

IMPACT OF OVEN DRYING, SUN DRYING AND FREEZING ON THE NUTRIENT COMPOSITION OF *HETEROBRANCHUS LONGIFILIS*

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ABSTRACT

Fish are highly perishable due to their biological composition, necessitating post-harvest preservation. Understanding how oven drying, sun drying, and freezing influence the shelf life and quality of *Heterobranchus longifilis* is essential for optimizing processing techniques and minimizing spoilage. Therefore, this study was designed to assess the effect of oven drying, sun drying, and freezing, on nutritional attributes of *H. longifilis*. *H. longifilis* specimens of average weight 500g were collected and weighed, gutted and cleaned. The fish specimens were processed using oven drying, sun drying and freezing methods. After wish samples were sent for proximate analysis. The moisture content of *H. longifilis* samples exhibited significant variation among the three methods. Freezing resulted in higher moisture content while sun drying was intermediate followed by oven drying. Ash content of *H. longifilis* was significantly different being higher in oven drying followed by sun drying while freezing resulted in the lowest ash content. The lipid content of *H. longifilis* showed significant differences with freezing resulting in higher lipid content followed by sun drying and then oven drying. The protein content of *H. longifilis* exhibited variation among the processing methods. Freezing resulted in higher protein content followed by sun drying and oven drying yielded the lowest. The protein in the freezing method was significantly higher when compared to other methods. This suggests that freezing better preserves the protein content of fish compared to other drying methods. The information obtained from this study indicate that both oven dried, sundried and frozen *H. longifilis* contain enough protein so can be eaten.

Keyword: Proximate composition, Oven Drying, Sun Drying, Freezing, *Heterobranchus longifilis*

INTRODUCTION

Heterobranchus longifilis, commonly known as African catfish, plays a pivotal role in providing aquatic protein in various regions (Olurin *et al.*, 2020). Understanding the proximate composition of this species is crucial for assessing its nutritional value and overall quality (Olurin *et al.*, 2020). However, there exists a significant research gap concerning the influence of different processing methods, such as oven drying, sun drying, and freezing, on the proximate composition of *H. longifilis*. Recent studies have highlighted the substantial variability in the proximate composition of fish, influenced by factors like species, age, sex, and environmental conditions (Banerjee *et al.*, 2019). Yet, there's limited knowledge regarding how processing methods may introduce additional variability or affect these compositional attributes in *H. longifilis*. The nutritional quality of fish is a critical consideration for human consumption (Xie *et al.*, 2021). Different processing techniques can potentially alter the levels of essential nutrients, including proteins, lipids, vitamins, and minerals (Makkar *et al.*, 2017). Therefore, investigating how processing methods impact the proximate composition of *H. longifilis* is imperative.

Fish are highly perishable due to their biological composition, necessitating post-harvest preservation (Choi *et al.*, 2018). Understanding how oven drying, sun drying, and freezing influence the shelf life and quality of *H. longifilis* is essential for optimizing processing techniques and minimizing spoilage (Torrissen *et al.*, 2011). *Heterobranchus longifilis*, commonly known as African catfish, is a valuable source of aquatic protein in many regions (Olurin *et al.*, 2020). As a staple animal protein in the diet of numerous communities, understanding its nutritional value is of paramount importance, particularly in regions where access to diverse protein sources may be limited. Given the nutritional and economic importance of *H. longifilis*, in Nigeria aquaculture addressing these knowledge gaps in the context of processing methods and proximate composition is essential. This study seeks to assess how commonly used methods, such as oven drying, sun drying, and freezing, affect the nutritional attributes of *H. longifilis*.

MATERIALS AND METHODS

Experimental Site The research was carried out at the Fisheries Unit of the College of Agriculture and Animal Science, within the Division of Agricultural College, Ahmadu Bello University, situated on Mando Road, Kaduna state. This location falls within the southern Guinea savanna zone of the state, with geographical coordinates ranging between latitudes 10°30' - 10°34' N and longitudes 7°04' - 7°07' E.

Sample Collection: *H. longifilis* specimens of average weight 500g were collected from Farin Gida, Igabi Local Government, Kaduna State. The specimens were carefully transported in plastic buckets and temporarily housed at the Fisheries Unit of the College of Agriculture and Animal Science, Mando Road, Kaduna State, where they were acclimatized for one day.

Preparation of Fish Sample: Stringent hygiene measures were observed throughout the handling of raw fish. Hands were meticulously washed before and after fish handling, and all equipment including cutting boards and utensils were thoroughly cleansed with water to prevent bacterial cross-contamination. The collected fish specimens were weighed and subsequently gutted. Each gutted fish sample underwent a thorough cleaning process.

Oven Drying Method: Three fish specimens were placed in an oven set to temperatures ranging from 40°C to 60°C for a duration of 7 hours. This method utilized hot air generated from charcoal as a source of heat, facilitating convection heating to dehydrate the fish. Temperature (°C) during the fish drying process was consistently monitored by placing a thermometer within the drying racks. Following the drying process, the fish samples were allowed to cool and then packaged in plastic bags for storage at room temperature, awaiting further analysis.

Sun Drying Method: Three fish specimens were arranged on an iron mesh and exposed to direct sunlight at an ambient temperature of approximately 30°C for a duration of 6 days.

Freezing Method: Fish specimens were placed in a freezer set at a temperature of -17.8°C for a period of 6 days.

Proximate Analysis

Representative specimens of each processing method were sent to Institute of Agricultural Research (IAR) for proximate analysis. This was carried according to methods described by (AOAC, 2000).

