Assessment of the Awareness of Poultry Farmers in Oyo and Ogun States of Nigeria to the effects of Mycotoxins in Poultry birds

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Abstract: This research was carried out in Ogun and Oyo States of the south-western region of Nigeria to determine the awareness level of selected poultry farmers to the risks and effects associated with mycotoxins. A structured questionnaire categorized into four sections viz; demographic information and characteristics of the farm, storage and processing of feed ingredients, awareness level of farmers to mycotoxins and preventive measures employed; was administered to 20 farms which were randomly selected. Selected farms had a minimum capacity of 10,000 birds within the two states and 5 workers per farm were administered the questionnaire. Data obtained was subjected to descriptive analysis using SPSS. Result obtained showed that majority (73.5%) of the respondents, who are into production of broiler and layer birds, were aware that mycotoxin is a major issue in Nigeria. 86.7% of the respondents knew that mycotoxins, especially aflatoxin, are dangerous to poultry birds. However, 49.0% of the respondents do not know of the carcinogenic characteristics of mycotoxins. This study also revealed that 34.7% of the farmers do not make use of toxin binders although they are aware of their availability. Conclusively, this study revealed a high level of mycotoxin awareness among the poultry farmers respondent. However, the awareness level is not yet at its maximum and there is still room for improvement. Improvement can be ensured through dissemination of information by extension agents, public campaigns and circulation of information during conferences among poultry farmers.

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Introduction

The Nigerian poultry industry is expanding rapidly with an annual growth rate of 2.17%, making it an enterprise that provides food, employment and other economic resources for the country (Ezekiel *et al.*, 2012). However, the major inhibiting factor to the growth and development of livestock production in the country is the inadequacy and poor quality of feed resources. According to Atteh (2004) 55-75% of the cost of producing egg and broiler meat respectively is associated with the cost of feeding. Poultry feeds are composed mainly of grains, root crops, nuts and animal products some of which are susceptible to mycotoxin contamination.

Zain (2011) defined mycotoxins as structurally diverse groups of mostly small molecular weight compounds, produced by the secondary metabolism of some filamentous fungi which develop on foods and feeds under suitable environmental conditions causing serious risks on human and animal health, the effect of which may be chronic or acute. When poultry birds feed on grains or feed ingredients contaminated by mycotoxins, they are prone to mycotoxicosis. Mycotoxicosis is one of the major causes of many unknown diseases leading to economic losses in poultry as it affects body weight gain, egg production and causes mortality of birds (Mohiuddin, 2007). In fact, humans can be exposed to mycotoxins by consuming plant derived foods or animal products such as eggs and meat contaminated with mycotoxins. Some mycotoxins of public health importance are; citrinin, aflatoxin, ochratoxin, zaerelonone, fuminosins, equisetin, deoxynivalenol and ergot alkaloids. Aflatoxin B1 (AFB_1) is hepatocarcinogenic and studies have shown that these groups of mycotoxins pose the biggest threat to poultry industry (Chukwu *et al.*, 2010; Pedrosa & Boruva, 2011). Ochratoxin A (OTA) is also classified as a possible human carcinogen by the International Agency of Research on Cancer (IARC, 1993a). T-2 toxin, the most toxic type of A trichothecene mycotoxin and a secondary metabolite of the *Fusarium* fungi common in grains and animal feeds has also shown toxic effect both in experimental animals and in livestock, as it has been implicated in several outbreaks of human mycotoxicosis (Sokolovic, 2008).

The toxic effects of mycotoxins in poultry as stated by Sokolovic *et al.*, (2008) are; inhibition of protein, RNA and DNA synthesis, cytotoxicity, immunomodulation, cell lesions in the digestive system, organs and skin,

neural disturbances, reduction in growth and reproductive performances. Studies by Ezekiel *et al.,* (2012); Osho *et al.,* (2007) have shown the high occurrence of mycotoxins producing moulds such as *Aspergillus* spp. and mycotoxins in poultry feeds in Nigeria. Apart from the health risk associated with mycotoxins, the economic losses and implications arising from the effect of mycotoxin contamination are enormous. This is because the presence of mycotoxins in food will pose an inhibition to international trade like exportation of produce and products to attractive European Union markets; thereby weakening the economic base of the country.

