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Elemental Composition and Proximate Analysis of Shea Butter Sold in Swali Market, Yenegoa, Nigeria

Sangoremi Anthony Abidemi* and Akens Hamilton-Amachree

Department of Chemistry, Federal University Otuoke, PMB 126, Yenagoa, Bayelsa State, Nigeria
*Corresponding Author

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Abstract**—** *This study evaluates the elemental and proximate composition of Shea butter sold in Swali market Yenagoa, Bayelsa State, Nigeria. Proximate analysis was carried out using standard method of AOAC (2005) while elemental analysis was determined using Atomic Absorption Spectrophotometer and Flame photometer. The proximate values were: Moisture (5.220±0.113 %), Crude fibre (0.111±0.001%), Crude Protein (42.316±0.000%), Crude fat (97.000±0.000%), Ash content (0.084±0.006%), Carbohydrate (34.096±0.011%). Results of the elemental analysis (mg/100g) showed that Sodium, Potassium, Iron, Magnesium, Copper, Calcium, Zinc and Manganese contents of the Shea butter were: 836.83±0.101, 45.81±000, 0.61±0.111, 2.56±0.111, 0.18±0.000, 31.31±0.113, 0.30±0.101 and 0.23±0.113 respectively. The elemental and proximate values indicated that Shea butter has nutritive components comparable to other popular nutritious food substances. Hence, its consumption for edible and non- edible purposes should be promoted.*

Keywords**— Shea butter, Swali market, crude protein, moisture, Yenagoa.**

I. INTRODUCTION

The African Shea tree (*Vitellaria paradoxa)* formerly known as (*Butyrospernum parkli)* is a tree of the Sapotaceae family, it is the only species in genus *Vitellaria* and is indigenous to Africa (Byakagaba *et al*., 2011). The English word "Shea" comes from "s'*i"* the tree name in the Bambara language of Mali. It is known by many local names e.g "*kade*" or "*kadanya*" in Hausa language, "*karate*" in Wolof language of Senegal (Goreja, 2004), "*ori*" in some parts of West Africa and many others.The Shea fruit consists of a thin, tart, nutritious pulp that surrounds a relatively large, oil-rich seed from which Shea butter is extracted. The Shea tree is a traditional African food plant, it has been claimed to have potential to improve nutrition, boost food supply in "annual hungry season" (Masters *et al*., 2010) foster rural development and support sustainable land care (NRC, 2006). Shea butter is a fat extracted from the nut of the African Shea tree (*V.paradoxa)*. It is usually yellow in colour when raw with refined, unrefined and ultra refined Shea butter being ivory or white in colour (Alfred, 2002) The Shea tree belongs to *Sapotaceae* family and was first named by the German botanist Carl Gaertner as *V. paradoxa*. In 1961, the species already described by Gaertner was renamed as *Butyrospermum parkli* (Maranz *et al*., 2003), with the epithet "*parkli*" referring to Mungo Park who was the great Scot's explorer introducing Shea butter to Europe (Goreja, 2004).

The trees grow wild across a 5000 km wide belt of savanna including West African Countries of Senegal, Mali, Cote d' Ivoire, Burkina Faso, Togo, Ghana, Benin Republic, Nigeria, Niger, Cameroon and further east in Uganda, Sudan and Ethiopia (Byakagaba *et al*., 2011; Chalfin, 2004; Goreja, 2004). This savanna belt is also called "Shea belt" among traders (Ferris *et al*., 2001). Among these countries Ghana and Burkina Faso are the main Shea nut exporters (Matt, 2009).

The Shea Tree starts bearing its fruits when it is 10 to 15 years old, full production is attained when the tree is about 20 to 30 years old. It then produces nuts for up to 200 years. The fruit resembles large plums and takes 4 to 6 months to ripen. The average yield is 15 to 20 kilogram of fresh fruits per tree, with optimum yield up to 45 kilogram. Each kilogram of fruit gives approximately 400 grams of dry seeds (Maranz *et al*., 2003). Fat and oil is considered to be a basic requirement for the human health and well being and Shea butter is a poly saturated fatty acid joined together in groups of three forming a molecule called triglycerides. When fatty acid is taken into the body, it is converted into glucose and stored in the body as energy. It is an essential study with aids to know the health benefits of Shea butter sold in Swali market, Bayelsa State, Nigeria. Shea butter is oil rich in fat extracted from the nuts of the African Shea tree. It exists as solid at room temperature. It is usually yellowish in colour when raw, with unrefined, refined and ultra Shea butter being ivory or white in colour (Lovett and Haq, 2000). Shea butter is a triglyceride (fat) derived mainly from stearic acid and oleic acid. Shea butter is edible in most cases and used in food preparation in some African countries

Traditionally, the extraction of Shea butter has been done at the village level, where Shea butter is sold in local markets. In recent years, the dried kernels have been exported to processing countries in Europe, Japan and Asia where Shea butter is extracted in large - scale industrial plants (Lovett *et al*., 2000). Traditional extraction has been usually done by boiling water and skimming off the released oil while commercial one is conducted by pressing or solvent extraction with further refining and deodorizing of Shea butter (Israel, 2014). However, with the increased interest in naturally derived products, organic Shea butter production is preferred and thus efforts have been made to industrially produce Shea butter by following the traditional extraction methods. The Shea butter obtained from the traditional extraction procedure not including a refining stage is called "unrefined Shea butter". Either at the village or industrial level, Shea butter is extracted from dried Shea kernels.