Statistical Analysis

To assess any significant differences among the treatment groups, all collected data underwent a one-way analysis of variance (ANOVA). This statistical analysis was carried out using SPSS version 15.0, a widely recognized software for data analysis and statistical procedures. The ANOVA test was employed to evaluate variations between the different processing methods and their potential impact on the studied parameters. The use of this statistical method will help determine whether there are statistically significant differences in the proximate composition of *H. longifilis* among the various processing techniques employed in this study.

RESULTS AND DISCUSSION

Proximate analysis of *H. longifilis* subjected to different processing methods is shown in Table 1. The proximate analysis of *H. longifilis*, subjected to various processing methods of oven drying, sun drying, and freezing, revealed substantial variations in key nutritional parameters.

Table 1: Proximate Analysis of *Heterobranchus longifilis* Subjected to Different Processing Methods

S/N	Processing methods Parameters	Oven Dried	Sun Dried	Freezing
1	MO	9.30±0.06 ^c	10.13±0.03 ^b	21.86±0.47 ^a
2	Ash	9.99±0.09 ^a	8.70±0.18 ^b	8.12±0.03 ^b
3	Lipid	15.26±0.04 ^b	18.45±0.05 ^b	19.65±0.3 ^a
4	Protein	44.89±0.01 ^b	45.13±0.25 ^b	46.56±0.07 ^a
5	Fiber	ND	ND	ND
6	CHO	17.56±0.05 ^a	17.55±0.20 ^a	3.82±0.28 ^b

The moisture content of the processed *H. longifilis* samples exhibited significant variation among the three methods. Freezing resulted in the higher moisture content ($21.86\% \pm 0.47$), while sun drying had intermediate moisture levels ($10.13\% \pm 0.03$), and oven drying yielded the lowest moisture content ($9.30\% \pm 0.06$). This variation is likely due to the different mechanisms of moisture removal employed by these methods. Sun drying and oven drying involve natural and controlled evaporation, respectively, while freezing preserves moisture by converting it into ice. The findings are in accordance with earlier studies that have shown freezing to maintain elevated moisture levels in comparison to drying techniques (Xiong, 2013). The moisture content of catfish is of great importance in storage as it affects the shelf life of the product. The result of the moisture content is different to that reported by Ajayi *et al.* (2020) for frozen and smoked *C. gariepinus*. This observation corroborates existing research, underscoring the substantial impact of various processing methods on the moisture content of fish (Adeyemi *et al.*, 2017). The ash content of *H. longifilis* varied significantly based on the processing method. Oven drying produced fish samples with the highest ash content (9.99 ± 0.09), followed by sun drying (8.70 ± 0.18), while freezing resulted in the lowest ash content (8.12 ± 0.03). Ash content represents the mineral composition of the fish, and these variations may be attributed to the different heat treatments and exposure to sunlight. Oven drying might have resulted in elevated ash content, potentially as a consequence of mineral concentration during the drying process (Chowdhury *et al.*, 2018). The rise in ash content in the oven-dried samples can be ascribed to the concentration effect stemming from moisture loss during the drying process (Koca *et al.*, 2007). These observations are consistent with studies involving different fish species, where changes in ash content have been documented following diverse processing techniques (Nakchat *et al.*, 2010). The lipid content of *H. longifilis* showed significant differences among the processing methods. Freezing resulted in the highest lipid content (19.65 ± 0.3), followed by Sun drying (18.45 ± 0.05), and oven drying had the lowest lipid content (15.26 ± 0.04). The variations in lipid content are primarily a result of the chosen preservation methods. The protein content of *H. longifilis* exhibited variation among the processing methods. Freezing resulted in the highest protein content (46.56 ± 0.07), followed closely by sun drying (45.13 ± 0.25), and Oven Drying yielded the lowest protein content (44.89 ± 0.01). This outcome is consistent with findings indicating that freezing better preserves the protein content of fish compared to other drying methods (Chowdhury *et al.*, 2018). Protein is a vital nutritional component and its retention is essential for the quality of fish products. This observation is in line with the studies by Nakchat *et al.* (2010) that reported similar trends, demonstrating that freezing tends to better retain the protein content of various fish species during processing. These findings collectively emphasize the advantage of freezing as a preservation method for preserving the protein content of fish, including *H. longifilis*. Other methods may have led to denaturing of protein due to heat. The analysis of the fish samples subjected to all three processing methods revealed negligible fiber content. However, notable differences were observed in carbohydrate (CHO) content. Oven drying and sun drying resulted in higher carbohydrate content (17.56 ± 0.05 and 17.55 ± 0.20 respectively), while freezing led to substantially lower carbohydrate content (3.82 ± 0.28). The decrease in carbohydrate content during freezing is due to carbohydrate conversion into simple sugars and moisture loss (Chowdhury *et al.*, 2018). This trend aligns with various studies, demonstrating that freezing can reduce carbohydrate levels through enzymatic and chemical reactions during freezing and storage.

CONCLUSION AND RECOMMENDATIONS

The observed variations in proximate composition among the processing methods underscore the importance of selecting the most suitable method based on desired nutritional attributes. Oven drying effectively reduced moisture content but resulted in slightly higher ash content. Freezing preserved lipid and protein content better than drying. The populace should be educated on fact that both oven dried, sundried and frozen *H. longifilis* contained enough protein. More research work should be carried out on the proximate composition of *H. longifilis* using other processing methods such as smoking, frying and fermentation.

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