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RESEARCH PAPER

A SURVEY OF PEST (*Dermestes maculatus*) INFESTATION OF DRIED PRESERVED *Clarias gariepinus*: ITS EFFECT ON NUTRIENT QUANTITY AND QUALITY

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ABSTRACT

Studies on the nutrient composition of smoked-dried *Clarias gariepinus* were carried out, to assess the effects of pest infestation on the dried catfish from two different market (Abakpa and Kpirikpiri market) area in Abakaliki Metropolis, Ebonyi State, Nigeria. Fish samples from the two markets where kept for pest to infest it and it were taken to Biochemistry Laboratory of Food Science and Technology in Ebonyi State University to assess the damage of pest on dried catfish using standard methods. There was a significant different among the mean weight of fish from the two markets (Abakpa and kpirikpiri; 19.13kg and 18.98kg respectively) compared with the mean weight of the control 20.09kg. There was a variation in the proximate composition of the fishes from the two markets compared with the control, the decreases of the proximate composition are: crude protein from 60.07% to 40.27%; fat from 8.35% to 5.90%; moisture content from 11.67% to 10.67; fiber from 12.93 to 11.93; ash from 4.02% to 3.54% and carbohydrate 12.67% to 5.89%. The longer the storage periods of the infested smoked fish the more the tissue was degraded. Proper handling and storage of dried catfish are required to prolong the shelf life and nutrient content of dried catfish.

KEYWORDS: *Dermestes maculates*, pest infestation, preservation, *Clarias gariepinus*, nutritional composition

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INTRODUCTION

Fish is one of the cheapest animal protein sources and it is being used increasingly to correct protein deficiency in human diets in the tropics. The consumption of fish provides an important nutrient to a large number of people worldwide and thus makes a very significant contribution to nutrition (Moses, 2002). However, fish is highly susceptible to damage by insects and microorganisms as soon as it is caught (Afolabi *et al*., 1990). The African mud catfish, *Clarias gariepinus* is the most popular, widely cultivated and mostly smoked fish in Nigeria. Losses in quality and quantity of smoked fish during storage have been attributed to *Dermestes maculatus* infestation. This pest accounts for about 71.5% of dried fish infestation recorded in most of the producing areas with a substantial loss in dry weights of about 43-62.7% from both larvae and adults (Emokpae, 1998). The need to protect smoked fish from pests is imperative when the crucial role it plays in ensuring food security, income generation and employment opportunities are considered (Emokpae, 1998 and Proctor, 2007). Fish provides an excellent source of protein in the diet of many families in tropical Africa. Of all the animal protein foods produced and consumed in Nigeria, fish is of prime importance as it has remained a major source of protein which is rich in essential-amino acids for both rural and urban poor households. The fish is rich in protein, which is very essential for the health of

the body and it account for about 40 percent of the total animal protein of an average person in the tropics (Olatunde, 2003; Reed *et al*., 2009). Fish is rich in fats, phosphorus, sulphur, potassium, iron, calcium and copper. Fish fat is characterized by high poly-unsaturated acid, which provides diet low in cholesterol. Its oil has high quantities of vitamin especially vitamin A, B and D, thiamin, riboflavin, nicotinic acid and vitamin B12. Fish contains less than 1% fat and about 10% protein with energy value ranging from 220 – 330 Kilojoules (50 – 80Kcal/100g) of fish. In Nigeria, fish is consumed fresh or processed (dried). Fish meal and fish flour are two products produced by fishing industries, which are used as food in dairy animals and poultry (Horn, 1974). This revealed that the recent ban on the importation of broilers has further put the cost of animal protein beyond the reach of many, especially the rural population; they have resorted to consumer fish. The low price per kilogram of fish, is a very strong indicator that they can be used to bridge the wide animal protein gap that has become the hallmark of most developing countries (Mabawonku and Ajayi 2007). The world population reaching the 6.0 billion mark by year 2000 A.D, a lot of pressure is being placed on the world fish production in order to meet the high demand from the teaming human population. This demand is greater in tropical countries including Nigeria with increasingly rising human population. In Nigeria, fish production over the years has been inadequate to bridge the demand supply gap. Nigeria with about 13 million hectares of fresh water bodies capable of producing 511,702 metric tones of fish under adequate management but the actual production is about 334,213 metric tones. The potential yield of fish from the coastal and brackish water of Nigeria has been estimated as follows 22,000 metric tones from demersal resources, 120,000 metric tones from pelagic resource and 48,000 metric a total yield of 190,000 metric tones which is far below the quantity demanded in the markets (Mabawonku and Ajayi 2007). Dried fish is one of the highly digestible and respectable sources of proteins and essential minerals but it is highly susceptible to insect pest infestation. The major pests on smoked catfish, *Clarias gariepinus* include *Dermestes maculatus* (hide beetle) and *Necrobia rufipes* (copra beetle) which could be controlled by synthesized chemicals. However, in recent years, there have been increasing and concerted efforts directed at developing natural pest management control agents that are relatively cheap, safe, biodegradable and environment friendly as alternatives to synthesized insecticides (Mabawonku and Ajayi 2007). Therefore this research was carried out to know the common pest that infests catfish within this region of the tropic of Nigeria, determine the effect of pest infestation on the nutrient composition of dried catfish.

