

Sensory evaluation and acceptability of some selected lima bean products at Erin-Oke, Osun State, Nigeria

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Abstract

Lima bean is a nutritious legume and a potential food crop for addressing malnutrition and enhancing food and nutrition security in the country. It is one of the underutilized legumes in Nigeria due to lack of knowledge on its processing and utilization potentials. Processing and utilization of lima beans were promoted through evaluation of acceptability of some selected products from lima bean among the farmers in Erin-Oke in Osun State of Nigeria. Lima bean was processed into cooked lima beans, lima bean *daddawa* (*iru*), plantain-lima bean *momo*, wheat-lima bean biscuit and wheat-lima bean *chinchin*. The lima bean products were sensory evaluated and compared with the conventional products that the farmers were familiar with. Results showed that cooked lima bean was preferred over cooked cowpea in terms of colour, appearance and flavor. Lima bean *daddawa* and locust bean *daddawa*; plantain lima *momo* and the normal *momo* were not significantly different ($p < 0.05$) in flavor, texture, taste and overall acceptability respectively. Similarly, wheat-lima bean biscuit and plain wheat biscuit were not significantly different ($p < 0.05$) in the colour, appearance, taste and overall acceptability. Plain-wheat *chinchin* and wheat-lima *chinchin* were accepted in all the sensory attributes evaluated. All the lima bean products disseminated and evaluated were accepted by the farmers. The high acceptability of the lima bean products by farmers in Erin-Oke is expected to facilitate improved lima bean production and utilization in Nigeria and subsequently enhance food and nutrition security.

Keywords: Lima bean, Processing, Utilization, Promotion, Acceptability

Introduction

Legumes are important food protein source through-out the world, particularly in the developing countries where they serve as alternative to animal protein. Vegetable proteins are cheaper and more accessible compared with animal protein such as meat, fish, and egg (Siddhuraju *et al.*, 2002). Legumes are important cultural crops that have been known for their significant roles in the description of the food patterns of many tribes in Nigeria particularly among the Yoruba people of Southwest Nigeria.

Lima bean (*Phaseolus lunatus*) is one of the underutilized legumes that are already going into extinction in Nigeria. This may be due to lack of knowledge and awareness on the processing technologies for optimal

utilization of these food crops (Olanipekun *et al.*, 2017). Lima bean seeds are good sources of macronutrients including proteins, carbohydrates and fiber (Kathirvel and Kumudha, 2011). Lima beans contain both soluble and insoluble fibre which makes it a very good food crop for blood sugar regulation. Lima bean has been reported to have both anti-hypoglycemic and anti-hypolipidemic effect (Ojo *et al.*, 2013). Lima beans are also rich in important minerals such as calcium, potassium, phosphorus, iron and zinc. Different products of nutritional value have been produced from lima beans (Farinde *et al.*, 2011, 2017a&b)

Lima bean *daddawa (iru)* is a fermented condiment, and an alternative to locust bean *daddawa* (Farinde *et al.*, 2011; 2014; 2017). *Daddawa* improves flavor and taste in soup and also serves as meat or fish alternative in the diet of the poor populace in Nigeria and some West African communities. Locust bean has been the traditional raw material for processing *daddawa* and farmers are familiar with the processing technology of locust bean into *daddawa*. Lima bean *daddawa* is nutritious and compared well with locust bean *daddawa* in terms of nutrients composition (Farinde *et al.*, 2011).

Cooked beans from cowpea are a traditional popular plant protein diet for majority of people in Nigeria. It is consumed by both the young and old. It is usually cooked plain and served with fried pepper sauce as "*Ewa-woro*" or it is cooked in form of porridge with addition of pepper, palm oil, onions and salt as "*Ewa-pete*" or "*Adalu*" among the yorubas. It is also cooked in combination with cereals such as rice and maize, and tubers such as yam and potatoes to fortify the carbohydrate based sources with plant protein. In Nigeria, Lima beans have been traditionally consumed the same way cowpeas are consumed, i.e. as sole cooked beans or mixed with cereals such as rice and maize or tuber such as yam and potatoes but its' utilization this way started to reduce due to drudgery in its dehulling and prolonged cooking. This also removes lima beans consumption or utilization from the food pattern of the people of western Nigeria. In a study by Farinde *et al.* (2018), cooking time for lima beans was reduced to 2 hours from the usual cooking time of about 4 hour and above by first soaking the bean seeds in water for 8 to 10 h prior cooking. Cooked beans have been found to be nutritious (Rocha-Guzman *et al.*, 2013; Farinde *et al.*, 2017b). Hence, concentration of research efforts on the propagation, processing, utilization and reintegration of lima beans into the food pattern of the people of western Nigeria.

