

# Processing and Sensory Attributes of Improved Shea butter

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**ABSTRACT---** *Shea butter is an under-utilized fat that contributes minimally to edible fat and oil supply due to poor sensory quality and low acceptability. Literature is sparse on simple, non-solvent, and adoptable methods of improving the sensory attributes of shea butter. This research was designed to produce improved shea butter and ascertain the effect of simple processing methods on its sensory scores and acceptability. Shea butter was manually extracted by hand-churning the paste from fried, toasted, boiled and parboiled sheanuts. Extracted shea butters were clarified by addition of citric acid, steam deodorized and flavoured by addition of coconut and onion/ginger essences. Sensory evaluations of improved shea butters were determined using panelists on a 9 point hedonic scale. Data were analyzed using ANOVA at  $p = 0.05$ . All the improved shea butter was acceptable, though boiled sheanut butter was preferred. Treatment with citric acid solution clarified and improved the sensory properties of shea butter. Addition of coconut flavour also, significantly improved the sensory attributes. This method of improving the sensory attributes of shea butter is simple and if extended and adopted, could increase its acceptability as an edible fat/oil. It should be noted that other appropriate food flavours could be used.*

**Keywords---** Improved shea butter, simple processing methods, citric acid and sensory attributes

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## 1. INTRODUCTION

Fats and oils of plant origin are important in nutrition and commerce. They are sources of dietary energy, antioxidants, biofuels and raw materials for the manufacture of industrial products and are useful in the food, pharmaceutical, chemical and cosmetics industries (Chukwu, and Adgidzi 2008; Okullo *et al.*, 2010). Vegetable fats and oils are used locally in cooking, production of soap and as body cream. Processing improves their quality and acceptability. Good quality edible oils and fats are free from odours and signs of rancidity (Akinoso, 2006). Oilseed plants such as groundnut, soya beans, melon, sesame, palm, olive account for 80% of the world natural edible fat and oil supply (Oresanya *et al.*, 2000; Okullo *et al.*, 2010). Oil is obtained from oilseeds by manual, solvent or mechanical extraction methods. The pooled vegetable oils are not enough for the booming population and without importation of vegetable oils Nigeria cannot meet her domestic demand (Garba *et al.*, 2011). Importation puts a heavy strain on the country's foreign exchange position.

Sheanut from the shea tree, (*Vitellaria paradoxa*) is an under-utilized economic oil crop with great potentials for the Nigerian economy. Garba *et al.* (2011) reported that it is a potential asset for national economic development and adequate exploitation could make a significant contribution to Nigeria's Gross Domestic Production. The shea butter plant is a perennial, deciduous, tropical oil-yielding tree belonging to the family Sapotaceae. Poulsen (1990) reported that shea butter tree is the second most important oil-yielding tree in Africa after oil palm and it grows naturally throughout the Guinea Savannah region. According to Elemo *et al.* 2000 and Ibanga *et al.* (2015) sheanuts contain between 47 to 52% shea butter oil, a complex lipid of plant origin which has saturated unsaturated and essential fatty acids (UNIFEM, 2000, Ibanga *et al.* 2015). Shea butter is rich in saponifiable and unsaponifiable fractions, antioxidants, fat soluble vitamins, minerals, carotenes, cinnamic acid, has healing properties and it is a promising multi-functional fat in the industries (Alander, 2004; Alander and Anderson, 2004; Nikiema and Umali, 2007; Ibanga *et al.*, 2015). In Europe, shea butter compares favourably with cocoa butter in the chocolate and confectionery industries because they have similar melting point of 32 -45°C (Okullo *et al.*, 2010). However, in most producing areas in Nigeria, shea butter is consumed only by the natives.

Shea butter trees grow in abundance in most Middle Belt and some Northern areas of Nigeria (Olaoye, 1994). In 1999, Nigeria was reported to have produced 58% of the African output (414, 000M T) and was also the largest producer of shea butter in 2008 in West Africa (Garba *et al.*, 2011). There is great demand for Africa handcrafted shea butter in the

international market as cocoa butter substitutes in the confectioneries, pharmaceutical and cosmetic industries (Akosang –Sapong, 2003, Okullo *et al.* , 2010). Most of the sheanuts in Nigeria are exported and less than 10% are used. A considerable proportion of sheanuts are lost post-harvest and others sold in the international market at low prices for urgent cash need locally (Garba *et al.* , 2011). This is because most people dislike shea butter and do not regard it as an edible fat.

