Consumption pattern and standardization of some food recipes from Lima Bean in Kaduna State, Northwestern Nigeria

Dankat Charity Baliyat[1,2,] Owolabi Olumuyiwa Adeyemi[1] and Okolo Ijeoma[1]

[1]*Department of Biochemistry, Ahmadu Bello University Zaria, Kaduna State*
[2]*Department of Home Economics, Kaduna State College of Education Gidan-waya, Kafanchan,*

*Corresponding author: cdankat@gmail.com

ABSTRACT

Background: *Adequate nutrients are vital for healthy growth and development, in this regard, assessing the nutrient content of foods is very essential. However, many Nigerian dishes are difficult to assess because, they have not been standardized.*

Objective*: This study was carried out to assess the consumption frequency of lima bean foods and to standardize the commonly consumed lima bean foods in Kaduna State.*

Methods*: A validated semi-structured questionnaire was used to obtain information on the consumption of lima bean foods. The study involved 400 households selected using a multi-stage sampling technique. The means for each ingredient of commonly consumed foods were calculated from twenty randomly selected recipes and then used for the preparation of the standardized foods. These foods were then subjected to sensory analysis using standard procedures.*

Results*: Data revealed that only 54.3% of the population consumed lima bean foods, four out of ten (23.1%) of the respondents consumed lima beans at least once to twice a week with 17.5% consuming only once or occasionally per year. The most consumed lima bean foods in Kaduna state are lima bean porridge (64.9%), followed by lima bean-benniseed (14.8%) and lima bean-hungry rice (11.5%). All the foods scored more than 3, the benchmark for acceptability.*

Conclusion*: The three commonly consumed lima bean foods were considered acceptable. There is need for an increase extension work in the utilization of lima bean foods to help in alleviating the effects of malnutrition.*

Keywords: Standardization, Lima bean, Foods, Consumption, Sensory attributes

INTRODUCTION

Micronutrients are vital to healthy development and disease prevention. These nutrients are required in small amounts and are derived from diets; insufficient intake from the diet may lead to hidden hunger or micronutrient deficiency states (1). Nutrient deficiencies account for a significant number of child deaths, child undernutrition, wasting, and stunting as well as delayed child cognitive development (2). Millions of people are suffering from different forms of malnutrition, about 1.9 billion adults are overweight or obese while 462 million are underweight and 52 million under-fives are suffering from wasting, where they have low weight for height (3). In Nigeria, nearly 37% children under-fives are stunted which is an indication of chronic undernutrition

while 28% mothers age 15-49 are overweight or obese (4). One of the effective nutrition intervention methods is the food-based strategies (5).

Animal protein is expensive (6) therefore, diets can be supplemented with legumes which are cheaper sources of protein and important source of minerals. Most legumes are poorly utilized due to the presence of antinutritional factors which can cause stomach cramping, diarrhea, flatulence and vomiting (7). Lima beans are underutilized in many parts of tropical Africa probably due to its hard-to cook phenomenon (8). Cooking and some traditional methods of processing cause significant reduction in antinutritional factors (9). The proximate, antinutrients and mineral composition of common foods from Lima beans was recently published by (10). Lima beans foods can be used as one of the complementary foods for children to ensure adequate nutrient for optimum growth and development. The World Health Organization (WHO) recommends introduction of appropriate, adequate and safe complementary foods at six months along with continuing breastfeeding up to two years (11). Also improving infant feeding practices among children under five years could reduce the risk of malnutrition and its consequences (12).

As efforts are being made to combat malnutrition, there is need to provide information on how standardization of food recipes from legumes affects their acceptability, thereby impacting their use as complementary foods. Therefore, this work was undertaken in order to ascertain the consumption pattern and standardization of commonly consumed Lima beans in Kaduna State.

METHODOLOGY
Research Design
The study was a cross-sectional survey design.

