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Research Article

Comparison of Different Sweet Potato (*Ipomoea Batatas L*) Varieties in Terms of Nutritional Value

Halabo Hazo[1*], Admasu Yirgalem[2]

[1]Department of Food Science and Postharvest Technology, Arba Minch University, Ethiopia; [2]Department of Horticulture, Arba Minch University, Ethiopia

ABSTRACT

Sweet potato (*Ipomoea batatas L.*) is one of the globally important root crops. In this study the comparison of nutritional status for white fleshed sweet potato (Awassa-83, Awassa-09, Berkume, Beletech and Tola) varieties were determined. The nutritional values of five sweet potato varieties were significantly ($p<0.05$) varied due to cultivar variation. The experimental design was arranged in randomized complete block design with triplications. The data obtained was analyzed by SAS version 9.1 and means separation were compared by Duncan's Multiple Range Test. The result revealed that the moisture content ranged between 61.45-68.83%, 0.213-0.58 mg/100 g of crud ash, 0.225-259 mg/100 g of crude fiber, 0.11-0.24 mg/100 g of crude fat, 1.24-85 mg/100 g of crude protein, 29.17-35.65 mg/100 g of carbohydrate and 124.24-152.6 Kcal/100 g of total energy. From the results obtained this study concluded that the Beletech variety has high nutritional value than other four varieties. Since it has potential to source good nutrients among five sweet potato varieties, more emphasis should be given for its cultivation in agricultural sectors as well as farmers land. It is also highly recommended that all variety should be conducted further study in its anti-nutritional factors like phytate, oxalate and tannin which are important issue related to healthy consumption.

Keywords: White flesh; Sweet potato; Variety; Nutritional value

INTRODUCTION

Root and tuber crops refer to any growing plant that stores edible material in underground root, corm or tuber [1]. Many of the developing world's poorest farmers and food insecure people are highly dependent on root and tuber crops as a source of food, nutrition, and cash income [2]. The nutritional value of root and tuber crops lies in their potential ability to provide one of the cheapest sources of dietary energy in the form of carbohydrates. The amount of energy supplied by these crops is about one third of that of an equivalent weight of grains such as rice or wheat because these crops have high water content than cereals. However, the high yields of these root and tuber crops ensure an energy output per hectare per day which is considerably higher than that of grains [3].

In Ethiopia, sweet potato (*Ipomoea batatas*) production ranks third after Enset (*Enset ventricosum*) and potato (*Solanum tuberosum*) compared to other root and tuber crops. It is one of the major traditional food crops in the country. The crop cultivation is common in densely populated areas of the South, South-West and Eastern parts of the country and Southern Nation and Nationalities People Region (SNNPR) is the highest producing area. It is an important food crop during hunger periods in areas such as Wolaita, Sidama, Kanbata, Gamo, Gofa and Hadiya zones in SNNPR from February to May [4].

When compared to other crops sweet potato is an attractive crop among farmers due to its high productivity, universal uses, high caloric content and good taste. Other important characteristics of sweet potato are; it tolerant adverse environmental conditions such as drought, it requires low soil fertility, high rainfall and very little labor and care [5]. In addition to these attributes, it

Correspondence author: Halabo Hazo, Department of Food Science and Postharvest Technology, Arba Minch University, Ethiopia; Tel: 920978841, E-mail: halaboazo@gmail.com

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has also short production cycle, high nutritional value and sensory attributes in terms of flesh colors, taste and texture [20,4,11].

Moreover, it contributes to food security and farmers' income in countries like Ethiopia [17]. Currently different varieties of sweet potato cultivars are cultivated and consumed in Ethiopia. These cultivars contain different skin colors (pink, cream, orange and white) and flesh colors (white, cream, orange and yellow). As with all crops the nutritional status of sweet potato cultivars vary from place to place depending on the climate, soil type, the crop variety and other factors [12]. Depending on the variety, sweet potatoes are rich in carbohydrates, dietary fiber, ash, ß-carotene, minerals and other nutrients [20,4,11]. However, with all its desirable traits, sweet potatoes also contain potential plant toxins and ant nutritional factors such as phytate, oxalate and tannin [13,7] that affect the nutrient utilization in the body. Thus, this study was conducted with the aim of selecting sweet potato variety with high nutritive value among different sweet potato varieties that are currently cultivated in Gamo Zone.

