Evaluation of nutrient and anti-nutritional properties in air-dried and sun-dried sweet potato (*Ipomoea batatas*) flour widely consumed in Kaduna state, Nigeria

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Abstract

Sweet potato (*Ipoema batatas*) flour remains a staple food meal commonly consumed in sub-Saharan Africa, especially in Northern Nigeria. Even though processing methods can impact on the nutritional quality of the sweet potato flour. This study investigated the nutrients and anti-nutritional properties of air and sun-dried sweet potato flour currently widely consumed in Kaduna State, Nigeria. Standard analytical methods were used to determine proximate, vitamins, minerals and phytochemical compositions of air and sundried sweet potato flour. The results from the study demonstrated that there is a significant difference ($p<0.05$) in the proximate, vitamins, minerals, phytochemical and energy contents between the air and sundried sweet potato flour respectively. The results clearly demonstrated that both sun and air-dried sweet potato flour are good source of macro and micro nutrients, but air-dried sweet potato flour retains more of the nutrients. There is a reduction in the level of the nutritional factors after sun-drying compared to the air-dried sweet potato flour. The data derived from the nutrient characterization of sweet potato flour in this study are clear indications that the sweet potato flour is rich in nutrients and can be used in food formulation to address malnutrition (undernutrition) in vulnerable population especially among under five children, which is currently a serious challenge in Kaduna State.

Keywords: Nutrients, Anti-nutrients, Energy, Sweet-potato, Air-dried.

Introduction

Malnutrition is one of the overwhelming universal health problems affecting the developing countries including Nigeria, the Africa's most populous country. Malnutrition results from the improper supply of cellular energy and nutrients required for the growth and maintenance of specialized functions. Taking of inadequate or excess micro and macronutrients such as proteins, minerals and vitamins results in the onset of nutritional imbalances. Malnutrition affects structural and physiological state of brain leading to the growth impairment, tissue damage, impediment of myelination, and reduced activities of neurotransmitters among others. It affects both children and adults accounting for about 3 million death of children under the age of five annually [1]. According to the Global Nutrition Report of 2020, about 149 million children under the age of 5 are stunted, 49.5 million are wasted and 40.1 million are overweight while 677.6 million adults are obese. In Nigeria, 32% of children below the age 5 are stunted, making the country the second with highest burden of stunted children world-wide. It has been well recognized that poor diet and associated malnutrition are amongst the key public health challenges of nowadays. These challenges have triggered initiation of various programs and campaigns tilted towards boosting the production, utilization, and consumption of functional traditional foods. In this respect, cost effective, readily available, and accessible high nutrients foods would be extremely helpful in combating malnutrition and its sound effects.

Sweet potato (*Ipomoea batatas* Lam) is cultivated throughout the tropics and warm temperate regions of the world for its starchy roots, which can provide nutrition, besides energy. Some cultivars which are orange/yellow fleshed are very rich in carotenoids and a good dietary source of β-carotene from which the human body synthesizes the vitamin A. It is a crop that thrives very well in both temperate and tropical climates. In Nigeria sweet potato (*Ipomoea batatas* Lam), is grown

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virtually in all part of the country, but with Northern Nigeria having a large chunk of its cultivation. As of 2019, Nigeria has been listed among the top five global producers of the sweet potato [2].

The roots are edible, long and tapered and bears smooth skin. The short cultivation period of 3 to 4 months, high nutritional content and sweet taste of sweet potato makes it a highly valuable crop. Sweet potato is a vital nutritional source of carbohydrates, protein, dietary fiber, vitamins such as vitamin A, B_6 and C, minerals like sodium, potassium, calcium, manganese, zinc, iron and magnesium. Sweet potato is also a rich source of phytochemicals, carotene. Sugar and starch are the main carbohydrate found in sweet potato, and they account for between 30-80 gram of the entire crop and it provides about 300-450 kilocalories of energy, making it an excellent material for energy to the body.

As a staple food in Nigeria that is currently been processed and consume as solid paste other than boiling, frying and roasting, sweet potato is rich in phytochemicals, high in dietary fibre, this has contributed to it bioactivities in managing diabetes, hypertension, neuroprotective, anti-inflammatory properties which has been widely reported. Consequently, the outcome will be to promote good health and nutrition, especially for the most vulnerable. In this study we will assess the nutrient and anti-nutritional properties of air and sundried sweet potato flour commonly consumed in Kaduna State, Nigeria [3].