Information on the awareness and knowledge of the potential risks involved in mycotoxin contamination by poultry farmers in Nigeria is scanty. This study therefore seeks to determine the level of awareness and knowledge of poultry farmers to the effects and risks associated with mycotoxin contamination in poultry birds.

Materials and Methods

Site of Study

This study was conducted among selected poultry farmers in Oyo and Ogun states of Nigeria. Ogun and Oyo states are located in the south-western geopolitical zone of Nigeria.

Oyo state covers a landmass of 28,259km^2 with agriculture being one of the major occupations in the state. Oyo state has an equatorial climate with dry and wet seasons and a relatively high humidity. The average daily temperature ranges between 25^{o}C and 35^{o}C, average rainfall is between 1200mm-1800mm in the south and 800mm-1500mm in the north.

Ogun state covers a landmass of 16,409km^2 and the soil composition of the southern part of the state is suitable for the propagation of cash crops while the northern region is suitable for animal husbandry. The temperature range of the state is from 24^{o}C to 30^{o}C with a rainfall distribution that varies from about 1000mm in the western part to about 2000mm in the eastern part.

Sampling procedure

Farms used for this study were randomly selected. Popular commercial farms with a capacity of 10,000 or more birds in Ogun and Oyo states were listed out separately then 10 farms from each state were randomly selected by balloting.

Data collection

Data used was collected using a questionnaire. The questionnaire was divided into four sections which are;

1. demographic information and characteristics of the farm,
2. storage and processing of feed ingredients,
3. level of awareness of mycotoxins,
4. preventive measures employed against mycotoxins contamination.

The questionnaire was administered to five farm workers in each farm, making it a total of 100 questionnaires administered in both states (50 questionnaires in each state).

Statistical analysis

Data obtained was analysed using descriptive statistics (frequencies and percentages) and SPSS version 17 was used to run the analysis.

Results and Discussion

Demographic information and characteristics of farm

Table 1 show the demographic information obtained from respondents in the selected farms. 73.5% of the respondents had tertiary education while 9.2% had only primary school education. This is an indication that many of the farm workers had high educational level, a factor which could contribute to their awareness of the risks involved in mycotoxin occurrence. Majority of the selected farms (30.6%) had been in existence for 4-6 years while a substantial number (27%) had been established for more than 10 years. Also, a large number of the farms (42.9% and 40.8%) purchased their feed ingredients from commercial feed mills and open markets respectively. This could be due to the fact that those are the two common sources of feed ingredients in Nigeria. 45.9% of the farms raise layer birds and practise the battery cage system of intensive poultry production; a system that makes egg collection easier and neater. Majority (52.9%) of the farmers have their own feed mill and this is an advantage as it guarantees feed availability for the birds.

Table1: Demographic information and characteristics of selected farms

Parameters	Frequency	Percentage
Level of education		
Primary	9	9.2
Secondary	17	17.3
Tertiary	72	73.5
Total	98	100.0
Age of farm (years)		
1-3	26	26.5
4-6	30	30.6
7-9	15	15.3
10 and above	27	27.6
Total	98	100.0
Location of farm		
Oyo	48	49.0
Ogun	50	51.0
Total	98	100.0
Feed ingredient purchase		
Research institutes	14	14.3
Open market	40	40.8
Previous harvest	2	2.0
Commercial feed mill	42	42.9
Total	98	100.0
Type of bird raised		
Layers	45	45.9
Breeders	6	6.1
Broilers	19	19.4
Others	2	2.0
All of the above	3	3.1
Layers/breeders	4	4.1
Layers/broilers	17	17.3
Breeders/broilers	2	2.0
Total	98	100.0
Management system		
Deep litter	35	35.7
Battery cage	49	50.0
Semi-intensive	5	5.1
Others	2	2.0
Deep litter/battery cage	7	7.1
Total	98	100.0
Ownership of feed mill		
Yes	58	59.2
No	40	40.8
Total	98	100.0

Practices prevalent among poultry farmers that contribute to feed contamination

Practises among poultry farmers that could contribute to feed contamination by mycotoxins are shown in table 2. 44.9% of the farms store their feed ingredients and processed feeds in warehouses. However most of the farms (80.6%) store their processed feeds for less than one month. The short period of storage adopted by farmers may be due to the knowledge of the effect of the losses that may occur in stored feeds. According to Chow (2000) losses occurring in feedstuffs during storage are; weight loss, quality loss, health risks and economic losses. These losses may result from the foraging activities of insects, micro-organisms, improper handling, physical and chemical changes.

