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Proximate and Mineral Analysis of Watermelon Sold at North Bank Market, Makurdi, Nigeria

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Keywords: watermelon, proximate, minerals, AAS.

I. Introduction

Humans possess great capacity to adapt physiologically to different types of foods. In spite of this, nutrition science has demonstrated that there are certain foods that cannot be eliminated, such as fruits and fresh vegetables. Fruits offer the most rapid methods of providing adequate supplies of vitamins, minerals and fibres to people living in the tropics. Most fruits and vegetables have low energy density and are recommended for weight management (Rolls & Ello Martins *et al.,* 2004). The optimal diet for everyone as recommended by the world health and food/agricultural organization is a low-fat, and fibre diet rich in complex carbohydrate characterized by a frequent consumption of fruits and vegetables at least 400g daily as well as whole-grains, cereals and legumes at least 30g daily (WHO/FAO, 2003).Watermelon (*Citrullus lanatus)* is a scrambling and trailing vine in the flowering plant family *cucurbitaceae.* The species originated in Southern Africa, with evidences of its cultivation in Ancient Egypt. It is grown mostly in tropical and sub-tropical areas worldwide for its large edible fruit, which is a special kind of berry with a hard rind and no internal division, botanically called a *pepo.* Watermelon consists mostly of water (91 %) and carbs (7.5 %). It contains almost no protein (0.6 g) or fat (0.15 g), and is very low in calorie (30 kcal). The carbs are mostly simple sugars such as glucose, fructose and sucrose. Watermelon also contains small amount of fibers about 0.4 grams per 100 grams. However, it is considered high in fermentable short chain carbohydrate referred to as FODMAPs. FODMAPs cause unpleasant digestive symptoms in individuals who cannot digest them, such as those with irritable bowel syndrome.

Watermelon is the richest known dietary source of amino acid *Citrulline.* The highest amount is found in the white rind that surrounds the flesh (Tarazona– Diaz *et al.,* 2011). In the body, *Citrulline* is transformed into the essential amino acid Arginine. Both *Citrulline* and Arginine plays an important role in the synthesis of nitric oxide (NO), which helps to lower blood pressure by dilating and relaxing our blood vessels (Rimando *et al.,* 2005). Arginine is also important for many organs such as the lungs, kidneys, liver and the immune and reproductive systems. It has been shown to facilitate the healing of wounds (Ikeda *et al.,* 2000). Studies have shown that watermelon juice is able to increase blood levels of both *Citrulline* and Arginine considerably (Wu *et al.,* 2000). Despite being one of the best dietary sources of *Citrulline* one would have to consume about 5 pounds (2.3 kg) of watermelon to meet the recommended daily intake for Arginine.

Watermelon is a good source of vitamin C and also a decent source of several other vitamins and minerals. Vitamin C an antioxidant that is essential for skin health and immune function. Potassium (K) a mineral that is important for blood pressure control and heart health.VitaminB_5 also known as Pantothenic acid which to some extent is almost present in all food. The aim of this study is to carry out the proximate and mineral analysis of watermelon fruits sold in North Bank Market.

II. Materials and Methods

a) Study Area

According to Benue State Ministry for Lands and Survey, 2011, Makurdi lies between coordinate of 704350 North and 803210 East within central Nigeria

