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Nutritional and Phytochemical Composition of *Vitellaria paradoxa* (Shea fruit pulp)

Abstract

The nutritional and phytochemical compositions of the Shea fruit (*Vitellaria paradoxa*) were investigated using standard methods. The phytochemical screening reveal the presence of tannins, alkaloids, saponins, carbohydrates, steroids, flavonoids, anthraquinones and cardiac glycosides while the proximate analysis (%) showed the moisture (75.4), ash (11.6), crude fat (10.6), crude protein (4.4), crude fibre (9.1), carbohydrate (17.8) and energy value (385.2 kcal/g) contents. Also, the mineral composition (%) of the dried Shea fruit pulp as evaluated in this study consist of K (1.97), Na (0.47), Ca (5.50), Mg (1.75), P (1.24); Zn (1.81) and Fe (3.01). The results obtained in this study further reiterate the reason why there is high consumption of Shea fruits by farmers in West and Central Africa for both its nutritional and medicinal benefits.

Key words: Nutritional properties, Phytochemicals, Shea fruit pulp

Introduction

Traditional and folk medicines derived from plants-stem, bark, root, fruit, leaves and seeds have been discovered to play significant role in the prevention and cure of diseases, sickness and disorders in humans around the globe (Gabbe *et al.,* 2006). About three quarter of the world's population relies on plants and their extracts for healthcare (Premanathan *et al.,* 2006). More so, a good number of people especially those living in the rural areas depends largely on the therapeutic effects of herbs because most of these effects have stood the taste of time particularly for the treatment of allergic, metabolic, cardiovascular and other degenerative or life threatening diseases and as well as food sources (Igole *et al.,* 2005), this is because of their bioactive and nutritional compositions (Lamien *et al.,* 2007). Generally,

UNDER PEER REVIEW

fruits from plants particularly those from agro forestry species have been reported as good source of dietary supplement because of their vital minerals and vitamins which provides the nutritional and energy requirements needed by the human body to grow and also curtail malnutrition among children (FAO, 2005).

Fruits from agro forestry species such as that of *V. paradoxa* tree have been recognized by the rural dwellers to supplement their daily energy need (FAO, 2005). *Vitellaria paradoxa* commonly known as Shea butter tree (*Sapotaceae*); is the only specie in the genus indigenous to Africa and found prominently growing in west and central Africa (Lovett *et al.,* 2000). The Shea tree fruit consist of a thin tart nutritious pulp that surrounds a relatively large oil-rich seed from which Shea butter is extracted. The importance of the Shea nut is considered second to the palm nut because of the benefit of butter to many industries both locally and internationally in cosmetics, pharmaceutical and food uses (Akihisal *et al.,* 2010). The sweet pulp is consumed locally when ripped because it is a rich source of sugars, calcium, iron, potassium, magnesium and phosphorus (Maramz *et al.,* 2004). The major constituent of the pulp is vitamin C which is required as an essential nutrient by both humans and animals as an anti-oxidant (Niji *et al.,* 2002). Vitamin C also facilitate lowering of hypertension, enhance human immunity and lack of it may result in scurvy (tooth bleed) diseases (Lang *et al.,* 2007). The pulp is also anti-carcinogenic hence have chemotherapeutic quality It is also used as pain reliever in bones, nerves, inflammation, dislocation and joints arthritis (Akihisa *et al.,* 2010). The oil is also used as local lamp illuminant and for soap production. The fruit contains carbohydrates such as glucose, fructose and galactose (Aremu *et al.,* 2006) and usually, the period of harvesting of the fruit coincides with the high energy requirements in farm planting and the consumption of this fruit meet this immediate energy demand by farmers after hard labour (Okullo *et al.,* 2010). The objective of this study is to evaluate the nutritional and phytochemical properties of dried Shea fruit pulp.

UNDER PEER REVIEW

Materials and methods

Sample collection and preparation

The mature *Vitellaria paradoxa* (Shea butter) fruit were collected from Dzwayagi village, Gbako Local Government Area in Niger State in June, 2017 following which it was depulped manually. The pulp comprising of the epicarp and mesocarp were oven dried at 35^{o}C to a constant weight for five (5) days and then pulverized using laboratory blender, sieved (mesh size 350µm); the fine powder obtained after sieving was weighed then packaged in a transparent air tight glass bottle and stored at ambient temperature (31±2^{o}C) for analyses.

