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Sensory Evaluation and Nutritional Profile of Instant Miyan Kuka Powder Assortments from Dried Baobab (*Adansonia digitata*) Leaves as A Traditional Food for Food Security, Environmental Health, and Sustainable Development Goals (SDGs)

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ABSTRACT

This study evaluated the sensory acceptability and nutritional profile of instant Miyan Kuka powder assortments prepared from dried baobab (*Adansonia digitata*) leaves. Miyan Kuka is a traditional Northern Nigerian soup commonly made from powdered dried baobab leaves and consumed as a local food resource. Nine formulations were developed by combining baobab leaf powder with fish, beef, and chicken condiments at different mixing ratios. Proximate analysis was conducted to determine ash, moisture, fat, protein, fibre, and carbohydrate contents, while sensory evaluation assessed appearance, texture, taste, flavor, and overall acceptability. The results showed that the fish-flavoured formulation at a 60:40 ratio had the highest protein content and best overall sensory acceptability. The findings indicate that instant Miyan Kuka powder can support food security, local food processing, environmental health, and Sustainable Development Goals (SDGs).

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1. INTRODUCTION

Miyan Kuka is a traditional soup commonly consumed in Northern Nigeria and prepared from powdered dried baobab leaves. The baobab tree, scientifically known as *Adansonia digitata* L., is widely recognized as a multipurpose African plant with food, medicinal, ecological, and socio-economic importance. Different parts of the plant, including the leaves, fruit pulp, bark, and seeds, have been used in traditional food systems and local health practices (De Caluwé et al., 2010; Gebauer et al., 2002; Kamatou et al., 2011; Rahul et al., 2015). In local food processing, dried baobab leaves are especially important because they are used as the main ingredient in Miyan Kuka, a culturally familiar soup that contributes to household nutrition.

The nutritional relevance of *Adansonia digitata* has been reported in previous studies. Baobab products contain important nutrients and bioactive compounds, including minerals, amino acids, antioxidants, and phytochemical components (Nour et al., 1980; Vertuani et al., 2002; Yazzie et al., 1994). The leaves are particularly relevant as a food ingredient because they can contribute protein, fibre, minerals, and other nutrients needed in daily diets. Previous studies also reported antioxidant, anti-inflammatory, antipyretic, and other medicinal properties of *Adansonia digitata*, suggesting that baobab-based foods may have nutritional and functional value beyond ordinary consumption (Kiyawa and Mukhtar, 2019; Ntchapda et al., 2020; Ramadan et al., 1994).

Despite the nutritional importance of Miyan Kuka, its traditional preparation can be time-consuming and may vary from one household to another. Differences in ingredient proportion, condiment use, hygiene, packaging, and preparation practice may affect product quality, sensory acceptability, and nutritional consistency. Developing instant Miyan Kuka powder assortments from dried baobab leaves can therefore provide a more convenient and standardized form of this traditional food. Such a product may help preserve local food heritage while improving accessibility, preparation efficiency, and consumer acceptability.

Food security is not only related to food availability but also to food utilization, nutritional quality, affordability, and cultural acceptability. Instant food products made from indigenous ingredients can support food security when they are nutritious, easy to prepare, locally acceptable, and based on sustainable resources. In this regard, instant Miyan Kuka powder has potential as a value-added indigenous food product because it uses baobab leaves, which are locally known and culturally accepted in Northern Nigeria. The addition of protein-based condiments such as fish, beef, and chicken may further improve nutrient composition and sensory quality.

The environmental relevance of baobab-based food development is also important. *Adansonia digitata* is considered a multipurpose tree with ecological and conservation value, especially in African dryland environments (Gebauer et al., 2002; Kamatou et al., 2011). Promoting value-added baobab products may encourage sustainable use of local biodiversity and reduce dependence on highly processed or imported food products. However, sustainable utilization must be supported by appropriate conservation strategies because climate change and environmental pressures can affect baobab resources (Sanchez et al., 2011). Therefore, the development of baobab-based foods can be linked to environmental health, local resource use, and responsible food production.

This study is also relevant to the Sustainable Development Goals (SDGs), particularly SDG 2 on zero hunger, SDG 3 on good health and well-being, and SDG 12 on responsible

consumption and production. General discussions on the role of sustainable materials and SDGs have been reported elsewhere (Ragadhita et al., 2026). By developing a nutritious and culturally familiar instant soup powder, the study contributes to discussions on local food security and dietary improvement. By using *Adansonia digitata* leaves as a local plant resource, it also supports the sustainable use of indigenous food materials. Furthermore, by evaluating sensory acceptability, the study considers consumer preference, which is important for the practical adoption of any food product.

