Sensory Evaluation and Physicochemical Qualities of Maize-Based Flaked Snacks Complemented with *Mucuna Pruriens* Seed Flour

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KEYWORDS

Maize,
Mucuna,
Snacks,
Flour,
Complement

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ABSTRACT

The objective of this study was to produce Maize-Mucuna pruriens seed flaked snacks and evaluate their consumer acceptability and physicochemical properties. Maize was cleaned, tempered, decorticated, milled and sieved to obtain maize flour. Mucuna pruriens seed was soaked (twice for 6 h respectively with change of water), dehulled, boiled (1 h), dried (70ºC) and milled into flour. The five Maize-Mucuna seed flour ratios were formulated as follows: 95:5 (EFA), 90:10 (EMU), 85:15 (PRO), 80:20 (UZY) and 100:0 (ABC – control). The snacks proximate composition, functional and sensory qualities were evaluated. With the addition of Mucuna pruriens seed flour the moisture content of the samples had no significant difference ($p > 0.05$) while significant increase ($p < 0.05$) existed in the ash and protein contents. Sample with 90:10 Maize:Mucuna flour (EMU) had the lowest value of 7.20% while sample with 80:20 Maize:Mucuna seed flour (UZY) had the highest protein value of 11.59%. Swelling power increased significantly ($p < 0.05$) with inclusion of Mucuna pruriens seed while water absorption capacity decreased significantly ($p < 0.05$). Sample with 80:20 Maize:Mucuna flour (UZY) had the lowest water absorption capacity (183 g/ml). The control sample ABC (100:0 Maize:Mucuna) had the highest overall acceptability score (8.33) and significantly differed from the other samples. Inclusion of Mucuna pruriens seed significantly reduced the overall acceptability of the snacks. This research showed that maize-based snacks could be complemented with up to 20% Mucuna pruriens seed flour which could help decrease protein-energy malnutrition.

INTRODUCTION

Street foods such as snacks are one of the major energy contributors in the world (Félix-Medina *et al*., 2021). Snacks are foods or beverages that are consumed in between main regular meals without being substituted for the regular meals (Almoraie *et al.*, 2021). They are largely characterized with low nutritional value compared to main meals, irrespective of the form or amount eaten (Almoraie *et al*., 2021). The demand for snacks has increased over the years as a result of change in feeding behaviour, elevated durations at work, increasing population of single persons in households and disparity in the timing for feeding (Sahua *et al*., 2022). Snacks play an important role in between meals in reducing hunger in both growing and aged persons (Netshishivhe *et al*., 2019). A number of raw materials have been used in snacks production including maize (Sahua *et al*., 2022). Notably, the most consumed and popular dry snacks are made from flours gotten from cereal grains; most especially from maize (Netshishivhe *et al*., 2019).

Amongst the many snacks that exist, maize is the major raw material for dry snacks production as it is contained in many of the popularly consumed dry snacks around the globe (Netshishivhe *et al*., 2019). Maize (*Zea mays* L.) is a cereal crop with edible grains and a member of the grass family *Poaceae.* It is considered as a staple food in many countries in Latin America, Africa, and some parts of Asia (Ramos *et al*., 2022). Maize (*Zea mays* L.) is widely cultivated throughout the world (Ten Berge *et al*., 2019; Yan *et al*., 2022) and it is a relatively affordable crop (Ramos *et al*., 2022). Nonetheless, maize is nutritionally deficient as regards its protein quality which is limiting in lysine and tryptophan (Félix-Medina *et al*., 2021) as well as its minerals' composition. These nutritional considerations necessitate complementation processes to ensure that these limiting nutrients are captured during the formulation of maize-based snacks. Sequel to these identified nutritional deficits in cereals like maize, legumes have been unequivocally identified as being ideal for complementation with legumes in cereal-based snacks (Sahua *et al*., 2022).

