

# Effects of Processing on the Proximate Composition, Mineral Content and the Phytochemical Analysis of Groundnut Seeds (*Arachis hypogaea*)

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## Abstract

Effect of processing on the nutritional composition of groundnut seeds were carried out using standard analytical methods. Raw, boiled and fried groundnut seeds were analyzed for proximate composition, mineral contents, and phytochemical screening. The result reported that the raw, boiled, and fried contains (5.357±0.190%, 4.545±0.050% and 3.896±0.015%, moisture contents), (2.401±0.011%, 3.225±0.004% and 2.816±0.001%, ash contents), (46.591±0.001%, 25.333±0.003% and 48.012±0.953%, crude fat), (4.126±0.887%, 15.001±0.030% and 7.692±0.002%, crude fibre), (19.520±0.040%, 21.580±0.040% and 23.540±0.000%, crude protein), (22.005±0.587%, 30.316±0.056% and 14.044±0.939%, carbohydrate) respectively. A significant difference was observed. Processing has significant effects on the mineral components of the seeds. The results revealed that raw, boiled and fried contains (56.900mg/100g, 48.400mg/100g and 35.00mg/100g Sodium), (0.215mg/100g, 0.185mg/100g and 0.540mg/100g Zinc), (65.500mg/100g, 42.700mg/100g and 25.500mg/100g Magnesium), (0.218mg/100g, 0.230mg/100g and 0.230mg/100g Iron), (0.250mg/100g, 0.110mg/100g and 0.100mg/100g Manganese). The phytochemical screening shows the presence of alkaloids, carbohydrates and proteins in all the samples and the result reveals that processing does not really have effect on phytochemical constituents. The investigation shows that fresh groundnut is a good source of mineral content, while raw and processed groundnut is a good source of some phytochemical constituents and processed groundnut is a good source of protein, fat, and carbohydrate with high nutritional value.

**Keywords:** *Arachis hypogaea*; Proximate composition; Mineral contents; Phytochemical screening.

## INTRODUCTION

Groundnut or peanut scientifically known as *Arachis hypogaea*, derived from two Greek words *Arachis* meaning legume and *hypogaea* meaning underground whose formation of pods is done in the soil are a widely cultivated crop that holds great significance in various aspects of human life (ICAR, 2002). Belonging to the *Fabaceae* family, it is a self-pollinating allotetraploid legume crop (Janila *et al.*, 2013). It is globally cultivated in both temperate and tropical regions; groundnut is a significant oilseed crop (Ayoola and Adeyeye, 2010). In Sub-Saharan Africa, groundnut holds the distinction of being the most crucial monoecious annual legume, serving as a vital source of human food, forage, and income (Alemayehu *et al.*, 2014; Ajeigbe *et al.* 2015).

Groundnut is a precious nutritional resource for human consumption, providing essential calories, dietary fiber, high energy value, protein, vital fatty acids,

vitamins (such as vitamin E), minerals (including K, Na, Ca, Mn, Fe, and Zn), as well as biologically active compounds (such as arginine, resveratrol, phytosterols, and flavonoids) (Willett *et al.*, 2019). In Africa, particularly among rural households, zinc deficiency is a prevalent issue, particularly impacting infants and young individuals as one of the critical limiting micronutrients (Wessells and Brown, 2012). The significance of groundnut protein as a food and feed source is growing, particularly in developing nations where access to protein from animal sources is financially out of reach for a large portion of the population (Arya *et al.*, 2016). By fixing nitrogen in the soil, groundnut enhances soil fertility, leading to increased yields of other crops when employed in rotation or intercropping systems (Ajeigbe *et al.*, 2015). Despite its nutritional value and positive impact on soil fertility, adoption of this crop remains lower in comparison (Ahmed *et al.*, 2016).