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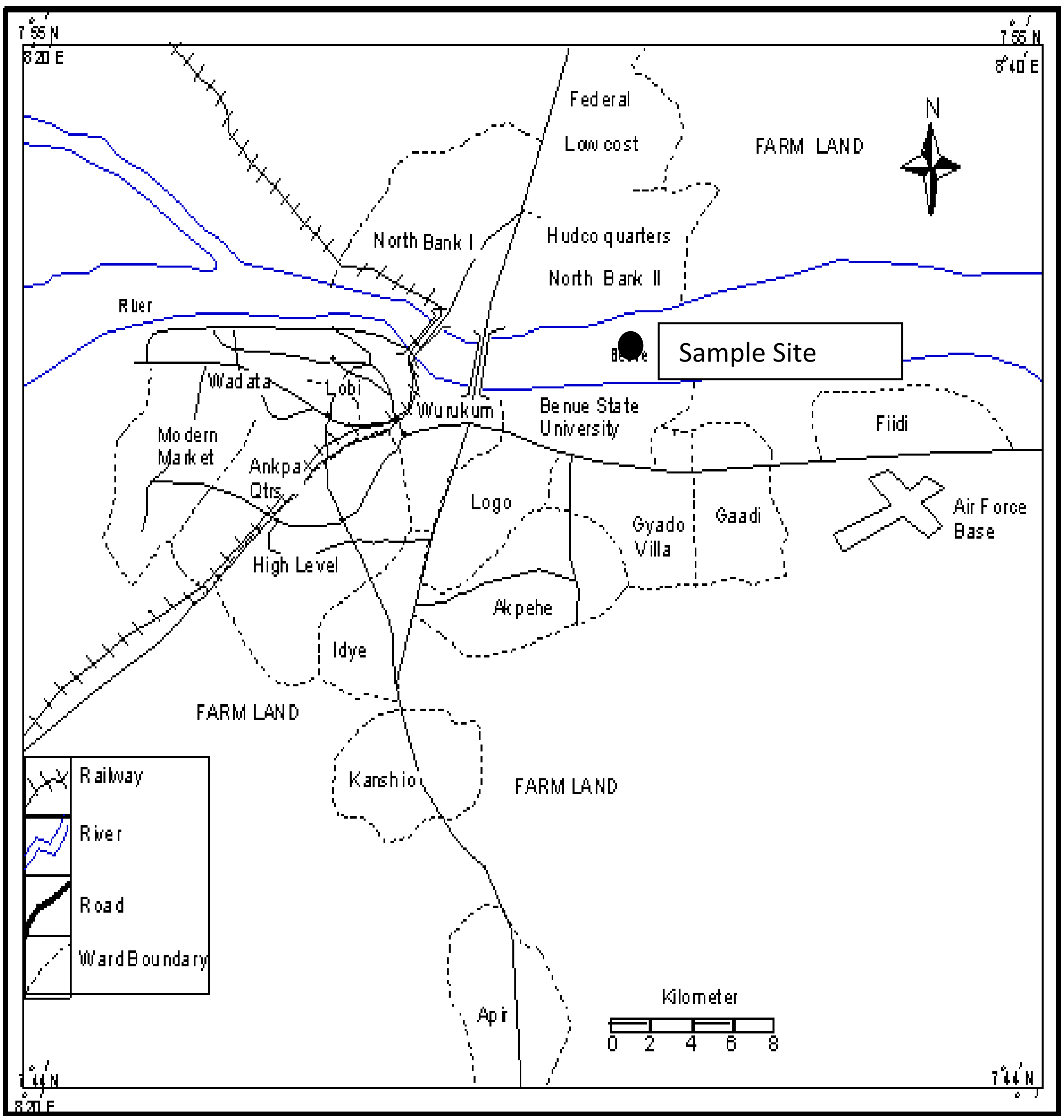
with an estimated population of five hundred thousand, seven hundred and ninety-seven persons (500,797) base on "The world Gazette" (2007). The network of rivers, gutters, standing pool of water, streams blocked gutters which enhanced disease emergence from time to time drains the area. Makurdi, the state capital was established in the early twenties and gained prominence in 1927 when it became the headquarters of the Benue province. Being a river port, it attracted the establishment of trading depots by companies such as United Africa Company of Nigeria and John Holt Plc. Its commercial status was further enhanced when the Railway Bridge was completed and opened in 1932. In 1976, the town became the capital of Benue State and today doubles as the headquarters of Makurdi Local Government Area. The town is divided by the River Benue into the North and South Banks, which are connected by two bridges. The sampling site is indicated in Figure 1.



(Source: Benue State Ministry for Lands and Survey, 2011).