Shea butter processing by women in the producing rural areas of Nigeria is traditionally by manual methods. Traditional processing and heat treatment methods of shea nuts differ from place to place. Among the Kambaris in Nigeria sheanuts are fried, in Burkino Faso the nuts are toasted or roasted; in some parts of Ghana and Southern Chad they are boiled or parboiled (Olaoye, 1994; Fobil 2002; Kapseu *et al.* , 2005; Womeni *et al.* , 2006; Ibanga, 2007; Mbaigninam *et al.* , 2007 and Coulibaly *et al.* , 2010). Manual methods involve vigorous hand kneading or churning of the wet brown paste after pounding and grinding till the fat separates from the mixture. In some places in Western Nigeria the shea paste is kneaded using the feet (Ogundele, 1993). The fat is washed several times till it is white and then heated to melt. Sometimes, the ground shea paste is briefly hand-mixed and then boiled for the oil to ooze out and later collected.

Shea butter in Kainji lake area like in many places of its production in Nigeria is not attractive as an edible vegetable fat and oil. Little or nothing is known about its utilization potentials by the populace. The elites especially civil servants and students look down on it as inferior to groundnut and other vegetable oils mainly because of its unpleasant odour and taste, poor packaging and presentation (Ibanga, 2007). Shea butter is cheap and if properly processed with improved sensory and keeping qualities can complement and compete with groundnut and other vegetable oils which have become too expensive for regular household use. In some areas in Nigeria onions, pap water, scent leaves or ginger are added during processing to deodourize and improve the acceptability of shea butter.

There is however paucity of information on simple, non- solvent and adoptable sensory improvement techniques for value addition to increase the acceptability and utilization of manually extracted shea butter from fried, toasted, boiled and parboiled sheanuts in Nigeria. This study aimed at achieving this.

## 2. MATERIALS AND METHODS

### 2.1 The study area

New Bussa, the head quarter of Borgu local government area (Kainji area) of Niger state, Nigeria is situated between latitude 9° 50' to 10° 57' N and longitude 40° 25 – 40 45' E with a surface area of 1, 270km<sup>2</sup>. It lies at the border of sub-Saharan and Guinea Savanna. The typical vegetation of the area is characterized by tall grasses and land with tall trees forming canopies. The climate is under the control of two main winds the Sudan-west monsoon winds from the Atlantic Ocean and the East trade winds from the South regions thereby giving two distinct seasons (Olokor, 1995).

The cool and rainy season is between May and October and the hot dry is between October and May. Average annual rainfall is between 900mm – 1000mm for seven months. Local microclimate may alter this from Yelwa to Mokwa on the influence of the Lake Kainji. Immediately before the rainy season, diurnal temperature rises up to about 38<sup>0</sup>C in March due to greenhouse effect. The average duration of sunshine is 4 to 5 hours mostly shaded by the rain clouds of April to October. Relative humidity is lowest in January (30%) and highest in August (98%). Evaporation is highest in April and March and lowest in July to September (Olokor, 1995). This climate favours the establishment and yield of shea butter and other economic and non-economic trees.

### 2.2 Source of Materials

Sheanuts used for the work were obtained from the Federal College of Freshwater Fisheries Technology New Bussa and nearby Monnai village both in Borgu L. G. A of Niger State. The native shea butter was purchased from Monnai village and the commercial vegetable oil (Kings) from Okpalagu Supermarket, New Bussa.

### 2.3 Preparation of samples for processing

The methods of Ibanga *et al.* (2015) were used. Ripe fresh shea fruits were handpicked, left to ferment for 3 days at ambient temperature (26 ± 2<sup>0</sup>C) washed, parboiled for 10 minutes, sundried, weighed, cracked, winnowed and further dried to approximately 10 - 11% moisture content. The dried kernels were stored in sacks at ambient temperature (26±2<sup>0</sup>C) till required for processing. Five kilograms sheanuts paste each were used to produce shea butter from four heat treatment methods (frying, toasting, boiling and parboiling). Before use, the stored, dried, dehusked sheanuts were washed and sun dried for 4 to 5 hours.

### 2.4 Heat Treatment Methods

#### 2. 4. 1 Frying method

Six kilograms of clean, dehusked dried sheanuts were fried with approximately 530 ml of previous shea butter oil (from the natives) for about 30 minutes in a metallic pot. The initial frying temperature of 180°C was reduced to 85±5°C after 5 minutes to avoid burning (Olaniyan and Oje, 2007). The sizes of the fried sheanuts were cracked and reduced using cracking machine, mortar and pestle. The semi pounded shea paste was ground to a chocolate brown paste using a locally fabricated electric motor grinder before oil extraction from 5kg shea paste.

