DETERMINATION OF ANTI-NUTRITIONAL FACTORS OF RAW AND ROASTED PEANUT (*ARACHIS HYPOGEAE*)

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ABSTRACT

The research was focussed on the determination of anti-nutritional factors of roasted and raw peanut. The oil was extracted using aqueous method. Saponin was determined gravimetrically and flavonoid, tannin, phenol, alkaloid and terpenoids were determined using UV-Spectrophotometer while phytate was determined titrimetrically. The results showed that flavonoid in roasted peanuts was 0.90±0.003 and raw peanuts was 1.92±0.007%, alkaloids in roasted peanuts was 1.57±0.12 and that of raw peanuts was 1.82±0.012%, the saponin in roasted peanuts was 2.17±0.007and that of raw peanuts was 2.44±0.019, tannin in roasted peanuts was 1.43±0.012 and the raw peanuts was 0.92±0.009, the phenolic acid in roasted peanuts was 1.08±0.005 and raw peanuts 0.97±0.009, Terpenoid on roasted peanuts was 0.28±0.005 and raw peanuts was 0.27±0.003, phytic acid in roasted peanuts was 1.35±0.005 and raw peanuts was 1.28±0.01%. The results were compared with some literatures and our findings agreed with majority of the researches. The oil was found to contain phytochemicals in various quantities and qualities. Further researches are recommended using more complex instruments.

Keywords: Spectrophotometer, anti-nutritional, peanuts, roasted and alkaloids

INTRODUCTION

Groundnut also known as peanut or pignut, is scientifically known as *Arachis hypogaea* L. It is a plant which belongs to the family of Fabacea (Eke-Ejiofor *et al*, 2012). Peanut is identified as nuts and has a similar nutrient profile with tree nuts (Ross, 2016). This annual plant is generally distributed in the tropical, sub-tropical and warm temperature areas and represents the second most important legume in the world based on total production after soybean (Pattee and Young, 1982; Yadav *et al*, 2005).

Its important nut is a delicious and healthy one which has turned out to be a fad among health enthusiasts for its amazing health benefits, high protein content taste. And it has been an inseparable part of several culinary cultures. George Washington Carver (1865-1943) discovered 300 derivative products from peanuts, including plastics, soap, cosmetic nitro-glycerine, dyes, paints and flour. Unlike peanut seed important constituent for human consumption and food manufacturing, peanut root and shell are common by –products that are eliminated from processing. Basically, anti-nutrients are classified as heat stable and heat labile (Felix and Mello, 2000), and their presence in plants or food materials limits its application in food industries and also reduce the bioavailability of the nutrient composition of such plant. The presence of trysine inhibits the activities of proteases such as plasmin and trysin (Ramakrishna et al, 2006). However, the presence of anti-nutrients such as phytates, oxalates and hydrogen cyanide in peanuts have been reported to have health implications on human health (Pahnwar, 2005). Anti-nutrients such as phytic acids and oxalates have been reported to impair the absorption of essential minerals such as Zn, Fe, Mn, Mg and many others. Other phytochemicals such as alkaloids and saponins have been reported to have therapeutics effects in biological system and though may have some inhibitory function in the absorption of some nutrients in the body (Olarunju, 1999). Tannins are a broad class of polyphenol compounds of high molecular weight (500–3000 Daltons) ubiquitously present in commonly consumed plant foods and are responsible for the astringent taste of many fruits and beverages (De Jesus *et al*, 2012). They can be chemically classified into two groups: hydrolysable tannins and condensed tannins (also known as catechin tannins, flavanols, or proanthocyanidins). Hydrolysable tannins, including gallotannins and ellagitannins, are selectively found in the diet. Condensed tannins, or proanthocyanidins, on the other hand, are the most abundant plant-derived polyphenols in the diet and include catechin, epicatechin (EC), epigallocatechin (EGC), epicatechin-3-gallate, and (-)-epigallocatechin-3-gallate (EGCG) (Kum

et al, 2011). Petroski and Minichi (2020) in their work submitted that Tannins inhibit iron absorption and hence, negatively impact iron stores. Some of the anti-nutrients such as flavonoids possess a number of medicinal benefits, including anticancer, antioxidant, antiflammatory and antiviral properties (Asad *et al*, 2020): while alkaloids in plants largely protect plants from predators and regulate their growth, therapeutically, alkaloids are particularly well known as anaesthetics, cardioprotective and anti-inflammatory agents (Michael *et al*, 2021).

