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Effect of insect infestation on the economic value of smoked fish sold in selected markets in Nigeria

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Abstract*. In the present study a multistage sampling technique using semi-structured questionnaire was used to obtain information on socio-economic characteristics of the respondents and on economic loss of smoked fish resulting from insect pest infestation. Smoked fishes were bought from 10 markets in Oyo state, South West of Nigeria and checked in the laboratory for the insect pests. Data were analyzed using descriptive statistics and Chi-square. Results indicated that insects at their larvae stage cause more economic loss to smoked fish than adult insects while Necrobia rufipes and Dermestes spp. are the insects found to infest the smoked fishes in this study. The insect infestation of the smoked fish leads to huge economic loss. Of all respondent groups the women dominate smoked fish business.*

Keywords*:* smoked fish, markets, respondents, questionnaire, economic loss

Introduction

Fish is important in the diet of people as healthier meat option due to the high content of long chain polyunsaturated fatty acids (LCPUFAS) which are associated with improving health and preventing diseases of old age (Kabaherda et al., 2009). However, it is highly susceptible to damage and spoilage as soon as it is harvested (Eyo, 1997). Some factors responsible for this spoilage or damage include high temperature, chemical action, enzymes and bacteria (Ojutiku et al., 2009; Oparaku and Mgbenka, 2012). Processing and preservation methods slow down fish spoilage, preserve its quality and also extend fish shelf life (Okonta and Ekelemu, 2005). Several processing and preservation methods have been considered and used to prevent fish from spoilage, including: salting, sun drying, solar drying, smoke drying and canning (Ugwu et al., 2005). The most common method of fish preservation employed in the tropics is smoking; it increases fish shelf life, gives the product a desirable taste and odour, it also provides antibacterial and oxidative effects, lowers pH, imparts colouration as well as accelerates the drying process and acts as an antagonist to spoilage agents (Akintola et al., 2013). Johnson and Esser (2005) stated that smoking provides very little control against insect attack, it was estimated that between 25% and 75% of the nutritional value of fish is lost during attack by insect pests. FAO (2019) also reported that insects infest smoked dried fish during storage and cause economic loss to fish mongers and loss in the qualitative and quantitative composition of the fish. Infested fish will attract lower price compared with intact whole smoked dried fish that will attract higher market price (Johnson and Esser, 2005). According to Eyo (1997) insects mainly known to infest dried smoked fish are beetles (*Necrobia* spp.) and bugs (*Dermestes* spp.). Insect infestation is one of the main problems faced by fish mongers as it leads to qualitative and quantitative loss of fish during storage, thereby justifying the need to study the effect of insect infestation on the economic value of smoked dried fish.

Material and methods

Sampling technique

The study was carried out in Oyo state, South West of Nigeria. The study area has heterogeneous population of Yoruba, Igbo and Hausa. The study population comprises of catfish processors in Oyo State metropolis. Primary data were collected with the use of interview schedule using structured questionnaire. A multistage sampling technique was employed in the selection of respondents: the first stage involves the selection of 8 Local Government Areas (LGAs) out of 33 LGAs that consist of Oyo State LGA using

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simple random technique; the second stage involves the compilation of fish market places in the 8 LGA selected which gave a total of 40 market places; the third stage involved 25% selection of market places compiled from the LGA selected using simple random technique which resulted in 10 market places including Odo-ona kekere, Omi Adio, Bodija, Oje, Ojoo, Apata, Akesan, Dansai, Sabo and Sango markets; the fourth stage involved the selection of 10 fish mongers involved in the sales of smoked fish from the selected markets using snowball techniques which gave a total of 100 respondents which were used as the sample size. The various markets had ambient temperature of 27±3°C and average relative humidity of 49.2% at the time of sample collection for this study.

Statistics

The data obtained were subjected to descriptive statistical analysis in the form of frequencies and percentages which were used in organizing, summarizing and presenting the research findings.

