



Standardization and Nutrient Composition of Melon and Groundnut Soups as Consumed in Cross River State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Author SOB conceived the work and designed the initial protocol, did the literature review, laboratory works, statistical analysis and contributed to the financing of the work. Author LCA modified the protocol and supervised every step of the study and wrote the draft of the manuscript. Authors GEI and VO participated in the laboratory work, statistical analysis and finance. Author MAA reviewed the design of the work and made inputs. All authors read and approved the final manuscript.

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ABSTRACT

Aim: The variability in the methods of preparing indigenous foods have led to uncertainty in the nutrient composition, sensory properties and quality of many foods consumed in Nigeria. This study is aimed at standardizing the different methods of preparing melon and groundnut soups and assessing their nutrient compositions as consumed in Cross River State (CRS), Nigeria.

Methodology: Melon (*Citrullus vulgaris*) and Groundnut (*Arachis hypogea*) seeds were purchased in Calabar, CRS, Nigeria in the month of February. Twelve Local Governments Areas (LGA) were randomly selected from the Eighteen LGAs in CRS. Focus group discussions (FGD) were conducted in each of the communities to determine common methods of cooking melon and groundnut soup and variations in recipes. Recipes collected during the FGD were standardized and prepared as described. Nutrient compositions were determined using standard laboratory

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methods. Data generated were analyzed using descriptive statistics. The least significant difference (LSD) was accepted at $P < 0.05$.

Results: All the soup samples were liked and accepted. For melon soup, method 1 and 2 had better rating and similar values for all the sensory parameters, although, method 1 had better general acceptability score. For groundnut soup, method 1 and 3 had better ratings and similar values for aroma, taste, colour, texture and general acceptability. The range for the proximate compositions were as follows; for melon soup, moisture 68.8- 70.9%; protein 10.1-11 %, fat 9.5-11.2%, ash 2.3-2.7%, dietary fibre 5.5-6%. For the groundnut soup, moisture ranged from 68.6-71.1%, protein 10.1-10.9%, fat 9.4-12.1%, ash 2.2-2.5%, dietary fibre 6-6.8%.

Conclusion: The standardized methods of preparing these soups will be useful in maintaining quality and quantity for easy reproducibility.

Keywords: Standardization; melon; groundnut; sensory evaluation; proximate composition.

1. INTRODUCTION

Nigeria is a multi-cultural society endowed with different traditional vegetable and seed-based soups which are indigenous to different ethnic groups and consumed with different traditional dietary staples, obtained from cassava, yam, cocoyam, sweet potatoes, plantain, millet, rice and maize [1]. Soup is defined as liquid foods usually savoury, made by stewing ingredients, such as meat, vegetables, fish, or game often as in a stock and with the required thickeners/legumes like 'ofo' 'achi' 'ofo' melon seed, groundnut seeds, 'ogbono' and cocoyam among others. Typical Nigerian soups like melon soup or Groundnut soup are usually seasoned with vegetables and are known to retain their nutritive values after cooking [2,3,4]. Soups are important type of food delicacy in the world. They are enjoyed by consumers of all social strata. The nutritional value of a soup type depends on their ingredients which are also determined by the financial strength of the individuals involved. There are various types of soups, which are peculiar to different tribes. They include; melon (egusi) (*Citrillus vulgaris*) seeds soup, the groundnut (*Arachis hypogaea* L) soup, Ogbono soup, Okazi soup, bitter leaf soup among others.

The Nigerian melon ('Egusi') soup is thickened with blended melon seeds with other leafy vegetables and other ingredients that make up the soup. Some of the ingredients used in preparing the soup are meat, fish, crayfish, vegetables seasoning and palm oil. It is popularly eaten by most tribes in Nigeria, often eaten with Nigerian staples like pounded yams, Garri, fofofo and rice. Typical leafy vegetables added to melon soups includes bitter leaves, pumpkin leaves, hot leaves (Uziza) and spinach leaves. In Nigeria, melon is popular among the Igbos, the

Efiks and the Ibibio people of South Eastern Nigeria, the Hausas of Northern Nigeria, the Yorubas, Edo, Esan, and Etsako of South-western Nigeria. The groundnut or Peanut soup on the other hand is another soup which is also eaten in some Southern and Northern parts of Nigeria and quite popular in the whole of West Africa. It is popularly called peanut soup or Omisagwe (Etsako people of Edo State) and Maafe amongst the Yorubas and also popular among the people of the Northern part of Cross River State (CRS) (Ogoja, Bekwarra, Obanliku and Yala and Obudu). The soup is a staple diet in most African cuisine as well as some other cultures like Taiwan in East Asia and Virginia in the States. It is warm, nourishing, full of flavours and very versatile which makes it perfect for any season of the year. It is loaded with a lot of protein from the peanuts and prepared with the addition of meat like chicken, beef or fish and vegetables. It can be made with or without vegetable leaves like bitter leaf, pumpkin, or Spinach leaves.