Peanuts can be boiled, roasted or eaten without sugar and are an excellent source of fat and protein, and this contributes their low glycaemic index and makes them suitable for diabetic patients (Foster-Powell et al, 2002). Peanut contains some vitamins and minerals which include zinc, potassium, riboflavin, thiamine,, folate, niacin and other vitamins which makes them essential to humans.

The aim of this study is to determine the anti-nutritional composition of roasted and raw peanuts.

Materials and Methods

Sample collection and preparation

Determination of flavonoids

Exactly 10 g of the plant sample was extracted repeatedly with 100ml of 80% aqueous room temperature. The solution was filtered through Whatman filter paper no. 42 (125 mm). The filtrate was later transferred into a crucible and evaporated into dryness over a temperature of 60℃ and dried at a constant weight.

Calculation

$$\% \text{ Flavonoids} = \frac{(\text{Weight of crucible} + \text{Residue}) - (\text{Weight of crucible})}{\text{Weight of sample analyzed}} \times 100$$

Determination of Saponins

Exactly 5 g of the sample was put into 20% acetic acid in ethanol and allowed to stand in a water bath at 50℃ for 24 hours. This was filtered and the extract was concentrated using a water bath at a temperature of 60℃o one-quarter of the original volume. Concentrated NH_4OH was added drop-wise to the extract until precipitation was complete. The solution was allowed to settle and the

precipitate was collected by filtration and weighted. The saponin content was calculated in percentage.

$$\% \text{ Weight of saponin} = \frac{(\text{Weight of filter paper with residue}) - (\text{Weight of filter paper})}{\text{Weight of sample analyzed}} \times 100$$

Determination of Tannin

Exactly 20 g of the crushed sample in a conical flask was added to 100ml of petroleum ether and covered for 24 hours. The sample was then filtered and allowed to stand for 15 minutes allowing petroleum ether to evaporate. It was then re-extracted by soaking in 100ml of 10 % acetic acid in ethanol for 4 hours. The sample was then filtered and the filtrate collected. A 25ml of 0.10M of NH4OH was added to the filtrate to precipitate the alkaloids. The alkaloids was heated on electric hot plate to remove of the NH_4OH still in solution. The remaining volume was measured to be 33ml. A 5 ml of this was taken and 20 ml of ethanol was added to it. It was titrated with 0.1 M NaOH using phenolphthalein indicator until a pink end point is reached. Tannin content was then calculated in % ($C_1V_1 = C_2V_2$) molarity.

Calculation

C_1 = Conc. of Tannin as acid

C_2 = Conc. of Base

V_1 = Volume of Tannin as acid

V_2 = Volume of Base

Therefore,

$$C_1 = \frac{C_2V_2}{V_1}$$

$$\% \text{ of Tannic acid content} = \frac{C_1 \text{ X } 100}{\text{Weight of sample analyzed}}$$

Determination of Phenolics

Exactly 0.2 g of the sample was added into a test tube and 10 ml of methanol was added to it and shaken thoroughly and the mixture was left to stand for 15 minutes before being filtered using Whatman filter paper. An lml of the extract was placed in a test-tube and 1ml of isopropanol and

5ml of distilled water was added and colour was allowed to develop for about 1 to 2 hours at room temperature. The absorbance of the developed colour was measured at 760nm spectrophotometer.

Calculation

$$\text{Phenol content} = \frac{\text{Absorbance of sample x concentration of standard}}{\text{Absorbance of standard}}$$

Determination of Phytates

Exactly 0.2g of the sample was weighed into a 250 ml conical flask. A 100 ml of 2 % Conc. HCl was poured into the beaker containing the sample and soaked for 3 hours. The sample was then filtered. A 50 ml of the filtrate was placed in 250 ml beaker and 100 ml distilled water added to it and stirred vigorously. A 10 ml of 0.3% ammonium thiocyanate solution was added as an indicator and titrated with standard iron (III) chloride solution which contained 0.00195g iron per ml.

