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Nutrient Composition and Sensory Evaluation of Molded Melon (*Carcubita citrullus*) and Elephant Grass (*Pennisetum purpureum*) (*Achara*) Indigenous Soup (*Ofe Akpuruakpu Mgbam*)

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Abstract

This study investigated nutrient and mineral compositions of elephant grass (*Pennisetum purpureum*) *achara* soup. All ingredients used in the soup preparation were sourced from Watt Market in Calabar, Cross River State, Nigeria. The study adopted experimentaldesign. Standard procedures were employed at all steps of the experiment. A 9-point hedonic scale was used for sensory evaluation to rate the flavor, color, appearance, texture, and general acceptability. Findings nutrient contents reveal moisture 32.10g/100g; protein 22.50 g/100g; fat 34.10g/100g; fiber 2.80 g/100g; carbohydrate 4.74 g/100g; and ash 3.40 g/100g. Mineral composition of the soup include 0.013mg/100g for potassium, calcium 21.40mg/100g, magnesium 138.30mg/100g, iron 0.82mg/100g, and phosphorus 2.84 mg/100g. It was concluded that consumption of the soup can positively impact the nutritional status of individuals. Nutrient and mineral compositionsof the soup can provide essential dietary components that can help address nutrition-related conditions. Encouraging increased consumption of this soup among communities may contribute to the reduction of malnutrition and associated health issues.

Keywords: Elephant Grass, Melon, Indigenous, Soup, Nutrient, Composition, Evaluation, Sensory.

Introduction

Soup is a replenishing, aromatized and a complete meal. In most cases it plays a very important role on the menu and is served as appetizer to stimulate appetite for the rest of heavier foods to follow (Shivesh, 2013). Soups can be classified based on their texture. Some soups are either light or thick hence certain soups are classified into a category called international soups. These soups are essentially national soups of different countries. Soups represent the region of origin therefore that is where African soups especially Nigerian soups fall into. This is because they are garnished or have varied ingredients are added to the soup. For instance, the *ofe* Owerri (Owerri vegetable soup) are garnished with stock fish, smoke fish, big snails, vegetables, crayfish, pepper and palm oil with seasoning (Ukam and Udonwa

2020). The molded-melon (*mgbam*) and (*Pennisetum purpureum*)soup falls into this category.It is prepared with blended melon *achara*(elephant grass) tender stalk and *ukazi* (*Gentumafricanum*) enriched with beef, fish, snail and other ingredient. This soup meal is prepared and consumed on special occasions like traditional and white wedding, funeral and new year ceremonies as a delicacy and a relish among the Ngwa people of Isiala Ngwa and Umuahia in Abia state and some part of Akwa Ibom state in Nigeria. However, as popular this soup meal is among these people, it is not found in the food composition table of Nigeria and West Africa. This is because there is dearth of information on the nutrient profile of this soup meal. Hence this research into the investigation of the nutrient content of molded melon (Mgbam) *Pennisetum purpureum* (Achara, elephant grass) soup.

The consumption patterns of starchy staples, including cassava *fufu, garri,* and *amala*, are highly prevalent different regions in Nigeria and sub-Saharan West Africa. These staples are commonly consumed alongside soups, as they provide incomplete nutrition when consumed alone. In these regions, carbohydrate-rich foods such as fufu (fermented cassava paste), *garri* (fermented cassava granules), and *amala* (yam peel flour) when prepared into a gelatinized paste, are consumed on a daily basis, often multiple times a day, in combination with various soups, particularly the molded melon-*Achara* (Elephant grass) soup. This study aims to assess the nutrient composition of this soup and emphasizes the importance of incorporating standardized recipes of these local soups into the national cuisine. By doing so, Nigeria can attract tourists seeking an authentic taste of Nigerian soup meals, consequently promoting and establishing Nigerian cuisine as an integral part of international or continental culinary traditions.

Chemical analysis investigates the composition of a food usually a 100g portion. This is because the chemical analyses of nutrients present in foods are recorded in food composition table. The food tables are reference sources for estimating the nutrient content of a diet. The information about the energy and chemical composition of a particular food item can be seen in a food composition table (Omaha and Okaka, 2008).

