

UTILIZATION POTENTIALS OF *MORINGA OLEIFERA* AND *TELFARIA*

OCCIDENTALIS SEEDS

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Abstract

Moringa oleifera and *Telfairia Occidentalis* plants are popularly grown for their leaves which are used for the preparation of various indigenous delicacies in Nigeria. The seeds of the trees which are produced annually are often neglected and underutilized by the populace. The main objective of this work is to review the potential uses of these seeds with a view to forestall its wastage and enhance its usage at both the domestic and commercial levels. These seeds have high nutritional values capable of enhancing the health status of consumers, useful in traditional medicine, water purification, agriculture and biodiesel production. These seeds inspite of their high nutritional content and industrial potentials, they still remained underutilized in Nigeria. It is therefore suggested that these seeds should be produced more on commercial level and more research be carried out on the design and production of processing and handling equipments for these seeds. This will not only enhance its utilization but will encourage new product development and provide more employment opportunity to the teaming youth in Nigeria.

Keywords: *Moringa oleifera*, *Telfairia Occidentalis*, seed, medicine, water purification

1.0 Introduction

Moringa oleifera, a nutritious vegetable tree commonly refers to as "*Moringa*", the horseradish tree, drumstick tree or Ben oil tree is the most widely cultivated species of a monogeneric family, the Moringaceae. The popular name of *Moringa* in Nigeria is "*Zogale*" in the north, "*Ewe Igbale*" and "*Idagba Manoye*" in the southern part and "*Odudu Oyinbo*" in the eastern part of Nigeria. *Moringa oleifera* is a fast-growing, drought-resistant tree and is considered one of the world's most useful trees. All its parts are edible and have long been consumed by humans. *Moringa oleifera* tree has a wide-open typically umbrella-shaped crown, usually a single stem which tends to be deeply rooted, the wood is soft and its bark is light green (Anwar *et al.*, 2007). *Moringa* leaves are imparipinnate-rachis 3 to 6 cm long with 2 to 6 pairs of pinnules. Each pinnule has 3 to 5 obovate leaflets that are 1 to 2 cm long. *Moringa* trees are relatively short-lived reaching only 20 years on average. *Moringa* leaves are excellent, concentrated source of proteins, vitamins and minerals. Out of the 120 vegetable species tested for their nutrient content, antioxidant activity, gustatory qualities and the facility with which they are grown and processed, *Moringa* leaves were top ranked by the World Vegetable Centre (AVRDC) (Moyo, *et al.*, 2011).

Telfairia Occidentalis commonly called fluted pumpkin grows in the forest zone of West and Central Africa, most frequently in Benin, Nigeria and Cameroon. It is known as *Ugwu* in Yoruba, *ubong* in Efik, *umee* in Urhobo and *umeke* in Edo (Akoroda 1990; Badifu and Ogunsanya, 1991). The plant is a drought-tolerant, dioecious perennial that is usually grown trellised and it bears large fruits of various sizes (Kayode *et al.*, 2009). *Telfairia occidentalis* is a perennial, dioecious plant climbing by coiled, often branch tendrils to a height of more than 20 m. The root system splits on the top surface of the soil with angular stem, glabrous and becoming fibrous when old. The leaves are arranged spirally with 3-5 leaflets without stipules and with petiole 2-15 cm long. Leaflets with leafstalk are 0.5-3.5 cm long with central one largest, up to 15-19 cm x 10-12 cm. It has been reported that *Telfairia Occidentalis* leaves has hypolipidemic effect and may be a useful therapy in hypercholesterolemia (Adaramoye, *et al.*, 2007). The leaves are used for various traditional dishes in Nigeria.

Although *Moringa oleifera* and *Telfairia Occidentalis* are very common and widely known for their leaves, their seeds in spite of its high nutritional content and high industrial potential, still remains underutilized in Nigeria.