Calculation

$$\text{Phytic acid} = \frac{\text{Titre value x 0.00195 x 1,19 x 100}}{\text{Weight of sample anallyzed}}$$

Determination of Alkaloids

Exactly 5g of the sample was weighed into a 250 ml beaker and 200ml of 20% acetic acid in ethanol was added and covered and allowed to stand for 4 hours at 25℃. This was filtered with filter paper No. 42 and the filtrate was concentrated using a water-bath at a temperature of 60℃ to one-quarter of the original volume. Concentrated ammonium hydroxide was added droop-wise to the extract until the precipitation was completed. The solution was allowed to settle and the precipitate was collected and mixed with dilute NH_4OH (1% ammonia solution). Then, it was filtered with pre-weighed filter paper. The residue on the paper was dissolved and titrated with excess $AgNO_3$ in combined filtrate and washed with 0.02 M KCN, using Fe the alkaloid, which was dried on the oven at 80℃.

$$\text{\% Weight of Alkaloid} = \frac{\text{Weight of filter of paper - weight of filter paer x 100}}{\text{Weight of sample anallyzed}}$$

Determination of Terpenoids

About 2g of the plant was weighed and soaked in 50ml of 95 % ethanol for 24 hours. The extract was filtered and the filtrate extracted with petroleum ether at temperature of 60 - 80℃ and concentrated to dryness with the aid of crucible on water bath at a temperature of 60℃. The dried petroleum ether extract was treated as total terpenoids.

Calculation

$$\% \text{ Terpenoids} = \frac{(\text{Weight of crucible + residue}) - (\text{weight of crucible}) \times 100}{\text{Weight of sample anallyzed}}$$

Table 1: Statistical Analysis of Levels of Anti-nutrient in Roasted Peanut

Phytochemical	**1st**	**2nd`**	**3rd**	**Mean**	**StDev**	**SEM**
Flavonoid, %	0.90	0.89	0.90	0.90	0.005	0.003
Alkaloid, %	1.60	1.57	1.55	1.57	0.021	0.012
Saponin, %	2.18	2.17	2.15	2.17	0.012	0.007
Tannin, %	1.43	1.40	1.47	1.43	0.029	0.017
Phenolic acid, %	1.09	1.07	1.09	1.08	0.009	0.005
Terpenoid, %	0.29	0.28	0.27	0.28	0.008	0.005
Phytic acid, mg/100	1.35	1.34	1.36	1.35	0.008	0.005

StDev: Standard Deviation; SEM: Standard Error of Mean

Table 2: Statistical Analysis of levels of Anti-nutrient in Raw peanut

Phytochemical	**1st**	**2nd`**	**3rd**	**Mean**	**StDev**	**SEM**
Flavonoid, %	1.90	1.92	1.93	1.92	0.012	0.007
Alkaloid, %	1.80	1.85	1.82	1.82	0.021	0.012
Saponin, %	2.48	2.44	2.40	2.44	0.033	0.019
Tannin, %	0.94	0.90	0.92	0.92	0.016	0.009
Phenolic acid, %	0.97	0.95	0.99	0.97	0.016	0.009
Terpenoid, %	0.27	0.28	0.27	0.27	0.005	0.003
Phytic acid, mg/100	1.27	1.30	1.26	1.28	0.017	0.01

Table 3: Statistical Analysis of Comparative Levels of Anti-nutrients of Roasted and Raw Peanut

Phytochemical	Roasted Peanut	Raw Peanut	Mean
Flavonoid, %	0.90	1.92	1.41
Alkaloid, %	1.57	1.82	1.70
Saponin, %	2.17	2.44	2.31
Tannin, %	1.43	0.92	1.18
Phenolic acid, %	1.08	0.97	1.01
Terpenoid, %	0.28	0.27	0.28
Phytic acid, mg/100	1.35	1.28	1.32

Discussion

The results are presented in Tables 1, 2, and 3. The results showed that the levels of flavonoid in the roasted and raw peanuts were 0.90 ± 0.003 and 1.92 ± 0.007mg/100g, respectively with a mean value of 1.41. The results as shown in Figure 3 showed that the level of flavonoid in the raw peanuts was higher than that of roasted peanut. According to (Asad *et al*, 2020), flavonoids possess a number of medicinal benefits, including anticancer, antioxidant, antiflammatory and antiviral properties. With the flavonoid content of the raw peanuts being more than the roasted peanuts, the raw peanuts is preferable than the roasted peanuts.

