International Journal of Biotechnology and Microbiology
www.biotechnologyjournals.com
Online ISSN: 2664-7680, Print ISSN: 2664-7672
Received: 19-04-2022, Accepted: 04-05-2022, Published: 20-05-2022
Volume 4, Issue 1, 2022, Page No. 74-76

Fungal contamination and mycotoxins detection in some selected indigenous fermented foods of northern, Nigeria

Rabiu Ibrahim[1], Ogbonna C I C[2], Abigail Ogbonna[2]
[1] Department of Science Laboratory Technology, Abubakar Tatari Ali Polytechnic, Bauchi, Nigeria
[2] Department of Plant Science and Biotechnology, University of Jos, Nigeria

Abstract
A research was carried out on the species of fungi associated with indigenous fermented foods commonly consumed in some selected states of Northern, Nigeria. Samples of indigenous fermented foods were collected using random sampling techniques from three different States in Northern, Nigeria. Three samples each of locally fermented foods (dry meat, dry fish, Iru-dadawa, cassava flour and pap-ogi) were collected from three States within the study areas. The experimental samples were plated out on Malt Extract Agar (MEA) using 30 culture plates for each sample. The resultant culture plates were then incubated at room temperature 25^0C for the isolation of different fungal species. The incubated culture plates were examined after 4-7 days for the development of fungal species. Moreover, the culture plates were re-examined after 14 days for the appearance of additional fungal species. Result of fungal counts from the indigenous fermented products ranges between $13.22x10^6$ cful/ml, to $6.44x10^3$cfu/ml. A total of thirteen species of fungi were isolated from the indigenous fermented foods. *Aspergillus spp* were found in all the indigenous fermented products and *Rhodotorula spp* is the least. This study shows that *Aspergillus spp* is the most predominant fungal species in the indigenous fermented products. Different types and levels of mycotoxins were also detected and determined appropriately using mycotoxin testing kits.

Keywords: fermented foods, mycotoxins, northern Nigeria

Introduction
Mycotoxins are fungal metabolites produced by fungi that are capable of causing diseases such as cancer, bone marrow failure and bleeding, birth defects and even death in humans and other animals, particularly livestock's (Hussein *et al.*,2001) [1]. Due to their pharmacological activity, some mycotoxins or their derivatives have found use as antibiotics (Kendra, 2008). On the other hand, mycotoxins are metabolites of fungal origin that are toxic to humans and can be present in stored foods not properly preserved. The most common food borne mycotoxins are aflatoxins and ochratoxins. Aflatoxins are known to be produced by many species of *Aspergillus,* and these fungi can be found in soil and foods (such as groundnuts, peanut butter, olive oil) and some cosmetics. Ochratoxin is produced by *Aspergillus* and *Penicillium* species, and can be found in cereal, coffee and wine (Shephard, 2008) [7].
Mycotoxins are secondary metabolities produced by certain strains of filamentous fungi such as *Aspergillus, Penicillium* and *Fusarium*, which invade crops in the field and may grow in foods during storage under favourable conditions of temperature and humidity. They are regularly implicated in toxic syndromes in humans and animals (Smith *et al*., 1995).
Fermentation is one of the easiest and cheapest means of food preservation in addition to imparting nutritional and organoleptic benefits to fermented foods. Fermentation is effected by the natural microbiota of raw materials, micro organisms attached to the fermentation equipments or from externally added starter cultures.Yeast, especially *Saccharomycetes cerevisiae* and *Candida krusei*, and lactic acid bacteria.
The elimination of absorbable mycotoxins is possible to be done through adsorption. Dried fish a fresh fish rapidly deteriorate unless some way can be found to preserve it. Drying is a method of food preservation that works by removing water from the food, which inhibits the growth of microorganisms. Open air drying using sun and wind practiced since ancient times to preserve food kevmaha *et al.,* 2014. Soya bean derivatives such as soya-gari, soya-milk, soya-ogi, soya-cake have been developed and found to be good substitutes for more conventional food ingredients like melon, cow milk, and cowpea. Therefore, the value of soya beans both for satisfying human dietary needs and for compounding livestock feeds cannot be overlooked.