Diverse Lima beans products such as baked and cooked lima beans, lima bean *daddawa (iru)*, lima bean soup (*gbegiri*), lima bean veggie; lima bean flour, lima bean *akara* and maize-lima bean *ogi*, plantain-lima bean *momo*, wheat-lima bean biscuit and wheat-lima bean *chinchin* were produced for dissemination to people for household consumption, acquisition of entrepreneurial and vocational skills and job creation for rural women (Farinde, 2019).

Momo is a traditional food diet of people of Osun, Ondo and Ekiti States of Nigeria. It is usually prepared from unripe plantain. The plantain is normally peeled, sliced, dried and milled into powder. The plantain flour is then reconstituted in water and made into paste; palm oil, pepper and salt are then added. The plantain paste and the ingredients are mixed, wrapped in cooking leaves and steamed to cook.

Biscuit belong to the flour confectionary. Biscuits are usually flat crisps which may or may not be sweetened. Biscuit can be made into varieties; crackers from hard dough, digestives and rich tea from sweet hard dough, short bread and short cake from soft dough. It is usually produced from unfermented dough and baked in an oven. Wheat flour is the conventional and fundamental ingredient for biscuit production (Zoullias *et al.*, 2002). Biscuits are consumed extensively in Nigeria as a snack, ready-to-eat and convenient food.

Chinchin also belong to the flour confectionary. *Chinchin* is one of the popular snacks in Nigeria and West Africa at large. It is made by mixing wheat flour, butter, sugar and egg into a dough (Akubor, 2004). The dough is then kneaded, rolled tightly to 1cm thickness on a board and cut into small sizes, usually cubed or rectangular shape prior to frying. *Chinchin* is made conventionally from wheat flour.

The objective of the work was to promote lima bean processing and utilization through assessment of acceptability of some selected lima bean products among the farmers in Erin-Oke in Osun State of Nigeria.

Materials and Methods

Demonstration of lima beans processing technologies

Appropriate processing technologies for lima beans into selected food products (Farinde, 2019) were demonstrated to farmers in Erin-Oke, Osun State, Nigeria. A total number of fifty four (54) farmers including male and female participated in the training. The women assisted in the processing of the food products while the men watch the demonstration activities. The health and economic benefits of the lima bean products were highlighted to the farmers. Importance of food safety and hygiene during processing was also discussed. Farmers were allowed to ask questions for better understanding and clarification.

Processing of lima beans into products

Lima bean was processed into five type of products, the products were selected to represent whole lima bean products (Lima bean *daddawa*, cooked lima beans) and products fortified with lima bean (plantain-lima bean *momo*, wheat-lima bean biscuit and wheat-lima bean chinchin).

Cooked lima beans

Cooked lima beans were processed using modified method of Farinde *et al.* (2018). Lima bean seeds (500g) were sorted, cleaned and soaked in water (1litre) for 10 – 12 h or overnight. The soaked beans were washed thoroughly in portable tap water three times so as to properly wash off the soaking water. The soaked beans were drained and the beans put in a pressure cooking pot, water (about 1.5 litres) was added to the beans, two big sliced onions (450 g) and half teaspoon salt (2 g) was added. The pressure pot and the content were placed on gas cooker and cooked for about 1 hour. Cooking water was allowed to dry with the beans so as to retain the nutrients that must have been leached into the cooking water. The cooked beans were served with fried pepper sauce.

Lima bean daddawa

Lima bean *daddawa* was processed using the method described by Farinde *et al.* (2014). Lima bean seeds were sorted to remove dirt and broken beans. The beans were roasted in open frying pan for about 10 minutes. The roasted beans were dropped in boiling water and boiled for about 20 minutes. The roasted, boiled beans were dehulled manually by robbing the beans between palms and washing off the beans coats with water. The dehulled beans were cooked for 30 minutes using pressure cooker during which the beans became soft. The cooked beans were drained and poured while still warm into clean calabash lined with clean banana leaves, another set of clean banana leaves were placed on the cooked beans in the calabash and this was covered with another clean calabash. This was to provide warm environment (35 – 45°C) for fermentation of the beans. The calabash with its content was placed in a warm place for 3 days (72 h).