#### 2. 4. 2 Toasting method

Six kilograms of cleaned sheanuts were toasted at 180°C for 5 minutes and continued at 85±5°C for 25minutes (modified from Coulibaly *et al.* , 2010 village method) in a metallic pot without oil. The toasted sheanuts were cracked using hammer mill and the size further reduced with mortar and pestle before grinding and extraction from 5kg shea paste.

#### 2. 4. 3 Boiling method

A modified method of (Fobil, 2002) was used. Six kilograms cleaned sheanuts were boiled at 100°C for 30 minutes and sundried for four hours before size reduction using cracking machine, mortar and pestle before grinding and shea butter extraction from 5kg of shea powder.

#### 2. 4. 4 Parboiling method

Six kilograms of stored parboiled sheanuts (adopted from the village after the survey and Mbaigninam *et al.* , 2007) were washed and sun dried for four hours before size reduction, grinding and oil extraction from 5kg shea paste. This served as the control. All the sheanuts were parboiled before further treatment. All the extractions were carried out in triplicates.

#### 2. 4. 5 Manual extraction method

##### 2. 4. 5. 1

**Hand-churning:** Five kilograms of the shea pastes were placed in a strong Fulani calabash and was slowly hand - mixed and churned with gradual addition of warm water and later vigorously churned till a brownish white shea fat separated from the brownish water solution. The shea fat was scooped out and washed several times using potable water to remove the brownish colour. The fat was heated to melt and water dried off. The shea oil in the pot was allowed to cool and settle overnight before filtration through muslin cloth, measured and packaged into clean plastic sample bottles and one liter plastic containers before solidification. The packaged solidified shea butter samples were stored in the freezer till required. The little brownish residue was discarded. The processing flow chart is as shown in Figure 1

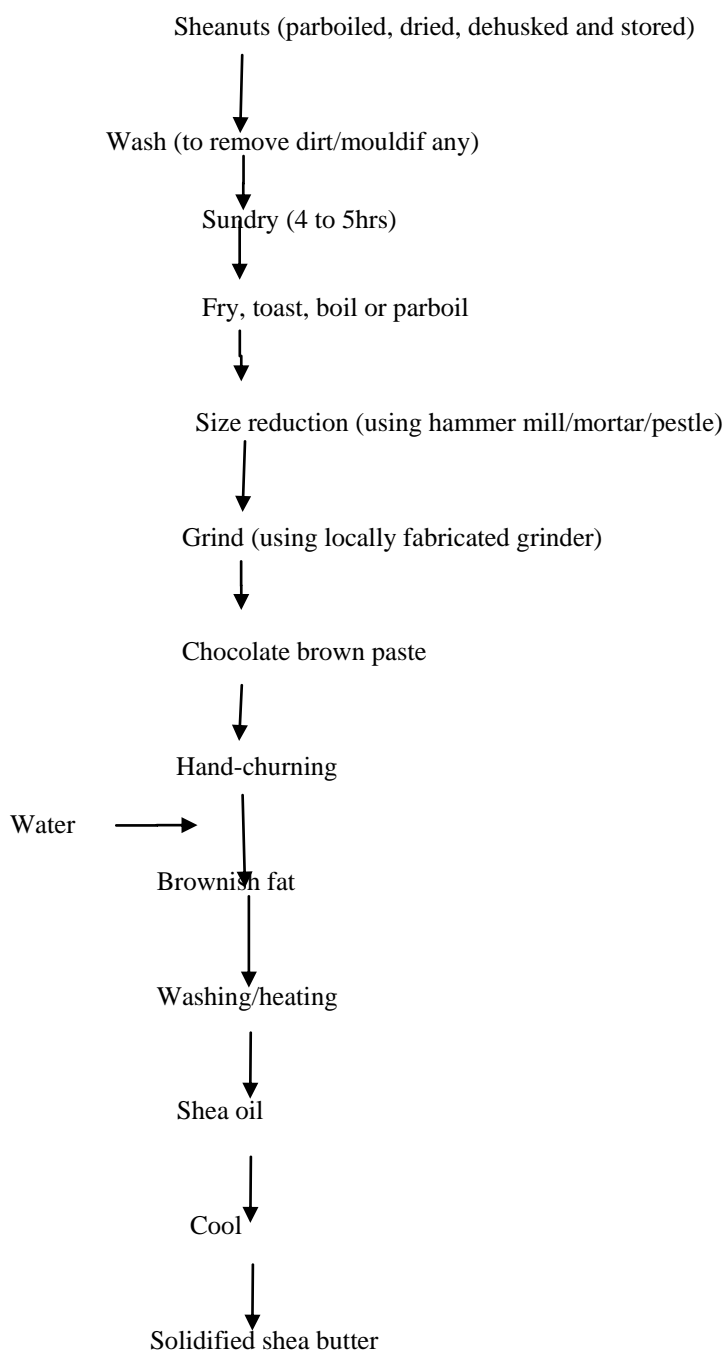


Figure 1: Processing of shea butter from (fried, toasted, boiled and parboiled sheanuts) using manual method