Groundnut has primarily been used commercially for the production of oil (Kline, 2016; List, 2016; Smithson *et al.*, 2018; Tu and Wu, 2019). In addition to oil, peanut by-products contain numerous functional compounds such as proteins, fibers, polyphenols, antioxidants, vitamins, and minerals. These valuable components can be incorporated as functional ingredients in a wide range of processed foods (Akgül and Tozluoğlu, 2008; Nepote *et al.*, 2006; Zhao *et al.*, 2012).

Recent discoveries have highlighted groundnuts as an exceptional source of compounds such as resveratrol, phenolic acids, flavonoids, and phytosterols. These compounds have demonstrated the ability to hinder the absorption of dietary cholesterol (Garcia *et al.*, 2016; Limmongkon *et al.*, 2017; Sebei *et al.*, 2013). Groundnut seeds boast a rich composition containing approximately 40-50% fat, 20-50% protein, 10-20% carbohydrates, as well as various vitamins and minerals. Additionally, they offer a calorie content of 567 per 100 grams (Ahmed *et al.*, 2016). Groundnut's combination of high energy value, protein, and minerals makes it a plentiful and cost-effective source of nutrients. Consuming groundnuts has been linked to numerous health benefits (Kris-Etherton *et al.* 2008; Sabate *et al.*, 2010; Guasch-Ferré *et al.*, 2017). The seed of the groundnut is used in the production of oil, which serves various purposes such as cooking, salad dressings, and margarine. Lower quality oils derived from groundnuts are employed in the manufacturing of soap (Pradhan, 2011).

Groundnut seeds possess a wealth of nutritional value due to their abundant content of oil, protein, niacin, fiber, magnesium, vitamins, manganese, and phosphorus (Davis and Dean, 2016; Fletcher and Shi, 2016). On a dry seed basis, groundnut seeds can contain a substantial amount of oil ranging from 44 to 56%, and protein, ranging from 22 to 30%. They are also abundant in minerals such as phosphorus, calcium, magnesium, and potassium, as well as vitamins E, K, and various B group vitamins (Arya *et al.*, 2016). Groundnut seed has a multitude of applications, both in its whole form or when processed into products such as peanut butter, oil, soups, stews, and more. Additionally, the cake derived from groundnuts finds various uses in feed and infant food formulations (Dhamsaniya *et al.*, 2012; Francisco and Resurreccion, 2008; Timbabadiya *et al.*, 2017). Enhancing the functionality of groundnut seed systems is crucial for improving the accessibility and adoption of improved varieties. Well-established and efficient seed value chains play a vital role in ensuring timely and affordable delivery of superior crop varieties. They also facilitate effective planning of demand and supply, spanning from individual farms to national levels, which is essential for ensuring seed security (Sperling, 2008; McGuire and Sperling, 2016).

The objective of this study is to determine the effect of processing on the proximate composition, mineral content, and phytochemical screening of raw *Arachis*

*hypogaea* (Groundnut seeds) and the processed forms in order to know their possible usefulness as food rich in nutrients and also to ascertain the best form in which it should be consumed.

## MATERIALS AND METHODS

### Materials

Powdered (raw groundnut, boiled groundnut and fried groundnut), HCl, H<sub>2</sub>SO<sub>4</sub>, NaOH, weighing balance, filter paper, heating mantle, crucible, thread, beaker, conical flask, distilled water, reagent bottle, chloroform, water bath, acetic acid, and pipette.

