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Comparative Analysis On The Quality And Quantity Of Oil Extracted From Two Species Of Groundnut Seeds (Virginia *specie* and Spanish *specie*)

Ismail Abdulkarim[1] & Abdullahi Usman[2]

[1]Department of Integrated Science,
Isa Kaita College of Education Dutsin-ma Katsina State, Nigeria
[2]Department of Chemistry, Kaduna Polytechnic, Kaduna State, Nigeria
***Corresponding authors' email: ismailabdulkarimimam@gmail.com**

ABSTRACT

Comparative analysis on the quality and quantity of oil extracted from two species of Groundnut seeds (Virginia specie and Spanish Specie) was conducted with the seeds obtained from Dutsin-ma local government area Katsina State and the oil present was extracted by pressing method. The proximate constituents of the Groundnut seeds were also investigated. The proximate analyses revealed moisture content of 2.00 and 1.97, crude fat of 30.15 and 29.30, ash content of 1.66 and 1.39, crude protein of 30.00 and 30.63 and carbohydrate 33.70 and 34.01 for Virginia specie and Spanish Specie respectively. The oil content of the Virginia and Spanish Species were found to be 675 cm^3 and 525 cm^3 respectively 2000grams of each seed. The amount of free fatty acid in percentage was found to be 0.141% for Virginia specie and 0.169% for Spanish type. This signifies that Virginia specie (Jar Gyada) has higher oil content and has lower free fatty acid than the Spanish specie (Yar Jingila) which makes it more profitable in terms of oil production and will also have more health benefits. Based on the findings of this research it is recommended that: further work should be done on the other species,oil processing companies should lay their hands more on Virginia specie, farmers should endeavor to be cultivating more of Virginia specie of Groundnut and government should support the farmers by enlightening them on the better seed modern way of bursting groundnut yield as well as subsidizing the cost of fertilizer.

Keywords: Comparative analysis, Qualitative, Quantitative, Virginia *specie* and Spanish *specie*

INTRODUCTION

Ground nut/ Peanut *Arachis hypogaea* is a leguminous herbaceous plant commonly grown in Nigeria. The plant has a South American origin and are basically of two distinct morphological features. The runner type has a history of being transported to Nigeria by the Portuguese. While, the erect type that originated from Dakar, Senegal was transported by Nigerian traders during the trans-Saharan trade, in the northern part of Nigeria. Kano state is the first largest producer of the Groundnut. The chief producers of groundnut in the world are Chine, India, United States of America and Africa. The seeds are shelled, cleaned and crushed and the oil is expresses by both hydrolic presses and expellers. The reminant of squash nuts is processed as groundnut cake popularly called Kuli-Kuli which contain large amount of Proteins, this is valuable for cattle feed.

Groundnut/peanut is an important crop grown worldwide. Commercially it is used mainly for oil production but apart from oil, the by products of peanut contains many other functional compounds like proteins, fibers, polyphenols, antioxidantrs, vitamins and minerals which can be added as a functional ingredient into many processed foods. Recently, it has also revealed that peanuts are excellent source of compounds like resveratrol, phenolic acids, flavonoids and phytosterols that block the absorption of cholesterol from diet.

The plant is a bushy or creeping annual with the peculiar habit of ripening it fruit underground. A sandy oil is best for it's cultivation. The soil must be friable so that the ripening fruit can be buried, and it must be well fertilized (Pandey, 2005).

Groundnut are of four types:

S/N.	English/Common name(Species)	Botanical Name	Local Name
1.	Runner specie	*Arachis hypogaea*	Mai Kala-Kala
2.	Spanish specie	*Arachis hypogaea*	'Yar jingila
3.	Valencia specie	*Arachis hypogaea*	Mai Kwara uku
4.	Virginia specie	*Arachis hypogaea*	Jar gyada

Table 1.1: Itemizing the groundnut species.

And all the type are cultivated in Nigeria depending on the type of soil of a particular state.

