OPEN ACCESS
Global Journal of Research in Agriculture & Life Sciences
ISSN: 2583-4576 (Online)
Volume 06 | Issue 01 | Jan.-Feb. | 2026
Journal homepage: https://gjrpublication.com/gjrals/
Research Article

Effect of Processing Methods and Varieties on Nutrient Composition and Sensory Acceptability of Yam *(Dioscorea esculenta)* in Debube Ari District, Southern Ethiopia

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DOI: 10.5281/zenodo.18734033 **Submission Date: 10 Dec. 2025 | Published Date: 23 Feb. 2026**

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Abstract

This study investigated the nutritional and sensory properties of three yam varieties namely: Wenago-1, Wenago Red, Bulcha and a local control under different processing methods (raw vs. boiled + sun-dried) in Debube Ari District, Ari Zone, Southern Ethiopia. Using a Completely Randomized Design with three replications for nutritional analysis and a Randomized Complete Block Design for sensory evaluation, we assessed proximate composition and food acceptability yam flour samples. Results showed significant (P < 0.05) variations in moisture (11.05-12.32%), crude protein (13.14-15.98%), fat, and carbohydrate (67.57-72.78%) content. Processed yam flour exhibited higher carbohydrates but lower moisture and protein compared to raw flour. Among varieties, Bulcha showed the highest moisture (12.32%) and protein (15.98%), while processed Wenago Red contained the maximum carbohydrates (72.78%). Sensory attributes varied significantly, with boiled+sun-dried Wenago Red demonstrating the best potential for complementary foods despite lower ratings than the control. The findings suggest that processing method significantly impacts nutritional quality, with boiling and sun-drying enhancing carbohydrate content. It is concluded that, both Bulcha and Wenago Red yam cultivars were recommended to use in the study areas for its higher moisture, protein and good sensory attributes, respectively. Yam flour can be used for food preparation and commercial purpose which may in turn increase the utilization. We recommend further research on anti-nutritional factors, mineral composition, vitamins, amino acid and fatty acid content along with promotion of yam cultivation for improved nutrition.

Keywords: *Yam varieties, processing methods, proximate composition, sensory evaluation, complementary foods.*

Introduction

Yam (Dioscorea spp.) is considered a famine food and plays a prime role in the food habits of small and marginal rural families and forest-dwelling communities during the food scarcity periods (Ngo Ngwe et al., 2015). It is recognized as the fourth most important tuber crop after potatoes, cassava, and sweet potatoes and contributes about 10% of the total root and tuber production around the world (Viruel et al., 2016). It contains a good source of essential dietary supplements such as protein, well-balanced essential amino acids, and many dietary minerals (Baah et al., 2009).

Yam is considered the most nutritious of tropical root crops (Wanasundera and Ravindra, 1994). Yams serve as an important source of carbohydrates and serve as a major source of income in countries where they are cultivated. Bradbury and Holloway (1998) reported that yam contains approximately four times as much protein as cassava. Yam is the only root crop that exceeds rice in protein content to digestible energy. The amino acid composition of yam protein is rich in sulphur-containing amino acids (cysteine and methionine). Bhandari et al. (2003) and Splittstesse et al. (1973) reported that the overall rating for essential amino acids in yam is relatively higher and superior to sweet potato.

Yam is also a good source of vitamins and minerals. Osagie (1992) reported vitamin C contents of 5-10 mg/100 g in D. alata. Bradbury and Singh (1986) reported that the total ascorbic acid content of yam tubers is 50% greater than that of cassava. Values ranging from 200 to 2100 µg/100 g (fresh weight basis) have been reported for various species. Ascorbic acid is important for the normal function of the nerves and muscles. Adepoju (2012) reported mineral content as sodium 350 mg/100 g, potassium 470 mg/100 g, calcium 68 mg/100 g, iron 4.1 mg/100 g, and phosphorus 163 mg/100 g for D. rotundata.

Yam is considered the most nutritious of tropical root crops (Wanasundera and Ravindra, 1994). Bradbury and Holloway (1998) reported that yam contains approximately four times as much protein as cassava. Yam is the only root crop that exceeds rice in protein content to digestible energy. The amino acid composition of yam protein is rich in sulphur-containing amino acids (cysteine and methionine). Bhandari et al. (2003) and Splittstesse et al. (1973) reported that the overall rating for essential amino acids in yam is relatively higher and superior to sweet potato.

