ISSN: 2338-1345 – Vol. 12 (1) 28-41 https://ojs.bakrie.ac.id/index.php/APJSAFE/about

Asia Pacific Journal of Sustainable Agriculture Food and Energy (APJSAFE)

# Effect of Substituting Cashew Nut Paste (*Anarcadium occidentale*) with Baking Fat on The Quality of Acha (*Digitaria exillis*) -Orange Fleshed Sweet Potato (*Ipomoea batatas*) Based Biscuits

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*Received: 19 May 2024 | Revised: 10 June 2024 | Accepted: 29 June 2024*

*Abstract*— The aim of this research was to determine the effect of substituting cashew nut paste into baking fat on the quality of acha-orange fleshed sweet potato base biscuits. Preliminary studies was carried out on acha-OFSP at ratio 100:0% acha, 95:5% acha-OFSP; 90:10% acha-OFSP, 85:15% Acha-OFSP, 80:20%, 75:5% acha-OFSP and ratio 80:20 of acha-orange fleshed sweet potato flour blends was preferred by the panellist to be used in the maim work. The experimental design were coded as follows: A-100:30:0, B-100:25:5, C-100:20:10, D-100:15:15, E-100:10:20, F-5:25, G-100:0:30 of acha-orange fleshed sweet potato: baking fat: cashew nut paste blends. The biscuits produced were analysed for proximate, minerals, vitamins, phytochemical, physical and sensory of blends biscuits. The proximate composition of the biscuit; moisture, fat, fibre, ash, protein, carbohydrate ranged from 5.96-13.36, 15.26-24.41, 1.43-2.31, 0.94-1.44 12.47-22.60, 47.20-59.99. Minerals composition of the biscuit; Ca, K, Mg and P, ranged from 35.54-49.46, 44.64-63.50, 23.13-40.73, 11.43-21.50. Vitamins composition of the biscuit; E, B2, B12 ranged from 0.32-0.48, 0.20-0.56, 0.09-0.36. Phytochemicals composition of the biscuit; flavonoids, carotenoids and phenolic ranged from 1.09-1.66, 2.08-2.57, 10.46-17.91. Physical properties: break strength, diameter, thickness, volume, weight and density ranged from 927.50-3442.50(g), 3.70-3.78(cm), 0.26-0.28(mm), 10 (cm), 5.38-6.72(g), 0.53-0.70. The average means of the aroma, texture, colour, taste and overall acceptability range from 5.90-6.75, 4.60-6.85, 5.26-7.30, 5.30-7.05, 5.65-6.80. The substitution of cashew nut paste into baking fat improved the micro, macro nutrients content and the physical of acha- OFSP flour blends based biscuits.

***Keywords*— Substitution, Cashew nut paste, Protein, Baking fat, Carbohydrate.**

## INTRODUCTION

Biscuit is a small quick bread made from dough that has been rolled out. It is also a small baked unleavened cake, typically crisp, flat, and sweet (Rai, 2022). They are usually sweet and may be made with sugar, chocolate, icing, jam, ginger, or cinnamon. They can also be savoury, similar to crackers. Biscuit and other baked food products are important items belonging to the class of food that are sold as ready-to-serve (Ogunka-Nnoka *et al*., 2020). They have become post weaning food as mothers feed their children with it at day cares, schools, offices, churches and other institutions. Biscuit is a rich source of protein, fat, carbohydrate, mineral and energy. Types of biscuit include sandwich biscuits, digestive biscuits, ginger biscuits, shortbread biscuits, chocolate chip cookies, chocolate-coated marshmallow treats, Anzac biscuits, biscotti, and specula (Semenova and Semenov, 2023).

Selection of suitable ingredients is an important step in manufacturing the food products. It is, therefore, necessary to have proper idea regarding ingredients, their function and uses (He *et al*., 2020). Methods of producing biscuit include roll and cut out method, shape and slice method, scoop and bake method. The most significant benefit of eating biscuits is the instant energy they provide due to their high-calorie content. However, biscuits can have some health benefits, including a good source of fibre, vitamins and minerals, anti-inflammatory components, and a good amount of calories (Milla *et al*., 2021). Biscuits are usually eaten hot with butter and fruit preserves, sausage gravy, or ham. They are especially associated with the American South. The dough for beaten biscuits, also a Southern specialty, is literally beaten with a mallet or other utensil for about 30 minutes to produce a fine texture. Biscuit ingredients can be classified as binding or tenderizing materials, depending on their expected effect on the finished product (Dhal *et al*., 2023). It includes flour, water, milk solid, egg white, cocoa powder, sugar, shortenings, leaving agents, emulsifier, starch and salt etc. (Chakraborty *et al*., 2022).

Biscuits are prominent ready-to-eat baked snack among the people, globally. The association of wheat consumption with such health problems as celiac disease makes it pertinent to utilize composite flour in biscuit manufacture (Adeola and Ohizua, 2018). Composite flour is desirable in this regard because it improves the nutritional value of food products such as bakery products, especially when blended with legumes such as pigeon pea (Miyahira *et al*., 2021). In fact, biscuits have been suggested as better use for composite flour than bread due to their ready-to-eat form, wide consumption, relatively long shelf life, and good eating quality (Adeola and Ohizua, 2018).

Cashew nut is a heart like shaped fruit widely grown in Africa and West Indies. It's belonging to family Anacardiaceaean is extremely hardy tree that grows on poor soil under various climatic conditions (Oliveira *et al*., 2020). It is a native to Brazil and is being extensively grown in India, East Africa and Vietnam (Monteiro et al., 2022). These countries including Nigeria are the main producers of cashew (Kolliesuah *et al*., 2020).

In Nigeria, about 5000-7000 tones are produced annually mainly as an export crop (Obani and Ikotun, 2023). Trends in production of cashew are also related to consumption and these in turn will depend on the world economic situation. Cashew nut is a high value edible nut. It yields two "Oils" one of these found, between the seed coat (or pericarp) and the nuts, is called the Cashew Nut Shell Liquid (CNSL).It is not a triglyceride and contains a high proportion of phenolic compound. It is used in industry (healthy snack, skincare, food ingredients and pharmacy) which serve as a raw material for brake lining compounds, as a water proofing agent, a preservative and in the manufacturing of paints and plastics (Visković *et al*., 2023).

The kernel is considered to be of high nutritive quality and growing conditions, or the variety of cashew may have an influence on kernel composition (Bai *et al*., 2019). The overall composition of the kernel is protein 21%, fat 46% and carbohydrates 25%. which contain all essential amino acid. Cashew nuts are quite popular and are used while baking food, as well as while cooking savoury meals. They can be crushed and added to a variety of vegetarian and non-vegetarian dishes, or can just be eaten raw, roasted, and/or with salt (Mihiranie *et al*., 2020). It also has antibiotic effects and is used medicinally to treat a sore tooth, ringworm, scurvy, leprosy, warts and elephantiasis. Village level technology in which number of processors use pieces of wood and stones during de-shelling instead of processing machine which lead to inferior quality of cashew nuts with high level of contamination'' (Mgonja and Shausi, 2022).This challenge can be caused by inadequate market for the products, lack of demand forecasting and absence of relationship with the organization that would conduct marketing research.