Sensory evaluations are carried out with standardized recipe. United state Department of Agriculture (USDA) defined a standard recipe as one that has been tried, adapted and retried several times for use by a given food service operation and has been found to produce the same good results and yield every time with the same type of equipment and the same quantity and quality of ingredients. USDA also pointed out that it must contain nine compulsory components; recipe title, category, ingredient weight and volume of each ingredient, preparation instructions, cooking temperature and time, serving size, yield, equipment and utensils used. It may also contain other components such as contribution to the food-based menu system/ state/federal reviews, nutrient analysis (nutrient per serving) and market guide (Mellingard, Civille and Carr, 1997).

The appearance of food is crucial in determining its tastiness. It includes color, shape, portion size, greasiness, transparency, and brightness. These aspects should meet consumers' expectations. Once food visually appeals, the evaluation shifts to the sense of smell, taste, and texture in the mouth, collectively known as flavor.The study aimed to investigate the nutrient content and sensory attributes of molded melon-elephant grass soup meal. Specifically, it examined the proximate, mineral, and sensory attributes of the meal.

Purpose of the Study

The general purpose of the study was to investigate attributes of molded melon-*achara* soup meal. Specifically the study determined:

1. nutrient content of *achara* soup meal.
2. mineral composition of *achara* soup meal.
3. sensory attributes of*achara* soup meal.

Materials and Methods

***Design of the Study*:** The study adopted an experimental design. It involved using standard procedures to determine the nutrient and mineral content of the soup meal.

***Materials and Procurement*:** The food crops used in the study were wild spinach (*Gnetum africanum*) also known as *ukazi* or *afan* in southern Nigeria, elephant grass (*Pennisetumpurpurum*) known as *achara* in southern Nigeria, king tuber mushroom known as *usu* (*Pleurotustuber-regium*), *achi* (*Brachystegiaeurycoma*), beef, fish (*Mangala*), fresh chili pepper, crayfish, and salt. All ingredients were purchased from Watt Market in Calabar Metropolis, Cross River State.

***Preparation of Materials*:** The materials were prepared as follows:

Molded Melon: 750g of melon seeds were placed in a wooden mortar with 180g of sliced onions, 11g of fresh chili pepper, 8g of bouillon cubes (*Knorr* brand), 88g of powdered king tuber mushroom (*usu*), and one level tablespoon of salt. The mixture was kneaded until a paste formed. Then, 20ml of hot water was added to the melon paste and kneaded continuously until oil was extracted. The *usu* facilitated the process. The melon paste was then molded by hand into desired sizes. The molded melon was placed in 100ml of boiling water on a gas stove and boiled for 35 minutes.

Elephant grass: The elephant grass (*achara)* (*Pennisetum purpureum*) was peeled, removing the old hard stalks and keeping only the tender stalks. The tender stalks were cut into small pieces of about 1cm. The tender stalks were washed and used for soup preparation.

***Achara* Soup Preparation:** Ingredients (recipe) and procedure for soup preparation are as follow:

Ingredients	Quantity (g)
Achara (Elephant grass) (*Pennisetum purpireum*)	457
Ukazi (*Gnetum africanum*)	217
Melon seeds (for molded melon)	740
Achi (*Brachlystegiaeurycoma*)	26
King tuber mushroom (*Usu)*	88
Snail	282
Mangala fish (Shallow water caught fish)	194
Stockfish (head)	637
Crayfish (*Procambarusclarkia*)	167
Beef	108
Onions	108
Palm oil	256
Salt	4 levels tbsp
Black pepper	8 ½ levels tbsp
Seasoning bouillon cubes	4 cubes

Preparation Procedure

Boil beef, stock-fish, *mangala* (fish), snail with seasoning (billion cubes), till tender.

Add *achara,* pepper boil for 30 minutes.

Add mixed *achi* thoroughly with palm oil and *usu,* boil for 10 minutes.

Add molden melon and *ukazi,* onions and salt to taste, boil for 5 minutes.

Sensory Evaluation: This involved the following:

Panel of Judges: A total of 25 judges, consisting of laboratory attendants and four lecturers of Department of Human Nutrition and Dietetics University of Calabar, were purposively selected and trained.

Instrument for Data Collection**:** A 9-point hedonic scale was developed and used to assess the flavor/aroma, taste, color/appearance, texture, and general acceptance of the soup meal.

Data Collection Procedure**:** This took place in the Department of Human Nutrition and Dietetics laboratory at the University of Calabar, Calabar. To minimize distractions, each panelist was assigned to an individual compartment and served freshly prepared elephant grass soup. The judges evaluated the sample for flavor, taste, color, texture, and overall acceptability using a 9-point hedonic scale, where 9 was the highest score and 1 was the lowest. The method used by Amadi, Agumuo, and Ibegbulam (2004) was adopted.

