

Nutritional And Anti – Nutritional Composition Of Black – Plum (*Vitex Doniana*)

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ABSTRACT

The search for more nutrition sources among forest products has called for the analysis of nutritional and anti – nutritional composition of *Vitex doniana*. Although, *Vitex doniana* had been known to be very useful among people across tropical Africa and beyond, but there is lack of adequate data on its nutritional composition. The result of this study presented *Vitex doniana* as highly nutritious plant that contain moisture of about, 77.03%, ash content: 1.65%, fat: 2.9%, fibre: 2.75, protein: 8.10 and carbohydrate: 7.57. *Vitex doniana* contains vitamins, macro and micro – nutrient in different proportions. Among anti –nutritive factors found in *Vitex doniana* are: tannins, saponin, alkaloids and trace of cardiac glycoside, yet this can be controlled by boiling. It is concluded that the young leaf is highly rich in nutrients and contains the nutrient levels that fall within other popular edible vegetables. It is therefore recommended for human consumption in every household. It is also suggested that further research should be carried out on its economic status and feasibility of the seed as feed supplement in animal feed.

INTRODUCTION

Black – plum (*Vitex doniana* Sweet) of the family *Verbanaceae* is a tree crop that grows in open woodland and savannah regions of tropical Africa; it is the commonest of the *Vitex* species in West Africa (Dalziel *et al.*, 1964; Dalziel and Hutchison, 1955). It produces fruits which are plum – like, sweet and edible (Keay, *et al.*, 1964). The fruit is green when mature and changes to dark brown when fully ripe, with the pulp surrounding a hard stone containing 1 – 4 seeds. It is a savanna species and can therefore be found in northern, eastern and western Nigeria.

It is known by the local names: Hausa – dinyar; Fulani – galbihi; Yoruba - ori nla; Ibo – ucha koro. The fruits are also referred to as black-plum or African olive (Glew *et al.*, 1997). It has been reported that syrup similar to honey was produced from the fruit and that physicochemical and sensory results showed that it can be substituted for other syrups as a nutritive sweetener (Egbekun, *et al.*, 1996). There are also reports of its potential use in the production of wine and jam (Okigbo, 2001).

The stem bark extract of the tree is used for the control of hypertension and its anti – hepatotoxic effect and treatment of stomach ache, pains, disorders and indigestion (Ladeji and Okoye, 1996). Ladeji, *et al.*, (2005), extracted and analyzed the bark of *Vitex doniana* and found to contain much more potassium and phosphate than calcium, magnesium, zinc and iron. Therefore, it was concluded that, the use of *Vitex doniana* to control postpartum bleeding after child birth may be justified. In Ghana it is used for treatment of colds and cough in children and its bark in treatment of sterility (Abbiw, 1990).

Various parts of the plant are used by traditional medicine practitioners in Nigeria in the management and treatment of several disorders which include rheumatism, hypertension, cancer, and inflammatory diseases (Shofowora, 1993). Kilani, (2006) assess the antibacterial effect of whole stem bark of *Vitex doniana* against some enterobacteriaceae, and supports the use of *Vitex doniana* by traditional medicine practitioners in the treatment of dysentary and gastroenteritis. He stressed further that, antimicrobial activity of the *Vitex doniana* extract could be attributed to the presence of phenolic compounds that have been linked with antimicrobial properties.

George (2003) stated that even though the bulk of their weight is water, leafy vegetables represent a veritable natural pharmacy of mineral, vitamins and phytochemicals. He concluded that the potassium content of leafy vegetables is good in the control of diuretic and hypertensive complications, because its lower arterial blood pressure. Vegetables like *Vitex doniana* are important sources of protective foods, which are highly beneficial for the maintenance of good health and prevention of diseases (Sheela *et al.*, 2004; Nnamani, *et al.*, 2007). Although, they can be raised comparatively at lower management cost and on poor marginal soil, they have

remained under – utilized, due to lack of awareness of their nutritional values in favour of the exotic ones (Odhav, 2007).