Acha Digitaria exilis an underutilized food security crop, is considered as one of the cereal crops of health benefit. Acha flour contains 3.4 % fat, 6.7 % crude protein, 7.4% crude fibre and 67.60% carbohydrate (Majekodunmi and Olapade, 2018 and Ayo *et al*., 2018) opined that Acha contributes significantly to wellness, economic status improvement and food security in developing economy of a nation like Nigeria.

Acha has the potential to contribute significantly to whole grain diets, wellness, economic status improvement, and play important role in food security in developing economy. Acha is considered as a health grain in the sense that it is often consumed whole and is gluten-free. Whole meal acha flours can be used in the preparation of a number of biscuits and snacks that could be useful for individuals with gluten intolerance (Ayo and Gidado, 2018). From functionality and health perspectives, Acha Can serve as ingredients in formulating bars, breakfast mueslis and ready-to-eat cereals, pasta, crackers, cookies and biscuits. There are many varieties of Acha, but the most prominent two are the white Acha Digitaria exillis and brown Acha Digitaria iburua (Kawuyo *et al*., 2019).Acha rich in energy aids digestion, good for cardiovascular function, good for diabetics, an excellent meal for weight loss, and good for skin and hair formation. It is a great alternative for gluten-intolerant people particularly those suffering from celiac disease (Olagunju *et al*., 2018).

Acha Digitaria exillis and brown Acha Digitaria iburua. Acha is used in the production of food and beverages, and manufacture of medicines (Gbadamosi *et al*., 2018). The grain, therefore, has immense economic values. Acha has nutritional contents which are rich in B-vitamins, minerals, essential amino acids, carbs, protein, fat, dietary fiber, calcium, iron, phosphorous, methionine and cysteine (Ayo *et al*., 2022). It also contains trace amounts of zinc, magnesium, manganese, potassium, phenylalanine, tyrosine and other essential amino acids except for lysine.The major problem of producing and processing Acha are its' tedious nature of harvesting and processing which takes much energy, time and attention (Brunton *et al*., 2021).

Orange-fleshed sweet potato Ipomoea Batatas is a special specie of sweet potato that contains high levels of beta-carotene, a rich source of Vitamin A in the body. Orange-fleshed sweet potato (OFSP) is one type of sweet potatoes that is in great demand as it has attractive colour, high starch and fibre content, and excellent source of strong antioxidants, provide health beneficial effect (Neela and Fanta 2019).

OFSP, as described by the National president of Potato Farmers Association of Nigeria (POFAN), Chief Daniel Okafor, is cultivated and harvested within 2-months and is orange in colour. According to Neela and Fanta (2019), Orange Fleshed Sweet Potato (OFSP) is classified into different varieties: variety Beletech (192026 II), Birtukanie (Saluboro), Kulfo (Lo-323), Tulla (CIP 420027). The chemical composition of OFSP showed that, the dried-OFSP contained ash (3.69-4.09 %), fat (4.09-5.09 %), crude fibre (4.69-5.15 %), protein (5.87-8.28 %), carbohydrate (78.22-82.21 %), vitamin C (8.55-20.49 mg/100g), phenolics (0.1-1.28 mg/kg), flavonoids (984-145 mg/kg) and reducing sugar (35.01-82.23 g/100g) (Pessu *et al*., 2020).

OFSP is a nutritious type of sweet potato that is additionally rich in beta-carotene, a precursor of vitamin A. Beta-Carotene is an organic, strongly colored red-orange pigment abundant in plants and fruits. Beta-carotene is what gives OFSP an orange color and is converted to Vitamin A in the body after consumption (Pessu *et al*., 2020). Orange fleshed sweet potato is used for making puree, dried chips, juice, bread, noodles, candy, pap (Akamu), and pectin, biscuits, cake, gari doughnut, chin-chin etc.

The most Prominent among the limiting factors and problems associated orange fleshed sweet potato in application to food by products and yield gaps, include high perishability of sweet potato, limited availability of the orange fleshed variety and nonavailability of its nutritious processed forms equivalent to local dietary preferences, drought, poor access to planting material., unavailability of markets and lack of transportation network, inadequate extension services and postharvest losses (Pessu *et al*., 2020).

Baking fat which is used for the production of biscuit is expensive as it is imported and calls for search for alternative. Cashew nuts paste which can serve as alternative in baked products is under used but has relatively rich in nutrient (protein, fat and carbohydrate etc.). Acha-Orange flesh sweet potato which can serve as a better alternative for wheat flour which is underutilized due to relatively low in nutrient content. The work is aimed at evaluating the effect of substituting cashew nut paste into baking fat on the quality of Acha based biscuits.

## MATERIALS AND METHODS

### *A. Materials*

The material used in this study include Acha grains Digitaria exilis, cashew nut Anarcadium occidentale, orange fleshed sweet potato Ipomoea batatas L. wheat flour, baking powder (double-acting), magarine, salt (palm salt), baking fats, sugar (dangote), water (portable water) all was purchase in Wukari New Market, Wukari Local Government Taraba State.

### *B. Preparation of acha flour*

Acha flour was prepared according to the procedure in fig.1. Cream coloured Acha was washed with portable water to separate the stones and, then it was dried in the cabinet drier at 500c for 6h. The resultant dried acha was milled into flour using theattrition mill with 0.2 mm screen size. This method was carried out as describe by (Ayo *et al*., 2018).

### *C. Preparation of cashew nut paste*

For the treatment of cashew, the modified method of Badje et al. (2018) was used. Healthy, dry nuts were steamed in a 115°C cooker for 45 minutes. Once pre-cooked, the nuts were allowed to cool for 48 hours at room temperature and separated into two equal halves using a manually controlled de-huller. The almonds, inside the hulls was then removed using small knives and oven dried in hot air in cupboards at 85°C for 2 hours before blanching. After pruning, the nuts were dried at 65°C for 6 hours to reduce the moisture content to 5-6%, cooled, grind, packaged and stored for further analysis. Below are the processes involving in the production of cashew nut paste

### *D. Blend formulation of acha –orange fleshed sweet potato and cashew nut paste with baking fat*

The composite flours composed of Acha and defatted cashew kernel flours was obtained by the incorporation of respective proportions of 0, 5, 10, 15, 20, 25, 30% of the cashew nut paste respectively 100%, Acha-OFSP flour.30, 25, 20, 15, 10, 5, 0% of baking fat. Finally, each formulation (Table 1) was carefully mixed in a blender (Philips) for 15 minutes at high speed and stored in polyethylene bags at room temperature until use.

