PROXIMATE AND MICRONUTRIENT ANALYSES OF *SYNSEPALUM DULCIFICUM* PULP

Chinelo Nkwocha
Email: austinelonwa@gmail.com

Correspondence authors: Obioma Njoku and Florence Ekwueme

***Abstract*- The proximate composition shows that S. dulcificum contains 7.75% protein, 59.55% moisture content, 4.36% ash, 6.24% crude fibre, 3.26% fat and 18.84% carbohydrate. The result of the mineral analysis shows that S.dulcificum pulp contains 100ppm calcium, 24.20ppm iron, 9.49ppm zinc, 6.22ppm copper, 0.01ppm chromium and 0.01ppm cobalt. Minerals like magnesium, potassium, sodium, manganese and lead were not detected in the pulp. Vitamin analyses show that the S. dulcificum pulp contains 0.04% vitamin A, 22.69% vitamin C, 0.01% vitamin D and 0.02% vitamin K.**

***Keywords*- Synsepalum dulcificum; proximate; mineral; vitamins**

I. INTRODUCTION

Synsepalum dulcificum is known variously as miracle fruit, magic fruit, miraculous or flavour fruit (Duke and Ducellier, 1993). It is a shrub that grows up to 20 feet (6.1m) high in its native habitat but does not usually grow higher than 10feet in cultivation (Wiersema and Leon,1999). Its leaves are 5-10cm long, 2-3.7cm wide and glabrous below and are clustered at the end of the branchlets. The shrub carries orange coloured fruits with each containing one seed (Duke and Ducellier, 1993). The seeds are about the size of coffee beans. The fruit has been used in West Africa since the 18th century, when explorer from Europe namely Chevalier des Marchais was searching for different fruits native to West Africa (Roecklein and Leung,1987). The fruit has a low sugar content and contains a glycoprotein molecule called miraculin (Forester and Waterhouse, 2009). When the fleshy part of the fruit is eaten, the glycoprotein binds to the tongue's taste bud causing sour foods to taste sweet. While the exact cause for this change is unknown, it is believed that the glycoprotein, miraculin works by distorting the sweet receptors so that they become responsive to acids, instead of sugar and other sweet things (Hirai *et al.*, 2006). This effect lasts 10min-2hours (Joseph *et al.*, 2009). Preliminary studies on the leaves of the plant show that the leaves are very rich source of phytosterol (Chen *et al*., 2010). In Africa, *S.dulcificum* leaves are attacked by lepidopterous larvae and the fruits are infested with the larvae of fruit flies (Peter, 2001). A fungus which has been found on this plant is microporus (Duke and Ducellier, 1993). In tropical West Africa where this specie originates, the fruit pulp is used to sweeten palm wine (Joseph *et al.*, 2009). There is really no information on this fruit as regards its nutritive and antinutritive composition. This study is therefore aimed at finding out the proximate composition and micronutrient composition of *synsepalum dulcificum* pulp for public awareness of its nutritional status.

II. MATERIALS AND METHODS

Sample Collection and Preparation

Samples of the fruit of *S.dulcificum* (miracle fruit) were collected from Uke in Anambra State, Nigeria. The plant material obtained was identified by Mr. Alfred Ozioko, the botanist at Bioresource and Development Conservative Programme (BDCP), Nsukka, Nigeria. The fruit was cleaned and washed; the pulp removed from the fruit and was extracted with methanol. The methanol extract was administered to the animals through intubation. Proximate analyses of pulp of *S. dulcificum* for the percentage composition of crude protein, crude fat, crude fibre, moisture was carried out using the methods described by the Association of Official and Analytical Chemists (AOAC, 1990). Carbohydrate was calculated by differences. Vitamins A, C, D and E concentrations of the pulp of *S. dulcificum* were estimated using methods described by Ojiakor and Akubugwo (1997). Mineral contents (sodium, calcium, copper, iron, phosphorus, magnesium, chromium, cobalt and zinc) of the pulp of *S. dulcificum* were estimated by the use of an atomic absorption spectrophotometer (AAS).

III. RESULTS AND DISCUSSION

The proximate composition of a food crop is a major index of nutritional potential of the crop. The result of proximate composition of *S. dulcificum* (miracle fruit) pulp is presented in Fig. 3.1. Moisture content of the pulp of *S. dulcificum* obtained from the analysis was 59.55%. This value is higher than 42.10% reported for *Chrysophyllum africanum* fruit (Amusa *et al.*, 2003) and lower than (85.1%) moisture content reported for *Averrhoa carambola* (Edem *et al.*,2008), 94.8% reported for *Solanum gilo* and 94.6% for *Solanum aubergine* fruits (Edem *et al.*, 2009). The moisture content of any fruit is an index of its water activity (Frazier and Wwstoff, 1978) and is used as a measure of the stability and susceptibility of microbial contamination (Scott, 1980). This implies that *S. dulcificum* pulp may have a short shelf-life due to its high moisture content. The high moisture content of the pulp also implies that dehydration would increase the relative concentrations of the other food nutrients and improve shelf-life of *S. dulcificum* pulp (Edem *et al.*, 2009; Igboh *et al.*, 2009). The crude fat (3.26%) observed for the fruit in this study is lower than (16.20%) reported for *Chrysophyllum africanum* fruit (Amusa *et al.*, 2003), 11.7% crude fat content reported for *Averrhoa carambola* (Edem *et al.*,2008), 7.0% and 4.0% reported for *Solanum gilo* and for *Solanum*

