



Effect of Processing on the Proximate Composition and Vitamins A and E in Groundnut (*Arachis hypogaea*) From New Bussa, Borgu Local Government, Niger State, Nigeria

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Abstract

Groundnuts are nutrient dense foods and also contain a high fat content half of which is unsaturated, which includes monounsaturated fatty acids and polyunsaturated fatty acids. Raw groundnut samples were bought from Adamu Acici Farms, New Bussa, Niger State, Nigeria. They were then washed and shed dried. Raw groundnut (RWG) served as control and part of it was used to prepare roasted groundnut with shell (RGS), roasted groundnut without shell (RGW) and kulikuli (KKL). The proximate composition (including moisture content, crude fat, crude protein, ash, nitrogen free extract and crude fibre) and vitamins (A and E) were determined for the four samples. The proximate range for RWG, RGS, RGW and KKL were 0.72 to 8.68% moisture content, 14.05 to 25.10% crude protein, 20.99 to 45.80% crude fat, 0.56 to 1.70% crude fibre, 4.32 to 4.50% total ash and 14.22 to 59.46% nitrogen free extract. The vitamin content ranged from 0.25 to 0.44 mg/g vitamin A and 6.62 to 14.89 mg/g vitamin E. The processing of groundnut was found to have significant effect on the proximate composition as well as both vitamin A and E contents. Therefore, this research was carried out for the determination of effect of processing on the proximate and vitamin compositions in groundnut.

Keywords: Groundnut, Effects of Processing, Proximate Analysis, Vitamin.

Introduction

Peanut also known as groundnut (*Arachis hypogaea*), are a significant oilseed crop cultivated in both tropical and temperate regions of the world [1]. Groundnut seeds are a rich source of oil (35–56%), protein (25–30%), carbohydrates (9.5–19.0%), minerals (P, Ca, Mg and K) and vitamins (E, K and B) [2]. Groundnut

seed has various uses as whole seed or it can be processed to make peanut butter, oil, soups, stews and some other products, while peanut cake has numerous uses in feed and infant food formulations [3],[4]. Due to their accessibility and affordability, peanuts and their derivatives are frequently categorised as street food, meeting the basic needs of the urban populace [5].

In spite of the widely publicised huge research work on groundnut and its products, there is still remarkable scarcity of scientific information on groundnut and its derivatives. The nutritional value of groundnuts and their products must be assessed in order to improve human health, ensure food safety, and raise public awareness of food safety. Therefore, this research was carried out to assess the effect of processing on the proximate composition and vitamins A and E contents in groundnut.

Material and Methods

Collection of Samples

Fresh samples of groundnut were bought directly from Muhammed Adamu Acici Farms, New Bussa, Borgu Local Government Area, Niger State and transported to the Federal College of Animal Health and Production Technology, Moor Plantation, Ibadan for sample preparation and sample analysis was carried out at Precision food and feed analysis laboratory Irewumi community, off Ajia road, Iyana Agbala, Ejikeye, Ibadan.

Sample Preparation

The fresh samples of the groundnut were carefully washed with distilled water, air dried and divided into four portions as (raw, roasted groundnut with shell, roasted groundnut without shell and groundnut cake). The raw samples were used as control for the experiment.

Raw groundnut without shell

About 80 g of the raw samples were pulverized into powder by the use of mortar and pestle and

then sieved to obtain fine powder. The sieved fine powder was stored in a pre-cleaned and dried polyethylene bag until analysis [6].

Preparation of roasted groundnut with shell

Roasted groundnut was prepared according to a method by [7] with little modifications. The cleaned and dried raw groundnut was poured into a bowl containing hot water and salt and covered for 5 to 10 minutes. It was poured into a basket to remove water from the groundnut; the wet groundnut was spread on a tray and allowed to air dry.

A clean pot containing the mixture of fine sand and ash was put on fire, the groundnut was added to it and stirred for 10 to 15 minutes to roast it. A basket was put on a bowl and the roasted groundnut, ash and fine sand were poured into it. The basket was shaken in a circular form until all the roasted groundnut had been separated from the fine sand and ash. The roasted groundnut was spread on a tray to cool. The same procedure was repeated for roasted groundnut without husk.

Preparation of groundnut cake (kulikuli)

The preparation of kulikuli was done as described by [8] with slight modification.

Determination of proximate composition

The recommended methods of Association of Official Analytical Chemicals [9] were used for the determination of proximate constituent (moisture, ash, crude fat, crude fibre, crude protein and nitrogen free extract) at Precision food and feeds analysis laboratory Irewumi

community, off Ajia road, Iyana Agbala, Ejikeye, Ibadan.