This study evaluates the sensory acceptability and nutritional profile of instant Miyan Kuka powder assortments prepared from dried baobab (*Adansonia digitata*) leaves. Specifically, it formulates fish-, beef-, and chicken-flavoured assortments at different ratios, analyzes their proximate composition, and assesses their sensory attributes. The study aims to identify the most acceptable and nutritionally promising formulation and to highlight the potential of instant Miyan Kuka powder as a local food product that supports food security, environmental health, and selected SDGs.

2. METHODS

This study used an experimental food formulation approach to develop instant Miyan Kuka powder assortments from dried baobab (*Adansonia digitata*) leaves. The study focused on preparing different formulations, analyzing their proximate composition, and evaluating their sensory acceptability.

The instant powder was prepared using dried baobab leaf powder as the main ingredient (see **Table 1**). Three flavour assortments were developed using fish, beef, and chicken condiments. Each flavour assortment was prepared in three mixing ratios of baobab leaf powder to condiment powder: 40:60, 50:50, and 60:40. This produced nine samples: FF1, FF2, FF3, BF1, BF2, BF3, CF1, CF2, and CF3. FF represents fish-flavoured samples, BF represents beef-flavoured samples, and CF represents chicken-flavoured samples. Additional ingredients included ginger, daddawa, crayfish, pepper, and minced protein powder.

Proximate analysis was conducted at the Food and Nutrition Laboratory, Department of Biochemistry, Bayero University Kano. The analysis determined ash, moisture, fat, protein, fibre, and carbohydrate contents of the nine instant Miyan Kuka powder samples. These parameters were used to assess the nutritional profile of each formulation.

Table 1. Formulation of instant Miyan Kuka powder assortments.

SAMPLE CODE	FLAVOUR ASSORTMENT	BAOBAB LEAF AND CONDIMENT RATIO	MAIN CONDIMENT
FF1	Fish-flavoured	40:60	Fish powder
FF2	Fish-flavoured	50:50	Fish powder
FF3	Fish-flavoured	60:40	Fish powder
BF1	Beef-flavoured	40:60	Beef powder
BF2	Beef-flavoured	50:50	Beef powder
BF3	Beef-flavoured	60:40	Beef powder
CF1	Chicken-flavoured	40:60	Chicken powder
CF2	Chicken-flavoured	50:50	Chicken powder
CF3	Chicken-flavoured	60:40	Chicken powder

Note: FF = fish-flavoured sample, BF = beef-flavoured sample, and CF = chicken-flavoured sample.

Sensory evaluation was conducted using a panel of 60 volunteers. The prepared soup samples were assessed based on appearance, texture, taste, flavour, and overall acceptability. The panelists evaluated each sample using a sensory scoring form, and the results were summarized as mean values with standard deviations.

The collected data were organized according to formulation type and mixing ratio. Proximate composition and sensory scores were compared across the nine samples to identify the formulation with the best nutritional and sensory performance. The optimal sample was selected based on high protein content, acceptable fibre level, and overall sensory score.

3. RESULTS AND DISCUSSION

The proximate analysis and sensory evaluation were conducted to determine the nutritional quality and acceptability of instant Miyan Kuka powder assortments prepared from dried baobab (*Adansonia digitata*) leaves. The formulations were developed using three flavour assortments, namely fish, beef, and chicken, with different ratios of baobab leaf powder and condiment powder. The results are discussed in relation to nutritional composition, sensory acceptability, optimal formulation, and the potential contribution of instant Miyan Kuka powder to food security, environmental health, and selected SDGs.

The proximate composition of the nine instant Miyan Kuka powder samples is presented in **Table 2**. The table shows the ash, moisture, fat, protein, fibre, and carbohydrate contents of the fish-, beef-, and chicken-flavoured assortments. The protein content varied among the formulations. The fish-flavoured sample FF3 recorded the highest protein content, followed by the chicken-flavoured sample CF3. This indicates that the formulation ratio influenced the nutritional profile of the instant Miyan Kuka powder. The relatively high protein values in the fish- and chicken-flavoured samples suggest that the addition of protein-based condiments improved the nutritional quality of the baobab leaf powder. Previous studies have reported that *Adansonia digitata* leaves contain important nutrients, including amino acids and minerals, which support their relevance as a traditional food ingredient (Yazzie et al., 1994). The nutritional potential of baobab has also been emphasized in studies describing its food value, multipurpose use, and phytochemical properties (De Caluwé et al., 2010; Gebauer et al., 2002; Kamatou et al., 2011).

