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Original Research Article

Study on proximate composition of four genotypes of Arachis hypogea l. (groundnut)

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ABSTRACT

Background: Groundnut (*Arachis hypogea* L.) also known as peanut is one of the world's principal oilseed crop. The plant originated in South America, but is widely distributed throughout the tropic and warm temperate areas in Asia, Africa, Oceania, North and South America and Europe. This study aimed to evaluate the proximate content of some genotype of groundnut (*Arachis hypogea* L.).
Methods: A total of four different groundnut varieties were used in this study; the varieties were obtained from international crop research institute for the semi-arid tropic (ICRISAT) Kano station. Samples selected were Samaru nut 11 (Samnut-11); Samaru nut 22 (Samnut-22); Samaru nut 23 (Samnut-23); and Samaru nut 24 (Samnut-24). The analysis was conducted in the animal laboratory faculty of Agricultural sciences, in Bayero University Kano, Nigeria. The moisture, ash, crude protein, crude fat, crude fiber and nitrogen free extract of the samples were detected using a standard procedure adapted from official methods of analysis 1990. Data was analyzed using the analysis of variance (ANOVA) and means were separated using Student-Newman-Keuls (SNK) in SAS version 9.3.
Results: The higher content of ash was found in Samnut-24 (4.4%), and Samnut-23 (11.8%) was found to have highest moisture. Samnut-23 has the highest content of crude protein (30.6%) and crude fiber (4.7%). A higher content of fat and oil (ether extraction) was found in Samnut-23 (40.0%) and a higher content of soluble carbohydrate (NFE) was found in Samnut-11(27.4%) and Samnut-22 (27.4%).
Conclusions: Groundnut characteristically contained high level of oil and protein with low level of moisture, ash and carbohydrate; this makes it a potential source of edible-oil. The high protein of the defatted groundnut makes it good as cake for human consumption and useful as animal feeds. Samnut-23 has enriched edible-oil content and the crude protein, while Samnut-22 has low oil content and protein, but has enriched with NFE. Based on the conclusion it was recommended that further research should be carried out on the quality of proximate content of groundnut between the four varieties.

Keywords: *Arachis hypogea* L., Groundnut, Nutrition, Nigeria

INTRODUCTION

Groundnut (*Arachis hypogea* L.) also known as peanut is one of the world's principal oilseed crop. It is widely grown in areas ranging from latitude 40^0 N to 40 ^{0}S. The plant originated in South America, but is widely distributed throughout the tropic and warm temperate areas in Asia, Africa, Oceania, North and South America and Europe.[1] Cultivated groundnut (*Arachis hypogea* L.) belongs to the family *Fabaceae*, subfamily *Papiionoideae* tribe *Aeschynomenea* in subtribe *Stylosanthinae* of genus *Araches.* It is a self-pollinated tropical annual legume. At locations where bee activity is high; some cross-pollination can occur.[2] Africa accounts for about 35.0% of global groundnut area but only 21.0% of output, concentrated mainly in Senegal, Nigeria and Sudan. In Nigeria, groundnut production is concentrated within the semi-arid zone of country (lat. 8^0-13^0 N). Although, groundnut is produced in all the northern Nigeria, traditional commercial groundnut producing areas include Sokoto, Kano, Jigawa, Katsina, Zamfara, Yobe, Borno and Adamawa states (Sudan savanna,10^0-13^0 N) and in the northern half of the northern Guinea savannah (8^0-11^0 N) around Kaduna, Bauchi, Gombe and Taraba states and some central states of Benue, Plateau and Niger states. However Kano state alone produces about half of Nigeria's groundnut.[3]

Groundnuts are an annual leguminous crop and in general the two main types are grown commercially in Nigeria are distinct in appearance. One is upright with an erect central stem with vertical braches, while the other is a runner with creeping laterals. Research conducted have revealed that growth habit was the most important factor associated with the different characteristics observed in groundnut.[4] However, strictly speaking, groundnut as it is well known has three growth habits corresponding to its time to maturity. Erect (early maturing), intermediate (intermediate maturing) and runner types (late maturing). The runners have been found to perform better than either the erect or the intermediate types in the northern guinea Savannah. This is mainly due to the fact that the ones mostly are land races, adapted to the environmental conditions especially the rainfall duration, which supports the runner to have higher number of branches and pods and to attain, high per cent pod, fill at harvest. In the Sudan savannah, especially around Borno, Adamawa, Yobe and Sokoto state where rainfall duration last for only two to three months, the early maturing types perform better in pod yield than either the intermediate or the runner types.[5]

Good nutrition is a basic human right. In order to have a healthy population that can promote development, the relation between food, nutrition and health should be reinforced. In developing countries, one of the ways of achieving this is through the exploitation of available local resources, in order to satisfy the needs of the increasing population.[6] Knowledge of the nutrition value of local dishes, soup ingredients and local foodstuffs is necessary in order to encourage the increase cultivation and consumption of this highly nutritive nut. Consumption will help to supplement the nutrients of the staple carbohydrate foods of the poor who cannot afford enough proteins good of animal origin.[6] Several studies have been carried out on the chemical and functional properties of kernals and defatted cakes of groundnut (*Arachidhypogaea* L.) an under exploited nut, largely consumed by the western and most populations in Africa.[4,7-9] They showed these nuts are good nutritional value, as soup thickener and when cooked, roasted, dried or fried serve as snacks. Sometimes, paste used as margarine or butter. Moreso, there are less expensive, widely distributed easily cultivated, consumed and sold by the masses. This study aimed to evaluate the proximate content of some genotype of groundnut (*Arachis hypogea* L.).