Determination of vitamin A (retinol)

A colorimetric method of vitamin A evaluation as reported by [10] was used.

Determination of vitamin E (tocopherol)

A method reported by [11] was used to determine the vitamin E composition of RWG, RGS, RGW and KKL.

Statistical Analysis

Two-way Analysis of Variance (ANOVA) was carried out using the statistical software SPSS.

Results and Discussion

Below is the proximate composition of the raw and processed groundnut of the study.

Table 1.0: Proximate Analysis of Raw and Processed Groundnut (%)

Sample	Moisture	Crude protein	Crude fat	Crude fibre	Total ash	NFE (%)
RWG	8.68±0.037 ^a	25.10±0.01 ^a	45.80±0.11 ^a	1.70±0.02 ^a	4.50±0.04 ^a	14.22±0.02 ^a
RGS	2.81±0.02 ^b	22.13±0.18 ^b	34.93±0.12 ^b	1.21±0.02 ^b	4.42±0.03 ^b	34.50±0.03 ^a
RGW	2.71±0.03 ^c	23.87±0.19 ^c	34.60±0.07 ^c	0.56±0.10 ^d	4.36±0.02 ^c	33.92±0.10 ^a
KKL	0.72±0.02 ^d	14.05±0.07 ^d	20.99±0.13 ^d	0.79±0.01 ^c	4.32±0.58 ^d	59.46±0.24 ^a

Keyword:

NFE Nitrogen Free Extract

RWG raw groundnut

RGS roasted groundnut with shell

RGW roasted groundnut without shell

KKL groundnut cake (kulikuli) spiced with pepper, ginger, garlic and sugar

The moisture content obtained from this study ranged from 0.72 ± 0.02 to 8.68 ± 0.37 as shown in Table 1.0 above. A significant difference at $p < 0.05$ was observed in all samples. The moisture content of RWG, RGS and RGW were relatively higher than those reported by [12]. [solommon] has reported relatively higher moisture content (7.55 ± 0.07) in KKL. High moisture contents imply that storage will lead to spoilage [13].

The crude protein content from this study were in the range of 14.05 ± 0.07 to 25.10 ± 0.01 . The data showed a significant difference at $p < 0.05$. KKL showed the least value while RWG recorded the highest value. The crude protein reported in [14] (for both raw and roasted) and [Solomon] (for kulikuli) recorded almost two times the values of this current study. This may be due to the variety of groundnut used. The high protein content is important in the body as it helps in the

replacement of worn out tissue and regulation of body metabolism [15].

RWG showed the highest value of fat content at 45.80 ± 0.11 while the least value was obtained for KKL at 20.90 ± 0.13 . A significant difference ($p < 0.05$) was observed in the treatment. This study shows that groundnut processing has significant effect on fat content. Crude fat obtained in this study is slightly higher than those reported by [16], [17]. Fat are essential for the make-up, biological functions and integrity of cells and also increase the tastiness of food by absorbing and retaining flavours [18]. Accumulations of fats can cause arteriosclerosis and aging [19].

Crude fibre contents collected from this study were in the range of 0.79 ± 0.01 to 1.70 ± 0.02 . A statistically significant difference among the samples analysed at $p < 0.05$ was observed. This finding is slightly similar to that of [20] who reported crude fibre contents of 0.90 to 1.63% for KKL. Similarly, [21] reported crude fibre of 2.30 to 2.94%. These values are high when compared to the value observed in this study. This difference could be attributed to the level of

drying temperature applied and the season at which the study was conducted. There is a natural phenomenon that food materials are moister during rainy season than in dry season. Adequate intake of fibre can lower serum cholesterol level, risk of coronary disease, hypertension, constipation, diabetes and breast cancer [22].

Total ash obtained from this study is in the range of 4.32 ± 0.58 to 4.59 ± 0.04 . The statistical analysis revealed that there is significant difference ($p < 0.05$) in all the treatment except in KKL. The data obtained shows that the ash contents are almost the same. This implies that processing does not have significant impact on groundnut. The ash content reported by [23] for both raw and roaststet groundnut are similar to the data obtained in this study while [24] reported a relatively lower value for kulikuli.

NFE values obtained from this study ranged from 14.22 ± 0.02 to 59.46 ± 0.24 . KKL has the highest NFE content which is due the quantity of sugar that was added to it. Except in RGW and KKL, a statistically significant difference ($p < 0.05$) was observed in other samples.