Plantain-lima bean momo

Plantain-lima momo was processed from composite mixture of unripe plantain and lima bean flour. Plantain flour and lima bean flour were mixed in ratio 3:1, i.e. 3 cups of plantain flour to 1 cup of lima bean flour in a bowl. Lima bean seeds (1 cup) was soaked overnight and half cooked. Cooking water was allowed to dry with the beans. To the mixture of plantain flour and lima bean flour was added grinded pepper (120 g), grinded onions (300 g), palm oil (65 ML), water (500 ML) and salt (4 g). The mixture was mixed together with spoon. Cooked lima beans were then added to serve as fish or meat in the *momo*. The mixture was mixed again and then wrapped in already washed and dried clean cooking leaves (*Thaumatococcus daniellii*). The leaves and the content were placed in cooking pot containing boiling water on gas cooker and steamed for about 40 min. Steamed *momo* was removed from fire and allowed to cool. (Farinde, 2019)

Wheat-lima bean biscuit

Processing of wheat-lima bean biscuit was carried out following the method described for cassava cookies (Sanni *et al.*, 2006) and wheat-muchroom cookies (Bello *et al.*, 2017) with slight modification (Farinde, 2019). Composite mixture of wheat flour and lima bean flour in the ratio 3:1, i.e. 3 cups of wheat flour (300 g) and 1 cup (100g) of lima bean flour was used. Both flours were weighed and mix in a bowl. To the mixture of the flour was added ½ cup of sugar (50 g), 3 heaped table spoon of margarine (150 g), ¼ teaspoon of baking powder (1g), nutmeg (1 g), and one medium sized egg (45 g). The ingredients were mixed together and water (75 mL) was added and then mixed thoroughly to form a consistent dough. The dough obtained was kneaded on a clean flat board for about 5 min and thinly rolled out using rolling pin to uniform thickness of 5 mm and cut out to desired shapes of uniform sizes using biscuit cutter. The cut out dough pieces were placed on greased baking tray and baked at 160°C for 15 min. The biscuits were cooled hygienically and packaged in packaging polythene.

Wheat-lima bean chinchin

Processing of *chinchin* was carried out following the method described by Adebayo-Adetoro *et al.* 2017; Farinde, 2019). Wheat-lima bean *chinchin* was processed from composite mixture of wheat and lima bean flour in the ratio 3:1, i.e. 3 cups of wheat flour (300 g) and 1 cup (100g) of lima bean flour. To the mixture in a bowl was added 1 cup of sugar (100 g), 1 heaped table spoon of margarine (50 g), One teaspoon of nut meg (5 g) and 1 teaspoon of baking powder (5g). One big Egg (45 g) was whisked and added to the mixture, three quarter to one cup of water (70 to 100 mL) was added and the mixture was mixed together with fingers until a stiff consistency of smooth dough was obtained. The dough was rolled evenly on a floured board, and then cut into desired shapes and sizes. The cut doughs were deep fried in vegetable oil until golden brown. Excess oil was drained from the *chinchin*, cooled and packed in clean packaging plastic containers with tight covers.

Sensory evaluation of the selected lima bean products

The method of Iwe (2002) was used to evaluate and assess the acceptability of the lima beans products. Lima bean was processed into lima bean *daddawa*, cooked lima beans, plantain-lima *momo*, wheat-lima biscuit and wheat-lima *chinchin* (Farinde, 2019). Conventional similar products from cowpea, locust bean and whole wheat flour that farmers are familiar with were also provided. Thirty educated farmers who have secondary school education and above (Twenty female and ten male) were selected as semi trained panelists and were trained briefly on sensory evaluation method. These represented more than half of the entire participants. The lima bean products as well as the similar conventional products were coded and presented to these selected farmers (used as sensory panel). The panelists were seated separately at a distance in such a way that none of them could see the evaluation of the other. The farmers (panelists) were provided with water for mouth rinsing after each tasting. The farmers were asked to score the products for colour, appearance, flavor, texture, taste and overall acceptability. The panelists were asked to score the attributes using 9-point hedonic scale where 1 represents dislike extremely and 9 represent like extremely. Data obtained were subjected to Analysis of Variance (ANOVA) using SPSS version 20. Means were separated by Duncan Multiple range test. Acceptance was determined at 5% significant level.