2.0 Moringa Seeds

Moringa seeds are produced annually in the tropical and sub tropical countries of Asia and Africa. *Moringa Oleifera* seeds have a unique and pleasing appearance. *Moringa* seeds are large and circular-shaped, and grow inside the lengthy pods of the *Moringa Oleifera* tree. *Moringa* seed pods can reach well over a foot in length and each pod can provide over a dozen large *Moringa* seeds. *Moringa* seeds have two sets of thin flaps extending from the main kernel of the seeds. These flaps serve as wings to carry the seed away from the mother tree, and with the help of the wind, they move across the ground until they find a resting place to germinate (Coote *et al.*, 1997).

Unlike the fast-growing leaves of the *Moringa Oleifera* tree, *Moringa* seed pods do not grow back every few months. *Moringa* trees produce seed pods on an annual basis, much like other similar species in the plant kingdom. *Moringa* trees produce incredible volume of seed pods during their reproduction months. An average-sized *Moringa* tree of fifteen to twenty feet high can produce hundreds or even thousands of seed pods, yielding countless *Moringa* seeds for a long period of time usually up to 15 years (Moges, 2004).

2.1 Nutritional properties of Moringa Seed

The immature green pods called "drumstick" are probably the most valued and widely used part of the tree. They are commonly consumed in South and South-east Asia and are generally prepared in a wide range of dishes. They are like green bean with a tint of asparagus taste. The seeds are sometimes removed from more mature pods and eaten like peas or roasted like nuts. The peas are not harvested until they harden; it is then strained or boiled to remove the bitter coating. The seeds offer concentrated nutrients including amino acids, proteins and a wide range of vitamins and minerals, making them an outstanding supplement for stressed and hurried individuals and a solid source of nutrition for undernourished populations around the world (Lydia, 2006).

2.2 Uses of Moringa Seeds

1. Water Purification

The water soluble *Moringa* seed possess coagulating property similar to that of alum and synthetic cationic polymers. Earlier studies have shown that *Moringa Oleifera* seed powder is effective in heavy metal remediation of water (Sajidu, *et al.*, 2005). Extraction of seed oil before crude extract preparation can be a suitable purification option allowing recovering oil for industrial and food processes. Recently there has been increased interest in the subject of natural coagulants for treatment of water and wastewater in developing countries (Ndabigengesere and Narasiah, 1998). To use moringa seeds for water purification, the mature pods can be dried naturally on the tree or removed and then dried. The seed coats and wings are removed and the kernel is crushed into powder, similar to making corn meal. The powder is then added to a small amount of water and shaken for a few minutes, then strained into the larger container of water. It is stirred vigorously for two minutes, then slowly for ten to fifteen minutes. It is then allowed to sit undisturbed for at least an hour so the solids attached to the powder particles can settle to the bottom. Because bacteria are attached to solids, this process removes particles and bacteria as well. It is recommended that boiling or further water treatment be done to finalize the purification process (Sutherland *et al.*, 1994).

2. Moringa Seeds in Traditional and Modern Medicine

The seeds of the *Moringa* plant have been used in *Ayurveda* medical practice for centuries to treat a variety of ailments and to improve overall health in patients. The antibiotic properties of *Moringa* seeds make them valuable in poultices and topical treatments for bacterial infections and other conditions of the skin. Taken internally, *Moringa* seeds have traditionally been used to reduce the frequency of epileptic fits, to treat arthritis and rheumatoid disorders. *Moringa* seeds are also recommended by traditional practitioners to treat a variety of sexual dysfunctions and to improve sex drive in both men and women (Anwar, *et al.*, 2007). The antibiotic properties of *moringa* seeds have been proven in laboratory testing (Jed and Fahey, 2008). *Moringa* seeds can be used to treat fungal infections as well due to the presence of pterygospermin, a naturally occurring antibiotic present throughout the *Moringa* plant. Additionally, the high protein and iron content of these seeds make them a valuable resource in combating malnutrition and anaemia in developing regions of the world.

3. Agriculture

Ground and defatted *Moringa* seeds can be used to supplement animal feed or as fertilizer for crops and enrichment of soil, allowing farmers and ranchers to enjoy increased production and improved results from their agricultural endeavors (Ghebremichael, 2004).