Yam is of higher nutritional value than some other root and tuber crops, such as cassava (Latham, 1969). Its protein content is about 3-6% as compared to 1–2% in cassava (Charles et al., 2004). It is an energy-rich tuber and provides protein three (3) times more superior than that of cassava and sweet potato (Ezeocha and Ojimelukwe, 2012). Yams are reported to contain relatively high levels of minerals (Afoakwa and Sefa-Dedeh, 2001). Yams are very good sources of nutrients, including carbohydrates, energy, vitamins (mostly vitamin C), proteins, and minerals. Some cultivated yam species have been reported to be rich in phosphorus and vitamins such as ascorbic acid, thiamine, niacin, and riboflavin (Dabonne, Kouakou, Martin, Hubert, & Kouame, 2011; Osunde, 2008).

Yam is considered to be an excellent source of carbohydrate, energy, vitamins, minerals, and protein (Wanasundera and Ravindran 1994). The chemical composition of yam is characterized by a high moisture content and dry mater. Yam species differ in terms of dry matter content, starch quality, texture, and flavor, which affect their suitability for different cooking procedures (Hariprakash and Nambisan, 1996). It contains approximately four times as much protein as cassava and is the only major root crop that exceeds rice in protein content in proportion to digestible energy (Bradbury and Holloway (1988)). Reports from a number of studies have shown that yam tubers contain high water content, up to 92% (Shajeela et al., 2011; Adepoju, 2012). Yams are the cheapest sources of calorific energy in the form of carbohydrates (mainly dietary starch) in developing countries (Ugwu, 2009; Coursey, 1973).

Yams in their raw forms are toxic. The toxin is, however, destroyed by processing techniques such as cooking, soaking, ensiling, and drying (FAO, 1999). Although yams are widely grown in Ethiopia, particularly in its southern parts, they are an underutilized crop, and little is known about their nutritional and sensory properties. Even though there is a little bit of practice of producing and eating the tubers of yams, particularly in the southern part of Ethiopia, the knowledge of the people to get good, nutritionally rich food and the proper conditions to be maintained is very limited. It has been observed that the potential uses of the starchy roots as a food and as an income-generating product in the rural areas could not be satisfactorily done in the developing countries, especially in Ethiopia. The yam is unpopular and less studied and received minimal interest and attention from food processors in Ethiopia. The high rate of post-harvest losses of the crop and inadequate methods of preservation probably resulted in its under exploitation as foodstuff and industrial uses. Therefore, promoting and supporting the use of yams can make a major contribution to the food security of Ethiopia and of the world as well.

It is reported that yams generally have high moisture content, and the dry matter is composed mainly of starch, vitamins, sugars, and minerals. Nutrient content varies with species and cooking procedures. Currently, some yam varieties are being adapted and promoted in Ari Zone, Southern Ethiopia, by the Jinka Agricultural Research Center (JARC). However, this distribution of the yam cultivars is not supported by proper training to process yams into value-added products or for domestic consumption. In addition to this, very limited studies have been carried out on the nutritional compositions and sensory acceptability in different yam varieties. Therefore, there is a need for the development of improved yam food processing methods, especially for populations living in rural and poor areas. Thus, the aim of this study is to evaluate the nutritional composition and sensory acceptability of different yam varieties and how they are affected by processing methods.

Objectives

To evaluate the effect of different processing methods and varieties on the proximate composition of selected varieties of yam. To assess the sensory acceptability of developed complementary foods from yam flour by mothers and their children.

Materials and methods

Description of the study area

Debub Ari district is one of the four woredas in the Aari zone with an area of 1,520 km² and is located at 50.67'-60.19' N & 360.30'-360.73'E and has a human population of 219,708. The population density of the woreda is 144.4 persons per km². The woreda is bordering with Semen Ari and Woba-Aari woreda in the north, Mago National Park in the south, Salamago woreda in the west, Malle woreda in the east, and Baka-Dawula Aari woreda in the southeast. The altitude of the woreda ranges between 500 m a.s.l. and 3000 m a.s.l. The traditional agroecologies Dega, woina-dega, and kola cover 30, 65, and 5 percent, respectively, of the total area. The woreda has a rainfall pattern of bimodal type (Belg = February-April and Meher = July-September). The mean annual rainfall ranges between 601 and 1600 mm. The mean annual temperature ranges between 10-10°C and greater than 27.50°C. The Ari ethnic group is the major one in the woreda with a mixed crop-livestock/ farming system. Maize, sorghum, barley, wheat, teff, and coffee are the major crops grown in the area. Debube Ari district was selected because of its potential for growing yams. These areas were selected to represent the area that yam is dominantly produced and consumed in, the Ari Zone.

