

## Proximate, Vitamins and Mineral Composition of *Vitex doniana* (black plum) Fruit Pulp

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**ABSTRACT:** Samples of *Vitex doniana* fruit (black plum) were collected from Vunchi village in Bida metropolis. The dried endocarp was washed, ground into powder and analysed for the proximate, vitamins and mineral compositions. The values (%DW) of moisture, ash, crude protein, crude fibre, crude fat and carbohydrate available were 16.66, 11.50, 8.24, 0.58, 34.62 and 28.40, respectively. Levels of Vitamin A, B1, B2, B6 and C were 0.27, 18.33, 4.80, 20.45 and 35.58 (mg/100g DW) respectively. Mineral (mg/100g DW) were: potassium (16.5), sodium (10.40), calcium (30.27), iron (5.20), Copper (2.70), magnesium (20.10) and phosphorus (16.50). The result indicates that *Vitex doniana* fruit pulp could be promoted as: carbohydrate and lipid supplements for cereal-based diets in rural communities, another cheaper source of raw material for juice production, fortified into feed of ruminants, while its moderate calcium value could be used for the management of osteomalacia.

**Keywords:** *Vitex doniana*, micronutrients, proximate, vitamins and mineral composition, Fruit.

### INTRODUCTION

Fruits are referred to as juicy seed bearing structure of flowering plant that may be eaten as food (Hyson, 2002). Fruits are not accorded the importance they deserve in the diet of Nigerians due to ignorance of their nutritive value, cost and difficulty in storage and distribution (Sai, 1997). The diet of many rural and urban dwellers is deficient in protein resulting in high incidence of malnutrition and increase in dietary diseases; a situation in which children and especially pregnant and lactating women are most vulnerable (Black, 2003). In developing nations, numerous types of edible wild plants are exploited as sources of food to provide supplementary nutrition to the inhabitants (Aberoumand and Deokule, 2009). Food and Agricultural Organization (FAO) reported that at least one billion people are thought to use wild food in their diet (Burhingame, 2000). In Ghana alone, the leaves of over 300 species of wild plants and fruits are consumed while about 150 wild plant species have been identified as sources of emergency food in India, Malaysia and Thailand (Umar *et al.*, 2007). Similarly, in South Africa about 1400 edible plant species are used (Hassan and Umar, 2004). It is therefore worthwhile to note that the incorporation of edible wild and semi-cultivated plant resources could be beneficial to nutritionally marginal populations, or to certain vulnerable groups within populations, especially in developing countries where poverty and climatic changes

are causing havoc to the rural populace (Aberoumand and Deokule, 2009).

The genus *Vitex* consists of over 270 species, predominantly trees and shrubs, and is restricted to tropical and sub tropical regions, although a few species are also found in the temperate zones (Padamalatha *et al.*, 2009). Among them is *V. doniana* also called black plum. Detail of its botany is given by Agbede and Ibitoye, (2007). *V. doniana* is widely spread in tropical West Africa and extending eastward to Uganda, Kenya and Tanzania and is also grown throughout the world as ornamental and as sources of wood and unusual chemical, some of which have medicinal properties (Kapooria and Aime, 2005). Nnajiolor, (2003) studied the fermentation of *V. doniana* (black plum) juice for the production of wine, while Agbede and Ibitoye, (2007) studied the sugar content as well as the anti-nutritional factor in its fruit. Egbekun *et al.*, (1996) showed that *V. doniana* could serve as good source of nutritive sweetener while Ladeji *et al.*, (2004) reported the anti diarrhoea effect of stem bark of *V. doniana*. Despite its use as food and medicine in this region, there has been little or no report on its proximate, vitamin and mineral composition. Therefore, this work is aimed at evaluating the nutritional content of *V. doniana* fruit obtained from Vunchi, in Lavun local government, Niger State with the hope that it would be incorporated into the food basket of the country.

### Experimental Sample Collection and Preparation

The matured and dried fruits of *V. doniana* were randomly sampled from different branches of the tree growing in areas around Vunchi village, Lavun local Government area, Niger state. The samples were transported to the laboratory in airtight polyethylene bags. The endocarp (edible portion) scrapped out.

**Analytical procedure:** The samples were oven dried at 70°C in an air circulated oven for 24 h, cooled and ground with porcelain mortar and pestle to fine particles and stored in screw capped plastic containers. Chemical analyses were carried out on the ground samples.

**Chemical analyses:** Moisture and Protein contents were determined by the method adopted by Anhwange *et al.* (2004). Ash and crude fibre contents by AOAC (1980), crude fat by AOAC (1990) and carbohydrate content by difference (Pomeranz, 1971).

