



REGULAR ARTICLE,

**PRODUCTION OF BREAD–SPREAD FROM BLENDS OF SHEA BUTTER  
(*VITELLARIA PARADOXA*), GARLIC (*ALLIUM SATIVUM*), GINGER (*ZINGIBER  
OFFICINALE*), SCENT LEAF (*OCCIMUM GRATISSIMUM*), AND SUYA SPICE**

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**ABSTRACT**

This study aimed at production of bread-spread from blends of shea butter with spices such as ginger, garlic, scent leaf, and suya spice. Two different ratios, 70% shea butter: 30% spices and 85% shea butter:15% spices were prepared from raw shea butter and various spices. The treatments were packaged in a transparent plastic bowl and stored at room temperature for 4 weeks while samples were taken for analysis at 0, 2 and 4 weeks of storage. Samples were examined for chemical, antioxidant properties, anti-nutritional factors and sensory evaluation. Saponification value ranged from 47.7 mg KOH/g -104.5 mg KOH/g while shea butter + spices exhibited lower values compared to 100% shea butter (control). It was observed that iodine value of both the blends and control decreased as storage days increased except for samples of shea butter + ginger (SGG) and shea butter + suya spice (SSS) at 70:30 ratio. Addition of spices to shea butter increased the 1,1-diphenyl-2-picrylhydrazyl (DPPH) values (44.96%-77.98%) and total phenol content (0.36 mg TAE/g-0.51 mg TAE/g) of the crude shea butter significantly. Phytate content of the blends increased upon addition of spices, whereas, a drastic reduction was observed in the alkaloid contents of the blends from 29.79% (control) to 2.29% in shea butter + scent leave. The sensory

evaluation result revealed that the general acceptability of shea butter treated with suya spice (70:30) and 100% shea butter were scored above average and were not different significantly.

**Keywords:** antioxidant, bread-spread, shea butter, spices, sensory test, phytochemical

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## INTRODUCTION

Shea butter is a vegetable fat produced from the seeds of *Vitellaria paradoxa* C.F. Gaertn. It is a unique natural product of African countries and is of great nutritional and commercial significance (Maranzet *et al.*, 2004). The fruit of shea tree is green in colour, has a fleshy edible pulp, rich in vitamins and minerals. It contains 0.7-1.3 g of protein, 41.2 g of carbohydrate and is very sweet. The fruit pulp is a particularly rich source of ascorbic acid (196.1mg/100g) compared with 50mg/100g in oranges. The iron and calcium content compares favourably with raspberries (FAO, 1988). The sugar content varies from 3-6%, equally distributed between glucose, fructose and sucrose. Two types of methods are usually employed for the preparation of shea butter. These include traditional and chemical methods which include extracting the oil with hexane, clay filtering, and the final product is usually referred to as refined shea butter (Davrieux *et al.*, 2010).

Shea butter is used as a base for medicinal ointments, and has been claimed to have anti-inflammatory, emollient and humectants properties. Furthermore, shea butter is used as a water proofing wax, for hairdressing and for candle-making. It is also used therapeutically for colds and flu. It is also used by makers of traditional African percussion instruments to increase the durability of wood and leather binds (Alander, 2004).

In West Africa, especially Ghana, Nigeria and Togo, shea butter is used as cooking oil (Olajideet *et al.*, 2000). It is edible and may be used in food preparation and occasionally the chocolate industry uses shea butter as a substitute for cocoa butter, although the taste is different. Due to its rich nutritional content, shea butter has found market as baking fat, margarine and other fatty spreads, confectionery and chocolate industry in Europe and Asia (Akhter *et al.*, 2008). At room temperature shea butter could be a creamy solid that easily spreads like dairy butter on bread. Extremely high in vitamins A and E, it provides the skin with all the essential elements it needs for good balance and elasticity.

Ginger, garlic, and scent leaf are common spices in Nigeria. They are a group of esoteric food adjuncts that have been in use for thousands of years to enhance the sensory quality of foods. These spice ingredients impart characteristic flavour, aroma, or piquancy and

colour to foods. Several researches have documented the use of plant extracts or their essential oils as additives in food which demonstrated antioxidant properties (**Banon et al., 2007; Carpenter et al., 2007; Ifesan et al., 2009a,b; Ifesan et al., 2010**). An increasing number of consumers prefer minimally processed foods, prepared without chemical preservatives. The natural smell of shea butter can be a bit off-putting (stinky), resulting in an unacceptable sensory quality.