Results and discussion

Distribution of respondents by their social-economic characteristics

Table 1 shows the demographic characteristics of the respondents. Most of the respondents that were more actively involved in smoked fish business were within the age group of 31-40. This result is similar to that reported by Ayo-Olalusi et al. (2010) where it was reported that 86% of their respondents were within 21-50 years age bracket which fell within the active age in human beings, while only 2% of them were above 60 years. Yisa et al. (2011) gave a similar report in their study that the highest percentage (32.5%) of women fish marketers fell within 36 to 45 years age bracket, while the lowest percentage (2.5%) fell within 56 years of age and above. 51% of the respondents were female, while 49% were male showing that female are more actively involved in smoked fish business than their male counterpart. This is in line with the report made by Ayo-Olalusi et al. (2010) that women are more involved in fish marketing than men. The study reveals that 74% of the total sampled populations of the respondents were married.

Enterprise characteristics of respondents

The result presented on Table 2 indicates that 57% of the respondents used self labor implying that they are actively involved in the business themselves, 47% used paid labor, while 27% used family members as labors; 76.19% of the respondents used self finance for their business, 27% of the respondents' source of finance is from contribution, while 3% is from family members. This is in line with the study of Nwabueze and Nwabueze (2010) where it was reported that few fish marketers in Delta State Nigeria had access to loans as many of them were self sponsored and many of them complained of not having any form of assistance and did not know how to go about obtaining loans from credit facilities. Oluwatoyin et al. (2010) also gave a similar report. The results also show that smoked *Clarias* spp. is majorly sold by the majority of the respondents (37.90%), followed by *Tilapia* spp. (22.98%)

Table 1. Demographic characteristics of the respondents

Variable	Frequency	%
Age		
≤ 20 years	10	12.05
21-30 years	19	22.89
31-40 years	29	34.94
41-50 years	22	26.51
>50 years	3	3.61
Total	83	100.00
Sex		
Male	49	49.00
Female	51	51.00
Total	100	100.00
Marital status		
Single	20	20.00
Married	74	74.00
Divorced	1	1.00
Widowed	4	4.00
Widower	1	1.00
Total	100	100.00
Religion		
Islam	71	71.00
Christianity	29	29.00
Total	100	100.00
Household size		
≤ 5	34	34.00
6-10 years	54	54.00
11-15 years	9	9.00
16-20 years	3	3.00
Total	100	100.00
Primary occupation		
Fish processing	33	33.00
Fish marketing	67	67.00
Total	100	100.00
Secondary occupation		
Fish processing	2	2.00
Fish marketing	98	98.00
Total	100	100.00

Table 2. Enterprise characteristics of respondents

Variable	Frequency	%
Source of labour		
Paid labour	47	27.17
Family member	29	16.76
Friends	0	0.00
Self	97	56.07
Association member	0	0.00
Total	173	100.00
Source of finance		
Self	96	76.19
Family members	3	2.38
Friends	0	0.00
Association member	0	0.00
Banks	0	0.00
Contribution	27	21.43
Others	0	0.00
Total	126	100.00
Business size		
≤50000	10	10.00
50001-100000	33	33.00
100001-150000	19	19.00
150001-200000	27	27.00
200001-250000	8	8.00
>250001	3	3.00
Total	100	100.00
Years of experience		
≤ 5 years	14	14.00
6-10 years	27	27.00
11-15 years	15	15.00
16-20 years	31	31.00
>20 years	13	13.00
Total	100	100.00
Types of smoked fish		
Clarias gariepinus	94	37.90
Tilapia spp.	57	22.98
Cynoglossus spp.	35	14.11
Gadus morhua	12	4.84
Protopterus spp.	25	10.08
Ethmalosa spp.	23	9.27
Gymnachus spp.	2	0.81
Total	248	100.00

Insect pest infestation of smoked fish at various markets

Figure 1 indicates the mean value of insect pest infestation of smoked fish in selected market within Oyo state. Oje market has the highest number of both adult insect pests with mean value of 2.0 and larvae pests with mean value of 15.6. Figure 1 also indicates that insect pest at larvae stage were observed to be abundant in smoked fish products than at adult stage, this being in conformity with the report by Ugwu et al. (2005) that the insect larvae are the most destructive of dried stored fish products. The results obtained in this study are in contrast with the data of Wahedi and Kefas (2013) in their investigation of insect pests on three species of smoked fish in Mubi North-Eastern Nigeria where it was found that the bulk of insects infesting the smoked fish in Mubi, Nigeria, are in the adult stage.