Chemical Analysis**:** Moisture, protein, fat and ash contents were analyzed using AOAC (2006).Carbohydrates content was obtained by difference, of the sum of percentage of protein, fat, ash, fibre and moisture which was subtracted from 100 percent to obtain the value for carbohydrate.

Mineral composition was determined using the atomic absorption spectrophotometer method as described by International Institute of Tropical Agriculture (2002). The minerals assessed included sodium, potassium, calcium, magnesium, iron, zinc, copper, manganese, and phosphorus.

***Data analysis*:** Data analyzed using mean, standard deviation and analysis of variance (ANOVA) using statistical package for the social sciences (SPSS

Results

Table 1: Proximate Composition of Molded-Melon*Achara* (Soup

Composition	g/100g
Moisture	32.10±0.03
Ash	3.04±0.06
Protein	22.30±0.04
Fat	34.10±0.06
Fibre	2.80±0.06
Carbohydrate	4.74±0.02

*Mean ± standard error mean

Table 1, reveals the following quantitative values: moisture content of 32.10g/100g, ash content of 3.40g/100g, protein content of 22.50g/100g, fat content of 34.10g/100g, fiber content of 2.80g/100g, and carbohydrate content of 4.74g/100g. When examining the proximate composition of the molded-melon *achara* soup, it is evident that the moisture content stands at 32.10g/100g. This measurement indicates the amount of water present in the soup and plays a crucial role in its texture and overall quality.

The ash content, 3.40g/100g, represents the inorganic residue left over after full combustion. The ash content reveals information about the mineral composition of the soup, which might affect its nutritional value and potential health benefits. A notable component of the soup is its protein content, which measures 22.50g/100g. Proteins are essential macronutrients that play a critical role in various physiological processes, such as tissue repair and enzyme synthesis. The substantial presence of protein in the soup suggests its potential as a source of dietary protein. In terms of fat content, the Molded melon-elephant grass soup contains 34.10g/100g. Fats serve as a concentrated energy source and contribute to the overall taste and mouthfeel of the soup. Additionally, fat-soluble vitamins and essential fatty acids are often present in fat, making it an important component of a balanced diet. The soup has a fiber content of 2.80g/100g. Fiber is an indigestible carbohydrate that is essential for promoting healthy digestion and intestinal regularity. The presence of fiber in the soup suggests that it may provide nutritional benefits such as increased satiety and gut health. The carbohydrate content of the molded-melon*achara* soup is 4.74g/100g. Carbohydrates are the body's major source of energy and are required for a variety of physiological activities. The soup's carbohydrate content contributes to its overall nutritional profile and can be a significant source of energy for users.

Table 2: The Mineral Nutrient Composition of *Achara* Soup Meal

Minerals	mg/100g
Sodium (Na)	0.02±0.03
Potassium (K)	0.24±0.0
Calcium (Ca)	21.40±0.04
Magnesium (Mg)	148.30±0.06
Iron (Fe)	0.82±0.06
Zinc (Zn)	0.15±0.02
Copper (Cu)	0.18±0.01
Manganese (Mn)	0.08±0.01
Phosphorus (P)	2.84±0.01

*Mean ± Standard error mean

Table 2 shows the mineral nutrient composition of the molded melon-elephant grass soup meal as follows: mineral content ranged from 0.02 to 148.30g. The mineral values were 0.02, 0.24, 21.40, 148.30, 0.82, 0.15, 0.18, 0.08, and 2.84mg/g for Na, K, Ca, Mg, Fe, Zn, Cu, Mn, and P respectively.

Table 3: Sensory Evaluation of *Achara* Soup Meal

Sensory attributes	Score
Aroma/Flavor	8.40±0.60
Colour/appearance	6.95±0.39
Taste	7.70±087
Texture	7.50±0.95
General acceptability	7.80±1.01

Mean ± Standard error mean

Table 3reveals the mean scores of sensory evaluations carried out on the molded melon-elephant grass soup meals as follows: Aroma/flavor (8.40%) colour/appearance (6.95%), taste (7.70%), texture (7.50%) and general acceptability (7.80%) respectively.

Discussion

This study investigated the proximate and mineral composition of *achara* soup meal commonly consumed by the Ngwa people of Abia state in Nigeria. The protein content was high (22.50±0.02%). The moisture content was very high (32.10±0.1) in comparison to the study carried out on traditional diet soup whose moisture content was 8.41±89% (Amadi, et al, 2018). The high moisture content of the soup may be due to amount of water used in the soup preparation.

