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Development and Evaluation of Instant Enhanced Baobab Leaves Soup (Miyan Kuka) Powder

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ABSTRACT

Miyan Kuka, a traditional baobab leaves soup widely consumed in northern Nigeria, is recognized for its nutritional and health benefits. Despite its popularity and ease of preparation, achieving optimal taste and quality requires skill and time. This study aimed to develop an instant, enhanced version of baobab leaves powder by incorporating appropriate proportions of selected condiments and spices to improve taste, convenience, and shelf life. The formulated products (standard, fish-flavoured, chicken-flavoured, and beef-flavoured variants) were subjected to proximate analysis and sensory evaluation. Results revealed that the standard baobab leaves powder had the highest fiber content, while the fish-flavoured sample recorded the highest protein content. All enhanced samples showed low moisture and ash content, with moderate carbohydrate levels. Sensory analysis indicated that the flavoured variants, particularly chicken and fish, achieved significantly higher acceptance ($P < 0.05$) than the standard formulation. These findings suggest the potential of instant miyan kuka powder as a nutritious and marketable food product.

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1. INTRODUCTION

Boabab leaves soup (Miyan Kuka) is a northern Nigerian soup made from ground dry baobab leaves, which is scientifically known as Adansonia digitata (Edogbanya *et al.,* 2021). The plant is native to the African continent and has been known to provide many medicinal benefits. Baobab trees are prolific in northern Nigeria, and the leaves are picked, dried, and ground into very fine green powder. The baobab leaf is nutrient-dense, and the tree is called the 'tree of life'. Nutritionists have identified baobab, popularly called 'Kuka' in Hausa language, as one of the foods with health benefits due to its high nutrient contents such as vitamin C, D, calcium, potassium, phosphorus, and fibre (Ahmed *et al.,* 2024; Chadare *et al.,* 2009; Nnam & Nwofor, 2022). The nourishing content and tasty nature of miyan kuka are widely accepted and are becoming increasingly recognized globally (Chadare *et al.,* 2009).

Miyan kuka is a delicious meal that everyone should enjoy (Salau *et al.,* 2020). The health benefits of miyan kuka are due to the main ingredient, baobab leaves. It is good for the digestive system, fights infection, and is rich in nutrients (Otong & Musa, 2019). Miyan kuka can be easily prepared in combination with other dry ingredients such as crayfish, dawa-dawa, stock fish, ginger powder, pepper, onions, palm oil, seasonings (maggi, salt), and water. It becomes more nutritious when combined with the spices, fish or meat, and other traditional soup condiments, and is usually served with swallows such as tuwo shinkafa, dawa or masara, and biski. It can also be eaten with couscous and semolina (Chadare *et al.,* 2009). The study was conducted to produce an enhanced miyan-kuka assortment (powder), which contains all the traditional ingredients blended in a more desirable proportion that can be used instantly to prepare a well-constituted baobab leaves soup (Onabanjo *et al.,* 2010). Sensory evaluation of the formulated products was conducted to examine the acceptability and ease of soup preparations using the assortment vis-à-vis the traditional kuka powder. The proportionately constituted instant miyan kuka powder can be packaged, used within the country, and exported.

2. METHODS

2.1. Study area

The study was conducted in the Nutrition and Dietetics Department, Federal University of Health Sciences, Azare. Bauchi State. Boabab leaves samples were collected within Azare and Environ, located in the North-Eastern region of Northern Nigeria (Ibrahim *et al.,* 2014).

Azare is the headquarters of the Katagum division in Bauchi State. Azare town is bordered to the east by Damban LGA and Potiskum, Yobe State, and to the south by Misau Local Government, in the west by Jama'are Local Government, and to the north by Itas/Gadau Local Government Area of Bauchi State. Its geographical coordinates are 11° 40' 42" North, 10° 11' 31" East. It is the largest city in the state in terms of population, with about 800,000 people living there. In terms of market, it has the largest market in the state.

