International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Production and Evaluation of Seed/Nut Bread Spread From Cashewnut (*Anacadium occidentale, L.*) and Sesame Seed (*Sesamum indicumL.*)

Mujidat Adenike, Olalekan-Adeniran*; Olayinka Christiana Jayeola; Lateef Eugene Yahaya; Wasilat Omotolani, Muhammed-Bashir.

Address(es): Value Addition Research Department, Cocoa Research Institute of Nigeria, Km 14, Ibadan/ Ijebu Ode Road P.M.B. 5244 Nigeria.
*Corresponding author: madenike@yahoo.com

ABSTRACT

Nuts and seeds are highly nutritional, contains generous quantities of phytochemicals and antioxidants that are highly medicinal against diseases, hence, the use of sesame seeds and cashew nuts to produce bread spreads. The study aims to produce and evaluate bread spread from cashew nut and sesame seed as new product development for increased utilization and value addition. The nuts and seeds were mixed at ratios of 80:20 (A), 60:40 (B), 50:50 (C), 40:60 (D), 20:80 (E). Equal quantities of additives were added and ground to fine paste. Commercial bread spread was used as control (F). Proximate, microbial and sensory analyses were conducted on the formulated samples. Moisture, ash, protein, crude fibre and energy value were found to increase with increased level of sesame seed for all the samples. Energy value, ash, fat, crude fibre and protein contents of sample C were comparable to that of commercial bread spread. Sensory evaluation shows no significant difference ($p>0.05$) between all the samples in texture, flavor, appearance and mouth feel. For overall acceptability, no significant difference between Sample C and control and were the most acceptable. Microbial load analysis results show that good manufacturing practices was employed in the production which has resulted in low microbial load for all the samples. Sample C gave the best result that was comparable to that of the control in chemical, microbial and sensory properties. The inclusion of sesame seed in the bread spread production was found to enhance the nutritional quality of the bread spread generally.

Keywords: Bread spread, sesame seed, cashew kernel, sensory, nutritional

INTRODUCTION

Mounting health concerns regarding the consumption of dairy butter due to its fat content has raised an alarm to search for alternative plant-based butters viz., nut butters and seed butters. During the last few years, the popularity for the plant-based butters (nut and seed butters) has increased considerably. Earlier, peanut butter was the only alternative to the dairy butter, but over the years development in the technologies and also the consumer awareness about the plant-based butters has led to the development of myriad varieties of butters with different nuts and seeds (**Kalyani *et. al,* 2015).**

Nuts and seeds are nutrient dense foods and have been a regular constituent of mankind's diet since pre-agricultural times **(Eatonand Konner 1985)**. Nuts and seeds are generally consumed as snack food in roasted form as they are of good taste, handy and easy to eat.Nut butters and nut spreads are spreadable products made from nuts that are ground into paste. Both nut products can be spread like commercially available butter; they can be produced from almond, cashew, hazelnut, macadamia nut, peanut, pecan, pistachio and walnut (**Mangels, 2001**). Similar spreads can also be made from other seeds such as sesame seed, pumpkin seed, soybean and sunflower seeds, but they are not categorized as nut spread **(Mangels, 2001**). Alternative spreads have a lot of benefits which has made it a preferred option due to their better-for-you reputation and its consumption has resulted in high interest from consumers due to its contribution to maintaining a good state of health. Nut spread is popular and widely accepted by consumers due to its flavour, good nutritional values and suitability for consumption either alone or in combination with a variety of other foods **(NBSM, 2014, 2012**).

Nut butters are an ideal source of plant-based fat. The cholesterol lowering effect associated with nut consumption may be said to arise primarily from the fatty acid composition of nuts and may also be caused by some other component (**Kris-Etherton,*et. al*., 2001, Chisholm *et. al*., 2005**). Generally, nut oils are rich in monounsaturated fatty acids, predominantly oleic acid, but contain much lower amounts of polyunsaturated fatty acids, predominantly linoleic acid, and small amounts of saturated lipids (**Alasalvar and Shahidi, 2008, Kris-Etherton,*et. al*., 2001, Chisholmet.. 2 *et. al*.,2005, Blomhoff*et. al*., 2006 and Miraliakbari and Shahidi, 2008).**They also contain valuable vitamin E, folate, protein,

potassium, magnesium, and zinc**(NHMRC, 2013**). The term nut/seed spread refers to a spreadable product having at least 40% nut ingredients which can be added in various forms e.g as nuts, a paste and/or slurry**(Wilkes 2012).**