Materials and Methods

Sample collection and preparation

About 30 grams of sweet potatoes (*Ipomea batatas*) was purchased from local farmers in Zaria Local Government area of Kaduna State, Nigeria. The sample were subsequently washed and taken in polythene bag to the Department of Chemistry and Biochemistry Laboratory of Nuhu Bamalli Polytechnic, Zaria. The samples were peeled and sliced into smaller pieces using stainless steel-knife into uniform sizes. The slices of sweet was then quickly soaked briefly in warm water (80°C) for 5 minutes to avoid browning caused by enzymatic action. To avoid further cooking, the samples of sweet potato were immersed in cool for the 3 days, with daily changing of the water. After the third day, the sweet potato sample were rinsed with clean water and divided into two portions and dried on a stainless tray separately. The first tray was air-dried in the laboratory for 14 days with an average temperature of 24°C, while the second tray was sun-dried in the open sun at an average temperature of 37°C for 5 days respectively. The dried slices were grounded into powder using electric grinder and sieved through 0.425 mm to obtain sweet potatoes powder. The powder obtained was packed in airtight plastic bags and kept in a refrigerator at 4°C until use [4].

Proximate composition of air and sundried sweet potato flour

The proximate composition and nutritional quality of the sweet potatoes (*Ipomea batatas*) flour will be determined using the standard methods as described by Association of Analytical Chemist (AOAC).

Determination of moisture content: A clean crucible will be dried to constant weight in an air oven at 150°C, cooled in a desiccator and weighed (W). 2 g of sample will be accurately weighed into the previously labeled crucible and reweighed (W_2). The crucible will be dried in oven to a constant weight. The percentage moisture content will be calculated thus:

$$\% \text{ moisture content} = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

Determination of ash content: The porcelain crucible will be dried in an oven at 100°C for ten minutes, cooled in a desiccator and weighed (W_1). 2 gram of the sample will be placed into the previously weighed porcelain crucible and weighed (W_2). The sample will be first ignited and transferred into a furnace which will then set at 550°C. The sample will be left in the furnace for 8 hours to ensure proper ashing. The crucible containing the ash will be remove, cooled in the desiccator and weighed (W_3). The percentage ash content will be calculated as:

$$\% \text{ ash content} = \frac{W_3 - W_1}{W_2 - W_1} \times 100$$

Determination of crude lipid content: A clean, dried 500 ml round bottom flask containing few anti-bumping granules will be weighed (W_1) and 300 ml of petroleum ether (40-60°C) for extraction will be poured into the flask fitted with Soxhlet extraction unit. The extractor thimble containing 20 g of the sample will be fixed into the Soxhlet extraction unit. The round bottom flask and condenser will be connected to the Soxhlet extractor and cold water circulation will be put on. The heating mantle will be switched on and the heating rate will be adjusted until the solvent is refluxing at a steady rate. Extraction will be carried out for six hours. The solvent will be recovered and the oil will be dried in the oven at 70°C for one hour. The round bottom flask containing the oil will be cooled in the desiccator and the weighed W_2. The lipid content will be calculated thus:

$$\% \text{ Crude lipid content} = \frac{W_2 - W_1}{\text{Weight of Sample}} \times 100$$

Determination of crude fibre: 2 g of sample will be weight out into a round bottom flask 100 ml of 0.25 m sulphuric acid solution will be added and the mixture boiled under reflux for 30 minutes. The hot solution will be quickly filtered under suction. The insoluble matter will be sieved several times with hot water until it is acid free. It will be quantitatively transferred into the flask and 100 ml of hot 0.31 m sodium

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hydroxide solution will be added and the mixture boiled again under reflux for 30 minutes and quickly filtered under suction. The insoluble residue will be based free. It will be dried to constant weight (C_1) will be then incinerated in a muffle furnace at 550°C for 2 hours, cooled in the desiccator and reweighed (C_2) [5].

$$\text{The loss of weight on incineration} = \frac{C_1 - C_2 \ X \ 100}{\text{Weight of original sample}}$$

Determination of crude protein: Exactly 1.5 g of the defatted sample in an ashless filter paper will be dropped into 300 ml Kjeldahl flask. 25 ml of H_2SO_4 and 3 g of digesting mixed catalyst (weighed separately into an ashless filter paper) will be drooped into the Kjeldahl flask. The flask was then transferred to the Kjeldahl digestion apparatus. The sample will be digested until a clear green colour will be obtained. The digest will be cooled and diluted to 100 ml with distilled water.

