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Comparative Study of Groundnut Oil and Sodium Chloride as Protectants against Insect Infestation of Smoked Dried Fish in Kainji Lake Areas

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ABSTRACT

The effects of groundnut oil and sodium chloride as protectants against insect infestation of dried fish were investigated for a period of 13 weeks. The fish samples were divided into 3 groups, a group was soaked for 10 min in 30% sodium chloride solution (Brine) and the second group was dipped in groundnut oil after smoking while the third group served as control. The samples were kept in different containers in the laboratory at temperature of 28°C and 70% relative humidity for 13 weeks. Results show that, the fish treated with 30% sodium chloride was effectively protected from insect and moulds compared to sample treated with groundnut oil. The odour and the texture were also more attractive to customers. However, fish treated with groundnut oil was attacked by insects at week 12th and 13th with 6 *Maculatus*, 4 *Necrobia rufipes* species and at few mould colonies. The control specimens however was attacked by insects from week 8th to 13th with numerous number of both *Necrobia rufipes* and *Maculatus* species as well as mould colonies showing as early as from the 6th week. The results proved that sodium chloride is more effective than groundnut oil for long period of storage.

Key words: Infestation, insects, *Clarias gariepinus*, groundnut oil, sodium chloride solution

INTRODUCTION

Fish is the major and important animal protein foods available in many of the developing countries (James, 1977). It is also considered as a cheap source of protein that gives it advantage over pork or beef (Eyo, 2001; Ligia, 2002). A major portion of the rural population in this country (Nigeria) are engaged in small scale fishery operation that directly affect their well being by means of employment opportunities as well as food consumption. Most of the catches are preserved by smoking and later carried to distant markets for commercial purpose.

Research has proved that most of the dried fish that are carried to long distant markets from fishing areas are susceptible to beetle attack during storage and marketing. *Dermestes maculatus* and *Necrobia rufipes* have been implicated as the major insects that infest dry fish during storage in Kainji fishing areas (Awoyemi, 1988). This insect infestation causes significant loses during processing and storage. Though fish processors have long recognized the need to combat these insects, they have until recently been hindered by the absence of effective techniques (Awoyemi, 1991). In Nigeria, smoking, drying and salting are the commonest methods of preservation as chilling and freezing methods are still beyond the means of an average fish monger. However, the

low level of acceptability of salted products to some consumers necessitates the development of other cheap and acceptable techniques to check insect pest infestation of dried fish particularly those been stored for distant consumer markets. Hence, various control measures were highlighted by many scientists such as, Walker and Evans (1984), Golob *et al.* (1987), Walker (1988) and Olokor *et al.* (2007).

There is death of information on the use of sodium chloride and groundnut oil as protectants against insect infestation of dried fish. This study is aimed at investigating the most effective method as protectants against insect infestation of dried fish and also the antimicrobial activities of sodium chloride and groundnut oil in controlling the organoleptic quality of dried fish.

MATERIALS AND METHODS

Preparation of fish prior to smoking: Fresh *Clarias gariepinus* fish was purchased from Dam site of Kainji Lake area. The fresh fish was gutted and washed thoroughly. The fish was placed in bowl containers. Three containers (Bowls) were labeled A, B and C and each container contained 1 kg of fish body weight. Two treatments were used as insect protectants which are Sodium chloride and Groundnut oil. The fish in container "A" was treated with (Brine) sodium chloride solution by dipping the fish in 30% dilute emulsions of sodium chloride before smoking while fish in containers "B" was treated with groundnut oil after smoking for three days by soaking the fish in groundnut oil dose of 30 mL kg^{-1} for one minute and dried in the laboratory. Container "C" received no treatment therefore served as control experiment.

Fish smoking: The smoking was carried out for three days in the same smoking kiln. After smoking, the fish were weighed again and the changes in weight were recorded before packaging and placed in the laboratory at an average temperature of 28°C and 70% relative humidity. At the end of 13th week, samples were broken up for final insect counts, mould and organoleptic assessment.

Statistical analysis: The microbial loads were transformed by logarithmic transformation after which they were subjected to analysis of variance (ANOVA). Where differences exist, they were separated by Fisher's least significant difference at $p \leq 0.05$ significant level.

RESULTS AND DISCUSSION

In Table 1, the weight of the smoked dried fish treated with sodium chloride at week 1 was 720 g. The smoked fish dries and looses weight as the week of storage increases. There was a loss in weight of 16.7% from 720 g in the first week to 600 g in the 13th week. In the sample treated with groundnut oil (Table 2), the weight of the smoked dried fish in the 1st week was 725 g. There was a loss in weight of 35% from 725 g in the first week to 471 g in the 13th week. The loss here was not only due to dryness but also due to the infestation of *Dermestes maculatus* and *Necrobia rufipes* insects' species found on the fish samples. In the control (Table 3), the weight of the smoked dried fish in the 1st week was 725 g. The highest loss in weight occurred in the control. The loss in weight was about 37.5%, from 653 g in the first week to 408 g in the 13th week. The loss here was also not only due to dryness but also due to high infestation of *D. maculatus* and *N. rufipes* insects species found on the fish samples. This result agrees with the study of Agbon *et al.* (2002) where *D. maculatus* infested smoked-cured fish had reduction in both quality and quantity. Similarly, various authors such as Azeza (1976), Osuji (1995) and FAO (1981) estimated the extent and value of quantitative losses caused on dried fish by insect pest such as *D. maculatus* and *N. rufipes* species and other species. They have reported up to 50% weight losses