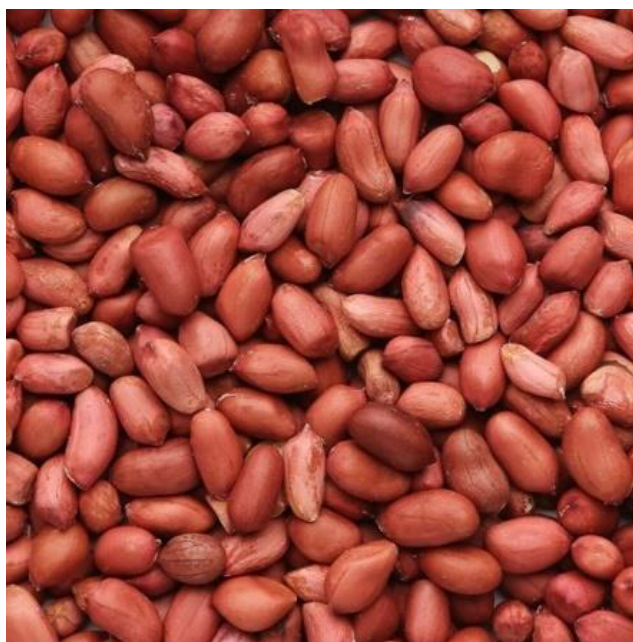


Figure 1. Pictorial representation of groundnut seeds (*Arachis hypogaea*).

### Method

#### Sample Preparation

Groundnut seeds (*Arachis hypogaea*) were obtained from Oja Oba, Owo Local Government Area of Ondo State and were then conveyed using a polythene bag to Rufus Giwa Polytechnic Chemistry Laboratory. The seeds were divided into three equal parts, which comprised raw, boiled and fried groundnut. The first sample, which happens to be the raw sample, was sundried for about seven days and grounded to powder form using EL-850W blender then stored for further analysis. The second portion, which was unshelled groundnut seeds (*Arachis hypogaea*) were washed thoroughly, using cold water until the water was clean. The nuts were soaked in water for some minutes before cooking. The cooking was done in a pot by adding 2g of salt in a liter of water and cooked for about 30 minutes. After cooking was finished, the water remaining in the pot was drained, the groundnut was dehulled, dried, milled and stored for

further analysis. To the third portion, which is the fried (*Arachis hypogaea*) seeds. 2g of salt in 5 ml of water was sprinkled on the *Arachis hypogaea* seeds and sundried for 2 hours and fried using a frying pan using sand at the base until the seeds turned golden brown. The *Arachis hypogaea* seeds were cooled, dehulled, milled and stored in an airtight container for further analysis.

### Proximate Analysis

#### Fat Content Determination

In the determination of the fat content, a clean fat-free filter paper was weighed ( $W_1$ ). Five g of the sample was added to the filter paper and weighed ( $W_2$ ). The weighted sample was tied with a piece of thread and dropped into the thimble of the soxhlet apparatus. 250 ml of petroleum ether was poured into the round bottom flask of the apparatus. Soxhlet apparatus was set up on the heating mantle and the extraction process was carried out for four hours to extract the fat with the help of the solvent. Petroleum ether was siphoned over the barrel, the condenser was detached and the thimble was removed. The solvent extract (lipid) mixture was carefully poured into a clean dried Petri dish and transferred into a fume cupboard for two hours. The solvent evaporated leaving behind the extracted fat. The filter paper containing the residue was dropped into a beaker and transferred into an oven at 50°C. It was then dried to constant weight and cooled in a desiccator and reweighed ( $W_3$ ). Afterward, the percentage of fat was calculated.

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

#### Moisture Content Determination

The moisture content of the sample was determined using a drying method based on weight loss. A clean and dry crucible was weighed using a weighing balance, and its weight was recorded as ( $W_1$ ). Samples were added to the empty crucible and weight ( $W_2$ ). The crucible containing the sample was then transferred into the oven, maintained at 105°C, and dried for four hours. The dish was then placed in a desiccator, cooled for an hour, and reweighed ( $W_3$ ). Afterward, the percentage of moisture content was calculated.

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

#### Ash Content

For the determination of ash content, a clean dried porcelain crucible was weighed and the weight was recorded ( $W_1$ ). 5g of the groundnut sample was measured into an empty crucible and reweighed as ( $W_2$ ). It was transferred into the muffle furnace. The muffle furnace was then ignited at 600 °C for about four hours until a grayish-white substance was obtained. The crucible was

later transferred into a desiccator, cooled, and reweighed ( $W_3$ ). The percentage ash content was calculated.

