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Aflatoxin in selected grain legumes from four states of North-Central Nigeria

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Abstract

According to the findings, the mean AfB1 concentrations in soyabeans were 1.48g/kg, 0.14g/kg, 0.95g/kg, and 0.29g/kg in the states of Niger, Kogi, Plateau, and Nasarawa, respectively. In Niger, Kogi Plateau, and Nasarawa states, the mean levels of total aflatoxin in soyabeans were 6.63g/kg, 7.28g/kg, 12.28g/kg, and 5.65g/kg, respectively. The mean AfB1 cowpea concentrations were 0.52g/kg, 0.9g/kg, 0.88g/kg, and 0.77g/kg in the states of Niger, Kogi, Plateau, and Nasarawa, respectively. In the states of Niger, Kogi, Plateau, and Nasarawa, the mean total aflatoxin levels in cowpea were 5.62g/kg, 3.67g/kg, 5.76 g/kg, and 4.77 g/kg, respectively. The mean concentrations of AfB1 in bambara nuts were 0.61g/kg, 1.15g/kg, 1.09g/kg, and 1.41g/kg in the states of Niger, Kogi, Plateau, and Nasarawa, respectively. Mean Total Aflatoxin in bambara nuts was found to be 2.8g/kg, 6.06g/kg, 3.89g/kg, and 4.91g/kg in the respective states of Niger, Kogi, Plateau, and Nasarawa. While Total Aflatoxin exceeded the EU's permissible limit of 2.0g/kg in all grains across all States, the mean concentration of AfB1 did not.

Keywords: Aflatoxin, leguminous grains, Soyabeans, Cowpea, Bambara nuts, EU.

Introduction

In the 1970s, it was discovered that crop contamination by fungi could begin in the field prior to harvest[1]. The likelihood of aflatoxin contamination increases when insects eat crops because the points of entry allow fungus to infect them[2,3]. Since aflatoxin invasion of crops and feedstock jeopardizes public health and development efforts[4], the incidence of aflatoxin contamination in crops and livestock is a serious issue in many parts of the world.

According to the United Nations Food and Agriculture Organization (FAO), which estimates that 25% of the world's food crops are contaminated by aflatoxin contamination, more than 4.5 billion individuals in underdeveloped nations are at danger of chronic aflatoxin exposure. Food security and improvements in health cannot be attained if the existing level of aflatoxin concentration in crops and livestock feeds is not properly handled. Aflatoxin contamination is limited to crops that are eaten by animals, hence it has become a significant problem for animal feeds. Rabbits, turkeys, chickens, pigs, cows, and goats are the most vulnerable species in this situation[7,8]. When contaminated eggs, meat, or dairy are ingested by humans, aflatoxin can be transferred from animals to food, with serious health repercussions. AfB_1 and AfM_1 are regarded as human carcinogens[9] by the International Agency for Research on Cancer (IRCA).

Six of the 18 different forms of aflatoxins have been identified and are categorized as B_1, B_2, G_1, G_2, M_1, and M_2, respectively[10]. These aflatoxin groupings show molecular variations. For instance, the G_1 and G2 aflatoxins have a lactone ring, but the B-group aflatoxins (B1 and B2) have a cyclopentane ring[11,12]. Ultraviolet (UV) light has a wavelength of 425nm for the B-group aflatoxins' blue florescence and 540 nm for the G-group aflatoxins' yellow-green fluorescence[13-15].

Materials and methods

The fluorescence serves as a tool for classifying and distinguishing between the B and G groups. Globally, Aflatoxin B_1 is the most prevalent[16] and plentiful[17]. Nearly all Aspergillus species excrete Aflatoxin B_1, which is thought to be the most deadly of the six. Some of the new effects of aflatoxin on human and animal health include gastroenteritis, malignancies, and acute and chronic aflatoxicosis[18,-21]. The four main aflatoxins found in nature are AfB_1, AfB_2, AfG_1, and AfG_2. A. flavus does not produce the G series; it only excretes AfB_1 and AfB_2. The U.S. Department of Agriculture examined 1046 samples of soyabeans from different parts of the nation in a prior research on soybeans to look for aflatoxin contamination. Only two of the 1046 samples used in the study contained aflatoxins at low concentrations, or between 7 and 14 g/kg[23]. According to a study done in the Asia and Pacific region, aflatoxin was present in all soybean samples at low concentrations (0.02 to 13g/kg) 25, 26. Soybeans are typically thought to be resistant to aflatoxins produced by Aspergillus. As a result, total aflatoxin contamination was discovered in 32 out of 51 samples, with the highest concentration level being 0.41 (ppb) 24. At a constant temperature of 25°C, a 4.6mmx250mm Altraspher ODS column was employed.