Velvet beans (*Mucuna pruriens*), is a specie of *Mucuna* and belongs to *Leguminosae family* and has been identified as an underutilized tropical legume in Africa and parts of America and Asia (Adebayo-Oyetoro *et al*., 2021). It grows in arid and infertile terrains, has high nutritional value, is relatively cheap price and widely cultivated in Nigeria (Fitriyah *et al*., 2021). It is nutritionally comparable to other legumes like soybean because of their similar contents of protein, fibre and carbohydrate (Fitriyah *et al*., 2021). *Mucuna pruriens* seed is a good source of crude protein (24 - 31.44 %), crude carbohydrate (42.79 - 64.88 %), crude fibre (5.3 - 11.5 %), ash (2.9 - 5.5 %) (Natarajan *et al*., 2012). *M. pruriens* seed is also rich in minerals such as iron (1.3-15 mg/100g), calcium (104-900 mg/100g) and zinc (1-15 mg/100g) (Pathania *et al*., 2020) as well as lysine, an essential amino acid that is deficient in cereals (Fitriyah *et al*., 2021).

The incorporation of *Mucuna pruriens* seed flour to maize-based snacks has the tendency of nutritionally complementing and improving the quality of the maize-based snacks by enhancing some nutrients that are limiting in maize, create variety of maize-based snacks and increase the utilization of *Mucuna pruriens* seed which is under-utilized. It is on this basis that this research set out to produce and evaluate the sensory and physicochemical qualities of maize-based flaked snacks complemented with *Mucuna pruriens* seed flour.

MATERIALS AND METHODS

Source of Materials

The maize (*Zea mays*) and velvet bean (*Mucuna pruriens*) were bought from Eke-Awka market in Awka, Anambra state. The chemicals used were of analytical grade. At the time of purchase, it was ensured that the materials do not show any sign of deterioration or physical damage.

Experimental Design

A mixture design was used. The five Maize: Mucuna seed flour ratios formulated were as follows: 100:0 (ABC), 95:5 (EFA), 90:10 (EMU), 85:15 (PRO) and 80:20 (UZY).

Maize flour preparation

The grit non-soaking (GNS) method was used to produce maize flour (Olajide and Nsakpuma, 2019). Stones, broken kernels and other foreign objects were manually removed from maize grains. The cleaned grains were tempered by sprinkling with 5% water (v/w) and mixed thoroughly. Following that, the grains were decorticated on a locally built corn decorticating machine to obtain maize grits. The grits that were obtained were utilized wisely. The grits were processed using a disc attrition mill (9FC-36, China) and sieved using a 40-mesh sieve for the grit non-soaking procedure (0.450 mm). The flour was sealed in airtight polyethylene bags (Ziploc, China) and kept at 27±2°C until it was needed.

Mucuna pruriens (Velvet beans) seed flour preparation

The seeds were first soaked for 6 h at room temperature (25°C), changed and steeped for another 6 h in tap water with a seed to water ratio of 1 to 10 (w/v). After soaking, the seeds were dehulled by hand, boiled for one hour and dried at 70°C for 24 h. The dehulled seeds were ground into flour with a hammer mill, sieved through a 200 µm mesh sieve and stored in polyethylene bags for analysis.

Maize based flaked snacks production

The procedure described by Al-Okbi *et al*. (2012) was adopted for the snacks production. In a large bowl, these ingredients were mixed together: 192 g of Maize-*Mucuna pruriens* seed composite flour, sugar (15 g), salt (2.1 g) and vanilla extract (4.2 g). A small amount of water (178 ml) was added and stirred until the batter is smooth. A lining was made on a baking tray with foil and it was lightly greased with vegetable oil (Power oil, Raffles Oil LFTZ Enterprise, Lagos, Nigeria). The batter was poured into a tray, spread out evenly and cut into thin layers of about 0.3 to 0.4 inches. It was flaked in an oven at (250°C) for 4 minutes. The temperature was afterwards lowered to 120°C and allowed for 5 minutes to attain a golden brown colour and crispy. Snacks was cooled and stored in airtight jars for analysis.