Dried Boabab leaves soup (Miyan kuka) forms part of the most popular cuisines and is among the most eaten soups by the people in this part of the country (Onabanjo *et al.,* 2014). The Boabab trees are found in abundance all over from Azarein Bauchi state, stretching down to the far northeast region- Yobe, Borno, Adamawa, and Taraba States.

2.2. Materials

The fresh baobab leaves were obtained from the trees in the bush/farms within Azare. The leaves were sun-dried and ground into fine powder and kept in glass jars (Gebauer *et al.,* 2002). Locust beans (daddawa), dried ginger, pepper, crayfish, stock fish, and seasonings were

purchased, cleaned thoroughly, ground separately, and kept in glass jars. Beef/chicken/smoked fish were purchased from a hygienic vendor's market.

2.3. Sample Collection

Boabab leaves were obtained from mature trees (as locally it's believed that leaves from different trees may have different characteristics, such as mucilage-thickening ability, taste, and flavor) (Sanchez, 2011). The leaves were sun-dried and ground with a spice mixer into a fine powder. Pure boabab leaves samples were measured and kept in a glass jar as a control.

Beef/chicken,/smoked fish were cleaned and minced separately for processing into powder.

The minced fish, beef, and chicken were further dried and ground into powder, and kept in separate clean containers.

2.4. Formulation of the Enhanced Boabab leaves assortment mixture

The enhanced Boabab leaves (miyan kuka) powder was produced in different flavours (beef, chicken, and fish). To 100g of each of the powdered baobab leaves sample, varying quantities of the other powdered ingredients (ginger, daddawa, crayfish, stock fish, pepper, minced beef powder, minced chicken powder, and minced fish powder) were added in measured quantities. The measurements were: 7:3, 6:4, 5:5, 3:7.

Each of the mixtures was kept in a separate labelled glass jar and used for proximate analysis and sensory evaluation to assess the taste, nutrient value, and aesthetic value (Olaniyi *et al.,* 2017). 100g of each of the baobab leaf powder samples was mixed with varying quantities of the ground spices to make an enhanced assortment. To each of the above mixtures, 50g of the powdered beef, chicken, or fish was added to form:

(i) Beef flavored,
(ii) Chicken flavored,
(iii) Fish flavored.

Each of the above samples was used to prepare a separate soup for Sensory Evaluation.

The ingredients were ground and processed, and then packaged in clean and healthy bags as shown in **Figure 1**. **Figures 1(a) and (b)** are the images for ingredients/spices for enhanced products and formulated product assortment, respectively.

2.5. Analyses

Proximate analysis of the formulated enhanced powder was carried out to ascertain the nutrient content of the enhanced product as well as the pure baobab leaves powder (Olatoye *et al.,* 2023). Sensory Evaluation, which entails appearance, aesthetic values, acceptance, and organoleptic properties of the soups prepared from the formulated and enhanced baobab leaves powder assortment and the standard pure baobab leaves, was assessed by employing 50 expert volunteers/questionnaire administration at the BUK Nutrition and Dietetics Sensory Evaluation Laboratory. Statistical analysis was conducted to ascertain possible correlation and difference between the means of the enhanced instant miyan kuka assortments and the traditional miyan kuka powder soups (Salau *et al.,* 2020).

Figure 1. Photograph images: (a) Ingredients/spices for enhanced products, and (b) Formulated product assortment

2.6. Preparation of the Soups

Methods of Boabab leaves soup (miyan kuka) preparation

2.6.1. Procedure for Preparing Boabab leaves soup (Miyan Kuka)

Put a clean pot on low heat and pour in palm oil, slice a little onion and put it into the pot, allow to fry for 3 to 5 minutes under low heat until it turns brown, add in grinded pepper, onions, cook for 10 minutes, add in the grinded locust beans, the boiled meat and/or fish and its broth, and 4 cups of water, allow to cook for 15 minutes. Add in spices and stir well with a wooden spoon, allow to cook for 5 minutes, add the kuka powder, spreading it little by little and keep stirring with a whisk (locally called maburgi) to get the desired mixture and avoid lumps, reduce the heat and allow it to simmer for 5 minutes. Miyan kuka is ready to be served.