Table 2. Proximate composition for assorted dried baobab leaf samples.

SAMPLE ID	ASH (%)	MOISTURE (%)	FAT (%)	PROTEIN (%)	FIBRE (%)	CHO (%)
FF1 (40:60 Fish)	14.56	4.52	16.69	23.33	28.37	14.63
FF2 (50:50 Fish)	14.15	4.87	16.43	24.18	27.71	14.62
FF3 (60:40 Fish)	15.03	4.23	17.16	26.63	24.13	12.38
BF1 (40:60 Beef)	19.01	6.41	5.59	21.70	26.72	14.87
BF2 (50:50 Beef)	18.52	6.78	5.03	22.00	26.66	14.44
BF3 (60:40 Beef)	18.68	7.15	5.27	23.40	24.75	13.08
CF1 (40:60 Chicken)	12.30	5.66	9.53	24.43	26.87	14.64
CF2 (50:50 Chicken)	12.24	5.68	8.94	24.83	25.98	14.23
CF3 (60:40 Chicken)	12.28	5.72	9.41	25.73	24.65	13.71

Note: FF, BF, and CF represent fish-, beef-, and chicken-flavoured assortments, respectively. CHO = carbohydrate.

The moisture content of the samples was relatively low, especially in the fish-flavoured formulations. Low moisture content is desirable in powdered food products because it can help improve shelf stability and reduce the risk of microbial spoilage when the product is properly packaged. In this study, FF3 had the lowest moisture content among the samples, which may make it more suitable for storage compared with samples that had higher moisture values. This supports the potential of instant Miyan Kuka powder as a shelf-stable traditional food product when supported by appropriate packaging.

The ash content was highest in the beef-flavoured samples, especially BF1, BF2, and BF3. Ash content reflects the mineral contribution of the food material. This result suggests that beef-based condiment inclusion may contribute to higher mineral content in the formulation. However, the fish-flavoured samples showed better balance in terms of protein, fat, moisture, and overall sensory performance. The fibre content was also high across all samples, showing that dried baobab leaves remain an important source of dietary fibre in the formulations. Fibre is relevant for food security and health because it supports dietary quality and contributes to the nutritional value of traditional plant-based foods.

The fat content was highest in the fish-flavoured samples and lower in the beef-flavoured samples. This variation may be related to the composition of the condiments used in each formulation. The carbohydrate content was relatively moderate across the samples, with lower values in the 60:40 formulations. These results show that different ratios of baobab leaf powder and condiments can affect the nutritional balance of instant Miyan Kuka powder. The findings support the broader view that *Adansonia digitata* is a useful traditional food resource with nutritional and functional potential (Nour et al., 1980; Rahul et al., 2015).

The sensory evaluation results are presented in **Table 3**. The panelists evaluated the samples based on appearance, texture, taste, flavour, and overall acceptability. FF3 had the highest overall sensory score among the nine formulations. This sample also recorded the highest taste and flavour scores, indicating that the fish-flavoured 60:40 formulation was more acceptable to the panelists. The high sensory score of FF3 suggests that a higher proportion of baobab leaf powder combined with fish condiment produced a favourable balance of taste, flavour, texture, and appearance. This result is important because nutritional improvement alone is not enough for food product development. A product must also be acceptable to consumers if it is to be adopted in daily diets.

Table 3. Sensory evaluation results for instant Miyan Kuka soup.

NO.	ASSORTMENT FLAVOUR AND RATIO	APPEARANCE	TEXTURE	TASTE	FLAVOUR	OVERALL SCORE
1	FF1 (Fish 40:60)	6.6±1.9	6.4±2.0	4.8±1.6	4.8±1.7	5.3±1.0
2	FF2 (Fish 50:50)	6.1±1.5	6.3±1.8	5.5±1.9	5.5±2.6	5.8±0.3
3	FF3 (Fish 60:40)	6.5±1.6	6.5±1.5	6.2±1.4	6.2±1.7	6.2±0.2
4	BF1 (Beef 40:60)	6.3±1.8	5.9±1.7	6.0±2.0	6.0±1.8	5.6±0.7
5	BF2 (Beef 50:50)	6.2±1.6	6.4±1.5	5.7±1.8	5.7±1.6	5.9±0.3
6	BF3 (Beef 60:40)	5.6±1.8	5.8±1.8	6.0±1.6	6.0±1.1	5.7±0.3
7	CF1 (Chicken 40:60)	6.3±1.8	5.9±1.7	5.4±1.6	5.4±1.4	5.9±0.4
8	CF2 (Chicken 50:50)	6.5±1.8	6.7±1.6	5.7±1.4	5.7±1.4	5.9±0.6
9	CF3 (Chicken 60:40)	6.3±1.8	5.8±1.8	5.3±1.4	5.3±1.7	5.5±0.4

Note: FF, BF, and CF represent fish-, beef-, and chicken-flavoured assortments, respectively.