**Vitamins:** Vitamin A and Vitamin B<sub>1</sub> were determined in accordance with Jacobs (1999). British Pharmacopoeia (1988) was used for Vitamin B<sub>2</sub> and Spectrophotometric method for Vitamin B<sub>6</sub>, while titrimetric method was used for Vitamin C.

**Mineral content:** Mineral analysis was carried out after sample digestion with 24 cm<sup>3</sup> mixture of the conc. HNO<sub>3</sub>, Conc. H<sub>2</sub>SO<sub>4</sub> and 60% HClO<sub>3</sub> (9:2:1 v/v). Standard methods of AOAC (1990) were used for elemental analysis. Sodium and Potassium were analysed using a flame photometer. Calcium, copper, iron, magnesium and manganese were analysed using Unicam 969 model atomic absorption spectrophotometer, while phosphorus content was determined colorimetrically with Jenway 6100 spectrophotometer (Umar *et al.*, 2007).

### RESULTS AND DISCUSSION

**Proximate analyses:** The results of proximate composition of *V. doniana* fruit are shown in Table 1. Pearson (1994) reported that moisture content is a measure of the water content in the fruit samples, generally moderate, an indication that it can be stored for a long time without the development of moulds, as it is within the range of required value as safe storage limit for plant food materials (Umar *et al.*, 2007). The moisture content of *V. doniana* was 16.66% (Table 1).

The value is slightly higher than 4.68% and 3.5% reported for *V. doniana* and *Detarium microcarpum* (Nnamani *et al.*, 2009; Anhwange *et al.*, 2004) respectively.

**Table 1:** Proximate composition of the edible part of the fruit

Parameter	Concentration (% DW)*
Moisture content	16.66 ± 1.06
Ash content	11.50 ± 1.10
Crude protein	8.24 ± 0.24
Crude fibre	0.58 ± 0.08
Crude fat	34.62 ± 0.56
Carbohydrate content	28.40 ± 1.06

The data are Mean values ± Standard deviation (SD) of three replicates.

\*Values expressed as % Dry weight.

Ash content is a measure of the total mineral content of a food. The sample analysed had a value of 11.50%, is high compared to 5.27% reported by Agbede and Ibitoye (2007). The differences could be due to environmental factors. Crude protein of *V. doniana* was 8.24%, which is similar to 10.0 % reported by Nnamani *et al.* (2009). The value is low when compared to the seeds of *M. oleifera* (40.1±1.63), *D. microcarpum* (35.96±1.63) and *B. monandra* (33.09±2.30 %) (Anhwange *et al.*, 2004). Crude fat of the edible portion of *V. doniana* was 34.62%. The value was higher than 3% reported by Agbede and Ibitoye (2007).

Dreon *et al.* (1990) showed that most fruits had high carbohydrate content depending on the fruit type, maturity and environment. However *V. doniana* is on the contrary by having a slightly lower value of 28.40%. The value was also low when compared to 67.0% reported in *V. doniana* leaves (Nnamani *et al.*, 2009). Crude fibre obtained from *V. doniana* fruit (0.58%) was grossly lower than 15.0% reported for *V. doniana* leaves (Nnamani *et al.*, 2009) or 18.80% for *Asparagus officinalis* stem (Ali, 2009). The fibre RDA values for children, adults, pregnant and breast feeding mothers are 19-25%, 21-38%, 28% and 29% respectively. Thus *V. doniana* fruit is a poor source of dietary fibre for humans.

**Vitamins:** The value of vitamin A obtained (0.27mg/100g) is significantly higher than that reported by Rod *et al.* (1996). Vitamins B<sub>1</sub>, B<sub>2</sub> and B<sub>6</sub> principally function in macronutrient metabolism and are present in *V. doniana* fruit

at appreciable amounts of 18.33, 4.80, and 20.45 mg / 100g respectively. The values are relatively high when compared with RDA values of 1.2, 1.4, and 1.5 mg/100g respectively. Ascorbic acid is generally used for protein metabolism and collagen synthesis. The fruit had vitamin C (ascorbic acid) content of 35.58 mg/100g which is lower than the RDA value (60 mg/100g) for adult (Rod *et al.*, 1996).

**Table 2:** Vitamin content of the edible part of the fruit

Parameter	Concentration (mg/100gDW)*
Vitamin A	0.27 ± 0.02
Vitamin B <sub>1</sub>	18.33 ± 1.01
Vitamin B <sub>2</sub>	4.80 ± 0.20
Vitamin B <sub>6</sub>	20.45 ± 0.48
Vitamin C	35.58 ± 1.57

\*The data are Mean values ± Standard deviation (SD) of three replicates

**Mineral composition:** Table 3 shows the mineral composition of *V. doniana* fruit pulp. Calcium forms component of bones and teeth, necessary for blood clotting and muscle contraction. The calcium content of the fruit pulp was 30.27mg/100g which is lower than 139 mg/100g obtained by Robert *et al.* (1997) which could be probably due to environmental factors.