2.6.2. Procedure for Preparing the enhanced Miyan Kuka

Put a clean pot on low heat and pour in 4 table spoons of palm oil or groundnut oil, slice a 10g onion and put it into the pot, and allow to fry for 3 minutes under low heat, add 1 litre of water and allow to boil; add boiled beef/chicken/mutton, add seasoning of choice and salt to taste, add the enhanced mixture of Kuka powder, spreading it little by little and keep stirring with a whisk or maburgi to get the desired mixture and avoid lumps, reduce the heat and allow it to simmer for 10 minutes. (The timing was determined as the best time the mixture will be thoroughly cooked). Adopted from (Nnam & Nwofor, 2022) with modifications.

2.7. Procedure for Sensory Evaluation of the Enhanced miyan kuka Assortment

Sensory analysis examines the properties (texture, flavor, taste, appearance, smell, etc.) of a product or food through the senses (sight, taste, smell). Sensory analysis of the freshly formulated instant miyan Kuka powder samples was carried out by trained panellists who were known day-to-day users and adored Kuka soup as one of their favourites. Approximately 10 mL each of the 3 varieties of the formulated instant powders were placed in separate containers, labelled with two-digit numbers for identification. The trained Nutritionists

prepared the soups using the various formulated baobab leaves powder as described in 2.6.2 above, and kept them in separate soup bowls. Tuwon Masara was also prepared by the Nutritionists and eaten by the panellists with the various soups prepared as is traditionally done. The Panellists were seated in the evaluation chamber, served with the various soups in turns as they took portions, ate, and recorded their experiences.

3. RESULTS AND DISCUSSION

3.1. Proximate Analysis of the Enhanced Boabab Leaves Powder Assortment

Proximate analysis is used for the quantitative estimation of food substances, including moisture, crude protein, total fat, total carbohydrate, and dietary fiber (Atasie *et al.,* 2009). Proximate analysis is crucial in the food industry because it quantifies macronutrients (moisture, protein, fat, fiber, ash, and carbohydrates) in food, enabling quality control, regulatory compliance, and understanding nutritional value, which is vital for both consumer health and manufacturer. The proximate analysis of the baobab leaves soup powder showed high fibre contents, with the standard baobab leaves powder (sample A) having the highest percentage of fibre, followed by samples E, D, and H. There is also a high percentage of protein and fat, a moderate percentage of carbohydrates, with the indicated low moisture and ash contents as shown in **Figure 2**. The sample C, which is the formulated fish-flavoured, got the highest percentage of proteins, followed by samples B, H, and E, as shown in **Figure 2**.