MATERIALS AND METHODS

Sample Collection

Dried African catfish, *C. gariepinus* (Burchell, 1822) were bought from Abakpa market and Kpirikpiri market at Abakaliki, Ebonyi State, Nigeria. Samples were taken to Food Science and Technology (FST) Laboratory of Ebonyi State University, Abakaliki, for determination of pest infestation.

Collection of pest

The catfish was kept for some weeks so that pest can infest it and the pest discovered in the catfish were removed, counted and was taken to Department of Applied Biology for identification, classification and naming.

Chemical Analysis

Fat contents of fish samples were extracted by Bligh and Dyer (2001) method. The fatty acids were determined by gas-lipid chromatography (GLC) through esterification by refluxing in 4% sulphuric acid (H_2SO_4) and methylation with methyl-hydroxide (MeOH) for 16h at 79^oC (Bligh and Dyer, 2001). Complete esterification was confirmed by thin layer chromatography (TLC) on silica gel G plates using a solution of petroleum ether, diethyl ether, and acetic acid (90:10:1) as solvent system. Total nitrogen was measured by micro-kjeldahl method and the crude protein content determined by multiplying by 6.25 (AOAC, 1995). The pH was determined with a pH meter immersed in a suspension of finely ground fish samples. All the data obtained were subjected to analysis of variance to determine the levels of significance (Steel and Torrie 1990).

RESULTS

The design of the experiment ensured that the fish samples were of very low moisture content and long shelf life. The total weight of the infested fish from Abakpa, Kpirikpiri market and control were purchased and weighed as follows Abakpa, Kpirikpiri and control; 19.13kg, 18.98kg and 20.09kg respectively. The number and percentage of pest found in infested fish are as showed in Table 1. The number of parasites found in those infested fish is showed in Table 2 as the percentage of parasites found in Kpirikpiri market was higher than those found in Abakpa market. Thus, an urgent step must be taken for its protection against destructive agents like microorganisms. The fish species examined belonged to high-protein (40 to 60%) and low-oil (< 5%) category. The low ash, carbohydrate, fat, high protein and moisture content values obtained from the proximate analysis as shown in figure 2 is as a result of the infection parasites. There was significant different in the mean percentage of the proximate composition of the dried infested catfish and the control as showed in the Figures 1 and figure 2.

Table 1: Mean weight of dried catfish

Sample location	Weight (kg)
Abakpa	19.13
Kpirikpiri	18.98
Control	20.09

Table 2: Percentage of parasites found in the catfish from two of the market.

Sample location	Number of parasite	% of parasites
Abakpa	20	44.44
Kpirikpiri	25	55.55
Control	None	None

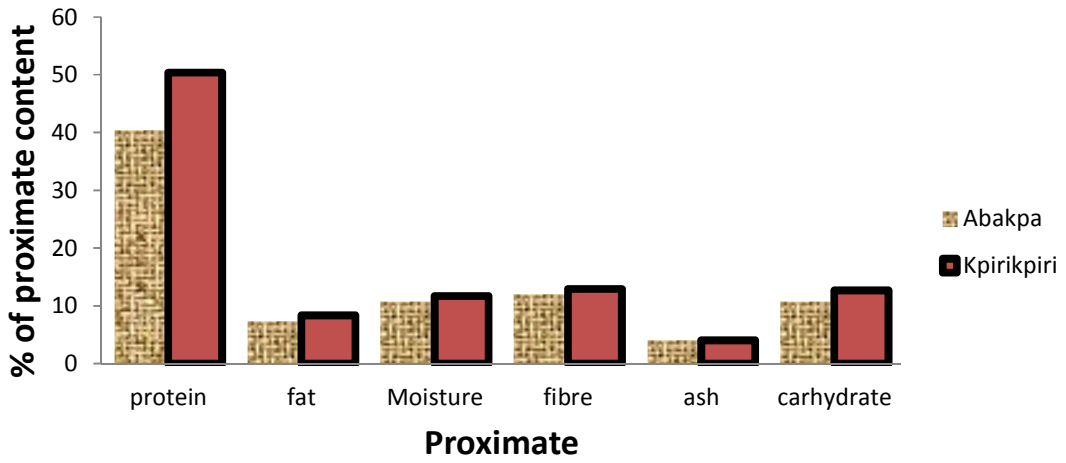

Figure 1: Mean percentage proximate composition of dried infested catfish from Abakpa and Kpirikpiri