Groundnut and melon seeds are nutrient dense but there is a dearth of information on the nutrient composition of soups prepared from them because the methods of preparation are variable and needs to be standardized. Lack of a standardized recipe on most of the traditional dishes especially groundnut and melon soups as prepared and consumed in CRS contribute to the variability in quality, nutrient, chemical compositions, sensory properties as well as their functional properties. This study therefore seeks to harmonize the various methods of preparing these soups and then standardize the recipe to enhance uniformity of the soup as consumed in CRS and hence the nutrient composition. These will help meal planners and can also enhance the food database.

2. MATERIALS AND METHODS

2.1 Area of the Study

The study was carried out in Cross River State, South-southern Nigeria with an area of 20,156 km². The state is bounded by Benue State in the north, Ebonyi State in the West, and Akwa Ibom State in the Southwest, the Republic of Cameroun in the East and the Coastal zone (Atlantic Littoral) in the South. There are Eighteen Local Government Areas (LGAs) in CRS [5]. Melon soup is popular among the Ibibio people and the Efik people while Groundnut soup is mostly eaten in Northern Cross River (Obudu, Ogoja, Bekwarra, Obanliku and Yala). 'Editan', 'Atama' and 'Afang' soups are also popular soups in Cross River State.

2.2 Study Design

The recipe documentation was done using cross-sectional survey. The harmonization, standardization and chemical analysis of the recipe was achieved by using the quasi experimental design.

2.3 Study Population

The population for this study consisted of twelve (12) LGAs in Cross River State, Nigeria, which included: Calabar Municipal, Calabar South, Odukpani, Bakassi. Akamkpa, Biase Abi, Etung, Ogoja, Bekwarra, Boki and Obudu,

2.4 Study Sample

Stratified random sampling technique involving the use of random selection and purposive sampling technique was used in the study. The recipes were standardized based on the similarities in methods of preparation of these soups by clusters of selected ethnic groups across the three Senatorial districts of Cross River State, Nigeria, which includes the Efik and Qua ethnic groups in Calabar Municipality and Calabar South LGAs of the Southern Senatorial District; Ugep, Agoi, Bahumono ethnic groups in Yakurr and Abi LGAs, Mbembe in Obubra LGA, Etung, Olulumo, Ofutop, Nkim/Nkum, Abanajum, Nseke and Boki ethnic groups in Ikom, Etung, and Boki LGAs all of Central Senatorial district; Yala/Yache, Igede, Ukelle, Ekajuk, Mbube ethnic groups in Yala and Ogoja LGAs; Bette, Utugwan, Obanliku, Bekwarra ethnic groups in Obudu, Obanliku and Bekwarra LGAs all of Northern Senatorial District of the State. Focused group discussion was conducted by purposefully selecting the study community from Twelve (12) local Government Areas.

2.5 Data Collection

2.5.1 Focus group discussion

The recipes and methods of preparation of melon and groundnut soups were collected through a focused group discussion. This took place in all the communities that were selected for the study. Twelve adult who were familiar with the soups were purposefully selected through a community representative that served as the facilitator. The focused group discussions lasted for about one hour [6].

2.5.2 Recipe standardization

The recipe standardization process was in three phases which included recipe verification, product evaluation and recipe adjustment [7]. The verification phase included the recipe review for important components like title, category, measurement, ingredients, methods of preparation, time, temperature, yield, portion size and equipment. After the review, the recipes were harmonized to avoid duplication. The harmonization process involved the determination of the mean values of each ingredient as described by Davidson, Ene-Obong and Chima [8]. Similar recipes were merged. The traditional methods of preparing melon and groundnut soups as described by the indigenous people of CRS, Nigeria during the FGD was used to prepare the soups.

2.6 Recipe and Methods of Preparation

2.6.1 Recipe for melon ('egusi') Soup (See Table 1)

Preparation of melon soup (method 1)

Method of preparation

- I. Melon seeds were sorted and blended
- II. Water was added to deboned and washed fish, washed stock fish and beef
- III. Seasoning (salt, pepper, onion, bouillon cube) was added to the mixture
- IV. It was boiled for 20 minutes
- V. Grounded melon seeds were added and simmered for 5 minutes
- VI. Palm oil was added and simmered for 5 minutes under a low heat
- VII. Crayfish and bitter leaf were added and was simmered for 2 minutes and cooking was terminated.