### *E. Orange-fleshed Sweet Potato Flour Production*

The method as described by Ubbor *et al*. (2022) was used in the production of orange sweet potato flour. The wholesome orange fleshed sweet potato tubers were sorted, washed, peeled and sliced to 1-1.5mm thickness with stainless steel kitchen knife. The sweet potato slices were blanched in boiling water for 2-3 minutes, drained using plastic sieve and shield dried for 4 days. The dried potato slices were milled into flour with an attrition mill (model SK-30-SS) and subsequently sieved through a 0.02 mm sieve mesh. The resultant fine flour was packaged in a transparent hermetically sealed Ziploc poly bag and stored at room temperature (24ºC).

### *F. Production of Biscuits*

Biscuits was prepared according to the method of Ikechukwu, *et al*. (2018) with some modifications in the recipe. The dry ingredients (flour, sugar, salt, and baking powder baking fat etc,) was carefully mixed in a bowl by hand for 3min. Egg and water was then added to the mixture and kneaded. The batter was rolled and cut with a biscuit cutter. The cut dough was placed on oil greased baking trays, leaving 25mm spaces in between and it's was baked at 180ºC for 25min in the baking oven.

Following baking, the biscuits was cooled at ambient temperature, the polyethylene was used to pack the biscuits stored at ambient temperature (28±20ºC) prior to subsequent analysis and sensory evaluation. Ingredients used for biscuit making was flour (200g), sugar (60g), milk powder (30g), egg (30g), baking powder (1.5g), salt (1.5g), vanilla powder (4 drops), water (15ml), while 80g of margarine was added to the mixture. The procedure is shown in Figure 3.

### *G. Analytical Methods*

*Spread ratio*

The spread ratio was calculated as diameter of biscuits divided by height (Doğan and Meral, 2019). Two rows of five well-formed biscuits was made and the height was measured, arranged horizontally edge to edge and the sum of the diameters was also measured as well.

*Break strength*

Putra (2021) method was used. Biscuit of known thickness was placed centrally between two parallel metal bars (3 cm apart). The weights was added on the biscuit until the biscuit snapped. The least weight that caused the breaking of the biscuit was regarded as the break strength of the biscuit.

*Thickness and Weight*

Thickness of the biscuit sample was determined using a venire calliper, while the weight of the sample was determined with a top loading balance (Putra, 2020).

*Texture*

Texture profile analysis of biscuit samples: Hardness and fracture ability analysis of the biscuit samples was determined using the TA-XT Plus texture analyzer (Stable Micro Systems Serial No.5014 England) according to the method described by Liu, *et al*. (2019). The analyzer was set to perform single-cycle measurements which was used for the determination of the first bite force of the product. The measurement speed of 2 mm/s and a distance of 5 mm was applied. The force–time plots was analyzed for hardness or breaking force (g) and fracturability (mm) to reach the peak. Textural attributes was measured in six independent samples.

*H. Determination of Chemical Composition*

Nutrient composition of the food samples was determined in triplicate using the standard procedures of Association of Official Analytical Chemists as follows:

*Determination of Moisture Contents*

Determination of Moisture Content Two (2) g of each sample was weighed inside a clean dried crucible (W1) and was dried at 60°C in a hot stimulating oven for 24 hours to a constant weight. It was cooled in desiccators for 30minutes and weighed (W2). The crucible was washed, dried in the oven and the weight was recorded (W0) Aguirre, (2020).

$Moisture\ content$ (%) =

$$\frac{W1-W2}{W1} \times 100 \qquad (1)$$

Where;
$W1 = weight\ of\ flour\ before\ drying$
$W2 = weight\ of\ flour\ after\ drying$

*Determination of Crude Protein*

Determination of Crude Protein The crude protein content (N x 6.25) was determined by Aguirre method (2023). A quantity of 0.5 g of each sample was added to 10 ml of concentration, sulphurics acid and 1 g of the catalyst mixture. It was then heated cautiously on digestion rack under fume hood until a greenish clear solution appeared, cooled and then made up to 50 ml with distilled water. The digested sample was transferred into distillation apparatus and distilled. 10 ml of the distillate was titrated with 0.1M HCL to first pink colour. Temperature of digester was above 420°C for about 30 min.

$Crude\ protein$ (%) =

$$1.401 \times M \times F\ \frac{(ml\ titrant - ml\ blank)}{sample\ weight} \qquad (2)$$

*Determination of Crude Fiber*

Determination of Crude Fibre 2g of the sample was defatted with 99% ethanol, boiled under reflux for 30 minutes with 200 ml of a solution containing 1.25 g of $H_2SO_4$ per 100 ml of solution (Oguezi 2019). And was filtered with Whatmann No 1 filter paper, washed with boiled water until the washing was no longer acid. The residue was transferred to a beaker and boiled for 30 minutes with 200ml of a solution containing 1.25 g of carbonate free sodium hydroxide per 100ml. It was filtered and transferred into a crucible. The residue was dried in the oven at 600ºC in a muffle furnace and the dried weight recorded.

$$Cf = \frac{(W1-W2)}{W3} \times 100 \qquad (3)$$

Where,
Cf = Crude fibre (%)
$W1 = mass\ of\ crucible\ with\ the\ dried\ residue\ (g)$
$W2 = mass\ of\ crucible\ with\ the\ ash\ (g)$
$W3 = mass\ of\ (g)$

*Determination of Crude Fat*

Determination of Crude Fat Crude fat was determined by exhaustively extracting each sample in petroleum ether in a soxhlet extractor. The weighed sample (W0) was poured into a thimble and covered with a clean white cotton wool. 99% ethanol (200 ml) was poured into a 250 ml extraction flask which was previously dried in the oven at 1050C for 30 minutes and weighed (W2). Extraction was done for 5 hours. And was cooled in desiccators and reweighed (W1) (Mordi *et al*., 2019).

$$Ether\ extract\ (\%) = \frac{W1-W2}{W3} \times 100 \qquad (4)$$

*Determination of Ash Content*

Determination of Ash Content 2 g sample was transferred into a previously heated, cooled and weighed crucible (W0) and then weighed (w1). It was placed into a Gallenkamp muffle furnace at 550°C for 3 hours. And was allowed to cool in desiccators and weighed (W2) (Ahaotu *et al*., 2020).

$$Ash\ \% = \frac{(W1-W2)}{W3} \times 100 \qquad (5)$$

Carbohydrate content was determined by difference using the method described by (Dahal *et al*., 2022). Total carbohydrate content of the samples was calculated by difference (subtracting the sum of percent moisture, crude protein, crude fibre, crude fat, and ash from 100%).

