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Proximate analysis of the edible part of the African walnut *(Juglans spiecie)*

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ABSTRACT

The juglans spiecie of the African walnut was collected from three major towns in Osun state and a local market in Abia state. Both the raw and boiled samples were analysed, the percentage range of the results are: moisture content 4.30 -4.50, 5.00 – 5.20, ash content; 7.00 – 7.10' 6.20 – 6.30; 6.50 -6.60; crude protein 17.73 -17.75, 25.27 – 25.30; crude fibre 6.50 – 6.60, 6.00 – 6.20; crude oil 56.55 – 56.60, 53.95- 54.00 and carboyhyrate 25.72 – 25.80, 20.77 – 20.78 while the range values of the following minerals in mg/100g are Ca 40.06 – 40.07; 41/06 – 41.00,Mg 55.50 – 56.00; 57.40 – 58.00, P 460.00 – 460.66; 470.55 – 470.95; these were the major minerals while Cu, Fe, Zn,Mn were also detected at low concentrations. The oils were also analysed and 75% of the oil was found to be unsaturated.

KEYWORDS

Walnut;
Boiled;
Unboiled;
Mineral contents.

INTRODUCTION

Walnut is one of the most widely used nuts among the desert nuts, it belongs to the juglndaceae family. It originated from the temperate region,where it grows spontaneously and 50% of the production is consumed without processing in Turkey[1] while in Nigeria, all the production is consumed locally[2]. The ripe nuts is eaten as a desert in Nigeria either in boiled or roasred form unlike in some other countries[3].

African walnut is also known as conophor nut (Tetra carpidum conophorum). Its local name is Awusa or Asala in yoruba area of Nigeria and formerly called Plukeletia Conofora[4]. The nut is rich in fat, protein and in minerals and vitamins. The minerals content and percentage oil content of the nut varies depending on its cultival, soil paprameters and climatic conditions of where it is grown[3]. The oil is rich in monounsaturated oil- Oleic and other two polyunsaturated oil; Linolenic and α-linolenic acids, in fact, 60% of the oil is of oleic and linoleic acids[3] and[1], thus, its oil is edible and could also be used as an industrial raw material.

A bitter after taste is usually observed upon drinking water immediately after eating the nuts[5] and this could be attributed to the presence of alkaloids and anti-nutritional material int the nut. The shelf life of the traditionally processed (cooked) nut is more than three days, after which it can develop off-flavour as a result of rancidity of its oil but this could be successfully extended to at least one month through combination of heat procrssing,burning, frying and frozen storage[6]. The nut is also reported to have medicinal values in that its consumption can reduce the level of cholesterol in the blood[7].

The aim of this research work is to determine the physico-chemical properties of the edible part of walnut and compare these properties of local specie (Nigeria *specie*) with those from other parts of the World.

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MATERIALS AND METHODS

Cultivars of some locally produced walnuts were obtained from four major towns in Osun and Abia states of Nigeria through market survey. The nut both boiled and unboiled samples were deshelled and the edible part was sliced, some was air dried, while 10g was oven dried at 105°C for 2 hours to determine its moisture content. The air dried samples was milled to obtain the flour sample of the nut. For oil analysis, 2g of the milled samples were subjected to extraction by soxhlet extraction method, using petroleum ether as solvent. The extraction was done for 24 hours; after which the extracted oil was passed over anhydrous sodium sulphate to dry and the petroleum ether was separated from the oil by using rotary evaporator[8].

The nitrogen content wa estimated by the Kjedhal method and was converted to protein content by using the conversion factor of 6.25. also, the ash content and crude fibre were determined by using[8] method. The carbohydrate content was obtained by difference[9]. The mineral elements were determined by digesting the ash with 3mol/dm^3 HCl and using the flame photometer for sodium and potasium while atomic absorption spectrophotometer was used for Ca, Mg, Mn, and Zn[9]. Phosphorous was determined by molybdate method. The oil parameters were determined using the standard methods[10] while the esters were prepared by the method of Hartman and Lago has reported in Pearson's chemical Analysis of foods[11].