METHODS

Source of the seeds and sample selection

A total of four different groundnut varieties were used in this study; the varieties were obtained from international crop research institute for the semi-arid tropic (ICRISAT) Kano station. Samples selected were Samaru nut 11 (Samnut-11); Samaru nut 22 (Samnut-22); Samaru nut 23 (Samnut-23); and Samaru nut 24 (Samnut-24). The analysis was conducted in the animal laboratory faculty of Agricultural sciences, in Bayero University Kano, Nigeria.

Procedure for detection moisture

An aluminum dish with cover was used to determine the moisture on the sample and the ash determination followed on the dry matter residue. A porcelain crucible with cover was used and the appropriate container was dried at 100 ^{0}C for at least 2 hours. The containers were covered and rapidly move to desiccators. The desiccators were covered and allowed containers to cool at room temperature. The container with cover was weighed and approximately about 2 g ground samples into each container was weighed using Tare balance. The dishes were shaken gently and the samples were distributed and the maximum area was exposed for drying. The samples were placed in oven which was preheated to 100 ^{0}C at least 3 hours prior to use. The samples were leaved uncovered in oven for about 24 hours at 100^{0}C and samples were moved to desiccators and cover was placed on each container. The desiccators were sealed and allowed to cool for at least 1 hour. The container with cover and dried sample was weighed; it was recorded to the nearest weight of 0.1 mg. The procedure described in official methods of analysis, 1990 was adapted.[10]

Procedure for detection ash

The crucibles with cover which have been dried for 2 hours at 100 ^{0}C were removed and 1.5 to 2.0 g of sample was weighed into the crucible, recording weight of crucible and sample to the nearest 0.1 mg was done. Then ash in furnace at 600 ^{0}C for about 2 hours after the furnace reaches

temperature; the crucibles were allowed to cool in furnace to less than 200 ^{0}C and crucibles were placed in desiccators with vented top. The crucible and ash were cooled and weighed to the nearest 0.1 mg. The procedure described in official methods of analysis was adapted.[11]

Procedure for detection of crude protein

Digestion

0.2 g of sample was weighed into the digestion tube and 15 ml concentration of sulphuric acid was added and the tube was swirled gently until the sample and acid were thoroughly mixed. A 5 kg of Kjeldahl catalyst mixture was added and was heated cautiously until the solution clears. The temperature was raised and heated to boil for about 2 hours after the solution has cleared. It was allowed to cool and then the content of the tune was transferred into 100 ml volumetric flask and diluted to volume with distilled water and mixed thoroughly.

Distillation

10 ml of 2% boric acid and 1-2 drops of mixed indicator were measured into 100 ml Erlenmeyer flask. 10 ml aliquot of the digest was measured into a distillation apparatus and 15 ml of 40% NaOH was measured into the mixture. It was distil into the boric acid/indicator flask for at least 10-15 minutes.

Titration

Distillation was titrated with standard 0.025 N sulphuric acid to a pink end point and takes the burette reading (TV). The procedure described in official methods of analysis, 1990 was adapted.[10]

Procedure for detection of crude fat (ether extract)

The filter paper was folded into a thimble shape; 1-2 g of sample was weighed and place into the thimble. The thimble was slipped into a thimble holder and about 250 ml of petroleum diethyl ether was added using glass funnel from the top of the condenser. The heater switch, the main power switch and the condenser water were turned on and after the ether has begun to boil, the ether leakage was checked. It was extracted for minimum of 4 hours on a Hi setting and after the extraction, the heater was lowered, power and water were shut off, and the ether was allowed to drain out the thimbles. The thimble was removed from the holder, and allowed to drain and dry at 70 ^{0}C for 30 minutes. It was cooled in desiccators, weighed and recorded weight to the nearest 0.1mg. The procedure described in official methods of analysis, 1990 was adapted.[10]

Procedure for detection crude fiber

About 2 g of the sample was accurately weighed and transferred to a 9 cm hard filter paper supported on a filter cone in a 60 ^{0}C funnel. It was extracted with three 25 ml portions of ether and vacuum was applied until the sample dried. The extraction sample was transferred quantitatively by brushing into a 600 ml beaker of the fiber digestion apparatus and 200 ml of 1.25% sulphuric acid solution was added. A beaker was place on digestion apparatus with pre-adjusted heater and boiled exactly for 30 minutes, the beaker was rotated periodically to keep solids from adhering to sides. The beaker and filter contents were removed through California Buchner funnel and the beaker was rinsed with 50-75 ml of boiling water and washed through funnel. It was repeated with three 50 ml portions of water, and suck dry.