aubergine fruits respectively (Edem *et al.,* 2009). This indicates that *S. dulcificum* pulp contains a low level of crude fat. Fat is important in the diet because it promotes fat soluble vitamin absorption (Bogert *et al.,* 1994). It is a high energy nutrient but does not add to the bulk of the diet. The ash content of *S. dulcificum* pulp obtained in this study was 4.36%. This value is higher than 2.95% reported for *Chrysophyllum africanum* fruit (Amusa *et al.,* 2003), 3.50% reported for *Averrhoa carambola* (Edem *et al.,*2008) and lower than 10.0% reported for both *Solanum gilo* and *Solanum aubergine* fruits (Edem *et al.,* 2009). The protein content of *S. dulcificum* pulp obtained from the analysis was 7.75% which is lower than 8.75% reported for *Chrysophyllum africanum* fruit (Amusa *et al.,* 2003), 14.87% and 15.75% reported for *Solanum gilo* and for *Solanum aubergine* fruits respectively (Edem *et al.,* 2009) but higher than 4.0% reported for *Averrhoa carambola* (Edem *et al.,*2008). Proteins are essential components of the diet needed for survival of animals and human, their basic function in nutrition is to supply adequate amounts of required amino acids (Pugalenthi *et al., 2004*). Protein deficiency causes growth retardation, muscle wasting, oedema, abnormal swelling of the belly and collection of fluids in the body. This value can be improved by the dehydration of the fruits (Igboh *et al.,* 2009). The crude fibre content of *S. dulcificum* pulp (6.24%) obtained from the analysis is higher than 4.50% reported for *Chrysophyllum africanum* fruit (Amusa *et al.,* 2003) and lower than 8.60% reported for *Averrhoa carambola* (Edem *et al.,*2008). This value is also lower than 16.0% and 11.75% reported for *Solanum gilo* and for *Solanum aubergine* fruits respectively (Edem *et al.,* 2009). Fibre helps in maintenance of human health and has been known to reduce cholesterol level in the body. The low level of fibre in *S. dulcificum* pulp may be desirable in their incorporation in weaning diets. Emphases have been placed on the importance of keeping fibre intakes low in the nutrition of infants and pre-school children (Eromosele and Eromosele, 1993). High fibre levels in weaning diets can lead to irritation of the gut mucosa, reduced digestibility and vitamin and mineral availability. Those with high fibre content are desirable in adult diet. However, the crude fibre content of *S. dulcificum* pulp can be increased by the dehydration of the fruits, as the consumption of fruits with high crude fibre content may contribute to a reduction in the incidence of certain diseases like colon cancer, coronary heart disease, high blood pressure, obesity and other digestive disorders (Igboh *et al.,* 2009; Walker, 1978; FAO, 1990; Eriyamremu and Adamson, 1994; SACH, 2008). Fibre diets promote the wave-like contraction that move food through the intestine, high fibre food expands the inside wall of the colon, easing the passage of wastes, thus making it an effective anti-constipation. Presence of high crude fibre improves glucose tolerance and is beneficial in treating maturity on set diabetics (Eromosele and Eromosele, 1993) thus the incorporation of this fruit into human diet would increase the level of fibre intake and could be of tremendous benefit. Increase crude fibre consumption also increase fecal bulk and rate of intestinal transit and have prebiotic effects (Igboh *et al.,* 2009). The carbohydrate content obtained for *S. dulcificum* pulp (18.84%) is lower than 67.60% reported for *Chrysophyllum africanum* fruit (Amusa *et al.,* 2003), 72.20% reported for *Averrhoa carambola* (Edem *et al.,*2008), 52.13% and 58.5% reported for *Solanum gilo* and for *Solanum aubergine* fruits respectively (Edem *et al.,* 2009).

Mineral elements in plants become important when their health benefits are considered in the body of organisms. Most of these minerals occur as chemical compounds in solution form hence, they are able to diffuse in different parts of plants. The mineral composition of *S.dulcificum* pulp as shown in Table 1 shows that *S. dulcificum* pulp contains 100ppm calcium, 24.20ppm iron, 9.49ppm zinc, 6.22ppm copper, 0.01ppm chromium and 0.01ppm cobalt. These minerals are very important to the health of humans. Calcium is important in blood clotting, muscle contraction and in certain enzymes of metabolic processes. Zinc plays a role in wound healing and zinc is essential for general growth and proper development of the reproductive organs and for normal functioning of the prostate gland. In addition to the numerous biological roles these minerals play, they also serve as co-factors in certain biochemical reactions including those involving antioxidant enzymes. Iron serves as a co-factor for the enzyme catalase, a primary antioxidant that detoxifies hydrogen peroxide by dismutation to water and oxygen. Iron is a vital component of haemoglobin, the oxygen carrying pigment in red blood cells. People with iron deficiency suffer from anaemia, which is characterized by such symptoms as fatigue, paleness, headache and shortness of breath during mild exertion arising from a decreased ability of blood to transport oxygen to tissues. The result of the metal analysis shows that the pulp is a good source of iron and may be useful for the treatment of anaemia. Minerals like magnesium, potassium, sodium, manganese and lead were not detected in the pulp. The absence of lead and trace amount of chromium could be an indication that the investigated pulp is free from toxic metals.