Preparation of melon soup (method 2)

Method of preparation

- I. Melon seeds were sorted and blended
- II. Fish was deboned and washed, stock fish and beef were also washed
- III. Water, salt, pepper, onion, bouillon cube were added to the beef, stock fish and fish; they were boiled for 20 minutes
- IV. Melon powder was soaked in 200ml of water for 10 minutes
- V. Palm oil was heated slightly in a different pot
- VI. Diced onion was added to the oil and heated slightly
- VII. The soaked melon was added to the oil and fried till dry for 5 minutes
- VIII. The mixture was stirred continuously to avoid getting burnt.
- IX. The stock was added to the mixture, water leaves was also added and simmered for 15 minutes
- X. Crayfish and pumpkin leaves were added and allowed to simmer for 2 minutes and cooking was terminated.

Preparation of Melon soup (method 3)

Method of preparation

- I. Melon seeds were sorted and blended
- II. Fish was deboned and washed, stock fish and beef were also washed

- III. water was added to the beef, stockfish and fish
- IV. Seasonings (salt, pepper, onion, bouillon cube) were added to the beef, fish and stockfish and was boiled for 20minutes
- V. Milled melon was added and boiled for 20 minutes
- VI. Palm oil was added to the stock
- VII. Crayfish, and pumpkin were added
- VIII. Hot leaf was cut and added and simmered for 2 minutes and cooking was terminated.

Method of preparation of melon soup method 4

Method of preparation

- I. Melon seed was sorted and blended
- II. Fish was deboned and washed, stock fish and beef were also washed
- III. Water, salt, pepper, onion, bouillon cubes were added to the beef, fish and stock fish and was boiled for 20minutes
- IV. Palm oil was added to the stock
- V. 100 ml of water was added to milled melon in other to make balls.
- VI. The Melon balls were added to the stock and boiled for 20 minutes
- VII. Sliced pumpkin leaves and crayfish were added to the mixture and was simmered for 3 minutes and cooking was terminated.

Table 1. List of ingredients and quantity for melon ('egusi') soup

Ingredients	Quantity (g)			
	Soup 1	Soup 2	Soup 3	Soup 4
Melons	245	245	245	245
Meat	500	500	500	500
Dry fish	350	350	350	350
Stock fish	380	380	380	380
Crayfish	50	50	50	50
Salt	7.5	7.5	7.5	7.5
Pepper	5	5	5	5
Bouillon cube	16	16	16	16
Onion	65	65	65	65
palm oil	75 ml	75 ml	75 ml	75 ml
Water	1500 ml	1500 ml	1500 ml	1500 ml
Bitter leaves	100 g	-----	-----	-----
Water leaves	-----	50	-----	-----
Pumpkin leaves	-----	50	50	100
Hot leaves	-----	-----	50	-----

Table 2. List of ingredients and quantity for groundnut soup

Ingredients	Quantity (g)			
	Soup 1	Soup 2	Soup 3	Soup 4
Groundnuts	338	338	338	338
Meat	500	500	500	500
Dry fish	350	350	350	350
Stock fish	380	380	380	380
Crayfish	50	50	50	50
Pepper	13	13	13	13
Salt	11	11	11	11
Bouillon cube	16	16	16	16
Locust bean (<i>Dawadawa</i>)	42	42	-----	-----
Onions	5	5	5	5
palm oil	150 ml	150 ml	150 ml	150 ml
Water	1750 ml	1750 ml	1750 ml	1750 ml
Hot leaves	100	-----	100	-
Bitter leaves	-----	100	-----	100

Method of preparation of groundnut soup (method 2)

- I. Groundnut seeds were toasted for 5 minutes and then milled to powder
- II. Fish was deboned and washed, stock fish and beef were also washed
- III. Water, beef, stock fish, fish, salt, pepper, onion, bouillon cube were added to the beef, fish and stock fish and was boiled for 10minutes
- IV. Palm oil was added
- V. Milled groundnut and dawadawa (locust beans) were added and simmered for 10 minutes.
- VI. Crayfish and squeezed and washed bitter leaf were added and simmered for 5 minutes and cooking was terminated.