Determination of Proximate Composition

Samples were evaluated for % moisture, % ash, % fat, % crude fibre and % crude protein as described by AOAC (2000).

Functional Properties Determination

Bulk density, water and oil absorption capacity, solubility and swelling index were determined as described by Onwuka (2018).

Sensory evaluation

The method described by Iwe *et al*. (2014) was adopted for the sensory evaluation. A sensory panel of 20 semi-trained panelists evaluated the quality features of the "flaked snacks". They rated the samples on a 9-point Hedonic scale for taste, colour, texture, aroma, and overall acceptability, with 9 representing strongly like and 1 representing extremely dislike.

Statistical Analysis

The Statistical Package for Social Science (SPSS) version 23.0 software was used to analyze the data. Duncans Multiple Range Test was used to detect significant differences ($p < 0.05$) among the sample means using Analysis of Variance (ANOVA) and Least Significant Difference (LSD) for separation of significant means.

RESULTS AND DISCUSSION

Proximate Composition of maize-based snacks complemented with *Mucuna pruriens* seed flour.

The proximate composition of the samples revealed significant differences ($p < 0.05$) in the ash, crude fibre, protein, carbohydrate, moisture and fat levels as shown in Table 1.

Table 1: Proximate composition of maize-based snacks complemented with *Mucuna pruriens* seed flour

Sample code	Maize: Mucuna	Moisture content (%)	Crude protein (%)	Ash (%)	Crude fibre (%)	Crude fat (%)	Carbohydrate (%)
ABC	100:0	$7.00^{a}\pm2.65$	$9.40^{c}\pm0.26$	$1.67^{a}\pm0.03$	$10.30^{a}\pm0.26$	$9.40^{c}\pm0.26$	$69.63^{e}\pm0.03$
EFA	95:5	$8.20^{a}\pm0.26$	$8.30^{d}\pm0.10$	$1.50^{c}\pm0.03$	$9.55^{b}\pm0.03$	$8.30^{d}\pm0.26$	$70.48^{c}\pm0.03$
EMU	90:10	$7.50^{a}\pm0.26$	$7.20^{e}\pm0.02$	$1.45^{d}\pm0.03$	$7.40^{c}\pm0.26$	$7.20^{e}\pm0.26$	$74.61^{a}\pm0.03$
PRO	85:15	$8.30^{a}\pm0.26$	$10.40^{b}\pm0.10$	$1.40^{e}\pm0.03$	$6.30^{d}\pm0.26$	$10.40^{b}\pm0.26$	$71.84^{b}\pm0.03$
UZY	80:20	$7.60^{a}\pm0.26$	$11.50^{a}\pm0.10$	$1.55^{b}\pm0.03$	$6.40^{d}\pm0.26$	$11.50^{a}\pm0.26$	$71.40^{d}\pm0.03$

Values are means ± standard deviation of triplicate determinations. Values in the same column with different letters differed significantly ($p < 0.05$).

The moisture content (%) of the samples ranged from 7- 8.3, with 100 % maize flour (ABC) having the lowest moisture content of 7.0 and sample PRO (85:15 Maize:Mucuna flour) having the highest moisture content of 8.3%. The moisture content of the flour blends did not differ significantly ($p > 0.05$). The relatively low moisture content would have resulted from the flaking process during which the samples would have lost moisture. The relatively low moisture content of the samples indicated better storage stability of the flakes. The American Association of Cereal Chemists (2001) approved techniques for measuring various flour qualities state that the higher the moisture content, the less dry particles in the flour. The moisture level of flour is normally limited to 14% or below in flour specifications (Iwe and Onadipe, 2001). At room temperature, grains with moisture content greater than 14% are unstable and organisms present will begin to thrive, causing off odours and flavours.