*Determination of minerals*

*Calcium*

Calcium was determined by titrimetric method after precipitation as calcium oxalate as outlined by Stanković *et al*. (2020). About 5 mL of samples was mixed with 1 mL of ammonium oxalate solution. pH was adjusted to 8 using ammonium hydroxide solution and adjusted again to 5 using dilute acetic acid. The mixtures was allowed to stand for 4 hours, centrifuged and decanted. About 2 mL dilute sulphuric acid was added and heated. Titration was then carried out using 0.02 N potassium permanganate (1 mL = 0.0004 g Ca) until colour changes. Calcium was calculated using equation

$$Calcium = \frac{A_s \times C_{ss} \times D_f}{A_{ss} \times S_v} \times 100 \quad ......................(6)$$

Where As is absorbance of sample, Css is concencentration of standard solution, Df is Dilution factor, Ass is absorbance of standard solution and Sv is sample volume.

*Magnesium*

Colourimetric method was used to determined magnesium content as outlined by Phuyal *et al*., (2020). About1 mL of magnesium buffer and 2.5 mL of eriochrome blue black tea was added to 5 mL of sample. This was allowed to stand for 10 minutes. Absorbance was taken at 520 nm using a colourimeter. Magnesium was calculated using equation.

$$Magnesium = \frac{A_s \times C_{ss} \times D_f}{A_{ss} \times S_v} \times 100 \quad ...................(7)$$

Where As was absorbance of sample, Css was concentration of standard solution, Df was dilute on factor, Ass was absorbance of standard solution and Sv was sample volume.

*Potassium*

Potassium stock solution and standard dilute potassium solution was prepared with the method for sodium solution as outlined by (Na *et al*., 2019). A calibration graph was prepared from the reading obtained. About 2 mL of sample was mixed with 2 mL of sodium cobaltonitrate and allowed to stand for 45 minutes. About 2 mL of water was added to the mixture and centrifuged for 15minutes. The supernatant was obtained and mixed with 2 mL of 99 % ethanol. The mixture was centrifuged for 5 minutes, and the supernatant boiled in a water bath for 10 minutes. About 1 ml of 1 % chlorine hydrochloride, 1 ml potassium fericyanide and 2 mL of distilled water was added to the extract. Absorbance was determined at 620 nm using a colorimeter. The sample solution was then read and potassium content was calculated using equation

$$Potassium = \frac{A_s \times C_{ss} \times D_f}{A_{ss} \times S_v} \times 100 \quad .......................(8)$$

Where $A_s$ = absorbance of sample, $C_{ss}$ = concencentration of standard solution, $D_f$ = Dilution factor, $A_{ss}$ = aborbance of standard solution and $S_v$ = sample volume.

*Sodium*

Colorimetric method was determined according to Faghiri *et al*. (2019). Sodium stock solution was prepared by dissolving 1.271 g sodium chloride in water and diluting to 1 litre and a standard dilute sodium solution was prepared by diluting 10 mL stock sodium solution to 500 mL with water and kept aside. A calibration graph was prepared from the readings obtained. About 5 mL of sample was mixed with 5 mL of uranyl acetate, shaken and allowed to stand for 5 minutes. The sample was centrifuged and the supernatant obtained and mixed with 1 % acetic acid and 0.4 mL of potassium fericyanide. The colorimeter was set to scale 0 with distilled water and the standard dilute sodium. Absorbance will be read off and the sodium content was calculated using equation.

$$Sodium = \frac{A_s \times C_{ss} \times D_f}{A_{ss} \times S_v} \times 100 \quad ..........................(9)$$

Where $A_s$ = absorbance of sample, $C_{ss}$ = concencentration of standard solution, $D_f$ = Dilution factor, $A_{ss}$ = aborbance of standard solution and $S_v$ = sample volume.

*Determination of Vitamins*

Vitamin B2, E and B12 was the vitamins analyzed for the food formulation by the method described by Sharma et al. (2020). This was performed at the optimum separation condition by High Performance Liquid Chromatography (HPLC) with isocratic binary mobile phase consisting of methanol: water (65:35 v/v) with flow rate of 1ml.min-1. The pH was measured using pH meter combined with a glass electrode. A 320R Hettich centrifuge and a digital 10P ultrasonic bath was used. A calibration curve was prepared for each vitamin and the correlation coefficient based on the concentration curve was obtained.

*Determination of Phytochemicals*

Carotenoids content was determined according to the method described by Ke *et al*. (2019). A measured weight of sample was homogenized in methanol using a laboratory blender. A 1:10 (1%) mixture was used. The homogenate was filtered to obtain the initial crude extract, 20 ml of other was added to the filtrate and mixed well and then treated with 20 ml of distilled water in a separating funnel. The ether layer was recovered and evaporated to dryness at low temperature (35 – 50°C) in a vacuum desiccator. The dry extract was then saponified with 20 ml of ethanoic potassium hydroxide and left over in a dark cupboard. The next day, the carotenoid was taken up in 20 ml of ether and the washed with two portions of 20 ml distilled water. The carotenoid extract (ether layer) was dried in a dessicator and then treated with light petroleum (petroleum spirit) and allowed to stand overnight in a freezer (-10°C). The precipitated steroid was removed by centrifugation after 12 h and the carotenoid extract was evaporated to dryness in a weighed evaporation dish, cooled in a dessicator and weighed. The weight of carotenoid was determined and expressed as a percentage of the sample weight.

$$\% \text{ carotenoids content } = \frac{weight\ of\ sample}{weight\ of\ sample\ taken} \times 100 .......(10)$$

*Total phenolic content (TPC)*

Total polyphenols was determined following the Folin-Ciocalteu's method using gallic acid as standard as described by Gueboudji *et al*., (2021). FolinCiocalteu's reagent (12.5 µl) along with 7% sodium carbonate (125 µl) was added to the samples. Samples will then be incubated for 90 min at room temperature. The absorbance was measured at 750 nm using microplate reader (Synergy HT, Bio Tek Instruments, Winooski, VT, USA).

*Determination of flavonoids content*

The flavonoid content was determined as described by Kainama *et al*. (2020). 10g of flour sample will be extracted respectively with 100 ml of 80% aqueous methanol at room temperature (30±200ºC). The mixture was then filtered through a Whatman No. 42 grade filter paper into a weighed 250 ml beaker. The filtrate was transferred into a water bath, evaporated to dryness and weighed.

