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EVALUATION OF PROXIMATE COMPOSITION AND ORGANOLEPTIC PROPERTIES OF *Heterotis niloticus* (CUVIER MULLER1843) PROCESSED WITH BRINE AND POTASH

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ABSTRACT

"The study was aimed at evaluation of the effects of potash and salt solutions on proximate composition, and organoleptic properties on Heterotis niloticus smoked under different periods. Fish pieces were treated with brine (salt solution) and potash on fish at 10g, 20g and 40g as treatments 1, 2 and 3 respectively fishes were smoked using smoking kiln for a period of 1 hour, 2 hours and 4 hours. Composition analysis of Crude protein, moisture content, ash, carbohydrate and lipid of the smoked fish was carried out in accordance with the standard methods. Sensory evaluation of Heterotis niloticus was carried out with the aid of nine panelists and was analyzed for tenderness, flavor, color, juiciness, texture and overall acceptability on a 1-9 hedonic scale. The result indicates values range from 12.11 to 30.55, 4.00 to 22, 13.06 to 66.7, 3.74 to 36.5 and 3.32 to 30.89 for protein, fat, moisture, ash and carbohydrate respectively with significant variation statistically according to the treatments and smoking period. With the organoleptic properties of the fish based on the treatments of brine and potash samples, it indicates salt treatment to be more acceptable at low concentration and one hour of smoking time."

INTRODUCTION

Fish is one of the most important foods on our planet. Its flesh is a source of top quality protein and for many in less developed part of the world, it represent a significant portion of animals protein in their diet, either as fresh fish or cured in a variety of way such as smoking, salting, drying, charring, icing and chilling. Fish can also be seen as renewable natural resources provided that the seas, lakes, river and reservoirs, lagoons are not over exploited. Fish harvesting, handling, processing and distribution provide livelihood for millions of people as well as providing foreign exchange earning to many countries (Al-jufaili and Opara, 2006). Appropriate processing of fish enables maximal use of raw materials and product of value-added product, which is obviously the basis of profitability (Ita, 2005; Davies, 2009). Fish is one of the most perishable of all stable commodities. Spoilage occurs because of the

action of enzymes (autolysis) and bacteria present in the fish and also chemical oxidation of fat which causes rancidity. At a high temperature prevalent in tropical countries like Nigeria, bacterial and enzymic actions are enhanced. Fish invariably becomes putrid within a few hours of capture unless they are preserved or processed in some way to reduce this microbial and autolytic activity and hence retard spoilage. If the moisture content of fresh fish is reduced during drying to around 25 % bacteria cannot survive and autolytic activity will be greatly reduced (khoshmanesh, 2006), but to prevent mould growth, the moisture content must be reduced to <15%. Also the presence of salt retard bacteria action and, in addition, it aid the removal of water by osmosis (khoshmanesh, 2006). There is a high demand of fish either fresh, frozen or smoke dried throughout the year and this confers high economic value of fish.

Fish and fish product provide as much as 17-63 % protein intake of large Nigeria population. This means that any short fall in fish availability will affect the animal protein intake of Nigeria populace.

Heterotis niloticus is a naturally distributed in the savannah river of the Nilosudanese region from Ethiopia to Senegal. It is also naturally distributed in Chad basin and Lake Turkana. The species current distribution is now far wider spread because of manmade introductions. *Heterotis niloticus* feeds on invertebrate, Copepods and Chironomids. Young ones are found in the swampy places among aquatic vegetation (Moreau 1982 and Dankwa et al., 1999). Adult fish live in an open water of the river and lakes where they can be found in the pelagic zone as well as the littoral zone (Moreau, 1982). Smoking is the major method of preserving fish in Nigeria. Smoking is the process of flavoring, cooking, or preserving food by exposing it to smoke from burning or smoldering material, most often wood. The process of smoking fish occurs with fire. Wood contains three major components that are broken down in the burning process to form smoke. The burning process is called pyrolysis, which is simply defined as the chemical decomposition by heat. The major wood components are cellulose, hemicellulose and lignin. Smoking is one of the oldest preservation methods, combines the effects of salting, drying, heating and smoking.