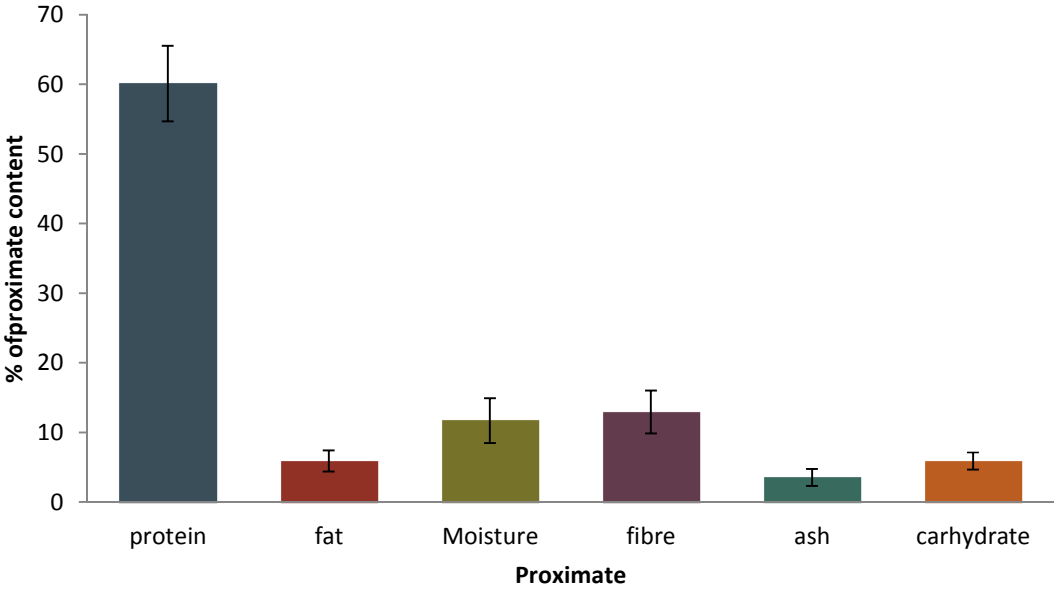

Figure 2: Mean percentage proximate composition of dried catfish (control).

Table 3: Mean percentage proximate composition of dried catfish.

Sample location	% Protein	% Fat	% Moisture content	% Fibre	% Ash	% Carbohydrate
Abakpa	50.37±5.79	5.90±1.53	11.67±3.21	12.93±3.10	3.54±1.20	5.89±1.25
Kpirikpiri	40.27±4.69	7.25±1.44	10.67±2.21	11.93±3.10	4.02±1.34	10.67±3.04
Control	60.07±5.41	8.35±2.54	11.67±3.21	12.93±3.10	4.02±1.34	12.67±4.04

DISCUSSION

The decreased crude protein (CP) content of fish samples within 4 weeks (28 days) of this study (Table 3) contradicted an earlier report that pest infestations did not affect the nutrient quality (proteins, fatty acids) of smoked fish tissues (Nduh, 2004). The decrease in the CP content of fish from 60.07% to 40.27% of the control experiment was a clear manifestation that the nutritional qualities of fish depleted where pest infestation was absent. This result was probably due to fish spoilage and deterioration resulting from the combined activities of micro-organisms and tissue enzyme (Shewan, 2008 and Frazier, 2009). Hydrolytic activities of fish tissue enzymes (cattepsins and glutamic dehydrogenases) have been known to breakdown proteins into peptones, polypeptides and amino acids resulting in fish deterioration (FAO, 2009). The result of fish tissue degradation led to loss in weight of smoked *C. gariepinus* (Table 2). *C. gariepinus* infested with parasites suffered the greatest loss in tissue weight contrary to Osuji (2005) and Nduh (2004) views that the larvae of *D. maculatus* are the most destructive of dried stored fish products. The well-developed biting mouth-parts of adult *D. maculatus* in comparism with those of the larvae must have contributed to the rapid loss in tissue weight of fish samples infested with the adults in this study. The reason was that the well-developed mouth-parts of the adults conferred on them a more destructive tendency than the larvae. The treatment of smoked fish samples from different location varying in levels of infestation did affect the free fatty acids (FFA) (Table 3) and percent total lipids (% TL) (Table 3) of the tissue. FFA and % TL of fish infested by pests increased with prolonged period of storage. These results compared favourably with the observations made by Olley and Watson (2002) and Nduh (1984) that attributed these increases to the hydrolysis of Phospholipids by lipases and also agreed with Chen *et al*. (2004) report that during storage, fats become rancid

owing to peroxide formations at the double bond by atmospheric oxygen. The authors further stated that rancidity may also be as a result of hydrolytic breakdown by micro-organisms leading to the liberation of free fatty acids.

CONCLUSION

In conclusion, the results of this study showed that the crude protein contents of infested fish decreased with increase in storage time. This may be attributed to the activities of certain micro-organisms which facilitated enzymatic breakdown of proteins to amino acids. Storage time may be due to the oxidation of fats to fatty acids resulting in rancidity. Tissue degradation of smoked fish samples was related to the infestation levels and exposure time. Thus, the longer the periods of storage of infested smoked fish the more the tissues are degraded.

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