The fatty acid of methyl esters were chromatographed using High Pressure Liquid Chromatography (HPLC) HP 6890 presented with HP Chem station Rw A09.01 (1206) software with the following conditions: oven temperature:- initial temperature 60°C for 3 minutes raised by 8°C to 140°C and kept for 10 minutes, after which it was raised to 250°C at the rate of 10°C/min. and kept for another 10mins. The HPLC is equiped with FID fused with HP-INNO wax (cross-linked PEG, capillary column (30m x 0.32mm i.d) film thickness, 0.50 micrometer, injector and detector temperature 230°C ans 275°C respectively, carrier gas is nitrogen at flow rate of 30.0ml/min. Peaks of the methyl esters where identified by comparing thier retention times with those of auhtentic standards under the same operating conditions. The percentage areas were measured by triangulation and the relative proportion of the induvidual componets obtained by determing the proportional area in relation to total area.

RESULTS AND DISCUSSION

The physco-chemical properties of the walnut is shown in TABLE 1, the percentage moisture content of the unboiled sample is higher than that of the boiled sample, 4.30 and 5.01% respectivelly. This value is comparable to the previous work done on walnut sample in Nigeria as reported by[12] was 3.63% and 5.13% respectively for unboiled and boiled samples. The percentage ash content of the raw sample and the boiled sample are 7.00 and 6.20 respectively, the value of the raw sample is higher than that of the boiled, but both value are higher than those reported by [1] which ranged between 1.99% and 2,53%.

The fat content of the nut is high, 44.50 and 51.21% respectively for both raw and boiled samples; both values are lower than those of the species form Turkey as reported by[1]; the value was reported to range between 61.37-72.13% respectively. The crude fibre values are 6.5 and 6.0 % for both raw and boiled samples, higher than that from Turkey. Also, the crude protein, whose values are 28.22 and 27.48% respectively. It is higher in value than that reported in literature 109.47 and 22.53% respectively and also that reported from Turkey whose value ranged between 7.01 – 8.10% for various species[1],but[13] also from Turkey reported a higher value that ranged from 15.50 – 19.24% respectivelt for dry weight of the nut.

The percentage total carbohyrate of the raw nut was 9.48, while that of the boiled was 4.10, the value for raw sample was found to be higher than that of the boiled sample, while[13] reported a value that ranged between 8.05 – 13 23%. The physical and chemical properties of the walnut karnel are also reported in TABLE 1.

The percentage free fatty acid for the raw and boiled samples are 2.50 and 1.97 respectively. If the free fatty acid is greater tahn 0.5%, the the probability that the oil will have a taste defect was reported by[14], thus walnut oil will have a taste defect, but may not smoke at higher temperature because its of high free fatty acid. The percentage acid value of the nut also revealed a value of 3.60 for raw sample and 2.80 for boiled sample. The value for the boiled sample is higher than that of the raw sample, while the percentage saponification value of the raw sample is 110.05 while

for the boiled sample, it is 100.00.

TABLE 1 : Physco-chemical properties of the walnut kernel and oil.

Properties	Raw Sample	Boiled sample
% moisture content	4.30	5.01
% Ash content	7.00	6.20
% fat content	44.50	51.21
% Crude fibre	6.50	6.00
% Crude protein	28.22	27.48
% Carbohydrate	9.48	4.10
% Free fatty acid	2.50	1.97
% Acid value	3.60	2.80
% Saponification value	110.05	100.00
Peroxide value	9.40	9.35
Refractive Index	1.512	1.520
Viscosity	3.76×10^2	3.74×10^2
Specific gravity	0.8911	0.8825
% Iodine value	90.11	80.12

Average of 10 replicate results

Both values are less than that reported by[12]. The high value indicate the number of ester bonds in the fatty acid, hence that the molecules are intact during processing and that the oil will be good for soap making and in salad dressing or in making salad cream[12]. The peroxide value in Meq/Kg gave a value of 9.40 and 9.35 for both the raw and boiled samples respectively, the low value showed that the oil was not rancid as at the time of extraction, however, it shows that the oil is prone to easy deterioration[15]. Peroxide value is a measure of the active oxygen in the oil, and its high value in young oils suggest a short shelf life.

