J. Sci. Technol. Environ. Inform. 03(02): 207-212 | Mgbemena & Obodo (2016)
EISSN: 2409-7632, www.journalbinet.com
DOI: http://dx.doi.org/10.18801/jstei.030216.23

Volume 03, Issue 02, Article no. 23, pp. 207-212 Mgbemena & Obodo (2016)
http://www.journalbinet.com/jstei-volume-03.html
Original Research Paper

Comparative analysis of the proximate and mineral composition of *moringa olerifera* roots, leaves and seeds obtained in okigwe imo state Nigeria

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Article info.

Key Words:
Moringa, Fibre, Diet, Cholesterol, Moisture, Mineral, Biofuel

Received: 03.03.2016
Published: 14.06.2016

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ABSTRACT

Proximate and mineral compositions were carried out on the leaves, seeds and roots of moringa oleifera obtained from Okigwe, Nigeria. Mineral and proximate compositions were determined using their various methods of analysis. Results of proximate analysis in percentage showed moisture content in the following range; leaves 4.84, seeds 9.56 and roots 6.06, crude protein; leaves 24.94, seeds, 17.94 and roots 12.25, fat content; leaves 11.50, seeds, 12.60 and roots, 2.66 while mineral content still in percentage showed potassium in the roots 0.850, leaves 0.625, seeds 0.950 magnesium; roots 1.64, leaves 1.277 and seeds, 1.094 and calcium; roots 4.22, leaves 2.91 and seeds 2.61. These results showed that for proximate composition, the leaves had higher values followed by the roots and lastly by the seeds for most of the analysis while the mineral value contents showed higher percentages in the roots and the leaves .Even though all the various parts of moringa olerifera are nutritionally valuable the leaves and roots are highly recommended for their higher nutritional values.

Citation (APA): Mgbemena, N. M. & Obodo, G. A. (2016). Comparative analysis of the proximate and mineral composition of *moringa olerifera* roots, leaves and seeds obtained in okigwe imo state Nigeria. *Journal of Science, Technology and Environment Informatics*, 03(02), 207-212.

I. Introduction

Moringa oleifera is the widely grown of the family *moringaceae* because of its nutritional value. It belongs to order *Brassicalis,* family *moringaceae*, genus moringa, and species, *moringa oleifera*. It is the most widely cultivated species of the genus moringa (Ramachandran et al., 1980). Its fruit is large and distinctional up to 90cm long and 12mm broad, light brown, angular dehiscent capsules containing 3-winged seeds. It splits along each angle to expose the rows of rounded blackish oily seed (Anwar

and Bhanger, 2003). It originated from India. Today, it is widely cultivated in Africa including Cameroon, Ghana, Gambia, Guinea, Niger, Nigeria, Sierra Leone, Sudan, Togo etc. It is also cultivated in other countries like Central and Southern American, Sri-Lanka, Mexico, Malaysia, Indonesia and the Philippines etc. (Posmontier, 2011). Moringa tree is grown mainly in semi-arid and tropical subtropical areas. It is considered as one of the world's most useful trees, as almost every part of it can be used for food or has some other beneficial property.

Moring oleifera seeds and roots showed high content of crude fiber indicating it is a good sources of vegetable (Donovan, 2007). The leaves are highly nutritious being a significant source of beta carotene, vitamin C, protein, iron and potassium. Leaves can be cooked and used as spinach, the leaves can also be dried and pulverized into powder and used in soups and sauces. The leaves and pods are helpful in increasing breast-milk in the breast feeding mothers one table spoon of leaf powder provides 14%of protein, 40% of calcium, 23% of iron and most of the vitamin A needs of a child, aged one to three. Six table spoons of leaf powder provide nearly all of the woman's daily iron and calcium needs during pregnancy and breast feeding. The leaves are also used in making biofuels (Babu, 2000).

