

# Proximate and Mineral Composition of Atlantic Mackerel (*Scomber scombrus*) and Atlantic Horse Mackerel (*Trachurus trachurus*)

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## Abstract

Atlantic mackerel (*Scomber scombrus*) and Atlantic horse mackerel (*Trachurus trachurus*), locally known as kote, are fishery species consumed in Nigeria due to their high nutritional values. This research determined the nutritional composition of the local dried fish, *Scomber scombrus* and *Trachurus trachurus*. Results for *Scomber scombrus* shows the mean value of the moisture, ash, crude fat, crude fiber, and crude protein contents in percent (%) as: 5.26±0.00, 5.20±0.10, 35.60±0.00, 2.90±0.10 and 46.30±0.01 respectively. For *Trachurus trachurus*, the moisture, ash, crude fat, crude fiber, and crude protein contents in percent (%) were 9.52±0.00, 32.26±0.01, 24.14±0.00, 11.91±0.85 and 40.95±0.00 respectively. The mineral composition of *Scomber scombrus* was as follows: Sodium (Na) had the highest mineral composition with 78.90 mg/100g, followed by magnesium (Mg) with 15.90 mg/100g, manganese (Mn) with 0.86 mg/100g, zinc (Zn) with 0.282 mg/100g, and iron (Fe) with 0.10 mg/100g. *Trachurus trachurus* has magnesium (Mg) at 27.00 mg/100g as its highest mineral composition, followed by sodium (Na) at 22.50 mg/100g, zinc (Zn), iron (Fe) at 0.17 mg/100g, and manganese (Mn) at 0.09 mg/100g. It is concluded from the study, that *Scomber scombrus* and *Trachurus trachurus* are good sources of essential nitrates, fat, proteins containing essential amino acids, and other micronutrients that are beneficial to human health.

**Keywords:** Proximate composition; Mineral content; *Scomber scombrus*; *Trachurus trachurus*.

## INTRODUCTION

Fish is an essential food consumed in developing countries like Nigeria because of its abundance and nutritional values, like its high protein, unsaturated fatty acids, carbohydrate, and mineral contents. It is cheap and available in urban and rural areas (Bene and Heck, 2005). It is acceptable worldwide because of its high nutritional value and low cholesterol content when compared with meat and is thus often recommended for consumption, especially among the adult population (Eyo, 2001).

Several studies have recorded the importance of including fish in diets. Fish contains essential nutrients, especially protein, vitamins, and minerals, which enhance the management of cardiovascular and other related diseases (Damsgaard *et al.*, 2006). According to (Damsgaard, 2006), fish contains eicosapentaenoic and docosahexaenoic acids, long-chain n-3 polyunsaturated fatty acids that supply essential nutrients and promote good health.

Atlantic mackerel (*Scomber scombrus*) and Atlantic horse mackerel (*Trachurus trachurus*), locally known as kote are the most predominant fishery species in various

markets and are well consumed among the Nigerian populace. *Trachurus trachurus* originates from Portugal and is consumed widely because of its availability and nutritional value (Nadeisa *et al.*, 2001). *Scomber scombrus* is known for its high protein and fat content (Ackman, 1990).

Proximate analysis or nutritional evaluation of fish indicates the percentage composition of essential nutrients or constituents such as proteins, crude fats, and other minerals in fish products. The chemical constituents are naturally used as a pointer to the nutritional value found in fish (Moghaddam *et al.*, 2007; Aberoumand, 2011). Fish generally differ from species to species. The differences can result from seasonal variation, feeding habits, or sex (Islam *et al.*, 2005).

This study evaluates two samples of commercially available fish species obtained from a market in southwestern Nigeria. Therefore, this work determines the proximate and mineral compositions of *Scomber scombrus* and *Trachurus trachurus* to identify similarities and differences in their nutritional content.

## MATERIALS AND METHOD

### Materials

Powdered *Scomber scombrus* and *Trachurus trachurus*, HCl, H<sub>2</sub>SO<sub>4</sub>, NaOH, weighing balance, filter paper, heating mantle, crucible, thread, beaker, conical flask, distilled water, reagent bottle, chloroform, water bath, acetic acid, and pipette.



Figure 1. Pictorial representation of *Scomber scombrus*.



Figure 2. Pictorial representation of *Trachurus trachurus*.

### Method

#### Sample Preparation

The materials were obtained from Oja Oba, Owo Local Government Area of Ondo State. The fish was cut into small pieces, sundried for a month, and placed in an oven for further drying. The dried sample was crushed into powder using an EL-850W blender and packed into a container.