Study Population
The study was conducted in three randomly selected LGA of Kaduna state, Kaura, Chikun and Sabon Gari Local Government Areas, one LGA per each senatorial zone of the state. Kaduna state lies on the geographical coordinates of 10°31'23'N/7°26'25'E. The study population consisted of 400 households with at least one under-five child in the randomly selected community.

Sample Size
The minimum sample size was calculated to be 384 using Cochran formula (13) as shown below:

$$ n = t^2 \times \frac{p(1-p)}{M^2} $$

where,
n = required sample size
t = confidence level at 95% (standard value of 1.96)
p = proportion in the target population estimated to have a particular characteristic (set at 0.5 because the proportion is not known)
M = margin of error at 5% (standard value of 0.05). Adjusted for design defect and non-response cases

Sampling procedure
A multistage sampling procedure was used to select households following these procedures:
i. The Local Government Areas in each senatorial districts of Kaduna state were listed alphabetically and one Local Government Area from each senatorial zone was randomly selected using Random Integers Generator-RIG (14).
ii. Each randomly selected Local Government Area was then stratified into North and South.
   Using the RIG as above, one ward each was selected per strata of the selected LGA, making a total of two communities/wards per Local Government Area.
iii. The households in the selected community were then listed and the eligible ones noted. The number of eligible households required per ward/community was selected using probability proportional to size based on the calculated sample size. (Table 1).

Using the hat method, the number of required households was randomly selected.

Data Collection
Informed consent was obtained from all participants prior to the commencement of the survey. Pre-tested semi-structured questionnaire was used to obtain information regarding the frequency of consumption of lima bean foods and methods of preparing different dishes using lima beans. The questionnaire was administered to

participants and retrieval was done immediately after completion of the questionnaire.

Purchase of Materials

All seeds and ingredients for recipe standardization were purchased from Sabo market in Kaduna South Local Government Area of Kaduna State, Nigeria. The seeds obtained are; Dry Lima beans (*Phaseolus lunatus*), hungry-rice (*Digitaria exilis*) and benniseed (*Sesamum radiatum*). Other items purchased are: beef, dry curry powder, dry thyme, salt, tomatoes, onions, palm oil, red chilli pepper, Knorr bouillon cubes, sunflower vegetable oil. The seeds were then identified at the herbarium of Department of Botany, Ahmadu Bello University, Zaria, Kaduna state. The seeds were then cleaned and sorted by hand and kept at room temperature until use.

Standardization and Preparation of the Dishes

Standardization was done according to the method described by (15). The dishes were prepared using ingredients listed in Table 2. The amount of ingredients used for standardized recipe was obtained by calculating the means of 20 randomly selected recipes described by the respondents. Cooking was done with the following standardized recipes at the kitchen facilities of the Department of Home Economics of the Kaduna state College of Education, Gidan-waya, Kaduna state, with the assistance of selected women with broad knowledge in the preparation of the selected dishes.

I. Preparation of Lima bean porridge dish

1. Rinsed beans
2. Par-boiled beans for 1 hour
3. Seasoned beef with bouillon cubes, thyme, curry, onions, salt and cooked for 40 minutes
4. Drained beans and par-boiled a second time for 20 minutes after which the beans were drained
5. Poured vegetable oil into frying pan and heat for 2 minutes then fried beef for 15 minutes
6. Sliced tomatoes, pepper and onions
7. Poured palm-oil into the pot and heat for 2 minutes then added the sliced ingredients and fried for 10 minutes
8. Added 340mls of broth from cooked beef and brought to a boil
9. Added beans and allowed to cook 20 minutes

II. Preparation of Lima bean hungry-rice dish

1. Rinsed beans and hungry rice to remove tiny stones
2. Par-boiled beans for 1 hour
3. Seasoned beef with curry, thyme, bouillon cubes, onions, salt and cooked for 40 minutes
4. Drained beans and parboiled a second time for 20 minutes after which the beans were drained
5. Poured vegetable oil into frying pan and heat for 3 minutes then fried beef for 15 minutes
6. Sliced tomatoes, pepper and onions
7. Poured palm-oil into the pot and heat for 2 minutes then added the sliced ingredients and fried for 10 minutes
8. Added 900ml of water (broth water inclusive) and brought to boil
9. Added hungry rice and cooked for 10 minutes