Fig. 1: Map of Makurdi Local Government Area showing the study area.

b) Collection of Samples

Three watermelon samples of average weight of 20 kg and diameter of 28 – 30 cm were purchased from North bank market in Makurdi metropolis, Benue State, Nigeria. All samples were collected in January, 2018.

c) Sample preparation/Digestion

The watermelon fruits were bought from North bank market, Makurdi, Benue State. The fruits were sliced/ chopped into small sizes using kitchen knife. The seeds were removed from the pulp before separating the red pulp from the rind. The seeds were washed, allowed to drain and placed on a foil. The pulps were chopped into shreds, allowed to drain and placed in another lined with foil. The rinds were chopped into tiny cubes and placed in a separate tray line with foil. The whole set up were afterward dried under Sun for 5 – 10 days ensure total dryness prior analysis.

5 g of each sample was weighed into 150 cm^3 conical flask and digested using 150cm^3 nitric acid, 2cm^3 perchloricacid and was placed on a hot plate for 3 hours. On cooling the digest was filtered into 100cm^3 volumetric flask and made up to the mark with distilled water. The digested sample were stored in a safe place prior to the AAS analysis.

d) Proximate Analysis of Sample

Proximate analysis of the sample for moisture content, ash content, crude lipid, crude fibre and crude protein were carried out in triplicate using the methods as described in AOAC(2000) while carbohydrate was determined by difference as shown below; %Carbohydrate = 100- (%moisture + %crude protein + %crude fat + %ether extract + %ash). All the proximate values were reported in g/100g sample. All chemicals used were of Analar grade.

e) Trace Metal Determination

2.0 cm^3 of the samples were each weighed and digested with concentrated HNO_3. After complete digestion, the volume was made up with deionized water in a volumetric flask. The samples were analyzed for trace metal using a computer controlled Atomic Absorption Spectrophotometer (AAS 696 Model).

f) Statistical Analysis

The results obtained were subjected to statistical evaluation. Data obtained from the parameters were evaluated using mean, standard deviation and coefficient of variation. All determinations were in triplicates.

III. Result

Table 1: Proximate composition of watermelon part

S/N	Parameter	Bark (%)	Pulp (%)	Seeds (%)	Mean($\bar{X}$)	SD	Coefficient of variation(%)
1	Moisture	8.702	10.903	3.500	7.7016	3.104	40.30
2	Ash content	6.501	4.202	2.801	4.5013	1.525	33.90
3	Crude fat	2.400	0.404	13.103	5.3023	5.576	105.20
4	Crude protein	4.202	3.200	19.201	8.868	7.318	82.50
5	Crude fibre	10.500	5.801	15.300	10.534	3.878	36.80
6	Carbohydrate	67.804	75.502	46.100	63.135	12.449	19.70

Table 2: Metal concentrations of watermelon part samples in mg/100g

S/N	Metal	Bark (%)	Pulp (%)	Seeds (%)	Mean($\bar{X}$)	SD	Coefficient of variation(%)	WHO Standard
1	Mg	4.36	3.61	2.83	3.60	0.62	17.30	50.00
2	Ca	29.25	25.14	22.67	25.69	2.71	10.60	75.00
3	Fe	0.28	0.22	0.16	0.22	0.05	23.70	0.30
4	Pb	ND	ND	ND	ND	ND	ND	0.01
5	Cd	ND	ND	ND	ND	ND	ND	0.003
6	Cr	0.17	0.10	0.05	0.11	0.05	45.10	0.05

ND = Not Detected.

IV. Discussion

a) *Proximate analysis*

The proximate composition of *Citrullus lanatus* bark, pulp and seeds are shown in Table 1. The result showed that the moisture content of the seed (3.50%) was significantly lower than that of the pulp, the bark (8.70%) was also significantly lower than the pulp (10.90%) but higher than the seeds. The moisture content of either the rind (bark) or the seed flour is lower than that of processed and unprocessed *Dioscorea dumentorium* (Egbuonu *et al.*, 2014). In particular, the moisture content of the rind (8.70%) is higher than the value (5.08%) reported by Fila *et al.* (2013) where as that of the seed flour is lower than that reported by Ogunlade *et al.* (2011) for *Afzelia Africana* (9.49%) and *Pachira glabara* (9.13%). The lower moisture content of seed sample suggests higher dry matter yield (Bamigboye *et al., 2010*). The lower moisture could enhance storage stability (Ejikeme *et al.,* 2010*;* Bamigboye *et al., 2010;* Nzewi and Egbuonu, 2011) of the seed flour compared to that of the rind and pulp.

