter basis

Table 5: Mean Crude Fiber content (%) of different varieties of sweet potato (*Ipomoea batatas* Lam.) powder with different treatments

Treatments	Varieties			Mean
	CIP-440127	ST-14	PRDF-I-2	
Blanched sun dried	2.07±0.08	2.23±0.08	2.12±0.10	2.14±0.08
Blanched oven dried	2.04±0.08	2.11±0.08	2.32±0.12	2.16±0.09
Mean	2.06±0.08	2.17±0.08	2.22±0.11	2.15±0.09
Un blanched sun dried	2.11±0.04	2.19±0.03	2.45±0.07	2.25±0.05
Un blanched oven dried	2.22±0.12	2.28±0.12	2.36±0.15	2.28±0.13
Mean	2.16±0.08	2.24±0.08	2.41±0.11	2.20±0.09
Total Mean	2.11±0.08	2.20±0.08	2.31±0.11	2.19±0.09
Interaction effect	SEm±		C.D. (P=0.05)	
Between varieties (V)	0.050		0.147	
Between processing method (P)	0.041		0.120	
Between method of drying (D)	0.041		NS	
V × P	0.071		NS	
V × D	0.071		NS	
P × D	0.058		NS	
V × P × D	0.100		NS	

*All values are on dry matter basis

Table 6: Mean Total Ash Content (%) of different varieties of sweet potato (*Ipomoea batatas* Lam.) powder with different treatments

Treatments	Varieties			Mean
	CIP-440127	ST-14	PRDF-I-2	
Blanched sun dried	1.91±0.06	1.85±0.08	1.27±0.04	1.68±0.06
Blanched oven dried	1.93±0.08	1.05±0.09	1.51±0.04	1.49±0.07
Mean	1.92±0.07	1.45±0.09	1.39±0.04	1.56±0.07
Un blanched sun dried	1.92±0.03	1.28±0.08	1.49±0.06	1.56±0.06
Un blanched oven dried	1.93±0.10	1.63±0.09	1.47±0.03	1.67±0.08
Mean	1.93±0.07	1.46±0.09	1.48±0.04	1.62±0.07
Total Mean	1.92±0.07	1.45±0.09	1.45±0.04	1.61±0.07
Interaction effect	SEm±		C.D. (P=0.05)	
Between varieties (V)	0.038		0.111	
Between processing method (P)	0.031		NS	
Between method of drying (D)	0.031		NS	

V × P	0.054	NS
V × D	0.054	0.157
P × D	0.044	0.128
V × P × D	0.076	0.222

*All values are on dry matter basis

Table 7: Mean Total Carbohydrate content (%) of different varieties of sweet potato (*Ipomoea batatas* Lam.) powder with different treatments

Treatments	Varieties			Mean
	CIP-440127	ST-14	PRDF-I-2	
Blanched sun dried	86±3.46	87±5.43	88±2.49	87±3.79
Blanched oven dried	86±4.56	87±3.29	85±1.42	86±3.09
Mean	86±4.01	87±4.36	86±1.96	86±3.44
Un blanched sun dried	85±2.83	87±3.10	86±2.81	86±2.91
Un blanched oven dried	85±5.82	87±5.62	88±1.10	87±3.97
Mean	85±4.01	87±4.36	87±1.96	86±3.44
Total Mean	85±4.01	87±4.36	86±1.96	86±3.44
Interaction effect	SEm±		C.D. (P=0.05)	
Between varieties (V)	1.954		NS	
Between processing method (P)	1.596		NS	
Between method of drying (D)	1.596		NS	
V × P	2.764		NS	
V × D	2.764		NS	
P × D	2.257		NS	
V × P × D	3.908		NS	