Acetonitrile, water, and acetic acid (10:50:40, v/v/v) were pumped at a flow rate of 0.8mL/min as the mobile phase. Both the used samples and standards had injection volumes of 20 L. Given the prevalence of aflatoxin and the threats it poses to food crops and livestock feed.

Results and discussion

Table-1 shows the average concentrations of AfB1 and Total Aflatoxin in soyabeans for four states in North Central Nigeria. With a mean concentration of 1.48g/kg, Niger State had the highest AfB1 levels in soyabeans, compared to 0.14g/kg in Kogi, 0.95g/kg in Plateau, and 0.29g/kg in Nasarawa. The mean AfB1 concentration was significantly different between Niger and the other three states at the p0.05 threshold of probability. However, there was no obvious variation in the mean AfB1 concentration between the Plateau and Nasarawa States at the level of probability (p>0.05).

Table-2 shows the average levels of AfB1 and Total Aflatoxin in cowpea for four states in central Nigeria. With a mean concentration of 1.41g/kg, Nasarawa State had the highest concentration of AfB1 in cowpea, compared to 1.15g/kg in Kogi, 1.09g/kg in Plateau, and 0.61g/kg in Niger. This difference in mean AfB1 concentration between Nasarawa and the other three states was statistically significant at the p0.05 level of probability. However, there was no discernible variation in the mean AfB1 concentration between the Plateau, Kogi, and Niger States at the level of probability (p>0.05).

The results for the four states are reported in Table-3 along with the concentrations of aflatoxin B1 (AfB1) and total aflatoxin in bambara nuts. According to the results, there was no significant difference between the mean AfB1 concentrations in Kogi, Niger, or Plateau at (p>0.05) level of probability, but there was a significant difference between the mean AfB1 concentration in Nasarawa and the other three States at (p0.05) level of probability. Table-3 includes the results for the four states as well as the levels of aflatoxin B1 (AfB1) and total aflatoxin in bambara nuts. According to the findings, there was a significant difference between the mean AfB1 concentration in Nasarawa and the other three States at (p0.05) level of probability, but not between the mean AfB1 concentrations in Kogi, Niger, or Plateau.

Results from a comparative investigation of the mean levels of aflatoxin B1 (AfB1) in soyabeans, cowpea, and bambara nuts in three local government areas of Niger State are presented in Table-4. AfB1 in soyabeans had a mean concentration of soyabean in Wushishi, 0.45 g/kg, 0.81 g/kg, and 2.33 g/kg in Bosso local government districts. The findings revealed that the three local government areas of Niger State had significantly different mean AfB1 concentrations in soyabeans (p 0.05 level of probability), However, Bosso's mean AfB1 concentration, 2.33g/kg, was higher than that of the other local governments and the EU-permitted limit of 2g/kg.

According to a study done in the Asia and Pacific region, aflatoxin was present in small amounts (0.02 to 13.0g/kg) in all soyabean samples, does not support the high concentration of the toxin found in soyabeans. According to Table-4's findings, soyabeans had a mean total aflatoxin concentration of in Wushishi, 2.52g/kg, and 2.96 g/kg in Lapai, and 11.15g/kg in Bosso. Bosso had a mean total aflatoxin concentration of 11.15g/kg, which was much higher than the EU limit of 4 g/kg and significantly different from that of Wushishi and Lapai. In accordance with Table-4, the mean AfB1 concentration in cowpea was 0.4g/kg in Wushishi, 0.51 g/kg in Lapai, and 0.55g/kg in Bosso. At the level of probability (p>0.05), there was no discernible variation in the average AfB1 content in cowpea between the three local government regions.According to Table-4's findings, cowpea had a mean total aflatoxin concentration of 7.6 g/kg in Wushishi, 6.23 g/kg in Lapai, and 3.82 g/kg in Bosso. There were no significant differences in the mean concentration of Total Aflatoxin in cowpea in the three local government areas. However, the mean Total Aflatoxin concentrations in Wushishi (7.6 g/kg) and Lapai (6.23 g/kg) above the 4 g/kg EU permitted limit. The results in Table-4 also showed the mean concentration of AfB_1 in bambara nuts was 0.14 μg/kg in Wushishi, 0.51μg/kg in Lapai and 1.12μg/kg in Bosso local government areas respectively. The mean AfB1 concentration did not differ significantly between Wushishi and Lapai, however there was a significant difference between Bosso, Wushishi, and Lapai local government areas at the level of probability (p0.05). Total Aflatoxin levels in bambara nuts ranged from 2.09 g/kg in Wushishi to 3.63g/kg in Lapai to 3.17g/kg in Bosso. According to the data for tree crops, soyabeans for Bosso had a mean concentration of AfB1 that was higher than that of cowpea and bambara nuts, but there were no discernible changes in the mean concentration of total aflatoxin amongst the three local government areas. Furthermore, the causing fungi may have been present in the cowpea and bambara, which may have been properly dried in the field prior to storage, or it's possible that the handlers maintained the soybeans in conditions that promoted the growth of the causal fungus.