Method of preparation of groundnut soup (method 3)

- I. Fresh groundnut seed were milled to powder
- II. Fish were deboned and washed, stock fish and beef were also washed
- III. Water, beef, stock fish, salt, pepper, onion, bouillon cube were added to the beef, fish and stock fish and boiled for 10minutes and stock was ready
- IV. Blended groundnut was soaked in 35ml of water for 5 minutes
- V. Oil was heated lightly in a different pot
- VI. Diced onion was added to the oil and was fried lightly
- VII. The soaked groundnut was added and fried for 5 minutes

- VIII. Continuous stirring to avoid sticking to the pot
- IX. The stock was added and stirred continuously to avoid burning and sticking to the pot
- X. It simmered for 10 minutes
- XI. Crayfish was added and simmered for 5 minutes
- XII. Hot leaves were cut and added and simmered for 1 minutes and cooking was terminated.

Method of preparation of groundnut soup (method 4)

- I. Fresh groundnut seeds were milled to powder
- II. Fish was deboned and washed, stock fish and beef were also washed
- III. Water, beef, stock fish, fish, salt, pepper, onion, bouillon cube were added to the beef, fish and stock fish and was boiled for 10minutes
- IV. The groundnut paste was added
- V. Palm oil was added and simmered for 10 minutes
- VI. Cut and washed bitter leaves and crayfish were added and simmered for 5 minutes and cooking was terminated.

2.7 Sensory Evaluation

Consumer acceptability of the products was carried out using the Affective tests. The affective test is based on individual acceptability or preferences and involves the rating/acceptance test on a 9- point hedonic scale to determine the

degree of acceptability of the new products [9,10].

2.7.1 Description of method of test

This test involves an emotion for a stimulus, liking, acceptance or preference of a product over another. The panelist rates his or her preference for one of the samples on a specific quality on the score sheet. Hedonic rating scales was used to measure the degree of acceptability experienced with each sample. The frequency that a panelist might desire to eat the soup was measured to determine the acceptability of the various samples [11].

2.7.2 Test panel

A thirty-member untrained panelist consisting of lecturers, technologist, and students at the University of Calabar were engaged to evaluate the sensory characteristic of the soups. The test procedure was explained to the panelist until they became familiar with the test format, and the meaning of the scale.

2.7.3 Test environment

The soups were prepared under the same condition of temperature. The products were coded and rated for colour, taste, aroma, texture, and overall acceptability. Panelists were seated individually in a well-ventilated room to reduce odour build up. The room was well lighted to permit visual cues to contribute to the assessment. Subjects were not allowed to communicate to avoid influence. The doors were separated to ensure a separate entrance and exit. This is to avoid any communication that could interfere with the test result.

2.7.4 Procedure for consumer test

The soups were displayed for sensory evaluation on separate days. In this evaluation, a 30 member panelist (each soup) was selected to rate the soups on a 9- point hedonic scale, where 1 represents lowest and 9 represents the highest for colour, consistency, flavor, texture and general acceptability. The products were presented separately in an appropriate food warmer and coded. On arrival, the judges were served a coded product using a side plate. An evaluation form was also given immediately to each of the judges. A glass of water was given to rinse the mouth after each tasting; this is to avoid a carryover taste from preceding samples.

2.8 Sample Preparation

The moisture contents of the soup were determined on wet weight basis by using five

grams of each sample to determine the actual moisture at 100°C. The remaining soups were dehydrated and homogenized with the use of electric blender. The homogenized samples were stored in an airtight container and refrigerated for chemical analysis.

2.9 Chemical Analysis

Protein, moisture (actual and residual), fat, ash, soluble and insoluble dietary fibre, minerals (were determined according to the method of AOAC [12]. Moisture was determined using the air oven method. Crude protein and fat were determined by Kjeldahl procedure and Soxhlet solvent extraction method, respectively. Total dietary fibre was determined by enzyme gravimetric method of Prosky et al. [13]. Ash was determined by incineration of samples in a muffle furnace at 550°C for six hours. Available carbohydrate was calculated by difference $100 - (\text{moisture} + \text{protein} + \text{fat} + \text{ash} + \text{dietary fibre})$ [14].

