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ARE SMALL-SCALE POULTRY FARMERS AWARE OF AFLATOXIN CONTAMINANTS IN FEED IN OYO STATE, NIGERIA?

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Abstract

Aflatoxins, feed contaminants formed by certain moulds occur naturally as feed and food impurities and have toxic consequences on both animals and humans. Earlier studies on aflatoxins in Nigeria did not consider small-scale poultry farmers' awareness of feed contamination. Thus, this study examined the level of awareness of aflatoxins in poultry feed and its determinants. Descriptive Statistics and the Logistic Regression Model were the analytical tools employed to analyse data collected from field survey in 2019. One-third of the farmers were aware of aflatoxins in feed which depicts that the level of awareness of aflatoxin in feed by the poultry farmers in the study area is low. Years of education, primary occupation, farm-scale, years of farming experience, access to information from research institutions, and membership in cooperative societies were among the key determinants of the awareness of aflatoxin in feed by the farmers. Efforts should be geared towards increasing the level of awareness of the farmers on the highly toxic contaminant even when fed to poultry at non-fatal levels. Agricultural information highlighting the detrimental consequences of aflatoxin on the health and productivity of poultry and how to minimize aflatoxin contamination in feed should be made more accessible to all farmers.

Key words: aflatoxins, poultry feed, agricultural information, awareness, Nigeria.

JEL⁴: C87, I10, Q12

Introduction

Animal feeds are mixtures of organic materials which are formulated to meet the nutritional requirements of livestock which include physical functioning, growth, body maintenance, development, and reproduction. Animal nutrition impacts both directly and indirectly all the aspects of livestock production, from breeding, health

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4 Article info: Original Article, Received: 24th September 2022, Accepted: 10th November 2022.

and farmers' welfare to farm profitability, animal product quality, and safety (Makkar, 2016). Specifically, feeding has a direct impact on production capacity, growth rate and health status of animal (Farm4Trade, 2021). Thus, it is pertinent that animal feeds are of excellent quality and free from all forms of contamination (physical, biological, or chemical). However, preventing contamination in feed pose serious challenges to livestock farmers given that the bulk of animal and poultry feeds are formulated from cereals which are highly susceptible to contamination by mycotoxins (Nakavuma et al., 2020). Although maize forms the largest proportion of grains in poultry a feed which is highly vulnerable to aflatoxin contamination, contamination is common in other crops such as cottonseed, groundnuts, and tree nuts (Perrone et al., 2014; Pickova et al., 2021; Solo, 2022). The most prevalent mycotoxin in warm and humid areas, like Nigeria, is aflatoxins which are produced by *Aspergillus parasiticus* and *Aspergillus flavus* (Paterson, Lima, 2011; Alshannaq et al., 2018).

Aflatoxins are feed contaminants caused by specific moulds naturally occurring as food and feed impurities which have toxic effects on both animals and human beings (Nakavuma et al., 2020). Animals get infected by aflatoxins through the consumption of contaminated feeds which leaves a residue in the animal meat through the hydroxylated derivative and this constitutes a serious threat to human health when consumed (Hussain et al., 2010). For instance, the health devastating effect of aflatoxins on the human population was demonstrated by the outbreak of aflatoxicosis (aflatoxin poisoning) in Kenya in 2014 which was responsible for at least 317 cases of poisoning and 125 reported deaths. This led to very strict regulations on food and feed in the country. Consumption of aflatoxin-contaminated feed in large quantities by poultry birds could lead to loss of weight, slow feed intake, low feed conversion efficiency, poor reproductive performance, and eventually, death of the birds (Shashidhara, Devegowda, 2003). Ultimately, the consumption of aflatoxin-infected poultry birds by humans could cause impaired immunity which may promote susceptibility to infectious diseases, consequently reducing productivity as a result of illness (Golob, 2007).

