Effect of Traditional Processing Methods on the Protein and Lipid Content of *Arachis Hypogaea* (Groundnut)

Adegoke Bosede M.[*], Shittu Suraj A[**], Raimi Monsurat M.[**], Oyetade Olumide A.[**], Oyekanmi Adeyinka M.[**]

[*] Department of Applied Sciences, Osun State Polytechnic, Iree, Nigeria.
[**] Department of Applied Sciences, Osun State Polytechnic, Iree, Nigeria.

Abstract- Groundnut (*Arachis hypogaea*), a legume largely consumed by most populations in Africa, is widely grown as a food crop. This study is aimed at assessing the effect of some selected traditional processing methods (roasting with/without pod and boiling) on the protein and lipid composition of groundnut for optimal nutritional yield of the end product(s). Standard procedures were employed in the determination of the proximate composition of raw groundnut samples with emphasis on the lipid and protein content. Some selected traditional processing methods (roasting with/without pod and boiling with pod) were also employed and their effects on the lipid and protein content evaluated. Results demonstrated that groundnuts are excellent sources of protein and lipid. The processing technique, especially, dehulling before roasting manifested a significant ($p<0.05$) increase in the protein and lipid contents when compared with raw samples and other techniques. Overall, groundnut seed is a rich source of protein and fat. Hence, may be employed in animal feeds and human diet. The processing technique, roasting without pod, amongst others, resulted in greater improvement in the protein and lipid contents. Hence, the traditional processing method could effectively enhance the nutritional value of legume seeds, particularly groundnut, and for industrial/commercial purposes.

Index Terms- Boiling, Dehulling, Groundnut, Lipid, Protein, Roasting

I. INTRODUCTION

Good nutrition is an essential human right. In order to have a healthy population that can promote development, the relation between food, nutrition and health should be reinforced. 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 [1]. In the developing countries, majority of the populace depends solely on carbohydrate which has become their staple food because it is assumed to be relatively cheaper than the proteinous diet (especially) of the animal origin. However, knowledge of the nutritional value of local dishes, soup ingredients and local foodstuffs is necessary in order to encourage its cultivation and consumption.

Legumes (Family: Fabaceae or Leguminosae) are among the best protein sources in the plant kingdom and are also relatively cheap compared to protein source of the animal origin, so including them as the main protein in meals may be an alternative for some. Hence, may serve as a good substitute for meat (which is expensive) as a protein source.

Groundnuts (*Arachis hypogaea*) or peanut, a nut largely consumed by the western and most populations in Africa, is a legume which is widely grown as a food crop. Groundnut is the sixth most important oilseed crop in the world and it is grown in 100 countries of the world both in the tropical and temperate zones [2]. In Nigeria, groundnut in many forms such as roasted (with or without pods) and boiled are consumed as delicacy especially as snack. The oil extracted from the seeds are also employed in many local dishes at home. It is known that the cereal diets in developing countries deprive humans from indispensable amino acids and energy [3]. Studies pertaining to the search of alternative source of nutrition and protein quality are of great importance in tropical developing countries to alleviate hunger and malnutrition particularly in children and pregnant women, as they are most vulnerable [4]. The vast food preparations incorporating groundnut to improve the protein level has helped in no small way in reducing malnutrition in the developing Countries [5]. Several studies have been carried out on the chemical and functional properties of kernels of groundnut (*Arachis hypogaea* L.) [5], [6], [7], indicating the nuts as good sources of lipid and protein in human nutrition.

Protein sources are sometimes treated with heat, oxidizing agents, organic solvents, alkalis and acids during food processing for a variety of reasons but such treatments may cause modification of the nutritional value of proteins, decreasing the amino acid content through desulfuration, deamination or isomerization. However, traditional processing methods such as germination and roasting could effectively improve the nutritional value of legume seeds [8],[9]. In spite of this, information on the comparative effects of the different traditional processing method on the nutritive composition (Protein and Lipid) of groundnut remains scarce. This study is aimed at elucidating the effect of some selected traditional processing methods (roasting with/without pod and boiling) on the protein and lipid composition in groundnut for an optimal nutritional yield of the end product.

II. MATERIALS AND METHODS

A. Materials

(i) Collection of Seed Samples

The *Arachis hypogea* (Boro variety) with pods were purchased at a local market in Ada town, Osun State, Nigeria and thereafter transported in a polythene bag to the Laboratory.

B. Methods

(i) Processing of Seed Samples

The good groundnuts were sorted out from debris, immature and damaged seeds and were thereafter divided into three parts of 100g each. The groundnut samples were respectively were air-dried for two weeks at room temperature (28^{o}C ± 2.00).

The first portion was roasted with the pod following the conventional method as described by [10], in which about 100 g of the dried groundnut pods were put into an iron pot and mixed with clean fine sand and stirred to prevent burning of the sample and to ensure uniform distribution of heat. The groundnut pods were roasted for about 30 minutes at 120-130°C using Gallenkamp thermostat hot plate until a characteristic brownish nutty smell seed was obtained which indicated complete roasting. The sand was then separated from the groundnut using a sieve and the groundnut pods were allowed to cool. Thereafter, the pods were shelled and the seeds collected.

The pods of the groundnut samples in the second portion were removed with the hands and thereafter roasted just as in the first portion for about 35 minutes at 120-130°C using Gallenkamp thermostat hot plate until a characteristic brownish nutty smell seed was obtained which indicated complete roasting. The sand was then separated from the groundnut using a sieve and the groundnut were allowed to cool.

