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Proximate Composition of Amaranth (*Amaranthus Hybridus*) Leaves

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Abstract
The proximate composition of Amaranth leaves (*Amaranthus hybridus*) was examined. The fresh sample of the experimental material was obtained from the dry season farm at Mararraba village, 20km away from Bauchi, the dual headquarters of Bauchi Local Government Area and Bauchi State. Sample collection bag was used to convey the samples from the collection area yo the laboratory (Forestry Technology laboratory, Federal Polytechnic, Bauchi) where the sample was shade dried for five days. The dreid leaves were grounded using pestle and mortar, mixed thoroughly to obtain composite sample and pass through 2mm sieve. The analysis was conducted at Biochemistry laboratory of Federal College of Animal Health and Production Vom, Plateau State – Nigeria using the instructions of Association of Analytical Chemists (2000). The results of the analysis reveals that at the time of the analysis, the moisture content was found to be 18.85%, Ash 11.18%, Crude protein 5.27%, Carbohydrate 9.28%, Crude fat 5.65%, and Crude fiber 41.21% respectively. The observed nutrient levels and types may add value to the dietary needs of both humans and animals. Considering its popularity among inhabitants of the tropics, as a source of food and feed, its cultivation is highly encouraged and being the most populous leafy vegetables in terms of usage among household in the Sahelian region of the tropics, processing and packaging of its leaves will go along way in promoting food security and value to the product.

Key Words: Amaranth- Proximate- Composition- Laboratory- Vegetables

Introduction
Global vegetable cultivation and consumption continue to witness a global expansion that is greater than any other plant group (Nuez, 2007). This is connected to their valued phytochemical contents and the diversity of plant species that can be exploited for their fruits, flowers, tubers or leaves as vegetables. Moreover,

technological advancements have made their production more attractive due to less disease incidence and pest attacks. Together, these have led to increased food and income security value for vegetables.

Amaranth species belong to the Caryophyllales order, *Amaranthaceae* family, Amaranthoideae subfamily and Amaranthus genus. (*Montoya et al,* 2015) Amaranth is also a herbaceous plant or shrub that is either annual or perennial across the genus. Flowers vary inter specifically from the presence of 3 or 5 sepals and stamens, whereas a 7-porate pollen grain structure remains consistent across the family. Species across the genus contain concentric rings of vascular bundles, and fix carbon efficiently with a C4 photosynthetic pathway. Leaves are approximately 6.5–15 centimeters and of oval or elliptical shape that are either opposite or alternate across species, although most leaves are whole and simple with entire margins. Amaranth has a primary root with deeper spreading secondary fibrous root structures. Inflorescences are in the form a large panicle that varies from terminal to axial, color, and sex. The tassel of fluorescence is either erect or bent and varies in width and length between species. Flowers are radially symmetric and either bisexual or unisexual with very small, bristly perianth and pointy bracts. Species in this genus are either monecious (i.e. *A. hybridus*,) or dioecious (i.e. *Amaranthus palmeri*). Fruits are in the form of capsules referred to as a unilocularpixdio that opens at maturity. (Keding *et al,* 2007*)* The top (operculum) of the unilocularpixdio releases the urn that contains the seed. Seeds are circular form from 1 to 1.5 millimeters in diameter and range in color with a shiny, smooth seed coat. The panicle is harvested 200 days after cultivation with approximately 1,000 to 3,000 seeds harvested per gram. (Keding *et al,* 2007)

Amaranth originated in America and is one of the oldest food crops in the world, with evidence of its cultivation reaching back as far as 6700 BC. The genus Amaranth consists of nearly 60 species, several of which are cultivated as leaf vegetables, grains or ornamental plants, while others are weeds.

Sequel to the United Nation Development Program (UNDP, 2008) reports, that Sub-Saharan Africa suffers food insecurity and poor health facilities most especially among rural dwellers. The inability of Sub-Saharan continent to identify and categorized valuable floral resources base on their food value may be responsible for it's underdevelopment in term of food security and ability to tackle tropical diseases.