In a bid to grapple with this menace and ameliorate these adverse effects in Nigeria, the Standards Organization of Nigeria (SON) set an approved standard for maximum total aflatoxin concentrations in maize to be 4 µg/kg (SON, 2008). The organization currently regulates the acceptable levels of aflatoxins in other agricultural products and food. However, such efforts have not yielded the desired results, particularly in Nigeria because small-scale poultry farmers in Nigeria have little or no knowledge about aflatoxins and their health implications (Batagarawa et al., 2015). While there is limited information available about aflatoxin levels in poultry feed, there is evidence of human exposure from consumption of animals (animal products)

which were fed contaminated feed (Raduly et al., 2020; Dhakal, Sbar, 2022). Thus, in addition to the institution of various control strategies, successful management of aflatoxins will require that farmers and all actors along the value-chain be aware of aflatoxin contamination at each node. The main goal of this study is to examine the level and determinants of awareness of aflatoxins in poultry feed among small-scale poultry farmers in Oyo State Nigeria. Apart from contributing to scarce literature on awareness of aflatoxin contamination in feed by small-scale poultry farmers, this study highlights the key determinants of level of awareness to guide policy makers and regulatory agencies in making informed decisions about controlling aflatoxin contamination of maize and by extension of poultry feed. This will in turn ensure feed safety and a lower likelihood of toxicity in humans.

Materials and Methods

The study population included selected small-scale farmers who were involved in poultry production in Afijio Local Government Area of Oyo State, Nigeria. Primary data were collected on selected socio-economic characteristics of respondents such as age, years of poultry farming, highest level of education, ethnic group, and marital status. Information on awareness of aflatoxins in feed was also collected from the respondents employing a well-structured questionnaire. A multistage sampling procedure was employed in selecting respondents. The first stage involved the purposive sampling of the study area given the concentration of poultry farmers within the community, while the second stage involved the random selection of five wards from the ten wards in the Local Government Area. In the final stage, 30 respondents each were selected from the five selected wards making a total of 150 respondents. Only 113 respondents provided complete information that was used for this study. The study conducted in 2019, is however limited in terms of the scope and coverage owing to paucity of funds. Data on the various sources of agricultural information available to the poultry farmers were analysed by descriptive statistics such as percentages, mean, frequency counts and standard deviation, while crosstabs and percentages were further used to profile the awareness level of the farmers. A Logistic regression model was analysed using the STATA 14.2 software to isolate the factors influencing the awareness of aflatoxins in poultry feed among the respondents.

Identification of the sources of agricultural information

The sources of information available to the poultry farmers are summarized in the table (Table 1.). A vast majority of the respondents (93.0%) obtained agricultural information from their fellow farmers. This was followed by cooperative societies with more than half of the total respondents having obtained agricultural information

from this source. On the other hand, less than one-fifth of the respondents had access to extension agents, research institutions, and television as sources of agricultural information, while only a few farmers had access to newspapers (9.0%), posters (7.0%), or radio (5.0%) as sources of agricultural information.

Table 1. Source of agricultural information available to the poultry farmers

Type	Frequency	Percentage*
Fellow Farmers	105	93.0
Coop. Soc.	61	54.0
Research Inst.	20	18.0
Extension Agents	19	17.0
Television	16	14.0
Newspaper	10	9.0
Posters	7	7.0
Radio	6	5.0

Source: Adepoju et al., 2019. * Note that the total percentage will not add up to 100% because of the overlapping in responses.

Profile the level of awareness of aflatoxins in poultry feed

A profile of poultry farmers' level of awareness of aflatoxins in poultry feeds by selected socio-demographic characteristics is presented in the following table (Table 2.). Access to formal information, poultry farm-scale, feed procurement method, poultry farming experience, primary occupation, and educational status of the farmers were the major promoters of awareness of aflatoxins among the respondents. Differences between categories were also observed for gender and age but to a lower extent. A slightly higher percentage of male respondents (33.0%) were aware of aflatoxins in poultry feed than female respondents (29.0%). The differences in awareness levels across different age groups is in consonance with the work of Ayo et al. (2017) who attributed the observed differences to the higher educational levels expected of younger respondents. This may also explain the observed differences in this study. There is a steady rise in awareness levels with increasing educational status. This can be attributed to the direct and indirect effects of education on awareness. In other words, increased educational status increases the propensity to be exposed to aflatoxin knowledge. The educational status also has an indirect effect on awareness because it influences other socioeconomic characteristics such as occupation. For instance, there were observed differences in awareness levels under different occupation categories following research efforts by Ngoma et al. (2017) and Jolly et al. (2006).