It is divided into two uses primarily: Medicinal use and industrial use of Shea butter. Shea butter is sometimes used as a base for medicinal ointment. Some of the isolated chemical constituents are reported to have ant-inflammatory, emollient and humectants properties. The butter has been used as a sun-blocking lotion and some of its components have limited capacity to absorb ultraviolet radiation (Israel, 2014). It is mainly used in the cosmetics industry for skin and hair related products (lip moisturizer, skin moisturizers, creams and hair conditioners for dry and brittle hair (Israel, 2014). It is also used by soap makers typically in small amounts (5-7% of the oils in the recipe), because it has plenty of unsaponifiables, and higher amounts results in softer soaps that have less cleaning abilitpries. The economic importance of Shea butter includes: moisturizes dry skin, treats acne and blemishes through its healing properties attributed to the presence of fatty acid and plant sterols such oleic, palmitic, stearic and linoleic acids. It also reduces skin inflammation, the presence of cinnamic acid that exhibits anti – inflammatory process (Israel, 2014). It has also been reportedly used as an anti – ageing and anti free radical agents. Provides relief to itchy and peeling skin, reduces stretch marks during pregnancy. Helps soothes skin and baby diaper rash. Excellent lips care during harmattan. Repair damaged hair and prevents dandruff. It soothes and helps to soften the hair. Soothes dry and itchy skin, serves as natural hair conditioners because of the presence of vitamin A and E to the end of the hair. Used in the treatment of rheumatism and arthritis (Moharram *et al*., 2006).

II. MATERIALS AND METHODS

Sample collection

Shea butter was procured from traders at Swali market Bayelsa state, Nigeria on 12th April, 2018 from five different stores.

Chemicals and Reagents

The reagents used in the current study include Sulphuric acid, Sodium hydroxide, Petroleum ether, Nitric acid and Ethanol. All reagents are of Analytical grades.

Apparatus and Equipment

Petri dishes, Crucibles, Conical flask, Beakers, Hot plate, Burette, Round bottom flask, Soxhlet apparatus, Vacuum oven, Furnace, Water bath, Measuring cylinders and 100ml volumetric flask, AAS, Flame photometer.

Sample Preparation

A container was washed, cleaned and sun dried, a composite mixture of the Shea butter was blended together in an electric blending machine (Qlink QBL-20L330) and the homogeneous mixture was stored in a clean glass container with lid and stored at room temperature for further analysis

Determination of Moisture Content

Three Petri dishes were cleaned with ethanol, dried, labeled A, B & C and pre-weighed using an analytical weighing balance. 2g of Shea butter was weighed in each Petri dish.

The sample was dried in the vacuum oven at a temperature of 50^0C for 3 hours, cooled in desiccators and weighed. The drying and weighing was repeated twice until constant weight was achieved. The moisture content was achieved following the method of AOAC (2005).

$$\%\ Moisture\ content = \frac{weight\ of\ fresh\ sample - weight\ of\ dry\ sample}{weight\ of\ fresh\ sample} \times \frac{100}{1}$$

Determination of Ash Content

Three crucibles were cleaned with ethanol, dried, labeled A, B & C and pre-weighed using an analytical weighing balance. 2g of Shea butter was weighed in each crucible. The samples were dried in the furnace at a temperature of 650^0C for 4 hours, cooled in desiccators and weighed (AOAC, 2005).

$$\%\ Ash\ Content = \frac{Mass\ of crucible + fresh\ sample - Mass\ of\ crucible =}{mass\ of\ crucible + fresh\ sample} \times \frac{100}{1}$$

Determination of Crude protein

1g of Shea butter was weighed into a conical flask, 15ml of H_2SO_4 was added and heated using a hot plate inside a fume cupboard for 3 minutes until a reddish brown colour was achieved. 50ml of deionized of water was added to the digest. The mixture was filtered using a whatmann filter paper no 14 and a funnel into a 100ml volumetric flask and filled to mark with distilled water.

20ml of digested Shea butter was pipette into a conical flask, 5 drops of phenolpthalin indicator was added to give a reddish pale colour. Then NaOH was titrated against the digested Shea butter till end point was reached.