Since the acceptability of a product is of utmost importance in product development, the objective of this work was to investigate the effect of spices on the nutritional and sensory quality of shea butter as a bread-spread.

## **MATERIAL AND METHODS**

### **Source of shea butter (*Vitellaria paradoxa*)**

Processed shea butter was purchased from a local factory in Ilorin, Kwara State. Spices: ginger, garlic, scent leaf were purchased at a local market in Akure, Ondo State while suya spice was purchased at Wuse, Abuja, Nigeria.

### **Preparation of spices**

Ginger, garlic and scent leaves were sorted and washed with water. They were placed in the air oven at a temperature of about 50 – 55<sup>0</sup> C to dry. After drying, the spices were grounded into powdered form.

### **Preparation of shea butter-spice blend samples**

Blends of shea butter and spices were prepared using two ratios; 70:30 (shea butter: spice) and 85:15 (shea butter: spice). Appropriate ratios of shea butter and spice were then weighed into the blender and mixed thoroughly to obtain a homogenous mixture and packaged in a transparent rubber plastic and stored for period of 4 weeks at room temperature. The samples were labeled as follow; SGG (70:30) -Shea butter +Ginger, SGG (85:15) -Shea butter + Ginger, SSS (70:30)- Shea butter + Suya spice, SSS (85:15) -Shea butter + Suya spice, SGL (70:30) -Shea butter + Garlic, SGL (85:15) -Shea butter + Garlic, SSL (70:30) -

Shea butter + Scent leaf SSL (85:15) -Shea butter + Scent leaf, S (100%) -Shea butter (control).

### **Determination of chemical properties of shea butter-spice blend**

The chemical properties of bread-spread samples, such as saponification value, peroxide value, iodine value, free fatty acid were analyzed at 0 day, 2 weeks and 4 weeks of storage following the method of AOAC Official Methods, (AOAC, 2000), 969.18, 969.17, 965.33 and 965.15 respectively.

### **Determination of free radical scavenging capacity of shea butter-spice blend (DPPH TEST)**

The free radical scavenging ability of bread-spread blends against 1,1-diphenyl-2-picrylhydrazyl was evaluated as described as Pearson (1999)

### **Determination of Vitamin C content**

The vitamin C content was determined according to AOAC (2000).

### **Determination of Total Phenol Content**

The total phenol content was determined according to the modified method of Singleton *et al.* (1999). Appropriate dilutions of the melted fat were oxidised with 2.5 ml of 10% Folin-Ciocalteu assayreagent (v/v) and neutralized by 2.0 ml of 7.5% sodium carbonate. The reaction mixture was incubated for 40 minutes at 45°C and the absorbance was measured at 765 nm in the spectrophotometer. The total phenol content was calculated as gallic acid curve.

### **Phytate Determination**

Phytate content was determined following modified method of Chitravadivu *et al.* (2009). Four grams of the melted fats were soaked in 100 ml of 2% HCl for 3 hours and then filtered off. About 25 ml of the filtrate was placed in a 100 ml conical flask and 5cm<sup>3</sup> of

0.03% NH<sub>4</sub>SCN solution was added as indicator. Distilled water was then added to give it the proper acidity. This was titrated with ferric chloride solution which contained about 0.005 mg of Fe per ml of FeCl<sub>3</sub> used, the equivalent was obtained and from this, the phytate content in mg/100g was calculated.

### **Tannin Content Determination**

Tannin content determination was carried out following the method described by **Makkar and Goodchild (1996)**.

### **Oxalate content determination**

Oxalate content of the bread-spread was determined using the method of **Day and Underwood (1986)**.

### **Alkaloids Determination**

Alkaloid content was determined according to **Chitravadivu et al. (2009)**.

