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NUTRITIVE AND ORGANOLEPTIC EVALUATION OF THE AFRICAN CATFISH (*Clarias gariepinus*) SMOKED WITH BRIQUETTE AND CHARCOAL

Akinwole A.O[1], **Fawole O.O**[2]* and **Oyediran F.S**[1]

1. *Department of Aquaculture and Fisheries, University of Ibadan, Ibadan*
2. *Department of Fisheries and Aquaculture, Ladoke Akintola University of Technology, Ogbomoso*

*Corresponding Author email: oofawole78@lautech.edu.ng.

ABSTRACT

Smoking is a preservation method which improves the nutritional value and organoleptic properties of fish. However, consumers are becoming more aware of possible hazards and detrimental health impacts arising from food they consume and are more demanding in respect of freshness, freedom from pollutant and other intrinsic qualities of smoked fish. The nutritive and organoleptic qualities of African Catfish smoked using charcoal and briquette as energy source were assessed. Sensory evaluation was conducted on tenderness, taste, juiceness, texture, colour and overall acceptability of the smoked fish samples based on 9-point Hedonic scale. Proximate and nutritive value of the smoked fish was also determined using standard methods. Data collected were analyzed using descriptive statistics. The mean value of crude protein, ash, ether extract, crude fibre and moisture content were 74.02±10.70, 4.53±1.20, 8.08±0.63, 8.08±0.63, 0.08±0.05 and 6.92±0.97 respectively for charcoal smoked fish samples and 76.86±2.95, 4.73±0.15, 8.08±0.33, 0.07±0.03 and 6.31±0.80 for briquette. The mean overall acceptability was also higher in charcoal (7.85±0.89) than briquette (7.72±0.52). T-test however showed that there was no significant difference (p>0.05) in the overall acceptability between charcoal and briquette. In conclusion, briquette produce good quality smoked fish just like charcoal.

Keywords: Catfish, charcoal, smoked fish, briquette, organoleptic properties, nutritional value

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INTRODUCTION

Due to its high content of polyunsaturated fatty acids, iron, phosphorus, calcium, riboflavin, vitamin A and D, thiamine, and other nutrients, fish is a vital source of protein in the fight against malnutrition and hunger (Areola, 2008). However, fish is one of the most perishable of all staple commodities (Umar et al. 2018). Preservation of fish is necessary because of the significant losses caused by germs and the destruction of tissue by enzymes, often known as catalytic spoiling (Ndakatu, et al. 2011). Spoilage is a metabolic process that causes food to be undesirable or unacceptable for human consumption due to changes in sensory and nutritional

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characteristics (Doyle, 2007). This spoilage in fish is usually accompanied by change in physical characteristics, change in colour, odour, texture, colour of eyes, colour of gills and softness of the muscle (Getu et al. 2015). Freshness of fish is usually judged in the trade entirely by appearance, odour and texture of the raw materials (Nwaigwe, 2017). Fish smoking, which involves heating, drying, salting, and smoking the fish in a chamber, is a method of preserving fish by exposing it to smoke from biomass combustion (Codex Alimentarium Commission, 2013). Studies have shown a relatively good acceptability of charcoal as an alternative to wood for smoking fish due to its effective reduction of polycyclic aromatic hydrocarbons contamination in smoke cured fish products (Essumang, et al. 2014). Consumer-desired sensory attributes like flavor, taste, and color are added to the fish by the smoke, along with preservation chemicals (Arason, et al. 2014). According to research studies, 75% of the population in sub-Saharan Africa uses biomass energy exclusively for domestic requirements like cooking (Muenjina, 2013). However, the methods are inefficient and present unsustainable harvesting practices of charcoal production and wood fuel (Demirbas et al. 2016). Little or no information is known about comparison of charcoal with another alternative like briquette. Waste materials like rice husk, jute, coal dust, alfalfa, nutshells, wood waste, leaf straw, sawdust, sunflower husks, leather waste among others are densified to make briquette (Nasrin et al. 2011). Through an appropriate technology, briquette production promotes sustainable development and environmental integrity (Kwofie and Ngadi, 2016). This research work helps to enlighten fish processors and home makers on other energy sources that could be used to preserve fish with high nutritional value and most acceptable as the commercially consumed smoke fish at the same time be less strenuous.