III. Preparation of Lima bean benniseed dish

1. Rinsed beans and Par-boiled beans for 1 hour
2. Seasoned beef with bouillon cubes, thyme, curry, onions, salt and cooked for 40 minutes
3. Drained beans and par-boiled a second time for 20 minutes after which the beans were drained
4. Roasted benniseed for 3 minutes
5. Grinded benniseed
6. Poured vegetable oil into frying pan and heat for 2 minutes then put beef into oil and fried for 15 minutes
7. Sliced tomatoes, pepper and onions
8. Poured palm-oil into the pot and heat for 2 minutes then added the sliced ingredients and fried for 10 minutes
9. Added 340mls of broth from cooked beef and brought to a boil
10. Added beans and allowed to cook for 20 minutes
11. Added benniseed to cooked beans and mixed

Sensory evaluation

The evaluation session was carried out by semi-trained panelist consisting of ten members using

5-points hedonic scale (1-Dislike very much; 2 - Dislike; 3 -Neither like nor dislike; 4 -Like; 5-Like very much) to evaluate the samples for colour, taste, texture, aroma and overall acceptability. (16)

Statistical analysis

The results are expressed as mean ± standard deviation except where otherwise stated. The data was analyzed by descriptive statistics and analysis of variance (ANOVA) using Statistical Package for the Social Sciences (SPSS), version 20. Duncan multiple range test was used for multiple mean comparison tests and pvalues less than 0.05 (P<0.05) was taken as significant.

RESULTS

Distribution of Respondents by Local Government Areas, Wards and Communities in Kaduna State.

Table 1. shows the study area and distribution of respondents selected for the study.

Standardized Lima Beans (*Phaseolus lunatus*) Foods in Kaduna State

Table 2 presents three most preferred foods consumed in Kaduna State that were standardized, it shows the ingredients and, quantity of ingredients used in preparing the foods.

Socio-demographic Characteristics of Caregivers in selected Households in Kaduna State

The socio-demographic characteristics of caregivers of selected households in Kaduna state are presented in Table 3. The study populations (43.3%) were mainly within the age range 31-40. Most (79%) caregivers were females and 86% of the respondents were married while 13% were single and 1% divorced. About 58% of the caregivers had a household size within the range of numbers 4-6, 24.3% had 7-9 and 9.3% had 10-12. In terms of the ethnic group, 16.8% of the respondents were Kataf, 13.8% were Hausa and about 36% were of other ethnic groups.

Pattern of Consumption of Lima Bean (*Phaseolus lunatus*) Foods in Kaduna State.

Table 4. shows the frequency of consumption of lima bean foods. The percentage of households consuming lima bean foods weekly, monthly and yearly indicates that 54.3% of the respondents consume lima bean foods, with 19.4%, 44.7%, and 12.4% consuming it once weekly, monthly and yearly respectively. Also, the result reveals that more than half (76.5%) of the respondents consume more of cowpea than lima beans, 77.9% accepted that lima beans taste better than cowpea while 91.2% find cooking lima beans to be more difficult than cooking cowpea.

Commonly Consumed Lima Beans (*Phaseolus lunatus*) Foods in Kaduna State

Lima bean foods that are commonly consumed in Kaduna State are presented in Table 5. It shows the types of foods processed from lima beans with the most preferred being lima bean porridge (64.9%), followed by lima bean-benniseed (14.8%) and lima bean-hungry rice (11.5%). Other lima beans foods are; lima bean-rice, lima bean-maize pate, lima bean-guinea corn, lima bean-yam.

Sensory Attributes of Standardized Commonly Consumed Lima Bean (*Phaseolus lunatus*) Foods in Kaduna State.