Distillation of the digest: 20 ml of the diluted digest sample will be measured into a 500 ml Kjeldahl flask containing anti bumping chips and 40 ml of 40% NaOH will slowly be added by the side of the flask. A 250 ml conical flask containing a mixture of 50 ml of 2% Boric acid and 4 drops of indicator will be used to trap the ammonia liberated. The conical flask and the Kjeldahl flask will be then placed on the Kjeldahl distillation apparatus, with the tubes inserted into the conical flask and the Kjeldahl flask. The flask will be heated to distill out NH_3 evolved. The distillate will be collected into the boric acid solution. From the point when the boric turned green, 10 minutes will be allowed for complete distillation of the ammonia present in the digest. The distillate will then be titrated with 0.1 m HCL.

$$\%\ N = \frac{14 \ X \ M \ x \ V_t \ X \ T_v \ X \ 100}{\text{Weight of sample (mg)} \ X \ V_a}$$

% Crude protein=% Nitrogen (N2) × 6.25

Where:

M=Actual molarity of acid

T_v=Titre volume of HCL used

V_t=Total volume of diluted digest

V_a=Aliquot volume distilled

Determination of carbohydrate: The total carbohydrate content was determined by difference as described by Ibrahim et al. The sum of the percentage moisture; ash, crude lipid, crude protein and crude fiber will be subtracted from 100

% Total carbohydrate (CHO)=100–(% moisture+% Ash+% Fat+% Protein+% Fiber)

Determination of minerals content in air and sundried sweet potato

The mineral elements (Mn, K, Ca, Mg, Fe and Zn, chromium, Ni and Cu) were determined by Atomic Absorption Spectrophotometry (AAS) according to the methods described by AOAC. Briefly, about 2 g of the sample of each sweet potato variety were dried using hot oven at 100°C for 30 minutes. The dried samples were placed on hot plate until smoke-free. Subsequently, furnace set at 550°C for 3 hours was used to obtained white ash of the samples. The ash was dissolved in 5 ml of 6 M HCl by warming on hot plate for 2-3 minutes. The solution obtained was put into 50 ml flask followed by addition of 1 M HNO_3. The standard solutions of the mineral elements were prepared by dissolving the stock standard in 0.3 M HCl to the desired conczentrations. The AAS was calibrated using the standard solution. The solutions were sprayed into the Atomic Absorption Spectrophotometer (AAS) and minerals were quantified by taking the absorbance at a specific wavelength of the elements. This was repeated twice [6].

Vitamins content determination in air and sundried potato flour

Determination of vitamin C: The modified method of the method adopted by Awolu et al. was used. The vitamin C content of the hydrophilic extracts from the sample was determined by the spectrophotometric method using ascorbic acid as a reference compound. Exactly 10.0 ml of the juice sample was weighed into 10 ml of water and mixed together. 200 µl, that is, 0.2 ml of the extract was pipetted and mixed with 300 µl (0.3 ml) of 13.3% of Trichloro-Acetic Acid (TCA) and 75 µl (0.075 ml) of Dinitrophenylhydrazyl (DNPH). The mixture was incubated in water bath at 37°C for 3 h. After 3 h, 500 µl (0.5 ml) of 65% sulphuric acid was added and the absorbance was read with the spectrophotometer at 520 nm. The concentration of vitamin C was calculated as follows:

$$\frac{\text{Absorbance of standard}}{\text{Concentration of Sample}} = \frac{\text{Absorption of sample}}{\text{Concentration of sample}}$$

Determination of vitamin A: Method of AOAC was used. Exactly 1 ml of the hydrophilic extracts from the sample was measured to the test-tube I (centrifugal) with a tight stopper and 1 ml of the KOH solution was added, the tube was plugged and shake vigorously for 1 min. The tube was heated in a water bath (60°C, 20 min), and was then cooled down in cold water. About 1 ml of xylene was added, the tube was plugged and shake vigorously again for 1 min. The tube was centrifuged (1500 × g, 10 min), the whole of the separated extract (upper layer) was collected and transferred into the test tube II made of "soft" (sodium) glass. The absorbance A1 of the obtained extract was measured at 335 nm against xylene. The extract in the test tube II was irradiated to the UV light for 30 min, then the absorbance A2 was measured. The concentration (Cx) of vitamin A (µM) in the analyzed liquid was calculated using the equation:

Cx=[A1]-[A2] × 22.23

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Where 22.23 is the multiplier received on basis of the absorption coefficient of 1% solution of vitamin A (as the retinol form) in xylene at 335 nm in a measuring cuvette, 1 cm thickness [7].