## 2. 6. 0 Clarification/ Steam deodorization and Flavouring of crude shea butter

### 2. 6. 1 Improvement treatments of crude shea butter:

#### 2. 6. 1. 1 Addition of Citric acid

One and half (1. 5g), 2. 5g and 3. 5g of food grade citric acid (M. W. 210. 14 crystalline powder, A. B. No 170309. 500GM) were dissolved in 100mls of potable water respectively. Each citric acid solution concentration was added to the corresponding 500mls of shea butter. The mixtures were warmed for 5 minutes in a beaker and cooled overnight on the shelf. The mixture separated into three parts from the top, the shea oil, the dirt and dirty water. The

water and dirt were separated using a separating funnel and the oil was carefully decanted, filtered through folded muslin cloth and mesh size 200 $\mu$ m. The oils were served to a panel of 10 judges for preference and acceptability test. The preferred concentration (2.5g in 100ml of distilled water) was adopted. Five hundred (500ml) of the various shea butter samples was treated with 0.05 w/v citric acid solution (2.5g in 100ml of distilled water in 500 shea oil) and heated for 5mins at 60°C. The mixture was stirred and left overnight at ambient temperature to cool and settle. It separated into three layers, the oil, the dirt and the dirty water. The oil at the top was decanted and filtered through folded muslin cloth and sieve size 200 $\mu$ m.

#### **2. 6. 1. 2 Steaming**

Triplicates of (500mls) of shea butter in conical flasks were steamed at 121°C, (1.2kg/cm<sup>2</sup>) for 30 minutes in an autoclave. The first was uncovered; the second was covered with cotton wool while the third was covered with perforated aluminum foil. A panel of 10 judges assessed them for preference. The preferred method (steamed, uncovered) was used.

#### **2. 6. 1. 3 Addition of Coconut flavour**

Half (0.5) ml, 1ml and 1.5mls of coconut flavour (Conflaco Aromatics Ltd. England) were added to 500mls of shea butter each. They were heated for 5 minutes at 60°C, cooled and served to a panel of ten judges for preference test. The preferred concentration 0.002v/v (1ml in 500mls of shea oil) was used. Into 500ml of the citric acid solution treated shea butter samples was added a 0.002%v/v of coconut flavour. The mixture was stirred and heated for 5minutes at 60°C for proper mixing and allowed to cool.

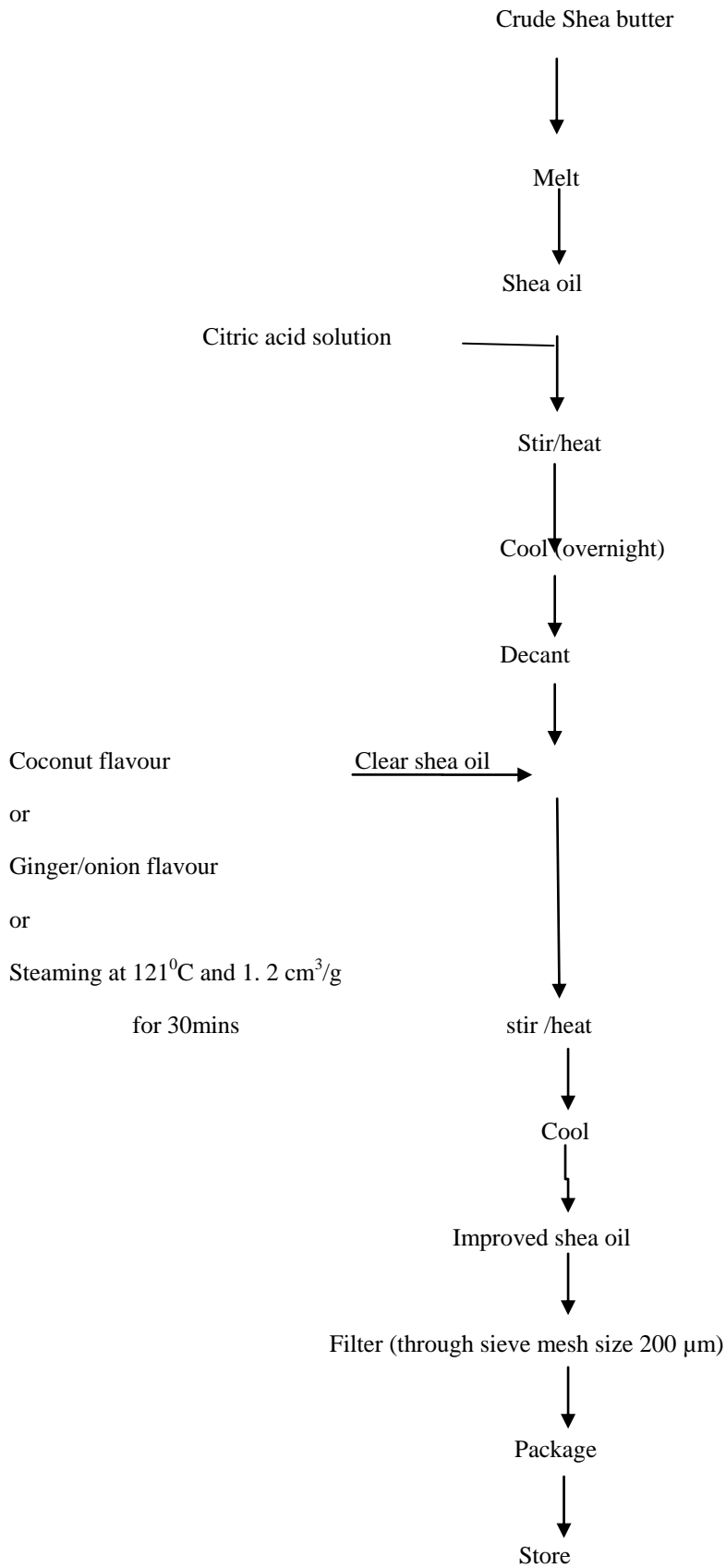
#### **2. 6. 1. 4 Preparation of Ginger and onions flavour**