Treatments and Experimental design

A completely randomized design (CRD) with three replications assessed nutritional content, while a randomized complete block design (RCBD) evaluated sensory attributes. Two levels of processing methods (boiling and sun drying) vs. three improved yam varieties (Bulcha, Wonago Red, and Wonago-1, with a local yam variety as control) were arranged in a randomized complete design (CRD), and the treatments were replicated three times.

Experimental study setting

Sample collection and preparation were conducted at the Jinka Agricultural Research Center (JARC) Nutrition and Food Science Laboratory. A laboratory experiment was conducted at the Jinka Agricultural Research Center (JARC) soil laboratory for nutrient analysis of formulated food (proximate composition). Demonstration and nutrition education were provided. Promotional materials (brochures and preparation guidelines) were prepared and distributed.

Yam sample collection

Tubers of four yam varieties were obtained from the Jinka Agricultural Research Center (JARC) field experimental trial. They were identified as white, purple, and yellow cultivars. This root was treated with two different processing methods, which are boiling and sun-drying, and local variety as control.

Processing methods

Sun-drying: The yam tubers were peeled, washed in water, sliced and sun dried for 2 to 3 days.
Boiling method: The yam tubers were peeled, sliced, washed and boiled in water for 15 minutes at 60oC. After boiling, the boiled yam tuber samples were dried in an oven at 60oC.

All the dried samples were milled to 0.50mm sieve size with Perten Laboratory Hammer Mill 3102 for further laboratory analysis.

Yam flour sample Preparation

High-quality yam flour was processed according to the procedures described by Wahab et al. (2016). The yam samples selected contained large, middle, and small tuber sizes that were not damaged during harvest and that were not attacked by pests. The freshly harvested yam tubers were washed thoroughly to remove sand and other dirt. The washed tubers were then peeled separately using a stainless steel knife. The peeled tubers were sliced into 1 mm pieces using a stainless steel vegetable slicer. The slices were then washed in distilled water. The yam slices were blanched in a hot water bath at 70°C for 15 min. For sun drying, each pretreated yam slice was dried on black polythene nylon for 2 days. The dried slices were milled separately with a laboratory hammer mill and sieved using a 250 µm mesh to obtain yam flour, herein referred to as high-quality yam flour. The flour samples were packaged in airtight plastic containers and stored at 4°C for further analysis.

Data collection

Proximate composition (moisture content, ash, fiber, crude protein, carbohydrate, and energy) data were collected and analyzed from each ingredient.

Proximate Analysis

The proximate composition of yam flour samples was analyzed for moisture, ash, fiber, protein, and fat contents according to the method of AOAC (2000). The carbohydrate content was determined by difference.

Sensory evaluation

Sensory evaluation of the products was carried out by a group of 30 panelists made up of nursing mothers. 100% of the products were used as the control. The evaluation was carried out in mother-child pairs. The judges evaluated the products using a five-point hedonic scale where 5 = like very much, 4 = like a little, 3 = neither like nor dislike, 2 = dislike a little, and 1 = dislike very much. Panelists scored the sample for four sensory attributes—color, appearance, flavor, taste, consistency/mouthfeel, and overall acceptability. A cup of potable water was given to the panelist to rinse his/her mouth after each tasting.

Data analysis

All analyses were carried out in triplicates. Results were expressed by means of ± SD. Statistical significance was established using one-way analysis of Variance (ANOVA) models to estimate the effect of different yam varieties and processing methods on proximate composition and sensory acceptability of yam at 5 % level. Means were separated according to least significant difference (LSD) test at ($P < 0.05$), with the help of the software STATISTICA 7 (Statsoft Inc, Tulsa-USA Headquarters).