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

#### Crude-fiber Content Determination

Five g of the defatted sample was weighed ( $W_1$ ) into a 2500 ml conical flask. 200 ml of 1.25%  $H_2SO_4$  was added. The mixture was then heated for about 30 minutes, after which it was cooled and filtered through a poplin cloth by suction using a Bunchier funnel. The residue was rinsed in hot distilled water and scraped back into a flask. 200 ml of 1.25% NaOH was added, and the mixture was heated for 30 minutes. It was cooled, filtered, and washed once with hot distilled water, once with 10% HCL, four times with hot water, and twice with methylated spirit. The residue was drained, placed in a crucible, and dried in an oven at 105°C. After drying in an oven has been completed, it was then cooled in a desiccator and weighed ( $W_2$ ). The crucible containing the residue was placed in a muffle furnace at 300°C for 30 min, placed in a desiccator to cool to room temperature, and re-weighed ( $W_3$ ).

$$\% \text{ crude fibre} = \frac{W_2 - W_3}{W_1} \times 100$$

#### Determination of Protein Content

Five g of the ground sample was weighed into a 50 ml Kjeldahl flask containing 12.5 ml of concentrated  $H_2SO_4$  with one Kjeldahl catalyst tablet. The flask was heated on low heat for about 15 minutes, on medium heat for 30 minutes, and then on high heat until digested. The flask was then rotated at intervals until a clear solution was observed and the heating continued for a few minutes to ensure complete digestion. The flask was allowed to cool, the sample residue was washed and filtered to make the digest up to 50 ml ( $V_1$ ). After the digestion was completed, 5 ml of 2% boric acid ( $H_3BO_3$ ) was placed into a 100 ml conical flask, and 3 drops of the mixed indicator were added. The receiving flask was placed so that the tip of the condenser tube was below the surface of the boric acid. 5 ml of the digest ( $V_2$ ) was pipetted into the distillation tube, and 10 ml of 40% NaOH was added. The heater was turned on and the distillation continued until approximately 50 ml of distillate was collected into the receiving flask. The distillate was titrated with 0.01M HCl, and the blank was titrated with the acid.

$$\%N = \frac{M \times T \times 0.014}{W} \times \frac{V_1}{V_2} \times 100$$

$$\% \text{ protein} = \% N \times 6.25$$

Where 6.25 = conversion factor

### **Carbohydrate Content Determination**

The term carbohydrates embrace a broad spectrum of compounds ranging from simple monosaccharides to complex polysaccharides. This carbohydrate content determination was done by subtracting other nutritional composition parameters (protein content, fat content, ash content, moisture content and fibre content) from 100. Therefore, the carbohydrate content = 100 – (protein + Fat + Ash + Moisture + Fibre).

### **Phytochemical screening**

#### ▪ **Test for tannins**

In the test for the presence of tannins, 0.30g of the sample was weighed into a test tube and boiled for 10 minutes in a water bath containing 30cm<sup>3</sup> of water. After boiling, filtration was carried out using number 42 (125mm) Whatman filter paper. After filtration, 3 drops of 0.1% ferric chloride solution was added to the filtrate. A brownish-green or blue-black coloration observed shows a positive test. (Eikeme *et al.*, 2009).

#### ▪ **Test for Phlobatannins**

0.30g of the sample was weighed into a beaker containing 30 cm<sup>3</sup> of distilled water. At the end of 24 hours of extraction, 10cm<sup>3</sup> of each sample was boiled with 5cm<sup>3</sup> of 1% aqueous hydrochloric acid. A deposit of a red precipitate showed a positive test (Eikeme *et al.*, 2009).

#### ▪ **Test of Saponin**

Thirty cm<sup>3</sup> of distilled water was added to 0.30g of the sample and boiled for 10 minutes in a water bath and filtered using Whatman filter paper number 42 (125mm). The mixture of 5 cm<sup>3</sup> of distilled water and 10cm<sup>3</sup> of the filtrate was agitated vigorously for a stable persistent froth. The formation of emulsions in addition to three drops of olive oil showed positive results (Eikeme *et al.*, 2009).