4. As Source of Bio-Fuel

Because *Moringa* seeds are rich in natural oils, they have been considered as a potential source for bio-fuel materials. Newer extraction techniques may make this even more profitable and prevalent as fossil fuels supplies continue to shrink (Agarwal and Das 2001).

5. Moringa Oil

Moringa Oleifera seeds contain between 38-40% edible oil (Sengupta and Gupta 1997) which is known as Ben oil. The oil resembles olive oil and rich in fatty acids and oleic acid, which makes it suitable for edible purposes. If *Moringa* seeds are to be used for oil production, the seeds are harvested and immediately processed. The fresh soft *Moringa* seeds are broken into pieces and heated with water and then they are pressed for oil.

Moringa seeds oil is the most stable oil in nature and it does not go rancid. The oil pressed from its seeds is chock-full of radiance-boosting fatty acids and vitamins A and C (Lydia, 2006). *Moringa* oil possesses exceptional oxidative stability which may explain why the Egyptians placed vases of *Moringa* oil in their tombs. *Moringa* oil is non-drying flavored oil with a pale yellow consistency (Anwar and Bhangar, 2003). The healing properties of *Moringa* oil were documented by ancient cultures. This is very long lasting oil with a shelf life of up to 5 years. *Moringa* oil has a potent antioxidant considered to be the factor behind its remarkable stability. Therefore, extracting oil from seeds has a lot of commercial potentials for communities in developing countries. There is already an existing demand for *Moringa* oil in the West, which is recognized as luxury aromatherapy oil. The oil has a huge variety of uses, this include:

1. **Cooking:** Ben oil is used for household cooking, because it is colourless, odourless and resist rancidity, this property of the oil enhance the improvement and retention of taste and natural flavor. This oil also contains fatty acids, vitamin A and C, which is needed in the human body (Fuglie, 1999).
2. **Cosmetics and Soap making:** Beauty companies around the world now uses *Moringa* oil in perfumes, massages, aromatherapy, because the oil has a property which is nourishing to the skin. The *Moringa* seed extract is slightly sweet and it is used in cosmetics as the oil penetrates deeply into the skin; carrying essential nutrients and helping the skin refresh and rejuvenate it. It has tremendous cosmetic value and is used in body and hair care as a moisturizer and skin conditioner. *Moringa* oil has been used in skin preparations and ointments since Egyptian times. The oil is also used in making soaps because of the constituent of the oil which is essential.
3. **Lubricating:** *Moringa* oil due to its light weight is used for lubricating machinery parts, which do not require heavy oil for effective movement of such parts.

3.0 Telfaria Occidentalis seed

The fruits *Telfairia Occidentalis* are drooping, ellipsoid berry between 40 x 20 cm and 95 x 50 cm. The fruit usually weigh up to 6 kg, with 10 prominent ribs, pale green and covered with white bloom wax. The fruit pulps are often yellow with many-seeds. The seeds are compressed ovoid, up to 4.5 cm long, black or brown-red (Akoroda *et al*, 1990). A large variation occurs between and within plants in the number of seeds per fruit, from 6 seeds per fruit up to 196, with an average of 62 seeds. The seeds are also unequal in size, varying from 1 g to 68 g. Some seeds exhibit multiple embryo production (polyembryony). The highly nutritious seed of *Telfairia Occidentalis* can be left intact in the pod until when required (Nkang *et al*, 2000).

3.1 Nutritional value

The composition of the seed per 100 g edible portion is: water 6.2 g, energy 2280 kJ (543 kcal), protein 20.5 g, fat 45.0 g, carbohydrate 23.5 g, fibre 2.2 g, calcium 84 mg, phosphorus 572 mg. The mineral content of the seed is reported to be high. The seeds are high in essential amino acids (except lysine) and can be compared with soya bean meal (Christian, 2007). The main constituents of the seed oil are oleic acid (37%), stearic and palmitic acid both (21 %) and linoleic acid (15%) (Adaramoye *et al*, 2007). The essential amino acids contents compared favorably with those of important legumes. The amino acid profile of *Telfairia occidentalis* seed had also been shown to be very rich in alanine, aspartate, glycine, glutamine, histidine, methionine, tryptophan, cystine, leucine, arginine, serine, threonine, phenylalanine, valine, tyrosine and isoleucine (Fasuyi,

2006). Seeds play an important role in the diet of man. They serve to supplement the nutrients provided by cereals and tubers.