Groundnut oil/ Peanut oil is a type of vegetable oil commonly used in cooking that comes in a number of varieties, including refined, unrefined, roasted, and cold-pressed, which have slight differences in their nutritional value and health benefits. Most of the health benefits of pea nut oil come from its diverse types of fatty acids such as oleic acid, stearic acid, palmitic acid, and linoleic acid, among others. It is also used to make soap by the saponification process and also as a back massage oil.

Ground nut oil is considered cholesterol free and not only that, it can also reduce the level of cholesterol because it contains Plant sterols, boost heart health because it contains monounsaturated fatty acids like Oleic acid which increases the level of HDL in the blood, anti-cancer, lower blood pressure, prevent cognitive disorders, burst immune system, increase insulin production and aid in skin care. (Staughton, 2021)

Katsina state is one of the states in the northern part of Nigeria that are cultivating large quantity of groundnut. Dutsin-ma is one of the local governments that are cultivating groundnut. The types of groundnut cultivated are usually Virginia, Spanish and Valencia species. 70 % of the soil in Dutsin-ma region is Sandy soil with remaining percent (30 %) covered by Loam and Clay. Sandy soil is the best for cultivating groundnut, the soil are friable so that the ripening fruit can be buried and it is well fertilized. Thus, the reason why Dutsin-ma cultivates groundnut.

Some of the impressive health benefit of Groundnut oil include:

- Anti- cancer: Shalini et al 2016, in their research, they found out that groundnut oil contains beta-sitosterol which have the ability of protecting body from Colon, Prostate and breast cancer and has the ability to inhibit carcinogenic and cancer-cell growth.
- Lowering of Blood pressure: Alonso et al 2007, in their research on hypertension, discovered that Resveratol present in Groundnut oil has the ability of interacting with various hormones like Angiotensin that constrict blood vessels and arteries by neutralizing its effect and hence reduces stress on the cardiovascular system.
- Skin Care: Ground nut oil like many vegetable oils contain vitamin E, which is an essential vitamin for human beings. It is known to be particularly important for the maintenance and health of the skin, protecting it from the effects of free radicals that cause wrinkles, blemishes, and other signs of aging. The vitamin E keeps your skin looking young and healthy as you get older (Staughton, 2021).
- Lowering the risk of type – 2 diabetes in women: Groundnut oil which contains oleic acid shows an increase in insulin production to undo the inhibitory insulin effect of TNT-α: Tumor Necrosis Factor-alpha (Shalini et al, 2016).
- Other health benefits are: lowering of Body mass index (BMI), Hunger maintenance, weight management, protection against Alzheimer's and gallstone disease, strengthening of immune system e.t.c

Staughton, 2021 discovered that, the nutritional facts of groundnut oil in 100g to contains: Energy 884 Kj, Total lipid (100 g), Iron, Fe (0.03 g), Zinc, Zn (0.01 mg), Cholin (0.1 mg), Vitamin E (15.69 mg), β Tocopherol (0.46 mg), ϒ Tocopherol (15.91 mg), Delta Tocopherol (1.37 mg), Vitamin K (0.7µg) Fatty acids, Total Saturated (16.9 mg).

Aremu et al, 2011, conducted a research on the physicochemical characteristics of six varieties of Bambara nut (*Vigna subterranea*) seed oils using standard analytical techniques. The result indicates the mean range value of the following parameters: Color (Light brown-reddish brown); Saponification value (174.80-181.02mgKOH/g); Peroxide value (9.10-11.05 meq/kg); iodine value (111.98-122.22mg of 1/100g); acid value (1.28-1.40 mgKOH); specific gravity at 25c (0.874-0.881) and Unsaponifiable matter (2.39-2.47). It was also revealed that the oil may be useful industrially for manufacturing products such as; paint, liquid soap and shampoo.

Muhammad and Sa'idu 2011, conducted a research on the analysis of oil extracted from two species of ground nut seeds (Runner type and bunch type) in Yobe state, Nigeria. The two species were obtained from Fika and Gadaka village in Fika local Government area. Oil was extracted from four samples of which are: Bunch fried, Runner fried, Bunch unfried and Runner unfried. Each of the sample was analysed for free fatty acids and the availability of Cholesterol. Slight differences in all the parameters were observed between the two species.

