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Proximate analysis of raw and roasted groundnut (*Arachis hypogaea* L.): Red Valencia and manikanta varieties

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Abstract
Proximate analysis of raw and roasted groundnuts of red Valencia and manipinta varieties were determined. The moisture content of raw and roasted peanut ranged from 4.84-5.11% and 2.02 - 2.17% respectively while fat content of raw and roasted peanut ranged from 43.3-48.3% and 47.3-49.1% respectively. Protein content in raw peanut ranged from 22.02-28.99% while roasted peanut ranged from 31.4-33.1%. Total ash in raw peanut ranged from 2.37-2.54% while roasted peanut ranged from 4.04-4.13%. Fiber content in raw peanut ranged from 9.8-10.83% while in roasted it ranged from 5.47-6.56%. Carbohydrate content in raw peanut ranged from9.49-12.37% while roasted ranged from 6.63-7.87%. Fat content, moisture and fibre content were significantly higher in Red Valencia than Manipinta. Roasting significantly affects moisture, fat and fibre content.

Keywords: proximate analysis, Manipinta, Red Valencia, raw, roasted

1. Introduction
Nuts are from different plant families and are classified as tree nuts (a one-seeded fruit with a hard shell) or peanuts (a member of the leguminous family). Peanuts are also called ground nuts because they develop in the soil. Despite their diversity tree nut varieties share common nutritional characteristics with peanut Peanuts are nutrient dense foods and also contain a high fat content half of which is unsaturated, which includes monounsaturated fatty acids (oleic) and polyunsaturated fatty acids [1].

2. Methodology
2.1 Proximate composition
Proximate composition includes moisture, crude protein, ether extract for fat content, crude fiber, ash and nitrogen free extract (NFE). The dried peanuts were weighed into various proportions for proximate analysis.

2.1.1 Determination of the moisture content
Procedure
Moisture was determined by oven drying method [2]. Peanut powder was well-mixed and 2 g was accurately weighed in clean, dried crucible. The crucible was put in an oven at 100-105°C for 6-12 hours until a constant weight was obtained. Then the crucible was placed in the desiccator for 30 minutes to cool. After cooling it was weighed again, the percent moisture content was calculated by the following formula:

$$\%\ moisture = \left(1 - \frac{Weight_{\ Dry\ Sample}}{Weight_{\ Wet\ Sample}}\right) \times 100$$

2.1.2 Determination of ash content
Procedure
For the determination of ash, clean empty crucible was placed in a muffle furnace at 600°C for an hour, cooled in desiccator and then weight of empty crucible was noted (W1). One gram of the peanut powder was taken in crucible (W2). This was then ignited over a burner with the help of blowpipe, until it is charred. Then the crucible was placed in muffle furnace at 550°C for 2-4 hours. The appearances of gray white ash indicated complete oxidation of all organic matter in the peanut material. After ashing furnace was switched off. The crucible was cooled and weighed (W3). Percent ash was calculated by following formula:

$$\%\ Ash = \frac{Difference\ in\ weight\ of\ Ash}{Weight\ of\ the\ peanut\ powder} \times 100$$

Difference in weight of ash = W3 - W1

2.1.3 Determination of crude protein content
Procedure
Protein in the sample was determined by Kjeldahl method. The samples were digested by heating with concentrated sulphuric acid (H_2SO_4) in the presence of digestion mixture. The mixture was then made alkaline. Ammonium sulphate formed, released ammonia which was collected in 2% boric acid solution and titrated against standard HCl. Total protein was calculated by multiplying the amount of nitrogen with appropriate factor (6.25) and the amount of protein was then calculated. To 1.0g of dried samples in digestion flask, 15ml of concentrated H_2SO_4 was added and 8g of digestion mixture composed of potassium sulphate and copper sulphate in the ration of 8:1.
The flask was swirled in order to mix the contents thoroughly and then placed on the heater to start digestion till the mixture became clear (blue green in color) for 2 hours. The digest was cooled and transferred to 100 ml volumetric flask and volume was made up to mark by the addition of distilled water.
Distillation of the digest was performed in Markam Still

Distillation Apparatus (Khalil and Manan, 1990). Briefly, 10ml of digest was introduced in the distillation tube then 10ml of 0.5 N NaOH was gradually added through the same way. Distillation was continued for at least 10 min and NH_3 produced was collected as NH_4OH in a conical flask containing 20ml of 4% boric acid solution with few drops of modified methyl red indicator.
During distillation yellowish color appears due to NH_4OH. The distillate was then titrated against standard 0.1 N HCl solution till the appearance of pink color.
A blank was also run through all steps as above. Protein in the sample was determined by Kjeldahl method. Percent crude protein content of the sample was calculated by using the following formula:

$$\% \, Crude \, Protein = 6.2^{*} \times \% \, N$$

(Whereby * stands for the Correction factor).