Table 2. Awareness profile of respondents by selected socioeconomic characteristics

Socioeconomic Characteristics	Categories	Number of Respondents	Number of Respondents Aware of Aflatoxins	Percentage*
Gender	Female	31	9	29.0
	Male	82	27	33.0
Age	<30	3	1	33.0
	30-40	29	13	45.0
	41-50	54	16	30.0
	>50	27	6	22.0
Educational Status	None	4	0	0.0
	Primary	20	2	10.0
	Secondary	56	17	30.0
	Tertiary	33	17	52.0
Primary Occupation	Artisan	19	2	11.0
	Civil Servant	8	3	38.0
	Crop Farmer	26	5	19.0
	Government Worker	5	2	40.0
	Poultry Farmer	55	24	44.0
Poultry Farming Experience	5 years and below	70	14	20.0
	Above 5 years	43	27	51.0
Feed Procurement	Self-milled	32	18	56.0
	Purchased	81	18	22.0
Access to Formal Sources of Information	Yes	31	21	57.0
	No	76	15	20.0

Source: Adepoju et al., 2019. * Note that the percentages under each characteristic will not add up to 100% because, only positive responses were counted.

Awareness levels among civil servants, government workers, and individuals who were primarily engaged in poultry farming were observed to be higher than those of respondents in other occupational categories. The higher awareness levels among civil servants and government workers may be due to their higher educational levels while individuals that are primarily engaged in poultry farming are expected to be more aware of aflatoxins since it has a direct impact on their livelihoods.

Factors influencing the level of awareness of aflatoxins in poultry feed

In the next table (Table 3.), the regression result of the factors influencing the level of awareness of small-scale poultry farmers of aflatoxins in poultry feed are presented. The likelihood ratio of 53.07, which is significant at $p < 0.01$ is indicative of the overall

goodness of fit and statistical significance of the model. Of the nineteen variables included in the model, 8 were significant in explaining the likelihood of awareness of aflatoxins in poultry feed in the study area. The variables include sex, age, years of education, primary occupation, years of experience, access to information from research institutions, and membership in cooperative societies.

Table 3. Factors influencing awareness of aflatoxin in poultry feed

Variables	Coefficients	Z	dy/dx
Sex	1.575*	1.84	0.319
Age of Respondent	0.134*	1.85	0.041
Marital Status	-0.078	-0.09	-0.014
Household Size	-0.327	-1.33	-0.057
Years of Education	0.134*	1.85	0.042
Access to Credit	-0.991	-0.80	-0.148
Cooperative Membership	-1.332	-1.30	0.194
Ownership of Land	0.250	0.46	0.044
Primary Occupation	2.640**	2.55	0.181
Farming Experience	0.217*	1.67	0.294
Extension Access	0.414***	3.48	0.043
Research Institution Access	2.342***	2.85	0.506
Radio Access	1.240*	1.73	0.142
Cooperative Information Access	-0.554*	-1.95	0.058
Television Access	-0.306	-0.34	0.051
Fellow Farmers Access	1.323	0.98	0.165
Newspaper Access	1.120	0.94	0.165
Poster Access	-0.333	-0.22	-0.054

Source: Adepoju et al., 2019.

Note: *, ** and *** represent significance at 10%, 5% and 1% respectively. Number of Observations = 113; Log likelihood = -44.179816; LR chi sq = 53.07; Pseudo R² = 0.3358; Prob > chi sq = 0.0005.

Discussion

Institutions or individuals who disseminate or construct messages are referred to as information sources (Starasts, 2004). Examples of such sources available to farmers include: extension agents, friends, neighbours, contact farmers, radio, cooperative, commercial agents, newspapers, television, posters, pamphlets, and leaflets (Bawa et al., 2014; Adio et al., 2016; Uwandu et al., 2018). There is also a consensus by scholars that for successful farming, information is pertinent. In other words, information sources play a pivotal role in disseminating development messages to farmers (Sani et al., 2014; Rahman et al., 2016; Duhan, Singh, 2017). Findings from this study showed that almost all the respondents (93.0%) obtained

agricultural information from their fellow farmers, implying that information dissemination is mainly through snow-balling among the poultry farmers in the study. The study however found very limited use of social media or even print media as sources of agricultural information. A similar study by Toma et al. (2021) reported that co-farmers and family members were major sources of agricultural information available to the farmers, while extension agents were less available to them. The marginal effect of the age on the likelihood of awareness of aflatoxins in feed indicates that for each additional year, the likelihood of awareness increased by 4.1%. This could be attributed to the fact that older farmers are more likely to have more farming experience and thus, a higher likelihood of being aware of aflatoxin contamination of poultry feeds than the younger farmers. This is however contrary to the findings of Ayo et al. (2017), in which awareness levels decreased as age increased. The study also showed that the number of years of education obtained by the farmer had significant effects on the level of awareness of aflatoxins in poultry feed among the respondents. Specifically, the marginal effect result indicates that for every additional year of formal education, a farmer's likelihood of awareness of aflatoxins in poultry feed also increased by 4.2%. It is expected that a higher level of education should naturally predispose individuals to a higher level of information about both past and current situations. Ilesanmi and Ilesanmi (2011) in their study reported that a large number of the respondents (over 70%) had heard of aflatoxins while in a classroom or while reading educational materials at the University. The finding of this study also corroborates the findings of Johnson et al. (2018).

