

PROXIMATE AND MINERAL COMPOSITIONS OF FRESH ATLANTIC MACKEREL (*Scomber scombrus*) SOLD IN MAJOR MARKETS WITHIN GOMBE METROPOLIS, GOMBE STATE, NIGERIA

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ABSTRACT

The study determined the proximate composition and Mineral Compositions of Atlantic mackerel (*Scomber scombrus*) sold in various markets within Gombe Local Government of Gombe State. Atlantic mackerel is one of the most commercialized marine fish species consumed in Nigeria due to its high nutritional values. Fresh samples of Atlantic mackerel sold in Gombe local markets were bought, chilled in an ice in a plastic container and transported to the Department of Animal Science, Federal University of Kashere for Mineral and Proximate Analysis. The samples were purchased in triplicates from the four major Gombe markets and were tagged as; New Market (A), Old Market (B), Tashan Dukku (C) Pantami Market (D). Proximate analysis was conducted using the Association of Official Analytical Chemists (AOAC 2005) method to determine the Protein, Fiber, Moisture, Ether Extract and ash. Mineral contents of the samples were determined by atomic absorption spectrometry, flame photometry and spectrophotometry method. Mineral elements detected includes; Potassium (K), Iron, Copper, Phosphorous and Zinc. Results showed that highest mean value of the moisture, ash, ether extract, crude fiber, and crude protein contents in percent (%) as: 75.92, 1.22, 7.55, 1.10 and 19.65 respectively. The mineral composition was found to be higher in D with 148.52 (Phosphorous), A 14.67 (Zinc), C 11.93 in Copper, 3.02 (D) in Iron and 192.03 in Potassium with treatment D. In conclusion, the study revealed that there is a significant differences in nutritional content among fish sourced from the various markets. Both fish sold in the markets are rich in essential nutrients and minerals, making them a valuable food source. The findings also highlight the importance of marine species in human nutrition and health. Results from this study can also inform policy makers on food security and nutrition to regulate the available fish species sold in the major markets for public health concern.

Keywords: Proximate, Atlantic Mackerel, Mineral, Gombe, *Scomber scombrus*

1.0 INTRODUCTION

Fish is an essential dietary food item, particularly in underdeveloped nations, because of its high nutritional and protein value which might be the only economical and or easily accessible source of animal protein for low-income households (Abdullahi *et al.*, 2024). Fish also contains Omega-3 fatty acids that are polyunsaturated which are essential for good health particularly EPA and DHA that have proven to have numerous health benefits (Okwakpam *et al.*, 2023). These include reducing the risk of heart disease, improving brain function and mental health, and reducing inflammation in the body (Calder, 2015). *Scomber scombrus* which belongs to the family Scombridae, are widely recognized for their economic and nutritional value. They are pelagic species rich in nutrients

which include omega-3 fatty acids, proteins, vitamins, and minerals, making them a valuable dietary component in many cultures (Abdullahiet *al.*, 2024). Essential Minerals such as calcium, potassium, magnesium, sodium, and phosphorus are important for both human and animal nutrition because they support a number of physiological functions such as cellular signaling, enzymatic activity and bone formation (Carter *et al.*, 2021). The essential minerals and proximate compositions of food are important for assessing the economic viability of any nation. Since a healthy man brings about a healthy economic development and invariably a healthy nation (Hafsat *et al.*, 2024). Most of our diets are deficient of essential minerals derivable from animals which has led to malnutrition and

increase in various health challenges amongst the populace (Hafsat *et al.*, 2024). Global changes in consumer's life style marked by the increasing demand for nutritional and healthy food products has resulted in the continuing rise in demand for fresh and ready-made food such as fish which account for the greater percentage of total protein intake in our diet (Sudhakaret *et al.*, 2018). It is therefore important to evaluate the proximate composition or nutritional value of the fish which indicates the percentage composition of essential nutrients and minerals that are naturally used as a pointer to the nutritional value of the food (Sanni *et al.*, 2023). *Scomber scombrus* was used for this study because of its wide acceptability and availability as well as its high flesh quality. Hence, this study assessed the nutritional benefits associated with its consumption in relation to public safety among various source in Gombe State.

2.0 MATERIALS AND METHODS

2.1 Study Area

The study was conducted at Gombe Local Government area of Gombe State. Gombe State is located in Northeastern part of Nigeria. **It lies between latitude**10° 16' 59.9988" N and longitude11° 10' 0.0012" E. The annual rainfall of Gombe ranges between 800mm -900mm per annum and it's characterized by distinct dry season (October – May) and rainy season (June - September). The annual temperature ranges from 30-32⁰ C, and it experiences a relative humidity of 70-90%.

2.2 Sample Selection and Collection

Fresh samples of Atlantic mackerel (*Scomber scombrus*) sold in Gombe local markets were bought, chilled in an ice in a plastic container and transported to the department of Animal Science, Federal University of Kashere for Mineral and Proximate Analysis.