The percentage of flavonoid was be calculated as:

$$\% \text{ flavonoids content } = \frac{weight\ of\ sample}{weight\ of\ sample\ taken} \times 100 .......(11)$$

*I. Sensory Evalution*

Sensory evaluations of the biscuits was determined using twenty-member panellist consisting of staff and students of the Department of Food Science and Technology, Federal University of wukari Taraba state. The panellists consisted of 13 female and 7 male, their ages ranging from 20 to 45 years. The biscuits samples prepared from each flour blend was presented in coded white microwavable plastic container. The order of presentation of samples to the panellists was randomized. Potable water was provided to rinse the mouth between evaluations. The panellists was instructed to evaluate the coded samples for taste, aroma, colour, texture, crispiness and overall acceptability. Each sensory attribute was rated on a 9-point Hedonic scale (for taste, aroma and overall acceptability, 1 = disliked extremely, 5 = neither like nor dislike, while 9 = liked extremely. For colour, 1 = extremely white, 5 = neither brown nor white, while 9 = extremely brown. The panellists were required to append their signatures on the questionnaires appropriately.

*J. Statistical Analysis*

All the analyses was carried out in duplicate. Data obtained was subjected to Analysis of Variance (ANOVA); differences between means was evaluated using Turkey's multiple comparison tests with 95% confidence level. The statistical package in Minitab software version 16 was used. Means was separated with Duncan Multiple Range Test (DMRT) at 95% confidence level (p=0.05)

## RESULTS AND DISCUSSIONS

*Proximate composition*

The result of the proximate composition of biscuit from Acha- Orange Flesh Sweet Potato and Cashew Nut Paste is presented in Table 3.1; The results showed that the moisture content decreased from 13.36 – 5.96%, crude fat decrease from 24.41- 15.26%, crude fibre increased from 1.43 – 2.31%, ash increased from 0.94 – 1.44%, crude protein increased from 12.47 – 22.60% and carbohydrate increased from 47.39 – 52.42% respectively.

There were significant differences ($P<0.05$) among the entire samples. It was observed that there was progressive reduction in moisture content as the proportion of cashew nut paste increased. This is evidence show that biscuit sample with high level of cashew nut paste with low moisture content will have a longer shelf life than the biscuit produced from other sample such as wheat which is mostly used for the production of biscuit. There was significant difference ($p<0.05$) among the samples in terms of moisture content.

According to Ayo *et al*. (2019), biscuit are generally low moisture foods. Baked products with moisture content less than 13% are stable from moisture-dependent deterioration (Ubbor, *et al*., 2021). The moisture content of all the biscuit produced was below this specified moisture content indicating that they can be stored at room temperature and be less prone to fungal and microorganism infections (Awuchi, 2019).

There was decrease in fat content of flour blends biscuits with inclusion of cashew nut paste. There were significant difference ($p>0.05$) in fat content due to the decrease in proportion of baking fat from 30 down to 0% with increase in cashew nut paste proportion which has low fat compared to baking fat. Lowest value of fat content was obtained in sample with 100 % Acha-OFSP, 0% baking fat and 30% cashew nut paste based biscuits. The decreasing trend could be attributed to baking fat proportion in the flour blends as baking fat is reported to be high in fat (80-100%), (Ashwath and Sudha 2021). The finding by this study does not agree with the report of Guyih *et al*., (2020) who showed increase in fat content (0.36 to 0.97%, ) in biscuit produced from wheat, almond seed and carrot flour blends as a result of decrease in the addition of fat.

The increase in protein content could be due to the amount of protein content (18.22%) in the cashew nut paste. Therefore, cashew nuts flour and/ or paste served as a complementary purpose in increasing the protein content of the biscuit products which can helps in providing the limiting protein (lysine and tryptophan).

The highest fibre value was recorded from sample H which was acha-OFSP 100% and 30% of cashew nut paste biscuit and the lowest value in sample A (100% Acha/ofsp) and 05% cashew nut paste. This result indicated that both Acha, Orange Flesh Sweet Potato flour and cashew nut paste contain larger amount of crude fibre. This could be the reason that an increasing in fiber content was observed as the proportion of cashew nut paste increased. Similar result was also observed by Osuji, *et al*. (2022) in their study of blending of wheat and cocoyam, flour, cashew and groundnut paste which contains higher fibre (1.50 to 2.07%). Increase in the ash content indicates that the samples with high percentage of ash will be good sources of minerals. Cashew nuts are excellent sources of potassium, phosphorus, magnesium, sodium, calcium and iron (Dakuyo *et al*., 2022).

The substituting of baking fat into cashew nut paste samples were different at 5% level of significance ($p<0.05$). Higher ash contents indicated that the mineral content is higher in the cashew nuts. Carbohydrate content decreased with increased substitution of cashew nuts paste and as well decrease in the substitution of baking fat and the effect was significant difference ($p>0.05$). Reduction in carbohydrate content of the biscuit was observed, when the proportion of baking fat and cashew nut paste in the formulation was substituted.

*Minerals and vitamin composition of CNP into Baking Fat Acha-OFSP of Biscuits*

The mineral contents of the biscuit samples are presented in Table 3.2. The inclusion of cashew nut paste in the blends has significant ($p<0.05$) effect on the mineral content of flour blends biscuits. All the minerals significantly ($p<0.05$) increased with the incorporation of cashew nut paste with decrease in baking fat substitution. The increase in calcium content could be attributed high calcium content in cashew nut paste. The sample with 30% cashew nut paste inclusion had higher calcium content (49.46), while lowest calcium content (35.46) was obtained 0% cashew nut paste inclusion biscuit sample.

Generally, the calcium content of biscuit samples increased with the addition of cashew nut paste. The finding by this study agrees with the report of Guyih *et al.* (2020) who reported increase in calcium content (185.77 to 230.16 mg/100g) with inclusion of almond seed and carrot flour in flour blends biscuit. Low calcium content (2.12 – 4.45 mg/100) was reported by Adegbanke *et al*. (2020) in biscuit made from Wheat and Bambara nut flour. The inclusion of Cashew Nut Paste could be responsible for the variation in result. Calcium is involved in the mechanism of muscle contraction, but also in the transmission of nerve impulses. It plays a role in the cascade of blood clotting and in the metabolism of many hormones. The biscuits produced from the mixture of Acha-OFSP flour cashew nut paste would be beneficial for strengthening bones and reducing calcium deficiencies.

Magnesium is necessary for biochemical reactions in the body, helping to maintain muscle, improving the functioning of the nerve, maintaining the heart rate, and regulating the blood sugar (Mathew and Panonnummal, 2021). The magnesium content of flour blend biscuit significantly ($p<0.05$) increased with level of soybeans and acha-OFSP flour and cashew nut paste inclusion in the blends. The increase in magnesium content could be due to high magnesium (19.36mg/100g) in cashew nut paste, (Ukim *et al*., 2018). The finding by this study is in agreement with the from 32 - 49 mg/100 g reported by Ndjang *et al*., (2022) in biscuit made from wheat and sweet potato flour blends. (Guyih *et al*., 2020) also reported increase in magnesium content (58.96 – 56.12 mg/100 g) in biscuit made from wheat, almond seed and carrot flour blends.