*All values are on dry matter basis

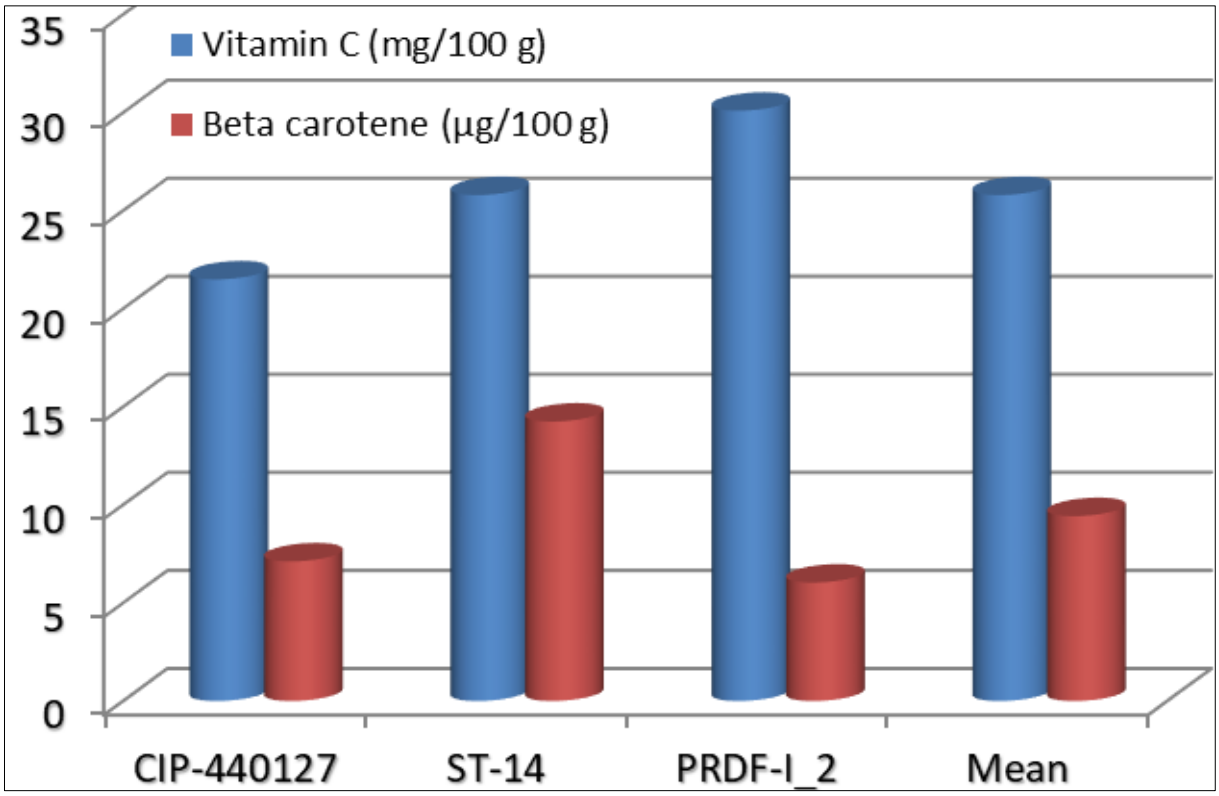
Table 8: Mean Energy content (Kcal/100g) of different varieties of sweet potato (*Ipomoea batatas* Lam.) powder with different treatments

Treatments	Varieties			Mean
	CIP-440127	ST-14	PRDF-I-2	
Blanched sun dried	363±11.51	361±7.35	366±18.02	363±12.29
Blanched oven dried	360±10.24	366±6.58	357±13.16	361±10.00
Mean	362±10.88	364±6.97	362±15.59	363±11.14
Un blanched sun dried	362±14.83	363±4.60	363±3.83	363±7.75
Un blanched oven dried	360±6.93	364±9.33	370±27.35	365±14.54
Mean	361±10.88	364±6.97	367±15.59	364±11.14
Total Mean	361±10.88	363±6.97	364±15.59	363±11.14
Interaction effect	SEm±		C.D. (P=0.05)	
Between varieties (V)	6.946		NS	
Between processing method (P)	5.671		NS	
Between method of drying (D)	5.671		NS	
V × P	9.823		NS	
V × D	9.823		NS	
P × D	8.020		NS	
V × P × D	13.891		NS	