The World Health Organization (1992) reported that chronic under – nutrition affects over 200 million people or 42% of the population in Sub – Sahara Africa. *Vitex doniana*, an indigenous leafy vegetable represent inexpensive but high quality nutritional sources, for the poor segment of the population especially where malnutrition is widespread in Nigeria. It is then needful to assess its nutritional composition to justify its uses in human diets.

MATERIAL AND METHOD

Freshly harvested leaves of *Vitex doniana* (Black plum) were collected from Federal College of Wildlife Management Estate, New Bussa, Niger State, Nigeria. The plant was identified and registered in the herbarium of Forestry Research Institute of Nigeria (FRIN), Ibadan. The proximate and phytochemical analysis were carried out in the laboratory of National Institute for Freshwater Fisheries Research (NIFFR), New Bussa, Niger State, Nigeria while the mineral and vitamins analysis were carried out in the laboratory of Institute for Agriculture Research and Training (IAR&T), Moor plantation, Ibadan, Oyo State, Nigeria.

RESULTS AND DISCUSSION

PROXIMATE COMPOSITION OF RAW *Vitex doniana* YOUNG LEAF

The result of proximate composition of *Vitex doniana* young leaf is shown in Table 1. The moisture content was high (77.03%). This is similar to other observations reported for *Amaranthus hybridus* (Amaranthus / Tete) 84%, *Celosia argentea* (Celosia / Soko) 71%, *Talinum triangulare* (Water leaf / Gbure) 81%, and *Cnodoscolus acotifolus* (Iyana ipaja) 81% in the literatures (FAO, 1990 and Irvine, 1969).

The proximate analysis further showed that the ash content was 1.63%, fat and fibre content of the leaf were (2.92%) and (2.75%) respectively, the crude protein was 8.1%, all these values were within the acceptable range for leafy vegetables in Nigeria (Lucas, 1988). *Vitex doniana* young leaf is very rich in carbohydrates (7.57%) when compared with other edible vegetables; *Teleferia occidentalis* (Fluted pumpkin/Ugwu) 4.88%, *A. hybridus* (Tete) 5.59%, *C. argentea*, *T. triangulare* (Gbure) 6.01%, *Celosia argentea* (Soko) 11.22% (FAO, 1990).

Table 1: Comparison of proximate composition of raw *Vitex doniana* young leaf with some raw Nigerian leafy vegetables.

Common/Local names	Botanical name	Description	Moisture (%)	Protein (%)	Fat (%)	Crude fibre (%)	Ash (%)	Carbohydrate (%)
*Blackplum (Oori)	<i>Vitex doniana</i>	Raw	77.03	8.10	2.92	2.75	1.63	7.57
**Amaranthus (Tete)	<i>Amaranthus hybridus</i>	Raw	86.6	4.6	0.2	1.8	2.2	5.1
**Water leaf (Gbure)	<i>Talinum triangulare</i>	Raw	87.8	2.4	0.4	1	1.5	6.01
**Celosia (Sokoyokoto)	<i>Celosia argentea</i>	Raw	76.8	5.8	0.4	3.5	1.5	9.22
**Fluted Pumpkin(Ugwu)	<i>Teleferia occidentalis</i>	Raw	86	4.3	0.8	1.6	1.6	4.88

Source: *Laboratory Analysis, 2012.
 **Abidemi et al., 2009.

VITAMINS COMPOSITION OF RAW *Vitex doniana* YOUNG LEAVES AND RECOMMENDED DAILY INTAKE VITAMINS FOR HUMAN

Vitamin analysis of *Vitex doniana* young leaf confirmed the presence of vitamin A, B₁, B₂, B₃, C, D, E and K. The result shows that vitamin C has the highest of 20.80mg/100g and vitamin K has the lowest value of 0.017µg/100mg. The recommended daily allowance (RDA) vitamins for human showed that vitamin C is most needed among all the listed vitamins, with recommended quantity of 75mg per day. Vitamin K is the least needed among all the vitamins listed with recommended quantity of 80µg per day (Lennetech, 2011).