Salting of fish is a traditional processing method in most countries of the world. Most of the modern drying technologies available are expensive with a lot other limitation in developing country like Nigeria, particularly in the areas where prerequisites for these technologies, such as electricity are simply not available and adequate. The main objective of the study is to evaluate the effect of processing *H. niloticus* with brine and potash under different concentration on proximate composition and organoleptic properties

MATERIALS AND METHOD

Description of Study area

Kano lies between longitude 9° 30' and 12° 30' north and latitude 8° 42' and 9° 30' east in the semi arid region of northern Nigeria. The state occupies a land area of 20,400km² with a population of over 15 million people (NPC, 2006). The climate of Kano is hot during dry season and cold during harmattan. The ambient temperature ranges from 16.6°C to 42.8°C in the month of January to June and 23.9°C to 26.7°C from July to December (Anonymous, 2010). An average monthly precipitation of 0 to 30 mm was recorded from

January to June and 780-1320 mm in July to December (Knarda, 2001).

COLLECTION OF FISH SAMPLE

The experiment was conducted in July to October 2014, at University farm of Department of Forestry, Fisheries and Wildlife. Kano University of Science and Technology, Wudil. A total of eighteen pieces of *Heterotis niloticus* were purchased in uniform size to avoid the possible error due to size differences. Sample of *H. niloticus* were slaughtered and taken in ice chest to the traditional kiln smokers located at Garin dau Wudil where the fish samples were smoked.

Fishes smoked were treated with brine (salt solution) and potash on fish at 10g, 20g and 40g as treatments 1,2 and 3 respectively fishes were smoked using smoking kiln for a period of 1hour, 2 hours and 4 hours respectively. The smoked fish was labeled according to the quantity of salt and potash and the time it took to be smoked.

Proximate analysis of fish sample

Composition analysis of Crude protein, moisture content, ash, carbohydrate and lipid of the smoked fish was carried out in accordance with the AOAC (1995) procedure.

ORGANOLEPTIC ASSESSMENT

Sensory evaluation of the smoked *H. niloticus* was performed according to salt and potash treatments concentrations and smoking time with the aid of nine (9) panelists for each treatment. Each panelist was served with the sample on disposable plate and provide with a cup of water to rinse their mouths after testing each sample. Their assessment for each parameter that is for tenderness, flavor, color, juiciness, texture and general acceptability was indicated by ticking the appropriate box on a score sheet provided with a 1-9 hedonic scale as follows (Ihekoronye and Ngoddy, 1985):

1. Like extremely
2. Like very much
3. Like moderately
4. Like slightly
5. Neither like nor dislike
6. Dislike slightly
7. Dislike moderately
8. Dislike very much
9. Dislike extremely

Statistical Analysis

All data were subjected to analysis of variance (ANOVA) and Duncan multiple range tests for mean separation using SAS computer software.

RESULTS AND DISCUSSION

The results of the organoleptic properties and proximate analysis are illustrated below.

Table1: Mean values of proximate composition of *H. niloticus* processed with Brine and smoked under different time periods

parameters	1 (hr)			2 (hrs)			4 (hrs)		
	10 g	20 g	40 g	10g	20 g	40 g	10 g	20 g	40 g
Ash	5.12 ⁱ	7.54 ^h	11.32 ^g	13.76 ^f	15.46 ^e	16.76 ^d	19.34 ^c	28.82 ^b	36.14 ^a
Moisture	66.74 ^a	61.62 ^b	55.68 ^c	43.26 ^d	43.12 ^e	39.32 ^f	33.66 ^g	30.62 ^h	28.24 ⁱ
Fat	4.00 ^d	6.00 ^c	8.00 ^b	4.00 ^d	6.00 ^c	8.00 ^b	4.00 ^d	8.00 ^b	12.00 ^a
Protein	12.29 ^h	16.59 ^b	19.86 ^a	23.99 ^c	27.75 ^b	30.55 ^a	12.11 ⁱ	16.89 ^f	20.55 ^d
CHO	11.85 ^d	8.25 ^e	5.14 ^h	14.99 ^c	7.67 ^f	5.37 ^g	30.89 ^a	15.67 ^b	3.07 ⁱ

- Means in the same rows with the same superscript are not significantly different at 5% level of significance.

In Table 1: The ash content was in the range of 5.12 to 36.14 and the trend indicates increase in salt concentration and smoking hour increases the ash content, but a reverse trend was noticed in moisture content having values ranging from 28.24 to 66.74 as smoking hours increases moisture content reduces so also salt content increases moisture levels reduces. Carbohydrates values ranges from 3.07 to 30.89 with fluctuation in

content according to salt concentration and smoking hours having lower carbohydrates with higher salt content as well as higher values as smoking hours increases. Protein content which should have been heat liable exhibits a values ranging from 12.11 to 30.55 with highest in smoking time of two hours and least in four hours smoking time.