The percentage crude protein in the flours varied between 7.2 and 11.5. There were significant differences ($p < 0.05$) in the crude protein contents of the samples. Increased quantities of *Mucuna pruriens* seed flour inclusion increased the protein content of the flours (Table 1). The higher proportion of protein in *Mucuna pruriens* seed flour would have resulted in an increase in crude protein content. This increase in crude protein with increased *Mucuna pruriens* flour inclusion was not unexpected, and it served as the foundation for formulating the blends so that the final product would have not only higher protein but also better protein quality.

The fat content of the flakes was generally low (Table 1), ranging from 6.3% (PRO) to 10.93% (ABC). This could be related to the low-fat content of cereals and legumes. Amongst the samples, there were significant differences ($p < 0.05$). Low-fat levels are advantageous because they offer a longer shelf life for the items since unsaturated fatty acids in fats and fat-containing foods are prone to oxidative rancidity (Félix-Medina *et al*., 2021). Sample PRO (85:15 Maize: Mucuna flour) had the lowest fat content (6.3%), whereas the control sample ABC (100:0 Maize:Mucuna flour) had the greatest fat content (10.3%).

The ash content of the flours varied between 1.4 and 1.67%, with sample PRO (85:15 Maize: Mucuna flour) having the lowest value (1.40%) and sample ABC having the highest value (1.67%). There were significant differences ($p < 0.05$) between the samples. Except for UZY (80:20 Maize:Mucuna flour), the ash content decreased significantly ($p < 0.05$) as the amount of *Mucuna pruriens* seed flour inclusion was increased. The amount of ash in a food sample indicates the mineral elements components that are present. It showed the composition of inorganic elements after incineration had destroyed organic materials (fats, proteins, and carbohydrates) and moisture. It's essentially a food sample's aggregate of all minerals it contains. Minerals are a collection of essential nutrients that are found in molecules like haemoglobin, adenosine triphosphate (ATP), and deoxyribonucleic acid (DNA) and serve a variety of key metabolic roles ( ).

The crude fibre level of the flour blends ranged from 1.55 to 2.00%. There were significant differences ($p < 0.05$) between the samples. UZY flour sample (80:20 Maize:Mucuna) had the lowest value (1.55%) while sample ABC (100:0 Maize:Mucuna flour) had the highest value (2.00%). The crude fibre content of sample ABC (100:0 Maize: Mucuna) flour was highest at 2.00% and reduced when the amount of *Mucuna pruriens* seed flour was increased. The crude fibre content of the blends decreased significantly ($p < 0.05$) as the percentage of legume flour substitution rose. This could be due to legumes' relative lower crude fibre compared to Maize which had a decreasing impact on maize. Crude fibre reduces the risk of colon cancer by slowing the flow of glucose into the bloodstream and lowering inter-colonic pressure (Ten Berge *et al*., 2019).

The carbohydrate composition of the flake samples ranged from 69.63- 74.61%, with ABC (100:00 Maize: Mucuna flour) having the lowest carbohydrate content of 69.63% and EMU (90:10 Maize:Mucuna flour) having the greatest carbohydrate content (74.61%). The carbohydrate contents of the flours and their blends were significantly different ($p < 0.05$). The carbohydrate content of the flaked snacks significantly increased with the inclusion of *Mucuna pruriens seed*. These flake samples have high carbohydrate content, indicating that the products will be good sources of energy.

Functional Properties of maize-based snacks complemented with *Mucuna pruriens* flour