MINERALS COMPOSITION OF RAW *Vitex doniana* YOUNG LEAF

Minerals are essential nutrients, which are said to be present in small amounts in the body or in several parts per million (Gafar and Itodo, 2011). They are essential because they each play important role in metabolic processes of the body and their absence can cause deficiency symptoms in animals (Gafar and Itodo, 2011; McDonald *et al.*, 1995). The essential mineral elements of nutritional importance are macro (major) elements such as Ca, K, Na, and Mg. The micro (trace) elements are Fe, Mn, Zn and Cu (A.O.A.C, 1999).

Macronutrient

The result on the analysis of macro mineral content of the *Vitex doniana* young leaf revealed that Calcium (Ca) content is very high (0.73%) while the value observed for Magnesium (Mg), Potassium (K) and Sodium (Na) are 0.41%, 0.26% and 1.87ppm respectively and similar to content in *Amaranthus hybridus* (Decuyper, 2012). Sodium was low in *Vitex doniana* young leaf but rich in potassium, whereas Na and K take part in ionic balance of the human body and maintain tissue excitability. Because of the solubility of salts, Na plays an important role in the transport of metabolites. K is of importance as a diuretic. Calcium was high and constitutes a large proportion of the bone, human blood and extracellular fluid; it is necessary for the normal functioning of cardiac muscles, blood coagulation and milk clotting, and the regulation of cell permeability. It also plays an important part in nerve-impulse transmission and in the mechanism of neuromuscular system. Magnesium was moderate because of chlorophyll content in leaves. In humans, Mg is required in the plasma and extracellular fluid, where it helps maintain osmotic equilibrium (Gafar and Itodo, 2011).

Micronutrient

The result of the analysis of micro mineral content of the *Vitex doniana* young leaf revealed that Iron (Fe) content is very high (24.156ppm) and fall within the range earlier published for edible vegetables (Romeran and Clifton, 1981) while the value observed for Manganese (Mn), Zinc (Zn) and Copper (Cu) are 18.36ppm, 9.487ppm and 6.224ppm respectively is moderate for Vegetables (Decuyper, 2012). Copper (Cu) and Iron (Fe) are cellular activity and oxygen transport; Fe is useful in prevention of anaemia and other related diseases (Oluyemi *et al.*, 2006) while Cu is a component of many enzyme systems such as cytochrome oxidase, lysyl oxidase and ceruloplasmin, an iron-oxidizing enzyme in blood (Mills, 1981). The observation of anaemia in Cu deficiency may probably be related to its role in facilitating iron absorption and in the incorporation of iron into haemoglobin (FAO/WHO, 1974).

PHYTOCHEMICAL AND ANTI-NUTRIENTS COMPOSITION OF *Vitex doniana* YOUNG LEAF

Results of phytochemical analysis and anti-nutrients showed that *Vitex doniana* young leaf contained tannins, saponins, Alkaloids and trace of Cardiac glycosides. Boiling in hot water reduces anti-nutrients of plant products (Enechi and Odonwodu, 2003). Saponins (in excess), causes hypocholesterolaemia because it binds cholesterol making it unavailable for absorption (Soetan and Oyewole, 2009). Saponins also have haemolytic activity against RBC (Khalil and El-adawy, 1994). Saponins – protein complex formation can reduce protein digestibility (Potter *et al.*, 1993; Shimoyamada, *et al.*, 1998). Alkaloids have been implicated in the inhibition activities of many bacterial species (Nuhu *et al.*, 2000; Tor-Anyiin, 2009).

CONCLUSION

The evaluation of nutrient composition of *Vitex doniana* young leaf showed that it is highly rich in nutrients and therefore good for human consumption for the maintenance of health and vitality. The nutrients analysis shows that *Vitex doniana* young leaf contains the nutrient levels that fall within those of edible vegetables: Carbohydrate, crude protein, crude fat, crude fibre, moisture, ash (minerals) and vitamins and low content of anti-nutrients. The high moisture content of blackplum young leaves will encourage microbial growth, increase the rate of enzymatic reaction and hence deterioration. The implication of this is that the vegetable cannot be stored for more than 24 hour before it starts to deteriorate. The low fibre content of blackplum may decrease the absorption of bile (Marfo *et al.*, 1990), but its protein content makes it nutritionally a good source of plant protein; this validates its use in diet.