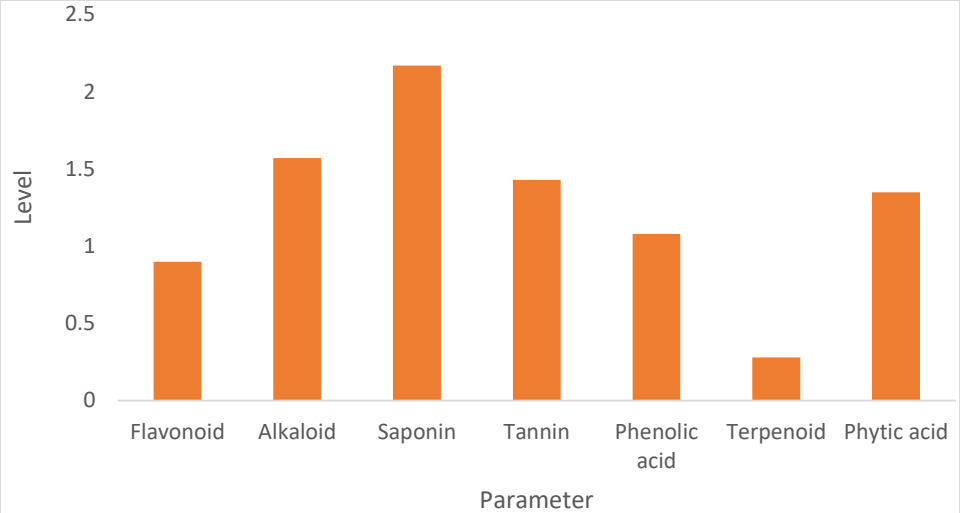


Figure 1: Levels of Anti-nutrients in Roasted Peanut

The results for alkaloid in the roasted and raw peanuts were 1.57±0.012 and 1.82±0.012, respectively with mean value of 1.70 %. The results showed that the level of alkaloid in the raw peanut was higher than that of roasted peanut. The higher content of the alkaloids in the raw peanuts could be responsible for the longer shelf life of the raw peanuts as alkaloids give protection to the peanuts against predators like weevils and other insects. Alkaloids (Michael *et al*, 2021) in plants largely protect plants from predators and regulate their growth, therapeutically, alkaloids are particularly well known as anaesthetics, cardioprotective and anti-inflammatory agents.

The results for the saponins in the roasted and raw peanut were 2.17±0.07 and 2.44±0.019%, respectively with mean value of 2.31%. The raw peanut recorded higher value than roasted peanut.

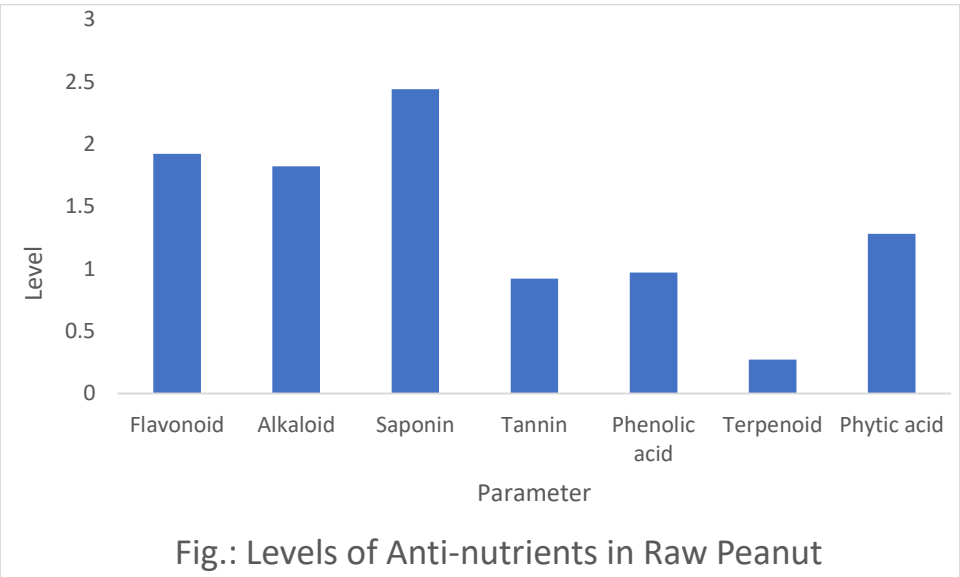
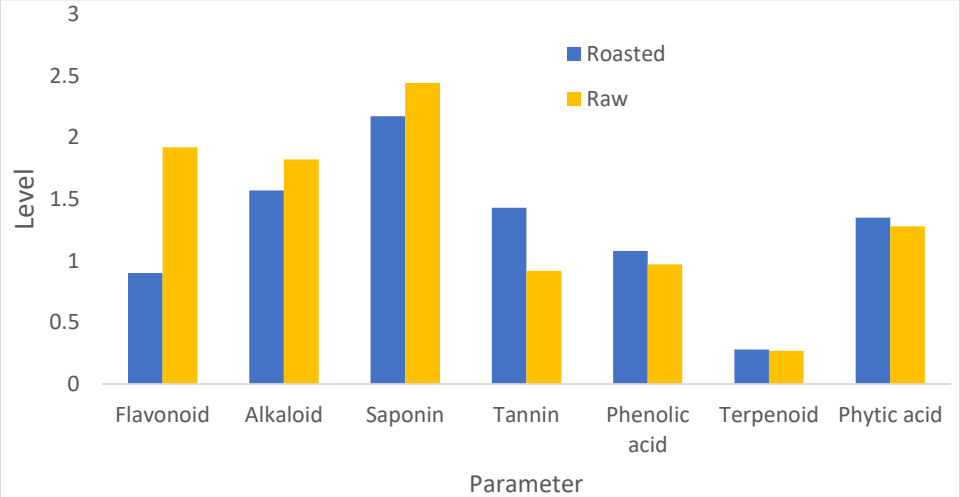