The samples were purchased in triplicates from the four major Gombe markets (treatments). The markets include; New Market (A), Old Market (B), Tashan Dukku (C) Pantami Market (D)

2.3 Proximate Analysis

The proximate composition of the samples was determined using the standard methods of the Association of Official Analytical Chemists (AOAC, 2005). All proximate components were analyzed in triplicates and reported as mean % dry weight basis.

2.4 Mineral Content Determination

Mineral contents (phosphorus, potassium, iron, zinc and copper) of the samples were determined by atomic absorption spectrometry, flame photometry and spectrophotometry method. All determinations were done in triplicates and calculated as mean mineral content in (mg/100g dry weight).

2.4.1 Wet Digestion of Sample

For wet digestion of sample, exactly (1.0000 g) of the powdered sample was taken in digesting glass tube. Twelve milliliters (12ml) of HNO₃ were added to the food samples and mixture was kept for overnight at room temperature. Then 4.0 ml perchloric acid (HClO₄) was added to this mixture and was kept in the fumes block 4 for digestion. The temperature was increased gradually, starting from 50°C and increasing up to 250-300°C. The digestion completed in about 70-85min as indicated by the appearance of white fumes. The mixture was left to cool down and the contents of the tubes were transferred to 100 ml volumetric flasks and the volumes of the contents were made to 100 ml with distilled water. The wet digested solution was transferred to plastic bottles labeled accurately, stored (digest) and used for mineral determination.



Figure1: Fresh Atlantic mackerel (*Scomber scombrus*)

3.0 RESULTS AND DISCUSSIONS

3.1 Proximate Composition

The Proximate Compositions of Fresh Atlantic Mackerel (*Scomber scombrus*) is presented in Table 1

The maximum (75.92%) moisture content was found in (A) while the lowest moisture content (66.21%) was determined in C. Ash is a measure of the mineral content in fish. The highest ash content was determined in B (1.22) while the lowest was found in A (1.04). The total Protein content ranged from 17.24 to 14.65%. The crude protein contents of these fish differed significantly among fish species ($P < 0.05$). Treatment C is highest in crude protein content (19.64), while 14.65 is lowest in crude protein.

Considering the specie, there are variations depending on age, sex, and environment. These variations help to determine their nutritional status (Aberoumad, 2010). The moisture content of the sample fish species is an indication of the wetness caused by water, and could also be due to the stable water levels in the environmental location where the fish were collected from (Sobuj *et al.*, 2024). The moisture content values obtained from this study differ from the result earlier reported by (Sobuj *et al.*, 2024) on the microbial content and proximate composition of six marine fish species in Mudasalodai coastal region. The variation may be attributed to the different water bodies. However, moisture content is one of the limiting factors in deciding the storage life of cured fishery products (Abdullahi *et al.*, 2024), and its quantitative

determination is absolutely essential in any quality control programme for such products. The lipid (ether extract) values recorded in this study corroborate with the lipid content of Atlantic mackerel (*Scomber scombrus*) Fish Species reported by (Bamidele *et al.*, 2025) while investigating the proximate composition of *Sargassum* spp from Badagry coast, Lagos state, Nigeria. Bamidele *et al.* (2025) reported that lipids from fish are well known as a rich source of some longchain n-3 polyunsaturated fatty acids which cannot be synthesized by humans from their diets. Usually, moisture and lipid contents in fish are co-related inversely and the lipid content directly related to the nutritional quality of the fish (Abdullahi *et al.*, 2024). The protein content recorded in this study is an indication of the protein-rich nature of the sampled fish. The result obtained in this study is similar to the report of (Dewinta *et al.*, 2020) who reported 19.7 – 23.00 % protein while evaluating the chemical composition of fish species captured in the lower stretch of Itapecuru River. Fishes are well known to be vital sources of good quality digestible protein as they contain all the naturally-occurring amino acids (Yucetepe *et al.*, 2023). Silva *et al.* (2023) reported that proteins contribute to a wide variety of functions within each cell, ranging from being structural materials to performing mechanical functions in muscular tissues. However, the protein content in fish may vary with species due to factors as differences in genotype, seasons of the year, the effect of

spawning, migration and food availability (Okwakpam *et al.*, 2023). The ash contents from this study varied from the result reported by (Bamidele *et al.*, 2025) who reported a considerably higher value than those obtained in this study. The variations may be attributed to the inherent differences in the fish species. The

nutritional components of fishes tend to differ among species, sexes, sizes, season and geographical localities (Bamidele *et al.*, 2025). Waterman (2000) reported that the measurements of proximate profiles are often necessary to ensure that they meet the requirements of food regulations, and commercial specificatio

Table1: Proximate Compositions of Fresh Atlantic Mackerel (*Scomber scombrus*)

