EFFECT OF CINNAMON(*Cinnamon verum*) ON PROXIMATE COMPOSITION AND ORGANOLEPTIC EVALUATION OF *Mormyrusrume*

ABSTRACT

The study on the effect of cinnamon(*Cinnamon verum*) on proximate composition and organoleptic evaluation of *Mormyrusrume*was conducted for three months. Twenty four (24kg) of fresh *Mormyrusrume*were purchased from Doma market. Cinnamon sticks were purchased from Lafia Modern Market. The experiment was carried out using different concentration of cinnamon powder (0g/l, 5g/l, 10/l, 15g/l) representing T1,T2,T3,and T4. Each treatment was replicated twice. The results showed significant differences ($P<0.05$) in the proximate composition of *Mormyrusrume* smoked using cinnamon. Fish smoked using 15g/l of cinnamon had the highest amount of crude protein (38.24%) which is higher than other treatments however, higher content of ash (18.58%), ether extract (5.36%) and low NFE (4.81%) were also reported in this treatment. The result of this study indicated that cinnamon had significant effect on the sensory properties of the fish samples in taste, appearance, texture, flavor, color and general acceptability. *Mormyrusrume*should be processed using 5g/l of cinnamon to achieve good sensory evaluation.

Keyword: Cinnamon, *Mormyrusrume,* proximate composition, sensory properties

INTRODUCTION

Fish has an important role in food security and poverty alleviation in both rural and urban areas of Nigeria (Bouzgarrouand Sadok, 2017)).It provides food for the populace because it has a high biological value in terms of high protein retention in the body, higher protein assimilation as compared to other protein sources and low cholesterol content. It contains good amount of nutrient especially crude protein between 50-60%, minerals including calcium, phosphorus and magnesium, and amino acid such as lysine, methionine and isoleucine (Aremu*et al.,* 2013).

Fish is an extremely perishable commodity, spoiling soon after death, due to enzymatic and microbial actions (Msukuand Kapute, 2018). Although preservation methods for fish and products are often used in order to make the fish safer and to prolong its shelf– life(Adeyeye*et al.,* 2010) either through natural or synthetic means of preservation.

One of the natural spices usually used in food preservation include cinnamon (*Cinnamon verum*). Cinnamon is a spice obtained from the inner bark of several trees from the genus cinnamonthat is used in both sweet and savory foods. Cinnamon is a good preservative with high antioxidant and antibacterial activity (Ahmed, 2019). Diyawaree*t al.* (2021) stated that cinnamon (*Cinnamon verum*) can be utilized in fish smoking at various concentrations and fish smoked with cinnamon is attractive in color and texture, compared with those smoked with other spices and better proximate composition content (Ahmed, 2019). It's application in fish processing could promote the fish value chain, minimize deterioration damages of smoked fish, and provide supplemental business chances for investors. The main objective of the study aimed at determining the effect of cinnamon on proximate composition and organoleptic evaluation of *Mormyrusrume*.

MATERIALS AND METHODS

Description of Experimental Site

The experiment was carried out at the Teaching and Research Farm of the Department of Aquaculture and Fisheries Management, Faculty of Agriculture Shabu, Lafia Campus, Nasarawa

State University Keffi. The study area falls within the southern guinea savanna zone of Nigeria and located between latitude $8^{o}33^{I}22^{II}$N and longitude $8^{o}32^{I}82^{II}$E.

Collectionof Fish and Cinnamon

The experimentconsisted of 24kg of fresh *Mormyrusrume*purchased from Doma market ofNasarawa State, Nigeria.The sampleswere taken to Teaching and ResearchFarm of the Department of Aquaculture and Fisheries Management Nasarawa State University Keffi. The fishes were degutted, washed and weighed before smoking. The cinnamon was purchased from Lafia Modern Market and was redried under shade for three days, and milled into powder using pestle and mortar.

Experimental Design

The experiment was carried out using different concentration of cinnamon powder (0g/l, 5g/l, 10/l, 15g/l) representing T1,T2,T3,and T4 respectively. Each treatment was replicated twice. The fish were emerged in stock solution of cinnamon for 15minutes. Each treatment consisted of three(6kg) of the fish samples and smoked using charcoal smoking kiln. After smoking of the fish, 100g of the dried samples were milled separately into fine powder using Kenwood food blenderand transported to the Laboratory for analysis.