The third portion of the dried groundnut pods were put in a pot, tap water added (groundnut pods/water ratio 1:5 w/v), and cooked at 85-90°C on a Gallenkamp thermostat hot plate for 20 minutes. The seeds were considered cooked when they became soft to touch on pressing between the thumb and fingers. At the end of cooking time, the boiling water was drained and seeds were removed, air-dried and later oven-dried at 60°C to constant weight. The seed samples (Roasted with pod, Roasted without pod and Boiled with pod) were pulverized using an electric blender (Holt Star, Model BE 768-2, John Holt product, UK) separately. The samples were thereafter labeled.

(ii) Determination of Proximate Composition

The proximate composition were determined in the raw groundnut samples following the method outlined in AOAC [11], and the effect of the different processing techniques on the protein and lipid contents were thereafter analysed by assessing their compositions in each processed samples.

(iii) Statistical Analysis

All values obtained are means of three replicates. The data were subjected to analysis of variance (ANOVA) and significant differences between treatment means were determined at 5% confidence level using the Duncan Multiple Range Test (SPSS 16).

III. RESULTS AND DISCUSSION

Table 1: Proximate Composition of Raw *Arachis hypogaea* Seed

Parameters	Composition (%)
Moisture	7.18 ± 0.020
Total Ash	5.40 ± 0.011
Ether Extract	39.30 ± 0.018
Crude Protein	19.81 ± 0.012
Crude Fibre	4.11 ± 0.010
Nitrogen Free Extract	24.28 ± 0.012

Each value is a mean of three determination ± SEM.

Table 2: Percentage Lipid and Protein Composition of Processed *Arachis hypogaea* Seed

Parameters	RGP	DRG	BGP
Ether Extract (%)	41.60 ± 1.23^{a}	45.50 ± 2.23^{b}	29.20 ± 1.49^{c}
Crude Extract(%)	20.50 ± 0.83^{a}	22.70 ± 0.77^{b}	19.60 ± 0.82^{c}

Each value is a mean of three determination ± SEM.

Values along the same row with different superscripts are significantly different ($p<0.05$) and are on dry matter basis.

RGP = Roasted Groundnut with Pod
DRG = Dehulled Roasted Groundnut
BGP = Boiled Groundnut with Pod

The proximate analysis shows variable proportions of nutrients in the raw groundnut seeds (Table 1). The most pertinent information is its crude protein content of 19.81% which falls within the range of the protein content recorded for most legumes [12]. Musa *et al.,* [13] in their study on the proximate composition of selected groundnut varieties and their susceptibility to *Trogodermagranarium* evert attack also reported crude protein percentage in the groundnut varieties ranging from 19.7-31.3% which is similar to that which is obtained in this study. The present study confirmed the previous observations that groundnut is rich in protein. Ayoola *et al*., [14] reported that the protein in groundnut seeds contributes to the growth and repair of worn-out tissues and will also improve the nutrition of humans and animals.

In the present study, the ether extract in raw groundnut seed is 39.30% (Table 1). This is comparable to the value obtained in a similar study of the comparative physico-chemical, proximate and mineral analysis on raw and roasted seeds of groundnut [2]. Fat is important in human diet as it may facilitate fat - soluble vitamin absorption [15]. It may also provide an inexpensive source of high quality dietary lipid which may constitute a very good source of monounsaturated and polyunsaturated fat and hence, low in cholesterol and thereby reducing the risk of coronary heart diseases, although the lipid profile was not assessed in this study.

Although the raw seed is rich in both lipid and protein, the processing technique resulted in greater yield of the protein and lipid contents when compared to the raw groundnut samples. However, this study showed that the dehulled and roasted groundnut samples exhibited a significant ($p<0.05$) increase in crude protein and lipid content when compared to the other traditional processing techniques (Table 2). Dehulling of the seed might have enhanced the nutritive levels of the seed. Alonso *et al*., [9] also observed significant increase in protein levels in kidney beans after dehulling. The processing technique (Dehulling and Roasting) also has the advantage of reducing the antinutritional factors though this was not appraised in the present study. There was a significant ($p<0.05$) reduction in the level of protein and lipid from raw to cooked groundnut seed samples.

IV. CONCLUSION

Groundnut seed is a rich source of plant protein and fat. Hence, may be incorporated in diet for children, vegetarians and protein deficient people. The procesing technique (dehulling and roasting) resulted in increase in the yield of protein and lipid content of groundnut and may be employed industrially.

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AUTHORS

First Author – Adegoke Bosede M., (Ph.D. Biochemistry), Osun State Polytechnic, Iree, Osun State, Nigeria, abosedeadegoke@yahoo.com
Second Author – Shittu Suraj A., (M.Sc. Biochemistry), Osun State Polytechnic, Iree, Osun State, Nigeria, shittusuraj@yahoo.com
Third Author – Raimi Monsurat M., (M.Sc. Biochemistry), Osun State Polytechnic, Iree, Osun State, Nigeria, raimimonsurat@ymail.com
Fourth Author – Oyetade Olumide A, (M.Sc, Chemistry), Osun State Polytechnic, Iree, Osun State, Nigeria, sammary4life2000@yahoo.com

Correspondence Author – Adegoke Bosede M., abosedeadegoke@yahoo.com, +2348034271498