The most predominant feed ingredient used is maize (33.7%) others are combination of maize and soybean (17.3%), soybean (6.1%) and groundnut cake (4.1%). The choice of the prevalent feed ingredients among farmers depends on the nutrient composition of the feed ingredients, knowledge of the nutrient requirements of the animals, availability of the feed ingredients and the economics of producing the feeds (Chiba, 2014). About 82.7% of the farmers do not experience relatively high humidity in their feed stores; however, 41.8% of them still experience the occurrence of mouldy feeds. The tropical climate of the states could be responsible for the growth of moulds on the feed since humid climates have reported to support the growth of moulds and the production of mycotoxins (Mclean and Berjak, 1987).

88.8% of the farmers check their feed ingredients before use and 39% of those who experience mouldiness in feed do not dispose off the feeds, they still go ahead to feed their birds with it. This action, though detrimental to the health of the birds, might be as a result of farmers' assumption that it is a waste of resources leading to increase in cost of production without corresponding increase in output. According to Akowuah *et al.*, (2015) the disposal of such feeds is assumed to constitute an economic loss in food production. The perceived sources of contamination of feeds by moulds are; the store, during transportation and on the field. This supports the report of Akowuah *et al.*, (2015) that aflatoxin contamination in maize increases through the channel of distribution from the farm to the market centres before reaching the final consumers.

Table 2: Practices prevalent among poultry farmers that contribute to feed contamination

Practices	Frequency	Percentage
Methods of storing feeds		
Open area	9	9.2
Warehouse	44	44.9
Feed mill	33	33.7
Others	12	12.2
Length of storage		
Less than a month	79	80.6
1-3months	14	14.3
More than 3 months	5	5.1
Type of feed ingredient used		
Maize	33	33.7
Groundnut cake (GNC)	4	4.1
Sorghum	3	3.1
Soybean	6	6.1
Others	2	2.0
All of the above	5	5.1
Maize/GNC	4	4.1
Maize/Soybean	17	17.3
Maize/GNC/Soybean	13	13.3
Maize/GNC/Soybean/others	7	7.1
Maize/others	4	4.1
Humid store		
Yes	17	17.3
No	81	82.7
Mouldiness of feed ingredient		
Yes	41	41.8
No	57	58.2
Check of feed ingredients for mould during purchase		
Yes	72	73.5
No	26	26.5
Check of feed ingredients before use		
Yes	87	88.8
No	11	11.2
Treatment of mouldy feeds		
Air dry	18	18.4

Dispose	61	62.2
Use as it is	4	4.1
Others	9	9.2
Air dry and dispose	6	6.1
Mode of contamination of feed materials		
In the field	13	13.3
In the store	18	18.4
During transportation	10	10.2
On the field and in the store	3	3.1
All of the above	54	55.1

Awareness level of poultry farmers to mycotoxins and mycotoxicosis

Table 3 shows the level of poultry farmers' awareness to mycotoxins and mycotoxicosis. 86.7% of the respondents were aware of mycotoxins and the most common means of knowledge about mycotoxin is through formal education (25.5%). 66.3% of the respondents perceived that fungi is the causative organism of mycotoxicosis while 18.4% do not know the causal organism. 82.7% of the respondents were aware that high humidity promotes the production of mycotoxins. Aflatoxin is the most common mycotoxin known to the farmers (58.2%), however, 8.2% do not know about any mycotoxin. This could mean that aflatoxin is prevalent in the study areas. According to Chukwuka *et al.*, (2010) aflatoxin is the mycotoxin of the greatest economic importance to both the livestock industry and to humans. 86.7% of the respondents were aware of the dangerous effects of mycotoxins to livestock but 51% of them do not know of its carcinogenic effects. Also, 84.7% of the farmers know it is possible to prevent the occurrence of mycotoxins.