### **Sensory evaluation Test**

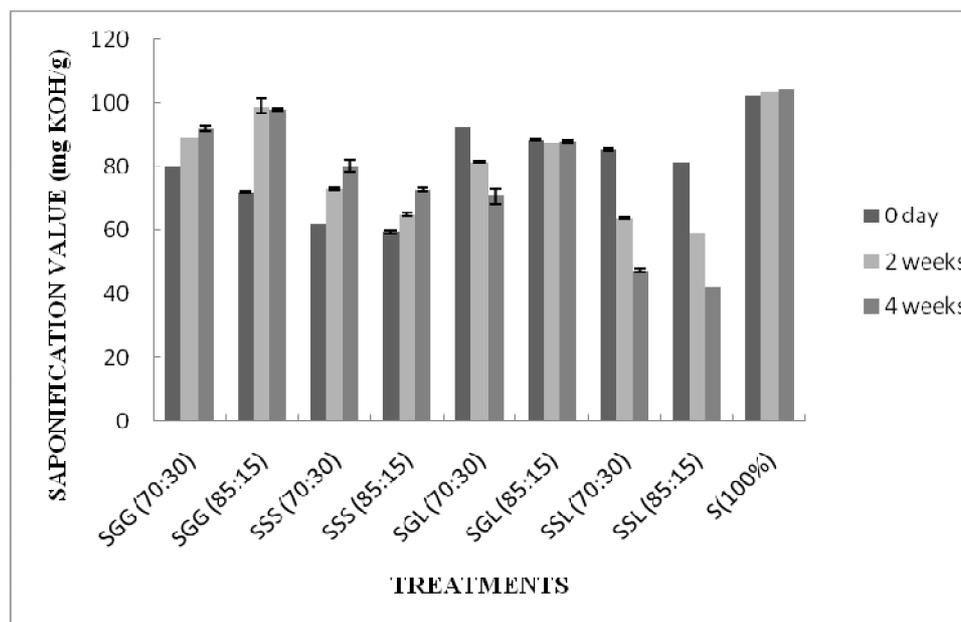
A total of 20 untrained assessors drawn from the community of Federal University of Technology Akure served as panellist. Sensory evaluation test was carried out on each shea butter-spice samples (bread-spread) using 9-point hedonic scale, the scale ranges from 1- dislike extremely to 9- like extremely while the limit of acceptability neither was 5- neither like nor dislike (**Ifesan et al., 2009b**). The shea butter-spice blend (bread-spread) was applied to slice bread. The following attributes: appearance, colour, viscosity, texture, taste and the overall acceptability were evaluated

## RESULTS AND DISCUSSION

### Chemical properties of shea butter-spice blend

#### Saponification value

The saponification value of shea butter-spices blend at different storage interval, 0 week, 2 weeks, and 4 weeks is shown in Figure 1. It was observed that saponification value of shea butter without spice (S100%) ranged from 102.1-104.5 mg KOH/g and appeared to be stable throughout the storage period compared to the shea butter with different spices. There were some fluctuations in the saponification values of the blends as storage days increased. For samples of shea butter + ginger (SGG) and shea butter + suya spice (SSS) there were increases in saponification value as storage days increased. However, addition of spices especially garlic (SGL) and scent leaf (SSL) to shea butter resulted in reduction in the saponification values. Saponification values obtained in this study are lower than the saponification values reported for most vegetable fat and oils (**Anhwange et al., 2004; Dhellot et al., 2006**). The higher the saponification value of oil, the higher the lauric acid content of that oil. The lauric acid content and the saponification value of oil serve as important parameters in determining the suitability of oil in soap making.