In Nigeria, as in most other tropical countries of Africa where the daily diet is dominated by starchy staple foods, vegetables are the cheapest and most readily available sources of important vitamins, minerals and essential amino acids.

However, the nutritive value of the most commonly used part of this leafy vegetable (i.e. leaves) is not well understood due to little or non-availability of literature about its nutritive value that will serves as a guide to food and medicine formulators, as well as government and nongovernmental agencies wishing to cultivate same with a view to making its resources most especially the leaves, available to general public to curtail the negative effects of malnutrition among the populace. These factors formed the bases for the design of this research work, to evaluate the nutritive status of Amaranth leaves.

METHODOLOGY

Sample Collection and Preparation

The sample of experimental material (Amaranth leaves) was collected from Mararraba dry season farm, 20 kilometers from Bauchi, the headquarters of Bauchi state Nigeria ($9^0 30^1$ and $12^0 30^1$ N and $8^0 50^1$ and 11^0 E). The leaves were cut using secateurs and enveloped in specimen poly-bag and transported to Federal Polytechnic Bauchi where the sample was shade dried in Forestry Technology Laboratory for a period of five days in accordance with Wakili (2016). The dried leaves were pounded using pestle and mortar and pass through 2mm sieve. The powdered leaves were used in the determination of food value (proximate composition).
The analysis was conducted at Biochemistry laboratory of Federal College of Animal Health and Production VOM, Plateau State Nigeria.

Determination of Proximate Composition

The analysis was conducted using the instructions of Association of Analytical Chemists (2000) to ascertain the moisture content, crude protein, crude fiber, crude fat, ash and carbohydrate content of the sample.

Determination of Moisture content

2g of leaf powdered sample were weighed and place in pre-weighed moisture can, it was dried to constant weight at 105^0C in a drying oven. The moisture content was determined by the formula.

$$MC = \frac{A-B}{B} * 100$$

Where MC = Moisture content
A = Original mass of dried leaves powdered sample
B = Oven dry mass of dried leaves powdered sample

Determination of Crude Protein (CP)

This analysis was conducted with an aid of micro Kjedhal system in accordance with AOAC (2000). A small quantity of the sample (Approximately 1g) was introduced in to the digestion tube (Kjeltec 2200 FOSS) and, a catalyst (2 tablets of $5gK_2SO_4$ and 5g of Se) and 12ml of concentrated tetra oxosulphate VI acid (H_2SO_4) were added. The digestion was run for one hour at 420^{o}C. 80ml and 40ml of water and sodium hydroxide (NaOH) respectfully were used in the distillation using 2200 FOSS distillation unit and the distillate was collected in 4% Boric acid. Percentage Nitrogen was calculated thus:

$$\%N = \frac{(\text{Titre- Blank}) \times 14.007 \times 0.1 \times 100}{1000 \times \text{sample weight (mg)}}$$

$$\%CP = \%N \times 6.25$$

Determination of Crude Fiber (CF)

The crude fiber of the sample was determined according to AOAC (2000). 2g of the sample was defatted with petroleum ether and then boil under reflux for 30minutes with 200ml of a solution containing 1.25g of H_2SO_4 per 100ml of solution. The solution was then filtered

through linen on a fluted funnel. It is then washed with boiling water until the washings are no longer acid. The residue was then transferred to a beaker and boils for 30minutes with 200ml of a solution containing 1.25g of carbonate free NaOH per 100ml. the final residue was then filtered through a thin but close pad of washed and ignited asbestos in a Gooch crucible and dried in an electric oven and weigh. It was then incinerated, cooled and weighed. The percentage crude fiber was calculated as:

%CF = Loss of weight after incineration x 100

Determination of Crude Fat

The fat contents were determined using Fat extractor with automated control unit (FOSS Soxtec 2055) according to AOAC (2000). The equipment has six extraction units with each unit carrying a thimble which accommodate the samples and aluminum cups for collection of the extracted fat. These units enable six samples to be analyzed within 75minutes. Percentage of fat is the differences between weight of the pre-weighed cups and after extraction. One gram of the samples was weighed into the thimble and its mouth plugged with defatted cotton wool, after which it was inserted in to the extraction unit. 80ml of petroleum ether were dropped in to each cup and maintained at 135ºC. Each cup was aligned with its corresponding thimble. The extraction and rinsing were done for 30minutes each, after which the sample was aerated for 15minutes and crude fat calculated as:

$$\%Fat = \frac{W_3 - W_2}{W_1} \times 100$$

Where w_1 = weight of sample, W_2 = weight of empty cup and W_3 = weight of cup with the extracted oil

Determination of Ash

The instruction of AOAC (2000) was adhered to in the running of this analysis. Crucibles were rinsed and dried in hot air oven (SM9053) maintained for 30minutes at 105ºC. These were cooled in desiccators and weighed. 2.5g of the sample was burnt on a heater inside a fume cupboard to get rid of smoke. The samples were moved to pre-heated muffle furnace (SM9080) maintained at 550ºC until such a time when a light grey ash was noticed. The crucibles were cooled in a desiccators and weighed. The ash content was calculated as:

$$\%Ash = \frac{(\text{weight of crucible + Ash}) - \text{weight of empty crucible}}{\text{Weight of sample}} \times 100$$

RESULTS AND DISCUSSION

Table 1. Nutritional composition of Amaranth Leaves

Variable	Results (%)
Moisture Content	**18.85**
Crude Protein	**5.27**
Crude Fiber	**41.21**
Crude Fat	**5.65**
Ash	**11.18**
Carbohydrate	**9.25**

Moisture Content

The moisture content of Amaranth leaves in this experiment was found to be 18.85%. This moisture value was higher than that of *Pachira glabra* (0.17%) as reported by Oni et al., 2015. The reason for the variation may be as a result of plant part(s) used for the analysis. Oni et al., 2015 uses fruit of *Pachira glabra* which is high forest species while this research used leaves of leafy amaranth, and which was dried for five days prior to the analysis. The findings of Wakili et al., 2015 shows moisture value of some commonly used horticultural plants in Northern Nigeria: orange (87.12%), *Ananas comosus* (80.10%), *Solanum melongena* (78.95%) and *Cocos nucifera* (42.92%) respectively. These values were higher than the value of this study. The variation may be attributed to the part(s) of the plant used for the analysis and the mode of drying. Wakili *et al.,* 2015, uses fruits which mainly contain water and the collected fruits were not subjected to long drying period of time as does in this methodology. In this work, the leaves were collected and subjected to drying process for a period of five days. This makes the moisture content to be too low. In powdered form the leaves of amaranth can be stored for a considerable period of time without deterioration. This attribute may guarantee the storage of amaranth products for future use most especially in rural areas where modern storage facilities are not available.

Crude Protein

The protein content observed in this study was found to be 5.27% which is lower compared to the findings of Ogunlade *et al.,* 2011, who reported protein value of 10.38% for *pachira glabra* and Oni et al., 2015, who reported protein value of 7.67% for *pachira glabra*. Wakili *et al.,* 2015 reported 18.48% for *Solanum melongena*, 12.81% for *Daucus carota,* 9.38% for *Citrus sinensis*, 8.32% for *Cocos nucifera* and *Ananas comosus* (2.77%) and thus giving protein range value of between 2.77% and 12.8%. This protein range agrees with the findings of this work. Tabitha, 2013 reported a protein content of *Solanum melongena* from northern guinea savanna zone of Nigeria to be 16.25%. The variation may be as a result of the part of the tree used for the study. Fruits were used in the later studies while the former uses leaves. According to Ninfaa (2011), the protein content of the desert date leaves and fruit pulp were 17.06% and 3.85% respectively.