Table 2 shows the functional properties of flaked maize-based snacks complemented with *Mucuna pruriens* seed flour. The water absorption capacities of Maize:Mucuna flours - ABC (100:0), EFA (95:5), EMU (90:10), PRO (85:15) and UZY (80:20) were 200, 210, 205, 197 and 183 g/ml respectively (Table 2). With the addition of *Mucuna pruriens* seed flour, the samples' water absorption capacity increased. Lorenz and Collins (2004) stated that water absorption capacity is a significant functional feature in food compositions, particularly those involving dough handling. Different protein concentrations, their degree of interaction with water, and their structural features may account for the observed variance in water absorption capabilities between ABC (100:0 – Maize:Mucuna) and other flour blends. This effect could be due to the starch granules' loose association of amylose and amylopectin, as well as reduced associative factors that keep the granular structure together (Lorenz and Collins, 2004)). The ability to absorb water is vital for product bulking and consistency, as well as baking. This shows the capacity the flakes have in absorbing water when water will be added for its consumption. Oil absorption capacity is an important functional property that improves mouth feel while retaining food flavour (Lorenz and Collins, 2004). The oil absorption capacity of the flour samples differed significantly ($p < 0.05$) according to statistical analysis. The flakes' oil absorption capabilities ranged from 140 to 160 g/100ml. With a capacity of 160 g/100 ml, sample UZY (80:20 Maize:Mucuna) had the highest oil absorption capability, while EMU had the lowest (140 g/100 ml). The oil absorption capacity decreased with increase in *Mucuna pruriens* seed flour except for 80:20 Maize:Mucuna sample (UZY). The result has shown that the sample with 100% maize absorbed the greatest oil. The ability of food products to absorb oil increases mouth feel and flavour retention, making it a significant attribute in food compositions (Al-Okbi *et al*., 2012).

Table 2: Functional properties of maize-based snacks complemented with *Mucuna pruriens* seed flour

Sample code	Maize: Mucuna	WAC (g/ml)	OAC (g/ml)	SP (mg/g)	Solubility (mg/g)	Bulk density (mg/g)	pH
ABC	100:0	$200^{c}\pm1.00$	$160^{b}\pm1.00$	$10^{d}\pm1.00$	$23^{a}\pm1.00$	$0.50^{d}\pm0.10$	$8.0^{a}\pm2.65$
EFA	95:5	$210^{a}\pm1.00$	$156^{c}\pm1.00$	$11^{cd}\pm1.00$	$22^{ab}\pm1.00$	$0.65^{c}\pm0.10$	$8.6^{a}\pm0.26$
EMU	90:10	$205^{b}\pm1.00$	$140^{e}\pm1.00$	$12^{c}\pm1.00$	$21^{ab}\pm2.65$	$0.74^{bc}\pm0.03$	$8.7^{a}\pm2.08$
PRO	85:15	$197^{d}\pm1.00$	$149^{d}\pm1.00$	$14^{b}\pm1.00$	$18^{bc}\pm2.65$	$0.83^{ab}\pm0.03$	$9.4^{a}\pm0.26$
UZY	80:20	$183^{e}\pm1.00$	$164^{a}\pm1.00$	$16^{a}\pm1.00$	$15^{c}\pm2.65$	$0.92^{a}\pm0.01$	$9.7^{a}\pm0.26$

Values are means ± standard deviation of triplicate results. Values in the same column with different letters are significantly different ($p < 0.05$). WAC; water absorption capacity, OAC; oil absorption capacity, SP; swelling power, BD; bulk density.

The samples swelling index values differed significantly ($p < 0.05$) and increased with increased inclusion of Mucuna seed flour in the flakes. The swelling index values were 10, 11, 12, 14 and 16 mg/g for 0, 5, 10, 15 and 20% Mucuna seed flour inclusion respectively. The increase in swelling index indicates a greater interaction between water molecules and the flour starch chain. This increase in the swelling index can partly be influenced by the processing method adopted in processing the product. In some good formulations, such as bakery products, swelling capacity is considered a quality factor. It is a factor of the ratio of α-amylose and amylopectin ratios and evidence of non-covalent interaction between molecules within starch granules (Lorenz and Collins, 2004)

The solubility power was in the range of 15 – 23 mg/g. Samples ABC, EFA, EMU, PRO, and UZY had the solubility power values of 23, 22, 21, 18, and 15, respectively. Some significant differences ($p < 0.05$) existed amongst the samples except that EFA (95:5 - Maize:Mucuna flour) and EMU (90:10 - Maize:Mucuna flour) did not differ between each other. This showed how easily the particles can get dissolved and disintegrated in water. The chemical and physical properties of the solvent and solute, as well as pressure, pH, temperature and the presence of additional chemical in the solution, all influence the solubility of a substance (Ramos *et al*., 2022).