$$\% \, N = \frac{(S-B) \times N \times 0.014 \times D \times 100}{\text{Weight of the sample} \times V}$$

Where; S = sample titration reading
B = Blank titration reading
N = Normality of HCl
D = Dilution of the peanut material after digestion
V = Volume taken for distillation
0.014 = Milli equivalent weight of Nitrogen

2.1.4 Determination of crude fat content
Procedure
Dry extraction method for fat determination was applied. It consisted of extracting dry peanuts with some organic solvent, since all the fat materials like fats, phospholipids, sterols, fatty acids, carotenoids, pigments, chlorophyll, are extracted together, the results are therefore frequently referred to as crude fat.
Fats were determined by intermittent Soxhlet extraction apparatus. Crude fat was determined by ether extract method using Soxhlet apparatus.
Approximately 1 g of moisture free sample was wrapped in filter paper, placed in fat free thimble and then introduced in the extraction tube. Weighed, cleaned and dried, the receiving beaker was filled with petroleum ether and fitted into the apparatus. Water and heater were turned on to start extraction. After 4-6 siphoning, ether was allowed to evaporate and beaker was disconnected before last siphoning. Extract was transferred into clean glass dish with ether washing and ether was evaporated on water bath. The dish was then placed in an oven at 105°C for 2 hrs and cooled it in a desiccator.
The percent crude fat was determined by using the following formula:

$$\% \, Crude \, fat = \frac{Weight \, of \, ether \, extract}{Weight \, of \, peanut \, material} \times 100$$

2.1.5 Determination of crude fiber content
A moisture free and ether extracted sample of crude fiber made of cellulose was first digested with dilute H_2SO_4 and then with dilute KOH solution. The undigested residue collected after digestion was ignited and loss in weight after ignition was registered as crude fiber. The peanut material was weighed (W0 of 0.153 g) and transferred to a porous crucible. The crucible was then placed into Dosi-fiber unit and the valve kept in "OFF" position. After that 150 ml of preheated H_2SO_4 solution was added and some drops of foam-suppresser to each column.
The cooling circuit was then openned and turned on the heating elements (power at 90%).
When it started boiling, the power was reduced to 30% and left for 30 min. Valves were opened for drainage of acid and rinsed with distilled water thrice to completely ensure the removal of acid from sample. The same procedure was used for alkali digestion by using KOH instead of H_2SO_4. Then the sample was dried in an oven at 150°C for 1 hour and then allowed to cool in a desiccator and weighed (W1). The samples were kept in crucibles in muffle furnace at 55°C for 3-4 hours. The samples were cooled in a desiccator and weighed again (W2). The percent crude fiber was calculated as follows:

$$\% \, Crude \, Fiber = \frac{W1-W2 \times 100}{Wo}$$

3. Results and Discussions
Table 1 shows the proximate analysis of raw and roasted peanuts of Manipinta and Valencia varieties. The moisture content of raw and roasted peanut ranged from 4.84-5.11% and 2.02 - 2.17% respectively while fat content of raw and roasted peanut ranged from 43.3-48.3% and 47.3-49.1% respectively.
Protein content in raw peanut ranged from 22.02-28.99% while roasted peanut ranged from 31.4-33.1%. Total ash in raw peanut ranged from 2.37-2.54% while roasted peanut ranged from 4.04-4.13%. Fiber content in raw peanut ranged from 9.8-10.83% while in roasted it ranged from 5.47-6.56%. Carbohydrate content in raw peanut ranged from9.49-12.37% while roasted ranged from 6.63-7.87%. Roasted red Valencia were significantly different than raw Red Valencia while in Manipinta the significant difference were only seen in moisture, fat and fibre content. Fat content, moisture and fibre content were significantly higher in Red Valencia than Manipinta.

Table 1: Proximate composition of raw and roasted Red Valencia peanut varieties

	Red Valencia Raw	Red Valencia Roasted	P value (t-test)
Moisture (%)	5.11±0.05	2.17±0.04	0.001
Fat (%)	48.33±0.14	49.13±0.11	0.001
Protein (%)	22.02±0.23	31.45±0.65	0.003
Total ash (%)	2.37±0.04	4.04±0.03	0.001
Fibre (%)	9.80±0.19	6.56±0.07	0.001
Carbohydrate (%)	12.37±0.44	6.63±0.49	0.008

Values are expressed as mean Standard Deviation, n=3.