Table 6 highlights the sensory score of the standardized lima bean foods. It shows that lima bean-hungry rice food had higher values for all the sensory attributes assessed (colour 4.40, texture 4.10, taste 4.50, aroma 4.20). Lima bean-benniseed food had significant (*P* < 0.05) lower values for colour (2.90), taste (3.00), and aroma (3.10). Lima bean-hungry rice was the most acceptable (4.60), followed by lima bean-porridge (4.20) and then lima bean-benniseed (3.50).

Table 1: Distribution of Respondents by Local Government Areas, Wards and Communities in Kaduna State.

	Study area	Frequency(n=400)	Percentages (%)
LGA	Kaura	134	33.5
	Chikun	133	33.3
	Sabongari	133	33.3
Ward	Agban	88	22.0
	Mallagum	46	11.5
	Kakau	74	18.5
	Rido	59	14.8
	Jama'a	92	32.8
	Samaru	41	0.5
Communities	Garaje	88	22.0
	Ung. Shemang	46	11.5
	Ung Sauri/rimi	20	5.0
	Ung Tanko	8	2.0
	Ung Waziri	25	6.2
	Karatudu	21	5.2
	Ung Maigero	36	9.0
	Mahuta	23	5.7
	Zango shanu/Aviation	46	11.5
	Hayin Danyaro	41	10.2
	Aviation site II	46	11.5

Table 2: Standardized Lima Bean Foods Recipes in Kaduna State

Lima bean Porridge Recipe		Lima bean Hungryrice Recipe		Lima bean Benniseed Recipe	
Ingredients	Quantity (n=20)	Ingredients	Quantity (n=20)	Ingredients	Quantity (n=20)
Lima beans (g)	640±0.52	Lima beans (g)	320±5.20	Lima beans(g)	640±0.52
Beef (g)	500±0.81	Hungry rice (g)	330±3.33	Benniseed (g)	201±3.20
Curry (g)	2±0.52	Beef (g)	500±0.94	Beef (g)	500±0.81
Thyme (g)	4±0.94	Curry (g)	4±0.50	Curry (g)	2±0.52
Salt (g)	9±0.38	Thyme (g)	4±0.20	Thyme(g)	4±0.94
Water (ml)	340±0.23	Salt (g)	14±2.40	Salt (g)	9±0.38
Tomatoes (g)	262±0.55	Bouillon cubes	5±1.26	Water (ml)	340±0.23
Onions (g)	272±0.41	Water (ml)	900±2.22	Tomatoes (g)	262±0.55
Palm oil (ml)	400±2.73	Palm oil (ml)	220±3.35	Onions (g)	272±0.41
Red Pepper (g)	37±4.18	Tomatoes (g)	291±1.30	Palm oil (ml)	400±2.73
Bouillon cubes	4±2.07	Onions (g)	251±0.70	Pepper (g)	37±4.18
Groundnut oil (ml)	320±1.11	Pepper (g)	37±4.60	Bouillon cubes	5±0.10
		Groundnut oil (ml)	320±0.40	Groundnut oil (ml)	320±1.11

Table 3: Characteristics of Respondents in Chikun, Sabongari and Kaura LGA of Kaduna State.

Characteristics	Distribution	Frequency (n=400)	Percentages (%)
Sex	Male	84	21.0
	Female	316	79.0
Marital Status	Single	52	13.0
	Married	344	86.0
	Divorced	4	1.0
Age	<20	3	0.8
	21-30	101	25.2
	31-40	173	43.2
	41-50	86	21.5
	51-60	31	7.8
	>60	6	1.5
House hold size	1-3	19	4.8
	4-6	231	57.8
	7-9	97	24.3
	10-12	37	9.3
	13-15	8	2.0
	Above 15	8	2.0
Ethnic groups	Adara/Kadara	9	2.3
	Bajju	24	6.0
	Fanstwam	9	2.3
	Gbagyi	17	4.3
	Hausa	55	13.8
	Ikulu	6	1.5
	Jaba	26	6.5
	Kaninkon	8	2.0
	Kagoro	36	9.0
	Kataf	67	16.8
	Others	143	35.75