Table 2.0: Vitamin composition of raw and processed groundnut (mg/g)

Sample	Vitamin A	Vitamin E
RWG	0.44 ± 0.01^a	9.19 ± 0.14^c
RGS	0.41 ± 0.01^b	14.89 ± 0.06^a
RGW	0.39 ± 0.00^c	13.55 ± 0.08^b
KKL	0.25 ± 0.00^d	6.62 ± 0.03^d

Keyword

RWG raw groundnut RGS roasted groundnut with shell RGW roasted groundnut without shell
KKL groundnut cake (kulikuli) spiced with pepper, ginger, garlic and sugar

Vitamin A is a fat soluble vitamin and an essential nutrient for animals. It is essential for embryo development and growth, maintenance of the immune system and vision [25]. Vitamin A obtained from this study significantly differed in its value ranging from 0.25 ± 0.00 to 0.44 ± 0.01 . A significant difference ($p < 0.05$) was observed in all treatment. Vitamin A quantity in this is relatively higher than that reported by [26] for kulikuli.

Vitamin E contents as shown in Table 2.0 above range from 6.62 ± 0.03 to 14.89 ± 0.06 . Vitamin E is a fat soluble antioxidant which helps to protect cell membrane from reactive oxygen species [27]. There is paucity of literature on Vitamin E data relating to raw and processed groundnut.

Conclusion

The results obtained showed that processing had effect on the proximate compositions and Vitamins (A and E) levels in groundnut. RWG showed highest amounts of fat, fibre, protein and vitamin while there is considerable reduction in their quantities after roasting and KKL preparation. These findings clearly emphasise the importance of taking the effects of processing into consideration especially when considering groundnut- based foods. Results obtained in this study necessitate the use of techniques that reduce nutrient loss during processing.

Recommendations

Based on the study carried out, the following recommendations are hereby suggested:

- Further studies should be carried out on the proximate analysis of other varieties of groundnut.
- Similar analysis should be carried out on groundnut blended with other legumes (bambara nut, melon seeds) and even similar snacks consumed in our localities.
- A comparison should be carried out with other products sold in the market.
- Analysis on processed groundnut should be compared to other products of leguminous food.
- Other analysis like metal concentrations, vitamins (B1, B2 etc) should be carried.

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References

1. Ayoola, P.B. and Adeyeye, A. (2010). Effect of Heating on the Chemical Composition and Physico - Chemical Composition Properties Of *Arachis hypogea* (Groundnut) Seed Flour

- and Oil. *Pakistan Journal of Nutrition*, 9: 751-754.
2. Gulluoglu, L., Basal, H., Onat, B., Kurt, C. and Arioglu, H. (2016). The effect of harvesting on some agronomic and quality characteristics of peanut grown in the Mediterranean region of turkey. *Field Crops Res*, 21: 224-232. doi: 10.17557/tjfc.20186.
3. Dhamsaniya, N.K., Patel, N.C. and Dabhi, M.N. (2012). Selection of groundnut variety for making a good quality peanut butter. *Journal of Food Science and Technology*, 49: 115- 118.
4. Timbabadiya, P.N., Bheda, S.B., Gajera, H.P. and Patatel, S.V. (2017). Application of Peanut Butter to Improve the Nutritional Quality of Cookies. *Curr. Res. Nutr. Food Sci. J.*, 5: 398-405.
5. Boli, Z.A., Zoue, L.T., Alloue-Boraud, W.M., Kakou, C.A. and Koffi-Nevry, R. (2014). Proximate composition and mycological characterization of peanut butter sold in retail markets of Abidjan (Côte d'Ivoire). *Journal of Applied Biosciences*, 72(1): 5822-5829.
6. Ameha, B. and Leta, D.B. (2020). Proximate and Mineral Compositions of Raw and Roasted Groundnut (*Arachis hypogaea* L.) obtained from East Hararghe Zone, Ethiopia. *Journal of Science and Sustainable Development*, 8(1): 26- 38.
7. Ameha, B. and Leta, D.B. (2020). Proximate and Mineral Compositions of Raw and Roasted Groundnut (*Arachis hypogaea* L.) obtained from East Hararghe Zone, Ethiopia. *Journal of Science and Sustainable Development*, 8(1): 26- 38.
8. Emelike, N.J.T. and Akusu, M.O. (2018). Proximate Composition and Sensory properties of "kulikuli" produced from the blends of groundnut and cashew kernel. *International Journal of Food Science and Nutritional Engineering*, 8: 1-4.
9. Association Official methods Analytical Chemists (AOAC), (2005). Official exposure of analysis (15th edition), Washington D.C, pp 106.
10. Panth, M., John, A. and Sivakumar, B. (1989). Evaluation of colorimetric method for vitamin A estimation. *Indian Journal of Experimental Biology*, 27(12): 1044- 1047.
11. Rutkowski, M. and Grzegurczyk, K. (2005). Spectrophotometric methods for oxidative vitamins determination convenient in analytic practice. *Acta. Sci. Pol., Technol. Aliment*, 6(3): 17- 28.
12. Ameha, B. and Leta, D.B. (2020). Proximate and Mineral Compositions of Raw and Roasted Groundnut (*Arachis hypogaea* L.) obtained from East Hararghe Zone, Ethiopia. *Journal of Science and Sustainable Development*, 8(1): 26- 38.
13. Abdulhammed, M., Bello, M. O., Owuoye, G. and Yekeen, T. A. (2014). characterisation of Govrd Fruits (*Curcubitaceae*) for Dietary Values and Anti_ Nutrient constituents. *Research Journal of Pharmaceutical, Biological and chemical Science*, 5(4): 416 – 420.
14. Ameha, B. and Leta, D.B. (2020). Proximate and Mineral Compositions of Raw and Roasted Groundnut (*Arachis hypogaea* L.) obtained from East Hararghe Zone, Ethiopia. *Journal of Science and Sustainable Development*, 8(1): 26- 38.
15. Bello, B. K. and Akinyele, B. J. (2007). Effects of Fermentation on the Microbiology and Mineral Composition of