Phytochemicals analysis of air and sundried sweet potato flour

Tannins in the roots of red and yellow-fleshed sweet potatoes were determined using the method described by. About 10 ml of 70% acetone was mixed with 0.2 g of the powdered sample in a 50 ml bottle. The bottle was shaken in ice shaker for 2 hours at 30°C and centrifuged, the supernatant was kept in ice. About 0.2 ml and 0.8 ml of the supernatant and distilled water were mixed in a test tube to obtain a test solution of 1 ml. About 0.5 mg/ml of the standard tannate stock was treated with 0.5 ml distilled to make a standard solution of 1 ml. A 0.5 ml of Folin Ciocalteu reagent and 2.5 ml of 20% Na_2CO_3 were added to both test sample and standard solutions, vortexed and incubated at room temperature for 40 minutes. The absorbances were read at 725 nm and the concentrations of tannins were extrapolated from the calibration curve of standard tannate. For the determination of glycosides, the chloroform solution of the sample was filtered into 100 ml flask followed by addition of 10 ml of pyridine and 2 ml of 29% of sodium nitroprusside. Addition of 3 ml of 20% NaOH to the solution result in the development of brownish yellow color. The glycosides standard with concentration within the range of 0-50 mg/ml was used to prepare standard calibration curve, the absorbance of the sample and standard was taken at 510 nm. Saponins and flavonoids were assessed by the method explained by Bao.

Data analysis

Data collected was analysed using Statistical Package for Social Sciences (SPSS) version 20. Student t-test was used to compare means, results was presented as mean standard deviation of duplicate determination. ($P \leq 0.05$) was considered significant [8].

Results

Table 1 below revealed the results for proximate analysis for shed and sun-dried sweet potatoes (*Ipoema Batatas*) flour. The results indicated that there is a significant difference ($P<0.05$) in all the proximate compositions between shed and sun-dried sweet potatoes flour. In terms of energy, both shed and sun-dried sweet Potatoes can provide substantial number of calories required for other metabolic process.

Table 1. *Proximate composition of shed and sun-dried sweet potatoes flour.*

Parameters (%)	Shed dried	Sun-dried	WHO daily intake in food
Moisture	8.32 ± 0.02^{a}	6.13 ± 0.01^{b}	<10%
Ash	11.77 ± 0.03^{c}	8.57 ± 0.04^{d}	>7%
Crude protein	18.32 ± 0.04^{e}	16.09 ± 0.03^{f}	10-35% of total calories
Crude lipid	4.13 ± 0.02^{g}	2.37 ± 0.01^{h}	20-25% of daily calories
Crude fibre	8.31 ± 0.02^{i}	6.77 ± 0.01^{j}	22.4-33.6
Total carbohydrate	49.15 ± 0.03^{k}	60.07 ± 0.05^{l}	45-65% of daily calories
Kcal value	306.45 ± 1.13^{m}	501.89 ± 1.32^{n}	2000-2500
Note: Results are mean ± SD of duplicate determinations. Values on same rows with same super subscripts do not differ significantly at P<0.05			

Table 2 below demonstrates the results of vitamins presents in shed and sun-dried sweet potatoes flour. The results clearly indicate a significant difference ($P<0.05$) in the vitamin A in shed and sun-dried sweet potatoes as (1.33 ± 0.02-0.72 ± 0.01). A significant difference ($P<0.05$) was also observed in the vitamin C content of shed and sun-dried sweet potatoes flour (16.32 ± 0.06-12.13 ± 0.03), although amount of vitamin C within the WHO daily required intake. The table indicated that there is no significant difference ($P>0.05$) in the vitamin E content for shed and sun-dried sweet potatoes four respectively.

Table 2. *Vitamins composition of air and sun-dried sweet potatoes flour.*

Vitamins (mg/100 g)	Air-dried	Sun-dried	WHO daily intake in food
A	1.33 ± 0.02^{a}	0.72 ± 0.01^{b}	0.7-0.9
C	16.32 ± 0.06^{c}	12.13 ± 0.03^{d}	75-90
E	1.46 ± 0.02^{e}	1.11 ± 0.02^{f}	11-15
Note: Results are mean ± SD of duplicate determinations. Values on same rows with same super subscripts do not differ significantly at P<0.05			

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Table 3 below indicate the results for the mineral compositions in air-dried and sun-dried sweet potato flour. The results demonstrated that there was significant difference ($p<0.05$) the mineral compositions of the air-dried when compared to the sun-dried sweet potato flour respectively. The table also shows that iron and manganese are within the WHO daily required intake, while the heavy metals are far less than the WHO permissible level for consumption in food [9].