Cashew (*Anacardium occidentale*) belongs to the Anacardiaceae family and is a versatile tree nut (**Nayar *et al*., 1998; Azam-Ali *et al*., 2001)**. In general, tree nuts are dry fruits with one seed in which the outer wall becomes hard upon maturing. The most popular tree nuts in the world are almond, Brazil nut, cashew, hazelnut, macadamia, pecan, pine nut, pistachio and walnut. Considering the production of world's most popular tree nuts, cashew nut ranks first on a global basis with a production of 2,760,000 MT, followed by almond (2,560,000 MT), walnut (2,550,000 MT), Brazil nut (1,000,000 MT), pistachio (940,000 MT) and hazelnut (860,000 MT) in 2010 **(FAO Food Balance Sheet, 2012**). The cashew tree is a medium-sized tropical tree usually cultivated for its fruit (cashew nut) and pseudofruit (cashew apple). The ''cashew fruit'' comprises the cashew ''apple'', a pseudo-fruit formed by an enlarged peduncle, and the true fruit, a kidney-shaped achee about 3cm long with a hard grey-green pericarp **(Vaughan *et al*., 1997; Santos *et al*.,2007**). Around the world, and in Nigeria in particular, the name 'Cashew' refers to both the ''apple'' and the kidney-shaped, nutlike seed of the cashew tree (**Asogwa and Aliyu, 2008**). It plays an important role among tropical nuts, as an edible nut and is a principal industrialized product too **(Chandrasekara and Shahidi 2011)**.The cashew apple is well consumed during the season while the nut is roasted and consumed in large quantities in Nigeria all year round.Cashew plays an important role among tropical nuts, as an edible nut and is a principal industrialized product too **(Chandrasekara and Shahidi 2011**). Cashew nuts (kernels) when extracted from their shell it must be cautiously done in order not to get contaminated with the poisonous substances embedded in the shell called the cashew nut shell liquid (CNSL). Once extracted from the nut, the kernels are roasted to destroy the remaining toxins, allowed to cool before they are cracked and consumed**(Orwa et al., 2009; Morton, 1987**).The kernels are a nutritious food as they contain large amounts of fats, protein, carbohydrates, vitamins and minerals.

Generally, nuts and seeds contain generous amounts of phytochemicals that are highly medicinal against diseases **(Mangels 2001)**.Also, **Jiang et al. (2002)** reported reduction in the risk of developing diabetes in people who eats nuts frequently.

Sesame seeds (*Sesamun indicum)* are tiny, flat oval seeds with a nutty taste and a delicate, almost invisible crunch. They come in a host of different colors, depending upon the variety, including white, yellow, black and red but it is majorly white or black **(Naturland, 2002)**. The plant is usually 60 to 120cm tall and the fruit is a dehiscent capsule held close to the stem, when ripe, the capsule shatters to release a number of small seeds. The seeds are protected by a fibrous 'hull' or skin, which may be whitish to brown or black depending on the variety. 1000 seeds weigh some 4-8g. The seeds have a high oil content of 44-60% **(Chemonics, 2002**). Sesame seed is rich in fat, protein, carbohydrates, fibre and some minerals. Sesame seeds are highly valued for their high content of sesame oil, oil that is very resistant to oxidative rancidity even after long exposure to air (**Global AgriSystems, 2010; Ensminger *et al*., 1983**). This could be attributed to endogenous antioxidants namely lignins and tocopherols **(Elleuch, *et al*., 2007; Lee *et al*., 2008**). The seed plays an important role in human nutrition as it is an excellent source of copper, manganese, calcium, phosphorus, magnesium, iron, zinc, molybdenum, vitamin B1, selenium, and dietary fiber. (**Ensminger *et al*., 1986).**

Most of the sesame seeds are used for oil extraction since it is grown primarily for its oil-rich seeds and the rest are used for edible purposes **(El-Khier*et al*., 2008)**. Before seeds were appreciated for their ability to add nutty flavour or garnish foods, they were primarily used for oil and wine **(Ghandi, 2009**). After the extraction of oil, the cake is mostly used for production of livestock feed or often as manure.

In Nigeria, the notable colours for sesame seed are white, yellow and black **(Farikue*t al*., 2007)**. Sesame is an important crop to Nigerian agriculture and it is extensively cultivated in Northern part of Nigeria whereas it is widely used domestically throughout the country. It grows in relatively poor climatic condition; it is also an important component of Nigeria's agricultural exports (**Chemonics, 2002)**.

All proteins are made up of a chain of amino acids, most plant proteins are lacking in one or more of these essential amino acids. Most types of cashew are particularly high in glutamic acid, leucine, arginine and aspartic acid, but relatively low in cystine, methionine and tryptophan while sesame protein contains adequate amount of essential aminoacids such as methionine, cysteine, and tryptophan.

In order to utilize plant protein efficiently, there is need for complementarities of amino acids from different food sources.Therefore, cashew nuts and sesame seed are complementary because the key amino acids limiting in cashew nuts are found in sesame seeds and vice versa.Also as a means of value addition for new product development as well as to increase the local utilization of both cashew nut and sesame seed.

MATERIALS AND METHODS

Raw Material Sourcing

Sesame seed was purchased from National Cereal Research Institute (NCRI).Badeggi along Bida road Niger State. Cashew kernel was also obtained from Cashew nut processing plant of Cocoa Research Institute of Nigeria (CRIN), Ochaja, substation, Kogi state. Other ingredients like sugar, salt, emulsifier and vegetable oil were purchased from open market.