Blackplum young leaves contain essential vitamins necessary for body to survive. However, the value of vitamin B₂ is relatively low, but not too low for plant based vitamins. This study has established that *Vitex doniana* (Blackplum/Oori) young leaves are yet another route out of the nutritional “wilderness” presently experienced by many in Nigeria and perhaps West Africa. By inference, blackplum young leaves will supplement other sources of dietary iron in man if eaten, and since its magnesium content is high, it implies that adequate consumption of

the leaf would satisfy the recommended daily allowance when eaten in conjunction with other sources of dietary magnesium.

The health implications of anti-nutrients are well known. Some anti-nutritive factors such as tannins, alkaloids and saponin were detected from the result of the analysis. These were present in small quantities; these factors may not pose any serious nutritional problem in its consumption. Reduction of these anti-nutrients during the processing of blackplum young leaves such as boiling is therefore of great importance for the safety of the product.

RECOMMENDATION

It is therefore recommended that the young leaves of *Vitex doniana* should be consumed in every household as the study has revealed that its consumption poses no danger to human health, but rather a more healthy living. It is also suggested that further research should be carried out on its economic status and possibly, the seed should be worked on to verify its feasibility as feed supplement in animal feed.

REFERENCES

- Abidemi, T.A., Adebayo, O.J., Idowu, O. and Agbotoba, M.O. (2009). Nutrient content and anti-nutritional factors in Shea butter (*Butryospermum parkii*) leaves. *African Journal of Biotechnology*, Vol.8 (21), pp.5888-5890.
- Association of Official Analytical Chemists (A.O.A.C.). (1999). *Official Method of Analysis*. 2nd edition, Association of Official Analytical Chemists, Washington D.C., pp.807-928 (1990).
- Decuyper (2012). Dr. Decuyper's Nutrient Chart: Vegetables Chart. www.healthalternative2000.com
- Enechi O.C. and Odonwodu I. (2003). An assessment of the phytochemical and nutrient composition of the pulverized root of *Cissus quadrangularis*, *BioResearch*, (1), 63-68.
- F.A.O. (1990). *Traditional food plants*, Food Agric. Organisation of United Nation Nutritional paper, 42: 593.
- F.A.O./W.H.O. (1974). *Hand Book on Human Nutritional Requirements*, Food Agric. Organisation of United Nation Nutritional Studies. 28: 63 – 64.
- Gafar M.K. and Itodo A.U. (2011) Proximate and mineral composition of hairy indigo leaves. *Electronic Journal of Environmental, Agricultural and Food Chemistry*, 10(3), 2007-2018.
- Irvine F.R. (1969). *West Africa Botany* 2nd Edition, Oxford University Press Ely House, London. p. 91.
- Khalil A.H. and Eladawy T.A. (1994). Isolation, Identification and Toxicity of saponins from different legumes. *Food Chemistry*, 50(2), 197-20.
- Lenntech (2007). Recommended daily intake of vitamins and minerals. <http://www.lenntech.com/recommended-daily-intake.htm>, pp. 1-14.
- Lucas E.O. (1988). The potential of leaf vegetable in Nigeria. *Outlook on Agric.* 17(4): 163- 168.
- Marfo E.K., Simpson B.K., Idowu J.S., Oke O.L. (1990). Effect of local food processing on phytate level in Cassava, Cocoyam, Yam, Maize, Sorghum , Rice, Cowpea and Soya beans. *J. Agric. Food Chem.* 38: 1580-1585.
- McDonald P., Edward R.A., Greenhaldt F.D. and Morgan C.A. (1995). *Animal Nutrition*, Prentices Hall ,London, 101-122.
- Mills C.F. (1981). Symposia from the XII International Congress on Nutrition. *Prog. Clin. Biol. Res.* 77:165– 171.
- Nnamani C.V., Oselebe H.O., and Okporie E.O. (2007). Ethnobotany of Indigenous Leafy Vegetables of Izzi Clan, in Ebonyi State, Nigeria. In: *Proceeding of 20th Annual National Conference of Biotechnology Society of Nigeria*. Abakaliki, November 14th-17th, Pp.111-114.
- Nuhu A.M., Mshelia M.S., Yakubu Y. (2000). Antimicrobial screening of the bark extract of *Pterocarpus erinaceus* tree *J. Chem. Soc. Nig.* 28: 85-87.
- Oluyemi E.A., Akilua, A.A., Adenuya A.A. and Adebayo M.B. (2006) Mineral contents of some commonly consumed Nigerian foods, *Science Focus*, (11), 153157.
- Potter S.M., Jimenez-flores R., Pollack J., Lone T.A. and Berber-jimenez M.D. (1993). Protein saponin interaction and its influence on blood lipids, *Journal of Agricultural and Food Chemistry*, (41), 1287-1291.
- Romeran Y, and Clifton D (1981). *Food analysis theory and practices* ed.E.S Melon Av 1 Publishing Company, pp. 40-45.
- Sheela K., Kamal G.N., Vijayalakshmi D., Geeta M.Y., Roopa B.P. (2004). *Proximate Trees*. FRIN, Ibadan. Vol.II,