PARAMETERS (%)	A	B	C	D	SEM
Crude Protein	15.81 ^b	17.24 ^{ab}	19.64 ^a	14.65 ^b	0.1832
Carbohydrate	2.70 ^b	2.78 ^b	5.01 ^a	1.89 ^c	1.0456
Ash Content	1.04	1.22	1.16	1.10	1.1081
Moisture	75.92 ^a	74.76 ^a	66.21 ^b	72.38 ^a	0.1068
Crude Fiber	0.28 ^b	1.10 ^a	0.43 ^b	0.67 ^{ab}	1.4919
Ether Extract	4.16 ^{ab}	2.89 ^b	7.55 ^a	6.19 ^{ab}	1.8907

Mean values in the same row with different superscript letters are significantly different (p<0.05)

SEM Standard Error of Means

3.2 Mineral Composition

Mineral Elements Detected in Fresh Atlantic mackerel (*Scomber scombrus*) is shown in Table 2 Iron is an important micro mineral. Deficiency of Iron is associated with anemia and thus with reduced working capacity and impaired intellectual development. The range of Iron content was considerably varied in B from 0.69 to 3.03 mg/100gm in D with a mean value of 1.0 mg/100 gm. The highest iron content was found in D. Zinc concentration varied considerably in D from 5.44 to 14.68 mg/ 100 g in A with a mean content of 3.34 mg/100 g. There is no significant difference (p>0.05) found among zinc content. It is harmful for human body if zinc concentration is above t 3mg/100gm but in the result zinc is clearly below the permissible limit for human consumption. Zinc is essential for good health, but very high intakes can cause health problems such as liver and kidney damage. Potassium is one of the macro minerals. Potassium is indeed to synthesis protein and muscle tissue. Heart activity depends on Potassium as does muscle contraction. Potassium content was varied in B from 117.62b to 192.030amg/100gm in C. Highest amount was found in C may would fulfill >5% of RNI for adult and PLW and >20% for infants. Copper was presenting very lower in amount as trace elements in fish. The permissible limit for Manganese in D 10.4mg/100gm and

Copper is 1mg/100gm, the result is within the limit. Phosphorus concentration varied considerably in C from 146.51 to 148.52 mg/ 100 g in D with a mean content of 0.7 mg/100 g. There is no significant difference (p>0.05) found in Phosphorus among the treatments. The results indicated that the concentration of phosphorus, zinc and copper in *Scombrus scombrus* were within the (FAO, 2010) recommended levels of daily intake of minerals (Table 2). Therefore marine water fishes are good sources of iron and copper. Murray *et al.*(2000) demonstrated that copper plays a crucial role in iron absorption. The concentration of phosphorus in the marine water fishes were low, observed that phosphorus can be absorbed directly from the water, this result suggest that phosphorus content of the river inhabited by the fish was very low. The concentration of these mineral elements in this study compares favorably with the values obtained for calcium and magnesium by (Bamidele *et al.*, 2025) for some freshwater fishes. Both the fresh and marine water fishes are rich sources of minerals especially iron and copper; iron is important for the formation of haemoglobin and copper play crucial role in iron absorption. This research has shown that both the marine and freshwater fishes are rich sources of minerals for man and other animals

Table 2: Mineral Elements Detected in Fresh Atlantic mackerel (*Scomber scombrus*)

Minerals	A(mg/100gm)	B(mg/100gm)	C(mg/100gm)	D(mg/100gm)	SEM
Phosphorous	148.3908	148.2759	146.5134	148.5185	6.62E-1
Zinc	14.679	11.833	13.423	5.442	3.34004
Copper	8.067	11.933	11.133	10.6	3.99791
Iron	2.071	0.692	2.282	3.026	8.9885E-1
Potassium	145.40 ^{ab}	117.62 ^b	192.03 ^a	162.02 ^{ab}	20.2429

Mean values in the same row with different superscript letters are significantly different ($p < 0.05$)

SEM Standard Error of Means

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusions

In conclusion, the study on the mineral and proximate compositions of Atlantic mackerel sold in the major markets revealed significant differences in their nutritional content. Both fish sold in the markets are rich in essential nutrients and minerals, making them a valuable food source. The findings also highlight the importance of marine species in human nutrition and health. Results from this study can also inform policy makers on food security and nutrition to regulate the available fish species sold in the major markets for public health concern.

4.2 Recommendation

Based on the findings of the study, the following recommendations were made:

1. Nutrition Education and Awareness: National agencies and body need to develop and implement nutrition education programs to raise awareness about the nutritional benefits of Atlantic mackerel to the Nigerian consumers. This can include campaigns, workshops, and collaborations with healthcare professionals.
2. The findings contribute to the understanding of the nutritional value of Nigerian marine species and can inform policies on sustainable fishing practices and food security. The study demonstrates the value of Atlantic mackerel in addressing nutritional deficiencies and provides baseline data for future research on marine species in Nigeria.

Declaration

Authors declare no conflict of interest. Use of Artificial intelligence (AI): Not Applicable.

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