Significance of the Work
This investigation will help in the identification of various fungal species that could be associated with indigenous fermented foods sold in some selected states of northern, Nigeria.

Statement of Problem

The need to study the mycotoxins associated with indigenous fermented foods such as dried meat, dried fish, soya cake, cassava flour and pap-ogi, respectively, cannot be overemphasized as these are among the major toxic substances in foods which may lead to serious diseases and even dead in both humans and livestock's. Jibrin and Paul (2001) reported that most cases of natural deaths in Nigeria, are due to the ingestions of high concentrations of mycotoxins in some foods and indigenous domestic oils. In the last few years, it has been established that it is very necessary to study the levels and effects of mycotoxins in indigenous fermented foods (Jiang and Ma, 2008).

Materials and Method

Sample Collection

The samples were collected from Bauchi, Jigawa and Plateau States of Northern, Nigeria. A preliminary field survey was carried out to identify the indigenous fermented foods from three different states of Northern Nigeria. These were Bauchi of North Eastern part, Jigawa North Western part and Plateau State of north central respectively. Samples of the indigenous fermented foods were collected from these three different states using random sampling techniques (Harvard, 2001).Three samples each of the indigenous fermented foods and were collected from the three different states and transported to the laboratory for analysis.

Preparation of Medium

The fungal medium used was Malt Extract Agar (MEA), which was prepared according to manufacturer's instructions and thereafter sterilized by autoclaving at 121ºC for 15 minutes and then allowed to cool to 45ºC. Then 0.01g/l of Streptomycin Sulphate Powder was added to the sterilized media to suppress bacterial growth (Weschoff, 1998). The medium was then aseptically dispensed into sterile Petridishes and allowed to solidify under laminar air flow.

Isolation/Enumeration of Fungi

Isolation of fungi was carried out by a modification method of Olowolafe and Jonathan (2001). A 0.5g concentrate of each indigenous fermented foods was suspended separately in 0.5ml of sterile distilled water and then introduced into the Petri dishes containing solidified Malt Extract Agar (MEA) incorporated with 0.01g/l of Streptomycin Sulphate Powder. The inoculated suspension was aseptically spread with an L- shaped glass spreader and then incubated at room temperature (25°C) for 7 days. The colonies that developed were counted and expressed as colony forming unit (cfu/ml) / (cfu/g).

Mycotoxins Detection using Rida Kit

Rida kit quick mycotoxin/aflatoxins is done by using Rida quick scan, which is a modern optical reading device that were purely developed in order to perform the interpretation of the bands not by naked eye but electronically by an optical unit. However, the Rida quick scan enables you to obtain qualitative results.

Results and Discussion

The results of total fungal counts of indigenous fermented foods (dry meat, dry fish, cassava flour, pap-ogi and iru-dadawa) are presented in table 1. The results obtained show that fungal counts range from $13.22x10^6$CFU/ml to $6.44x10^3$CFU/ml. However, the total of thirteen (13) different fungal species were isolated and identified with *Aspergillus spp* as the most dominant fungi in the indigenous fermented foods and yeast (*Saccharomyces cerevisiae*) was the least on both samples. Occurrence on fungal isolates on the indigenous fermented foods sampled were indicated accordingly, which shows that *Aspergillus spp* had the highest occurrence as the dominant fungi on the fermented products. Various types and levels of different mycotoxins detected from indigenous fermented foods were also presented.

Table 1: Shows Mean Fungal Counts of Indigenous Fermented foods.

Fermented Foods	Coliform Forming Unit CFU/ml /(g)
Dry Fish	$13.22x10^6$ CFU/g
Dry Meat	$11.23x10^5$ CFU/g
Cassava Flour	$10.66x10^2$ CFU/g
Iru-Dadawa	$12.33x10^2$ CFU/g
Pap-Ogi	$6.44x10^3$ CFU/ml

Table 2: Distribution and Percentage Occurrence of Fungi in the Indigenous Fermented Foods.

