| RESEARCH ARTICLE

Paper Title:

EFFECT OF CINNAMON (CINNAMON VERUM) ON PROXIMATE COMPOSITION AND ORGANOLEPTIC EVALUATION OF MORMYRUSRUME

Adamu, W.D[1], Agbason[2], N.A , S.A. Okunsebor[1], Mwanle[3], C.S. Rabo, P.D[3] and Yahaya, S.O[4]

1. Nasarawa State University Keffi, Department of Aquaculture and Fisheries Management.
2. College of Agriculture, Science and Technology Lafia, Department of Fisheries Technology.
3. Plateau State College of Agriculture Garkawa, MikangL.G.A.
4. Nasarawa State University Keffi, Department of Zoology.

Corresponding Author: Author's Name, **Adamu, W.D**

| ABSTRACT

The study on the effect of cinnamon(Cinnamon verum) on proximate composition and organoleptic evaluation of Mormyrus rume was conducted for three months. Twenty four (24kg) of fresh Mormyrus rume 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 study on the effect of cinnamon (Cinnamon verum) on proximate composition and organoleptic evaluation of Mormyrus rume was conducted for three months. Twenty four (24kg) of fresh Mormyrus rume 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 Mormyrus rume 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. Mormyrus rume should be processed using 5g/l of cinnamon to achieve good sensory evaluation.

Introduction :-

Fish has an important role in food security and poverty alleviation in both rural and urban areas of Nigeria (Bouzgarrou and 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 (Aremuet 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(Adeyeyeet 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 cinnam on that is used in both sweet and savory foods. Cinnamon is a good preservative with high antioxidant and antibacterial activity (Ahmed, 2019). Diyawareet 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 Mormyrus rume.

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 $8°33^I22^{II}$N and longitude $8°32^I82^{II}$E.

Collection of Fish and Cinnamon
The experiment consisted of 24kg of fresh Mormyrus rume purchased from Doma market of Nasarawa State, Nigeria.The samples were taken to Teaching and Research Farm 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	$3.08\pm0.12b$	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 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% (Adefemiet 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 Mormyrus rume 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 Mormyrus rumeis rich in oil and could be used to produce fish oil in large quantity compared to Clarias gariepinus (Usman, 2027). The high fat content of the samples indicates that Mormyrus rume 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 reduce fibre content in Mormyrus rume. 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 cinnam on enhanced the sensory properties of Mormyrus rumein 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 Mormyrus rume can lead to reduction in acceptability. Studies showed that cinnam on contain 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 Mormyrus rumeis rich in nutrients and application of cinnamon on the fish samples significantly influences the organoleptic properties of Mormyrus rume. Cinnamon had the tendency of increasing the shell-life of smoked Mormyrus rume 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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