Table 1: Fish treated with sodium chloride solution

	Weight of fish			
Week	Initial weight (kg)	Recorded weight (g)	Weight difference (g)	Insect found
1	1	720	280	NIL
2	1	710	290	NIL
4	1	700	300	NIL
6	1	650	350	NIL
8	1	630	370	NIL
10	1	630	370	NIL
12	1	630	370	NIL
13	1	600	400	NIL

Table 2: Fish treated with groundnut oil

	Weight of fish			
Week	Initial weight (kg)	Recorded weight (g)	Weight difference (g)	Insect found
1	1	725	275	NIL
2	1	700	300	NIL
4	1	650	350	NIL
6	1	600	400	NIL
8	1	556	444	NIL
10	1	550	450	NIL
12	1	523	477	4 *D. maculatus* species
13	1	471	529	6 *D. maculatus*, 4 *Necrobia rufipes* seen and many of their larvae present

Table 3: Untreated (control) catfish

	Weight of fish			
Week	Initial weight (kg)	Recorded weight (g)	Weight difference (g)	Insect found and No.
1	1	653	347	NIL
2	1	550	450	NIL
4	1	549	451	NIL
6	1	540	460	NIL
8	1	537	463	4 species of *Maculatus* seen
10	1	460	540	16 *Maculatus* and many larvae seen
12	1	440	560	30 *D. maculatus* and 6 *Necrobia* species
13	1	408	592	45 *D. maculatus* species, 13 *Necrobia* species and many larvae of both *Maculatus* and *Necrobia* species

depending on length of storage, salt content, moisture content, climatic condition and general hygienic during processing storage.

The results therefore proved that sodium chloride treated catfish had the best effects in term of weight of 600 g at the end of the 13th week as shown in Table 1. In addition, there was no visible insect species seen on it and there was no mould infestation observed on the fish samples. Moreover, fish treated with sodium chloride attracted customers most due to the its texture, acceptable smell as well as the quality; hence the price per kg was valued at ₦500.00 as shown in Table 5 which is more than the fish treated with groundnut oil and that of the control which were valued at ₦350 kg^{-1} and ₦200 kg^{-1}, respectively. Fish treated with groundnut oil (Table 2)

Table 4: Results of mould counts in catfish samples

	Mould count (colonies g^{-1})		
Storage period (weeks)	Fish treated with sodium chloride	Fish treated with groundnut oil	Control
1	NIL	NIL	NIL
2	NIL	NIL	NIL
4	NIL	NIL	2.1×10^{6}
8	NIL	NIL	4.6×10^{6}
10	NIL	NIL	6.4×10^{7}
12	NIL	2.2×10^{6a}	8.6×10^{7b}
13	NIL	6.4×10^{7a}	12×10^{8b}

Values in the same row and with the same superscript alphabets are not significantly different at p>0.05

Table 5: Organoleptic assessment of treated and untreated catfish at the 13th weeks of storage

Treatment	Texture	Taste	Acceptability	Market price (₦ kg^{-1})
Control fish	2.70 ± 0.2^{a}	3.44 ± 0.2^{a}	3.02 ± 0.3^{a}	200
Groundnut oil treated fish	3.20 ± 0.5^{ab}	4.21 ± 0.4^{ab}	4.28 ± 0.9^{ab}	350
Sodium chloride treated fish	4.03 ± 0.4^{b}	5.48 ± 0.3^{b}	5.73 ± 0.3^{b}	500

Values in the same column and with the same superscript alphabets are not significantly different at p>0.05

however showed some insects species and of fungal growth. The insect's species observed on the fish samples are *Maculatus* and *Necrobia rufipes* species. The control specimen was highly attacked by the two types of beetle's species as shown in Table 3; this study also agreed with earlier research of Awoyemi (1988, 1991). The number of insects highly increased bi-weekly in control specimens to the end of the experiments. The fungal load of the fish samples is shown in Table 4. The microbial loads in the treatments were significantly different ($p<0.05$). The control recorded the highest number of fungal count of 12×108 CFU g^{-1} by the 13th week of storage while the groundnut oil treated samples had equally high number of fungal count of 6.4×10^{7} CFU g^{-1}. This high fungal count on the smoked dried fish categorized it as poor in terms of microbial quality. This result also agrees with the work of Omojowo *et al.* (2009a, b) where untreated fish had high fungal load.