Fungal Isolates	D-M	D-F	S-C	C-F	P-O	I-D	C-M	C-O	CT-O	P-O	B-P	TOTAL	FREQ. (%)
Aspergillus flavus	+	+	-	+	+	-	+	+	-	+	+	08	12.90
A. niger	+	+	+	-	-	-	+	+	-	+	+	07	11.29
A. fumigatus	-	+	-	+	+	-	-	+	+	+	-	06	9.67
A. terreus.	-	-	+	-	-	+	-	-	+	-	+	04	6.45

F. verticilliodes	-	+	-	-	-	+	-	-	-	+	+	04	6.45
Penicillium citrinum	-	+	-	+	-	+	+	-	-	-	+	05	8.06
F. sporotrichiodes	+	+	-	-	-	+	+	-	-	+	+	06	9.67
Rhizopus stolonifer	+	+	-	+	-	+	-	+	-	+	+	07	11.29
Saccharomyces cerevisiae	-	+	+	-	+	-	+	-	-	-	-	04	6.45
Rhodotorula rubra	-	-	-	+	-	-	+	-	-	-	-	02	3.22
Alternaria spp	+	-	-	-	+	-	-	-	-	-		02	3.22
Mucor spp	+	+	-	-	+	-	+	-	-	-	+	05	8.06
Neurospora spp-	-	+	-	-	-	+	-	-	-	-	-	02	3.22
Total No. of Isolates:	06	09	04	05	05	06	08	04	02	06	08	62	100

Table 3: Mycotoxin Types and Levels Part Per Billion (ppb) in the Indigenous Fermented Foods.

Fermented Foods	Total Aflatoxin	Ochratoxin
Dry Fish	3.2	3.0
Dry Meat	2.9	2.7
Cassava Flour	2.3	2.4
Iru-Dadawa	2.0	2.1
Pap-Ogi	2.3	2.4

Conclusion

From the result of this study, fungal loads of the indigenous fermented foods ranges between $13.22x10^6$ to $6.44x10^3$. The study also showed that all the indigenous fermented foods had a high fungal counts above 10^3 cfu/ml beyond acceptable limits (ICMSF, 2007).

Recommendations

1. Periodic monitoring of the indigenous fermented foods with improved screening techniques for monitoring fungi and mycotoxin levels is required.
2. A primary focus for continuing research is the development of management strategies to reduce the incidence of aflatoxigenicity strains, in indigenous fermented foods are necessary.
3. It is required that strict monitoring of indigenous fermented foods aprocessors should be enhanced by the monitoring organization to ensure strict compliance to quality.

Reference

1. Hussein BL, Brasel E. Toxicity, Metabolism, and impact of Mycotoxins on humans and animals. Toxicology,2001:167:(2)101-134
2. ICMSF Toxigenic fungi: Aspergillus. In: Roberts, T.A., Baird-Parker, A.C., Tompkin, R.B. editors. Microorganisms in foods 5: microbiological specifications of food pathogens. International Commission on Microbiological Specifications for Foods. London, UK: Blackie Academic and Professional. An Imprint of Chapman and Hall, 1996, 347-381.
3. Havard GC, Howard PC, Kovatch RM, Bucci TJ. Rat kidney pathology induced by chronic exposure to fumonisin B1 includes rare variants of renal tubule tumor. Toxicology and Pathology,2001:29:379-386.
4. Jian M, Ma S. Modern Food Microbiology. 7th edition. Springer, New York, 2008, 443-454.
5. Kendra DA, Dyer S. Opportunities for biotechnology and policy regarding Mycotoxins issue in international trade. International Journal of Microbiology,2007:119(1-2):147-51.
6. Smith JE, Anderson AB. Mycotoxins occurring in Animal foods. Community Resources Center Press, Boka, Raton, 2000, 207-209.
7. Shephard GS. Risk assessment of aflatoxins in food in Africa. Food Additives and Contaminants: Part A: Chemistry, Analysis, Control, Exposure and Risk Assessment,2008:25(10):1246-1256.
8. Weschott GE. Mycotoxins in foods and feeds in United States. Annual Science,1998:70(12):3941-9.