Table 2: Proximate composition of raw and roasted manipinta peanut varieties

	Manipinta raw	Manipinta roasted	P value
Moisture (%)	4.84±0.01	2.02±0.03	0.001
Fat (%)	43.30±0.27	47.32±0.24	0.005
Protein (%)	28.99±6.51	33.17±1.09	0.423
Total ash (%)	2.54±0.003	4.13±0.17	0.004
Fibre (%)	5.47±0.26	10.83±0.05	0.001
Carbohydrate (%)	9.49±6.75	7.87±1.64	0.753

Table 3: Proximate composition of raw and roasted manipinta peanut varieties

	Red Valencia raw	Manipinta raw	P value	Red Valencia roasted	Manipinta Roasted	P value
Moisture (%)	5.11±0.05	4.84±0.01	0.020	2.17±0.04	2.02±0.03	0.002
Fat (%)	48.33±0.14	43.30±0.27	0.002	49.13±0.11	47.32±0.24	0.002
Protein (%)	22.02±0.23	28.99±6.51	0.215	31.45±0.65	33.17±1.09	0.224
Total ash (%)	2.37±0.04	2.54±0.003	0.022	4.04±0.03	4.13±0.17	0.529
Fibre (%)	9.80±0.19	5.47±0.26	0.018	6.56±0.07	10.83±0.05	0.027
Carbohydrate (%)	12.37±0.44	9.49±6.75	0.561	6.63±0.49	7.87±1.64	0.413

The study shows crude protein in raw peanut is 22.02-28.99, while in roasted is 31.45-33.17%. This is higher than the results by other studies [3, 4, 5]. The results also show that protein content increased when roasted. This does not agree with [5] whose analysis reported that the percentage of crude protein decreases when the groundnut seeds are subjected to heat treatment (sun-dried and roasted). This increase in crude protein levels could be explained by decrease in the water content hence concentrating the proteins.

Fat content ranged between 43.3- 48.3 in raw and 47.3-49.15 in roasted peanuts. This is within the range reported as 48.06-50.99 [6], 33.6-54.95 [7], 45.09-51.63% [8] and 32.7-53.1% [3] respectively.

The fibre content in this study ranges between 9.80-10.83% in raw, and 5.47-6.56% in roasted peanuts. This is higher than 3.7%) [5], 3.3-4.4% [9] and 2.76-3.07% [6] respectively while [4] reported 2.91% crude fibre in raw peanuts and 3.09% in roasted peanut. Carbohydrate content in this study is between 9.49-12.37% in raw peanut and 6.63-7.87% in roasted peanut. This is lower than 19.02-27.16 % [7], 18.9-23.4% [9] and 17.03-18.5% [6] but higher than 1.81% [5]. While [4] reported carbohydrate content for raw peanut at 25.3% and 26.5% for raw peanut. The differences in these results could be attributed to the different varieties that others have analyzed.

The results indicated that total ash and crude protein content of raw groundnut was higher than the roasted groundnut seeds. These results are similar to [4] who also found higher crude protein content in roasted groundnut when compared to that of raw groundnut. This could be contributed by low moisture content in roasted groundnuts that results in concentration of this nutrient in dry matter. Crude carbohydrates levels of raw groundnut are lower when compared with that of roasted this also agrees with [4, 5, 10] stated that crude carbohydrate content were higher in the roasted and sun-dried than in raw groundnut seeds.

Groundnut seed is rich source of fat and protein content. Groundnut forms a very good source of monounsaturated fat and also it is very low in cholesterol. In this study, raw peanuts had significantly lower crude fat percentage and roasted groundnut seeds in both manipinta and red Valencia. This is different from [4] who found similar crude fat percentage whereas fat content was higher in raw groundnut seeds and seems to be declining in the sun-dried and roasted groundnut seeds depending on the intensity of heat [6].

Crude fiber content is low in roasted groundnut when compared to roasted groundnut. Study by [5] has reported that diet low in crude fiber is undesirable and may cause constipation, cancer and piles. Results show that the groundnut seeds of this cultivar maintain good crude fiber percentage both in raw and roasted form and roasted groundnut is more advantageous in nutritional value than the raw groundnut.

The moisture content of the raw groundnut seed sample is higher than that of the roasted groundnut seed. Previous studies have also shown that the moisture content of the raw seeds were reported to be higher than those of the groundnut seeds subjected to heat treatment [10, 11]. The moisture content of the raw groundnut is not higher than the roasted groundnut because the raw groundnut is not previously exposed to any heat. The groundnut seed with 10.1% moisture content at 35°C survived for 12 weeks and the survival period increased up to 120 weeks when the moisture content is reduced to 4.4%. Low moisture percentage of groundnut seed also prevents it from the susceptibility to the fungal pathogens [12].

4. Conclusions

Fat content, moisture and fibre content were significantly higher in Red Valencia than Manipinta. Roasting significantly affects moisture, fat and fibre content.

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6. References

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