3. RESULTS AND DISCUSSION

3.1 Sensory Evaluation of Egusi Soup

Table 3 presents the result of the sensory evaluations of melon soup prepared as consumed in Cross River state. The soup was prepared using four different methods and vegetables. The soup that was prepared using method 1 (bitter leaf as a vegetable source) had the best scores for all the sensory parameters (aroma 7.34, colour 7.66, taste 7.80, texture 7.80 and GA 8.11) assessed. Although, the scores of the sensory parameters were not significantly ($P < 0.05$) different from that of the soup prepared using method 2 (waterleaf and pumpkin leaves as vegetable source). The soups prepared using method 3 (hot leaves as vegetable source) and 4 (pumpkin leaves as vegetable source) had similar ($p > 0.05$) values which were lower than that of methods 1 and 2 with statistical difference ($P < 0.05$). These variations might be attributed to the variations in the vegetables used. Surprisingly soup 1 which was garnished with bitterleaf had the best acceptability status. The importance given to bitterleaf soup in the eastern part of Nigeria might explain this. Studies have reported favourable acceptability status of bitterleaf soup [15] and fish preserved with bitterleaf [16].

Table 4 presents the sensory evaluations of groundnut soup. The groundnut soups varied in

their methods of preparations and some ingredients like locust beans and leaves. Soups prepared with methods 1 and 3 had the best sensory and comparable ($P>0.05$) properties (aroma, colour, taste, texture and GA) which was significantly different ($P< 0.05$) from the soups prepared using methods 2 and 4. The groundnut soup that was prepared using method 1 had the best sensory scores for aroma (7.58), colour (7.73), taste (7.42) and general acceptability (7.55). These sensory attributes might have been conferred on it by the fermented locust bean seed commonly known as 'dawadawa' in Cross River State, Nigeria which was used. This condiment is popular among the populace of Northern CRS. It is known as a food flavour enhancer with about 54 volatiles, it is also known to improve other sensory characteristics of food [17,18]. Aside the condiment used, the method of preparation of the soups which differed from methods 3 and 4 by toasting of the groundnut before milling could also have contributed to the acceptability status of the soup. Toasting or roasting as a method of cooking is well known to improve flavour and food acceptability [19]. Aside the method of preparation and the use of 'dadawa' as the food condiment, the variant vegetables might have influenced the acceptability status of the soups. Methods 1 and 2 had similar condiments and methods of preparation but varied in the type of vegetable used for

garnishing. Method 1, which was garnished with hot leaves had the best acceptability status in almost all the sensory properties assessed.

The addition of hot leaves might be responsible for these observations. Hot leaves (Piper guineense) locally called 'uziza' leaves are can be used as spice for seasoning and imparting aroma to food, they are equally consumed as vegetable [20].

3.2 Sensory Evaluation of Groundnut Soup: Table 4

Table 5 presents the proximate compositions of two melon soups with the best acceptability status. They are the soups prepared using methods 1 & 2. Protein (11.2%), fat (11.2%) dietary fibres (6%) were significantly ($P<0.05$) higher in the melon soup that was prepared using method 2. The variation in the protein content might be attributed to the vegetables used, since that was the only ingredient that varied in the recipe. Studies have reported higher protein contents of bitterleaf leaves when compared to most vegetables [21], the protein contents of waterleaf (*Talinum triangular*) leaves and pumpkin leaves as reported by Aja et al., [22] and Orhuamen et al, [23] was also lower than that of bitterleaf leaves reported by Aburime et al. [21]. Also, the higher dietary fibre reported

Table 3. Sensory evaluation of melon ('Egusi') soup

Melon soup	Aroma	Colour	Taste	Texture	General acceptability(GA)
Method 1	7.34±1.35 ^a	7.66±1.55 ^a	7.80±.96 ^a	7.80±1.11 ^a	8.11±1.16 ^a
Method 2	7.34±1.96 ^a	7.71±1.55 ^a	7.37±1.72 ^{ab}	7.43±1.20 ^a	7.46±1.82 ^a
Method 3	6.43±1.15 ^b	6.14±2.02 ^b	6.69±1.23 ^{bc}	6.34±1.63 ^b	6.20±1.61 ^b
Method 4	6.83±1.36 ^{ab}	6.34±1.86 ^b	6.40±1.87 ^c	6.43±1.90 ^b	6.66±1.68 ^b

*mean of 30 panelist response on a 9-point hedonic scale with 9 = like extremely to 1 = dislike extremely. ^{a-b} values with different superscripts on the same column are significantly different ($P< 0.05$). Organoleptic Scores/rating 1. Dislike extremely, 2. Dislike very much, 3. Dislike moderately, 4. Dislike slightly, 5. Neither like nor dislike, 6. Like slightly, 7. Like moderately, 8. Like very much, 9. Like extremely