Table 2 Mean values of proximate evaluation of *H niloticus* processed with potash and smoked under different time periods

Parameters	1 (hr)			2 (hrs)			4 (hrs)		
	10 g	20 g	40 g	10 g	20 g	40 g	10 g	20 g	40 g
Ash	3.74 ⁱ	5.98 ^h	13.32 ^f	12.34 ^g	13.38 ^e	18.66 ^d	18.86 ^c	25.58 ^b	36.5 ^a
Moisture	52.46 ^a	51.2 ^b	49.02 ^c	37.98 ^d	36.7 ^e	35.24 ^f	20.66 ^g	17.94 ^h	13.06 ⁱ
Fat	4.00 ^e	8.00 ^d	10.00 ^c	2.00 ^f	10.00 ^c	16.00 ^b	8.00 ^d	10.00 ^c	22.00 ^a
Protein	15.59 ⁱ	20.00 ^f	23.5 ^d	18.44 ^h	23.62 ^c	25.41 ^a	18.99 ^g	21.34 ^e	25.12 ^b
CHO	24.21 ^d	14.82 ^f	4.16 ^h	29.24 ^b	16.3 ^e	4.69 ^g	33.49 ^a	25.14 ^c	3.32 ⁱ

Means in the same rows with the same superscript are not significantly different at 5% level of significance.

Based on the organoleptic properties the panelist were clearly able to distinguish the differences in color, texture and taste, overall acceptability and slightly also the juiciness and texture.

Table 3 indicate values for eating quality assessments according to brine treatments on smoked *Heterotis niloticus* under different smoking periods from the general response 40g salt is moderately liked as compared to 10g concentration which on average are liked very much in almost all the qualities for tenderness, flavor, texture and juiciness with only slightly liked on four hours smoking in overall acceptance the differences was statistically significant

The result of smoked fish processed with salt for two hours indicated poor eating quality with significant variation according to treatment with overall acceptability liked moderately.

The results in Table 2 above contain proximate values of potash solution treatment, the ash

content was in the range of 3.74 to 36.5 it shows a similar pattern to brine solution treatment with increase in potash concentration and smoking hour increase the ash content also increases, but a reverse trend was noticed in moisture content similar to brine solution treatment having values ranging from 13.06 to 52.46 as smoking hours increases moisture content reduces so also potash content increases moisture levels reduces. Carbohydrates values ranges from 3.32 to 33.49 with fluctuation in content according to potash concentration and smoking hours having lower carbohydrates with higher potash content as well as higher values as smoking hours increases. Protein content values were in the range of 18.44 to 25.41 with fluctuations as having highest in smoking time of two hours with 40g potash concentration and least in one hours smoking time and 10g potash concentration similar to the trend in brine solution treatment.

Table 3: Mean values of sensory evaluation of *H niloticus* processed with Brine under different time periods

	1 (hr)			2 (hrs)			4 (hrs)		
	10 g	20 g	40g	10 g	20 g	40g	10 g	20 g	40g
Tend	1.00 ^g	1.33 ^f	1.33 ^f	2.00 ^d	3.00 ^c	3.66 ^a	1.66 ^e	3.00 ^c	3.33 ^b
Flavor	3.33 ^b	1.33 ^g	2.00 ^e	1.33 ^g	1.66 ^f	3.66 ^a	2.33 ^d	2.66 ^c	3.33 ^b
Color	2.00 ^e	2.33 ^d	2.33 ^d	3.33 ^b	3.00 ^c	3.00 ^c	2.00 ^e	3.33 ^b	3.66 ^a
Juic.	1.33 ^e	1.66 ^d	1.33 ^e	2.33 ^c	3.00 ^b	3.00 ^b	1.66 ^d	3.00 ^b	3.33 ^a
Texture	2.00 ^e	3.00 ^c	3.33 ^b	3.00 ^c	1.66 ^f	2.33 ^d	1.66 ^f	3.66 ^a	3.33 ^b
G. accep	3.00 ^d	3.00 ^d	3.33 ^c	2.33 ^e	2.33 ^e	3.00 ^d	4.00 ^b	4.66 ^a	3.33 ^c

- Means in the same rows with the same superscript are not significantly different at 5% level of significance.