The fat content of the soup was high (34.10±0.06). In comparison with a similar study which had a fat content of 22.00±2.00% (Amadi, Eke, Wegwu, and Osuoha, 2018). The high fat content of the soup can therefore be recommended as part of a weight gaining diets both for children and adults. High fatty foods are also said to pose risk of cardiovascular disease and also obesity. However, this may be due to the large quantity of melon used in the soup preparation. It could be recommended for the convalesce, for malnourished people. The carbohydrate content was low (4.74±0.02%), however suggesting that the soup cannot be served alone as food but alongside with a staple (Fufu or Eba). It can be used for weight management.

Ash content of the soup was higher (3.40±0.02%) in comparison with a similar study carried out by Omaha and Okaka, (2008) on nutritive value of four common soups consumed in eastern Nigeria (melon soup) which was 2.42%. This indicates a moderate level of inorganic elements (minerals) such as iron, Zinc, sodium and Potassium in the soup meal. The fibre content in the soup sample was very low (2.80±0.1%) which indicates that the fibre is limited and it is unhealthy to consume the soup frequently because it is unhealthy for the digestive system which can lead to both short- and long-term health complications.

Among all the minerals analyzed in the soup sample, magnesium was the most abundant (148.30±0.1mg/100g) element. Magnesium plays fundamental roles in most reactions involving phosphate transfer. It is believed to be essential in the structural stability of nuclei acids. It plays a significant role in the intestinal absorption of electrolyte in the body. The deficiency in man

includes severe diarrhea and persistent migraines. The calcium content was determined to be 21.40±0.1mg/100g. calcium helps in the regulation of muscle contraction required by children, infants and fetuses for bones and teeth development (Margaret and Vickery, 2008). The concentration of sodium in the sample was low 0.013±0.01/100g. Excess sodium consumption leads to hypertension (NRC, 2011). A meal low in sodium has both the negative and positive implications. It is beneficial because it helps reduce blood pressure and risk of cardiovascular diseases (WHO, 2020). The implication of consuming a low sodium diet is that it may result to hyponatremia. The potassium content was analyzed to be 0.02±0.02mg/100g. Potassium helps to maintain body weight and regulates water and electrolyte balance in the blood and tissues (National Research Council, 2011). The phosphorus content of the soup sample was 2.84±0.02mg/100g. This figure is lower than that reported on processed water leaf and fluted pumpkin by Ukam and Udonwa in 2020. Phosphorus plays a vital role in normal kidney functioning and transfer of nerve impulse. The concentration of zinc in the sample was given as 0.15±0.01mg/100g. It is an essential trace element for protein and nucleic acid synthesis and normal body development (Metaku,2005). Zinc also stimulates the activity of vitamins and the formation of red blood cells (Claude and Paule, 2010), it also plays a role in improving fertility.

The iron content of the sample was given as 0.82±02mg/100g and cannot be compared with the content of a similar study carried out by Amadi, et al (2018). Iron is said to be an important element in the diet of pregnant women, nursing mothers, teenagers and adolescent girls, infants, convalescing patients and the elderly to prevent anaemia and other related diseases (Oluyemi, et al, 2010). The concentration of Manganese in the sample was determined to be 0.08±0.02mg/100g and compares favourably to a similar study on traditional diets (*Achara* soup) 0.08±0.1mg/100g (Amadi, et al, 2018).

Conclusion

This study showed that the proximate and mineral composition of *achara*soup is a rich source of macro and micronutrients. The results appear to suggest that the soup could be a source of essential nutrients (protein, fat fibre, ash and carbohydrate) for instance, e*gusi* (melon seeds) which is used in the meal preparation has a high protein value and its consumption should be encouraged.

It is also noted that the nutrient composition of the soup is dependent on the ingredients used for its preparation. The variety of ingredients makes the soup a rich source of some nutrients. Hence, *achara*soup is likely to contribute appreciably to the daily nutrient requirement of people consuming considerable quantities and good quality soups.

Recommendations

1. It will provide information to the homemakers with the basic knowledge on the nutritional content of the molded-melon*achara* soup meal and method of

preparation especially those who regularly consume the soup
2. Cooking demonstration should be carried out during workshops, seminars on churches, community festivals to popularize the soup meal.
3. This soup meal should be included in Nigerian cuisine at all level such as at homes, hotels and local cafeteria (Bukas) etc.

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