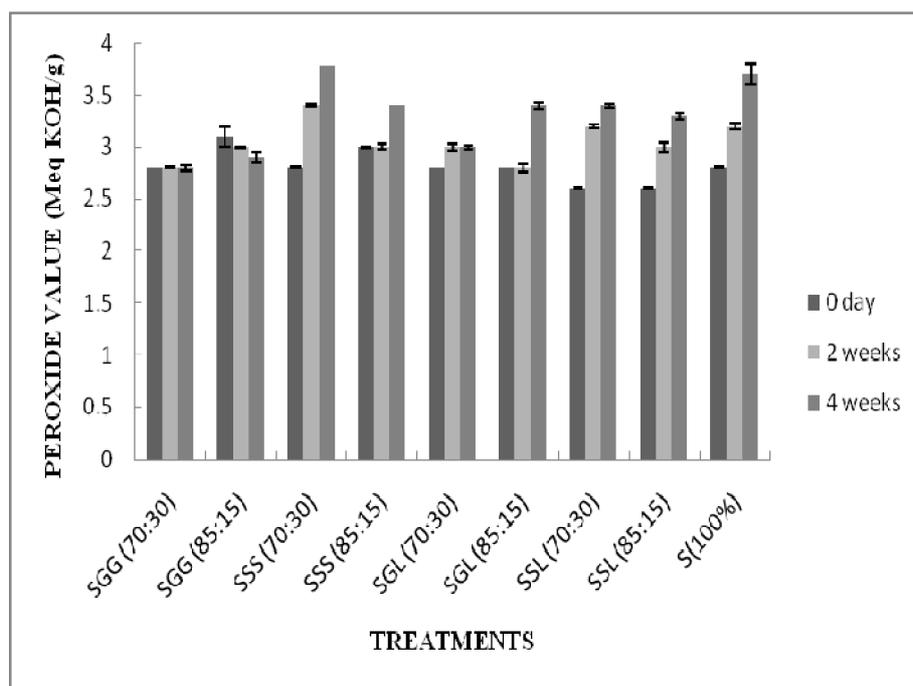


Legend: SGG (70:30) -shea butter +ginger, SGG (85:15) -shea butter + ginger, SSS (70:30)- shea butter + suya spice, SSS (85:15) -shea butter + suya spice, SGL (70:30) -shea butter + garlic, SGL (85:15) -shea butter + garlic, SSL (70:30) -shea butter + scent leaf, SSL (85:15) -shea butter + scent leaf, S (100%) -shea butter (control)

**Figure 1** Saponification values of shea butter-spices blends stored at room temperature for 4 weeks

### Peroxide value

The peroxide values (2.60 Meq KOH/g-3.70 Meq KOH/g) of the various treatments is shown in Figure 2. Generally for all the samples, there were increases in the peroxide value as storage days increased except for shea butter + ginger sample. It was observed that the peroxide value of shea butter + ginger (SGG 70:30) sample was stable during the period of storage while at 85:15 ratio of SGG there was reduction in the peroxide value from 0 day to 4 weeks. The peroxide values of shea butter samples are below the maximum acceptable value of 10 meq KOH/g set by the Codex Alimentarius Commission for groundnut seed oils (Abayeh *et al.*, 1998). The low peroxide values could be an indication that the oils would not easily go rancid when properly stored in a container free from atmospheric oxygen and other contaminants.