Flour samples had bulk densities ranging from 0.5 to 0.92 g/100 ml. The samples' bulk densities differed significantly ($p < 0.05$). The lowest value (0.50) was registered by sample ABC (100:0 – Maize:Mucuna flour) while the highest value (0.92) was registered by sample UZY (80:20 – Maize:Mucuna flour). The bulk density increased with increase in *Mucuna pruriens* seed flour inclusion. The difference in bulk density could be due to variations in starch content. Starch content enhanced bulk density, according to Iwe and Onadipe (2001). This could explain why maize flour had a low bulk density in this research. Bulk density is affected by a variety of elements, including the technique of measurement, geometry, size, solid density, and surface qualities of the materials, and can be improved when the particles are small, compactible, properly tapped/vibrated and with a suitable packaging material. Bulk density refers to the relative volume of packaging material needed. The denser the packaging material, the higher the bulk density. It indicates a product's porosity, which has an impact on packaging design and can be used to determine the type of packing material required (Shrivastava, 2018).

The results of the pH showed that the flour blends for sample ABC, EFA, EMU, PRO, and UZY were more alkaline (8.00, 8.60, 8.67, 9.40, 9.40). All of the pH readings were significantly different ($p < 0.05$). The pH increased with inclusion of Mucuna seed flour making them more alkaline. On a scale of 1.0 to 14.0, pH is a measurement of the hydrogen ion concentration in water (Ramos *et al*., 2022). Many functional qualities of food, such as colour, flavour and texture are influenced by pH. Microbial development in meals is also influenced by the pH of the food. The lower the pH, the more acidic the water. The more basic or alkaline water is, the higher the pH. pH has an impact on many chemical and biological processes in water and various organisms thrive in different pH ranges (Ramos *et al*., 2022).

Sensory evaluation of Maize-based snacks complemented with *Mucuna pruriens* seed flour

The sensory scores of maize-based snacks complemented with *Mucuna pruriens* seed flour are shown in Table 3. There were significant ($p < 0.05$) variations in the colour of the samples. The snacks had mean scores ranging from 6.33 to 8.33. Except for sample ABC (100:0 – Maize:Mucuna flour) which differed from the other samples, the rest of the samples were not significantly different from each other and were within the score of 6 indicating they liked the colour slightly. With the increased inclusion of *Mucuna pruriens* seed flour, the colour of the snacks darkened and the colour scores got reduced.

Table 3: Sensory evaluation of maize-bases snacks complemented with *Mucuna pruriens* seed flour

Sample code	Maize: Mucuna	Colour	Texture	Taste	Flavour	Overall acceptability
ABC	100:0	$8.33^a \pm 0.58$	$7.00^a \pm 1.00$	$7.67^a \pm 0.58$	$8.67^a \pm 0.58$	$8.33^a \pm 0.58$
EFA	95:5	$6.33^b \pm 2.08$	$6.67^a \pm 0.58$	$6.00^{ab} \pm 0.00$	$7.33^{ab} \pm 0.58$	$7.00^b \pm 1.00$
EMU	90:10	$6.33^b \pm 0.58$	$6.67^a \pm 0.58$	$6.67^{ab} \pm 1.53$	$7.00^{bc} \pm 1.00$	$7.00^b \pm 0.00$
PRO	85:15	$6.33^b \pm 1.15$	$6.33^a \pm 1.53$	$6.33^{ab} \pm 0.58$	$5.67^c \pm 0.58$	$6.67^b \pm 0.58$
UZY	80:20	$6.67^b \pm 0.58$	$6.33^a \pm 1.53$	$5.67^c \pm 1.15$	$7.00^{bc} \pm 1.00$	$6.33^c \pm 0.58$

Values are means ± standard deviation of triplicate results. Values in the same column with different letters are significantly different ($p < 0.05$).