Methods

Preparation of roasted sesame seed for paste

Sesame seed grain was poured in water enough to cover the grains and the floated seeds and other extraneous material were removed, it wasthenthoroughly washed, drained and then sun-dried (**NAERLS, 2010**). Dehulling was done by soaking the dried grain in 1 $^{0}/_{0}$salt solution for 12 h **(Kahyaoglu and Kaya 2006**). The seed was lightly pounded in a mortar to loosen the pericarp (seed coat) and then dried using a locally fabricated cabinet dryer (hot air) dryer at 80^{0}c, for 1hour (**NAERLS, 2010**). .After drying, the dehulled sesame seed was removed from the hulls by winnowing**(Chemonics, 2002)**. Roasting was done using electric cooker (thermo cool) with a pot at the temperature of 150°C for 25 minutes and moisture content of 7%-8%(**Torlak *et al*., 2013**). Thereafter the roasted seeds were then ground into paste.

Preparation of roasted Cashew Nut Paste

Cashew nut paste was prepared according to the general method used for nut spread processing as described by **Chun *et al*.,(2003**), where the roasted cashew nut was sorted then ground using hammer mill. The ground paste was then de- aerated, cooled and filled into high density poly ethylene nylon, sealed and kept in the refrigerator for further processing.

FORMULATION OF CASHEW NUT- SESAME SEED SPREAD

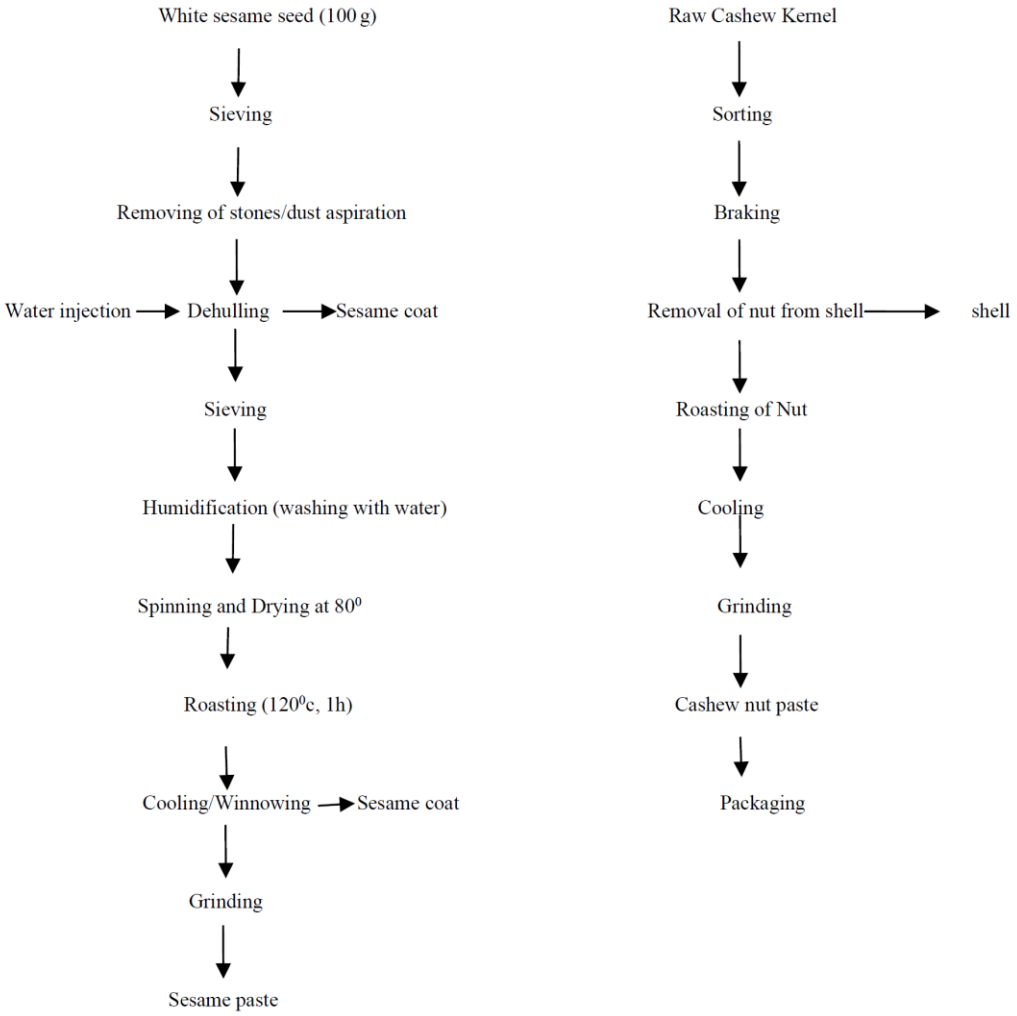
The roasted cashew nut paste and sesame seed paste were weighed and mixed at different ratios of Cashew: Sesame seed. Commercial bread spread was used as the standard. One kilogram (1kg) of each sample was ground using high power kitchen grinder and mixer into fine paste. Equal quantities of additives (salt, sugar, vegetable oiland lecithin) were added to the paste after standardization and mixed thoroughly to form a homogenous fine paste. The spread was then pasteurized at 60^0c for 3 minutes. Itwas allowed to cool, filled into airtight small plastic jars and stored at both room and refrigeration temperatures.