Table 4: Mean values of sensory evaluation of *H niloticus* processed with potash under different time periods

	1 (hr)			2 (hrs)			4 (hrs)		
	10 g	20 g	40 g	10 g	20 g	40 g	10 g	20 g	40 g
Tenderness	2.00 ^d	2.00 ^d	1.66 ^e	2.00 ^d	2.66 ^c	1.66 ^e	4.00 ^b	4.00 ^b	5.00 ^a
Flavor	2.00 ^e	2.66 ^d	2.66 ^d	2.00 ^e	2.00 ^e	3.00 ^c	3.00 ^c	4.00 ^b	4.33 ^a
Color	2.66 ^e	1.66 ^g	2.33 ^f	3.33 ^d	3.66 ^c	3.66 ^c	3.66 ^c	4.00 ^b	4.66 ^a
Juice	3.66 ^b	2.00 ^e	2.00 ^e	1.66 ^f	2.00 ^e	2.66 ^d	3.66 ^b	3.33 ^c	4.33 ^a
Texture	2.33 ^f	3.00 ^e	2.00 ^g	4.00 ^c	4.33 ^b	5.66 ^a	3.00 ^e	3.66 ^d	3.66 ^d
G. acce	3.00 ^f	4.33 ^d	3.33 ^e	1.66 ^h	2.33 ^g	4.66 ^c	4.66 ^c	6.33 ^b	7.33 ^a

- Means in the same rows with the same superscript are not significantly different at 5% level of significance.

Potash treatments values as in Table 4 above shows the values for eating quality assessments according to different smoking periods on smoked *Heterotis niloticus*. From the general response 4 hours smoking period in 20g and 40g potash eating quality score indicate neither liked nor disliked which showed that the taste is not distinct or clear as to make assessment. Upon all qualities assessed it's only at two hours smoking time for 10g potash that it's eating quality is liked moderately because of low concentration of the potash.

The proximate composition of *H. niloticus* processed with salt and potash showed encouragingly high crude protein contents of 38.40%, 41.28%, 44.28% and 46.28% respectively (Table 1 and 2). The relatively high to moderate percentage crude protein could be attributed to the fact that; fishes are good source of pure protein, but the differences observed, in the obtained values may also be attributed to concentrations and smoking time that is the heat supplied. Capability and conversion potentials of essential nutrients from their flesh and the heat supplied changes the biochemical attributes and the brine reduces the risk of spoilage (Burgess, 1975 and Adewoye and Omotosho, 1997). The percentage ether extract, ash contents, crude fibers and moisture contents followed the same order in the fish analyzed under the various treatments.

This study therefore, showed that *H. niloticus* when processed could be good sources of nutrients. Thus, it is right to say that, the mineral elemental contents of brine and potash function to reserve the availability of these macro nutrients in the fish. However, it was discovered that, macro nutrients recorded similar values; this may be due to the fact that the brine and potash treatments does not change the proximate composition but the smoking time significantly affect the composition. It is therefore become important to consider time of smoking to improve nutrients status of the fish. Qualitative evaluation of some organoleptic properties of the treated fish samples assessed by means of sense organs of the volunteers showed that fish samples from brine and potash under lower concentration of 10g had the highest acceptability. The taste, flavor, odor, appearance texture, and palatability were very good. One hour smoking time and higher concentration of the brine and potash was least accepted, because, its organoleptic parameters tested were not so pleasant. This observation agrees with the sensory evaluation done on fish dried by open-sun drying and low-cost solar driers for longer hours by Sengar *et al.* (2009) and Rahman *et al.* (2012). Thus, brine application is more effective and has more acceptability in terms of organoleptic properties and increased nutrients content than potash treatment as reported by Bhandary (1988) and Chavan *et al.* (2011).

Conclusion

Based on the proximate composition of the fish studied it clear to confirm that salt and potash treatments have no effect on proximate constituent but the time of smoking play a major effect. Depending on the parameter indicating four hours of smoking period indicates more ash

content less than at one hour more of protein value with significant difference at 5% level of significance. Assessments of organoleptic properties of the fish based on the treatments of brine and potash samples, indicates salt treatment to be more acceptable at low concentration and at one hour of smoking time.

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