Result and Discussions

As indicated above, there is a significant difference between treatments with respect to moisture, crude protein, fat, and carbohydrate content, but there is no significant difference with respect to ash, crude fiber, and energy content. Results of the analyses show that the flour from raw yam tubers has a higher percentage of moisture and crude protein but lower carbohydrate content than the boiled yam tubers (Table 1). Generally, this study revealed the presence of high moisture content in yam varieties. The presence of high moisture content in yam is an indication of the existence of a good source of minerals (Opara, 1999). The range for moisture content was between 11.05% and 12.32% dw (dry weight) for the flour from raw Wenago-1 and raw Bulcha varieties, respectively. All the samples had moisture content below 13%, which is the standard for dry food samples as described by Prinyawiwatkul et al. (1997). The variation in the moisture content of yam species might be due to the genetic differences that exist between them. The moisture content of every food sample reflects the quantity of solid matter in the sample. The rate of spoilage is closely related to the amount of moisture present. The higher the amount of moisture present, the higher the rate of spoilage (Sanful et al., 2013). Cultivars with low moisture content may have a longer shelf life.

The crude protein content ranged from 13.14% to 15.98% dw for the flour from boiled raw Wenago Red and raw Bulcha yam varieties, respectively. The flour from the raw tuber had the highest crude protein content, whereas the flour from the boiled tuber had the lowest crude protein content. The variations in the protein content of the two yam varieties may be due to the genetic composition of the varieties and environmental conditions (Woolfe, 1987). However, the observed variations in the protein content could be attributed to the differences in the cultivars, cultural, climatic, and other environmental factors during their growth stage. This result is in line with other research reports that indicated the nutritional content of yam varies with species (Zinash, 2008). The yam species are reported to have higher protein content than other important tuber crops like cassava (Charles et al., 2005) and sweet potato (Moongngarm, 2013).

The results showed that carbohydrate was 67.57 to 72.78% for the flour from raw Bulcha and boiled Wenago red yam variety, respectively. The combined processing methods of boiling and sun-drying improve the nutrient quality (carbohydrate content) of the wenago red yam variety more than the raw processing method. The high carbohydrate content indicates that the aerial yam cultivars are an excellent source of energy. Enwere (1986) also reported that carbohydrates predominate in all the solid nutrients in roots and tubers.

The insignificant differences obtained in the crude fiber, ash, and energy values of yam flour samples.

Table 1: Mean value of proximate composition of Yam varieties & Processing Methods

Yam Variety	Processing methods	N	Parameters						
			Moisture (%) w/w	Ash (%) w/w	Crude fiber (%) w/w	Crude Protein (%)	Fat (%) w/w	CHO (%)	Energy (kcal/ 100g)
Bulcha	Raw + Sundried	2	12.32± 0.17 [a]	1.61±0.82	0.63±0.04	15.98±1.68 [a]	1.88±0.05 [a]	67.57±2.58 [b]	351.12±4.12
	Boiled + sundried		11.55 ±0.35 [ab]	1.23±0.62	0.63±0.04	14.92±0.19 [ab]	1.68±0.07 [a]	69.98±0.09 [ab]	354.74±0.52
Wenago red	Raw + sundried	2	11.57±0.81 [ab]	1.19±0.50	0.62±0.03	13.78±0.24 [ab]	1.59±0.21 [a]	71.23±1.81 [ab]	354.39±4.30
	Boiled + sundried		11.17±0.03 [ab]	1.18±0.31	0.64±7.071	13.14±0.92 [b]	1.07 ±0.04 [b]	72.78±1.15 [a]	353.38±1.37
Wenago-1	Raw + sundried	2	11.05±0.70 [b]	1.12±0.53	0.74±0.084	14.77±1.27 [ab]	1.60±0.31 [a]	70.71±2.91 [ab]	356.37±3.69
	Boiled + sundried		11.07±0.24 [b]	1.25±0.65	0.75±0.06	14.52±1.00 [ab]	1.68±0.12 [a]	70.71±0.28 [ab]	356.08±3.96
Local (control)	Boiled + sundried	2	11.85±0.54 [ab]	1.72±0.50	0.69±0.09	14.78±0.31 [ab]	1.53±0.06 [a]	69.41±0.50 [ab]	350.58±0.21
CV (%)			4.25	43.83	8.90	6.63	10.11	2.41	0.88
LSD (0.05)			1.1572	NS	NS	2.2808	0.3775	4.0123	NS

In contrast, only one proximate parameter (fat content) showed significant variations ($p < 0.05$) between the different yam varieties and processing methods. The rest evaluated proximate parameters (moisture, ash, crude fiber, crude protein, CHO and energy content) didn't show any significant difference ($p > 0.05$) between the different yam varieties and processing methods (Table 2). According to Azeredo et al. (2021), dietary fats increase food's palatability by absorbing and retaining flavors, which is very important from the nutritional point of view because 1 g of fat gives 9kcal energy. Low-fat values in food samples potentially contribute to increased shelf duration due to decreased possibilities of rancidity (Adejuwon et al. 2020). However, excess crude fat intake has well-established health implications in humans (Hammad et al. 2016).