Proximate Composition

The proximate parameters such as moisture, ash, crude fat, crude protein, crude fibre and carbohydrate was determined in accordance with AOAC methods (AOAC, 2000). The crude protein content was determined using the Kjeldahl method, and the crude lipid content was determined using the Soxhlet method. To determine the ash content, the samples was burnt overnight at 550°C. The samples moisture content was determined by drying them overnight at 105°C.

Organoleptic Assessment of Fish

The organoleptic assessment was conducted for taste, appearance, texture, flavor, color, and acceptabilityof the smoked fish products. The organoleptic assessment was carried out using 60 panelists already familiar with scoring smoked fish were given the product scores at every three months interval. The evaluation of the smoked dried fish was done using five likert scales; Excellent (5), very good (4), good (3), fair (2) and poor (1), (Eyo, 2001).

Statistical Analysis

The data collected was subjected to statistical analysis using one way Analysis of variance (ANOVA) and Duncan Multiple Range Test was used for mean separation. The statistical analysis was conducted by using IBM SPSS version 20 software.

RESULTS AND DISCUSSION

Results

The effect of Cinnamon powder on the proximate composition of fish is presented in Table 1. The results showed significant differences ($P<0.05$) in the proximate composition of fish smoked using cinnamon. The moisture content of the fish samples ranged between 4.36% - 8.76% and the highest moisture content was found in fish smoked using 0g/l of cinnamonwhile the lowest was obtained in 10g/l respectively. The ash content was found highest in 15g/l application of cinnamonwhile the lowest was recorded in 10g/l of cinnamon. The crude protein values were 36.91%, 38.12%, 22.27%, and 38.24% respectively in 0g/l, 5g.l, 10g/l and 15g/l. The value of ether extract was significantly higher in 10g/l (28.93%) followed by 5g/l (28.90%), 0g/l (26.58%) while 15g/l (25.65%) was seen as the lowest in ether extract content respectively. The contents of crude fibre were 3.65%, 3.50%, 2.86%, and 5.36% in 0g/l, 5g/l, 10g/l and 15g/l

respectively. Fish smoked using 0g/l of cinnamonhad the highest NFE (9.63%), followed by 5g/l (8.75%), 10g/l (8.00%) while those smoked with 15g/l was the lowest (4.81%) respectively.

Table 1: Proximate Composition of Fish Smoked using different Graded Level of Cinnamon

Parameters	0g/l	5g/l	10g/l	15g/l	SEM	Prob.(5%)
%MD	8.76±0.17^{a}	6.89±0.12 ^{c}	4.36±0.04 ^{d}	7.36±0.17^{ab}	3.82	0.002
%Ash	14.47±0.25 ^{a}	13.84±0.19 ^{a}	13.58±0.26 ^{a}	18.58±0.73 ^{a}	6.29	0.001
%C.P	36.91±1.83^{c}	38.12±0.95^{b}	42.27±0.46^{a}	38.24±0.93^{b}	8.35	0.001
%E.E	26.58±0.56 ^{b}	28.90±0.64^{a}	28.93±0.38^{a}	25.65±0.83 ^{b}	4.84	0.001
%C.F	3.65±0.06 ^{b}	3.5±0.03 ^{b}	2.86±0.02 ^{bc}	5.36±0.12 ^{a}	1.73	0.002
%NFE	9.63±0.15^{a}	8.75±0.17 ^{ab}	8.00±0.36^{c}	4.81±0.06^{d}	4.29	0.001

Means with the same superscripts are not significantly different (P>0.05) from each other across the rows. MD = Moisture Determination, CP = Crude protein, E.E = Ether Extract, CF = Crude Fibre, NFE = Nitrogen Free Extract.

Table 2: Effect of Different levels of Cinnamon Concentration Sensory Parameters of Smoked *Mormyrusrume*