MATERIALS AND METHODS

Description of the study area: The experiment was conducted at Gamo Zone during 2020 cropping season at Arba Minch University. Arba Minch University is located in Southern part of Ethiopia at about 505 km far away from capital city of Ethiopia, Addis Ababa. It is located at 62'N Latitude and 3733'E Longitude having an altitude of 1200 meter above sea level. The research station receives an annual average rainfall of 900 mm with average temperature of 29.

Sampling method and experimental design: The plant stems and leaves of white fleshed different five sweet potato cultivars namely (Awassa-83, Berkume, Beletech, Awassa-09, and Tola) were collected from Arba Minch Agricultural Research Center and cultivated at Arba Minch University. The treatments consist of five white fleshed improved varieties of sweet potatoes and arranged in a randomized complete block design with three replications, making a total of fifteen experimental plots. A laboratory experiment was conducted in the Department of Horticulture and Chemistry laboratories, Arba Minch University, Ethiopian.

Preparation of sweet potato flour: Flour from sweet potato was prepared based on the method described by [18]. In the laboratory, within 24 hours of harvesting for all five varieties root samples with all root sizes were carefully selected and mixed separately for purpose of including all size in the study. The selected samples were manually cleaned by hand followed with clean water to remove adhering materials and soils. Then the cleaned samples were divided in to two parts for further operation. One portion was hand peeled and submerged in water to avoid enzymatic browning and then sliced to uniform thickness using a stainless steel knife [19].

The slices were blanched in hot water 80 for 5 min in order to inactivate enzymes that may cause browning reaction and followed by immediate cooling in cold water to avoid further cooking [7]. The cooled slices were then drained on perforated plastic tray. The slices were dried in a hot air oven (drying oven model, DHG-9055 A) at 60 until the chips were brittle and easy to be milled overnight. The dried samples were milled into fine powder using electric grinder (High-Speed sampling machine model-FW 100) until to pass through 0.425 mm sieve. Sample preparation for second portion was the same as above except that the cleaned samples were unpeeled [20].

Nutritional Composition Analysis

Moisture determination: The method described by [17] was used to determine moisture content of sweet potato samples. The method was based up on the removal of water from the sample and its measurement by loss of weight. Clean crucible was weighted and dried in the oven (w1). 1 g of each sample was weighted in to crucible (w2) and dried at oven 105 for 24 hrs. The crucibles were transferred from oven to desiccator, cooled and re-weighted (w3). The percentage of moisture content was calculated as:

x 100.

Total ash determination: The method [17] was used to measure the ash content of sweet potato sample. The porcelain crucibles were dried in an oven at 100 for 10 min cooled in a desiccator and weighed (w1). 2 g of the sample placed into the previously weighed porcelain crucible and reweighed (w2) and then placed in the furnace for four hours at 600 to ensure proper ash. The crucible containing the ash was removed cooled in the desiccator and weighed (w3). The ash content of sweet potato was calculated as:

x 100.

Crude fiber determination: The method described by [17] was used. As original sample (w0) 1 g of the finely ground sample was weighed out into a round bottom flask, 100 ml of 1.25% sulphuric acid solution was added and the mixture boiled under a reflux for 30 min. The hot solution was quickly filtered under suction. The insoluble matter washed several times with hot water until it was acid free. It was quantitatively transferred into the flask and 100 ml of hot 1.25% NaOH solution added and the mixture boiled again under reflux for 30 min and quickly filtered under suction. The soluble residue washed with boiling water until it was base free. It was dried to constant weight in the oven at 105, cooled in a desiccator for 30 min and weighed (w1). The weighed sample (w1) was incinerated in a muffle furnace at 300 for about 30 min, cooled in the desiccator for 30 min and reweighed (w2). The loss in weight of sample on incineration was calculated as:

x 100.