The result of the ash content indicates that *Citrullus lanatus* bark (6.50%) however was significantly higher than the seed (2.80%) and pulp (4.20%). The ash content of the rind agrees with that of Jack bean (6.51%) reported by Olalekan and Bosede (2010). The values were lower than the 7.45% of *cucurbita spp* reported by Aruah *et al.* (2011). The proportion of ash content is a reflection of the mineral content present in the food materials of the mineral contents presents in the food materials of the mineral contents presents in the food materials (Omotoso, 2006).

The result of the crude fat content of *Citrullus lanatus* in Table 1 showed that the seed (13.10%) was significantly higher than the pulp (0.40%) and the bark (2.40%). The mean value (5.30%) was higher compared with 1.6% for *Cucurbita spp* seeds reported by Aruah *et al.* (*2011*). However the values were lower than the 52.13% of *Cucurbita maxima* seed reported by Amoo *et al.* (2004). Dietary fats function in the increase of palatability of food by absorbing and retaining flavor (*Anita et al.,* 2006). Fats are also vital in the structural and biological functioning of cells and help in the transport of nutritionally essential fat soluble vitamins (Omotoso *et al.,* 2006)

The crude protein content result indicates that the bark (4.20%) is slightly higher than the pulp (3.20%) but significantly lower when compared with the seed (19.20%). The value of the seed was to be higher than the value (14.42 %) of *C. maxima* while that of the fruit pulp was of higher value to 0.2 – 2.7% reported for C. *maxima* by karaye *et al.*(2013). The level of protein in these indicates that they can contribute to the daily protein requirements for human which is based at 23-56g as stipulated by NRC.

The result of the crude fibre content revealed that the fibre content of the seed (15.30%) was higher than the pulp (5.80%) and the rind and seed flour is higher than the value (1.90%) reported by Fila *et al.* (2013). Fibre enhances the proper digestive function thereby preventing constipation and hemorrhoids (Erhirhie and Ekene, 2013).

The carbohydrate content of the Bark (67.80%) was significantly higher when compared with the seed (46.10%) but lower than the pulp (75.50%). These values were higher compared with the value of 6.39% reported for *Arachis hypogeal* by Loukou *et al.* (2007) and while the mean value was at an approximate range compared to 66.64% reported for *C. maxima* by Adebayo *et al.* (2013). The carbohydrate content obtained from these samples can be used to rank *Citrullus lanatus* as carbohydrate rich fruits due to the relatively high carbohydrate content of the fruit.

b) *Metal analysis*

The result for the mineral composition of the bark, pulp and seed are shown in Table 2. The most abundant mineral found in the samples is Calcium with a mean concentration of 25.69 mg/100g. The concentration was higher in the bark (29.25 mg/100g) compared to the pulp (25.14 mg/100g) and seed (22.67 mg/ 100g). These values were lower as compared to 294.74 ppm for *C. maxima* reported by Amoo *et al.* (2004). Calcium is a constituent of the bones and helps the body to contract correctly, blood to clot and nerves to convey messages. When Calcium supply to the body becomes insufficient the body on its own extracts the needed Calcium from the bones. If the body continues to tear down more Calcium than it replaces over a period of years, the bones will become weak and easily break.

Magnesium is the next abundant mineral element found in the samples with a mean value of 3.60 mg/100 g. The concentration was observed to be higher in the bark (4.36 mg/100 g). The least concentration occurs in the seed (2.83 mg/100 g) which is less than the value for the pulp (3.61 mg/100 g). Magnesium is beneficial to blood pressure and helps prevent sudden heart attack, cardiac arrest and stroke. Like Calcium, Magnesium is a very important component of bone and contribute to it structural development. While Calcium stimulates the muscles, Magnesium relaxes the muscles the daily value for Magnesium is 400 mg for Adult and Children aged 4 and older. Magnesium deficiency results in uncontrolled twisting of muscles leading to convulsion which may eventually lead to death and it is common in people with chronic alcoholism. The calcium and Magnesium content of the three parts fall within the WHO recommended range.