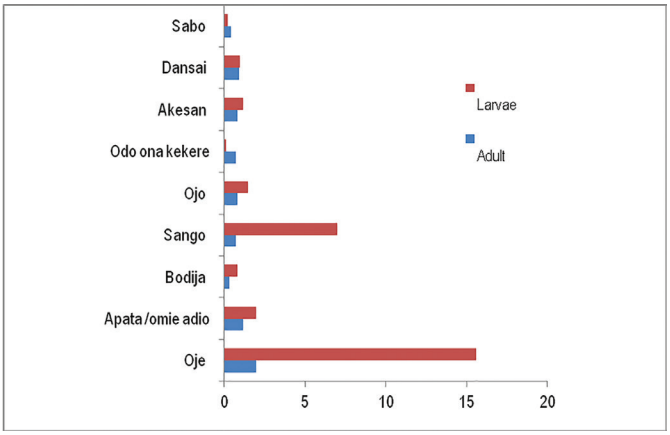

Figure 1. Insect pest infestation of smoked fish at various markets

Economic loss due to insect infestation on smoked fish mongers

Table 3 shows the impact of insect infestation on the economic loss of smoked fish. The stored smoked fish after being infested with insects resulted into an economic loss to the tune of ₦25044.54.

Table 3. Impact of insect infestation on the economic loss of smoked fish

	Revenue	Quantity	Rate	Naira, ₦
a.	Smoked fish	427.5 fish packs	1000/pack	427500.00
b.	Smoked fish not infested	397.58	1000/pack	397580.00
c.	Smoked fish Infested	29.92	₦162.95	4875.46
d.	Sub-total (b + c)			402455.46
e.	Economic Loss (a - d)			25044.54

*1₦ = 0.0028US$

Table 4 presents the information about problems facing fish mongers in the study area. 59% of the respondents experience a minor constraint on 'local processing technology', 23% of the respondents say that local processing technology is a major constraint, and 18% say it is not a constraint. This in line with the opinion of Oluwatoyin et al. (2010) in their study of the indigenous fish processing and preservation practices amongst women in Southwestern Nigeria. Inadequate extension service was a minor constraint to 48% of the respondents, this is in contrast with the report of Akpabio and Ekanem (2008) who found that there is a very high extension need by fish

marketers in the fish landing ports of Akwa Ibom State as many of the respondents perceived that they do require extension assistance in all aspects of the fish marketing chain. The majority of the respondents (71%) experience 'poor marketing' as a minor constraint, 18% of the respondents faced it as a major constraint, while 11% of the respondents say it is not a constraint. This is in contrast with the report of Oluwatoyin et al. (2010) where low sales of smoked fish products were seen as a major constraint. The majority (68%) of the respondents experienced lack of storage facilities as a major constraint facing smoked fish; this is in accordance with the opinion of Ayo-Olalusi et al. (2010). The majority (84%) of the respondents faced 'financial constraint' as a major constraint showing that financial constraint is a major problem facing smoked fish mongers. 15% of the respondents faced it as a minor constraint while only one percent of the respondent said that it is not a constraint, a similar opinion was expressed by Madugu and Edward (2011) in their study of the marketing and distribution channel of processed fish in Adamawa State, Nigeria where it was stated that one of the main problems confronting processed fish marketers in the area was poor access to capital which was ranked to be the first problem (45%) as a result of inadequate sources of finance and the problem of collateral before obtained loan. The majority of the fish mongers also saw poor transportation as a major constraint experienced (76%), Madugu and Edward (2011) gave a similar report that poor transportation was the second constraint to fish marketing in Adamawa State Nigeria after lack of access to capital. Just over half of the respondents (55%) experience 'inadequate processing facilities' as a minor constraint, 29% faced it as a major constraint while 16% said it is not a constraint. Most of the respondents (66%) experience poor storage facilities as a major constraint, this conforms to the findings of Akinbile and Alabi (2010) that Nigeria lacks infrastructure to enhance fish business. 34% of the respondents saw it as a minor constraint. 83% of the respondents said that lack of market structure is not a constraint, while 17% saw it as a minor constraint. 73% of the respondents faced unstable government policies not as a constraint, 24% experienced it as a minor constraint, while only 3% saw it as a major constraint. The majority of fish mongers (86%) also felt that lack of packaging facilities was not a constraint, while 13% of the respondents saw it as a minor constraint, while 1% of them saw it as a major constraint. Half of the respondents (50%) experienced high cost of processing facilities as a minor constraint, 33% saw it as a major constraint, and 17% do not see it as a constraint. Ayo-Olalusi et al. (2010) observed a similar result. The majority (54%) of the respondents experience insect infestation as a major constraint, showing that insect infestation is also a major problem affecting smoked fish, while 46% faced it as a minor constraint. Ayuba and Omeji (2006) gave a similar report that insect infestation is the cause of most prominent losses in quality and quantity of stored dried fish in Nigeria. Medugu and Kabir (2013) also stated that infestation of smoked fish by *D. maculatus* and *N. rufipes* results in substantial weight and quality losses resulting in financial losses. Amusan and Okorie (2002) also stated that larvae stages of *D. maculates* account for infestation of about 93% in dried fish. Mould growth was not a constraint to the majority of the respondents (58%), 39% faced it as a minor constraint, while it was experienced as a major constraint by only 3% of the respondents. Less than half of the respondents (43%) experienced price instability as a minor constraint, 42% saw it as a major constraint and 15% do not see it as a constraint.