The conversion factor of 6.25 was used to calculate the amount of protein contained in the Shea butter (AOAC, 2005)

$$\%\ Crude\ Protein = \left(\frac{Titrant\ value \times 1.401 \times N\ of\ base \times 6.25 \times Vol\ of\ NaOH}{Mass\ of\ Sheabutter\ digested}\right) \times 100$$

Determination of carbohydrate

Carbohydrates were determined by difference using the method in AOAC (2005)

$$Carbohydrates = [100 - (Moisture\ content - Crude\ lipids - Crude\ protein)]$$

Determination of Crude Fat

5g of Shea butter was extracted with petroleum ether solvent using soxhlet apparatus heated with a water bath for 4 hours. The crude fat extracted was concentrated in a water bath. The percentage crude oil content was then determined gravimetrically (AOAC, 2005).

Determination of Crude fibre

The residue of Shea butter and petroleum ether in the thimble of the soxhlet apparatus were collected in a pre-weighed beaker dried in a vacuum oven at 500C and kept in a desiccators to cool and weigh.

1 g of Shea butter was weighed into a 30ml digestion tube, 10ml of concentrated sulphuric acid (H_2SO_4), 5ml concentrated nitric acid (HNO_3) and 5ml of per chloric acid ($HClO_4$) was added. The sample was digested in a Gallenkamp Hot plate set at 300^0C.The digestion was continued until the solution was colourless this was to ensured the removal of all traces of nitric acid (HNO_3).

The samples were allowed to cool and 20ml of deionised water was added with gentle swirling, the solution was filtered using a Whatman filter paper No.42 followed by dilution to the mark with deionized water in a 50ml volumetric flask. The digested Shea butter was analyzed for the selected mineral elements concentration using Buck 211 Atomic Absorption Spectrophotometer and UV/V Spectrophotometer.

Determination of selected metals

Sodium (Na), Magnesium (Mg), Potassium (K), Copper (Cu), Manganese (Mn), Iron (Fe), Calcium (Ca), Zinc (Zn) was determined using Buck Scientific 200 AAS (AOAC, 2005)

III. RESULTS AND DISCUSSION

Proximate of composition Shea butter

Table 1: Proximate analysis for Shea butter sold in Swali market Yenagoa, Nigeria.

Parameters	Mean±SE
Moisture Content	5.220±0.113
Ash Content	0.084±0.006
Crude protein	42.316±0.000
Crude Fat	97.000±0.000

Carbohydrate	34.096±0.011
Crude Fiber	0.111±0.000

Table 2: Elemental analysis for Shea butter sold in Swali market Yenagoa, Nigeria.

Parameters	Mean±SE
Na	836.83±0.101
K	45.81±0.000
Mg	2.56±0.111
Ca	31.31±0.113
Cu	0.18±0.000
Zn	0.30±0.101
Fe	0.61±0.100
Mn	0.23±0.103

IV. DISCUSSION

The results showed that the carbohydrate content ranged between 30 and 40%. According to Pearson (1990), values of total carbohydrates in the range of 40-60% are for edible, domesticated and wild fruits. Carbohydrates are very vital in nutrition because they are good sources of energy (Anhwange *et al*., 2004). This therefore justifies the promotion of consumption and commercialization of Shea butter sold in Swali market Bayelsa state Nigeria.

The crude fibre content is beneficial in the diet of man because it plays an important role in decreasing many disorders such as constipation, diabetes, cardiovascular diseases and obesity. The value of crude fibre 0.111 when compared to other saturated fats is acceptable W.H.O (2007).

Protein is a large macromolecule consisting of a long chain amino acids held together by peptide linkages. The concentration of protein in the Shea butter is more than sufficient for consumption as advised by W.H.O (2003).

The crude fat (lipid) content of Shea butter has a concentration of 97.000±0.000%. Fat plays a very important role in nutrition and health. They are the second major sources of energy and antioxidant (Arayne *et al*., 2005).

As represented in Table 2, Shea butter contains very high concentration of Sodium (Na) (836.830±0.101 *mg/100g*) this makes it useful in the management of high blood pressure. Shea butter contains average amount of Potassium (K) (45.810±0.000 *mg/100g*) which is very good at managing Osteoporosis and kidney stone. The presence of Calcium and Magnesium in the Shea butter sample makes it useful in blood coagulation (clotting), the strengthening of the bones and teeth and in relieving anxiety (Bhutta *et al*., 2000). The values obtained for Copper, Zinc, Iron, and Manganese were within acceptable ranges.

The results show that consumption of Shea butter sold in Swali market is safe and has very good health benefits.

V. CONCLUSION

The findings of this study showed that Shea butter has adequate nutritional and health benefits. Hence, its consumption should be promoted among communities. Additionally, previous studies on physicochemical characteristics of Shea butter have shown that it has a very high industrial viability and as such; could be used as a raw material for cosmetics, soap and food processing industries.

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