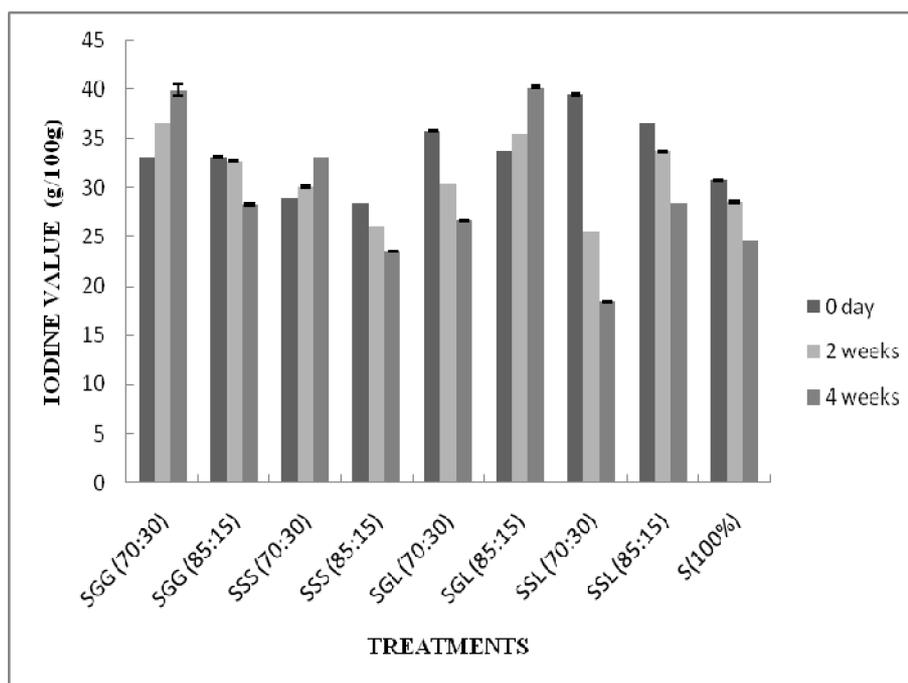


Legend: SGG (70:30) -shea butter +ginger, SGG (85:15) -shea butter + ginger, SSS (70:30)- shea butter + suya spice, SSS (85:15) -shea butter + suya spice, SGL (70:30) -shea butter + garlic, SGL (85:15) -shea butter + garlic, SSL (70:30) -shea butter + scent leaf SSL (85:15) -shea butter + scent leaf, S (100%) -shea butter (control)

**Figure 2** Peroxide values of shea butter-spices blends stored at room temperature for 4 weeks

### Iodine value

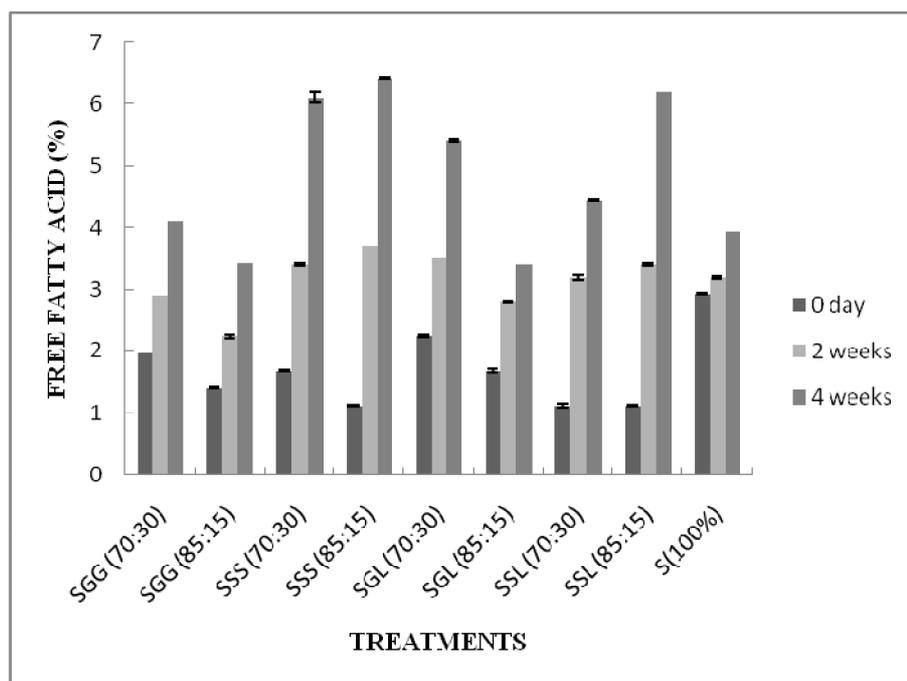
The iodine value of shea butter (18.34-40.18 g/100g) is lower than the values for most vegetable fat (**Tchobo et al., 2007**). It was observed that iodine value of both the blends and control (S100%) decreased as storage days increased except for samples of shea butter + ginger (SGG) and shea butter + suya spice (SSS) at 70:30 (Figure 3). Iodine value measures the degree of unstauration in a fat or vegetable oil and determines the stability of oils to oxidation (**Daintith, 2008**). Knowledge of the iodine value enables the combustion temperature of the oil to be evaluated (**Roger et al., 2010**). The low iodine value for shea butter oil may be an indication that the oil is rich in saturated fatty acids, which ensures stability against oxidation and rancidification of foods prepared with the oil (**Goh, 1994**).



Legend: SGG (70:30) -shea butter +ginger, SGG (85:15) -shea butter + ginger, SSS (70:30)- shea butter + suya spice, SSS (85:15) -shea butter + suya spice, SGL (70:30) -shea butter + garlic, SGL (85:15) -shea butter + garlic, SSL (70:30) -shea butter + scent leaf, SSL (85:15) -shea butter + scent leaf, S (100%) -shea butter (control)

**Figure 3** Iodine values of shea butter-spices blends stored at room temperature for 4 weeks

Figure 4 shows the free fatty acid (FFA) values of shea butter-spice blends from day 0 to 4 weeks of storage. The values ranged from 1.12% to 3.50% from 0-2 weeks and increases to about 6.4% on the 4<sup>th</sup> week. It was observed that there were increases in FFA of the shea butter with or without spices as storage days increased. At 4 weeks the FFA of some treatments shea butter + ginger (SGG) and shea butter + garlic (SGL 85:15) were at the same level with the control (S100%). The lower the acid value of an oil, the fewer free fatty acids it contains which makes it less exposed to the phenomenon of rancidification (Roger *et al.*, 2010).



