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Research Article

Mycological Evaluation and Nutritional Composition of Smoked-Dried Fish from Igbokoda Market in Ondo State, Nigeria

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Abstract

Smoked fish is a source of animal protein for majority of people in Nigeria. They are poorly handled during production which makes it aids microbial contamination. There is need therefore need to provide the types of fungi associated with fish infestation and deterioration of smoked dried fish. The samples were collected from Igbokoda market in Ondo State, Nigeria. The samples were blended and thoroughly mixed and one gram per sample was serially diluted and incubated on sterilized potato dextrose agar (PDA) for seven days. The associated fungi include *Fusarium oxysporum*, *Rhizopus oryzae*, *F. verticilloides*, *Neurospora crassa*, *Aspergillus flavus*, *Cladosporum sp*, *Penicillium chrysogenum*. The Prevalence of *Aspergillus flavus*, *Penicilium chrysogenum*, *Neurospora crassa* and *Rhizopus oryzae* were not significantly different from each other. The highest carbohydrate content was found in location C, the highest mean value for moisture content was found in location B while the fat and ash content of location B and C were not significantly different from each other, the protein content of sample A was the highest (60.1) while the least protein were found in location C (55.00). Moreover, the shelf-life of smoked dried fish was apparently reduced by the presence of *Aspergillus flavus*. In conclusion smoked dried fishes stored for sale in Igbokoda markets were contaminated with *A. flavus*. This present study indicates that there is a need to improve on the post-harvest storage condition of smoked dried fishes.

Key Words: *fungi, smoked dried fishes, shelf-life, post-harvest storage*

INTRODUCTION

Fish is a very perishable commodity and it is highly susceptible to rapid and high post-harvest quality losses (FAO, 2008). The most common occupation of people living in riverine area of Ondo State is fishing. Fish acts as protein supplement for the people living in 63% of countries (Bangladesh DOF, 2001). It is a valuable and nutritious food and an important source of high quality and cheap animal protein source crucial to balance of diet in marginally food secure communities while the fish oils play a significant role in decreasing the risk of developing cardiovascular diseases and in improving foetal brain development (FAO, 2005).

Smoke drying method is usually preferred in Nigeria because it requires no electricity and is conducted in camps and fish processing centuries in traditional smoking kilns of clay, drums and iron sheet. However, it is associated with increased germicidal actions. The dry fish products can be kept for 2 to 4 weeks in market stalls with poor storage facilities. Fish drying occurs slowly over a fire to remove its moisture content which aids bacterial activities and spoilages (Fafioye and Fafioye, 2013). The erratic supply of firewood and poor storage facilities in market sheds have led to poor preservation of dried fish products which favours the growth, colonization and multiplication of fungi. Consequently, this study aims at evaluating the spoilage fungi associated with stored smoked dried fish and the nutritional composition of the deteriorated smoked-dried fish.

MATERIALS AND METHODS

The smoked dried fish *Clarius gariepinus* used for this study were purchased at Igbokoda market in Ondo State, Nigeria and brought to the mycology and plant pathology laboratory of the Department of Botany, University of Ibadan, Ibadan, Nigeria in a sterile polythene bag. A small piece was dissected and powdered for nutritional and mycological analysis.

Mycological isolation: The isolation of fungi was carried out using pour plate method recommended by the US Food Drug Administration (1998) and serial dilution method of Taylor (1962). One gram of powdered smoked-dried was dissolved in nine milliliters of sterile distilled water and a tenfold dilution was carried out. One milliliters was aseptically drawn from dilutions three, four and five and inoculated into plate containing Potato Dextrose Agar. All plates were incubated at 30±2oc for 3 days. The growth rates of the pure culture were recorded for 3, 6, 9, 12 and 15 days. Pure culture were obtained by picking distinct colonies of fungi from the pour plate using inoculating needle and sub cultured into freshly prepared plates of PDA. The plates were incubated at room temperature. After which the pure culture was transferred into slant

Estimation of nutritional composition: The nutritional analysis like carbohydrate, fat, ash protein and moisture

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content were assayed as described by AOAC (2005). Each analysis was carried out in triplicates.

Statistical analysis: A one-way Analysis of Variance followed by a Duncan multiple range test post hoc test, was run in order to determine the significance level of the differences in mean values of the Fungi growth area and the proximate parameters among all three samples.