#### ▪ **Test for Steroids**

0.30 g of each sample was weighed into a beaker containing 20 cm<sup>3</sup> of ethanol. The component was extracted for 2 hours. To the ethanol extract of each sample was added 2cm<sup>3</sup> acetic anhydride followed by 2 cm<sup>3</sup> of concentrated tetraoxosulphate (vi) acid. A violet-blue or green colour change in the sample indicates the presence of steroids (Eikeme *et al.*, 2009).

#### ▪ **Test for Terpenoids**

0.30g of each wood powder sample was weighed into a beaker and extracted with 30 cm<sup>3</sup> of distilled water for 2 hours. 2 cm<sup>3</sup> of a mixture of chloroform and 3 cm<sup>3</sup> of concentrated tetraoxosulphate (vi) acid was introduced into 5cm<sup>3</sup> of each extract to form a layer. A reddish-brown coloration at the interface shows positive results for the presence of terpenoids (Eikeme *et al.*, 2009).

#### ▪ **Test for Flavonoids**

Each sample weighing 0.30g was introduced into a beaker, it was extracted with 30 cm<sup>3</sup> of distilled water for

about 2 hours and filtered with a Whatman filter paper number 42 (125mm). 5cm<sup>3</sup> of 1.0mol dilute solution was put into a test tube, followed by the addition of 5cm<sup>3</sup> of concentrated tetraoxosulphate (vi) acid, and 10cm<sup>3</sup> of the aqueous filtrate of each Sample extract was added. The appearance of yellow colouration which disappeared on standing shows the presence of flavonoids.

#### ▪ **Test for Proteins**

one hundred mg of the extract was dissolved in 10 ml of distilled water and filtered through Whatman No. 1 filter paper and the filtrate was subjected to a test for proteins.

#### ▪ **Biuret Test**

Two ml of filtrate was treated with a drop of 2% copper (ii) sulphate solution. To the filtrate, 1 ml of ethanol (95%) was added followed by excess potassium hydroxide pellets. A pink-coloured ethanolic layer indicates the presence of protein (Gahan *et al.*, 1984).

#### ▪ **Test for Alkaloids**

##### **Mayer's Test**

Two drops of Mayer's reagent were added to a few ml of the sample extract along the sides of the test tube. An appearance of white creamy colouration indicates the presence of alkaloids. (Evans *et al.*, 1997).

##### **Wagner's Test**

A few drops of Wagner's reagent were added to a few ml of the plant extract along the sides of the test tube. The presence of a reddish-brown precipitate confirms the presence of alkaloids (Wagner *et al.*, 1993).

#### ▪ **Test for Glycosides**

Fifty mg of the extract was hydrolyzed with concentrated hydrochloric acid for 2 hours in a water bath, filtered and the hydrolysate was subjected to the test.

#### ▪ **Borntrager's Test**

Three ml of chloroform was added to 2 ml of filtered hydrolysate and shaken, chloroform layer was separated and 10% ammonia solution was added to it. A pink colour indicates the presence of glycosides (Evans *et al.*, 1997).

#### ▪ **Test for Carbohydrates**

##### **Molisch's Test**

Two drops of alcoholic solution of  $\alpha$ - naphthol were added to 2 ml of the sample extract in a test tube. The mixture was shaken well and a few drops of concentrated sulphuric acid was added slowly along the sides of the test tube. A violet ring colouration indicates the presence of carbohydrates.

### **Determination of Mineral Composition**

Each sample was analyzed for mineral contents such as calcium, magnesium, sodium, potassium, and iron by instrumentation using an atomic absorption spectrophotometer (AAS Model; 2000). The method of AOAC (1997) was applied for the determination of ash and mineral content. 2 grams of the ground samples were weighed using a weighing balance and placed in a

crucible, it was ignited in a muffle furnace for 4 hours at 550 C. It was then cooled in a desiccator and weighed at room temperature to obtain the weight of the ash. To the resulting ash, a mixture of concentrated nitric acid and hydrochloric acid in a ratio of 1:3 was added and made up to 100 ml with distilled water in a measuring cylinder.

