

## BIOCHEMICAL EVALUATION OF PEPPER FRUIT (*DENNETTIA TRIPETALA*) AND ITS USE AS SUBSTITUTE FOR GINGER IN ZOBO DRINK PRODUCTION

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### ABSTRACT

*The Nutritional and anti-nutritional factors of Dennettia tripetala (ripe and unripe) were investigated. Result showed that ripe Dennettia tripetala contains protein (4.67%), moisture (18.73%), fat (5.78%), ash (3.18%), fiber (14.32%), carbohydrate (53.32%) while the unripe contains protein (6.59%), moisture (15.26%), fat (5.52%), ash (4.13%), fiber (17.05%) and carbohydrate (51.45%). The anti-nutritional content of Dennettia tripetala showed that the unripe has higher anti-nutrients; saponin (0.27mg/g), flavonoid (3.10mg/g), alkaloid (0.33mg/g) and tannin (0.36mg/g) while the ripe has saponin (0.15mg/g), flavonoid (1.25mg/g) alkaloid (0.14mg/g) and tannin (0.18mg/g). The sensory evaluation revealed that there was no significant difference at (p<0.05) between zobo-pepper fruit and zobo-ginger drinks.*

**Keywords:** Dennettia tripetala, zobo-pepper fruit, zobo-ginger drinks

### INTRODUCTION

*Dennettia tripetala* (pepper fruit) is an indigenous fruit tree of the family Annonaceae (Etukudo, 2000). It's widely distributed and consumed by the inhabitants of Western Camerouns, Ivory Coast and Southern Nigeria (Hutchinson and Dalziel, 1954; Keay *et al.*, 1960; Okiy, 1960). It is a medium- sized or small tree which spreads throughout the rain forest and sometimes found in forest within the Savanna areas (Keay *et al.*, 1964).

*Dennettia tripetala* fruits appear red when ripe and green when unripe. The matured fruits constitute the main edible portion. The leaves, fruit, bark and root of the plants possess strong pepperish and pungent spicy taste with a characteristic aroma and fragrance. The young leaves and fruits have instinctive spicy taste (Achinewhu *et al.*, 1995). The fruits are chewed in different forms (fresh green, fresh ripened red, black dry fruit and dry seed).

*Dennettia tripetala* fruit serve as mild stimulant to the consumer (Aiyeloja and Bello, 2006; Ndukwu and Nwadiibia, 2006; Oyemitan *et al.*, 2006). The fruits and leaves are used as seasonings which are added to prepared food such as meat, soup, sausage and in some special local dishes and vegetables (Ejechi and Akpomedaye, 2005). *Dennettia* plant yields a good fuel wood (Abbiw, 1990 and Duguma *et al.*, 1990). Its various parts are commonly used as spices and condiment (Oyemitan, 2008). The fruit is sold for money especially by rural women.

*Dennettia tripetala* fruits have been reported to contain important nutritive substances such as vitamins, minerals and fiber (Okwu *et al.*, 2005). It was also indicated that the rich presence of essential oil (oleoresins) determines the aromatic flavoring, coloring and pungent properties of pepper fruits. Nwaogu *et al.* (2007) investigated phytochemical content of *Dennettia tripetala* and detected the presence of saponins, flavonoids, tannins and cyanogenic glycosides. Also Adedayo *et al.*, (2006) reported the presence of flavonoids in *Dennettia*

*tripetala*. The intake of flavonoids in any fruit and vegetable tends to decrease cancer risk (Neuhouser, 2004; Graf *et al.*, 2005). Flavonoid according to Harpens *et al.*, (1979) contributes to the color of plants, their fruits and flowers. Timothy and Okeke (2005) reported that ingestion of 0.75g of *Dennettia tripetala* reduces the intraocular pressure (IOP) of normotensive emmetrops though not sustained at 30 minutes post consumption. The IOP was reduced by 17.30% (12.90 mmHg) from the mean baseline of 15.60mmHg.