Table 3. *Mineral concentrations of shed and sun-dried sweet potatoes flour.*

Minerals (mg/100g)	Air-dried	Sun-dried	WHO required daily intake
Zinc	1.12 ± 0.01^{a}	1.09 ± 0.01^{b}	8
Calcium	54.12 ± 0.03^{c}	47.31 ± 0.02^{d}	1200
Iron	17.07 ± 0.04^{e}	15 ± 0.03^{f}	8-18
Magnesium	9.31 ± 0.02^{g}	7.11 ± 0.02^{h}	320-420
Potassium	711.12 ± 1.34^{i}	537.13 ± 1.12^{j}	2600
Nickel mg/kg	0.53 ± 0.02^{l}	0.49 ± 0.01^{m}	0.72
Lead mg/kg	0.00 ± 0.00^{n}	0.0009 ± 0.01^{o}	0.045
Copper (mcg)	0.007 ± 0.01^{p}	0.002 ± 0.01^{q}	1400-1700
Chromium mg/kg	0.011 ± 0.01^{r}	0.014 ± 0.01^{s}	20-30
Manganese	1.78 ± 0.02^{t}	1.65 ± 0.01^{u}	1.8-2.3
Note: Results are mean ± SD of duplicate determinations. Values on same rows with same super subscripts do not differ significantly at P<0.05			

Table 4 below shows the results of phytochemicals for shed and sun-dried sweet potato flour, the results for alkaloids, flavonoids, tannins, oxalate, phytates, saponins and cyanogenic glycosides for the shed and sun-dried sweet potato flour are (2.23 ± 0.03-2.01 ± 0.02), (1.11 ± 0.02-0.09 ± 0.01), (0.23 ± 0.02-0.19 ± 0.01), (155.32 ± 0.33-136.41 ± 0.30), (1.33 ± 0.02-1.01 ± 0.01), (0.87 ± 0.01-0.07 ± 0.01) and (7.87 ± 0.03-6.77 ± 0.01) respectively. The results demonstrated that all the phytochemicals, except tannins shows significant difference ($p<0.05$) between shed and sun-dried sweet potato flour in the air and sundried sweet potato flour were significantly different ($p<0.05$).

Table 4. *Phytochemical content of shed and sun-dried sweet potatoes flour.*

Phytochemical (mg/10 g)	Air-dried	Sun-dried
Alkaloids	2.23 ± 0.03^{a}	2.01 ± 0.02^{b}
Flavonoids	1.11 ± 0.02^{c}	0.09 ± 0.01^{d}
Tannins	0.23 ± 0.02^{e}	0.19 ± 0.01^{e}
Oxalate	155.32 ± 0.33^{f}	136.41 ± 0.30^{g}
Phytates	1.33 ± 0.02^{h}	1.01 ± 0.01^{i}
Saponins	0.87 ± 0.01^{j}	0.07 ± 0.01^{k}
Cyanogenic glycosides	7.87 ± 0.03^{l}	6.77 ± 0.01^{m}
Note: Results are mean ± SD of duplicate determinations. Values on same rows with same super subscripts do not differ significantly at P<0.05		

Discussion

The proximate composition and vitamins, were analyzed in two different sweet potatoes varieties cultivated in Nigeria. The proximate analysis has revealed that air (shed) dried sweet potato contains significantly higher amount of moisture compared to the sundried sweet potato flour, these variations could be attributed to increased temperature during drying as sun drying removes water faster than air drying. This finding is in agreement with that reported by Agubosi, who reported a reduction in moisture content during sun drying of sweet potato peel. This study reported a moisture content of (8.32 ± 0.02 and 6.13 ± 0.01) percent, which is <10% required by WHO in food to maintain a longer shelf life which implies that both sundried and air-dried sweet potato flour will be less prone to damage from insect and moulds. This is particularly crucial for the processing, storage, stability and enhancement of the shelf life of the flour.

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The ash content is simply a reflection of the mineral content present in a substance. This study revealed a significant ($P<0.05$) higher ash content in the air-dried potato flour when compared to the sun-dried sweet potato flour. The findings from this study are similar to that reported by Ellong among different varieties of sweet potatoes in Nigeria. The ash content is an indication that sweet potato is a good source of minerals.