The primary occupation of a respondent had positive effects on the likelihood of awareness of aflatoxins in poultry feed. Marginal effect results obtained showed that respondents who were primarily poultry farmers were 18.1% more likely to be aware of aflatoxins in poultry feed as expected, than respondents who were primarily engaged in other occupations. This finding corroborates the findings of Jolly et al. (2006) in which the primary occupation of a respondent was also a determinant of their awareness of aflatoxins.

Further, the years of poultry farming experience amassed by a respondent had a positive effect on the likelihood of awareness of aflatoxin in feed among the respondents. Specifically, an additional year of poultry farming experience increased the likelihood of being aware of aflatoxins in poultry feed by 29.4%. This corroborates the findings of Marechera and Ndigwa (2014) in which the awareness of aflatoxin contamination was linked to farmers' experience with the toxin. In other words, as a farmer's experience increases, the more likely he is exposed to the effect of aflatoxin contamination on his farming activities. However, this is contrary to the findings of Ayo et al. (2017) in which less

experienced farmers were more aware of aflatoxins in feed. A farmer's access to agricultural information from research institutions also increased the likelihood of being aware of aflatoxin in poultry feed by 50.6%. Research institutions are highly reliable source of information on aflatoxins in feed and thus farmers with access to information from this source are expected to have a higher chance of being aware of aflatoxins. This finding also reiterates the pertinent role that research institutions play in the dissemination of agricultural information to small-scale farmers in particular.

In addition, having access to agricultural information via extension agents and radio increased the likelihood of being aware of aflatoxin in feed by 4.3% and 14.2% respectively, when compared with having access through other means. This suggests that extension agents and radio are potent sources of information on aflatoxins in feed and other agricultural information. Therefore, it should be explored as such for effective dissemination of information to farmers and in particular small-scale poultry farmers.

Similarly, respondents' access to agricultural information from cooperative societies was also found to be a determinant of their awareness of aflatoxins in feed. The marginal effect indicates that a respondent that accessed agricultural information through this source was more likely to be aware of aflatoxins in poultry feed than a respondent who did not obtain information from this source by about 5.8%. This could be owing to the fact that cooperative societies serve as a well-organized forum for discussion, information dissemination, and sharing of best practices among farmers.

Conclusion

In Oyo State Nigeria, there is a low level of awareness of aflatoxins in poultry feed among poultry farmers as revealed by this study. As such, coordinated efforts by all relevant stakeholders to ensure that farmers are more informed about the devastating effects of aflatoxins and any other food contaminants for improved productivity should be of utmost priority. Specifically, the findings of the study point to the fact that a farmer's likelihood of awareness of aflatoxins in poultry feed increased with an increase in the level of education, suggesting the need for increase in human capital development efforts among the farmers. Also, the importance of effective access to information from research institutions as shown by the increased likelihood of farmers being aware of aflatoxins in poultry feed cannot be overemphasized. Thus, agricultural information emanating from research institutions highlighting the detrimental effects of aflatoxin on the health

and productivity of poultry and how to minimize aflatoxin contamination in feed should be timely and more accessible to all farmers. In line with this, more extension services should be provided by government and research institutes to reach out to more farmers located in different and remote parts of Nigeria. More funds can also be made available to research institutes by increasing the share of Research and Development in Nigeria's annual budget. Similarly, farmers who had the radio access have a higher likelihood of being aware of aflatoxins in poultry feed than others without access. Hence, radio can be considered a potent means of disseminating relevant agricultural information to poultry farmers, especially in rural areas. Thus, more farmer-centric programmes should be aired on radio stations to increase the dissemination of information to the targeted audience. Finally, findings revealed that farmers who belonged to cooperative societies were more aware of aflatoxins in poultry feed compared to the other farmers. Thus, farmers should be encouraged to organize themselves into groups to facilitate information sharing among them. Further research on the awareness of regulatory standards with respect to aflatoxin contamination of major grains used in animal feed in Nigeria could guide policy makers regarding the reduction of the toxin to acceptable consumption levels.

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