The drum stick seeds are used as a sexual virility drug for treating erectile dysfunction in men and also in women for prolonging sexual activity (Barminas and Charles, 1998) moringa seeds yield oil. Seed cake remaining after oil extraction is used as fertilizer or as a flocculent to purify water (Mccleents, 2001). The seeds are used as excellent biofuel source for making biodiesel. Tree's bark, roots, fruit flowers, leaves seeds and gums are used medicinally in the following areas; antiseptic, in the treatment of rheumatism, venomous bites and other conditions. High amount of potassium in moringa helps to reduce the absorption of sodium and hence the risk of hypertension, the main cause of hypertension is the increased level of sodium in the blood which increases the systolic and diastolic pressrures (Caceres et al., 1991). Soup cooked with the leave is said to increase urination and thus benefit the kidney (Dahot and Memon, 1985). In Nigeria today, the infusion of the leaves has been taken for the treatment of diabetic symptoms and is used ethno medically for the treatment of hypertension (D'Souza and Kulkan, 1993). Various parts of the tree are of immense medicinal importance, the flowers attracts bees thus the plant has honey production potential (Dahot and Memon, 1987). The immature or premature green pods called "drum stick" are seen as the most valuable and widely used part of the tree.

They are eaten and also prepared in the similar fashion to green beans with its slight asparagus taste. Most often the seeds are removed from mature pods and eaten like peas or roasted like nuts. The flowers are edible when cooked and taste like mushroom. They can also be used to make tea as with the pulverized dry leaves. The roots are shredded and used as condiment like the horse radish. However, it contains the alkaloid spirodin, which is a potentially fatal nerve-paralyzing agent. A rayon-grade pulp hydrolyzed sulphate process is a suitable raw material for the production of high alpha cellulose pulp used in cellophone and textiles. The presence of the alkaloid spirochin is no worry because large amounts are required to elicit deleterious effects and spirochin even displays antibacterial properties when consumed in small amounts.

Viability and importance of virtually every part of moringa oleifera tree triggered the researcher to look into the comparative analysis of the roots, leaves and seeds to determine the most valuable part of the free.

II. Materials and Methods

Roots, leaves and seeds of *moringa oleifera* were got from Okigwe in Imo State, dried at 65^{0}C in the oven and pulverized using Thomas Willey milling machine. Proximate analyses were carried out on the powder to determine moisture, ash, crude protein and crude fibre using the methods described by Pearson (Pearson, 1976). Fat content was determined using the methods of James (James, 1995). Minerals like calcium, Magnesium, potassium, sodium and phosphorus were determined using their various methods of analysis. Carbohydrate content was calculated by the difference method deducting the sum of the percentages of crude protein lipid, moisture, ash and crude fibre contents from 100.

EISSN: 2409-7632, www.journalbinet.com
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III. Results and Discussion

Result of the proximate analysis of roots, leaves and seeds was shown in Table 01. From the result, the ash content showed 8.24% in seed, 9.08% in leaves and 13.40% in root. Ash content is a measure of the total amount of minerals, present within the food substance. Ash content in roots was highest followed by the seeds and lastly by the leaves indicating a significantly high value of the minerals in the root of *moringa oliefera*.

Moisture contents showed 4.84% in leaves, 6.06% in root and 9.56% in seeds. Moisture content indicates the amount of water present in the material and is very crucial as it serves as benchmark to evaluate the quality and stability (Shell-life) of food. A lot of biochemical reactions and physiological changes that occur in food are dependent on the moisture content. High moisture content increases the biochemical reactions. A variety of factors affect the moisture, content of food and usually the period and methods of harvesting contributes enormously to the moisture content (Pih, 1993).