This paper report finding of a study which assessed the nutritive value, proximate composition and organoleptic quality characteristics of the African Catfish (*Clarias gariepinus*) smoked with briquette and charcoal.

MATERIALS AND METHODS

The experiment was carried out on the fish farm of the Department of Aquaculture and Fisheries, University of Ibadan, Nigeria at Latitude 7.4585129^0 N, Longitude 3.8753065^0E. Forty (40) pieces of fresh African Catfish (*C. gariepinus*) was procured from a reputable fish farm in Ibadan. The fish were weighed before gutting and were washed after gutting to remove blood and slime and were immersed in 25% brine solution for 5-10minutes, folded and arranged on trays ready for the smoke drying process. The experimental design used for this project was 1x2x2 (Ajewole *et al*., 2021). One type of fish, African Catfish (*C. gariepinus*) was smoked with 2 replicates and 2 sources of heat of charcoal and briquette.

Experimental procedure

The smoking kiln was fired by burning a measured quantity of charcoal and briquettes in the charcoal chamber respectively. The weighed fish samples were loaded on the trays of the smoking kiln and the weight of the smoked fish was later taken to give the initial and final

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weight of the fish. Smoking was done thrice to serve as replicates for two treatments. Smoking schedule was as follow: Morning started by 6:00am; Afternoon started by 12 noon; Evening started by 6:00pm. The smoked fish samples were withdrawn from the smoking kiln to cool at room temperature after which they were subjected to sensory and proximate analysis.

Sensory Evaluation

This was carried out to assess the tenderness, taste, juiciness, texture, colour and overall acceptability of the smoked fish products. Twenty one (21) members taste panel already familiar with scoring smoked fish were given the product to score at every two-week interval. Products were scored on a 9-point hedonic scale (9 = Like extremely; 8 = Like very much; 7 = Like moderately; 6 = Like slightly; 5 = Neither like or dislike; 4 = dislike slightly; 3 = dislike moderately; 2 = dislike very much; 1 = dislike extremely) as described by (Peryam and Pilgrim, 1957).

Proximate Analysis

The smoked African Catfish (*C. gariepinus*) were taken to the laboratory and subsequently analyzed using standard methods AOAC (2002) for the percentages of crude protein, ash content, ether extract, crude fibre and moisture content.

Nutritive value

The nutritive value of smoked fish samples which include percentage carbohydrate, fatty acid and metabolisable energy was determined according to Merrill and Watt (1973).

Data Analysis

The data collected was subjected to statistical analysis using descriptive statistics of mean, standard deviation and frequency count. The statistical analysis was conducted by using IBM SPSS version 20 software.

RESULT AND DISCUSSION

Proximate composition

As depicted in Table 1, the mean percentage value of crude protein, ash, ether extract, crude fibre and moisture content for charcoal smoked fish samples are 74.02±10.70, 4.53±1.20, 8.08±0.63, 8.08±0.63, 0.08±0.05 and 6.92±0.97 while briquette are 76.86±2.95, 4.73±0.15, 8.08±0.33, 0.07±0.03 and 6.31±0.80 respectively. However, the mean moisture content of 6.92±0.97 and 6.31±0.80 respectively recorded for charcoal and briquette smoked samples has no significant difference ($p>0.05$). This was corroborated by similar work by Haruna et al. 2024 on smoked dried Redbelly Tilapia (*Coptodon zilli*) using Ebony wood and Sugarcane bagasse with recorded moisture content of 3.38±0.08% and 4.28±0.03 respectively. Moisture content less than 20% enhances the dried fish quality, reduces post harvest loss and elongates shelf life (Kumar, 2013; Haruna et al. 2021; Muhammed et al. 2023).