Legend: SGG (70:30) -shea butter +ginger, SGG (85:15) -shea butter + ginger, SSS (70:30)- shea butter + suya spice, SSS (85:15) -shea butter + suya spice, SGL (70:30) -shea butter + garlic, SGL (85:15) -shea butter + garlic, SSL (70:30) -shea butter + scent leaf SSL (85:15) -shea butter + scent leaf, S (100%) -shea butter (control)

**Figure 4** Free fatty acid values of shea butter-spices blends stored at room temperature for 4 weeks

### Free radical scavenging capacity of shea butter-spice blend (DPPH TEST)

Antioxidant properties of the shea butter-spices blend is shown in Table 1. The vitamin C, DPPH (1,1-diphenyl-2 picrylhydrazyl) and total phenol content of the crude shea butter (S 100%) increased significantly compared to sample without spices, which could be an indication that the spices added increased the antioxidant properties of shea butter. Increase in DPPH of shea butter increases the scavenging ability of shea butter in the body (Matthaus, 2002). Plant extract or their essential oils that exhibited antioxidant properties in foods have been reported to contain high phenolic compounds (Jayathilakan et al., 2007; Juntachote et al., 2007; Ifesan et al., 2009b). Phenolic compounds are capable of interacting with free radicals, chelate metal catalyst and inactivate enzymes (Amic et al., 2003). A recent study characterized and quantified about 10 important phenolic compounds in shea butter, eight of which are catechins, a family of compounds being studied for their antioxidant properties

(Maranz *et al.*, 2003). Crude shea butter demonstrates natural antioxidant properties due to its tocopherol content (Asintoke, 1987). The role of free radicals in many disease conditions has been well established and adequate consumption of natural polyphenols with antioxidant properties in diets may be an intervention.

**Table 1** Antioxidant properties of shea butter-spices blend bread-spread at 0 day

Samples	VitaminC (mg/100g)	DPPH (%)	Total Phenol (mg TAE/g)
SGG (70:30)	0.109 ± 0.001 <sup>b</sup>	67.58 ± 0.002 <sup>c</sup>	0.51 ± 0.001 <sup>c</sup>
SGG (85:15)	0.093 ± 0.008 <sup>d</sup>	61.35 ± 0.002 <sup>e</sup>	0.48 ± 0.001 <sup>e</sup>
SSS (70:30)	0.062 ± 0.001 <sup>f</sup>	59.75 ± 0.004 <sup>f</sup>	0.36 ± 0.002 <sup>g</sup>
SSS (85:15)	0.058 ± 0.001 <sup>g</sup>	48.44 ± 0.001 <sup>h</sup>	0.36 ± 0.001 <sup>g</sup>
SGL (70:30)	0.124 ± 0.002 <sup>a</sup>	77.98 ± 0.005 <sup>a</sup>	0.59 ± 0.001 <sup>a</sup>
SGL (85:15)	0.103 ± 0.002 <sup>c</sup>	63.70 ± 0.005 <sup>d</sup>	0.53 ± 0.001 <sup>b</sup>
SSL (70:30)	0.107 ± 0.001 <sup>bc</sup>	70.52 ± 0.019 <sup>b</sup>	0.50 ± 0.001 <sup>d</sup>
SSL (85:15)	0.088 ± 0.001 <sup>e</sup>	58.97 ± 0.001 <sup>g</sup>	0.39 ± 0.001 <sup>f</sup>
S (100%)	0.045 ± 0.001 <sup>h</sup>	44.96 ± 0.001 <sup>i</sup>	0.36 ± 0.001 <sup>h</sup>

Each value represents the mean and standard deviation from three replicates. a-i means within a column with a different letter are significantly different.