Crude fat determination: The sweet potato fat content was determined as with method of [2]. Known amount of sample (w0) in a round bottom flask, containing few anti-bumping granules weighed (w1) and 150 ml of petroleum ether was transferred into the flask fitted with Soxhlet extraction apparatus. The round bottom flask and a condenser were connected to the Soxhlet extractor and cold water circulation was put on. The heating mantles were switched on and the heating rate adjusted until the solvent was refluxing at a steady rate. Extraction was carried out for 6 hours. The round bottom

flask and extracted oil are cooled and then weighed (w2) and the fat content of sweet potato sample was calculated as:

x 100.

Crude protein determination: Crude protein was determined by method described by [2]. 1 g of each sample was weighed into separated digestion flask and 10 g of a catalyst sodium sulphate, copper sulphate and 25 ml of concentrated Sulphuric acid was added. The sample heated on a micro digestion bench which is thermostatically controlled to remove organic carbon for 2 hrs. After heating, the content of the flask was left to cool and transferred to a round bottom flask with distilled water. A little piece of anti-bumping granules was added to prevent pumping and 80 ml of 40% NaOH solution carefully added, mixed and then subjected to distillation until all the ammonia passed over into the standard sulfuric acid solution. It was titrated with standard 0.55 M of sodium hydroxide solution to an end point. The conversion factor 6.25 was used to get the percentage protein contents.

Total carbohydrate determination: The total carbohydrate content was determined by followed [2] method. The percentage sum of the moisture, ash, crude protein and crude fiber was subtracted from 100. Total carbohydrate content of sweet potato sample was calculated as: 100-%age of (moisture + ash + fat + protein + fiber).

Total energy determination: Total energy content was obtained using Atwater conversion factors 4, 9 and 4 for each gram of crude protein, crude fat and carbohydrate respectively and expressed in calories [10].

Data analysis: The data obtained for each parameter was subjected to statistical analysis software (SAS) version 9.1. All the experiments were conducted in triplicate and the mean were taken for statistical changes. The Analysis of Variance (ANOVA) was analyzed to determine the level of significance. The least significant differences among means at (P<0.05%) were further compared through Duncan Multiple Range Test.

RESULTS AND DISCUSSION

Table 1: Nutritional composition of different sweet potato in (mg/100 g).

Treatment	Moisture	Ash	Fiber	Fat	Protein	Carbohydrate	Energy
Awassa-83	65.22c	0.48b	0.26a	0.11d	1.34cb	32.58b	136.69b
Berkume	68.83a	0.21d	0.22c	0.20b	1.42b	29.17c	124.24c
Beletech	61.45d	0.55ab	0.24b	0.25a	1.85a	35.65a	152.60a
Awassa-09	67.65b	0.58a	0.22c	0.15c	1.73a	29.65c	126.88c
Tola	68.56ba	0.39c	0.24b	0.12d	1.24c	29.46c	123.82c
CV	0.9225	10.59	1.784	6.41	6.44	1.99	1.88

Nutritional Values of Different Sweet Potato Varieties

The nutritional composition of different sweet potato varieties of (Awassa-83, Berkume, Beletech, Awassa-09 and Tola) is presented in Table 1. The moisture content in fresh weight basis was ranged between 61.45-68.83 mg/100 g, 0.213-0.58 mg/100 g of crud ash, 0.225-259 mg/100 g of crude fiber, 0.11-0.24 mg/100 g of crude fat, 1.24-85 mg/100 g of crude protein, 29.17-35.65 mg/100 g of carbohydrate and 124.24-152.6 Kcal/100 g of total energy.

Moisture content: Moisture content of the different five sweet potato varieties are presented above in Table 1. The highest percentage of moisture content 68.83 mg/100 g was observed in Berkume variety followed by 68.56 mg/100 g of Tola variety, whereas the lowest percentage of moisture content 61.45 mg/100 g was observed in Beletech variety. Among different sweet potato varieties had significantly (P<0.05) affected the moisture content (Table 1). Results considering moisture in the present study are in the same line and comparable with works of [9,15]. The reason for the observed differences in moisture content of samples in the present study from earlier works could be attributed to the variety difference, the climate, the type of soils and others factors while the observed differences in moisture content in the current study might be contributed by variety difference.