The results showed that the formulated biscuit sample generally show increased in B2 vitamins increased from 0.20- 0.56 mg/100g. These results are similar to the findings of Nduka et al., (2022) who reported values increasing from 0.036 – 0.67 mg/100g, 0.065 – 0.096 mg/100g and 0.170 – 0.400 mg/100g for vitamins, B2 respectively produced from, Acha-OFSP flour blends and cashew nut paste. Kure *et al*. (2021) also reported similar values for biscuit produced from wheat-orange fleshed sweet potato composite flours. Vitamin B2 is essential for healthy eyes and mouth tissue; and in formation of coenzyme needed in metabolism of carbohydrate, Fat, and Protein. Vitamin B2 promotes Iron metabolism, and its deficiency also increase the risk of anemia or blood shortage (Sarwar, *et al*., 2021). Vitamin B12 is involved in production of red blood cells and also prevents the increase in level of homocysteine (Mikkelsen, and Apostolopoulos, 2019).

*Phytochemical composition of acha-OFSPF, CNP into Baking Fat Based Biscuits*

Phytochemicals composition of biscuits supplemented with cashew nut paste into baking fat are shown in Table 3.3. The levels of these phytochemicals were significantly different ($p < 0.05$) from those in the other biscuit samples. Phytochemicals have biological significance but are not established as essential nutrients (Starowicz, *et al*., 2021). They include antioxidants, and compounds that modify potential toxins and carcinogens. The flavonoid content increased from 1.09 to1.66mg/100g in substituting cashew nut paste with baking fat.

Flavonoids have been reported to function as pigments and antioxidants (D'Amelia, *et al*., 2018). Literature show that the most important flavonone in Acha-OFSP and cashew nut paste is hesperidin which has been reported to lower high blood pressure as well as cholesterol in animal studies and have strong anti-inflammatory properties (D'Amelia *et al*., 2018). In plants, they are not involved in photosynthesis, respiration or protein synthesis. When foods that contain phytochemicals are eaten, the phytochemicals will activate a group of enzymes that go round cleaning up the free radicals before they cause any harm to the body (D'Amelia *et al*., 2018).

The carotenoid content increased from 2.08 to 2.57mg/100g due to addition of cashew paste. Carotenoid is a class of micronutrient that cannot be replaced in the diet of humans. Literature reveal that there are over 800 natural carotenoids that have been discovered in different colours such as red, yellow, orange among others (Lu *et al*., 2021). They are lipophilic natural pigments stored in chloroplast; they exist in green tissues as photosynthetic pigments. Almost all fruits contain carotenoids. Carotenoids are effective oxygen scavengers that have pro-vitamin A activity and thus can reduce oxidative stress (Roohbakhsh *et al*., 2021).

The phenolic content increased from 10.46-17.91mg/100g as a result of increased in cashew nut paste with decreased in baking fat ratio.The role of phenol is similar to that of Vitamin C; they possess the ability to act as an antioxidant, thus preventing their diseases by scavenging free radicals (Agubosi *et al*., 2022).

*Physical Properties of The Biscuits*

The breaking strength ranged from 927.50-2041.41kg. Biscuit produced from the sample 100% Acha-OFSP, 0% baking fat and 30% cashew nut paste had the highest value for breaking strength while biscuits produced from Acha-OFSP: baking fat: cashew nut paste (100:30:0) had the least. The value of the breaking strength increases as a result of increase in cashew nut paste increase. The increase could be attributed to the carbohydrate/starch content of composite flours from Acha-OFSP and cashew nut paste which is caused by the interaction of proteins and starch by hydrogen bonding. A previous study confirmed that composite flours are utilized in achieving increase in breaking strength during biscuit production (Ayo *et al*., 2019). The breaking strength refers to the force required to break biscuit and is dependent on the interaction between the proteins and starch hydrogen bonds (Awuchi *et al*., 2019).

The thickness of the biscuit ranged from 0.26-0.28 mm for biscuit produced from Acha- OFSP flour and cashew nut paste. The higher value for thickness obtained in biscuit made with composite flours could be due to the higher adsorption of moisture of the dough owing to the presence of water binding component (Awuchi *et al*., 2019). Interestingly, Peter-Ikechukwu *et al*. (2017) reported that the higher the thickness of biscuit the higher its ability to withstand stress. This implies that biscuit from the composite flours have the ability to withstand stress. The range of thickness obtained in biscuit produced in this study was lower than 12.50 - 13.50mm reported for biscuit produced from wheat flour and fermented Afzeliaafricana flour (Ubbor *et al*., 2021) and values (9.49 - 10.13 mm) of thickness obtained in wheat based biscuit supplemented with OFSP flour (Ayo *et al*., 2019). The differences in the various biscuit could be attributed to the thickness of the dough rolled out during processing.

The weight of the biscuit samples increased as a result of the increase level of cashew nut paste substitution. The findings were in contrary to the observation of some researchers who reported significant reduction in the weight of biscuit produced from soya bean supplemented with wheat flour (Feyera, 2020) .There was a significant difference ($p<0.05$) between the value obtained for the biscuit diameter supplemented with Acha-OFSP flour cashew nut paste. As the proportion of cashew nut paste increased in the formulation, an increased in the average biscuit diameter was observed.

*Sensory Attributes of The Biscuits*

The result of the sensory attributes of the biscuit is as presented in Table 3.5: The results showed significant difference with average means scores for in aroma, texture, and colour at ($p<0.05$) with no significant difference in taste and overall acceptability at ($p<0.05$). The biscuit sample aroma ranged from 5.90 - 6.75, texture ranged from 5.85 - 6.85, taste ranged from 5.30 - 7.05 colour ranged from 6.30 - 7.30 and overall acceptability ranged from 5.85 – 6.80 respectively. The brown colour observed from the biscuit samples resulting from Maillard reaction which always associated with baked foods.

The average means scores for texture of the biscuit samples were not significantly different ($p>0.05$) from each other. Aroma is another attribute that influences the acceptance of baked food products even before they are tasted. Substitution of baking fat into cashew nut paste at different levels significantly ($p<0.05$) affect the sensory score of aroma and taste. The findings were in close agreement with the findings of Akubor and Ukwuru (2020), who studied the effect of soy flour on the functional properties and the potential of soybean and cassava flour blends in cookies production.The Aroma, texture, colour and taste indeed influence the overall acceptability of the biscuit samples. The final sensory analysis conducted by the panellist was the overall acceptability of the biscuit. The overall acceptability of the biscuit was significantly influence by the blend proportion ($p< 0.05$).