Table 2: Analysis of Variance (ANOVA) Results for Effect of Yam varieties & Processing Methods on Proximate Composition

Parameters	SV	DF	SS	MS	F	P
Moisture	Trt	6	2.6039	0.43398	1.81	0.2272
	Error	7	1.67645	0.23949		
	Total	13	4.28035			
Ash	Trt	6	0.67119	0.11186	0.33	0.9021
	Error	7	2.38625	0.34089		
	Total	13	3.05744			
Crude fiber	Trt	6	0.0361	6.02E-03	1.67	0.2588
	Error	7	0.02525	3.61E-03		
	Total	13	0.06135			
Crude protein	Trt	6	9.7013	1.62E+00	1.74	0.2429
	Error	7	6.5123	9.30E-01		
	Total	13	16.2135			
Fat	Trt	6	0.73784	1.23E-01	4.82	**0.0291***
	Error	7	0.17845	2.55E-02		
	Total	13	0.91629			
Carbohydrate	Trt	6	31.3666	5.23E+00	1.82	0.2265
	Error	7	20.1543	2.88E+00		
	Total	13	51.5208			
	Trt	6	61.603	1.03E+01	1.07	0.4593
Energy	Error	7	67.232	9.60E+00		
	Total	13	128.835			

Where: SV= Source of variation, DF= degree of freedom, SS= Sum of square, MS= Mean square, and a significant difference was at $P < 0.05$.

Sensory Acceptability of Yam Porridge Variants

There were significant differences in sensory acceptability of porridge developed from a flour of different yam varieties and processing methods. The sensory evaluation in the present study was done with mothers and their children at an age below two years. The flavor, taste, color, appearance, and mouthfeel of porridge ranged from 2.33 to 4.50, 2.06 to 4.50, 3.23 to 4.36, 3.20 to 4.53, and 3.46 to 4.66, respectively, while overall acceptability varied from 2.93 to 4.46 and was significantly ($p<0.05$) rated lower than in control samples. The variation between the formulated porridge rating and that of the control sample could be attributed to the familiarity of the panelists with the control sample or variation in food compositions.

The findings indicated that the porridge developed from different yam varieties and processing methods had a significant difference ($P < 005$) in all sensory attributes (Table 4).

Table 3: Sensory Acceptability of Porridge Developed from Different Yam Varieties & Processing methods

Yam Variety	Processing methods	Sensory attributes					
		Flavor	Taste	Color	Appearance	Mouth feel	Overall acceptability
Bulcha	Raw + Sundried	4.50±0.93a	4.50±1.00a	4.26±1.08ab	4.40±1.00a	4.66±0.66a	4.46±0.71a
	Boiled + sundried	2.83±1.55c	2.60±1.56c	3.70±1.34abcd	3.63±1.32bc	3.46±1.33d	3.24±1.10c
Wenago red	Raw + sundried	2.33±1.47c	2.13±1.30c	3.23±1.63d	3.20±1.62c	3.76±1.16cd	2.93±1.11c
	Boiled + sundried	2.50±1.71c	2.06±1.43c	3.53±1.63cd	3.63±1.56bc	3.76±1.16cd	3.10±1.16c
Wenago-1	Raw + sundried	4.16±1.11ab	4.20±1.12ab	4.33±1.06a	4.53±0.89a	4.13±0.93bc	4.27±0.68a
	Boiled + sundried	4.13±1.13ab	4.26±1.11ab	4.36±0.88a	4.36±0.88a	4.43±0.77ab	4.31±0.73a
Local (control)	Boiled + sundried	3.56±1.71b	3.70±1.68b	3.96±1.47abc	3.93±1.52ab	3.50±1.40d	3.73±1.16b
N		30	30	30	30	30	30
Grand mean		3.43	3.35	3.91	3.95	3.96	3.72
CV		36.97	35.19	31.72	30.97	23.62	22.60
LSD		0.7172	0.6826	0.6776	0.6610	0.5572	0.4976

CV = coefficient of variation; values are mean ± SD and mean values followed by the same letter in a column are not significantly different at 5% level of significance.