Table 3: Awareness level of poultry farmers to mycotoxins and mycotoxicosis

Awareness	Frequency	Percentage
Knowledge of mycotoxins		
Yes	85	86.7
No	13	13.3
Means of knowledge about mycotoxins		
Media	17	17.3
Community campaigns	1	1.0
Veterinary counsel	20	20.4
School/formal education	25	25.5
Others	9	9.2
All of the above	6	6.1
Media/veterinary/school	5	5.1
Veterinary/school	1	1.0
Media/school	1	1.0
None	13	13.3
Causes of mycotoxixosis		
Bacteria	10	10.2
Fungi	65	66.3
Virus	3	3.1
Insect	2	2.0
I do not know	18	18.4
Type of mycotoxin		
Citrinin	4	4.1
Aflatoxin	57	58.2
Ochratoxin	4	4.1
Fumonisins	2	2.0
Tricothecenes	1	1.0
All	8	8.2
Aflatoxin/ochratoxin/tricothecenes	3	3.1
Aflatoxin/ochratoxin/fumonisins	3	3.1
Aflatoxin/ochratoxin	4	4.1

Aflatoxin/ochratoxin/tricothecenes/fumonisins	1	1.0
None	8	8.2
Awareness that high humidity promotes mycotoxin production		
Yes	81	82.7
No	17	17.3
Mycotoxin as an issue in the Nigerian poultry and livestock industry		
Yes	72	73.5
No	26	26.5
Mycotoxin as a danger to poultry and livestock		
Yes	85	86.7
No	13	13.3

Awareness	Frequency	Percentage
Mycotoxin is dangerous to consumers of infected poultry products		
Yes	67	68.4
No	7	7.1
I do not know	24	24.5
Carcinogenicity of mycotoxins		
Yes	50	51.0
No	14	14.3
I do not know	34	34.7
Prevention of mycotoxins		
Yes		84.7
No		5.1
I do not know		10.2

Measures adopted by farmers that help to mitigate the effect of mycotoxins in feed

63.7% of the respondents were aware of toxin binders as a possible solution to mycotoxins in feed; however, 34.7% of them do not use it. Other measures adopted by farmers to prevent mycotoxins occurrence were proper storage of feed ingredients and feeds (40.8%), screening of feed ingredients (8.2%) and the use of antifungal additives (4.1%). 22% of the farmers do not use any particular method. The need to create awareness on the effect of mycotoxins was suggested by 86.7% of the respondents. Strosnider *et al.*, (2006) posited that an estimated 55million people all over the world suffer from uncontrollable aflatoxin poisoning and the number of people with hepatocarcinoma is growing as there are no drugs for mycotoxicosis both in humans and animals. Hence, there is the need to create awareness on the effect and preventive measures against mycotoxins. All these are shown in table 4.

Table 4: Measures adopted by farmers that help to mitigate the effect of mycotoxins in feed

Preventive measures	Frequency	Percentage
Do you know about toxin binders?		
Yes	66	67.3
No	32	32.7
Do you use toxin binders?		
Yes	64	65.3
No	34	34.7
What other methods do you employ to prevent mycotoxin occurrences?		
None	22	22.4
Proper storage	40	40.8
Screening of raw materials	8	8.2
Antifungal additives	4	4.1

Storage/screening	8	8.2
Acidifier	3	3.1
Do you think there is need to create awareness on the effect of mycotoxins and the preventive measures?		
Yes	85	86.7
No	13	13.3

Conclusion

Findings made from this study showed a high level of literacy among respondents which could be responsible for the high level of mycotoxin awareness as well as good practices employed in feed storage. However, the numbers of farmers who are still ignorant of the risk involved in mycotoxins, especially its carcinogenic effects are high. There is therefore a need to create more awareness through collaborative effort of all stakeholders involved in the production of poultry feeds and management of poultry birds.

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