Economic values: Fish treated with sodium chloride attracted customers most due to the texture and acceptable smell as well as the quality; hence the price per kg was valued at ₦500.00 as shown in Table 5 which is more than the fish treated with groundnut oil which was ₦350 kg^{-1} and ₦200 kg^{-1} for control specimen.

CONCLUSION AND RECOMMENDATION

This study has revealed that the sample treated with sodium chloride treated catfish had the best of weight at the end of the 13th week. This revealed that there was no appreciable loss in the weight which is really a good news to the fish processors which sometimes may few weeks to store freshly smoked fish until they gather enough for onward transportation to the market. Also the fact that there was no visible insect species seen on it revealed that sodium chloride treatment acts as protectants to the fish against the insects. Similarly, the microbial quality of the fish is well acceptable as there was no mould infestation observed on the sodium chloride treated fish. In addition, Fish treated with sodium chloride attracted appreciable customers due to its texture, acceptable smell as well as the quality; hence, the price per kg was valued at ₦500.00. Since every farmer's dream is to smile home with enough money in their pockets at the end of each sale. The

use of 30% sodium chloride solution in treating fish before smoking acts as a protectants against fungal attack and a good insect repellant against the common insect infestation of dried fish. Also, of advantage is the fact that the sodium chloride (table salt) is a well acceptable seasoning of food without rejection by consumers and no suspected negative impact on the quality of the fish in storage. Hence, the use of 30% sodium chloride as an insect and mould repellants against infestation of dried fish is here by recommended since it has been found to keep smoked fish in while some stage for 13 weeks. This will ensure prolonged shelf-life and safe consumption of smoked fish in Nigeria.

REFERENCES

Agbon, A.O., G.N.O. Ezeri, B.N. Ikenweiwe, W.O. Alegbeleye, O. Oke and D.T. Akomolede, 2002. A comparative study of different storage methods on the shelf-life of smoke-cured fish. J. Aquat. Sci., 17: 134-136.

Awoyemi, M.D., 1988. Insect infestation of dried fish in the Kainji Lake area. NIFFR Annual Report, pp: 183-190.

Awoyemi, M.D., 1991. Preliminary observations on the incidence of insect pests and related damage to stored dried fish in Kainji Lake area. Int. J. Trop. Insect Sci., 12: 361-365.

Azeza. N.I., 1976. Fish handling processing and marketing in the lake chad basin (North South shores). Proceeding of the Conference on the Handling, Processing and Marketing of Tropical Fish, July 5-9, 1976, Tropical product Institute, UK, London, pp: 348-352.

Eyo, A.A., 2001. Fish Processing Technology in the Tropics. University of Ilorin Press, Ilorin, Nigeria, pp: 1-20.

FAO, 1981. The prevention of losses in cured fish. FAO Fish Technical Paper, No. 219, pp: 87.

Golob, P.J., R. Cox and K. Kiliminster, 1987. Evaluation of insecticide dips as protectants of stored dried fish from Dermestid beetle infestation. J. Stored Prod. Res., 23: 47-56.

James, D.G., 1977. Post harvest losses of marine foods: Problems and prospects. Proceedings of the 37th Annual Meeting of the Institute of Food Technology, June 5-8, 1977, Philadelphia, PA., USA., pp: 15.

Ligia, V.T.A., 2002. Hazard Analysis and Critical Control Point (HACCP), Microbial safety and Shelf life of Smoked Blue catfish (*Ictalurus furcatus*). M.Sc. Thesis, Graduate Faculty of the Louisiana State University. Fisheries and Oceans, Canada.

Olokor, J.O., J.A. Ihuahi, F.S. Omojowo, B.A. Falayi and E.A. Adelowo, 2007. Handbook of Practical Fisheries Technology. Fisheries Technology Division, National Institute for Freshwater Fisheries Research (NIFFR), New Bussa, Nigeria, pp: 22-33.

Omojowo, F.S., G.L. Idris and J.A. Ihuahi, 2009a. Comparative assessment of potassium sorbate and sodium metabisulphite on the safety and shelf life of smoked catfish. Nature Sci., 7: 10-17.

Omojowo, F.S., P.F. Omojasola, G.L. Idris and J.A. Ihuahi, 2009b. Evaluation of citric acid and potassium sorbate as preservatives on the safety and shelf-life of smoked catfish. Nat. Sci., 7: 1-8.

Osuji, F.N.C., 1995. The development of Necrobia rufipes in dried fish and certain other commodities. Niger. J. Sci., 15: 21-32.

Walker, D.J. and N.J. Evans, 1984. Report on two visits to the Gambia to evaluate the use of insecticides in reducing losses in traditionally cured fish. Report R 1245 (S) of Tropical Development and Research Institute, London, UK.

Walker, D.J., 1988. Control of insect infestation in fishery product in less developed countries. Proceedings of the International Workshop on Post-harvest Fishery Losses, April 12-16, 1987, University of Rhode Island, Kingston, pp: 163-179.