Table 1:Formulation of recipe for the production of Cashew Nut-Sesame Spre

Sample	Roasted C.N(%)	Roasted S.S(%)	Salt (g)	Sugar (g)	Veg oil (ml)	Emulsifier (gm)
A	80	20	1	4	2	2
B	60	40	1	4	2	2
C	50	50	1	4	2	2
D	40	60	1	4	2	2
E	20	80	1	4	2	2

A=80% Cashew nut:20% Sesame Seed, B=60% Cashew nut:40% Sesame Seed, C=50% Cashew nut:50% Sesame Seed, D=40% Cashew nut:60% Sesame Seed, E=20% Cashew nut:80% Sesame Seed and F= Commercial bread spread

Production Flow Chart of Sesame Seed Paste Production Flow Chart for Cashew Nut Paste



Proximate Analysis

Determination of moisture content

AOAC (2010) method was adopted where the aluminum or plastics dishes were washed thoroughly and dried in the oven, and was cooled in the desiccators, then, three (5) g of the sample was weighed into the dish, in duplicate and then dried in the moisture oven at 70°-80°c for 2hours and at 100°-135°c (usually 105°c) for 4hours until weight is constant, the sample was allowed to cool again in the desiccator. Then, the dried weight of the sample plus petridishwas taken (i.e., weight after oven dried) to calculated the percentage moisture content as described in the equation below:

$$\%\text{moisture}=\frac{W2-W3}{W1}\times\frac{100}{1} \quad \text{.....Equation 1}$$

Where; W_1= initial weight of empty petridish, W_2= weight of sample + weight of petridish and W_3= final weight of both sample and petridish after oven dried.

Determination of Ash content

AOAC (2010) method was used. The ash content was determined by weighing accurately five (2) g of the finely ground dry sample into crucible and transferred into a pre-heated muffle furnace at 500°c for about 2hours or until a white or light gray ash results and then cooled in the desiccator and re-weighed and the percentage ash was calculated.

$$\%\text{ Ash (dry basis)} = \frac{W3-W1}{W2-W1}\times\frac{100}{1} \quad \text{.....Equation 2}$$

Where; W_1= weight of empty crucible, W_2= weight of crucible + sample before ash and W_3= weight of crucible + sample after ash.

Determination of Crude Fat

Two hundred and fifty milliliters of boiling flasks were washed with water, dried in an oven set at 105ºc for 25minutes, cooled in a desiccator and then used for each sample according to the method of **AOAC (2010)**. The flasks were firstly labeled, weighed and then filled with 200ml of petroleum ether in each case. Then, 1 gram of each of the samples was weighed out into a correspondingly labeled thimble. The extraction thimbles were in each case tightly plugged with cotton wool. The soxhlet apparatus was then assembled and allowed to reflux for 6 hours. Thereafter, the thimble was removed and the petroleum either was collected in each case in the top of the container in the set up and drained into another container for re-use. The flasks were then removed in each case and dried in an oven at 105ºc for 1hour. After drying, they were placed in a desiccator where they cooled for about 20minutes and thereafter weighed to get the percentage fat content.

$$\text{Percentage fat} =\frac{W2-W3}{W2-W1}\times\frac{100}{1} \quad \text{.....Equation 3}$$

Where: W_1= weight of empty flask, W_2 = weight of the sample and W_3 = weight of the oil after drying.

Determination of protein

AOAC (2010) method of Kjehdalprocedurewas used. This method also determined the amount of nitrogen in food which is the first procedure is protein digestion: The digestion tube was washed thoroughly and place in an oven to dry and 0.2g of the sample was taken, 1g of Kjehdal catalyst was added into the sample in the digestion test tube, 5ml of concentrated H_2SO_4. It was taken to heating chamber in the fume cupboard where the temperature was set to around 150-160°c the temperature is then increased by 50-60°C every 30-40 minutesuntil it reaches 350°C.Thereafter, it was digested and transferred into distillation, the data obtained was used to calculate the percentage crude protein.

$$\text{Crude protein (\%)} = \frac{TV\times0.1\times0.014\times5\times100\times6.25}{0.536} \quad \text{..... Equation 4}$$

Where;TV = Titre value of the acid, C = Concentration of acid used. V_1 = Volume of the distilled water used for diluting the digest, V_2 = Volume of the aliquot used for titration, W = Weight of the sample used and F = Protein conversion factor = 0.014.