Table 4. Sensory evaluation of groundnut soup

Groundnut soup	Aroma	Colour	Taste	Texture	General acceptability
Method 1	7.58±1.12 ^a	7.73±1.40 ^a	7.42±1.28 ^a	7.18±1.51 ^a	7.55±1.34 ^a
Method 2	6.85±1.50 ^b	7.48±1.56 ^a	7.27±1.67 ^a	7.33±1.53 ^{ab}	6.85±1.99 ^b
Method 3	7.03±1.67 ^{ab}	7.18±1.42 ^{ab}	7.36±1.34 ^{ab}	7.12±1.67 ^{ab}	7.21±1.60 ^{ab}
Method 4	6.67±1.90 ^b	6.45±2.09 ^b	6.97±1.69 ^b	7.39±1.01 ^b	6.55±1.82 ^b

*mean of 30 panelist response on a 9-point hedonic scale with 9 = like extremely to 1 = dislike extremely. ^{a-b} values with different superscripts on the same column are significantly different ($P< 0.05$). Organoleptic Scores/rating 1. Dislike extremely, 2. Dislike very much, 3. Dislike moderately, 4. Dislike slightly, 5. Neither like nor dislike, 6. Like slightly, 7. Like moderately, 8. Like very much, 9. Like extremely.

Table 5. Proximate composition of melon soups prepared using methods 1&2 as consumed (% wet weight basis)

Parameters	method 1	Method 2
Protein	10.3±0.14 ^b	11.2±0.10 ^a
Fat	9.5±0.15 ^b	11.2±0.15 ^a
ASH	2.7±0.11 ^a	2.3±0.15 ^b
Available carbohydrate	0.9 ±0.35 ^a	0.6±0.35 ^a
Moisture	71.1±0.69 ^a	68.8±0.45 ^b
Dietary Fibre	5.5±0.01 ^b	6.00±0.01 ^a

Values presented mean of triplicate values ± SD (Standard Deviation). . ^{a-b} values with different superscripts on the same row are significantly different (P< 0.05).

Table 6. Proximate composition of groundnut soup prepared using two different methods

Parameters	Groundnut Soup	Groundnut Soup
	Method 1	Method 3
Protein	10.1±0.04 ^b	10.9±0.08 ^a
Fat	12.1±0.08 ^a	9.4±0.075 ^b
Ash	2.2±0.165 ^b	2.5±0.145 ^a
Available carbohydrate	0.4±0.27 ^b	0.3 ± 0.23 ^b
Moisture	68.6±0.09 ^b	70.9±0.38 ^a
Dietary Fiber	6.8±0.007 ^a	6.0±0.007 ^b
Energy (kcal/KJ)	438.33/ 5967.1	424.95/ 4979.62

Values presented mean of triplicate values ± SD (Standard Deviation). . ^{a-b} values with different superscripts on the same row are significantly different (P< 0.05).

might also be attributed to the same reason. Consuming foods high in dietary fibre might help people live healthier lives by preventing and managing chronic non-communicable diseases like diabetes, hypertension, certain cancers, and other cardiovascular diseases [24].

Table 6 presents the proximate composition of two groundnut soups (as consumed) with the best acceptability status. They were prepared using methods 1 &3. The soup prepared using method 3 had the best protein content of 10.9% which was significantly (P<0.05) higher than that prepared using method 1 (10.1%). These higher protein content might be attributed to the method of preparation. The difference in the methods of preparation is in the toasting of the groundnut. Studies have observed lower protein contents of toasted/roasted foods [25]. It is not surprising that the groundnut soup that was prepared using method 1 had the highest fat content, this observation can also be attributed to toasting. Toasting reduces moisture and protein, leading to more concentration of fat. The reduced ash (2.2%) content of the soup prepared using method 1 is an indication of lower mineral content [26].

4. CONCLUSION

Non standardization of recipes and methods of preparing most indigenous foods in Nigeria has been a long-standing problem leading to variability in quality of food produced and the cost of production, among others. This study explored the different methods of preparing melon and groundnut soups in CRS using FGD. The data collected were verified, harmonized, and standardized using food standardization methods. From the results, the different methods used in preparing the soups were all accepted but methods 1 & 2 were best for melon soups, while methods 1& 3 had higher scores for the sensory properties (aroma, colour, taste and general acceptability) for Groundnut soup. The most accepted soups which were further subjected to proximate analysis which showed that moisture was more abundant followed by protein, fat and then dietary fibre. With the outlined methods, researchers, food processors and consumers can produce melon and groundnut soups with uniformity following the methods as used in CRS.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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