According to American peanut council, peanut fat profile contains about 50% monounsaturated fatty acids which is a heart friendly combination of fatty acids. The amount of trans fat in peanut butter with 2% stabilizer is 156 times less than what is needed to reach the 0g trans - fat cut-off on food labels (Sanders 2001).

Groundnut/peanuts are actually a legume and have more protein than any other nut with levels comparable to or better than serving of beans. After the groundnut oil is extracted, the protein content in the cake can reach 50% and the protein contain all the 20 amino acids in variable proportions and is the biggest source of the protein called '' Argenine'' (USDA, 2014).

The increasing high price of vegetable oil due to the ban placed by the federal government on importation of the vegetable oil pushed many people to be using long traditionally used groundnut oil with increasing number of groundnut oil processing factories both locally using Mortar and pestle and Mechanically. Many people nowadays consider all the type of groundnut seeds equal in their oil content and the oil composition. Two species of Groundnut seeds that are commonly cultivated in Dutsin-ma Local Government area Katsina state are used in this research with the aim of finding out the their oil content (Quantity) and analyzing the oil composition (Quality) in each of the species.

Objectives of the study

The aim of this study is to carry out the proximate analysis of the two sample seeds of groundnut and to extract the oil present in the two Groundnut seeds (Virginia and Spanish species) compare the oil content and compositions extracted from the species.

This can be achieved through the following objectives:

1. Proximate analysis of the two species of groundnut seeds.
2. Find out the level of oil content of the two species of groundnut seeds.
3. Find out the free fatty acid composition of the oil of the two species of groundnut seeds.

MATERIALS AND METHODS

The groundnut seeds were obtained from Dabawa and Makera village in Dutsin-Ma Local Government which is located in the north western region of Nigeria, located in the Sudan savanna zone of central part of katsina state. It is relatively bounded by Safana and Dan musa Local Governments by the west, Kurfi and Charanchi Local Government by the North, Kankia by the east, Matazu and Musawa Local Government to the south. In absolute terms, Dutsin-Ma town is found within latitude $12^0$27'10"N and longitude $07^0$29'56"E and 07^0 30'04" E.

Sample collection

The two different ground nut seeds for this research work i.e the Virginia type and Spanish type were obtained from two different farmers that are farming in Dutsin-ma Local Government area, one from the Dabawa and the other from Makera village. The seeds were identified at the department of Crop production and Protection from Federal University Dutsin-ma Katsina State. The seeds were fried and decorticated.

Proximate analysis

Determination of Moisture Content

The percentage of moisture content was determined by oven method following standard procedures (Ekpo *et al*, 2022). 2g of sample was dried in the oven for 24 hours at 100°C. The percentage moisture content was calculated by the following formula: Water content (%) = Initial mass (g) - Final mass (g) / Total mass (g)

Determination of Ash Content

The ash content was determined by direct heating method following standard procedures (Ekpo *et al,* 2022). 2g of each of the samples was weighed in dried glass crucibles separately. The samples were then incinerated to ash in a muffle furnace for 3 hours at 550°C. The crucibles were then removed, cooled in desiccator and the weight of the ash was determined.

Determination of Protein Content

The crude proteins were determined by the macro Kjeldahl method (Ekpo *et al,* 2022). 2g of samples was introduced into a Kjeldahl digestion flask together with 10g of copper sulphate and sodium sulphate in the ratio of 5:1. 25ml of concentrated sulphuric acid was added at about 1500°C in the fume cupboard until frothing ceased. The digest was cooled and diluted up to the mark with distilled water in 100ml volumetric flask. 10ml of the diluted mixture was poured into the distillation apparatus and 18ml of 40% sodium hydroxide was added. 25ml of 2% boric acid was added into the receiving conical flask and two drops of bromocresol green and methyl bred mixed indicator was added. The distillation was continued until boric acid solution turned from pink to yellowish green. After the distillation, the solution in the comical flash was titrated against 0.1N HCl until the end point was reached.