*Hibiscus sabdariffa* (Roselle) is a vegetable plant of West African origin being widely cultivated in West Africa, Asia, Austria and many tropical countries (David and Adam, 1988; Tindall, 1992). It belongs to the family Malvaceae and is highly cultivated in the Northern part of Nigeria probably because of favorable climates (Oguntona, 1998). The seeds are boiled, fermented and dried for use as a condiment for local soup preparation (Yakuwa or Balso in Hausa) (Mera *et al.*, 2004). The young shoot and leaves of the latter roselle variety are usually cooked and eaten as vegetables while the fleshy, swollen red calyxes and the flowers are used to color and season other foods as well as in the preparation of fruit drink called “Zobo” in Nigeria.

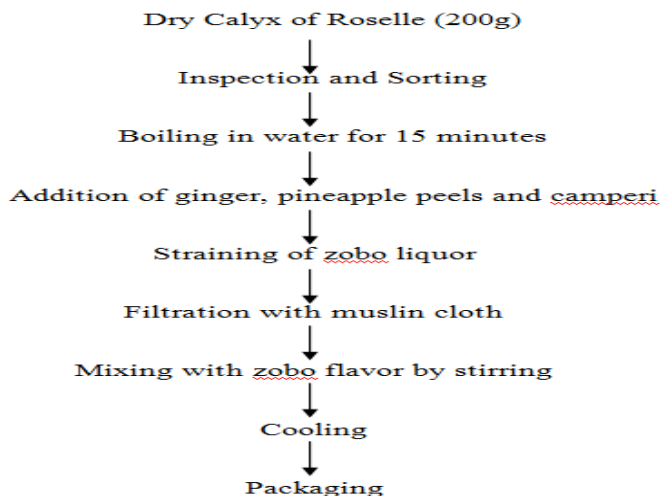
The name “zobo” was derived from zoborodo (Hausa, Nigeria) and it’s called sorrel in English. The extract is usually sweetened with sugar and flavored with other ingredients such as ginger, garlic, pineapple peels, alligator pepper seeds, vanilla extract and lemon. The roselle calyx of *Hibiscus sabdariffa* is rich in vitamins, carbohydrate, protein and vitamin C and also antioxidants (Wong *et al.*, 2000) which make up the major benefits of consuming soft drinks and fruits juice (Okoro, 2003; Ogiehor and Nwafor, 2004). Zobo drink is found to be naturally acidic fruit rich in organic acid: oxalic, tartaric, malic and succinic (Wong *et al.*, 2002). Therefore the objectives of the work were to investigate: the nutritional quality of ripe and unripe pepper fruit (*Dennettia tripetala*), ascertain the concentration of antinutrient in ripe and unripe pepper fruit and to evaluate the suitability of pepper fruit as a substitute for ginger in zobo drink production.

## MATERIALS AND METHODS

### Sample Collection and Preparation

The sample (*Dennettia tripetala*) was obtained from Relief Market in Owerri, Imo state. The sample was sorted, washed, dried and ground using attrition mill. After grinding, it was sieved to obtain a powdered sample used for the analysis.

### Flow Chart of Zobo Drink Production



## Nutritional Evaluation of Pepper Fruit

The carbohydrate, ash and crude fiber contents were determined following the methods of James (1995). Moisture and protein contents were determined according to AOAC (2000), Chang (2003) respectively. Fat, minerals and vitamin contents were evaluated following the procedure described by Kirk and Sawyer (1998).

## Determination of Anti-nutrient in Pepper Fruit

The concentrations of tannins and total phenol were determined using the methods of Kirk and Sawyer (1998) and Singleton *et al.* (1991) respectively while saponin, alkaloid and flavonoid content were evaluated as described by Harborne (1973).

## Sensory Evaluation

Organoleptic test was carried out on Zobo-ginger and Zobo-pepper fruit using a ten member panelist. The panelist were asked to rate the samples on color/appearance, aroma, taste, mouth feel and general acceptability based on the 9-point hedonic scale ranging from disliked extremely (1) to liked extremely (9).

## Statistical Analysis

The data collected from the organoleptic assessment was subjected to t-test analysis to determine significant differences (if any) among the samples.