The sensory results also show that several samples had acceptable appearance and texture scores, but taste and flavour varied more strongly across formulations. This indicates that condiment type and mixing ratio influenced consumer perception of the product. For example, CF2 showed the highest texture score, but it did not achieve the highest overall acceptability. Similarly, BF1 and BF3 showed relatively good taste and flavour scores, but their overall scores remained lower than FF3. These findings suggest that the best formulation should be selected based on the combined performance of nutritional composition and sensory acceptability rather than a single attribute.

Among all samples, FF3 was the most promising formulation because it combined the highest protein content with the highest overall sensory score. This makes FF3 suitable as the recommended instant Miyan Kuka powder formulation in this study. Its protein and fibre contents suggest nutritional value, while its sensory score suggests consumer acceptability. The result supports the potential of dried baobab leaf powder as a nutritious base material for developing convenient traditional foods. Previous studies have described *Adansonia digitata* as a valuable African food tree with nutritional, traditional, and commercial importance (De Caluwé et al., 2010; Gebauer et al., 2002; Kamatou et al., 2011).

The findings also have implications for food security. Instant Miyan Kuka powder can support food utilization by providing a convenient, culturally familiar, and nutrient-dense food option. Since Miyan Kuka is already known in Northern Nigeria, developing it into an instant powder may increase accessibility and reduce preparation time while preserving its traditional identity. The addition of fish, beef, and chicken condiments can also improve nutritional diversity. In this sense, the product can contribute to SDG 2 by supporting access to nutritious local foods and to SDG 3 by promoting dietary quality and health-oriented food development.

The environmental relevance of the product is also important. Baobab is a multipurpose tree that contributes to food, health, and ecological systems in African dryland environments (Gebauer et al., 2002; Kamatou et al., 2011). Developing value-added products from baobab leaves may encourage the sustainable use of indigenous plant resources and reduce dependence on highly processed imported foods. However, sustainable production should be balanced with conservation efforts because climate change may affect baobab distribution and availability (Sanchez et al., 2011). Therefore, the development of instant Miyan Kuka powder should be linked with responsible sourcing, local biodiversity conservation, and SDG 12 on responsible consumption and production.

The results further suggest the importance of packaging and storage in maintaining the quality of instant Miyan Kuka powder. Because powdered products can absorb moisture and may be affected by oxidation, air-tight glass jars, laminated pouches, or vacuum-sealed packaging may help preserve product quality. Proper packaging is especially relevant because the study aims to develop a convenient instant product with improved shelf stability. Packaging can protect the product from moisture ingress, flavour deterioration, and nutrient loss, making it more suitable for household and commercial use.

Instant Miyan Kuka powder assortments from dried baobab (*Adansonia digitata*) leaves have promising nutritional and sensory qualities. The FF3 sample was the most suitable formulation because it provided the best combination of protein content and sensory acceptability. These findings support the potential of baobab leaf-based instant foods as culturally relevant products that can contribute to food security, environmental health, and

sustainable development. These findings are also related to broader discussions on food security, food packaging, and the use of locally available biological resources in applied food and agricultural studies (Fadillah et al., 2024; Febriani and Pasaribu, 2024; Silverio and Ramoran, 2022).

4. CONCLUSION

Instant Miyan Kuka powder assortments prepared from dried baobab (*Adansonia digitata*) leaves have promising nutritional and sensory qualities. Among the nine formulations, the fish-flavoured sample at a 60:40 ratio was the most suitable formulation because it showed the highest protein content and the best overall sensory acceptability. Baobab leaf powder can be developed into a convenient and culturally familiar instant food product. The addition of protein-based condiments improved the nutritional value and sensory quality of the product. Instant Miyan Kuka powder may support food security by improving access to nutritious local foods, while also promoting the sustainable use of indigenous baobab resources. This study is relevant to SDG 2, SDG 3, and SDG 12 because it supports local food utilization, dietary quality, and responsible consumption and production. Future studies should examine shelf life, microbial safety, packaging stability, consumer acceptance, and the potential for small-scale commercial production.

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6. AUTHORS' NOTE

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

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