The role of antioxidants in human health has prompted some studies in the fields of food science and horticulture to assess fruit and vegetable antioxidants (Kalt *et al.,* 1999). The protective action of fruits and vegetables has been attributed to the presence of antioxidants, especially antioxidant vitamins including ascorbic acid, α-tocopherol and beta-carotene (Cao, 1996). The result of the vitamin analyses shows that the *S. dulcificum* pulp contained 0.04% vitamin A, 22.69% vitamin C, 0.01% vitamin D and 0.02% vitamin K. The high level of vitamin C in this fruit shows that the fruit could be used to promote healthy living such as protection against scurvy and other ascorbic acid deficiency related ailments. It has been reported that supplementing with 500 mg/day of vitamin C for two weeks increased the glutathione concentration of the blood by 50 per cent (Johnson *et al.,* 1993). Glutathione is one of the body's most important natural antioxidants. Vitamin C has also been shown to facilitate iron absorption by its ability to reduce inorganic ferric ion to the ferrous form (Charttejea and Shinde, 2005). Deficiency of vitamin C causes scurvy in human. Vitamin C facilitates wound healing, production of collagen, formation of red blood cells and boosts immune system.The vitamin C content of the *S.dulcificum* pulp is higher than 4.60% reported for *A.carambola* fruit (Edem *et al.,* 2008) and lower than 53.5% reported for *Tetracarpidum conophorum* seeds (Edem *et al.,* 2009), 93.7% and 75.9% reported for *S.gilo* and *S. aubergine* fruits respectively (Edem *et al.,* 2009). Vitamin A helps maintain good sight and prevents certain diseases of the eye. Vitamin D acts as a prohormone and it is needed by the body in the absorption of

calcium (Morrison and Hark, 1999).The deficiency of vitamin D leads to rickets.

Figure 1: Proximate composition of *S. dulcificum* pulp

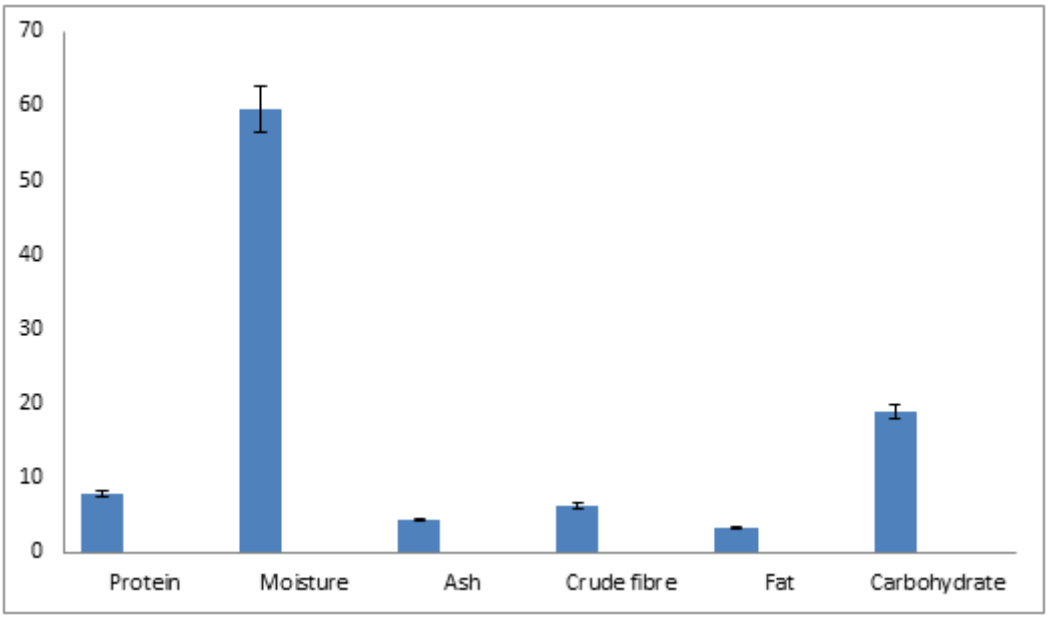

Table 1: The levels of some antioxidant minerals in *S. dulcificum* pulp

MINERALS	CONCENTRATION (ppm)
Calcium (Ca)	100.00
Iron (Fe)	24.20
Zinc (Zn)	9.49
Copper (Cu)	6.22
Chromium (Cr)	0.01
Cobalt (Co)	0.01

Table 2: Antioxidant vitamins composition of *S.dulcificum* pulp

VITAMINS	CONCENTRATION (%)
VITAMIN A	0.04
VITAMIN C	22.69
VITAMIN D	0.01
VITAMIN K	0.02

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