Result also showed the dry matter content in the order: leaves 95.16, roots 93.94% and seeds 90.44% indicating higher values in leaves followed by roots and lastly the seeds. Dry matter is very crucial since it ensures adequate nutrients balance. The nutrients required for the maintenance of animal's growth, pregnancy and lactation are part of the dry matter portion of the food (Cozzolina and Labandera, 2002). The carbohydrate values obtained were roots 51.83%, seeds 48.26% and leaves 44.84% indicating higher values in the root. Carbohydrate in food originates from photosynthesis, an endothermic reductive condensation of CO_2 requiring light energy and chlorophyll pigments (Dahot and Memon, 1987). It serves as a source and represents a substantial proportion of the body's energy supply (Pih, 1993). *Moringa oleifera* has an appreciable percentage of energy though it is not an energy giving plant.

Crude fibre content values ranged in the order; roots 13.8%, seeds 13.4 and leaves 4.80. Highest value was recorded in the roots while the leaves recorded the lowest value. Crude fibres are materials that are indigestible in human and animal organisms. Fibre consumption is regarded as essential because it absorbs water and provides roughage for the bowels, assisting intestinal transit and well normalizes blood lipids thereby reducing cardiovascular disease. It also helps to prevent constipation and decreases blood cholesterol levels. Very low fibre in food is however helpful to digestive processes though it lowers the vitamins and enzyme content of the food material. Higher fibre diet is important for gastro-intestinal health and cholesterol lowering benefits as well as its provision of better results in preventing diverticulosis inflammation. Studies showed that increased fibre content intake of 6g daily among men and women aged 50-70 years was associated with a 25% reduction in ischemic heart disease mortality, independent of calories fat and other dietary variables (Obodo, 2009).

Fat values obtained were leaves 11.50%, roots 2.66% and seeds 2.60%. The percentage of fat present in the leaves was far higher than those of the roots and seeds put together indicating a very high level of fat in the leaves. The values of fat in the seeds and roots of *moringa oleifera* were almost equal with that in roots being a little higher than the seeds. Lipids are the major components of food as they provide a good source of energy. Fats being made up of hydrogen carbon and oxygen provide essential fatty acids that are not made by the body. Fat makes up about 99% of the lipids fraction of food (Institute of Medicine, 2002).

Crude protein values ranged from 24.94% in leaves, 17.94% in seeds and 12.25% in roots. The protein content in leaves was more than 100% higher than in roots indicating a higher value in leaves than roots and seeds. Proteins are polymers of amino acids. Protein acts as enzymes, hormones and antibodies. They maintain fluid, acid and base balance in the body. They also transport substances like oxygen vitamins and minerals to target cells throughout the body. Structural proteins such as collagen and keratin are responsible for the formation of bones, teeth, hair and the outer layer of skin. They help to maintain the structure of blood vessels and other tissues. Moringa leaf is hence considered as a complete food as it contains all the essential amino acids required for a healthy body. All of the essential amino acids and the non-essential amino acids are seen in *morning oleifera* leave. Consumption of the

leaves of this tree is therefore encouraged as these essential amino acids cannot be synthesized by the body. Moreso, these amino acids are very crucial for proper functioning of the brain, muscle, and nervous tissue as well as providing the body as a solid base for physical health.

Table 01. Proximate Composition of Moringa Leaves, Roots and Seeds (%)

Mineral composition	Leaves	Seeds	Roots
Moisture	4.84	9.56	6.06
Ash	9.04	8.24	13.40
Fat	11.50	2.60	2.66
Crude fibre	4.80	13.4	13.80
Crude protein	24.94	17.94	12.25
Carbohydrate	44.84	48.26	51.83
Dry matter	95.16	90.44	93.94

Leaves of moringa contain higher percentages of fat, crude protein and dry matter while the seeds and the roots contain high values of ash, crude fibre and carbohydrate.