Legend: SGG (70:30) -shea butter +ginger, SGG (85:15) -shea butter + ginger, SSS (70:30)- shea butter + suya spice, SSS (85:15) -shea butter + suya spice, SGL (70:30) -shea butter + garlic, SGL (85:15) -shea butter + garlic, SSL (70:30) -shea butter + scent leaf SSL (85:15) -shea butter + scent leaf, S (100%) -shea butter (control)

### Phytochemical content of shea butter-spices blend

Phytochemical studies were only carried out on SGG (70:30), SGL (70:30), SSL (70:30), SSS (70:30) and S (100%) (Table 2). It was observed that addition of spices to shea butter led to increase in some phytochemical compounds in the samples. Phytate content of the blends increased upon addition of spices with values ranging from 4.35 mg/100g in crude shea butter (S 100%) to 16.88 mg/100g in sample of shea butter + scent leaf (SSL 70:30). The phytate contents of the blends are much lower than those reported for some legumes (Oboh, 2006). Despite its potentially harmful effects, studies have shown several beneficial results from phytate consumption. Phytate acts as an antioxidant, which prevents the creation of free radicals that can damage cells. Secondly, the mineral binding properties of phytate allow it to

combat colon cancer by reducing oxidative stress in the intestinal tract (**Pallauf and Rimbach, 1997**). Furthermore, addition of spices to shea butter resulted in slight increase in tannin content ranging from 6.06 mg/g-6.26 mg/g. These products may be considered safe for consumption as the tannin contents are below the critical values (7.3-9.0 mg/g) reported (**Aletor, 1993**). Many human physiological activities, such as stimulation of phagocytic cells, host-mediated tumor activity, and a wide range of anti-infective actions, have been assigned to tannins (**Haslam, 1996**). On the other hand, a drastic reduction was observed in the alkaloid contents of the blends from 29.79% in control sample to 2.29% in shea butter + scent leave. A glycoalkaloid from the berries of *Solanum khasianum*, and other alkaloids may be useful against HIV infection (**McMahon et al., 1995; McDevitt et al., 1996**) as well as intestinal infections associated with AIDS (**Sethi, 1979**).

**Table 2** Phytochemical content of the bread-spread at 0 day

Samples	Alkaloids (%)	Phytate (mg/100g)	Oxalate (mg/100g)	Phytin (mg/100g)	Tannin (mg/g)
SGG (70:30)	20.85±0.320 <sup>b</sup>	8.65±0.410 <sup>b</sup>	1.485±0.045 <sup>b</sup>	2.435±0.115 <sup>b</sup>	6.22±0.020 <sup>ab</sup>
SGL (70:30)	29.57±0.010 <sup>a</sup>	5.98±0.205 <sup>d</sup>	1.755±0.045 <sup>a</sup>	1.68±0.060 <sup>d</sup>	6.06±0.020 <sup>c</sup>
SSS (70:30)	10.68±0.010 <sup>c</sup>	7.00±0.410 <sup>c</sup>	0.745±0.025 <sup>c</sup>	1.975±0.115 <sup>c</sup>	6.20±0.040 <sup>b</sup>
SSL (70:30)	2.29±0.010 <sup>d</sup>	16.88±0.415 <sup>a</sup>	1.51±0.020 <sup>b</sup>	4.76±0.115 <sup>a</sup>	6.18±0.020 <sup>b</sup>
S (100%)	29.79±0.015 <sup>a</sup>	4.735±0.205 <sup>e</sup>	0.225±0.045 <sup>d</sup>	1.335±0.055 <sup>e</sup>	6.26±0.020 <sup>a</sup>

Each value represents the mean and standard deviation from three replicates. a-d means within a column with a different letter are significantly different.

Legend: SGG (70:30) -shea butter + ginger, SSS (70:30) -shea butter + suya spice, SGL (70:30) -shea butter + garlic, SSL (70:30) -shea butter + scent leaf, S (100%) -shea butter

## **Sensory evaluation**

Table 3 revealed the effect of spices on shea butter as expressed by the sensory results obtained. The control sample 100% shea butter (6.73) and shea butter + garlic sample (6.93) were significantly the same and scored highest for appearance. Also for colour and taste shea butter with suya spice and control sample yielded same level of significance. However, for viscosity and texture the control sample was significantly different from the blends. This may indicate that addition of spices to shea butter altered its viscosity and texture. Considering the general acceptability of the treatments, shea butter treated with suya spice (70:30) and 100% shea butter were scored above average and were not different significantly. From the sensory scores we may conclude that addition of suya spice, garlic and (85:15) shea butter + ginger produced acceptable bread-spread compared with the control while samples treated with scent leaves and 70:30 shea butter + garlic were scored below average.