The residue was returned to beaker by blowing back through funnel and 200 ml of boiling 1.25% sodium hydroxide solution was added and returned to heater and boiled for exactly 30 minutes. The beaker and filter were removed again and washed with 25 ml of boiling 1.25% sulphuric acid solution, three 50 ml portions of water, and 25 ml of alcohol. The fiber mat and residue was dried at 130 2^{0}C for 2 hours and cooled in a desiccators and weighed. It was ignited at 600 15^{0}C to constant weight (30 minutes usually sufficient) and cooled in desiccators and weighed. The procedure described by Holst, 1982 was adapted.[12]

Procedure for detection nitrogen free extract (soluble carbohydrates)

The nitrogen-free extract (NFE) is calculated by difference, all the errors associated with proximate analysis are additive in the estimate of nitrogen-free extract. It was calculated using the following formula:

$$\text{NFE} = 100 - (\text{ash} + \text{CP} + \text{CF} + \text{EE})$$

Data analysis

Data was analyzed using the analysis of variance (ANOVA) and means were separated using Student-Newman-Keuls (SNK) in SAS version 9.3.

RESULTS

Proximate analysis of four varieties

Table 1 shows the higher content of ash in Samnut-24 (4.4%), followed by Samnut-23 (3.3%) and based on the moisture content; Samnut-23 (11.8%) was found to have highest moisture, followed by Samnut-22 (11.1%). According to crude protein; Samnut-23 (30.6%) has the highest content, followed by Samnut-22 (30.0%). Based on crude fiber; Samnut-23 (4.7%) has the highest content and then Samnut-22 (4.3%). A higher content of Fat and oil (Ether Extraction) was found in Samnut-23 (40.0%), followed by Samnut-11 (37.1%). Based on soluble carbohydrate (NFE) Samnut-11(27.4%) and Samnut-22 (27.4%) has the higher content of NFE.

Table 1: Proximate analysis of four varieties.

Varieties	ASH	Moisture	CP	CF	EE	NFE
Samnut-11	2.8 b	10.4 b	28.9 b	3.6 b	37.1 b	27.4 a
Samnut-22	3.3 b	11.1 ab	30.0 a	4.3 a	34.9 c	27.4 a
Samnut-23	3.3 b	11.8 a	30.6 a	4.7 a	40.0 a	21.2 b
Samnut-24	4.4 a	9.2c	29.9 a	3.4 b	35.7 c	26.4 a
S E±	0.1	0.2	0.1	0.1	0.2	0.3

Table 2: Correlation analysis.

Variables	Ash	Moisture	CP	CF	EE	NFE
Ash	1.00	-	-	-	-	-
Moisture	-0.15	1.00	-	-	-	-
CP	0.41(*)	0.34	1.00	-	-	-
CF	-0.06	0.79 (**)	0.43 (*)	1.00	-	-
EE	-0.06	0.37 (*)	0.25	0.31	1.00	-
NFE	-0.23	-0.38 (*)	-0.73 (**)	-0.47 (*)	-0.54 (**)	1.00

*Correlation is significant at the 0.05 level (1-tailed), **correlation is significant at the 0.01 level (1-tailed); ash: ashing, Moisture: moisture content, CP: crude protein, CF: crude fiber, EE: ether extraction (fat and oil), NFE: nitrogen free extract

DISCUSSION

This study aimed to evaluate the proximate content of some genotype of groundnut (*Arachis hypogea* L.). Result of the proximate composition of the groundnut (Samnut-23) investigated shows that the moisture content was 11.8%; ash content 3.3%; crude fiber 4.7%; crude protein 30.6%; fat content 40.0%; and carbohydrate (by difference) 21.2%. The fat, protein and ash contents are similar to the reports of Nelson and Carlos (1995) which indicated that fat content among 29 cultivars between 40.0-50.1%, protein 30.6-30.9%, and ash 3.3-2.7%.[13] The moisture content and crude fiber agreed with that of NAS (1980) of 5.0% and 3.0% respectively.[14] The fat content is important in diets as it's promotes fat soluble vitamin absorption. It is a high energy nutrient and does not add to the bulk of the diet.[15] The crude fiber in this result indicates the ability of groundnut to maintain internal distention for a normal peristaltic movement of the intestine tract; a physiological role which crude fiber plays. Diets low in crude fiber is undesirable as it could cause constipation and that such diets have been associated with disease of colon like piles, appendicitis and cancer.[16] The carbohydrate value by difference is this work is very low which shows that groundnut is more of a body building food.

CONCLUSION

Groundnut characteristically contained high level of oil and protein with low level of moisture, ash and carbohydrate; this makes it a potential source of edible-oil. The high protein of the defatted groundnut makes it good as cake for human consumption and useful as animal feeds. Based on the findings of proximate analyses that we conducted among the four varieties; the Samnut-23 has enriched edible-oil content and the crude protein, while Samnut-22 has low oil content and protein, but has enriched with soluble carbohydrate. Based on the conclusion it was recommended that further research should be carried out on the quality of proximate content of groundnut between the four varieties.

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