## RESULT AND DISCUSSION

### Nutritional Evaluation of Unripe and Ripe Pepper Fruit (*Dennettia Tripetala*)

The nutritional evaluation of unripe *Dennettia tripetala* in percentage wet basis (Table 1) revealed protein (6.59), moisture content (15.26), fat (5.52), ash (4.13), fiber (17.05) and carbohydrate (51.45). Its mineral content comprises of calcium (181.69mg/g), magnesium (229.78mg/g), iron (0.2mg/g), phosphorus (285.8mg/g), potassium (360.8mg/g) and Sodium (6.12m/mg). The vitamins include ascorbic acid (85.65mg/g), niacin (0.40mg/g), thiamine (0.10mg/g), riboflavin (0.05mg/g) and vitamin A (65.58mg/g) while ripe *Dennettia tripetala* showed protein (4.67%), moisture content (18.73%), fat (5.78%), Ash (3.18%), fiber (14.32%) and carbohydrate (53.32%).

Evaluation of the ripe pepper fruit for its mineral content indicated calcium (138.94mg/g), magnesium (173.68mg/g), iron (0.23mg/g), phosphorus (243.8mg/g), potassium (324.27mg/g) and sodium (5.47mg/g). The study also revealed ascorbic acid (115.57mg/g), niacin (0.37mg/g), thiamine (0.08mg/g), riboflavin (0.05mg/g) and vitamin A (388.10mg/g).

**Table 1. Proximate composition *Dennettia Tripetala* (Pepper fruit)**

%	Samples	
	Unripe	Ripe
Moisture content	15.26 ± 0.07	18.73 ± 0.02
Protein	6.59 ± 0.08	4.67 ± 0.08
Fat	5.52 ± 0.3	5.78 ± 0.08
Ash	4.13 ± 0.02	3.18 ± 0.03
Fiber	17.05 ± 0.7	14.32 ± 0.3
Carbohydrate	51.45 ± 0.015	53.32 ± 0.02

(Values are means of triplicate analysis)

The unripe pepper fruit (*Dennettia tripetala*) showed higher value in protein (6.59%), ash (4.13%) and fiber (17.05%) than the ripe *Dennettia tripetala* which had protein (4.67%), ash (3.18%) and fiber (14.32%). Ripe *Dennettia tripetala* showed high moisture content (18.73%), fat (5.78%) and carbohydrate (53.32%) than the unripe. The higher the moisture content in a food material, the higher the chances of microbial attack. This justifies why ripe *Dennettia tripetala* is more prone to microbial spoilage than the unripe.

The high ash content of unripe pepper fruit is a reflective of its greater mineral content than the ripe (Table 2) which makes it important for little children. Minerals enhance the important functions of maintaining acid-base balance and proper osmotic pressure in the body (Onimawo and Egbekun, 1998). Minerals are required for normal functioning of the nerves and also muscular contraction and relaxation. Calcium and phosphorus are highly required by growing children, pregnant women and nursing mothers (Norman and Joseph, 2006). Hence *Dennettia tripetala* could be a fair and cheap source of these essential minerals.

**Table 2. Mineral Composition of *Dennettia tripetala* (pepper fruit)**

Mineral (mg/g)	Unripe	Ripe
Ca	181.69 ± 1.89	138.94 ± 1.89
Mg	229.78 ± 2	173.68 ± 6
Fe	0.27 ± 0.06	0.23 ± 0.05
P	285.8 ± 0.1	243.8 ± 0.2
K	360.8 ± 2	324.27 ± 0.4
Na	6.12 ± 0.03	5.47 ± 0.02

Mean of triplicate experiment

The result also showed that ripe *Dennettia tripetala* contains higher vitamin C and A than the unripe (Table 3). The increase in vitamin could be attributed to the effect of ripening. This corresponds with the work of Adebayo *et al.* (2010) on changes in the total phenol content and antioxidant properties of pepper fruit (*Dennettia tripetala*) with ripening.