Treatments	Taste	Appearance	Texture	Flavor	Color	Acceptability
1st Month						
0g/l	4.02±0.04^{a}	3.87±0.24 ^{a}	3.98±0.23^{a}	3.82±0.04^{a}	3.53±0.24^{ab}	4.03±0.19^{a}
5g/l	4.13±0.02^{a}	3.94±0.13 ^{a}	3.87±0.21^{a}	3.67±0.15 ^{ab}	3.67±0.27 ^{a}	4.13±0.17^{a}
10g/l	4.18±0.05 ^{a}	3.72±0.14^{b}	3.82±0.24^{a}	3.65±0.19^{b}	3.47±0.19^{ab}	4.37±0.28^{a}
15g/l	4.37±0.17 ^{a}	3.68±0.13^{b}	3.63±0.22^{b}	3.33±0.18^{c}	3.33±0.23^{b}	4.18±0.26^{a}
2nd Month						
0g/l	3.08±0.12b	3.37±0.17^{ab}	2.90±0.25^{b}	3.08±0.15^{c}	3.33±0.17^{a}	3.08±0.26^{c}
5g/l	3.92±0.15 ^{a}	3.50±0.12^{a}	3.53±0.16^{a}	3.92±0.17^{a}	3.33±0.19^{a}	3.92±0.24^{a}
10g/l	3.63±0.13^{ab}	3.47±0.15^{a}	3.47±0.09^{ab}	3.60±0.18^{b}	2.93±0.16^{b}	3.52±0.25^{ab}
15g/l	3.63±0.15^{ab}	3.38±0.17^{ab}	3.47±0.19^{ab}	3.10±0.14^{c}	2.61±0.19^{b}	3.37±0.26^{b}
3rd Month						
0g/l	2.75±0.11^{b}	1.75±0.08^{ab}	2.42±0.10^{b}	2.42±0.08^{b}	2.42±0.09^{b}	2.42±0.18^{b}
5g/l	2.93±0.12^{a}	1.93±0.01^{a}	2.27±0.09^{bc}	2.73±0.09^{a}	2.82±0.08^{a}	2.27±0.16^{b}
10g/l	2.90±0.18^{a}	1.90±0.02^{a}	1.90±0.08^{c}	2.80±0.19^{a}	2.27±0.04^{b}	2.82±0.18^{a}
15g/l	2.62±0.03^{c}	1.88±0.03^{a}	2.82±0.07^{a}	2.22±0.09^{b}	1.90±0.02^{c}	1.90±0.09^{c}

Means with the same superscripts are not statistically different (P>0.05) from each other

Effect of different level of Cinnamon Powder on Taste of Fish

The effect of cinnamon on the taste of fish is present in Table 2. At the 1st month of storage, all the samples of fish smoked with graded level of cinnamon had stronger mean values above the decision mean which showed a level of acceptance of the samples by the panelists. At the second

months, the mean values of the fish were above the decision mean however, there was reduction in the mean values compared to the mean values recorded in the first month even though fish samples were accepted. At the third month, the mean values reduced from the decision mean and all the samples were rejected. However, the highest mean value of fish in month 1 was obtained in fish with 15g/l (4.37) but in month 2 fish treated with 5g/l (3.92) showed highest value while in month 3, all the values ranged between mean of 2.76 – 2.93.

Effect of Cinnamon on Appearance of Fish

The result of the appearance of fish treated with graded level of cinnamon is presented in Table 2. The results showed that mean values of fish at month 1 and month 2 were above decision mean of the study but at month 3 the mean values of all the fish samples reduced drastically from the mean decision and the values ranged from 1.75 – 1.93. Throughout the months of the study, the mean values in month 1, 2 and 3 attain a reduction pattern until it goes below the decision mean respectively at month 3.

Effect of Cinnamon on the Texture of the smoked Fish

The effect of different levels of cinnamon on the texture of the fish samples is presented in Table 4. At month 1 the fish smoked without cinnamon had the highest (3.98) mean values followed by fish treated with 5g/l (3.87) while fish treated with 15g/l (3.63) had the lowest mean value however, mean values of fish obtained in month one was above the decision mean and were accepted. At month 2, the fish treated without Cinnamon had mean value of 2.90 and was rejected by the panelists. In the same month 2, other fish samples treated with Cinnamon were accepted by the panelists and the highest mean value was recorded in fish smoked with 5g/l (3.53) while fish treated with 15g/l (3.47) was the lowest respectively. At month 3, however, all the fish samples revealed mean value below the decision mean stipulated in the study and the panelists rejected the fish products.

Effect of different levels of Cinnamon on the Flavor of the Fish Samples

The table 5 below showed the result of the effect of different level of cinnamon on the flavor of smoked fish. The flavor of the fish samples in the study of the first month was observed highest (3.83) in fish treated without Cinnamon followed by fish treated with 5g/l (3.65), 10g/l (3.65) and the lowest was recorded in 15g/l (3.33) respectively. At the second month, the quality of the fish in terms of flavor was still intact whereby mean values ranged between 3.08 – 3.92 which are still above decision mean values of 3.0 respectively. At month 3, there was reduction in the mean values of fish samples and the fall falls below the decision mean of 3.0 drawn for the study, however, mean values ranged from 2.22 to 2.73 and the panelists rejected the fish samples.