The concentration of Iron was found to have a mean value of (0.22 mg/100g). The concentrations for the respective parts are bark (0.28 mg/100 g), pulp (0.22

mg/100 g) and seeds (0.16 mg/100g). These values were lower than the 13.66 mg/100g reported by Mohammed (2004). Iron deficiency is a major problem in women diet in the developing world, particularly among pregnant women and especially in Africa (Bamigboye *et al., 2010).* This implies that these samples serve as blood building food and should be use for human and animal feeds formulations.

The mean value of Chromium in the samples is 0.11 mg/100g with the value of the bark, pulp and seeds as 0.17, 0.10 and 0.05 mg/ 100g respectively. Chromium is an essential nutrient that potentiates insulin action and thus influences carbohydrate, lipid and protein metabolism. Chromium has a biochemical function that affects the ability of the insulin receptor to interact with Insulin.

There was no trace of Lead and cadmium in the samples. This is highly important because Lead is classified as a category 2B carcinogen by the International Agency for Research on Cancer (IARC/WHO, 1993). The nervous system of infant and children are particularly sensitive to lead toxicity. Adult exposed occupationally or accidentally to excessive high levels exhibit peripheral neuropathology and chronic nephropathy (WHO, 2003). However, the critical or most sensitive effect for adults in the general population may be the development of hypertension. Individuals with severe Cadmium may have renal calculi and exhibit excessive urinary loss of Calcium, with chronic exposure calcium may eventually decline to become less than normal. These metals Fe, Pb, Cd and Cr fall within the World Health Organization (WHO) limit for mineral element in *Citrullus lantus.*

V. Conclusion

The results obtained from this study have shown that there is a significant difference in the nutritional and mineral contents of the pulp, seeds and rind of *Citrullus lanatus* sold at north bank market Makurdi, On comparing the nutritional content, the result revealed that the moisture contents ranges from 3.5 % - 10.90 %, ash content (2.80% - 6.50%), fibre content (5.80% - 15.30 %), crude fat (0.40 % - 13.10 %), crude protein (3.20 % - 19.20 %) and carbohydrate (46.10 % - 75.50 %). Variations were also observed in the mineral constituent of the pulp, seeds and rind (bark) of *Citrullus lanatus*, Mg (2.83 – 4.36 mg/100g), Ca (22.67 – 29.25 mg/100g), Fe (0.16 – 0.28 mg/100g) and Cr (0.05 – 0.17 mg/100g). There were no trace of Lead (Pb) and Cadmium (Cd) which are highly toxic to the body. The result for the metal analysis indicate that all the tested metal fall below the world health standard (WHO).

The analytical information available from the research revealed that the three (3) portion of *Citrullus lanatus*(pulp, seeds and bark are very essential and nutritive to the human body and should all be consumed when eaten it without discarding any part.