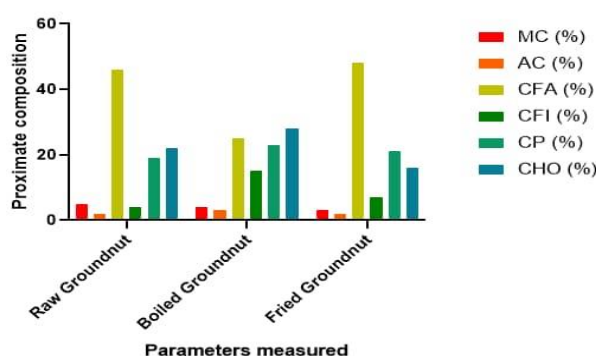
It was poured into a beaker and filtered then poured inside a sample bottle and maintained at room temperature. This solution was used for the determination of mineral content. An atomic absorption spectrophotometer (AAS) was then used to determine the presence of Mg, Fe, Mn, Cu, Ca, K, Na, and Zn.

## Result

### Proximate Composition

**Table 1.** shows the type and quantity of the nutritional composition of raw, boiled and fried groundnut seeds.

S/N	Compositions	Raw Groundnut	Boiled Groundnut	Fried Groundnut
1	Moisture content (%)	5.357±0.190	4.545±0.050	3.896±0.015
2	Ash content (%)	2.401±0.011	3.225±0.004	2.816±0.001
3	Crude fat (%)	46.591±0.001	25.333±0.003	48.012±0.953
4	Crude fibre (%)	4.126±0.887	15.001±0.030	7.692±0.002
5	Crude protein (%)	19.520±0.040	21.580±0.040	23.540±0.000
6	Carbohydrate (%)	22.005±0.587	30.316±0.056	14.044±0.939

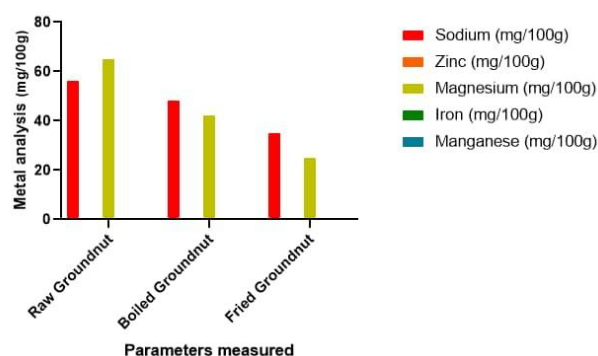


**Figure 2.** Graphical representation of the result of the proximate composition carried out on raw, boiled, and fried groundnut.

MC = Moisture contents; AC = Ash Contents; CFA = Crude Fat Content; CFI = Crude Fibre Content; CP = Crude Protein; CHO = Carbohydrate

**Table 2.** Showing the results of metal (mg/100mg) analysis of raw groundnut, boiled groundnut, and fried groundnut.

S/N	Minerals	Raw Groundnut	Boiled Groundnut	Fried Groundnut
1	Sodium(mg/100g)	56.900	48.400	35.00
2	Zinc(mg/100g)	0.215	0.185	0.540
3	Magnesium(mg/100g)	65.500	42.700	25.500
4	Iron(mg/100g)	0.218	0.230	0.230
5	Manganese(mg/100g)	0.250	0.110	0.100



**Figure 3.** Graphical representation of the result of the mineral composition of raw, boiled, and fried groundnut.

**Table 3.** Phytochemical Screening results of raw groundnut, boiled groundnut, and fried groundnut.

S/N	Phytochemicals	Raw Groundnut	Boiled Groundnut	Fried Groundnut
1	Alkaloids	++	+	+
2	Carbohydrates	++	++	+
3	Proteins	++	++	++
4	Phytosterols	-	+	-
5	Glycosides	-	-	-
6	Saponins	-	+	+
7	Tannins	-	-	-
8	Phlobatannins	-	-	-
9	Terpenoids	-	-	-
10	Flavonoids	-	+	-
11	Steroids	-	-	+

++ (Very present), + (present), - (Absent).