Determination of Crude Fat Content

The fat content was determined using standard procedures (Ekpo *et al,* 2022). 5g of sample was mixed with 0.88ml of ammonia solution and 10ml of 95% ethanol and mixed well. 25ml of diethyl ether was added to the mixture and shaken vigorously for 1 minute. This was then followed by addition of 25ml of petroleum ether and shaken vigorously to mix well. The mixture was then left to stand for an hour to allow aqueous and organic phase to separate. The fat extract (organic phase) was collected and the solvent was removed by distillation. The fat in the flask was dried in the oven at 100°C for 30 minutes and the solvent was removed completely. The flasks were then cooled in a desiccator and we're weighed for their mass of fat.

Determination of Crude Fibre

The crude fibre was determined according to the standard procedures (Ekpo *et al,* 2022). It was determined as the fraction remaining after digestion with standard sulphuric acid and sodium hydroxide. 2g of samples was hydrolyzed in a beaker containing 299ml of 1.25% of sulphuric acid and then boiled for 30 minutes. The mixture was filtered under vacuum and the residues washed with hot distilled water 3 times and then boiled again for 30 minutes with 200ml of 1.25% of sodium hydroxide and filtered again. The digested sample was washed with HCl to neutralize sodium hydroxide and then with hot distilled water 3 times. The residue was taken into a crucible dried at 100°C for 2 hours in an oven; the sample was cooled in a desiccator and then weighed. The sample in the crucible was incinerated at 500°C for 5 hours until all carbonaceous matter were burnt. Finally, the crucible containing the ash was cooled in the desiccator and weighed.

Determination of Carbohydrates Content

Carbohydrates we're determined using a mathematical function below as described (Ekpo *et al,* 2022). Carbohydrates= 100-% (ash + protein +fat + crude fibre + moisture)

Extraction and Analysis

The oil was extracted from the two fried ground nut seeds using Pressing method.

The fried decorticated ground nut seeds was grinded separately and each was be put into mortar and pressed with pestel. In each case, warm water was added, stired and pressed until the oil is extracted and removed separately. The percentage yield of the oil in each case was calculated using the relation below:

$$Yield = \frac{weight\ of\ the\ oil}{weight\ of\ the\ sample}\ X\ 100$$

Oil Analysis

A study on the following properties was carried out:

- Oil content of the two samples of the oils
- Free fatty acid composition of the two oil samples.

Determination of Percentage of Free Fatty Acid (Ffa)

2g of the oil was weighed and emptied in to a 250cm^3 conical flask and 10cm^3 of 95% pure ethanol (C_2H_5OH) was added. The resulting mixture was titrated against 0.1M Sodium Hydroxide (NaOH) using Phenolphthalein as an indicator. The titration was done with constant shaking until a pink color was formed which indicates the end point of the titration. This was repeated three times and the Average volume of the acid calculated.

The percentage of the free fatty acid was calculated using the formula:

$$Percentage\ (FFA) = \frac{V\ X\ M\ X\ 2.82}{Weight\ of\ the\ Sample}$$

Where; V (Cm^3) = Volume of NaOH Solution

M = Molarity of the NaOH

3.82 = Conversion Factor for Oleic acid

RESULT AND DISCUSSION

Proximate analysis

The Proximate contents of Virginia *specie* groundnut and Spanish *specie* were compared in Table 1. The parameters determined include moisture and ash content, crude fat and protein, carbohydrates.

Table 1: Proximate Analysis of Bambara groundnut (Vigna subterranean) and Cajanus cajan (Pigeon pea)

Samples	Moisture Content	Crude Fat	Ash Content	Crude Protein	Carbohydrates
Virginia specie	2.00	30.15	1.66	30.00	33.70
Spanish specie	1.97	29.30	1.39	30.63	34.01

Values expressed in % (percentage)

Oil analysis

Table 2: Contains the result obtained from the analysis of oil extracted from the two species of groundnut seeds:

Variety	Botanical Name	Local Name	Weight in Grams	Vol. of extract in cm^3	Vol. of oil present in the extract in cm^3	Amount of Free fatty acid in %
Virginia	Arachis hypogaea	Jar Gyada	2000	710	675	0.141%
Spanish	Arachis hypogaea	Yar Jingila	2000	585	525	0.169%

DISCUSSION

The Proximate contents of Virginia *specie* and Spanish *specie* were compared in Table1. The parameters determined include moisture and ash content, crude fat and protein, carbohydrates.