**Table 3:** Mineral composition of the edible part of the fruit

Parameter	<i>Vitex doniana</i> (mg/100gDW)*
K	15.70 ± 0.26
Na	10.40 ± 0.26
Ca	30.27 ± 0.30
P	16.50 ± 1.00
Mg	20.10 ± 0.10
Fe	5.20 ± 0.36
Cu	2.70 ± 0.45

\*The data are Mean values ±Standard deviation (SD) of three replicates

The value was also lower than 71.0 mg/100g reported in the sample's leaves (Nnamani *et al.*, 2009) and 160 mg/100g for *D. microcarpum* pulp (Umar *et al.*, 2007). Phosphorus is related to calcium for bone, teeth and muscles growth and maintenance (Umar *et al.*, 2007). 16.50 mg/100g obtained for phosphorus is appreciably lower than 95.7 mg/100g (Robert *et al.*, 1997) and 38.5mg/100g from its leaves (Nnamani *et al.*, 2009).

The availability of Calcium in the body depends on calcium to phosphorus ratio and presence of antinutritional factors. For good calcium intestinal absorption, Ca: P ratio must be 1:1 (Umar *et al.*, 2007). Ca: P ratio for the edible part of *V. doniana* is 2:1 which indicates that the diet required to be supplemented with phosphorus sources. Magnesium is an important element in connection with circulatory diseases and Calcium metabolism in bone (Ishida *et al.*, 2000). The value (20.10mg/100g) reported here was lower than 124 mg/100g reported by Robert *et al.* (1997) and 45.0mg/100g for *V. doniana* leaves (Nnamani *et al.*, 2009). Also seed of *D. microcarpum* was reported to contain 33.6 mg/100g (Umar *et al.*, 2007), while *D. microcarpum* pulp contained 90.07 mg/100g (Lockeett *et al.*, 2000) and 720±14.0 g/kg reported by Agbede and Ibitoye (2007).

Potassium content of *V. doniana* was 15.70 mg/100g lower than 880 mg/100g reported by Agbede and Ibitoye (2007) on the same spp. Leaves of *V. doniana* was also reported to contain 36.0 mg/100g (Nnamani *et al.*, 2009). Umar *et al.*, (2007) reported 1,593.75 mg/100g as potassium content of *D. microcarpum* pulp. Iron is essential micronutrient for haemoglobin formation, normal functioning of central nervous system (CNS) and in the oxidation of carbohydrate, protein and fat (Adeyeye and Otoketi, 1999). The sample iron content (5.20mg/100g) was higher than 0.191mg/g reported in *V. doniana* pulp (Robert *et al.*, 1997) and 2.11 - 2.53mg/100g for *D. microcarpum* (Umar *et al.*, 2007). Since it had significant amount of iron, its consumption should be encouraged particularly for menstruating and lactating women. Sodium content in combination with potassium is involved in maintaining proper acid-balance and in nerve transmission in the body (Adeyeye, 2002). The variation of Potassium to Sodium content in this work is of significant importance particularly to a hypertension patient (Umar *et al.*, 2007). The value of 10.40 mg/100g of Na obtained in this study is grossly lower than 438.50 mg/100g for *D. microcarpum* pulp (Umar *et al.*, 2007).

The concentration of copper in the fruit (2.70 mg/100g) is higher than 0.33 mg/100g and 0.50 mg/100g reported by Umar *et al.*, (2007) and Lockeett *et al.* (2000). Contrary, Nnamani *et al.* (2007) reported high amount (65.0 mg/100g) of Cu in *V. doniana* leaves. The value is higher

than the Cu RDA (1.5-3.0 mg/day) therefore 100g of *V. doniana* could provide the required value.

## CONCLUSION

The results of the nutritional analysis show that *V. doniana* fruit is a good source of vitamins particularly vitamin C and other macro and micronutrients. *V. doniana* fruit is suitable for high-temperature food processes, because it has very low carbohydrate concentration thereby reducing the possibility of Maillard reaction and then acryl amide formation. It is recommended for continuous use for nutritional purposes, considering the amount and diversity of nutrients it contain. The work also supports the earlier reports that environmental condition and genetic variation exert significant influences on chemical composition of plants (Umar *et al.*, 2007; Lockeett *et al.*, 2000). This study further showed that no single plant food could provide the required nutrient.

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