**Table 3** Sensory evaluation of the bread-spread

Sample	Appearance	Colour	Viscosity	Texture	Taste	General Acceptability
SSL (70:30)	3.67±1.950 <sup>d</sup>	2.93±1.750 <sup>e</sup>	4.40±1.760 <sup>e</sup>	4.67±1.630 <sup>d</sup>	4.60±1.590 <sup>ab</sup>	4.00±1.730 <sup>d</sup>
SSL (85:15)	2.87±1.960 <sup>d</sup>	2.87±1.680 <sup>e</sup>	4.67±1.630 <sup>de</sup>	5.20±1.080 <sup>bcd</sup>	4.33±1.680 <sup>ab</sup>	4.40±1.760 <sup>bd</sup>
SGL (70:30)	6.53±0.920 <sup>a</sup>	6.33±1.180 <sup>ab</sup>	5.87±1.770 <sup>abcd</sup>	5.80±1.470 <sup>abc</sup>	5.00±2.590 <sup>ab</sup>	5.80±2.810 <sup>abc</sup>
SGL (85:15)	6.93±0.880 <sup>a</sup>	6.87±1.060 <sup>a</sup>	6.07±1.160 <sup>abc</sup>	6.07±0.960 <sup>ab</sup>	4.73±2.090 <sup>ab</sup>	5.07±2.280 <sup>abcd</sup>
SGG (85:15)	5.20±1.610 <sup>bc</sup>	5.33±1.630 <sup>bc</sup>	4.93±1.490 <sup>bcde</sup>	4.87±1.810 <sup>cd</sup>	4.80±2.540 <sup>ab</sup>	5.0±2.040 <sup>abcd</sup>
SGG (70:30)	4.67±1.450 <sup>c</sup>	4.24±1.260 <sup>d</sup>	4.87±1.300 <sup>cde</sup>	5.07±1.160 <sup>bcd</sup>	4.13±1.800 <sup>b</sup>	4.6±1.500 <sup>bcd</sup>
SSS (85:15)	5.87±1.550 <sup>ab</sup>	6.67±1.230 <sup>a</sup>	6.13±1.850 <sup>ab</sup>	5.80±1.150 <sup>abc</sup>	5.6±1.600 <sup>ab</sup>	5.9±1.430 <sup>ab</sup>
SSS (70:30)	5.07±1.280 <sup>bc</sup>	5.07±1.330 <sup>cd</sup>	5.67±1.110 <sup>abcd</sup>	5.47±0.740 <sup>abcd</sup>	5.93±1.530 <sup>a</sup>	6.4±1.180 <sup>a</sup>
S (100%)	6.73±1.580 <sup>a</sup>	6.47±1.680 <sup>a</sup>	6.67±1.180 <sup>a</sup>	6.47±1.360 <sup>a</sup>	5.80±1.740 <sup>b</sup>	6.13±1.640 <sup>a</sup>

Each value represents the mean and standard deviation from three replicates. a-d means within a column with a different letter are significantly different.

Legend: SGG (70:30) -shea butter +ginger, SGG (85:15) -shea butter + ginger, SSS (70:30)- shea butter + suya spice, SSS (85:15) -shea butter + suya spice, SGL (70:30) -shea butter + garlic, SGL (85:15) -shea butter + garlic, SSL (70:30) -shea butter + scent leaf SSL (85:15) -shea butter + scent leaf, S (100%) -shea butter (control)

## CONCLUSION

Enhancement of shea butter quality with different spices to produce bread-spread led to reduction in saponification value in shea butter-spice samples. Addition of spices to shea butter increased the ability of the blends to scavenge free radicals which may result in

extension of shelf life of the products. Furthermore, sensory evaluation scores revealed that shea butter + suya spice blend was most preferable with reference to taste and colour.

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