Table 3.1. Recipe of Cashew Nut Paste-Acha-OFSP Composite Biscuit

| Sample | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| Acha-OFSP | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Banking fat | 30 | 25 | 20 | 15 | 10 | 5 | - |
| Cashew nut paste | - | 5 | 10 | 15 | 20 | 25 | 30 |
| Sugar | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Baking powder | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Salt | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Water | 15 | 15 | 15 | 15 | 15 | 15 | 15 |

Table 3.1 Proximate content of the blend biscuits

| SAMPLE | MOISTURE % | FAT% | FIBER% | ASH% | PROTEIN% | CARBO HYDRATE% |
|---|---|---|---|---|---|---|
| A | $13.36^{a} \pm 0.12$ | $24.41^{a} \pm 0.11$ | $1.43^{g} \pm 0.02$ | $0.94^{g} \pm 0.02$ | $12.47^{g} \pm 0.14$ | $47.39^{g} \pm 0.27$ |
| B | $13.04^{b} \pm 0.04$ | $24.26^{b} \pm 0.11$ | $1.54^{f} \pm 0.02$ | $1.03^{f} \pm 0.02$ | $12.92^{f} \pm 0.03$ | $47.20^{f} \pm 0.04$ |
| C | $7.61^{c} \pm 0.05$ | $16.50^{c} \pm 0.64$ | $1.75^{e} \pm 0,02$ | $1.09^{e} \pm 0.03$ | $13.30^{e} \pm 0.09$ | $59.73^{e} \pm 0.13$ |
| D | $7.44^{d} \pm 0.05$ | $16.11^{d} \pm 0.68$ | $1.9^{d} \pm 0.00$ | $1.17^{d} \pm 0.15$ | $17.45^{d} \pm 0.13$ | $55.99^{d} \pm 0.17$ |
| E | $7.26 \pm 0.06^{e}$ | $15.52 \pm 0.21^{e}$ | $2.14^{c} \pm 0.01$ | $1.23^{c} \pm 0.02$ | $21.59^{c} \pm 0.23$ | $52.24^{c} \pm 0.21$ |
| F | $6.61 \pm 0.02^{f}$ | $15.39 \pm 0.45^{f}$ | $2.22^{b} \pm 0.01$ | $1.30^{b} \pm 0.05$ | $22.10^{b} \pm 0,12$ | $52.33^{b} \pm 0.17$ |
| G | $5.96^{g} \pm 0.03$ | $15.26^{g} \pm 0.13$ | $2.31^{a} \pm 0.13$ | $1.44^{a} \pm 0.03$ | $22.60^{a} \pm 0.08$ | $52.42^{a} \pm 0.16$ |

Means with different superscripts within the same column are significantly different at ($p<0.05$); Values are mean ± Standard deviation for triplicate determinations.
A= 100% AOFSP + 30% BF + 0% CNP, B= 100% AOFSP + 25% BF + 5% CNP, 100% AOFSP + 20% BF + 10% CNP, D= 100% AOFSP + 15% BF + 15% CNP, E= 100% AOFSP + 10% BF + 20% CNP, F= 100% AOFSP + 5% BF + 25% CNP, G= 100% AOFSP + 0% BF + 30% CNP.
AOFSP= Acha/orange flesh sweet potato, BF= baking fat, CNP= cashew nut paste.

Table 3.2 Minerals and Vitamis Contents of Blend Biscuits

| SAMPLE | CA (mg/100g) | K (mg/ 100g) | MG (mg/100g) | P (mg/100g) | VIT E (mg/ 100g) | VIT $B_{12}$ (mg/ 100g) | VIT $B_2$ (mg/ 100g) |
|---|---|---|---|---|---|---|---|
| A | $35.46^{g} \pm 0.16$ | $44.64^{g} \pm 0.16$ | $23.13^{g} \pm 0.22$ | $11.43^{g} \pm 0.02$ | $0.32^{g} \pm 0.02$ | $0.09^{g} \pm 0.01$ | $0.20^{g} \pm 0.03$ |
| B | $37.54^{f} \pm 0.01$ | $49.64^{f} \pm 0.01$ | $27.50^{f} \pm 0.07$ | $11.91^{f} \pm 0.05$ | $0.37^{f} \pm 0.06$ | $0.13^{f} \pm 0.02$ | $0.37^{f} \pm 0.01^{f}$ |
| C | $41.31^{e} \pm 0.11$ | $56.46^{e} \pm 0.05$ | $34.30^{e} \pm 0.04$ | $14.53^{e} \pm 0.11$ | $0.42^{e} \pm 0.01$ | $0.22^{e} \pm 0.02$ | $0.45^{e} \pm 0.02$ |
| D | $43.83^{d} \pm 0.11$ | $58.05^{d} \pm 0.03$ | $34.43^{d} \pm 0.05$ | $16.09^{d} \pm 0.01$ | $0.44^{d} \pm 0.03$ | $0.24^{d} \pm 0.01$ | $0.48^{d} \pm 0.00$ |
| E | $46.37^{c} \pm 0.09$ | $58.63^{c} \pm 1.72$ | $34.57^{c} \pm 0.07$ | $17.75^{c} \pm 0.17$ | $0.46^{c} \pm 0.06$ | $0.26^{c} \pm 0.01$ | $0.53^{c} \pm 0.01$ |
| G | $47.89^{b} \pm 0.05$ | $63.57^{b} \pm 0.02$ | $37.65^{b} \pm 0.29$ | $19.63^{b} \pm 0.15$ | $0.47^{b} \pm 0.01$ | $0.31^{b} \pm 0.01$ | $0.55^{b} \pm 0.00$ |
| F | $49.46^{a} \pm 0.11$ | $63.50^{a} \pm 0.06$ | $40.73^{a} \pm 0.63$ | $21.50^{a} \pm 0.13$ | $0.48^{a} \pm 0.02$ | $0.35^{a} \pm 0.03$ | $0.56^{a} \pm 0.02$ |

Table 3.3 Phytochemical Composition of Blend Biscuits

| SAMPLE | FLAVONOIDS (mg/100g) | CAROTENOIDS (mg/100g) | PHENOLIC (mg/100g) |
|---|---|---|---|
| A | 1.09 $^{g}$ ±0.03 | 2.08 $^{g}$ ±0.03 | 10.46 $^{g}$ ±0.13 |
| B | 1.25 $^{f}$ ±0.02 | 2.17 $^{f}$ ±0.03 | 10.91 $^{f}$ ±0.07 |
| C | 1.45 $^{e}$ ±0.03 | 2.33 $^{e}$ ±0.02 | 13.35 $^{e}$ ±0.07 |
| D | 1.49 $^{d}$ ±0.01 | 2.42 $^{d}$ ±0.02 | 15.44 $^{d}$ ±0.07 |
| E | 1.54 $^{c}$ ±0.02 | 2.50 $^{c}$ ±0.04 | 17.54 $^{c}$ ±0.10 |
| F | 1.60 $^{b}$ ±0.00 | 2.54 $^{b}$ ±0.02 | 17.73 $^{b}$ ±0.05 |
| G | 1.66 $^{a}$ ±0.03 | 2.57 $^{a}$ ±0.01 | 17.91 $^{a}$ ±0.04 |