Proximate analysis

The proximate content of the dried pulverized Shea fruit was carried out according to standard methods described by AOAC (2012) to estimate the ash, crude protein, crude fat, crude fibre and carbohydrate contents of the sample.

Mineral analysis

The analysis of the mineral constituents of the sample were carried out using Atomic Absorption Spectrophotometer (Model 320N, Surgicare, England) for Mg, Zn, Ca, Fe, P while the Na and K contents were determined using Flame Photometer (Model FP 640, Mumbai, India) using the methods of AOAC (2003).

Phytochemical analysis

The phytochemical analysis of the methanol extract of the Shea fruit pulp (*Vitellaria paradoxa*) was carried out according to standard methods as described by Sofowora (1993) and Trease and Evans (2012).

UNDER PEER REVIEW

Statistical analysis

The mean data of the proximate and mineral analyses were computed.

Results and discussion

The result in Table 1 showed the nutritional composition of the Shea fruit pulp with moderate moisture content of 75.39% which contributes to it being perishable if poorly preserved but which also contributes to its softness and edibility. The moisture content of the dried Shea fruit pulp obtained in this study (Table 1) is in agreement with the moisture content of 72.4 - 75.3% reported by Okullo *et al.* (2010). The total carbohydrate content of 17.96% obtained in this study is within the range of the carbohydrate value (12.4-19.4%) reported in a similar study by Neuwinger (1994). Like in other edible fruits, the Shea fruit pulp is rich in carbohydrate content such as galactose, fructose and glucose which serves as source of high energy required by farmers during farm planting. Shea fruit has been reported to contain more carbohydrates that are vital in nutrition and as good source of energy (Anwange *et al.,* 2004) and it is believed that regular eating a Shea fruit after hard labour could provide immediate energy sources (Neuwinger, 1994).

Also, the result in Table 1 showed that the crude fibre content in the dried Shea fruit was 9.06 %; crude fibre helps in the maintenance of normal peristaltic movement of the digestive tract. Thus diet containing high crude fibre may reduce disorders such as constipation, colon diseases, diabetes, heart diseases and obesity (Omosuli *et al.,* 2009). The crude protein (4.49%) in the Shea fruit obtained in this study is higher than that reported on Shea fruit pulp in Uganda by Prokarite (2007). This variation may be due to differences in soil, climate and other environmental conditions. Also, the crude fat content (10.6%) obtained in study is higher than the 1.5-3.5% reported by Wilhelmina (2004) in his study on Shea fruit in Ghana. This may be due to differences in post harvest handling processing. The ash content (11.55%)

UNDER PEER REVIEW

of the Shea fruit pulp obtained in this study is comparable to those reported for other edible fruits across the West African region. Ash content of fruits and seeds is important because it determines the amount of minerals and trace metals that are vital in human dietary intake (Onwuka, 2005). Furthermore, the high energy value of Shea fruit recorded in this study (385.21 Kcal/g) is an indication of its high carbohydrate content and as well as the varieties of carbohydrates (fructose, galactose and glucose) it contains (Neuwinger, 2004); this therefore maybe the reason why it is highly patronize by farmers in West and Central Africa (Yeshajau and Clifton, 2004).

Mineral composition in Shea fruit pulp

The result in Table 2 showed that the Shea fruit pulp investigated in this study, contains Na, K, Mg, Fe, P, Zn, and Ca in various amounts which are important minerals that constitute the nutrients required by human and animals for growth and development (Agatemor and Ukhun, 2006). The K content in Shea fruit obtained in this study (1.97%) is comparable with the 2.0% K content reported in other wild and domesticated edible fruits. Potassium plays a vital role in protein, synthesis, body fluid balance, nerve and muscular function, glucose and glycogen absorption and regulating blood pressure (Omosuli *et al.,* 2009). The amount of Na present in the studied Shea fruit pulp is 0.47% and is still within the recommended daily allowance of 0.50 % as reported by NRC (2009). From this study, the Na/K ratio was calculated to be 0.24 % which is less than 1 %; this indicates that Shea fruit pulp is recommended for consumption and in the management and control of hypertension (NRC, 2009). The amount of Ca estimated in the Shea fruit pulp is 5.50% which indicates that Ca is the major mineral present in the Shea fruit pulp although it is lower than the 8.8 % Ca reported in a similar study (Okullo *et al.,* 2010). Calcium play the role of cofactor in many physiological and metabolized functions such as in bone and teeth formation, nervous system, hormonal secretions, enzyme activations, and blood clotting (Agatemor and Ukhun, 2006).