RESULTS

The mycological evaluations of smoked-dried fish samples were estimated and the results are presented in Table 1. The presence of *Fusarium oxysporum, Rhizopus oryzae, F. verticiloides* and *Cladosporum sp, Neurospora crassa, Aspergillus flavus* and *Penincillium chrysogenum* were associated with the stored smoked dried fish. However, the frequency of occurrence of fungi varies among the samples collected. In sample A, while the fungi with the least growth area were *Cladosporum sp*, the growth area of *Aspergillus flavus, Penicillum chrysogenum Neurospora crassa* and *Rhizopus oryzae* were not significantly different from each other. In sample B, the growth area of *Cladosporum sp, A. flavus, Fusarium verticilloides* and *Fusarium oxysporum* were not significantly different from each other. Sample C shows the same growth area for *Cladosporum sp*, A. *flavus, Rhizopus oryzae* and *F. verticiloides*, while the least growth area were found to be *F. oxysporum*. Plate 1 and 2 shows growth rate of *Fusarium oxysporum* and *Neurospora crassa* at 9 days.

Table 1:
Mean Square effect of Fungi growth area isolated from different samples of smoked dried fish

SAMPLE	Sample A	Sample B	Sample C
Cladosporum sp	1.33a	2.00a	2.11ab
Aspergillus flavus	1.66b	2.00a	2.11ab
Penicillum chrysogenum	1.66b	3.88b	2.22a
Neurospora crassa	1.77b	2.55ab	1.55ab
Rhizopus oryzae	1.88b	2.66ab	2.11ab
Fusarium verticiloides	1.88b	2.00a	1.22ab
Fusarium oxysporum	3.11c	2.00a	1.11b

Mean with the same letter in a column are not significantly different from each other

Plate 1:
Fusarium oxysporum

Plate 2:
Neurospora crassa

The proximate composition of the stored smoked dried fish is given in Table 2. The protein content of the smoked dried fish was found to be good. The carbohydrate content of Sample A, B and C were significantly different from each other while the highest carbohydrate content was found in sample C. The moisture content of Sample A and Sample C were not significantly different from each other, the highest mean value for moisture content was found in sample B while the fat and ash content of sample B and C were not significantly different from each other. The Protein content of sample A were the highest (60.1) while the least protein were found in Sample C (55.00)

Table 2:
Proximate composition of smoked-Dried fish

Proximate Comp.	Carbohydrate	Moisture content	Fat	Ash	Protein
Sample A	2.90a	5.3a	11.1b	5.3b	60.1c
Sample B	3.00b	6.4ab	10.25a	4.4a	57.30b
Sample C	4.00c	5.5a	9.75a	4.3a	55.00a

Mean with the same alphabets in a column are not significantly different from each other

DISCUSSION

In this study, the result of fungi isolated from the smoked dried fish showed that the market environment in which the smoked dried fishes were displayed could be an avenue for fungi contamination. This is in agreement with the report of Akande and Tobor (1992). Also, the fungal attack may be during the smoke-drying period or the overloading of the fishes on the trays may lead to improper processing. This is in accordance with the study done by Eyo *et al*., (1991) who reported that cat fish production causes fungal attack due to so many processes and Alfred-Ockiya (1988) who also reported fungal infestation of smoked dried fish. The fungi growth may also be due to processing, handling and display on the open market. This is also similar to the report made by Christianah *et al*., 2010) who reported the mycoflora of three smoked dried fish on a market stall. However, Venugopal (2002) stated that contamination of fish particularly by pathogens may occur prior to harvest, during capture, processing, distribution and/or storage.

The presence of *Aspergillus flavus* in the smoked dried fish which is hazardous to human health may be as a result of high mean value of moisture content of 6.40 favourable to the growth of the fungus (Guarro *et al*., 1999; Hawksworth, 2006). The growth of *P. chrysogenum* on PDA plates was in pairs. This is similar to the report made by Fafioye and Fafioye (2013) who reported fungal infestation and nutrient quality in smoked dried fish. The fungi found on these smoked dried fish are those found particularly in soil and water. The fungi isolated were similar to the microorganisms reported by Olawale *et al*. (2005), Adesokan *et al*. (2005) and Fafioye *et al*.,(2013).The moisture content of the dried fish which is of great importance in storage is still at safe level of 7.3% which is in between the recommended safe moisture content of dried fish (5.3 to 6.4%). The low ash, carbohydrate, fat, high protein and moisture content values obtained from the nutritional analysis as shown is in agreement the report made by Abdullahi (2001), Mumba and Jose (2005) and Effiong and Mohammed (2008). The significant increase in protein levels ($P < 0.05$) in smoked dried fish suggested that protein was not lost during drying. This is also in accordance with the findings of Puwastien *et al*,. (1999), and Tao and Linchun (2008).

This work revealed that smoked dried fish harbored fungi which can cause food poisoning or spoilage, however, smoked dried fish had a good nutritional quality. Consumers of smoked dried fish should wash or heat the fish to prevent food borne infections as a result of poor handling on the part of the sellers and some buyers.

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