A modification of the traditional method of ginger/onion deodorization was used. Ten grams of dried ginger powder was extracted using 50 milliliters of potable warm water through muslin cloth and a 10 gram bulb of onions was marcerated and the juice was extracted. Both were thoroughly mixed to form the ginger/onions flavour.

#### **2. 6. 1. 5 Addition of ginger and onions Flavour**

One and half (1.5) ml, 2ml and 2.5mls of ginger/onion flavour extract were added to 500ml each of shea butter. The mixture were stirred, heated for 5 minutes at 60°C, cooled and served to a panel of 10 judges for preference test. The preferred concentration 0.004v/v (2ml in 500mls of shea oil) was adopted. 0.004v/v of Ginger and onion extracts were added into 500ml of citric acid treated shea oil samples. The shea oil was heated for 5 minutes for proper mixing before cooling.

The flow chart for the improvement of crude shea butter is as shown in Figure 2



**Figure 2.** Processing of improved shea butter using a simple non –solvent and adoptable method.

## 2. 7 Sensory evaluation of improved shea butter

The shea butter samples and the controls were evaluated by a panel of 20 persons. They consisted of males and females drawn from the staff and students of the Federal college of freshwater Fisheries Technology, New Bussa and few others from outside. The samples were melted, cooled and poured into transparent plastic sample bottles and served. The panelists assessed the shea butter oil samples on a 9-point hedonic scale (9-1) for taste, colour, mouth feel, aroma and overall acceptability. They rinsed their mouths after evaluation of each sample. The native shea butter and the commercial vegetable oil were control A and control B respectively.

## 3. RESULTS AND DISCUSSION

### 3. 1 Sensory scores of improved fried sheanuts shea butter

The effects of citric acid, steaming and flavour treatments on sensory scores of fried sheanuts shea butter are shown on Table 1. Apart from native shea butter, other shea butter samples were treated with citric acid before further treatment by either steaming or flavour addition. The various treatments significantly ( $p \leq 0.05$ ) affected most of the sensory attributes of shea butter. Citric acid/coconut - flavoured shea butter had the highest sensory scores in mouthfeel, flavour, colour, taste and overall acceptability (Table 1). The aromatic flavour of the coconut flavour contributed greatly to the scores. The citric acid treated sample ranked second in all attributes. Native shea butter did not differ significantly ( $p \geq 0.05$ ) from the citric acid/ steamed shea butter in mouthfeel and colour. There was no significant difference ( $p \geq 0.05$ ) in the mouthfeel of the citric acid treated shea butter and the citric acid/ginger/onions flavoured shea butter. Native shea butter had the least scores in taste and the citric acid/steamed shea butter scored least in overall acceptability. Flavouring of shea butter with coconut flavour after clarification with citric acid solution thus enhanced its acceptability ( $p \geq 0.05$ ) as an edible fat. Citric acid ( $C_6H_8O_7$ ) is a flavouring agent that also contributes to the sensory attributes of foods (Food reference. about. com).