#### Proximate Analysis

##### Fat Content Determination

A clean fat-free filter paper was weighed ( $W_1$ ). 5g of the sample was added to the filter and weighed ( $W_2$ ). The weighed sample was tied with a piece of thread and dropped into the thimble of the soxhlet apparatus. 250 ml of petroleum ether was poured into the round bottom flask of the apparatus. Soxhlet was set up on the heating mantle, and the extraction process was done for four hours to extract the fat with the help of the solvent. Petroleum ether was siphoned over the barrel, the condenser was detached, and the thimble was removed. The solvent extract (lipid) mixture was carefully poured into a clean, dried Petri dish and transferred into a fume cupboard for two hours. The solvent evaporated, leaving behind the extracted fat. The filter paper containing the residue was dropped into a beaker and transferred into an

oven at 50°C. It was then dried to a constant weight and cooled in a desiccator and reweighed ( $W_3$ ). The percentage of fat was calculated.

$$\% \text{ Fat content} = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

##### Moisture Content Determination

The moisture content was determined using a drying method based on weight loss. A clean and dry crucible was weighed using a weighing balance, and its weight was recorded ( $W_1$ ). Samples were added to the empty crucible, and their weight was recorded ( $W_2$ ). The crucible containing the sample was transferred into the oven, maintained at 105°C, and dried for four hours. The dish was placed in a desiccator, cooled for one hour, and reweighed ( $W_3$ ). The percentage moisture content was calculated.

$$\text{Moisture content} = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

##### Ash Content

An ash-free crucible was weighed, and the weight was recorded ( $W_1$ ). 2g of sample was weighed into the crucible ( $W_2$ ) and transferred into the muffle furnace. The muffle furnace was then ignited at 600 °C for about four hours until a grayish-white substance was obtained. The crucible was transferred into a desiccator, cooled, and reweighed ( $W_3$ ). The percentage ash content was calculated.

$$\% \text{ ash content} = \frac{W_2 - W_3}{W_3 - W_1} \times 100$$

##### Crude-fiber Content Determination

5g of the defatted sample was weighed ( $W_1$ ) into a 2500 ml conical flask. 200 ml of 1.25% H<sub>2</sub>SO<sub>4</sub> was added. The mixture was heated for 30 minutes, then cooled and filtered through poplin cloth by suction using a Bunchier funnel. The residue was rinsed in hot, distilled water and scraped back into a flask. 200 ml of 1.25% NaOH was added, and the mixture was heated for 30 minutes. It was cooled, filtered, and washed once with hot, distilled water, once with 10% HCL, four times with hot water, and twice with methylated spirit. The residue was drained, placed in a crucible, and dried in an oven at 105°C. After drying in an oven, it was then cooled in a desiccator and weighed ( $W_2$ ). The crucible containing the residue was placed in a muffle furnace at 300°C for 30 minutes, placed in a desiccator to cool to room temperature, and weighed ( $W_3$ ).

$$\% \text{ crude fiber} = \frac{W_2 - W_3}{W_1} \times 100$$

##### Determination of Protein Content

2g of sample was weighed into a 50-ml Kjeldahl flask, and 12.5 ml of concentrated H<sub>2</sub>SO<sub>4</sub> was added with one Kjeldahl catalyst tablet. The flask was heated on low heat

for about 15 minutes, on medium heat for 30 minutes, and then on high heat until digested. The flask was rotated at intervals until the digest was clear, and the heating continued for a few minutes to ensure complete digestion. The flask was allowed to cool, and the sample residue was washed and filtered to make the digest up to 50 ml (V1).

After the digestion was completed, 5 ml of 2% boric acid ( $H_3BO_3$ ) was placed into a 100-ml conical flask, and 3 drops of the mixed indicator were added. The receiving flask was placed so that the tip of the condenser tube was below the surface of the boric acid. 5 ml of the digest (V2) was pipetted into the distillation tube, and 10 ml of 40% NaOH was added. The heater was turned on, and the distillation continued until approximately 50 ml of distillate was collected into the receiving flask. The distillate was titrated with 0.01M HCl, and the blank was titrated with the acid.

### Proximate Composition

**Table 1.** Shows the type and quantity of the nutritional composition of *Scomber scombrus* and *Trachurus trachurus*.

S/N	Parameters measured	<i>Scomber scombrus</i>	<i>Trachurus trachurus</i>
1	Moisture content (%)	5.26±0.00	9.52±0.00
2	Ash content (%)	5.20±0.10	32.26±0.01
3	Crude fat (%)	35.60±0.00	24.14±0.00
4	Crude fibre (%)	2.90±0.10	11.91±0.85
5	Crude protein (%)	46.30±0.01	40.95±0.00

**Table 2.** Showing the result of metal (mg/100g) analysis of *Scomber scombrus* and *Trachurus trachurus*.

S/N	Parameters measured	<i>Scomber scombrus</i>	<i>Trachurus trachurus</i>
1	Sodium(mg/100g)	78.90±0.02	22.50±0.01
2	Zinc(mg/100g)	0.28±0.00	0.17±0.00
3	Magnesium(mg/100g)	15.90±0.01	27.00±0.02
4	Iron(mg/100g)	0.10±0.00	0.17±0.00
5	Manganese(mg/100g)	0.09±0.00	0.09±0.00