Table 4: Pattern of Consumption of Lima Bean (*Phaseolus lunatus*) Foods in Kaduna State

Pattern of consumption		Frequency(n)	Percentage (%)
Household consuming Lima bean foods		217 **n=400**	54.3
Weekly	Once	42	19.4
	More than once	8 **n=217**	3.7
Monthly	Once	97	44.7
	More than once	32 **n=217**	14.8
Yearly	Once	27	12.4
	More than once	11 **n=217**	5.1
Comparing lima beans with cowpea			
Consumption Frequency	Less	166	76.5
	Same	15	6.9
	More	36 **n=217**	16.6
Taste/palatability	Less	32	14.8
	Same	16	7.4
	More	169 **n=217**	77.9
Ease of cooking	Less	198	91.2
	Same	3	1.4
	More	16 **n=217**	7.4

Table 5: Commonly Consumed Lima Bean (*Phaseolus lunatus*) Foods in Kaduna State

Lima Bean Foods	Frequency n = 217	Percentage (%)
Lima Bean Porridge	141	64.9
Lima Bean-Rice	1	0.5
Lima Bean-Maize Pate	13	5.9
Lima Bean-Benniseed	32	14.8
Lima Bean-Hungry rice	25	11.5
Lima Bean-Guinea corn	3	1.4
Lima Bean-Yam	2	0.9

Table 6. Sensory Attributes of Standardized Commonly Consumed Lima Bean (*Phaseolus lunatus*) Foods in Kaduna State

Lima Bean Foods	Colour	Taste	Texture	Aroma	Overall Acceptability
Bean porridge	4.30 ± 0.21^b	4.30 ± 0.21^b	3.70 ± 0.33^a	4.00 ± 0.26^{ab}	4.20 ± 0.29^{ab}
Bean-hungry rice	4.40 ± 0.16^b	4.50 ± 0.17^b	4.10 ± 0.23^a	4.20 ± 0.25^b	4.60 ± 0.16^b
Bean-benniseed	2.90 ± 0.48^a	3.00 ± 0.45^a	3.10 ± 0.41^a	3.10 ± 0.43^a	3.50 ± 0.52^a

Means within the same column with different superscripts are significantly ($P < 0.05$) different. Hedonic Scale: 1-Dislike very much; 2- Dislike; 3- Neither like nor dislike; 4- Like; 5-Like very much

DISCUSSION

The findings in this study show that most of the respondents (33.5%) who prepare and consume lima bean dishes are from Kaura LGA. This is not surprising because the LGA is in close proximity to the Middle-belt region of Nigeria which according to study by (17), reported that lima beans are widely cultivated in that region. The age range (31-40) for majority (43.25%) of caregivers in this study differ from study by (18) where 49.6% of

caregivers fall within the age range 21-30 years. However, the study reported similar results (86.75%) for household size (18). Another study by (19) revealed females (99.5%)as major caregivers in households, this is similar to the result of this study which recorded females as major caregivers at 79%. It is also not surprising because women bear the primary responsibility for health and survival of young children (20). Therefore, the use of food-based approaches in preventing malnutrition can be best realized by using women as channels to achieve optimum fetal, child nutrition and development.

The consumption frequency (16.6%), taste (77.9%) and ease of cooking lima beans (7.4%) as compared with cowpea shows that more people consume cowpea. However, most respondents agreed that lima beans taste better than cowpea. This indicates that the hard-to-cook nature of lima beans as stated by (8) limits its consumption. Employing faster, cost effective cooking methods could help to increase the consumption of lima beans.

Previous research by (17) stated that some indigenous people in Nigeria process lima bean seeds into pudding and porridge, the result from this study confirms this as lima bean porridge (64.9%) ranked highest of all the foods prepared from lima beans.

It would not be unusual for the standardized lima bean foods to increase consumers' satisfaction and increase its utilization. This is in line with report by (21) that stated standardization of recipes to be a necessary step at ensuring food quality/nutrient content consistency, increased consumer satisfaction and food/labour cost control.