### 3. 2 Sensory scores of improved toasted sheanuts shea butter

Table 2 shows the influence of citric acid, steaming and flavour treatments on the sensory scores of toasted sheanuts shea butter. Toasted shea butter samples had lower scores which ranged from  $5.30 \pm 2.25$  in taste to  $6.8 \pm 2.20$  in overall acceptability. Citric acid/coconut flavour treated shea butter (B) had the the highest scores in all attributes and significantly ( $p \leq 0.05$ ) differed from most of the other samples in overall acceptability. This could be due to the synergetic effect of citric acid and coconut flavour as flavouring agents. The citric acid/steamed shea butter had the least scores and differed significantly ( $p \leq 0.05$ ) from the others in mouthfeel, aroma, colour, taste and overall acceptability. Arising from the findings of this work, Citric acid treatment and coconut flavour enhanced the acceptability of shea butter from toasted sheanuts as an edible oil.

### 3. 3 Effect of citric acid, steaming and flavor treatment on sensory scores of improved boiled sheanuts shea butter

The effect of citric acid, steaming and flavour treatments on the sensory scores of boiled sheanuts shea butter are shown on Table 3. Citric acid/ coconut - flavoured shea butter had the highest scores of  $7.40 \pm 2.23$ ,  $7.65 \pm 2.23$ ,  $7.70 \pm 2.08$ ,  $7.65 \pm 2.25$  and  $7.50 \pm 2.32$  in mouthfeel, aroma, colour, taste and overall acceptability and it differed significantly ( $p \leq 0.05$ ) from other samples in all sensory attributes. Citric acid/steamed shea butter had the least score in colour while the ginger – Onions flavoured shea butter ranked second. This could be due to the fading effect of steaming on the carotenoids but the inviting aroma of the coconut flavour and citric acid flavouring effect positively influenced its acceptance in the samples.

### 3. 4 Effects of citric acid, steaming and flavour treatments on the sensory scores of parboiled sheanuts shea butter

Table 4 shows the influence of citric acid, steaming and flavour treatments on the sensory scores of parboiled sheanuts shea butter. The citric acid - coconut flavoured (sample) had the highest acceptable scores in mouthfeel, aroma, colour, colour, taste and overall acceptability (Table 4). It differed significantly ( $p \leq 0.05$ ) from the other samples except in aroma. Sensory evaluation is a subjective test that determines the intensity and preference of food flavours by panelists. The ginger/onions flavour used in this work was locally made and milder in aroma than the imported coconut flavour. This might account for its lower scores though some panelists preferred it. The degumming properties of citric acid might have contributed to the improved sensory attributes of the improved shea butter (Deffence, 2002)

**Table 1.** Effects of citric acid, steaming and flavour treatments on the sensory scores of fried sheanuts shea butter

Sample	Mouthfeel	Aroma	Colour	Taste	Overall Acceptability
A	5.80±1.99 <sup>c</sup>	6.15±2.23 <sup>b</sup>	6.30±2.22 <sup>b</sup>	5.50±2.37 <sup>c</sup>	6.50±2.04 <sup>b</sup>
B	6.15±1.50 <sup>b</sup>	5.90±1.77 <sup>c</sup>	6.20±1.50 <sup>b</sup>	6.35±1.87 <sup>b</sup>	6.45±1.90 <sup>b</sup>
C	7.30±1.22 <sup>a</sup>	7.55±1.63 <sup>a</sup>	7.60±1.43 <sup>a</sup>	7.35±1.89 <sup>a</sup>	7.30±1.65 <sup>a</sup>
D	6.10±1.48 <sup>b</sup>	5.65±1.81 <sup>d</sup>	6.05±2.14 <sup>c</sup>	5.85±1.22 <sup>c</sup>	6.45±1.90 <sup>b</sup>
E	5.60±2.40 <sup>c</sup>	5.65±2.47 <sup>d</sup>	6.25±1.89 <sup>b</sup>	6.15±1.75 <sup>b</sup>	6.00±1.94 <sup>c</sup>

**Legend**

- A. Native shea butter
- B. Citric acid (CA) treated shea butter from fried sheanuts
- C. Citric acid/ coconut flavour(CA/CF) shea butter from fried sheanuts
- D. Citric acid/ ginger-onion flavour(CA/GO) shea butter from fried sheanuts
- E. Citric acid/ steamed - deodourised uncovered(CA/SD) shea butter from fried sheanuts

±: Standard Deviation

Values are mean sensory scores and standard deviation of triplicate analysis.