UNDER PEER REVIEW

125 The result in Table 1 also showed that the Shea fruit pulp analyzed in this study contains P
126 (1.24%), Zn (1.86%) and Fe (3.01%). Also, the Mg in the Shea fruit pulp (1.75%) as
127 evaluated in this study is below the 6.0% recommended by NRC (2009) in similar fruit pulp.
128 Magnesium is an important element required for release of enzymes required for synthesis
129 and break down of carbohydrates, fats, proteins in synthesis of RNA and DNA (Grober *et al.,*
130 2005).

131 **Phytochemical constituent of Shea fruit pulp**

132 The presence of alkaloids, saponins, tannins, anthraquinones, terpenes, flavonoids,
133 carbohydrates and glycosides as phytochemical constituents in the Shea fruit pulp (Table 2)
134 may be the basis of its medicinal and health properties and hence explains why it has been
135 used to cure and prevent various illness and diseases (Hassan *et al.,* 2004); therefore, the
136 valuable pharmaceutical properties of *V. paradoxa* may be due to the presence of these
137 bioactive compounds (Table 2). Alkaloids are heterocyclic nitrogen containing compounds
138 found to have anti-malaria, antibacterial, anti-cancer, analgesic, anti-asthma, anti-
139 hyperglycemic and anti-arrhythmic effect (Karou *et al.,* 2007). This may be responsible for
140 the use of the Shea pulp in treating diseases such as cancer, body pain and diabetes. Tannins
141 are bioactive compounds with hot astringent taste that are toxic to microorganisms therefore,
142 their presence in Shea fruit pulp may be the basis for their anti-diarrheal and anti-hemorrhage
143 roles in human (Asquith and Butter, 1996). Furthermore, flavonoids are polyphenolic
144 bioactive compounds which reduces the risk of cardiovascular disorder and lower
145 hypertension; and this may be the reasons why Shea fruits is eaten by rural dwellers
146 especially those diagnosed as being hypertensive (Edeoga *et al.,* 2005). Also, the presence of
147 saponins could be responsible for the use of the Shea fruit ash in local soap making and to
148 cure skin diseases. Saponins generally have soapy feel, hemolytic activity and lowering of

UNDER PEER REVIEW

cholesterol thus the pulp is chewed raw to reduce high cholesterols in man (Ahmad and Geelen, 2013).

Conclusion

The findings of this research show that Shea fruit pulp has a high nutritional potential and health benefits. Therefore, large scale cultivation of *V. paradoxa* should be promoted so as to meet up with its high consumption.

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UNDER PEER REVIEW

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235

UNDER PEER REVIEW

Table 1: Proximate composition of dried Shea fruit pulp

Analysis	Concentration[1]
Proximate content (%)	
Moisture	75.39 ± 0.01
Ash	11.55 ± 0.78
Crude fat	10.60 ± 0.22
Crude protein	4.49 ± 0.28
Crude fibre	9.06 ± 0.67
Carbohydrate	17.97 ± 0.58
Energy value (Kcal/g)	385.21 ± 4.26
Mineral content (%)	
Potassium	1.97 ± 0.01
Sodium	0.47 ± 0.01
Calcium	5.50 ± 0.14
Magnesium	1.75 ± 0.01
Phosphorus	1.24 ± 0.11
Zinc	1.81 ± 0.12
Iron	3.01 ± 0.13

[1]Each data is mean ±SD of triplicate determinations

Table 2: Qualitative phytochemical constituent of methanol extracts of dried Shea fruit pulp

Phytochemical constituent	Inference[1]
Saponins	++
Flavonoids	++
Alkaloids	+++
Tannins	++
Anthraquinones	+
Carbohydrates	++
Steroids	+++
Cardiac glycosides	+

[1] Key ++ = high concentration; +++ = very high concentration and + = moderate concentration

236