**Table 3. Vitamin composition of *Dennettia Tripetala* (Pepper fruit)**

Vitamin (mg/g)	Unripe	Ripe
Vitamin C	85.65 ± 0.82	115.5 ± 0.82
Niacin	0.40 ± 0.01	0.37 ± 0.01
Thiamine	0.10 ± 0.03	0.08 ± 0.01
Riboflavin	0.05 ± 0.02	0.05 ± 0.02
Vitamin A	65.58 ± 0.29	388.10 ± 0.38

Mean of triplicate values

### Anti-nutritional Evaluation of Unripe and Ripe Pepper Fruit (*Dennettia Tripetala*)

The anti-nutritional evaluation of pepper fruit (Table 4) revealed that unripe *Dennettia tripetala* contains phenol(1.2mg/g), saponin (0.27mg/g), tannin(0.36mg/g), flavonoid (3.10mg/g) and alkaloid(0.33mg/g) while the ripe *D. tripetala* showed phenol (1.6mg/g), saponin (0.15mg/g), tannin (0.18mg/g), flavoniod (1.2mg/g) and alkaloid (0.14mg/g).

Unripe *D.tripetala* had higher saponin, tannin, flavonoid and alkaloid than the ripe while the ripe had higher phenol content (1.6mg/g) than the unripe (1.2mg/g) pepper fruit (Table 4). The significant difference ( $p < 0.05$ ) in phenol content of ripe and unripe pepper fruit may be due to the physiological changes that accomplish ripening which brings about changes in pigments (Obboh *et al.*, 2007; Materska and Perucka, 2005). This result corresponds with the study of Adebayo *et al.* (2010).

There was significant difference ( $P < 0.005$ ) in flavonoid content of the unripe (3.10mg/g) and ripe (1.25mg/g) pepper fruit in the study while the study of Adebayo *et al.* (2010) revealed no significant difference between the unripe (0.1mg/g) and ripe (0.1mg/g). Flavonoids are the class of widely distributed phytochemicals with antioxidant and biological activity. They are constituents of plant foods that have been implicated in the reduction of cancer risk (Wolfe and Liu, 2008). In the Zutphen elderly study, flavonoid intake from fruits and vegetables was inversely associated with all-cause cancer risk and cancer of alimentary and respiratory tracts (Hertog *et al.*, 1994). Many other epidemiological studies have shown a trend of decreased cancer risk with high flavonoid consumption (Neuhouser, 2004; Graf *et al.*, 2005).

**Table 4. Anti-nutrient composition of ripe and unripe *Dennettia Tripetala* (Pepper fruit)**

<i>Antinutrient</i>	<i>Unripe</i>	<i>Ripe</i>
Phenol	1.2 ± 0.16	1.6 ± 0.16
Saponin	0.27 ± 0.01	0.15 ± 0.01
Tannin	0.18 ± 0.005	0.36 ± 0
Flavonoid	3.10 ± 0.04	1.25 ± 0.01
Alkaloid	0.33 ± 0.01	0.14 ± 0.02

Mean of triplicate analysis

### Sensory Evaluation

Organoleptic assessment of zobo-ginger and zobo-pepper fruit using ANOVA showed that there was no significant difference ( $p < 0.05$ ) between the samples on all the parameters used, but numerically zobo ginger was rated higher than zobo mmimi for taste and aroma while for color and mouthfeel zobo ginger was rated numerically equal with zobo-pepper fruit.

**Table 5. Sensory Evaluation of zobo drink**

<i>Sample</i>	<i>Color</i>	<i>Aroma</i>	<i>Taste</i>	<i>Mouthfeel</i>	<i>General Acceptability</i>
Zobo ginger	73 <sup>a</sup>	74 <sup>a</sup>	73 <sup>a</sup>	69 <sup>a</sup>	75 <sup>a</sup>
Zobo-pepper f	73 <sup>a</sup>	69 <sup>a</sup>	67 <sup>a</sup>	69 <sup>a</sup>	75 <sup>a</sup>

\* Values carrying different superscript are significantly different ( $p < 0.05$ )

### CONCLUSION

The study showed that unripe pepper fruit has higher mineral content, vitamins (C and A) than the ripe pepper fruit.

The sensory evaluation revealed that zobo-ginger, zobo-pepper fruit drinks has no significant differences using ANOVA analysis. Therefore pepper fruit can be used as substitute for ginger in zobo drink production.

### RECOMMENDATION

It is recommend that pepper fruit (*Dennettia tripetala*) be consumed for its high nutritional content and should be used very often in zobo drink production.

There is also need for further work is done on zobo-pepper fruit drink to ascertain its health implications in addition to nutritional values.

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