Values with same letter in a column are not significantly different ( $p \geq 0.05$ )

**Table 2.** Effect of citric acid, steaming and flavour treatments on the sensory scores of toasted sheanuts shea butter

Sample	Mouthfeel	Aroma	Colour	Taste	Overall Acceptability
A	6.10±2.40 <sup>a</sup>	5.65±2.23 <sup>b</sup>	6.60±2.01 <sup>b</sup>	6.05±2.37 <sup>c</sup>	6.20±2.28 <sup>ab</sup>
B	6.50±2.43 <sup>a</sup>	6.65±1.90 <sup>a</sup>	6.75±1.74 <sup>a</sup>	6.75±1.86 <sup>a</sup>	6.80±2.20 <sup>a</sup>
C	6.30±2.73 <sup>a</sup>	6.65±2.46 <sup>a</sup>	6.40±1.79 <sup>b</sup>	5.35±2.25 <sup>d</sup>	6.70±2.15 <sup>a</sup>
D	5.30±2.25 <sup>c</sup>	5.70±2.80 <sup>b</sup>	5.85±2.36 <sup>d</sup>	6.40±2.18 <sup>b</sup>	5.80±2.78 <sup>b</sup>
E	5.80±1.99 <sup>b</sup>	6.15±2.23 <sup>a</sup>	6.03±2.22 <sup>c</sup>	5.50±2.37 <sup>d</sup>	6.50±2.04 <sup>a</sup>

**Legend**

- A. Citric acid(CA) treated shea butter from toasted sheanuts
- B. Citric acid/ coconut flavour(CA/CF) shea butter from toasted sheanuts



- C . Citric acid/ ginger-onion flavour(CA/GO) shea butter from toasted sheanuts  
D. Citric acid/ steamed- deodourised uncovered(CA/SDU) shea butter from toasted sheanuts  
E. Native shea butter

±: Standard Deviation

Values are mean sensory scores and standard deviation of triplicate analysis.

Values with same letter in a column are not significantly different ( $p \leq 0.05$ )

**Table 4. 22:** Effects of citric acid, steaming and flavour treatments on the sensory scores of boiled sheanuts shea butter

Sample	Mouthfeel	Aroma	Colour	Taste	Overall Acceptability
A	5.60±1.63 <sup>c</sup>	6.20±1.54 <sup>b</sup>	6.20±2.21 <sup>b</sup>	6.40±2.18 <sup>b</sup>	6.20±1.67 <sup>b</sup>
B	7.40±2.23 <sup>a</sup>	7.65±2.23 <sup>a</sup>	7.70±2.08 <sup>a</sup>	7.65±2.25 <sup>a</sup>	7.50±2.32 <sup>a</sup>
C	6.80±1.72 <sup>b</sup>	6.05±1.87 <sup>b</sup>	6.60±1.09 <sup>ab</sup>	6.40±1.57 <sup>b</sup>	6.15±2.03 <sup>b</sup>
D	6.50±1.43 <sup>b</sup>	6.80±1.69 <sup>ab</sup>	5.95±1.70 <sup>c</sup>	6.56±1.06 <sup>b</sup>	6.20±2.04 <sup>b</sup>
E	5.80±1.99 <sup>c</sup>	6.15±2.23 <sup>b</sup>	6.30±2.32 <sup>b</sup>	5.50±2.37 <sup>c</sup>	6.50±2.04 <sup>b</sup>

#### Legend

- A. Citric acid (CA) treated shea butter from boiled sheanuts  
B . Citric acid/ coconut flavour (CA/CF) shea butter from boiled sheanuts  
C . Citric acid/ ginger-onion flavour (CA/GO) shea butter from boiled sheanuts  
D. Citric acid/ steamed - deodourised uncovered (CA/SDU) shea butter boiled sheanus  
E. Native shea butter

±: Standard Deviation

Values are mean sensory scores and standard deviation of triplicate analysis.

Values with same letter in a column are not significantly different ( $p \geq 0.05$ )

**Table 4.** Effects of citric acid, steaming and flavour treatments on the sensory scores of parboiled sheanuts shea butter.