Results and Discussion

Result of sensory scores by farmers in Erin-Oke for the cooked lima beans and cooked cowpea is shown in Table 1. Both cooked lima beans and cooked cowpea recorded scores ranging between 6.5 and 8.1 in all the sensory attributes evaluated, an indication that they were both accepted. There was no significant difference ($p < 0.05$) in the taste and overall acceptability of cooked lima beans and cooked cowpea. Cooked lima bean was preferred in terms of colour, appearance and flavour while cooked cowpea was preferred in terms of texture. Both cooked lima bean and cooked cowpea were accepted in all the attributes evaluated. Previous study by Farinde *et al.* (2017) reported high acceptability for cooked lima bean. Table 2 presents the result of the sensory scores by

farmers in Erin-Oke for lima bean *daddawa* and locust bean *daddawa*. Both lima bean *daddawa* and locust bean *daddawa* recorded high scores for the sensory evaluation, ranging between 6.4 and 7.9, an indication that they were both well accepted. Lima bean *daddawa* compared favorably well with locust bean *daddawa* as both *daddawa* were not significantly different ($p < 0.05$) in the flavor, texture, taste and overall acceptability. However, locust bean *daddawa* was preferred in terms of colour and appearance. Both *daddawa* samples were accepted in all the sensory attributes evaluated. Previous study by Farinde et al. (2011) showed high acceptability of lima bean *daddawa* when sensory evaluated.

Table 3 shows the result of the sensory scores by farmers in Erin-Oke for plantain-lima bean *momo* and plain plantain *momo*. Plantain *momo* is an indigenous food of people of Erin-Oke. Plantain has been known to be a very good source of dietary fibre, and an anti-diabetics food due to its resistance starch content (Garcia-Valle et al., 2019). Fortifying it with lima bean empowered the food the more, by improving the protein content of the product. Plantain-lima *momo* and plain plantain *momo* were not significantly different ($p < 0.05$) in the flavor, texture, taste and overall acceptability. Both the plain plantain *momo* and plantain lima- *momo* were accepted in all the sensory attributes.

Biscuit and *chinchin* are popular snacks conventionally made from wheat. These snacks could have their nutritional status improved through fortification. Wheat biscuit was fortified with lima bean. Table 4 compares the result of sensory scores by the farmers in Erin-Oke for wheat-lima biscuit and plain wheat biscuit. Both wheat-lima biscuit and plain wheat biscuit were not significantly different ($p < 0.05$) in colour, appearance, taste and overall acceptability. Atobatele and Afolabi (2016) similarly reported no significance difference in the colour, texture, taste and overall acceptability of cookies produced from whole maize flour and mixture of maize and soybean flour at ratio 70:30. However this present study showed that plain wheat biscuit was preferred in terms of flavor and texture. Both wheat-lima biscuit and plain wheat biscuit were accepted in all the sensory attributes.

Wheat *chinchin* was also fortified with lima bean. Studies have shown nutritional improvement in *chinchin* through fortification with legumes, nuts and vegetables (Adebayo-Adetoro et al., 2017; Akindele et al., 2017). Acceptability of wheat-lima *chinchin* and plain wheat *chinchin* by farmers in Erin-Oke were compared (Table 5). Wheat-lima *chinchin* and plain wheat *chinchin* were significantly different ($p < 0.05$) in flavor and texture but not significantly different ($p < 0.05$) in terms of colour, appearance, taste and overall acceptability. Lima bean *chinchin* compared very well with plain wheat *chinchin*. Both wheat-lima *chinchin* and plain wheat *chinchin* were accepted in all the sensory attributes tested.

Conclusion

The selected lima bean products that were disseminated and evaluated for consumer acceptability by the farmers in Erin-Oke, Osun State were all accepted. This is an indication that the farmers are willing to adopt the technologies. Processing of lima beans into whole beans diets as in cooked beans and *daddawa*, fortification of food crops with lima bean as in plantain lima bean *momo*, wheat- lima biscuit and wheat-lima *chinchin* will provide dietary varieties of improved nutrition and livelihood for the farmer's households. High acceptability recorded for these products by the farmers in Erin-Oke is expected to enhance the utilization potentials of lima bean and subsequently improve the cultivation and production of the beans. It is recommended that the dissemination and evaluation of lima bean products be extended to other communities and States in Nigeria. This will go a long way to enhancing food and nutrition security in the country.