Total ash: The mean ash value of different sweet potato varieties of 0.48,0.21,0.55,0.58 and 0.39 mg/100 g was observed in Awassa-83, Berkume, Beletech, Awassa-09 and Tola varieties, respectively (Table 1). The mean total ash content of sweet potato variety was significantly (P<0.05) influenced in all varieties. Awassa-09 cultivar has the highest mean ash content and Berkume variety has lowest ash content was recorded. This might be either more inorganic matter is accumulated in outer skin layer than that of inner flesh layer in sweet potato root or some inorganic matter that adhered the skin layer of root might be contributed during peeling process.

Crude fiber: The crude fiber content of five sweet potato varieties was significantly affected (P<0.05) by variety difference. It was observed that the mean crude fiber content of five sweet potato cultivars was significantly varied (Table 1) and the mean value ranged from 0.22-0.26 mg/100 g. This difference among different varieties might be due to variety, soil and the amount of external skin while peeling, thus more dietary fiber

accumulated in outer skin layer than that of inner flesh layer of sweet potato root. A similar finding had been reported by [9].

Crude fat: It was observed that the crude fat content is generally low in all investigated sweet potato cultivars; a similar idea had been reported by [3]. The crude fat content of the five sweet potato varieties was indicated to be significantly affected ($P<0.05$) by variety. Result in Table 1 shows that the mean fat content of five sweet potato cultivars was significantly varied and the mean value ranged from 0.11-0.25 mg/100 g. This observed difference among the five sweet potato cultivars may be contributed by genetic variation, since other factors are kept constant. This result was similar with reported value of [9].

Crude protein: The crude protein content of five sweet potato varieties was significantly affected ($P<0.05$) by variety. As it can be seen from statistical analysis (Table 1), significant differences ($P<0.05$) exist between the protein content of the five sweet potato cultivars and the value ranged from 1.24-1.85 mg/100 g. Such observed differences in crude protein content in the current study might be contributed by cultivars or genetic difference, since all the studied varieties were collected from the same environment and soil type. These results are well agreed within the range of values (1.73-11.8%) that had been reported by [15].

Total carbohydrate: The total carbohydrate content was determined by difference. The total carbohydrate content of five sweet potato varieties was significantly affected ($P<0.05$) by variety. All the investigated sweet potato cultivars were significantly varied (Table 1) in their carbohydrate content and the mean value ranged from 29.17 35.65 mg/100 g. The highest carbohydrate content of 35.65 mg/100 g was observed in Beletech variety, whereas the lowest carbohydrate content of 29.17 mg/100 g was observed in Berkume variety followed by Tola variety of 29.46 mg/100 g. A similar idea had been reported by [6] and the carbohydrate content difference among difference variety could be due to the sum result of other previous parameters.

Total energy: The energy content of five sweet potato varieties was found significantly influenced ($P<0.05$) by variety. All the investigated sweet potato cultivars were significantly varied (Table 1) in their energy content and the mean value ranged from 124.24 152.6 Kcal/100 g. Similarly carbohydrate, the energy contents in all investigated sweet potato cultivars were high. Thus, the principle use of sweet potato like other starchy root and tuber crops as human food and animal feed is therefore as a source of dietary energy yielding ingredients [14].

CONCLUSION AND RECOMMENDATION

This study has covered information on the nutritional status of different five white fleshed sweet potato cultivars in their raw form. The result showed that the nutritional contents of five sweet potato varieties were significantly varied due to cultivar variation. It has concluded that the Beletech variety has high nutritional value than other four varieties. Since Beletech variety potentially good source of nutrients among five sweet potato varieties, more emphasis should be given for its cultivation in agricultural sectors as well as farmers land. It is highly recommended that all variety should be conducted further study in its anti-nutritional factors (phytate, oxalate and tannin) and its interaction by other minerals which are important issue related to healthy consumption.

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