Lima bean-hungry rice food is the most acceptable in terms of colour (4.40), texture (4.10), taste (4.50), aroma (4.20) and overall acceptability (4.60) which could possibly be due to hungry rice fine texture and taste as reported by (22). The colour, taste, texture, aroma and overall acceptability of lima bean porridge is not too different from that of lima beans-hungry rice food, possibly because of the soft texture and buttery taste of lima beans (23). Lima bean-benniseed food was the least acceptable; this could be due to roasting of benniseed that was done during cooking and the black-coloured variety of benniseed used. The sensory evaluation of these foods has no doubt provided feedback data in order to enable informed decisions to be made regarding the utilization of lima beans.

CONCLUSION
This study suggests that the standardized foods from lima beans possess good sensory attributes that could help increase its utilization especially as complementary foods.

ACKNOWLEDGEMENT

CONFLICT OF INTEREST
None

REFERENCES
1. Kalhoff, H. and Kersting, M. (2017) Programming Long-Term Health: Nutrition and Diet in Infants Aged 6 Months to 1 Year. In Early Nutrition and Long-Term Health.Pp 499-535.

2. Bhutta, Z.A. (2008) Micronutrient Needs of Malnourished Children. Current Opinion in Clinical Nutrition and Metabolic Care 11(3):309.

3. World Health Organization. (2019) World Food Day: Malnutrition is a World Health Crisis. Retrieved from https://www.globalcause.co.uk/world-food-day/malnutrition-is-a-world-health-crisis-says-who-expert/.

4. National Population Commission. (2018). Nigeria DHS Key Findings. Abuja, Nigeria and Rockville, Maryland, U.S.A.

5. Lewis, G., Sheringham, J., Kalim, K. and Crayford, T. (2008) Mastering Public Health: A Postgraduate Guide to Examinations and Revalidation. CRC Press. London. pp 145-309.

6. Schönfeldt, H.C., Pretorious, B. and Hall N. (2013) The Impact of Animal Source Food Products on Human Nutrition and Health. South African Journal of Animal Science, 41(3):394-412.

7. Egounlety, M. and Aworh, O. C. (2003) Effect of Soaking, Dehulling, Cooking and Fermentation with *Rhizopus oligosporus* on

the Oligosaccharides, Trypsin inhibitor, Phytic acid and Tannins of Soybean (*Glycine max Merr*.) Cowpea (*Vigna unguiculata L. Walp*) and Groundbean (*Macrotyloma geocarpa Harms*). Journal of Food Engineering, 56:249-254.

8. Subuola, F., Yudi, W. and Taiwo, K. (2012) Processing and Ultilization of Legumes in the Tropics. In: Ayman A. E.(eds) Trends in Vital Food and Control Engineering. Intech. Europe

9. Nakitto, M. A., Muyonga, H. J. and Nakimbugwe D. (2014) Effects of Combined Traditional Processing Methods on the Nutritional Quality of Beans. Journal of Food Science and Nutriton, 3: 233-41.

10. Owolabi, A. O.,Dankat, C. B., Okolo I. and Anigo K.M. (2020)Proximate, Antinutrient and Composition of Commonly Consumed Food from Lima Beans (*Phaseolus Lunatus*) in Kaduna State, North Western Nigeria**.** International Journal of Advances in Scientific Research Mineral and Engineering (IJASRE**),** 6 (6):40.

11. Omotoye, F.E. and Adesanmi R.A.S. (2019) Infant and Young Child-Feeding Practices in Two Local Government Areas in Southwest, Nigeria. Journal of Food Science and Nutrition Research 2: 136-145.

12. Jones, G., Steketee R.W. and Black R.E. (2003) How many Child Deaths can we Prevent this Year? Available at: www.thelancet.com

13. Cochran, W.G. (1977). Sampling techniques (3rd ed.) John Wiley & SonNew York

14. True Random Number Service (2015) Random Integer Generator. Retrieved September, 11, 2015 from https://www.random.org/integers/