The findings indicated that the porridge developed from different yam varieties and processing methods had a significant difference (P < 005) in all sensory attributes (Table 4).

Table 4: Analysis of Variance (ANOVA) results for sensory attributes of Porridge Developed from Different Yam Varieties & Processing methods

Attributes	SV	DF	SS	MS	F	P
Flavor	Replicati	29	122.424	4.2215		
	Product	6	138.733	23.1222	14.35	0.0000
	Error	174	280.41	1.6115		
	Total	209	541.567			
Taste	Replicati	29	122.781	4.2338		
	Product	6	200.924	33.4873	24.06	0.0000
	Error	174	242.219	1.3921		
	Total	209	565.924			
Color	Replicati	29	91.314	3.14877		
	Product	6	34.857	5.80952	3.77	0.0015
	Error	174	268.286	1.54187		
	Total	209	394.457			
Appearance	Replicati	29	80.9	2.78966		
	Product	6	44.381	7.39683	4.92	0.0001
	Error	174	261.333	1.50192		
	Total	209	386.614			
Mouth feel	Replicati	29	90.838	3.13235		
	Product	6	38.495	6.41587	7.33	0.0000
	Error	174	152.362	0.87564		
	Total	209	281.695			

Overall acceptability	Replicati	29	70.724	2.4388		
	Product	6	73.293	12.2155	17.25	0.0000
	Error	174	123.244	0.7083		
	Total	209	267.261			

Where: SV= Source of variation, DF= degree of freedom, SS= Sum of square, MS= Mean square, and a significant difference was at $P < 0.05$.

Conclusion and Recommendations

As indicated above, there is a significant difference between treatments with respect to moisture content, crude protein, fat, and carbohydrate content, but there is no significant difference with respect to ash, crude fiber, and energy content. The highest moisture content and crude protein content were recorded from the raw (fresh) Bulcha + sun-dried sample. Thus, incorporating yam tuber flour into the diet could contribute to amino acid balance. The highest carbohydrate content was recorded from the boiled Wonago red + sun-dried sample. The Bulcha variety revealed the highest mean value of moisture content and crude protein content compared to the rest of the yam varieties. Similarly, the Wonago Red variety revealed the highest mean value of carbohydrate content compared to the rest of the yam varieties.

The sensory analysis of the yam tubers indicated that Bulcha and Wenago-1 were the most preferred species in most of the sensory attributes. In conclusion, the good nutrient content and sensory attributes of the two yam tubers might make them potential food for the rural people in the country.

The high variability was observed among and within yam varieties and different processing techniques due to their proximate composition. The combined processing methods of boiling and sun-drying improve the nutrient quality (carbohydrate content) of the wenago red yam variety more than the raw processing method. They have shown an excellent source of valuable nutrients that can contribute significantly to the human diet and nutrition.

Based on the findings, the researchers would like to share the following recommendations: In order to obtain detailed scientific evidence on the variation of anti-nutritional, mineral, vitamin, amino acid, and fatty acid contents of yam, further studies are needed. It could be good if cultivation and consumption of yams are encouraged since they have high nutritional content, such as moisture content, crude protein, and carbohydrates.

Ethical Consideration

Permission was obtained from Ari Zone and Debube Ari woreda health offices. Informed consent was also obtained from the mother and father of the study-participating child. Data obtained from each study participant were kept confidential. Nutritional advice was also given to those mothers/caregivers on child feeding.

ACKNOWLEDGEMENTS

The authors would like to express their deepest appreciation to the Jinka Agricultural Research Center (JARC) for their efforts in allocating budget and facilitating logistics for data collecting and laboratory analyzing. Finally, we would like to express our appreciation for the cooperation and participation of the Debube district Agricultural office, developmental agents, health extension workers, and participant mother and child pairs during this study.

Author contributions

As the sole author of this work, all activities and the writing process were carried out independently by Anteneh Tadesse Ayalew.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Data availability

The datasets used to support the findings of this study are available from the corresponding author upon request.