## Discussion

### Proximate Composition

#### Moisture Content

The result of the proximate composition of *Arachis hypogaea* (groundnut seed) is shown in Table 1. The moisture contents for the groundnut seeds raw groundnut, boiled groundnut, and fried groundnut were recorded to be 5.357%, 4.545%, and 3.896%. From the results, it was observed that raw groundnut has the highest moisture content when compared to others. I.e. the Boiled and Fried groundnut. The presence of high moisture contents in the raw groundnut is due to the fact that the groundnut has not undergone processing using heat as its source which could have reduced the moisture content. From the results, the high moisture content of the raw groundnut will have a lower shelf life which will influence the growth of microorganisms that could result in its spoilage (Remi et al. 2023). Considering the results, the moisture content is in agreement with (4.11% raw groundnut) and (3.56% roasted groundnut) which was reported by (Kumar et al., 2013). The result was also in agreement with (5.41% raw groundnut) and (3.98% roasted groundnut) reported by (Belete et al., 2020). From the result, we could infer that frying could reduce the moisture content in groundnut.

#### Ash Content

The ash contents of raw groundnut, boiled groundnut, and fried groundnut were recorded to be 2.401%, 3.225%, and 2.816%. The boiled groundnut was recorded to have the highest ash content, followed by fried, then raw groundnut. The result obtained was a little bit lower when compared to the result reported for raw and roasted groundnut (4.62%, 4.80%) by (Belete et al., 2020). The result does not agree with the result reported by (et al., 2021) who reported the highest ash content in the fried groundnut followed by raw then boiled. The simple explanation could be due to species differences in the groundnut or environment where it was planted.

#### Crude Fat

Crude fat, which is the total lipid content, was determined in the three samples of groundnut seeds raw groundnut, boiled groundnut, and fried groundnut to be 46.591%, 25.333%, and 48.012%. From the results, it was observed that both the raw and fried groundnut were higher in fat content when compared to the boiled groundnut. The reduction in fat content is in agreement with the work of (Udo et al., 2021) who reported the fat content of raw, boiled, and fried groundnut seeds to be 39.32%, 32.76%, and 46.36%. The reduction in fat content of the boiled groundnut seed is also in agreement with the findings of (Ayoola and Adeyeye et al., 2010). The increase in the fat content of the fried groundnut seeds could be a result of an increased heating temperature which could have led to the cleavage of carbohydrate lipid or protein-lipid linkages which enables the easy absorption of fat (Esenusan et al., 2008). Considering the high lipid content, which is rich in monounsaturated fatty acids, consuming fried groundnuts will be beneficial to human health.

#### Crude Fibre

Crude fibre is known to represent the contents of the non-digestible components of food, examples of which are, cellulose, lignin, and hemicellulose (Remi et al., 2023). From the result, it was reported that the crude fibre for raw groundnut, boiled groundnut, and fried groundnut were 4.126%, 15.001%, and 7.692% with boiled groundnut having the highest crude fiber content. The crude fiber content was not in agreement with (Udo et al., 2021) who reported the crude fibre of the fried groundnut to be the highest followed by raw groundnut. The simple explanation could be due to some factors like the intensity of the heat, the geographical location where the seed was harvested or possibly the presence, or absence of soil enhancers.

#### Crude protein

The crude protein of the three samples was recorded to be 19.520% for raw groundnut, 21.580% for boiled

groundnut, and 23.540% for fried groundnut. From the results, fried groundnut was reported to have the highest crude protein value followed by the boiled groundnut and then the raw groundnut with the lowest crude protein value. This agrees with (Rehman *et al.*, 2005), who stated that boiling brings about a loss of structural components and a reduction of soluble proteins and fats content which leaches into the boiled water. It was observed that the result reported was almost the same as the result reported by (Udo *et al.*, 2021) for raw, boiled, and fried groundnut seeds (20.38%, 23.86%, and 25.64%). Fried groundnuts have been shown to be a good source of crude protein which would be good for consumption and for human health.