### Discussion

The proximate composition of both *Scomber scombrus* and *Trachurus trachurus* are in Table 1. Proteins and fats are known to be the major nutrients found in fish. Considering the various species, there are variations depending on age, sex, and environment. The variations help to determine their nutritional status (Aberoumad and Pourshafi, 2010). The mean value of crude protein obtained for *Scomber scombrus* was 46.29%. This was slightly higher than the value obtained from *Trachurus trachurus*, which was 40.95%. This value was found to be lower when compared to 57.80% obtained from *Scomber scombrus* reported when the sample was smoked with an electric oven (Aremu et al., 2014); lower compared with the 70.24% for melon husk heat treatment reported (Aremu et al., 2014); 62.14% for *Clarias gariepinus* as observed by Kumolu and Ndimele, 2010;

$$\%N = \frac{M \times T \times 0.014}{W} \times \frac{V1}{V2} \times 100$$

$$\% \text{ protein} = \% N \times 6.25$$

### RESULTS AND DISCUSSION

The result of proximate analysis of the nutritional composition of *Scomber scombrus* and *Trachurus trachurus* showed the presence of moisture, ash, crude fat, crude fiber, and crude protein in the following proportions, respectively:

The result of the mineral analysis of the nutritional composition of *Scomber scombrus* and *Trachurus trachurus* showed the presence of sodium (Na), zinc (Zn), magnesium (Mg), iron (Fe), and manganese (Mn), respectively:

and higher than 26.25% reported for *Scomber scombrus* (Agu and Bhandary, 2004). The value of the crude fat of *Scomber scombrus* was observed to be 35.60%, while that of *Trachurus trachurus* was recorded to be 24.14%. The mean value of crude fat for both *Scomber scombrus* and *Trachurus trachurus* was higher than the range of crude fat for *Scomber scombrus*, ranging between 7.41 and 17.51% using different heat sources, as reported by (Aremu et al., 2014). A moisture content of 5.26% was observed in *Scomber scombrus*, while 9.52% was recorded for *Trachurus trachurus*. The result shows that the moisture content found in *Trachurus trachurus* was higher than that obtained in *Scomber scombrus*. (Olusola et al., 2011) reported the moisture content of *Scomber scombrus* at 56.5% and *Roughear scad* at 66.7%, which was seen to have a higher mean value. This can be a result of the type of the environment in which the

samples were collected or the season in which the fish was collected. The 5.26% of *Scomber scombrus* is almost the same as the 5.28% reported by Aremu *et al.* (2014) in *Scomber scombrus* dried using an electric oven. Another study reported by Adeyi *et al.* (2010) gives a moisture content of 5.43% when coconut husk was used as a heat treatment. The result is almost similar, though it has about a 0.17% difference, which may imply that the heat generated from an electric oven dries the fish better and is stronger than the heat generated from the husk of a coconut. The ash content of *Scomber scombrus* is 5.20%, and that of *Trachurus trachurus* is 32.26%; this shows that *Trachurus trachurus* has a higher ash content compared to *Scomber scombrus*. The 5.20% of *Scomber scombrus* obtained using an electric oven was compared to the ash content of 5.70% obtained for heat treatment using sawdust by (Aremu *et al.*, 2014) and 6.01% reported for mackerel fish (Agu and Bhandary, 2004).

The mineral composition indicates certain organic matter that is not denatured by high heat intensity and is known for its low volatility compared to other food classes (Remi, 2023). The mineral composition in mg/100g of *Scomber scombrus* and *Trachurus trachurus* is shown in Table 2. From the result for *Scomber scombrus*, sodium (Na) was shown to be more abundant in the dried fish with 78.90 mg/100g, followed by magnesium (Mg) with 15.90 mg/100g, manganese (Mn) with 0.86 mg/100g, zinc (Zn) with 0.282 mg/100 g, and iron (Fe) with 0.10 mg/100g. For *Trachurus trachurus*, magnesium is more abundant at 27.00 mg/100g, followed by sodium at 15.90 mg/100g. This value is higher than the 7.43 mg/100g reported by (Aremu, 2014). Magnesium is an important element in connection with the treatment of diseases of the circulatory system, such as ischaemic heart disease, and calcium metabolism in bones (Ishida *et al.*, 2000). Iron (Fe), zinc (Zn), and manganese (Mn) were low, albeit available for biological functions.

## CONCLUSION

It is concluded from this study that *Scomber scombrus* and *Trachurus trachurus* are high in fat, proteins, and some essential micronutrients, which are good sources of nutrients for the growth of the body. *Scomber scombrus* was reported to have high protein and fat content, which implies that it would be a good source of protein for growing children and adults.

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