Determination of Crude Fibre

Two (2) grams of the ground sample was weighed and placed in 1litre conical flask containing 200cm^3 of 1.25% H_2SO_4 and boiled gently for thirty minutes. The content was filtered and the residue was scraped back into the flask with spatula. 200cm^3 of 1.25% NaOHwas added and allowed to boil gently for 30 minutes. The content was filtered and washed with hot distilled water. The precipitate was rinsed once with 10% HCl and twice with ethanol. The content was allowed to dry and the residue was scrapped into a crucible and dried overnight at 105^{0C} in a hot air oven. It was then removed and cooled in a desiccator. The sample was then weighed and ashed at 600^{0C} for ninety minutes in a furnace. This was finally cooled in a desiccator and weighed again **(AOAC, 1990).**The data obtained was used to calculate the percentage crude fibre.

$$\%\text{ crude fibre} = \frac{W2-W3}{W1}\times\frac{100}{1} \quad \text{..... Equation 5}$$

Where;W_0= weight of sample, W_1= weight after ash (incineration) and W_2= weight after oven dried.

Determination of Carbohydrate

Using **Muller and Tobi 1980**, the total carbohydrate was determined by difference. The sum of the percentage moisture, ash, crude fat, crude protein, and crude fiber was substracted from 100 to get the percentage total carbohydrate.

Determination of energy value in Kcal/100g

Energy value was calculated by taking the sum of (4×carbohydrate) + (9×fat) + (4×crude protein).

MICROBIAL ANALYSIS

Roasted cashew/ sesame seed spread was analyzed for Escherichia coli, salmonella and coagulase positive staphylococcus aureus according to the American public health association **(Downes and Ito, 2001)** guidelines.

SENSORY EVALUATION

Sensory evaluation was carried out using 10 panelists to assess the organoleptic attributes of the spread samples. The organoleptic attributes assessed were; texture, flavour, appearance, mouth-feel and the overall acceptability, the panelists were selected randomly from the staff and students of the University. The sensory assessment was done under controlled environment to avoid biased results. The bread spread samples were presented in small sizes and coded. The panelists were instructed to rate the samples based on 9- point hedonic scale ranging from 9 = liked extremely to 1= disliked extremely.

RESULT AND DISCUSSION

Proximate composition of Roasted cashew nut/sesame seed bread spread

Table 2. Below shows the data obtained from proximate analysis conducted on produced bread spread samples.

Spread sample	Moisture Content (%)	Ash Content (%)	Fat Content (%)	Fibre Content (%)	Protein Content (%)	Carbohydrate Content (%)	Energy Value Kcal/100
A	6.81^{a}±0.01	1.27^{f}±0.03	48.18^{f}±0.01	3.83^{e}±0.02	20.41^{f}±0.01	19.46^{a}±0.01	593.09^{f}±0.02
B	5.33^{c}±0.04	2.91^{e}±0.01	57.85^{d}±0.04	3.91^{d}±0.01	22.44^{e}±0.05	7.47^{b}±0.01	640.75^{d}±0.01
C	3.91^{d}±0.01	3.31^{c}±0.00	59.20^{bc}±0.00	4.11^{bc}±0.01	24.45^{ab}±0.03	5.67^{c}±0.03	651.82^{c}±0.03
D	3.28^{e}±0.01	4.02^{b}±0.02	61.08^{b}±0.01	4.24^{bc}±0.04	24.47^{c}±0.01	2.87^{e}±0.01	657.25^{ab}±0.03
E	2.74^{f}±0.01	4.10^{a}±0.01	61.81^{a}±0.01	5.74^{a}±0.05	25.05^{ab}±0.03	0.46^{f}±0.02	658.56^{a}±0.02
F	6.22^{b}±0.02	3.34^{c}±0.01	52.08^{e}±0.01	5.47^{b}±0.02	28.82^{a}±0.01	4.04^{d}±0.02	600.23^{e}±0.02

A=80% Cashew nut:20% Sesame Seed, B=60% Cashew nut:40% Sesame Seed, C=50% Cashew nut:50% Sesame Seed, D=40% Cashew nut:60% Sesame Seed, E=20% Cashew nut:80% Sesame Seed and F= Commercial bread spread