### **Carbohydrate**

Carbohydrate, an energy-giving food, was recorded as 22.005% in raw, 30.316% boiled, and 14.044% in fried groundnut. From the results, it was observed that the boiled groundnut seeds had the highest carbohydrate content when compared to the raw and fried groundnut. This result agrees with the result obtained by (Udo *et al.*, 2021) who reported the highest carbohydrate content in boiled groundnut but was in contrast to the result obtained by Ayoola and Adeyeye *et al.*, 2010 who reported the highest carbohydrate content in roasted groundnut.

### **Mineral Contents**

Minerals are inorganic matter which cannot be destroyed by high heat and are needed by the body to develop and function normally. Calcium, phosphorus, potassium, sodium, chloride, magnesium, iron, zinc, and iodine are some of the essential minerals needed for human health. Table 2 reports the result of the mineral composition of groundnut (*Arachis hypogaea*) seeds. The result shows a rapid decrease in the mineral contents of the processed seeds. This is in agreement with the research carried out on cashew nuts by (Okonkwo *et al.*, 2015) who reported a decrease in the mineral composition of the roasted cashew nut. However, this is contrary to the result of the study carried out by (Udoh *et al.*, 2021) who reported a significant increase in processed groundnut seeds. In the present study, it is important to note that only iron has an increased mineral content in both boiled and fried, which is in agreement with the observation of Ayoola and Adeyeye *et al.* 2010 who stated that roasted groundnut was more advantageous in mineral content than in raw groundnut. This present study is not completely in disagreement with other researchers but has similar results to a research carried out on Bambara groundnut seeds by (Ndidi *et al.*, 2010) where all the mineral contents gradually decreased on processing. However, the values of mineral contents in this study for sodium, zinc, magnesium, and iron were way higher than that in Bambara groundnut seeds. Comparing this result, it is similar to (Belete & Bayissa, 2020) which stated that the concentration levels of metals in groundnut were found

to decrease in the order of Mg>Na>Zn>K>P>Fe>Ca. The only simple explanation for the difference as regards the decrease in mineral contents on processing to other studies and similarities to Bambara groundnut may be due to multiple factors such as leaching of the minerals into the boiling water, geographical location, seasonal variation in the mineral contents of the soil, method of processing or the presence or absence of soil enhancers.

### **Phytochemical Screening**

The three samples of *Arachis hypogaea* were analyzed for their phytonutrients and it was reported that Alkaloids, Carbohydrates, and Proteins were present in all the samples, saponins were observed to be found in the boiled and fried samples, Phytosterols were observed in the boiled sample, flavonoid was found in the boiled sample and steroids was found to be present in the fried sample unlike glycosides, tannins, phlobatannins and terpenoids which were absent in all the samples. Saponins are known for their property in precipitating and coagulating red blood cells. Saponin is also known for its hemolytic activity, foams formation in aqueous solutions, and cholesterol-binding properties (Sodipo *et al.*, 2000), Steroids are reported for their antibacterial properties (Cowan, 1999; Okwu, 2001) and Alkaloids have also been reported for it analgesic, antispasmodic and antibacterial properties (Okwu *et al.*, 2004). From the result obtained in this study, it can be said that *Arachis hypogaea* contain some phytochemical compounds which can serve medicinal purposes for human health.

### **CONCLUSION**

From the research, it has been established through the proximate screening of the processed seeds that *Arachis hypogaea* can be used as a good source of fat, carbohydrate, and protein if properly treated and selected because of its high nutritional value and therapeutic potential. For the mineral contents, raw groundnut was observed to be the best because minerals play an important role in metabolic activities in the body. The results further revealed medicinally important phytochemical constituents in the groundnut seeds, which make them good for the management of diseases. This will aid in fighting diseases, malnutrition that would lead to better nutrition and good health in Africa and the world at large.

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