Fig.: Levels of Anti-nutrients in Raw Peanut

High saponin as recorded in the raw peanuts according to John Shi et al (2004) decreases blood lipids, lower cancer risks and lower blood glucose response. A higher saponin diet can be used in the inhibition of dental caries and platelet aggregation in the treatment of hypercalciuria in humans, and as an antidote against acute lead poisoning.

The results for Tannin in the roasted and raw peanut were 1.43±0.017 and 0.92±0.009 %, respectively with mean value of 1.18 %. The results showed that the roasted peanuts registered a higher value than that of the raw peanuts. Studies have it that tannin has been used to treat tonsillitis, pharyngitis, haemorrhoids, and skin eruptions and it has been administered internally to check diarrhoea and intestinal bleeding and as an antidote for metallic, alkaloidal, and glycosidic poisons, with which it forms insoluble precipitates form dark blue or dark green solutions with iron salts, a property utilized in the manufacture of ink (Britannica, 2022).

The results for phenolic acid in the roasted and raw peanut were 1.08±0.005 and 0.97±0.009%, respectively with mean value of 1.01%. The result of raw peanut obtained was lower than the roasted peanut. Phenolic compounds play a major role in the induction of resistance in plants. Generally, phenolic compounds released from seeds, roots or residue decomposition can act against soil borne pathogens and root-feeding insects (Santi *et al*, 2010) .



Fig, 3: Comparative Levels of the Anti-nutrients in Roasted and Raw peanut

The results for terpenoid were 0.28±0.005 for roasted and 0.27±0.003 for raw peanut with a mean value of 0.28%. The result showed that the level of terpenoid in the raw peanut was similar to that of the roasted peanut. Studies conducted by (Dash *et al*, 202) revealed that terpenoids play

some biological properties which includes cancer chemo-preventive effects, antimicrobial, antifungal, antiviral, anti-hyperglycemic, anti-inflammatory, anti-parasitic activities and memory enhancers.

The level of phytic acid in the roasted peanut was 1.35 ± 0.005 and $1.28 \pm 0.01\%$ was for the raw peanut with a mean value of 1.32%. The result showed that the level of terpenoid in the raw peanut was lower than the roasted peanut.

Conclusion

Peanut has high potential of protein content and it can be a veritable source of protein to the rural dwellers because of it nutritional content, affordability and availability.

The research reveals some phytochemicals such as tannins, alkaloids, saponin, terpenoids, phytic acid, flavonoid and phenolic acid.

The presence of these phytochemicals showed that apart from protein content of peanut that it can be a good source of medicine to the pharmaceutical world.

Recommendations

This research still has limitations because of the financial contrast which impeded the inability of analysing the more complex phytochemicals in peanut. Therefore, analysis of other complex phytochemicals are recommended for future researches.

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