References Références Referencias

1. Adebayo, O. R., Forombi, A. G. and Oyekanmi, A. M. (2013). Proximate and anti-nutritional evaluation of pumpskin pulp (*Cucurbita pepo*). *Journal of Applied Chemistry*, 4(5): 25–28.
2. Amoo, I. A. Eleyinmi, A. F., Illelaboye and Akoja, S. S. (2004). Characteristics of oil extract gourd (*Cucurbita maxima).* Seed Food Agric. Environ. 3: 38–39.
3. Anita, B. S., Akpan, E. J., Okon, P. A. and Omoren I. U. (2006). Nutritive and anti-nutritive evaluation of sweet potato (*Ipomea batata*). Leaves. *Pakistan Journal of Nutrition,* 5: 166 –168.
4. AOAC. (Association of Official Analytical Chemistry). (2000). Official method of analysis of the association of Official Analytical Chemists, Vol. 1 and 2.
5. Bamigboye, A. Y., A. C. Okafor and O. T. Adepoju, (2010). Proximate and mineral composition of whole and dehulled Nigerian sesame seed. *African Journal of Food Science Technology,* 1: 71–75.
6. Egbuonu, A. C. C., D. C. Nzewi and O. N. C. Egbuonu (2014). Effect of soaking prior to oven-drying on some nutrient and anti-nutrient properties of bitter yam (*Dioscorea dumentorum). Journal Nutrition of Food Science,* Vol. 4. 10. 4172/2155–9600. 1000280.
7. Ejikeme, P. M., N. L. Obasi and A. C. C. Egbuonu (2010). Physico– Chemical and toxicological studies on Afzelia Africana seed and oil. *African Journal Biotechnology*, 9: 1959 –1963.
8. Erhirhie, E. O. and N. E. Ekene, (2013). Medicinal value on *Citrullus lanatus* (watermelon): Pharmacological review. *International Journal Research of Pharmaceutical and Biomedical Science,* 4: 1305–1332.
9. Fila, W. A., E. H. Ifam, J. T. Johnson, M. O.Odey, E. E. Effiong, K. Dasofunjo and E. E. Anibo, (2013). Comparative proximate compositions of watermelon, squash cucurbita Pepoil and Rambutan, Nephelium lappaceum. *International Journal of Science Technology,* 21: 81– 88.
10. Ikeda, Y., (2000). Cardioprotective effects of *Citrulline*in Ischemia/reperfusion injury via a non-nitric oxide mediated mechanism. *Methods find ExpClinPharmacol,* Sep; 22(7): 563–571.
11. Karaye, I. U., Aliero, A. A., Mohammed, S., and Bilbis, L. S. (2013). Evaluation of Nutrient and Anti-nutrient content of selected Nigerian Cucurbita seed. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*, 4(1) 137–142.
12. Loukou, A. L., Gnakri, D., Dje, Y., Kippre, A. V., Malice, M., Baudoin, J. P., and Zarobi, I. A. (2007). Macro nutrient composition of three cucurbit

species cultivated for seed consumption in cote d'ivoire. *African Journal of Biotechnology* 6(5), 529–533.

13. NRC (National Research Council) (1980). Recommended dietary allowances, 9th edition. National Academic Science. Washington DC.
14. Nzewi, D. and A. C. C. Egbuonu (2011). Effect of boiling and roasting on the proximate properties of asparagus bean (*Vigna sesquipedalis*). *African Journal of Biotechnology,* 10: 11239–11244.
15. Ogunlade, L., A. Ilugbiyin and A. I. Osasona, (2011). A comparative study of proximate composition, anti-nutrient composition and functional properties of pachira glabra and Afzelia Africana seed flours. *African Journal of Food Science,* 5: 32–35.
16. Olalekan, A. J. and B. F. Bosede, 2010. Comparative study on Chemical composition and functional properties of three Nigerian legumes (Jack beans, Pigmean pea and Cowpea). *J. Emerg. Trends Eng. Applied Sci.,* 1: 89 – 95.
17. Omotoso, O. T. (2006). Nutritional quality, functional properties and anti-nutrients composition of larva of *Cirina forda* (Westwood), *Journal Zhejiang Univ. Sci*. 51–55.
18. Rimando, A. M. (2005). Determination of *Citrulline* in watermelon rind. *Journal of Agricultural Food Chemistry*; 1078 (1-2) 196-200.
19. Rolls, B. J. & Ello- martin, J. A. & Johill, B. C. (2004): What can intervention studies tell us about the relationship between fruits and vegetable consumption to weight management? Nutrition Review; 62: 1–17.
20. Tarazona– Diaz. (2011). Bioactive compounds from flesh and by-product of fresh cut watermelon cultivars. *Journal of Science Food and Agriculture*; 91 (5) 305 –12.
21. Wu, G. (2000). Arginine nutrition in development, health and disease. *Clin Nuts Metab care*. 3(1). 56–66.
22. Zhang, D., Hamauza, Y., (2004). Phenolic compounds and their antioxidant properties in different tissue of carrot. *Journal of Foods, Agricultural and Environment*; 2: 95–100.