The percentage of crude protein, demonstrated that the air-dried sweet potato flour was significantly higher ($P<0.05$) compared to the sun-dried sweet potato flour. These variations could likely be due to denaturation of proteins with increased temperature as peptide bond holding amino acids in protein are affected by temperature. The findings from this study are in contrast to that reported by Abdulmuini et al., who reported 6.32% of protein in different cultivars of sweet potato in North Western Nigeria. These variations could likely be due to processing methods of geographical locations. Proteins are critical macromolecules required for the proper growth and development of the human body. The crude protein content from this study even though smaller compared to the WHO daily required intake, it has shown that sweet potato flour is a good source of protein and can be use in formulation of food.

The differences observed in the nutrient value of fat, carbohydrate and energy between the air-dried and sun-dried sweet potato flour could be due to losses during drying as a result of the higher drying temperature compare to the air-dried sweet potato flour. There could also be lipid oxidation, leaching and increased solubilization of some micro-nutrients into the evaporating water.

Vitamin A, C and E are antioxidant needed for the proper functioning of the body. They are critical in removing free radicals from the cell of the body, they also play immune function to the body. This study demonstrated a significant ($P<0.05$) amount of vitamin A and C in air-dried sweet potato flour compare to the sun-dried flour. The variation could be due to the effect of high drying temperature. The nutritive value of food is affected by the dehydration process. Vitamins A and C are destroyed by heat and air drying, but the impact is much on during sun drying. The findings from this study corelate with that reported by Alagbe; Adewale et al., in South Western Nigeria who reported a significant reduction in vitamins A, C and E in sundried vegetable leaves.

Phytochemicals are secondary metabolites which protect plants against degenerative disease and exhibits several pharmacological effects in animals. The result from this study shows that all the phytochemicals are present in both the shed and sun-dried sweet potato. Even though, the phytochemical content in the air-dried sweet potato flour indicted a more than the sundried sweet potato flour, this could be as a result of the heat from the sun. This is evident that raw samples of sweet potato flour are grater in phytochemical contents. Saponins is characterized by a bitter taste, foaming properties and possess antimicrobial properties. The anti-nutritional effect of saponins is the retardation in growth rate, due to reduction in feed intake is probably the major concern. Phytates bind minerals like calcium, iron, magnesium and zinc and make them unavailable. Exposure to cyanide or intentional consumption of cyanogenic glycosides may lead to acute intoxications, characterized by growth retardation and neurological symptoms resulting from tissue damage in the central nervous system.

This agrees with the study of Ezeocha et al., on water yam and the study by Lewu et al., cocoyam and other tubers in South Africa and concluded that cooking remarkably reduced the anti-nutrient contents of tubers.

Table 2 shows the mineral composition of air-dried and sun-dried sweet potato flour. Results showed that air-dried sweet potato flour have a higher deposit of minerals than sun-dried sweet potato flour. However, sun-dried sweet potato peels have a higher value in lead when compared to the air-dried sweet potato flour, which could likely be due to contamination in the drying location. This finding is in agreement with that reported by Agubosi et al., who reported a reduction in the mineral contents of air-dried and sun-dried sweet potato peel. The minerals analyzed in this study are classified as micro and macro minerals. Lack of these minerals in right quantity and quality in the diet of humans and animals could result in deficiency. Calcium plays a vital role in providing rigidity and support to animals. Magnesium, zinc, iron and manganese are important co-factors found in the structure of certain enzymes and are indispensable in numerous biochemical pathways. Interrelationship also occurs between various minerals in the body, for instance, zinc, copper and magnesium deficiency could result in low birth rate, infertility and other reproductive abnormalities. Copper deficiency results in an increase in iron in the liver, potassium is an important cellular cation involved in the regulation of acid base balance and muscle contraction.

Conclusion

The data from this study demonstrated that, sweet potato either air or sun-dried contain different nutrients in varying amounts. The air-dried sweet potato flour retains more of the key nutrients than the sun-dried sweet potato flour. The proximate composition, minerals elements, vitamins and phytochemicals were analyzed in both air and sun-dried potato flour. The air-dried sweet potato flour contains substantial nutrients that when augmented with nutrients from other food will meet the WHO daily required intake. The potato flour can be used for food formulation for under five children and the elderly population in other to meet their nutritional needs and for and improve their quality of life.

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