Effect of different levels of Cinnamon Powder on the Color of the Fish Samples

The result displayed in Table 6 represent the effect of cinnamon on the color of the fish samples. The following mean values 3.53, 3.67, 3.47 and 3.33 in 0g/l, 5g/l, 10g/l and 15g/l were recorded in the study. Mean values obtained in month 1 of the study showed values higher than decision mean drawn for the study and the samples were accepted by the evaluators that tested the fish. In the second month, there was slight reduction in the color of the fish and the accepted fish only occurred in fish treated with 0g/l and 5g/l but fish treated with 10g/l and 15g.l were rejected by

the panelists. At month 3, the fish samples had mean values below the decision mean of 3.0 therefore they were rejected respectively.

General Acceptability of Fish Samples treated with different levels of Cinnamon

The result presented in table 7 showed the general acceptability effects on the smoked fish samples treated with graded level of cinnamon. The result revealed a very high mean values in the general acceptability of the fish at month one and the highest mean value was obtained in fish treated with 10g/l which is slightly higher than the other levels of treatment. The mean values in the first month ranged between 4.03 – 4.37 which are above the mean decision values therefore the fish samples were accepted in the first month. At month 2, the fish treated with 5g/l of the cinnamon was the highest (3.92) in mean values, though other treated fish had their mean values above 3.0 and the decision of the panelists showed a level of acceptance. At month 3, all the fish samples had their mean values below 3.0 and this rendered the samples unaccepted by the panelists therefore, they were rejected.

Discussion

Proximate Composition of Fish Smoked with Cinnamon Powder

The results obtained for proximate composition of fish in the study revealed good content of nutrient in the fish. The observation showed that cinnamon played significant role in increasing the nutrient composition of smoked *Mormyrusrume*. The moisture content of the smoked fish which is of great importance in storage is still at safe level of 5.99 – 8.57% and it falls between the recommended safe moisture content of dried fish of 6.0 to 8% (Adefemi*et al.*, 2023). The contrast in moisture content which is high in samples 0g/l and 15g/l indicates that the fish is composed mostly of water, and if not properly processed, it could be highly perishable. The reduction in the moisture content of the smoked samples is as a result of the water loss during the smoking process (Magawata and Musa, 2015).

The range of the ash content in the study indicates that *Mormyrusrume* is good sources of minerals such as calcium, potassium, zinc, iron and magnesium as reported by Andrew (2011). The amount of crude protein recorded in the study falls within the range ideal for many freshwater fishes. The result showed that the crude protein in cinnamon treated fish were higher than those recorded in fish treated with cinnamon. Also, the range of the values recorded for protein in this study agreed with the observation of Adebowale *et al*. (2018).

It was observed in the study that *Mormyrusrume*is rich in oil and could be used to produce fish oil in large quantity compared to *Clariasgariepinus* (Usman, 2027). The high fat content of the samples indicates that*Mormyrusrume*reserve fat in its tisues.

All the fish samples dried in the different concentration of Cinnamon showed an inconsistent reduction and increase in their crude fibre. A greater amount was observed in fish treated with 15g/l which shows that cinnamon tendency to reducefibre content in *Mormyrusrume*. The nitrogen free extract in the fish samples was very high in fish treated with 0g/l and slightly reduce in cinnamon treated fish.

Sensory Evaluation of the Fish Sample treated with Cinnamon with respect to Period of Storage

The result of this study indicated that Cinnamon had significant effect on the sensory properties of the fish samples. This effect was clearly observed in the mean values found in all the fish samples in their taste, appearance, texture, flavor, color and general acceptability. The fish samples treated with Cinnamon showed desirable acceptance of the fish products. The panelists

report showed that cinnamonenhanced the sensory properties of *Mormyrusrume*in the first and second months this shows that cinnamon can retain fish quality for two months before spoilage occur. this can be probably concluded that increasing cinnamon application on fish *Mormyrusrume* can lead to reduction in acceptability. Studies showed that cinnamoncontain pungent flavor and when applied in large quantity can affect its acceptability. The study also showed that sensory attributes improves in their properties with storage time. The final record of the sensory attributes showed that, fish products had lower mean values than their first and second months.

Conclusion

The results of the study showed that *Mormyrusrume*is rich in nutrients and application of cinnamon on the fish samples significantly influences the organoleptic properties of *Mormyrusrume.* Cinnamon had the tendency of increasing the shell-life of smoked *Mormyrusrume*for two months.

Recommendation

Fish should be processed with at 5g/l of water for better taste, appearance, texture and flavor. There is need to assess the phytochemical present in the Cinnamon plants. Fish processors should adopt the application of Cinnamon in their fish products to improve consumer satisfaction and value-chain added products.

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