Sample	Mouthfeel	Aroma	Colour	Taste	Overall Acceptability
A	5.80±1.99 <sup>c</sup>	6.15±2.23 <sup>b</sup>	6.03±2.22 <sup>c</sup>	5.05±2.37 <sup>c</sup>	6.50±2.04 <sup>b</sup>
B	6.10±2.02 <sup>b</sup>	6.25±2.40 <sup>b</sup>	6.70±1.75 <sup>b</sup>	6.60±1.60 <sup>b</sup>	6.20±2.04 <sup>b</sup>
C	7.00±2.03 <sup>a</sup>	6.90±1.99 <sup>a</sup>	7.10±1.91 <sup>a</sup>	7.00±1.68 <sup>a</sup>	7.15±2.13 <sup>a</sup>
D	5.80±2.35 <sup>c</sup>	6.30±2.00 <sup>b</sup>	6.65±2.60 <sup>b</sup>	6.85±1.78 <sup>ab</sup>	6.20±2.33 <sup>b</sup>
E	5.70±2.12 <sup>c</sup>	5.80±1.99 <sup>c</sup>	5.40±1.76 <sup>d</sup>	5.35±1.90 <sup>d</sup>	5.50±2.09 <sup>c</sup>

#### Legend

- A Native shea butter
- B Citric acid(CA) treated shea butter from parboiled sheanuts
- C Citric acid/ coconut flavour(CA/CF) shea butter from parboiled sheanuts
- D. Citric acid/ ginger-onion flavour(CA/GO) shea butter from parboiled sheanuts
- E. Citric acid/ steamed deodourised uncovered(CA/SDU) shea butter from parboiled Sheanuts.

±: Standard Deviation

Values are mean sensory scores and standard deviation of triplicate analysis.

Values with same letter in a column are not significantly different ( $p \leq 0.05$ )

#### 3.5 Sensory scores and acceptability of Improved Shea butter:

As shown on Table 5, Native shea butter had the least scores in all the sensory parameters and differed significantly ( $p \leq 0.05$ ) from the improved shea butters and the commercial kings vegetable oil which ranked fourth. The least acceptability of the native shea butter in all evaluated sensory attributes is in agreement with the findings of Megnanou *et al.* (2007) who reported that native shea butter is reputed for its poor quality and sometimes with high content of free fatty acid which leads to rancidity and Ibanga (2007) observation on the low acceptance of native shea butter due to unpleasant aroma. From Table 5, the improved shea butters had better sensory scores than the Kings commercial vegetable oil used as control B. The improvement in the sensory qualities of the improved shea butters is attributable to the effect of citric acid treatment and flavouring of the shea butters. The improved shea butter from boiled sheanuts (E) though not significantly different from other improved samples was preferred in all the sensory attributes as shown in Table 5.

Table 5: Sensory scores of improved shea butter

Sample	Flavour	Mouth feel	Colour	Taste	Overall Acceptability
A	5.40 ± 1.23 <sup>c</sup>	5.55 ± 1.43 <sup>c</sup>	5.75 ± 1.41 <sup>b</sup>	5.15 ± 0.99 <sup>b</sup>	5.55 ± 1.19 <sup>b</sup>
B	7.20 ± 1.43 <sup>b</sup>	7.05 ± 1.57 <sup>b</sup>	7.85 ± 1.23 <sup>a</sup>	7.20 ± 1.54 <sup>a</sup>	7.10 ± 1.48 <sup>a</sup>
C	7.85 ± 1.31 <sup>a</sup>	7.40 ± 0.99 <sup>b</sup>	7.20 ± 1.11 <sup>a</sup>	7.35 ± 1.14 <sup>a</sup>	7.50 ± 1.05 <sup>a</sup>
D	7.90 ± 1.37 <sup>a</sup>	7.30 ± 1.08 <sup>a</sup>	7.25 ± 1.07 <sup>a</sup>	7.20 ± 1.4 <sup>a</sup>	7.55 ± 0.94 <sup>a</sup>
E	8.35 ± 1.09 <sup>a</sup>	8.00 ± 0.97 <sup>a</sup>	7.50 ± 1.44 <sup>a</sup>	7.85 ± 1.22 <sup>a</sup>	7.85 ± 0.97 <sup>a</sup>

#### Legend

A. Native Shea butter.

B. Commercial vegetable oil.

C. Improved Shea butter from fried Shea nuts

D. Improved Shea butter from toasted Shea nuts

E. Improved Shea butter from boiled Shea nuts

±: Standard Deviation

Values are mean sensory scores and standard deviation of triplicate analysis.

Values with same letter on a column are not significantly different ( $p \geq 0.05$ ).

#### 4. CONCLUSION

From these sensory scores it can be deduced that treatment of shea butter with 0.005% (w/v) of citric acid solution and the addition of 0.2% coconut flavour in 500ml of shea butter are very good treatment for improving the sensory scores and acceptability of shea butter from parboiled, fried, boiled and toasted sheanuts. The technique or method of improving the sensory attributes of shea butter is simple and if extended and adopted, could go long way in awakening the utilization potentials of shea butter and increase its acceptability and demand as edible fat/oil. It should be noted that other appropriate food flavours could be used.

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