Table1 shows the recipe formulation of the developed cashew nut –sesame seed bread spread where sample A is in the of ratio 4:1, B is in the ratio 3:2, C is ratio 1:1, D is 2:3 and E in ratio 2:4 respectively while F is the commercial bread spread sample used as control. Table 2 shows the result of proximate analysis where the moisture contents of cashew nut-sesame seed bread spread samples were found to decreased with increasing level of sesame paste and all samples were significantly different ($p<0.05$) from one another, this tallies with the report of **Nwosu *et al*., (2014)** on cashew nut-groundnut bread spread. Moisture content is directly related with spoilage and deterioration of foods, however, moisture content of less than 10% has been reported to be responsible for prolonged keeping quality of seed paste **(Makkar *et al*., 1998, Adepoju and Adeniji, 2008),)**. Thus, the low moisture contentof the cashew nut-sesame bread spread is an indication of long shelf life.
Thecrude protein, ash, fat and crude fibrecontentsof the samples increase with increased levels of sesame paste in the recipe (Table 1). Sample C, D and E have highest ash content and are significantly higher than that of commercial bread spread (Sample F). The increase in the ash content could make the product a good source of minerals as observed in similar works of **De Lemen *et al.*, 2003 and Addo, 2005**. The fat contents of samples C, D and E are significantly higher than that of the commercial bread spread (sample F). The result obtained can be compared with that of **Nwosu *et al*., (2014)**. The crude fibre of Sample E was significantly higher than that of the commercial bread spread (Sample F). However, the crude fibre of sample C and D were not significantly different from that of sample F. This is an advantage as it helps in bowel movement and easy digestibility. Sesame is a legumes which is noted to be a good source of protein **(Olayanju*et al*., 2006; Eneche, 2005)**. They contain powerful antioxidants called lignin which are also anti-carcinogenic and contain phytosterols which block cholesterol production. Their protein has a good balance of amino acids with a chemical score of 62%, and a net protein utilization of 54% **(Alobo, 2007)**. These characteristics give sesame the potential of being a source of protein supplementation in cereal based foods. **Ayinde *et al*, (2012)** also observed an increase in protein content ofkokoro blend with sesame seed cake. The carbohydrate content decreased while the energy content increased with increase in sesame seed paste in the formulation (Table 1). The decrease in carbohydrate contents in the samples could be due to the low carbohydrate content of the added sesameseed paste as has been observed in similar research works using legumes **(Kent 1984; Ayo 1998**). This may also be due to the fact that most energy value in this bread spread is from fat. The energy values of sample C, D and E were significantly higher than that of sample F (Commercial bread spread).

Table 3. Microbial load of Cashew-sesame bread spread samples and Commercial bread spread (cfu/ml)

Organism/sample	A	B	C	D	E	F
Staphylococcus	9	7	11	10	13	Nil
Bacillus	nil	nil	nil	nil	nil	13
Salmonella	Nil	Nil	Nil	Nil	Nil	Nil
E. coli	Nil	Nil	Nil	Nil	Nil	Nil
Total plate Count (cfu/ml)	9×10^4	7×10^4	1.1×10^5	1.0×10^5	1.3×10^5	1.3×10^5

A=80% Cashew nut:20% Sesame Seed, B=60% Cashew nut:40% Sesame Seed, C=50% Cashew nut:50% Sesame Seed, D=40% Cashew nut:60% Sesame Seed, E=20% Cashew nut:80% Sesame Seed and F= Commercial bread spread

From the microbiological analysis results, *Salmonella spp, E coli* were not detected from the cashew-sesame formulations and the commercial bread spread. The total plate count was also found to be below the border line of 10×10^6 and the enumeration of Coagulase positive *Staphylococcus* was lower than 100 cfu/g safe limit (Lima et al, 2012). The results indicated that the production of the cashew-sesame bread spread samples and the commercial sample were carried out under good manufacturing practices that guaranteed good microbiological quality of the products. It was observed however, the counts were lower than 10^3 cfu/ g and did not present any health hazard.

Table 4. Sensory evaluation of cashew nut/ sesame seed bread spread

Sample	Texture	Flavour	Appearance	Spread ability	Mouth feel	Overall Acceptability
A	7.00 ± 1.16^a	7.10 ± 1.00^a	7.40 ± 1.07^a	5.00 ± 0.00^a	7.00 ± 1.25^a	7.90 ± 1.10^b
B	6.90 ± 1.00^a	7.00 ± 0.82^a	6.80 ± 1.23^a	5.00 ± 0.00^b	6.50 ± 0.85^a	7.30 ± 0.82^b
C	6.80 ± 1.32^a	6.60 ± 1.51^a	6.90 ± 0.89^a	5.00 ± 0.00^b	6.60 ± 1.51^a	8.60 ± 1.43^a
D	6.00 ± 2.10^a	6.40 ± 1.43^a	5.80±2.10a	4.20 ± 0.42^b	6.30 ± 1.83^a	6.90 ± 0.99^b
E	5.80 ± 2.30^a	5.70 ± 1.95^a	5.80 ± 2.40^a	4.80 ± 0.00^b	6.30 ± 1.77^a	6.40 ± 1.58^b
F	7.00 ± 1.94^a	6.70 ± 1.97^a	7.10 ± 1.50^a	4.70 ± 0.42^b	7.00 ± 1.50^a	8.70 ± 1.34^a

A=80% Cashew nut:20% Sesame Seed, B=60% Cashew nut:40% Sesame Seed, C=50% Cashew nut:50% Sesame Seed, D=40% Cashew nut:60% Sesame Seed, E=20% Cashew nut:80% Sesame Seed and F= Commercial bread spread

The results are mean ± SD results with different superscripts along the column are significantly different ($P<0.05$).
From the results of sensory evaluation of the cashew-sesame bread spread and the commercial bread spread (Table 4.3.1), it was observed that, there were no significant difference ($p>0.05$) between all the cashew-sesame bread spread samples and commercial bread spread in texture, flavour, appearance and mouth feel. However, there was significant difference ($p<0.05$) in spreadabilty between sample A and other samples. In the overall acceptability, Sample C and F are not ($p>0.05$) significantly different from each other, but were significantly different ($p<0.05$) and more acceptable than other samples.