Crude Fiber

Table 1 reveals that amaranth leaves have the crude fiber value of 41.21%. Crude fiber helps in the maintenance of cholesterol and lower blood sugar in addition to prevention of constipation among adults (Gopalane *et al.,* 1997). Amusa *et al.,* 2018 reported 7.92% as crude fiber value of *Talinium triangulae* which is relatively lower than the crude fiber of this study. The variation could be attributed to variation in ecological zone. This result was conducted in Sudan savannah zone of Northern part of Nigeria, whereas crude fiber reported by Amusa *et al., 2018* was carried out in low land high forest of Nigeria. According to the findings of Wakili et al., (2015), crude fiber of *cocos nucifera* has the value of 14%, *Ananas comosus*(7%), *citrus sinensis* (2.82%) *Daucus carota* (2.39%) and *solanum melongena* (2.28%). Therefore, the value of this finding was higher than the values reported by Wakili *et al.,* (2015). Diplocka *et al.,* (1998) reported 3.88% as crude fibre value of baobab leaves. This value was lower than

value obtained in this present study. The findings of Mona, (2014) reveal 5.64% as fibre value of baobab seeds.

Crude Fat

The result of the analysis indicated that the crude fat value of amaranth leaves was found to be 5.65% which is lower ompared to the value of *Talinium triangulae* (7.34 ± 0.05%) as reported by Eleazu and Eleazu (2013). This could be attributed to climatic factors. *Talinium triangulae* is leafy vegetable of high rainfall area compared to experimental material of this study been a leafy vegetable in savannah region of Nigeria. Osman, (2004) reported that baobab seeds contains 12.25% fat, this value was higher than that of this work. According to the findings of Akindahunsi and Salawu (2005), fat content of *Talinium triangulae* leaves was found to be 5.90%, this was also higher than the report of this study. The variation could be attributed to species of the plant used for the study.

Carbohydrate

The carbohydrate content of the present study was found to be 9.25% which is lower than 11.2% carbohydrate content of Baobab seeds as reported by Murray *et al.,* (2001). According to the findings of Proll (1998), the carbohydrate content of baobab seeds was found to be (56.75%). This shows that the carbohydrates present in baobab seeds is higher than that of amaranth leaves. The low carbohydrates content of amaranth leaves indicated a little role as a source of energy, a sample with high level of carbohydrates can regulate nerve tissue. According to the findings of Ninfaa, (2011) the carbohydrates content of the desert date fruit was 59.53% while that of the leaves was (30.92%). These values were higher than that of this study and therefore provide more energy than amaranth leaves.

Conclusion

In conclusion, it would be said that amaranth leaves are full of the required nutrients for growth and development and therefore all efforts aimed at its cultivation should be championed with all seriousness it deserved.

Recommendations

Considering the dietary contributions of amaranth in addition to its ecological and industrial values the following are here by recommended:

- That cultivation of amaranth be encouraged among the farmers by offering soft loan with long repay period
- Packaging of amaranth products will add utility value and therefore, cottage industries aimed at processing and packaging leafy vegetables be stationed in rural areas
- Farming inputs be subsidized (including machineries) and made available to leafy vegetables production areas at ease
- Demonstrative workshops and seminars be periodically organized among rural farmers on the need for massive production using technology
- Both government and Non Governmental Organizations (NGOs) should come up with an easy way of exporting vegetables by farmers with little or no problem

References

Akindahunsi, P.and Salawu, S. O. (2005). Phytochemical screening of Nutrient and Anti-nutrient Composition of Selected Tropical Green leafy Vegetables. *Afr. J. Biotech*, **4**: 497-507.

Amusat A. I. Adedokun M. A. Tairu H. M., Amuzat A. I. Adaramola K. A. and Olabamiji. S. O. (2018). Proximate Analysis Phyto-chemical screening and mineral composition of water leaves (Talinium Triangulae) Harvested in Oyo State College of Agriculture and Technology Igboora. *International Journal of Agriculture and Environmental Science* (SSRA-IJAES) – **5**:22-29

AOAC (2000). Association of Analytical Chemists. Official Methods of Analysis, 17th edition, Horowitz edition intern, Maryland, USA, Vol 1&2; 452-456,Washington DC

Assogbadjo, A. E. , Gleele, K. R., Edon, S. Kyridt, T. and Sinsin, B. (2011). Natural variation in fruit characteristics, seed germination and seedling growth of *Adansonia digitata L*. in Benin springer Sci., *New forest*, **41**:113-125.