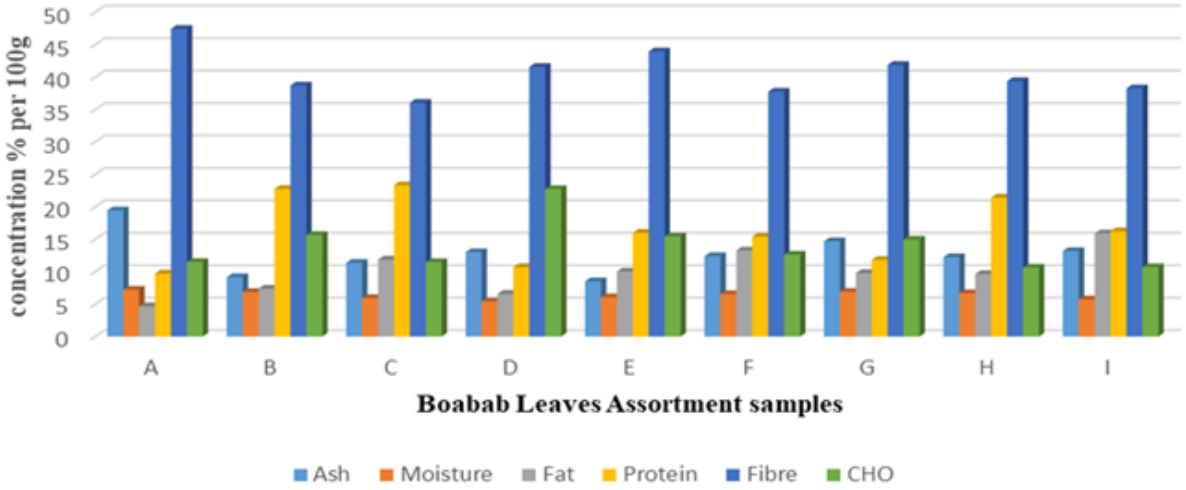

Figure 2. The proximate analysis of the formulated boabab leaves powder assortment. Ratio of baobab leaves to flavoured spices in the enhanced products

Figure 2 results of the proximate analysis of the formulated boabab leaves powder assortment. Ratio of baobab leaves to flavoured spices in the enhanced products. Keys: A= Pure Baobab leaves powder, B= 70:30 Formulated Fish Flovoured + spices baobab leaves powder, C= 50:50 Formulated Fish Flovoured + spices baobab leaves powder, D= 30:70 Formulated Fish Flovoured + spices baobab leaves powder, E= 70:30 Formulated Beef Flovoured + spices baobab leaves powder, F= 50:50 Formulated Beef Flovoured + spices baobab leaves powder, G= 30:70 Formulated Beef Flovoured + spices baobab leaves powder, H= 70:30 Formulated Chicken Flovoured + spices baobab leaves powder, I= 50:50 Formulated Chicken Flovoured + spices baobab leaves powder.

The proximate analysis of the baobab leaves soup powder showed high fibre contents, with the standard baobab leaves powder (sample A) having the highest percentage of fibre,

followed by samples E, D, and H. There is also a high percentage of protein and fat, a moderate percentage of carbohydrates, with the indicated low moisture and ash contents as shown in **Figure 2**. The sample C, which is the formulated fish-flavoured, has the highest percentage of proteins, followed by samples B, H, and E, as shown in **Figure 2**.

3.2. Sensory Evaluation of the Enhanced Boabab leaves soup powder Assortment

Sensory evaluation of foods refers to the process of assessing the characteristics of a food product using the five traditional senses: sight, smell, taste, touch, and hearing, conducted by panellists. This evaluation is important in the food industry as it helps to determine the quality and acceptability of a product. This type of analysis has been used for centuries to accept or reject food products (Nnam & Nwofor, 2022). The different flavors analysed were tested in graded percentages for optimization. The samples were eaten with the traditional complimentary swallow-corn flour food (tuwon masara) as a combination, and drinking water. A sample of pure standard boabab leaf powder was also analysed as a control (Isaac *et al.,* 2022). The panel of judges evaluated the sensory parameters: appearance, texture, taste, flavor, and overall acceptability of miyan kuka powdered assortments. The sensory attributes were rated using a 9-point hedonic scale. A multiple comparison test was done to compare the different instant Kuka flavors as shown in **Table 1**.