Conclusion

It could be concluded from this work that; good quality bread spread could be produced from the blends of cashew and sesame paste. Bread spread sample of 50% cashew paste and 50% sesame paste gave the best product that was comparable to the commercial bread sample in both chemical and sensory properties. The inclusion of sesame seed in the bread spread production was found to enhance the nutritional quality of the cashew nut-sesame seed bread spread with increased energy value, protein and fibre contents.

Reference

Alasalvar C., and Shahidi F., (2008). Tree nuts: composition, phytochemicals, and health effects(New York USA, DRC press, 2008).
Asogwa E.U., Hammed L.A., Ndubuaku T.C.N.(2008). Integrated production and protection practices of cashew (Anacardium occidentale) in Nigeria, African Journal of Biotechnology 7(25), 4868–4873.

Ayinde, F. A, Bolaji, O.T, Abdus-Salaam, R. B and Osidipe O. (2012). Functional properties and quality evaluation of "kokoro" blended with beniseed cake Sesame indicum. African Journal of Food Science Vol. 6(5), pp. 117-123, http://www.academicjournals.org/AJFS
Azam-Ali H., and E. C. Judge, P Fellows and M Battcock (1992) Small-scale Cashew Nut processing ITDG Schumacher Centre for Technology and Development Bourton on Dunsmore, Rugby, Warwickshire, UK .
Blomhoff R., Carlsen M.H., Andersen L.F., and Jacobs D.R. (2006). Health benefits of nuts: potential role of antioxidants, *British Journal of Nutrition*, 96(2), 2006, S52–S60.
Chandrasekara N, Shahidi F. (2011). Antioxidative potential of cashew phenolics in food and biological model systems as affected by roasting. Food Chem. 2011; 129(4), 1388–1396.
Chemonics International Inc. (2002). Overview of the Nigerian Sesame Industry. The United States Agency for International Development (USAID)/Nigeria RAISE IQC Contract No. PCE-I-00-99-00003-00.';
Chisholm A., Mc Auley K., Mann J., Williams S., and Skeaff M., (2005). Cholesterol lowering effects of nuts compared with Canola oil enrichedcereal of similar fat composition. Nutrition, *Metabolism and Cardiovascular Diseases*, 15(4), 2005, 284–292.
Chun, J.; Ye, L.; Lee, J.; Eitenmiller, R.R. (.2003). Effect of peanut butter manufacture on Vitamin E. J. Food Sci. 68, 2211–2214.
Nwosu JN, Iwouno JO, Uzoukwu AE, Anyanwu CO and Osuchukwu OA.(2014) Evaluation of the Proximate and Sensory Properties of Spread Produced from Cashew Nut and Groundnut Blend. Austin J Nutri Food Sci. 1031, ISSN: 2381-8980.
Eaton SB, Konner M. (1985). Paleolithic nutrition. A consideration of its nature and current implications. N Engl J Med.; 312:283–289.
Ghandi A.P. (2009). Simplified Processs for the Production of Sesame Seed (sesamum indicum L.) Butter and its Nutritional Profile. Asian Journal of Food and Agro-Industry. 2(01), 24-27.
Jiang, C. H.,LUI, Q.Z., Du, S. S., Deng, Z.W. and Liu, Z.L. (2012).Essential Oil omposition and Isecticidal Activity of Evodia lepta (Spreng) Merr. Root Barks fromChina Against Two Grain Storage Insects.Journal of Medicinal Plants Research, 6(18),3464-3469.
Olayanju T.M.A, Akinoso and Oresanya M.O. (2006). Effect of Warmshaft Speed, Moisture Content and Variety on oil Recovery from Expelled Beniseed. Agricultural Engineering International: the CIGR Ejournal, Manuscript FP06008. Vol. VIII.
Adepoju, O.T. and Adeniji, P.O. (2008). Nutrient Composition, Antinutritional Factors and Contribution of Native Pear (Dacryoides edulis) pulp to nutrient Intake of Consumers. Nig. J. Nutri Sci. 29(2),15-23
Lee, J.Y. Lee, Y.s. and Choe, E.O. (2008). Effects of Sesamol, Sesamin and Sesamolin Extracted from Roasted Sesame Oil on the Therma Oxidation of Methyllinoleate. Food Science and Technology 42: 1871-1875.
Elleuch, M., Besbes, S., Roiseux, O., Blecker, C. & Attia, H. (2007). Quality characteristics of sesame seeds and by-products. Food Chemistry 103 (2): 641 – 650.
Fariku, S., Ndonya, A.E., & Bitrus, P.Y. (2007). Biofuel characteristics of beniseed (Sesanum indicum) Oil. Afric. J. Biotech. 6(21), 2442-2443.