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Energy composition

African catfish smoked with charcoal recorded higher carbohydrates (6.19%) than briquette (3.95%) while percentage fats are the same for both at 6.46%. Briquette smoked fish samples recorded higher metabolisable energy of 1672.73KJ/100g than charcoal with 1662.53KJ/100g (Table 4). The protein content of the smoked fish samples is quite high at 74.02±0.70 for charcoal and 76.86±2.95 for briquette which indicates that the smoked catfish samples have high protein content. This is similar to another work by Leksono et al. (2014) who recorded 61.46 – 62.16% protein in traditionally smoked striped catfish (*Pangasium hypophthalmus*). There is no significant difference ($p>0.05$) in all the proximate composition and nutritive value of the two fish samples smoked with charcoal and briquette. This means that the two energy sources did not affect in any way the quality of the smoked fish produced.

Organoleptic score

Charcoal smoked fish samples recorded higher mean score of 7.43±0.62, 8.19±0.17 and 7.43±0.62 in tenderness, colour and texture than briquette with score of 7.14±0.49, 7.43±0.49 and 7.00±0.49 respectively. Briquette however has higher mean value in flavour and juiceness (7.81±0.29, 7.29±0.94) than charcoal with value of 7.52±0.68 and 7.14±1.08 respectively as shown in Table 2. This agreed with Eyo (2001) who posited that better flavoured smoked fish are obtained by smoking with hardwoods than softwoods due to higher content of some phenolic compounds particularly guaiacol and syringol in the hardwood. Recent result by Rinto et al. (2023) also showed that using different types of fuel affects the appearance and taste of skipjack smoked fish. The mean overall acceptability was also higher in charcoal (7.85±0.89) than briquette (7.72±0.52). The t-test however shows that there is no significant difference ($p>0.05$) in the overall acceptability between charcoal and briquette as heat source as shown in Table 3 which indicates that briquette can be used as energy source just like charcoal. This result was corroborated by Ayuba et al. (2022) in a similar work where they reported no significant difference in sensory attributes of African catfish smoked with briquette and firewood. This was also emphasized by Guillen and Manzanos (2002) who posited that there is no agreement about which wood or mixture of woods imparts the preferred sensory properties to smoked fish.

CONCLUSION

The findings from this study showed that briquette produce good quality smoked fish just like charcoal. The use of briquette as an alternative fuel source for smoking fish will give similar end result as charcoal.

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APPENDICES

Table 1: Proximate and Energy composition of charcoal and briquette smoked African catfish (*C. gariepinus*)

Parameters	**Heat source**	
	Charcoal	Briquette
% Crude protein	74.02±10.70	76.86±2.95
%Ash Content	4.53±1.20	4.73±0.15
%Ether extract	8.08±0.63	8.08±0.33
%Crude fibre	0.08±0.05	0.07±0.03
%Moisture content	6.92±0.97	6.31±0.80
%Carbohydrate	6.19	3.95
%Fatty acid	6.46	6.46
Metabolisable energy(KJ/100g)	1662.53	1672.73

Table 2: Mean scores of sensory evaluation parameters of charcoal and briquette smoked African catfish (*C. gariepinus*)

Heat source			Parameters			
	Tenderness	Flavour/Taste	Colour	Juiciness	Texture	Overall acceptability
Charcoal	7.43±0.62	7.52±0.68	8.19±0.17	7.14±1.08	7.43±0.62	7.87±0.89
Briquette	7.14±0.49	7.81±0.29	7.43±0.49	7.29±0.94	7.00±0.49	7.72±0.52

Table 3: T-test showing difference in overall acceptability of charcoal and briquette smoked African catfish (*C. gariepinus*)

	Heat sources	N	Mean	Std. deviation	T	df	Sig. (2-tailed)
Overall acceptability	Charcoal	21	7.8571	0.89489	0.236	4	0.825
	Briquette	21	7.7167	0.51588	0.236	3.197	0.825