Declarations Conflict of interest

The authors declare no competing interests.

References

1. Adejuwon, O. H., Jideani, A. I., & Falade, K. O. (2020). Quality and public health concerns of instant noodles as influenced by raw materials and processing technology. *Food Reviews International, 36*(3), 276–317. https://doi.org/10.1080/87559129.2019.1642348
2. Adepoju, O. T. (2012). Effect of processing methods on nutrient retention and contribution of white yam (*Dioscorea rotundata*) products to nutrient intake of Nigerians. *African Journal of Food Science, 6*(6), 163–167.
3. Alhassan, A. Y. (1994). *Post-harvest aspects of yam and cassava in Ghana: Consultancy and energy storage.* Consultancy Report, MOFA/GTZ, Ghana.
4. AOAC. (2000). *Official methods of analysis* (Vol. II, 17th ed.). Association of Official Analytical Chemists International.
5. Azeredo, H. M., Tonon, R. V., & McClements, D. J. (2021). Designing healthier foods: Reducing the content or digestibility of key nutrients. *Trends in Food Science & Technology, 118,* 459–470. https://doi.org/10.1016/j.tifs.2021.10.023
6. Baah, F. D., Maziya-Dixon, B., Asiedu, R., Oduro, I., & Ellis, W. O. (2009). Nutritional and biochemical composition of *D. alata* (*Dioscorea spp.*) tubers. *Journal of Food, Agriculture and Environment, 7*(2), 373–378.
7. Bhandari, M. R., Kasai, T., & Kawabata, J. (2003). Nutritional evaluation of wild yam (*Dioscorea spp.*) tubers of Nepal. *Food Chemistry, 82*(4), 619–623.
8. Bohm, B. A., & Kocipai-Abyazan, R. (1994). Flavonoids and condensed tannins from the leaves of *Vaccinium reticulatum* and *Vaccinium calycinum. Pacific Science, 48,* 458–463.
9. Bradbury, J. H., & Holloway, W. D. (1988). *Chemistry of tropical root crops.* Australian Centre for International Agricultural Research.
10. Bradbury, J. H., & Singh, U. (1986). Ascorbic acid and dehydroascorbic acid content of tropical root crops from the South Pacific. *Journal of Food Science, 51,* 915–920.
11. Brunner, J. H. (1984). Direct spectrophotometric determination of saponin. *Analytical Chemistry, 34,* 1314–132.
12. Cardoso, A. P., Mirione, E., Ernesto, M., & Massaza, F. (2005). Processing of cassava roots to remove cyanogens. *Journal of Food Composition and Analysis, 18,* 451–460.
13. Charles, A. L., Sriroth, K., & Huang, T. C. (2005). Proximate composition, mineral contents, hydrogen cyanide, and phytic acid of five cassava genotypes. *Food Chemistry, 92,* 615–620. https://doi.org/10.1016/j.foodchem.2004.08.024
14. Coursey, D. G. (1973). Cassava as food: Toxicity and technology. In B. L. Nestel, M. C. Band, & R. McIntyre (Eds.), *Chronic cassava toxicity: Proceedings of a workshop* (pp. 27–36). London.
15. Dabonne, S., Kouakou, D. J. E., Martin, K., Hubert, K., & Kouame, L. P. (2011). Enzymatic profile of different parts of yam (*Dioscorea*) tuber during storage. *Agriculture and Biology Journal of North America, 2*(4), 591–597. https://doi.org/10.5251/abjna.2011.2.4.591.597
16. Enwere, S. (1986). The effect of heat treatment on selected functional properties of tropical cowpea flour. *Science, 26,* 223–272.
17. Food and Agriculture Organization. (1999). *Taro cultivation in Asia and the Pacific.* FAO of the United Nations.
18. Fioreze, R., & Morini, B. (2000). Yam (*Dioscorea sp.*) drying with different cuts and temperatures: Experimental and simulated results. *Ciência e Tecnologia de Alimentos, 20*(2).
19. Guilarte, T. R., Shane, B., & McIntyre, P. A. (1981). Radiometric-microbiologic assay of vitamin B-6: Application to food analysis. *Journal of Nutrition, 111,* 1869–1875. https://doi.org/10.1093/jn/111.11.1869
20. Hammad, S., Pu, S., & Jones, P. J. (2016). Current evidence supporting the link between dietary fatty acids and cardiovascular disease. *Lipids, 51,* 507–517. https://doi.org/10.1007/s11745-015-4113-x
21. Hariprakash, C. S., & Nambisan, B. (1996). Carbohydrate metabolism during dormancy and sprouting in yam (*Dioscorea*) tubers. *Journal of Agricultural and Food Chemistry, 44,* 3066–3069.
22. Harborne, J. B. (1973). *Phytochemical methods.* Chapman and Hall.
23. Jimoh, K. O., & Olatidoye, O. P. (2009). Evaluation of physicochemical and rheological characteristics of soybean-fortified yam flour. *Journal of Applied Biosciences, 13,* 703–706.
24. Ministry of Food and Agriculture. (2007). *Statistics, research, and information directorate.*
25. Moongngarm, A. (2013). Chemical compositions and resistant starch content in starchy foods. *American Journal of Agricultural and Biological Sciences, 8,* 107–113. https://doi.org/10.3844/ajabssp.2013.107.113
26. Ngo Ngwe, M. F. S., Omokolo, D. N., & Joly, S. (2015). Evolution and phylogenetic diversity of yam species (*Dioscorea spp.*): Implication for conservation and agricultural practices. *PLoS One, 10*(12), e0145364. https://doi.org/10.1371/journal.pone.0145364
27. Nwosu, J. N. (2013). Evaluation of the functional and sensory properties of biscuits produced from aerial yam (*Dioscorea bulbifera*). *International Science and Investigation Journal, 2*(5), 1–17.
28. Okwu, D. E., & Ndu, C. U. (2006). Evaluation of the phytonutrient, mineral, and vitamin contents of some varieties of yam (*Dioscorea spp.*). *African Journal of Biotechnology, 5*(8), 123–127.
29. Onwuka, G. I. (2005). *Food analysis and instrumentation: Theory and practice.* Naphthali Prints.
30. Osagie, A. U. (1992). *The yam tuber in storage.* Post-Harvest Research Unit, University of Benin.