- Shimoyamada M., Ikedo S., Ootsubu R. and Watanabe K. (1998). Effect of Soya beans saponins on chmotryptic hydrolyses of soybeans proteins, *Journal of Agricultural and Food Chemistry*, (46), 4793-4797.
- Soetan K.O. and Oyewole O.E. (2009). The need for adequate processing to reduce the anti-nutritional factors in animal feeds, A review. *African Journal of Food Science*, 3(9), 223-232.
- Tor-Anyiin T.A. (2009). Chemical characterisation of stem bark of *Sterculia setigera*. Ph.D. Thesis, Nnamdi Azikiwe Univ., Awka, Nigeria.
- World Health Organisation (1992). Energy and Protein requirement. Report of a Joint FAO/WHO Ad Hoc Expert Committee. World Health Organisation, Geneva.
- Sofowora A. E. (1993). Medicinal plants and traditional medicine in Africa. Spectrum books Ltd. 2nd Edn. pp26-100
- Ladeji, O. and Okoye, Z.S.C. (1996). Anti-hepatotoxic properties of *Vitex doniana* bark extract. *Pharm. Biol.*, 34(5): 355-358.
- Dalziel, J. M., Keay, R. W. J., Onochie, C. F. A. and Stanfield, D. P. (1964). *Nigerian Trees*. FRIN, Ibadan, Vol. II, 1964.
- Dalziel, J. M. and Hutchison, J. (1955). *Useful Plants of West Tropical Africa*. Crown Agent, London, 1955.
- Keay, R. W. J., Onochie, C. F. A. and Stanfield, D. P. (1964). *Nigerian Trees*. FRIN, Ibadan, Vol. II, 1964.
- Glew, R. H., Vanderjagt, D. J., Lockett, C., Grivetti, L. E., Smith, G. C., Pastuszyn, A. and Millson, M. (1997). Amino Acid and Mineral Composition of 24 Indigenous Plants in Burkina Faso. *J. Food Comp. Anal* 1997; 10 (3): 205 -217.
- Egbekun, M. K., Akowe, J. I. and Ede, R. J. (1996). Physico-chemical Properties and Sensory Properties of Formulated Syrup from Black-plum (*Vitex doniana*) Fruit. *Plant Foods for Human Nutrition* 1996; 49 (4): 301-306.
- Okigbo, R. N. (2001). Mycoflora within Black-plum (*Vitex doniana* Sweet) Fruits. *Fruits* 2001; 56: 85-92.
- Ladeji O, Okoye, Z. S. C. and Udoh, F. (1996). Effects of *Vitex doniana* Stem Bark Extract on Blood Pressure. *Physiotherapy Research* 1996; 10 (3): 245-247.
- Abbiw, K. D. (1990). *Useful Plants of Ghana*. Intermediate Technology Publications & Royal Botanic Gardens, Kew, 1990.
- Kilani, A. M. (2006). Antibacterial assessment of whole stem bark of *Vitex doniana* against some enterobacteriaceae. *African Journal of Biotechnology* 2006; 5(10): 958 – 959.
- Ladeji O and ZS Okoye Anti-hepatotoxic Properties of *Vitex Doniana* Bark Extract. *Int. J. Pharmacognosy* 1996; 34 (5): 355-358.

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