Food and Agricultural of the United Nations (1995). Current Agricultura Situations – Facts and Figures.
Gandhi A.P., (2009). Soybean Processing and Utilization Centre Central Institute of Agricultural Engineering,India Asian Journal of Food and Agro-Industry 2(01), 24-27,ISSN 1906-3040.
Global Agrisystems (2010). Dehulled and roasted sesame seed oil processing unit. 18/08/11. Available at:http://www.nsic.co.in/schemes/documents/projpr/DEHULLEDofiles%20SESAME%20SEED.pdf.
El-Khier,M.K.S.iSHAQ, K.E.A. and Yaqoub, A.E.A. (2008). Chemmical Composition and Oil Characteristics of Sesame Seed Cultivars Grown in Sudan. Research Journal of Agriculture and Biological Sciences, 4(6):761-766.
Vaughan J.G. and GeisslerC.,(1997) The new oxford book of food plants.(New York: Oxford). Nordic J Botany, 18, 202-202.
Nayar, K.G. Cashew: (1998). A versatile nut for health. In ''Proceedings of International Cashew Coconut Conference. Trees for Life – The Key to Development'' (C.T. Topper, P.D.S. Caligari, A.K. Kulaya, S.H. Shomari, L.H. Kasuga, P.A.L. Masawe, and A.A. Mpunami, Eds.), BioHybrids International Ltd, Reading, UK, 195–199.
Kalyani Gorrepati, S. Balasubramanian, and PitamChandra (2015). Plant Based Butters. J Food Sci Technol. Jul; 52(7): 3965–3976.
Kris-Etherton P. M., Zhao G., Binkoski A.E, Coval S.M., and Etherton T.D. (2001). The Effects of Nuts on Coronary Heart Disease Risk, *Nutrition Reviews*, 59(4), 103-111.
Lima, J.R, Garruti D.S, Bruno L.M. (2012). Physicochemical, microbiological and sensory characteristics of cashew nut butter made from different kernel grades-quality. LWT-Food Sci Technol. 2012; 45:180–185. [CrossRef] [Google Scholar]
Mangels, R. (2001).Guide to nuts and nut butters. Vegetarian J XXI, 20–23.
Miraliakbari H., and Shahidi F., (2008). Lipid class compositions, tocopherols and sterols of tree nut oils extracted with different solvents, *Journal of Food Lipids*, 15, 81–96
Morton J. F., (2003). Cashew Nuts and Cashew Apples. Encyclopedia of Food Sciences and Nutrition. 958-964.
NAERLS (2010). Beniseed production and utilisation in Nigeria.Extension Bulletin No 154, Horticulture Series No 5. 17/07/11.
National Health and Medical Research Council (2013): Australian Dental Journal. 29(1), p. 49.
Nut-Based Spreads Market (2014). In the US.http:www.marketresearch.com/Datamonitor-v72/Nut-Based-spreads6462360/marketResearch
Orwa, C.; Mutua, A.; Kindt, R.; Jamnadass, R.; Anthony, S., (2009). Agroforestry Database: a tree reference and selection guide version 4.0. World Agroforestry Centre, Kenya.
Santos, R. P.; Santiago, A. A. X.; Gadelha, C. A. A.; Cajazeiras, J. B.; Cavada, B. S.; Martins, J. Oliveira L., Bezerra T.M., G. Santos G.A., R. P.; Freire V. N., (2007). Production and characterization of the cashew (*Anacardium occidentale*L.) peduncle bagasse ashes. J. Food Engineer. 79(4), 1432–1437.
Wilkes RS (2012) Nut butter and related products enriched with omega-3. US patent. Publication number: US 2012/0164307 A1. Accessed from google
Natureland. (2002). Organic Farming in the Tropics and Subtropiics: Sesame. 21/07/11. Available at:
Downes, F.P. and Ho, H. (2001). Compendium of Methods for The Microbiological Examination of Foods (4th Edition), Washington: American Public Health Association.
Makkar, H.P.S., Aderibigbe, A.O., Becker,k. (1998). Comparative Evaluation of Toxic and Non-toxic varietyof Jatropha curcas for Chemical Composition, Digestibility, protein Degradability and toxic factors. Food Chem.62(2): 207-215.
Addo,A.A. (2005). Preliminary Studies of the Microbiological and Nutrient Quality of three local Spices on the Ghanuan Market and the Control of Residents Microflora by Gamma Irradiation. B.Sc Hons. Dissertation. Department of Botany, University of Ghana, Legon; p. 68.
Eneche, H.E. (2005). Enrichment of Stared Flours with African Yam Bean Concentrates. Journal of Nutritional Science, 26; 30-37.
Ensminger, A.A., Ensminger, M.E., Kolande, J.E. and Robinson, J.R.K. (1983). Foods and Nutrition Encyclopedia. Pegus Press. Clovis, Califonia, U.S.A., 2: 1427-1441.