Diploka A. T., Charuleux, J. L., Crozier – Willi, G.F., Kok, J., Rice-evans, C., Roberfroid, M., Stahl, W. and Vina-Ribes, J. (1998). Functional food science and defence Against Reactive Oxidative species. *British Journal of Nutrition* **80**:77-112. DOI:https://doi.org/10.1079/bjn19980106.

Eleazu C. O. and Eleazu, K. C. (2013). Bioactive Constituents and in vitro Antioxidant capacity of water leaf (Talinium ttriangulae) as affected by Domestic Cooking. *European Journal of Medicinal plants*. **3**(4): 540-551.

Gopalan, V., Bax evanis, A. D., landsman, D. and Aitman, S. (1997). Analysis of the functional role of conserved residues in the protein subunit of ribonuclease P. from E. coli. *Journal of Mol.Biol.* **267**(4): 819-829.

Kabore D., Sawadogo – Lingani, H., Diawara, B., Compare, C., Dicko, M. and Jakobsen, M. (2011). A review of baobab (*Adansonia digitata*) products. Effect of Processing Techniques Medicinal Properties and Uses *Afr. J. food Sci*. **5**:833-844.

Keding GB, Krawinkel, MB, Maass, BL, Virchow, D and Msuya, J. (2007).“Traits and use of Traditional Vegtables in Tanzania” Technical Bulletin No.**40**, AVRD-C. The World Vegetables Centre, Taiwan, P-55

Mona, E. M. (2014). Phytochemical study of the leaves of Adansonia digitata. Unpublished Thesis Sudan University of Science and Technology, Collage of Graduate Studies.

Montoya R. A, Gomez. F. M.A, Reyes. M.C. and Milan,C.(2015). District Census Report. Ministry of Urban and Population Planning. Government of Pakistan. Islamabad

Murray, S. S.,Otanga, A.D. and Jane,Z.E.(2001). Nutritional composition of some wild plant foods and honey used by Hadza forages of Tanzania. *Journal of Food Composition and Analysis.* **14**: 3-13

Nifaa, D. A. (2011). Post-harvest handling of edible parts (leaves and fruits) of the desert date (Balanites aegyptiaca) available on ir.knust.edu.gh/handle/123456789/2087.

Nuez .J f. (2007) hand book of plant breeding. New York, United States: Springer nature. 364pp

Ogunlade., I., Ilugbiyin., A. and Osasona, A. I. (2011). A Comparative Study of Proximate Composition, Anti-nutrient Composition and Functional Properties of *Pachira glabra* and *Afeelia africana* seed flours. *African Journal of Food Science*, **5**(1): pp. 32-35.

Oni, P. T. Malomo, O. and Adekoyeni, O. O. (2015). Preliminary evaluation of the ecology economic importance and nutritional potentials of pachira glabra (pasq): a neglected fruit tree in Nigeria. *Int. J. curr. Microbiol.Appl.Sci.*, **4**(2): 1030-1036.

Osman, M. A. (2004). Chemical and Nutrient Analysis of Baobab (Adansonia digitata) fruit and seed protein solubility. *J. of plant foods for human nutrition* **59**: 29-33 Available at www.springer link.com/content/10/424514455215. Accessed 21st January.

Proll, J., Petzk, K. J., Ezeagu, I. E. and Metges, C.C. (1998). Low Nutritional Quality of Unconventional Tropical Crops Seed in Rats. *J. Nutri*. **128**: 2014-2022.

Tabitha, J. 2013. An evaluation of the nutritional status of some horticultural crops. Jewel J. Sci. Res., **1**(1): 44-49.

UNDP(2008). United Nations Development Programme.

Wakili A., Abdullahi, M. B. and Madara, M. S. (2015). Proximate Composition of five commonly used horticultural products in Northern Nigeria, J. Curr. Microbial.App.Sci., **9**(2): 924-928.

Wakili, A.(2016). Plant Nursery Production in the Tropics. New era Publishing Comp.Bauchi-Nigeria 171pp