The oil is golden yellow in colour with plesant odour, has a refractive index of 1.512 and 1.520 and viscosity of 3.76×10^2 and 3.74×10^2 and specific gravity of 0.8911 and 0.8825 respectively for both the raw and boiled samples. The values are comparable to those reported by[12]. Iodine value is a measure of proportion of unsaturated acid present inthe oil, high value indicates high average number of double bonds, thus better healthfulness, but a short shelf life, in the present study, the percentage of the iodine value of walnut oils are 90.11 and 80.12 for raw and boiled samples respectively, thus lower than those of other vegetable oils which varies between 91 – 119.4 as reported by[16].

TABLE 2 shows the result of the mineral constituents of both the raw and boiled kernel of the seed, the results of the boiled were higher in all the elements determined, however they were found to be very rich in calcium, sodium, potassium, magnesium and phosphorous and their values ranged between 80 – 215 mg/100g dry weight and this is comparable to the report of[17] in fresh walnut. Other minerals present but in low concentrations are Mn, Cu,Fe and Zn and their values ranged between 2.40 – 10.60 mg/100g of dry weight but higher than those in canavalia ensiforms[9].

TABLE 2 : The nutritive mineral constituents of the raw and boiled walnut kernel (Average of Ten Determinations).

Elements	Concentration in mg/100g	
	Raw	*Boiled*
Ca	80.08 ± 1.01	86.25±2.00
Mg	85.60±0.50	87.11±2.11
Mn	2.40±0.50	2.75±0.60
Cu	2.11±0.25	2.58±0.11
Fe	5.52±0.20	6.11±0.40
Zn	5.60±0.25	10.60±2.00
Na	158.88±5.22	160.25±10.25
K	199.11±10.15	205.11±10.25
P	200.00±2.85	215.61±2.56

The fatty acid profile of the crude oil of the raw and boiled nuts appears in TABLE 3 as with most plant seed oils which are rich in Oleic linoleic, linilenic and palmitic fatty acids[9], the walnut kernel is not an exception.

TABLE 3 : Fatty acid composition of walnut kernel oil.

Fatty acids	Raw	Boiled
Stearic	4.081	4.080
Palmitic	6.313	6.311
Linolenic	9.292	9.294
Linoleic	30.571	30.572
Oleic	49.230	49.231

There was no significant difference in the fatty acid composition of both the raw and boiled kernels. There is a good content of the essential fatty acids. The major monounsaturated fatty acid, oleic acid (C18:1) is the highest fatty acid in the seed, it accounts for 49.230% of the fatty acids, higher than the concentration reported by[13]: 21.18 - 40.20% of fatty acid from some cultivars from Turkey and[19] reported a range value of 13.80 -33.0% from cultivars from New-Zealand.

The higher concentartion of oleic acid will make its consumption healthful and also make it to have a good

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shelf-life. The seed is also rich in linoleic and linolenic acids respectively-major polyunsaturated fatty acids (C18:2 and C18:3), their concentartions are 30.571 and 9.292% respectively both are good for health even though their high level may constitute short shelf-life However, their values are less than the cultivars from Turkey as reported by[1]: 49.70 -55.50% for linoleic and 14.30 – 14.80% for linolenic acid respectively. The two fatty acids are beneficial to human health as regards to human cardiovascular system[1] and[13]. Other fatty acids obtained were palmitic acid,(6.313%) and stearic acid,(4.081%). These values were comparable to that reported by[13] for cultivars from Turkey. The value of palmitic acid ranged between 5.54 – 7.62%respectively while that of stearic acid ranged between 2.61 – 3.67% respectively. Both palmitic acid and stearic acid are major saturated fatty acids, and they are very low in content in the walnut kernel. These saturated fatty acids are considered very poor for health, but contributes positively to the shelf-life of the oil[18].

CONCLUSION

The kernel of walnut is a good source of food nutrients rich in dietary protein, nutritive minirals and essential fatty acids thus, making the nut nutritionally significant when compared to other nuts. However, the difference in the parameters of walnut kernels in Nigeria and that in other parts of the World (Turkey and Newzealand) could be due to the climatic variations and in the methods of analysis, since according to[17] these two parameters contributes to differences in values of agricultural samples.

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