Table 4. Level of constraints in marketing of smoked fish

Constraints	Not a constraint, %	Minor constraint, %	Major constraint, %	Mean value
Local processing technology	18	59	23	2.05
Inadequate extension service	14	48	38	2.24
Poor marketing	11	71	18	2.07
Lack of storage facilities	1	31	68	2.67
Lack of financial assistance	1	15	84	2.83
Poor transportation	1	23	76	2.75
Inadequate processing facilities	16	55	29	2.13
Poor storage facilities	-	34	66	2.66
Lack of market structure	83	17	-	1.17
Unstable government policies	73	24	3	1.30
Lack of packaging facilities	86	13	1	1.15
High cost of processing facilities	17	50	33	2.76
Insect infestation	-	46	54	2.54
Mould growth	58	39	3	1.45
Price instability	15	43	42	2.27

Relationship between selected socio-economic characteristics and respondents' income

Table 5 reveals the results of the Chi-square analysis on the relationship between selected socio economic characteristics and respondents' income. There is a significant relationship ($p<0.05$) between age, sex, marital status, household size, primary occupation, business size and years of business experience. However, the results showed that there is no significant relationship ($p>0.05$) between religion and secondary occupation.

Table 5. Chi square analysis of the socio-economic characteristics against income

Variables	χ^2	df	p
Age	373.870[a]	280	0.000
Sex	29.916[a]	14	0.011
Marital status	79.479[a]		
Religion	21.572[a]	14	0.088
Household size	220.194[a]	154	0.000
Primary occupation	55.495[a]	14	0.000
Secondary occupation	5.491[a]	14	0.978
Business size	268.623[a]	196	0.000
Years of experience	204.135[a]	168	0.030

Conclusion

This study indicates that the active group of the society within age group 31-40 are more involved in smoked fish business, dominated by women, financing their business themselves with limited access to financial assistance. It was also observed that insect infestation leads to huge economic loss for fish mongers as there was wide difference between the expected returns and the actual returns due to the effect of insect infestation on smoked fish. Lack of storage facilities, poor transportation, lack of financial assistance and insect infestation are the major constraints faced by fish mongers in Oyo State. Age, sex, marital status, household size, primary occupation, business size, and years of experience of fish mongers have direct influence on the income generated by fish mongers, while religion and secondary occupation have nothing to do with the income generated by fish mongers. This study reveals that insects at their larvae stage cause more economic loss to smoked fish than adult insects, while *Necrobia rufipes* and *Dermestes* spp. are the insects found to infest smoked fishes.

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