This could be as a result of the oxidative conversion of the L-3,4 dihydroxyphenylalanine (L-DOPA) in *Mucuna pruriens* seed to dopamine and other oxidation products (Avoseh *et al*., 2020). Apart from sample ABC (100:0 – Maize:Mucuna flour), the dark colour of the rest of the samples overshadowed the golden brown colour that the flaking process ought to have achieved. Colour is a key parameter in evaluating the quality of flaked and baked items and ultimately influence consumers choice. Colour gives an insight on the raw materials used in the preparation and also provides information about the product's constituents, formulation and quality (Feyera, 2020).

There was no significant difference ($p < 0.05$) in the texture of the flaked snacks. The range of the scores for texture was from 6.33 - 7.00. This implied that the addition of *Mucuna pruriens* seed flour to the samples did to influence the texture quality of the snacks. Texture determines how a food snack feels (Netshishivhe *et al*., 2019). All the flaked snacks samples were crispy. The texture scores provided important and insight on the compatibility of the Maize and *Mucuna pruriens* seed flours.

The flaked snacks had significant differences ($p < 0.05$) in taste and their values ranged from 5.67 to 7.67, with the UZY (80:20 Maize:Mucuna flour) having the lowest taste score of 5.67 and the control sample (ABC; 100:0 Maize:Mucuna flour) having the highest taste of 7.67. Scores for taste reduced as the percentage of *Mucuna pruriens* seed flour increased. EFA (95:5 - Maize:Mucuna flour), EMU (90:10 - Maize:Mucuna flour) and PRO (85:15 - Maize:Mucuna flour) did not differ ($p > 0.05$) from each other. Taste has been described to be the sensation of flavour perceived in the mouth and throat caused by contact with a material and it is one of the most significant characteristics to look out for in a food product (Olurin *et al*., 2021). The taste of food products is highly dependent on the quality of ingredients used in preparing the food product.

All of the samples demonstrated a significant difference ($p < 0.05$) in flavour. They varied from 5.67 to 8.67, with the PRO (85:15 Maize:Mucuna flour) sample having the least and the control (ABC, 100 % maize) sample having the most. Apart from the control which registered the highest flavour score, sample EFA (95:5 Maize:Mucuna) blend had the second to highest score for flavour. Because EFA was the most accepted aside ABC (100% maize), it may be the finest blend for maize-based snacks fortified with *Mucuna pruriens* flour.

There were significant differences ($p < 0.05$) in the overall acceptability of the snacks. The 100% maize flour flakes (ABC – control sample) received the highest score of 8.33. Overall acceptability also decreased with increase in the inclusion of *Mucuna pruriens* seed flour and *Mucuna pruriens* substitution at a 20% level (UZY) reduced the overall acceptability from 8.33 to 6.33 ± 0.58. Aside from the control (ABC), EFA (95:5 Maize:Mucuna flour) scored second in overall acceptability of flaked snacks. Other sensory qualities were also decreased as *Mucuna pruriens* seed flour inclusion increased which has direct relationship with the overall acceptability and is comparable to the trend and relationship documented by Aminigo and Akingbala (2004).

CONCLUSION

Mucuna pruriens seed flour can be used to improve the protein content of Maize based flaked snacks. *Mucuna pruriens* seed flour inclusion in maize-based flaked snacks increase bulk density and reduce water absorption capacity of the snacks. *Mucuna pruriens* seed flour inclusion in maize-based flaked snacks darkens its colour and reduces the overall acceptability of the snacks. The best level of inclusion of *Mucuna pruriens* seed flours in maize-based flaked snacks based on overall acceptability scores is 10% (90:10 – Maize:Mucuna flour) and contains 7.20 % crude protein and 7.40 % crude fibre.

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