- TermitomycesRobustus. *International Journal of Biological Chemistry*, 1(4): 237 - 243.
16. Ameha, B. and Leta, D.B. (2020). Proximate and Mineral Compositions of Raw and Roasted Groundnut (*Arachis hypogaea* L.) obtained from East Hararghe Zone, Ethiopia. *Journal of Science and Sustainable Development*, 8(1): 26- 38.
17. Solomon, A. and Judith, C.O. (2020). Evaluation of the Nutritional Quality of kuli-kuli (peanut cake) produced from melon seeds and Groundnut. *International Journal of Science and Innovative Research*, 1(1): 18- 25.
18. Adeolu, A. T, and Enesi, D. O. (2013). Assessment of Proximate Mineral, Vitamin and Phytochemical Composition of Plantain (*Musa Paradisloca*).Bacteria in Agricultural Waste. *International Resources Journal of plant Science*, 4(7): 192 - 199.
19. Shaheen, A., Naqvi, S. M. H. and Khan, M. A. (2013). Employees Training and Organisational Performance: Mediation by Employees Performance. *Interdisciplinary Journal of Contemporary Research in Business*, 5, 490-503. <http://journalachieves35.webs.com>.
20. Fokou, E., Achu, M. B., and Tchounguep, F. M. (2004). Preliminary nutritional evaluation of five species of egusi seed in Cameroon. *African Journal of Food, Agriculture, Nutrition and Development*, 4: 8.
21. Loukou, A. L., Nakri, D. G. Y. Dje, A., Ippre, V. K., Alice, M. M., Audoin, J. P. B. and Zoro, B. I. A. (2007). Macronutrient composition of three cucurbit species cultivated for seed consumption in Cote d'Ivoire. *African Journal of Biotechnology*, 6(5):529-533.
- 22.Sizer, F. and Whitney, E. (2003).Nutrition Concepts and Controversies, 9th Ed, Thompson Wadsworth, Canada, pp.284.
23. Ameha, B. and Leta, D.B. (2020). Proximate and Mineral Compositions of Raw and Roasted Groundnut (*Arachis hypogaea* L.) obtained from East Hararghe Zone, Ethiopia. *Journal of Science and Sustainable Development*, 8(1): 26- 38.
24. Henry, U.H.N. and Ubaji, N.M. (2022). Comparative Evaluation of the Proximate, Vitamins, Minerals, Phytochemicals and Anti-Nutrients Compositions of Purchased and Laboratory- Prepared Indigenous Snacks Commonly Consumed in Bida, Nigeria. *Art and Design*, 6(1); 1- 14.
25. Blaner, W.S.(2020). "Vitamin A." In Marriott, D.F., Stallings,V.A and Yate,A.A(eds). Present knowledge in Nutrition, Eleventh Edition.London, United Kingdom:Academic (Elsevier).pp 73 - 92.
26. Henry, U.H.N. and Ubaji, N.M. (2022). Comparative Evaluation of the Proximate, Vitamins, Minerals, Phytochemicals and Anti-Nutrients Compositions of Purchased and Laboratory- Prepared Indigenous Snacks Commonly Consumed in Bida, Nigeria. *Art and Design*, 6(1); 1- 14.
27. Traber, M.G. and Bruno, R.S.(2020). "Vitamin E."In Marriott, D.F., Stallings,V.A and Yate,A.A(eds). Present knowledge in Nutrition, Eleventh Edition. London, United Kingdom: Academic (Elsevier).pp 73 - 9.