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Conflict of Interests

The authors declare no conflict of interests

Tables, Figures and Charts

Table 1: Sensory scores for cooked lima bean and cooked cowpea

Sample	Colour	Appearance	Flavour	Texture	Taste	Overall acceptability
DR	7.5 ± 0.01 ^a	7.4 ± 0.03 ^a	8.6 ± 0.05 ^a	6.5 ± 0.05 ^b	7.9 ± 0.05 ^a	7.9 ± 0.06 ^a
DF	6.5 ± 0.02 ^b	6.3 ± 0.01 ^b	6.7 ± 0.01 ^b	7.1 ± 0.07 ^a	7.8 ± 0.04 ^a	8.1 ± 0.06 ^a

n = 30. Means with the same superscript are not significantly different at p<0.05

DR = Cooked lima beans; DF = Cooked cowpea

Table 2: Sensory scores for lima bean *daddawa* and locust bean *daddawa*

Sample	Colour	Appearance	Flavour	Texture	Taste	Overall acceptability
LD	6.4 ± 0.10 ^b	6.8 ± 0.07 ^b	7.3 ± 0.05 ^a	6.7 ± 0.05 ^a	6.9 ± 0.10 ^a	6.9 ± 0.06 ^a
CD	7.4 ± 0.12 ^a	7.9 ± 0.07 ^a	7.5 ± 0.11 ^a	7.0 ± 0.07 ^a	7.2 ± 0.08 ^a	7.0 ± 0.05 ^a

n = 30. Means with the same superscript are not significantly different at p<0.05

LD = Lima bean *daddawa*; CD = Locust bean *daddawa*

Table 3: Sensory score for plantain- lima *momo* and plain plantain *momo*

Sample	Colour	Appearance	Flavour	Texture	Taste	Overall acceptability
PM	6.3 ± 0.10 ^b	6.3 ± 0.07 ^b	7.6 ± 0.05 ^a	6.8 ± 0.05 ^a	8.0 ± 0.10 ^a	7.8 ± 0.06 ^a
PN	6.9 ± 0.12 ^a	7.0 ± 0.07 ^a	7.8 ± 0.11 ^a	6.6 ± 0.07 ^a	8.0 ± 0.08 ^a	7.6 ± 0.05 ^a

n = 30. Means with the same superscript are not significantly different at p<0.05

PM = Plantain-lima *momo*; PN = Plain plantain *momo*

Table 4: Sensory scores for wheat-lima biscuit and plain wheat biscuit

Sample	Colour	Appearance	Flavour	Texture	Taste	Overall acceptability
LB	7.3 ± 0.10 ^a	7.4 ± 0.05 ^a	6.5 ± 0.01 ^b	6.9 ± 0.02 ^b	7.9 ± 0.10 ^a	7.7 ± 0.05 ^a
WB	7.6 ± 0.01 ^a	7.3 ± 0.07 ^a	7.0 ± 0.01 ^a	7.3 ± 0.07 ^a	8.0 ± 0.10 ^a	7.9 ± 0.05 ^a

n = 30. Means with the same superscript are not significantly different p<0.05

LB = Wheat-lima biscuit; WB = Plain Wheat biscuit

Table 5: Sensory scores for wheat-lima chinchin and plain wheat chinchin

Sample	Colour	Appearance	Flavour	Texture	Taste	Overall acceptability
LC	6.8 ± 0.10 ^a	7.1 ± 0.05 ^a	6.5 ± 0.01 ^b	6.9 ± 0.02 ^b	7.9 ± 0.10 ^a	7.2 ± 0.05 ^a
WC	7.2 ± 0.01 ^a	7.3 ± 0.07 ^a	7.0 ± 0.01 ^a	7.3 ± 0.07 ^a	8.0 ± 0.10 ^a	7.2 ± 0.05 ^a

n = 30. Means with the same superscript are not significantly different at p<0.05

LC = Wheat-lima biscuit ; WC = Plain Wheat biscuit

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