Table 1. Sensory evaluation of prepared enhanced boabab leaves soup powder assortment

Sample id	Appearance	Texture	Taste	Flavor	Like	Overall Score
A	6.6 ± 1.9	6.4 ± 2.0	4.8 ± 1.6	4.8 ± 1.7	3.3 ± 1.6	5.3 ± 1.0
B	6.1 ± 1.5	6.3 ± 1.8	5.5 ± 1.9	5.5 ± 2.6	5.6 ± 1.9	5.8 ± 0.3
C	6.5 ± 1.6	6.5 ± 1.5	6.2 ± 1.4	6.2 ± 1.7	5.8 ±1.7	6.2 ± 0.2
D	6.3 ± 1.8	5.9 ± 1.7	6.0 ± 2.0	6.0 ± 1.8	3.9 ±1.9	5.6 ± 0.7
E	6.2 ± 1.6	6.4 ± 1.5	5.7 ± 1.8	5.7 ± 1.6	5.5 ± 2.4	5.9 ± 0.3
F	5.6 ± 1.8	5.8 ± 1.8	6.0 ± 1.6	6.0 ± 1.1	4.9 ± 1.8	5.7 ± 0.3
G	6.3 ± 1.8	5.9 ± 1.7	5.4 ± 1.6	5.4 ± 1.4	6.6 ± 2.5	5.9 ± 0.4
H	6.5 ± 1.8	6.7 ± 1.6	5.7 ± 1.4	5.7 ± 1.4	4.9 ± 1.8	5.9 ± 0.6
I	6.2 ± 2.0	6.6 ± 1.9	5.9 ± 1.5	5.9 ± 1.3	6.5 ± 1.5	6.2 ± 0.3
J	5.8 ± 1.6	5.9 ± 1.5	6.2 ± 1.8	6.2 ± 2.0	5.8 ± 1.6	6.0 ± 0.2
K	5.4 ± 1.3	4.9 ± 1.7	5.4 ± 1.2	5.4 ± 1.1	6.3 ± 2.1	5.5 ± 0.3
L	6.1 ± 2.1	6.1 ± 2.1	6.3 ± 1.5	6.3 ± 1.5	5.4 ± 1.9	6.0 ± 0.2

Keys: A = standad kuka powder, B = 50/50 chicken flavoured, C = 70/0 chicken flavored, D = 70/30 chicken flavoured, E = 30/70 chicken flavoure, F = 30/70 beaf flavoured, G = 60/40 beaf flavoured, H = 50/50 beaf flavoured, I = 70/30 beaf flavoured, J = 70/30 beaf flavoured, K = 70/30 fish flavoured, L = 50/50 fish flavor.

The findings of this research showed that the overall acceptability score of chicken flavored, 60:40 fish flavored, and 70/30 fish flavored assortments were similar and highest ($P<0.05$) compared to the standard kuka powder and the other formulations.

It is generally accepted that when consumed in moderation as part of a balanced diet, the baobab leaves powder can provide many benefits due to its rich nutritional profile and bioactive compounds. Baobab leaves are rich in vitamin C, antioxidants, fibre, calcium, iron, and other nutrients that are essential and can help with digestion, boost immunity, fight infection (used in traditional cancer medicine), and other conditions that may affect pregnant women and babies. Animal studies showed that baobab may help reduce inflammation and prevent oxidative damage to cells, but more research in humans is needed (Ahmed *et al.,* 2024).

The enhanced baobab leaves powder was found to be of high acceptability and ease of soup preparations using the assortment compared to the traditional miyan kuka powder. The enhanced mixture gives a better consistency, with reduced cooking time, thereby reducing the loss of nutrients than the traditional miyan kuka powder. The enhanced assortment, which is handy with all required ingredients in desired proportions, gives an improved, instant, tasty kuka soup in 3 different flavours.

4. CONCLUSION

Though traditional soups such as miyan kuka are often prepared in a free style, the condiments and spices must be added in appropriate quantities to make it delicious. The enhanced baobab leaves soup (miyan kuka) assortment instant powder has been formulated by the constitution of measured quantities of the traditional ingredients, considering their daily dietary intake requirements.

The formulated instant miyan kuka powder is rich, easy to cook, while retaining its nutrients compared to the standard pure baobab leaves powder, which has improved the nutritional and organoleptic values of the widely consumed miyan kuka soup.

This is innovative research in which the locally available materials have been enhanced for improved Environmental sustainability and nutrient-rich food accessibility.

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6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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