31. Prinyawiwatkul, W., Beuchat, L. R., McWatters, K. H., & Phillips, R. D. (1997). Functional properties of cowpea (*Vigna unguiculata*) flour as affected by soaking, boiling, and fungal fermentation. *Journal of Agricultural and Food Chemistry, 45,* 480–486.
32. Sanful, R. E., Oduro, I., & Ellis, W. O. (2013). Proximate and functional properties of five local varieties of aerial yam (*Dioscorea bulbifera*) in Ghana. *Middle-East Journal of Scientific Research, 14*(7), 947–951.
33. Shajeela, P. S., Mohan, V. R., Jesudas, L. L., & Soris, P. T. (2011). Nutritional and antinutritional evaluation of wild yam (*Dioscorea spp.*). *Tropical and Subtropical Agroecosystems, 14,* 723–730.
34. Splittstesser, W. E., Martin, F. W., & Rhodes, A. M. (1973). The amino acid composition of five species of yam (*Dioscorea*). *Journal of the American Society for Horticultural Science, 98*(6), 563–567.
35. Ugwu, F. M. (2009). The potentials of roots and tubers as weaning food. *Pakistan Journal of Nutrition, 8,* 1701–1708.
36. Viruel, J., Segarra-Moragues, J. G., Raz, L., Forest, F., & Sanmartín, I. (2016). Late Cretaceous–Early Eocene origin of yams (*Dioscorea, Dioscoreaceae*) in the Laurasian Palaearctic and their subsequent Oligocene–Miocene diversification. *Journal of Biogeography, 43*(4), 750–762. https://doi.org/10.1111/jbi.12678
37. Wanasundera, J. P. D., & Ravindran, G. (1994). Nutritional assessment of yam (*Dioscorea alata*) tubers. *Plant Foods for Human Nutrition, 46*(1), 33–39.
38. Woolfe, J. A. (1987). *The potato in the human diet.* Cambridge University Press.

CITATION

Tadesse, A., & Gutema, T. (2026). Effect of Processing Methods and Varieties on Nutrient Composition and Sensory Acceptability of Yam (Dioscorea esculenta) in Debube Ari District, Southern Ethiopia. In Global Journal of Research in Agriculture & Life Sciences (Vol. 6, Number 1, pp. 21–29).
https://doi.org/10.5281/zenodo.18734033