Mineral composition of *moringa oleifera* leaves, seeds and roots

Table 02 shows the result of mineral composition. In the table, calcium values ranged from 4.22 in roots to 2.911 in leaves to 2.61 in seeds indicating its highest concentration in the roots. It also shows that *moringa oliefera* is a good source of calcium in the body. Calcium is required in the formation of strong bones and teeth. The value of magnesium showed 1.64 in root, 1.28 in leaves and 1.10 in seeds also indicating higher value in roots. Magnesium is required for retention of calcium in teeth and constituents of bones. It also serves as the energy storage unit of the body's cells and as enzyme co-factors. Chlorophylls contain magnesium coordinated by chlorine groups. These are compounds essential in photosynthesis (Miessler and Tarr, 2011). The trends in the concentration of calcium and magnesium in the tree are the same with their highest values occurring in the roots followed by the leaves and lastly the seeds. Potassium values ranged from 0.850 in the roots to 0.750 in the leaves and 0.625 in the stem. Sodium ranged from 0.825 in the leaves to 0.375 in the roots to 0.300 in the seeds. Potassium is essential for the regulation of osmotic pressure and pH equilibrium and control of acid alkaline reaction of the blood. Sodium is also essential for osmotic equilibrium and body fluid volume as well as in the transmission of nerve impulses. The value of phosphorus ranged from 0.758 in the seeds to 0.540 in the leaves and to 0.249 in the roots. The root of *moringa oleigera* has lower percentage of phosphorus content than the leaves and the seeds with the seeds being the highest. The consumption of the seeds of moringa is vital as phosphorus helps to fllter out waste in the kidneys and plays essential role in the storage and uses of energy in the body (Chumark et al., 2008).

Table 02. Mineral Composition of the *Moringa oleifera* Seeds Leaves and Roots (%)

Mineral composition	Leaves	Seeds	Roots
Calcium	4.22	2.91	2.61
Magnesium	1.64	1.277	1.094
Potassium	0.850	0.625	0.750
Sodium	0.375	0.825	0.300
Phosphorus	0.249	0.540	0.758

Moringa oleifera has less values of phosphorus, potassium and sodium, but appreciable values of magnesium and calcium. Above mentioned minerals are macro minerals, which are required for basic human functions such as heart beat, muscle contraction, growth and regulatory processes (James, 1995). Some minerals are structural components (calcium and phosphorus) while others are hemostats (sodium and magnesium) and yet others are component of organic bimoleculars (all trace

elements such as zinc, iron etc.) (Duyff, 2002). From Table 01 and 02, it is seen that *moringa oleifera* leaves contain more food values like crude protein and fat which are essential food components. This is followed by the seeds and lastly by the roots. For the mineral composition, the roots contain more nutrients followed by the leaves and lastly by the seeds. Various works have confirmed that moringa is a natural energy booster, strengthens the immune system, has antibiotic properties, cures headaches, migraines, asthma and ulcers, reduces arthritic pains and inflammations and restricted tumour growths. Bureau of plant industry (BPI) showed that a steady diet of the moringa fruit boosts the sperm count of men, which improves their chances of fertilizing an egg (Daily Sun Newspaper, 2015).

Nutritionists say, the moringa plant has more iron and contains seven times the vitamin in oranges, four times the calcium in milk, four times the vitamin "A" in carrots; two times the protein in milk and three times the potassium in banana.

IV. Conclusion

Nutritionist confirm that Moringa plant is very nutritious and medicinal and therefore recommended for everybody.

Acknowledgements

Authors wish to thank everybody who in one way or the other contributed to the success of these works especially Mr. Osuji S. who started this work.

V. References

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How to cite this article?

APA (American Psychological Association)

Mgbemena, N. M. & Obodo, G. A. (2016). Comparative analysis of the proximate and mineral composition of *moringa olerifera* roots, leaves and seeds obtained in okigwe imo state Nigeria. *Journal of Science, Technology and Environment Informatics*, 03(02), 207-212.

MLA (Modern Language Association)

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Chicago/Turabian

Mgbemena, N. M. & Obodo, G. A. Comparative analysis of the proximate and mineral composition of *moringa olerifer*a roots, leaves and seeds obtained in okigwe imo state Nigeria. *Journal of Science, Technology and Environment Informatics,* 03, no. 02 (2016): 207-212.