A= 100% AOFSP + 30% BF + 0% CNP, B= 100% AOFSP + 25% BF + 5% CNP, 100% AOFSP + 20% BF + 10% CNP, D= 100% AOFSP + 15% BF + 15% CNP, E= 100% AOFSP + 10% BF + 20% CNP, F= 100% AOFSP + 5% BF + 25% CNP, G= 100% AOFSP + 0% BF + 30% CNP.
AOFSP= Acha/orange flesh sweet potato, BF= baking fat, CNP= cashew nut paste

Table 3.4 Physical properties of blend biscuits

| SAMPLE | BREAK STRENGTH | DIAMETER (cm) | THICK NESS | VOLUME (cm) | WEIGHT (g) | DENS ITY | Spread ratio. |
|---|---|---|---|---|---|---|---|
| **A** | 927.50$^{g}$± 3.53 | 3.70 $^{c}$ ± 0.01 | 0.27 $^{c}$ ± 0.00 | 10.00 ± 0.00 | 6.72±0.00$^{b}$ | 0.67±0.00$^{b}$ | 13.70$^{e}$±0.03 |
| **B** | 982.50 ± 3.53$^{f}$ | 3.71 $^{a}$ ± 0.05 | 0.28 $^{b}$ ± 0.00 | 10.00 ± 0.00 | 5.40$^{e}$±0.00 | 0.54 $^{e}$±0.0 | 13.25$^{g}$±0.06 |
| **C** | 2212.5 $^{e}$±3.53 | 3.74 $^{c}$ ± 0.14 | 0.26 $^{d}$± 0.00 | 10.00 ± 0.00 | 6.27$^{c}$±0.04 | 0.62$^{c}$±0.00 | 14.38$^{b}$±0.05 |
| **D** | 2457.50$^{d}$±3.3 | 3.76 $^{a}$ ± 0.07 | 0.26 $^{d}$ ± 0.00 | 10.00± 0.00 | 5.38$^{f}$±0.02 | 0.53$^{f}$±0.00 | 14.46$^{a}$±0.10 |
| **F** | 3442.50$^{c}$±3.51 | 3.78 ± 0.14$^{b}$ | 0.27 $^{b}$± 0.00 | 10.00 ± 0.00 | 5.9$^{d}$± 0.00 | 0.59$^{d}$±0.00 | 14.00$^{d}$±0.06 |
| **E** | 3527.5±.67.1$^{b}$ | 3.82 $^{c}$ ±0.02 | 0.27 $^{b}$ ± 0.00 | 10.00 ± 0.00 | 7.02$^{a}$±0.03 | 0.70$^{a}$±0.00 | 14.14$^{c}$±0.01 |
| **G** | 2041.41$^{a}$±1.41 | 3.86 $^{a}$ ± 0.02 | 0.29 $^{a}$ ± 0.00 | 10.00 ± 0.00 | 6.72$^{b}$±0.02 | 0.67$^{b}$±0.03 | 13.3$^{f}$ ±0.09 |

A= 100% AOFSP + 30% BF + 0% CNP, B= 100% AOFSP + 25% BF + 5% CNP, 100% AOFSP + 20% BF + 10% CNP, D= 100% AOFSP + 15% BF + 15% CNP, E= 100% AOFSP + 10% BF + 20% CNP, F= 100% AOFSP + 5% BF + 25% CNP, G= 100% AOFSP + 0% BF + 30% CNP.AOFSP= Acha/orange flesh sweet potato, BF= baking fat, CNP= cashew nut paste

Table 5. Sensory Quality of Blend Biscuits

| SAMPLE | AROMA | TEXTURE | COLOUR | TASTE | OVERALL |
|---|---|---|---|---|---|
| A | 5.90$^{g}$ ±1.11 | 5.85$^{e}$ ±2.10 | 6.30$^{e}$ ±2.00 | 5.30$^{g}$ ±1.72 | 5.85$^{e}$ ±1.53 |
| B | 6.05$^{e}$ ±1.53 | 6.00$^{d}$ ±2.02 | 5.60$^{f}$ ±1.75 | 6.20$^{e}$ ±1.85 | 6.05$^{d}$ ±1.76 |
| C | 6.55$^{c}$ ±1.50 | 6.00$^{d}$±2.02 | 6.45$^{d}$ ±2.23 | 6.60 $^{c}$ ±1.60 | 6.25$^{c}$ ±1.74 |
| D | 5.20$^{f}$ ±1.88 | 4.60$^{f}$ ±2.11 | 5.26$^{g}$ ±2.20 | 5.55$^{f}$ ±2.35 | 5.65$^{f}$ ±2.18 |
| E | 6.95$^{a}$ ±1.09 | 6.60$^{b}$±1.42 | 6.90 $^{c}$ ±1.58 | 6.45$^{d}$ ±1.43 | 6.55$^{b}$ ±2.28 |
| F | 6.25$^{d}$ ±2.29 | 6.50 $^{c}$ ± 1.93 | 7.20$^{b}$ ±1.94 | 6.65$^{b}$ ±1.75 | 6.80$^{a}$ ±1.64 |
| G | 6.75$^{b}$ ±1,65 | 6.85$^{a}$ ± 2.05 | 7.30$^{a}$ ± 1.08 | 7.05$^{a}$ ±1.23 | 6.80$^{a}$ ±1.88 |

A= 100% AOFSP + 30% BF + 0% CNP, B= 100% AOFSP + 25% BF + 5% CNP, 100% AOFSP + 20% BF + 10% CNP, D= 100% AOFSP + 15% BF + 15% CNP, E= 100% AOFSP + 10% BF + 20% CNP, F= 100% AOFSP + 5% BF + 25% CNP, G= 100% AOFSP + 0% BF + 30% CNP. AOFSP= Acha/Orange Flesh Sweet Potato, BF= Baking Fat, CNP= Cashew nut Past

## CONCLUSIONS

The result of this study revealed that, the substitution of cashew nut paste into baking fat improved the micro and macro nutrients content of acha- range flesh sweet potato flour blends based biscuits. The blends biscuit samples were generally accepted however, the inclusion of cashew nut paste was most preferred at 20%. The acceptance of this will reduce overdependence on imported baking fat and improve cashew nut paste utilization which is indigenous and under-used in Nigeria.

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