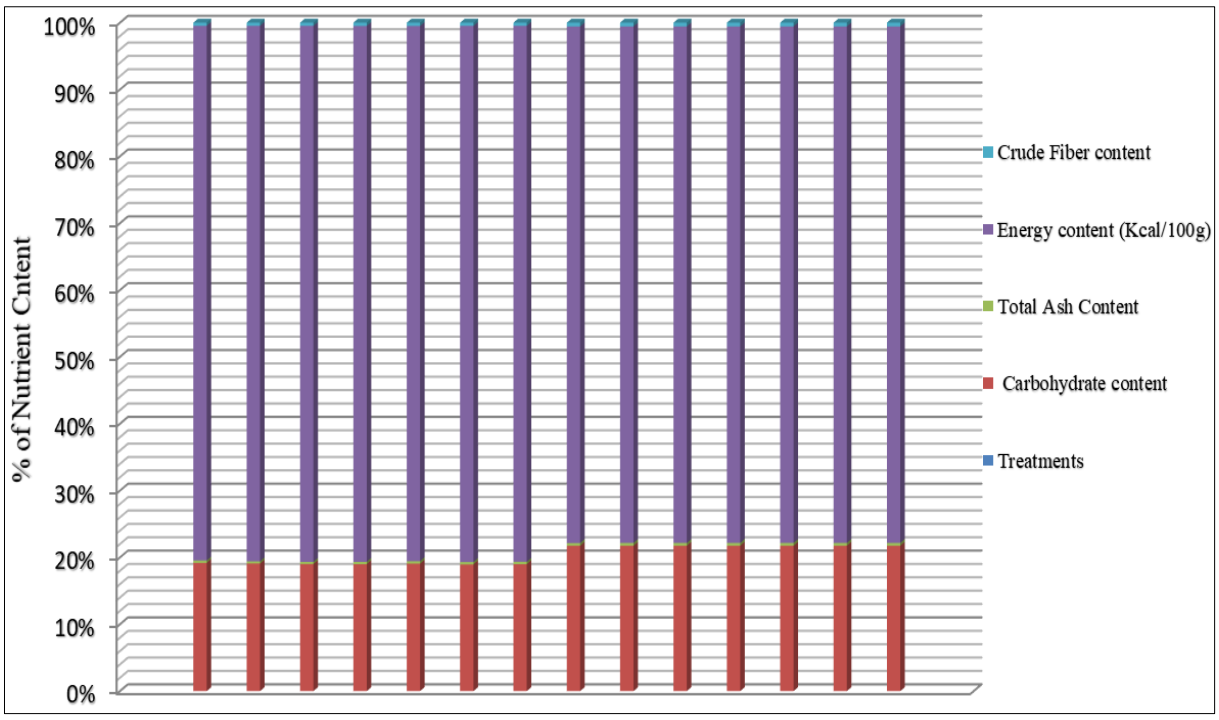
*All values are on dry matter basis

Table 9: Vitamin content of different varieties of fresh sweet potato (*Ipomoea batatas* Lam.)

Vitamin/ Variety	CIP-440127	ST-14	PRDF-I_2	Mean
Vitamin C (mg/100 g)	21.5	25.8	30.1	25.8
Beta carotene (µg/100 g)	7.12	14.25	6.04	9.43



Graph 1: Vitamin content of different varieties of fresh sweet potato (*Ipomoea batatas* Lam.)



Graph 2: Blanched, Un blanched, Sun dried, Oven dried treatment of sweet potato

Authorship Contribution

Parul Maurya (Student), Sadhna Singh (Major Advisor), Anjali Chaudhary (Student) and Mridula Pandey (Scholar). All authors are equally contributed.

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