3.2 Uses of *Telfairia Occidentalis* Seed

1. Agriculture and Domestic Uses

The seeds are used as propagating materials, eaten roasted, boiled or ground to paste as soup thickener. Seeds can also be fermented for several days and eaten as slurry (Nkang *et al*, 2003). The fruit case and pulp of *Telfaria Occidentalis* which constitute 64% of whole fresh fruit weight can be used as feedstuff for livestock (Essien, *et al.*, 1992), and the pectin content of the pulp (1.0%) has been used in the production of marmalade (Egbekun, *et al.*, 1998). The study of Emeka and Obidoa (2009) reveals that the long term feeding of *Telfaria Occidentalis* seed-supplemented diet caused a significant increase in weight of animals which may be due to its content of rich nutrients.

2. *Telfaria Occidentalis* Seeds in Traditional and Modern Medicine

The use of *Telfaria Occidentalis* in reproduction and fertility in traditional medicine is gradually becoming a thing of interest in medical science. A study carried out by Nwangwu *et al*, 2007 shows that *Telfaria Occidentalis* seed has the potential to regenerate testicular damage and also increase spermatogenesis. However, more research work is required to establish this observation. The study of Jude, *et al*, 2012 on the chemical constituents and analgesic activity of *Telfaria Occidentalis* seed shows that the seed is used commonly for nutritional and medicinally purposes in the treatment of malaria and inflammatory diseases. The study of Ehiagbonare, 2008 also shows the use of *Telfaria Occidentalis* seed in the ethnomedicinal treatment of anaemia in Nigeria.

3. Purification of Water

The study of Ugonabo, *et al*, 2012 shows the effect of coag-flocculation kinetics on *Telfaria Occidentalis* Seed Coagulant (TOC) in pharmaceutical wastewater. The result of the study shows that *Telfaria Occidentalis* seed can be used as renewable bio-raw materials as an alternative coagulant to inorganic salts for treatment of waste water thereby conserving the nation's foreign earning. The result of study of Okoye, *et al* 2010 also shows the lead removal from wastewater using *Telfaria Occidentalis* seed shell activated carbon. The use of *Telfaria Occidentalis* seed in water purification is to provide healthier and safer drinking water for many areas of the world in which technological advanced methods are not available (Folkard and Sutherland, 1996).

4. Industrial Uses

The raw flour of the seed shows better water and fat absorption properties than the oil, hence its useful application in baking products and ground-meat products. The potassium and sodium availability of *Telfaria Occidentalis* seeds are higher in *Telfaria Occidentalis* seed (58.8%) than that of soya bean seed cake (54.9%) (Esuoso, *et al.*, 2000). This indicates that *Telfaria Occidentalis* seed cake may be suitable to fortify foods, and the seed oil serves as food oil for making margarine. The oil can also be used as drying oil for paints and varnishes (Egbekan, *et al*, 1998). The high oil content makes it a potential source of raw material for the vegetable oil industries in Nigeria. These justify the apparent increase in its production in Nigeria. In some cases, *Telfaria Occidentalis* provides an appreciable cash income to small farm families (Akoroda, 1990). Bello, *et al*, 2005 reported the use of the oil extracted from *Telfaria Occidentalis* seed for the production of biodiesel.

Conclusions

The utilization potentials of *Moringa Oleifera* and *Telfaria Occidentalis* seed in medicine, human nutrition, agriculture, water purification, industrial uses and as biodiesel cannot be overemphasized. It is therefore recommended that more research work should be carried out not only on the mass production of these seeds, but also on the design of appropriate handling and processing equipments that enhance the new product development from these seeds.

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