The moisture content is to the tune of 1.97- 2.00% for Spanish and Virginia type respectively which is also similar to research findings of (Pardeshi, 2019) who established a moisture content of between 1.98-2.10% in varieties of groundnut seeds. The Ash content of 1.39 to 1.66 % for Spanish and Virginia type respectively, which is very low compared to the 3.0-7.4 % in the findings of (Musa *et al*, 2010). Ash refers to the inorganic residue remaining after either ignition or oxidation of organic matter in a food sample. The ash content of this study falls within the range of leguminosae crops. Hence, it can be recommended for animal feeds and human consumption as well as serving as microbial media without mineral supplements. Crude protein ranges from 30.00 to 30.63 %, fat content from 29.30 to 30.15 % and In terms of carbohydrates composition, the result obtained for Spanish and Virginia type were 33.70 to 34.01 %. This is in support to that of (Pardeshi, 2019) whose research findings revealed 33.77 to 36.29 %. The high carbohydrates content of the plant species indicates that their seeds provide energy to the body when consumed. Leguminous starch is digested slower than starch from cereals and tubers. As such, legumes have a low glycemic index (GI) rating for blood glucose control (Khalid Elharadallo 2013) making them suitable for consumption by diabetic patients and those with an elevated risk of developing diabetes. Furthermore, legumes are glutenfree, making them suitable for consumption by celiac disease patients or individuals sensitive to the proteins and glutenin The crude fiber in this result indicates the ability groundnut to maintain internal distention for a normal peristaltic movement of the intestinal tract, a physiological role which crude fiber plays. The carbohydrate value by difference in this work is very low which shows that groundnut is more of a building food.

The oil content of the two species of groundnut were found to be 675 cm3 of Virginia type (Jar gyada) and 525 cm3 of Spanish type (Yar Jingila), the oil contents of the two species of groundnut fall within the range of groundnut seeds potentiality.

In comparison, the oil contents present in Virginia specie (675 cm3) is higher than the oil content present in Spanish specie (525 cm3). These differences in the oil contents of different seeds are attributed to variation in species or variety. (Albert et al, 2007)

The amount of free fatty acid in the oil were found to be 0.141 and 0.169 in Virginia type (Jar gyada) and Spanish type (Yar jingila) respectively. Free fatty acid is an important variable in considering the quality of any given vegetable oil. This is because the lower the free acid of an oil, the better the quality of the oil.

The free fatty acid of Virginia specie (0.141) is lower than the free fatty acid of Spanish specie (0.169). This indicates that, the oil extracted from Virginia species have better quality (more edible, health wise and suitable for use in other industries) than the oil extracted from the Spanish specie with free fatty acids higher.

CONCLUSION

The two oils were analysed based on the amount of free fatty acid with the Virginia specie having 0.141 and Spanish Specie 0.169. The results obtained were discussed by comparing them. This indicated that, the free fatty acid of Spanish is higher than that in Virginia and in turn, Virginia is more suitable for oil producers and more health wise

RECOMMENDATIONS

Based on the results obtained, the following recommendations could be made:

1. Oil processing industries should be using Virginia specie (Jar Gyada) due to its high oil content.
2. Consumers of the oil should target oil processed from Virginia specie because of its lower free fatty acid content to avoid some health complications and enjoy the health benefits of the groundnut oil and the residue can be used as animal feeds and it’s high carbohydrate content reveals that it gives energy to the body when consumed.
3. Research should be conducted on other species of groundnut seeds
4. Farmers in Katsina state should give more emphasis in production of Virginia specie than the Spanish specie.
5. Katsina state government should enlighten farmers on the better species to be cultivated and ways on how to improve production.
6. Katsina state government should help farmers in providing fertilizers and pesticides suitable for the production of groundnut at subsidized rate.

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