According to Table-5's findings, Kogi State's mean concentrations of AfB1 soybeans, cowpeas, and bambara nuts were compared. In Yagba West, Okene, and Ajaokuta local governments, the mean AfB1 concentration in soyabeans was respectively 0.08g/kg, 0.13g/kg, and 0.28g/kg. standard concentration of AfB1 in soyabeans did not differ significantly between Yagba West and Okene at (p>0.05) level of probability, but it did differ significantly between Ajaokuta and the other two local government areas at (p0.05) level of probability. Total aflatoxin in soyabeans was 0.67g/kg in Yagba West, 9.87 and 20.1g/kg in Okene, respectively. Ajaokuta local governments, according to the results in Table 5. The Total Aflatoxin levels varied significantly between the three local government regions. Additionally, Table-5 revealed that the average AfB1 concentration in cowpea was 0.46g/kg in Yagba West, 0.92g/kg in Ajaokuta and 1.66g/kg in Okene.

At the ($p>0.05$) level of probability, there were no discernible differences in the mean AfB1 content of cowpea between the three local government regions. According to Table-5's findings, cowpeas in the Kogi State local government areas of Ajaokuta, Okene, and Yagba West had concentrations of total aflatoxin of 1.04g/kg, 3.45 correspondingly 6.83g/kg and g/kg. The amounts of Total Aflatoxin varied significantly among the three local government areas. Table 5's outcomes also displayed the typical concentration of Yagba West, Okene, and Ajaokuta local government districts had AfB1 concentrations of 0.93, 1.81, and 0.26 grams per kilogramin bambara nuts, respectively. At the ($p>0.05$) level of probability, there were significant variations in the AfB1 content in bambara nuts amongst the three local governments. The average values of total aflatoxin in bambara nuts were 6.62g/kg in Yagba West, 5.32g/kg in Okene, and 6.40 g/kg in Ajaokuta, according to the results in Table-5. At the ($p>0.05$) level of probability, there were no discernible differences in the concentration of total aflatoxin between the three local government areas. The average AfB1 concentrations for all the crops in the three Kogi State local government areas were less than the 2g/kg permitted by the EU. As a result, based on EU regulations, the AfB1 concentration in all of the grain legumes under review in these local governments had no bearing on consumers. This data supports the claims of various researchers that Aspergillus species that secrete AfB1 are found in areas that are dry or low in water activity, hot, and humid. Therefore, it is assumed that the grains were properly dried and stored in an environment that prevented the growth of Aspergillus species.

Table-6's findings revealed the average AfB1 concentrations in soybeans, cowpeas, and bambara nuts in Plateau State. AfB1 in soyabeans had a mean concentration of 0.12g/kg in Jos East, 2.38g/kg in Pankshing, and 0.58g/kg in Shendam. At the ($p>0.05$) level of probability, there was no difference in the mean AfB1 concentration between Jos East and Shendam, but at the (p0.05) level of probability, there was a difference in the mean AfB1 concentration between Jos East and Pankshing and between Shendam and Pankshing local government areas. The average amount of total aflatoxin in soyabeans was also shown in Table-6 to be 1.14g/kg in Jos East, 1.50g/kg in Pankshing, and 9.64g/kg in Shendam local government districts, respectively. Between the local government areas of Shendam and Pankshing as well as Jos East and Pankshing, there was a statistically significant variation in the mean concentration of total aflatoxin ($p>0.05$). AfB1 in cowpea had a mean concentration of 0.91 g/kg in Jos East, 1g/kg in Pankshing, and 0.67g/kg in Shendam local government areas, according to Table-6. The three local government districts' afB1 mean concentrations did not differ significantly from one another. Total Aflatoxin in cowpeas had a mean value of 1.77g/kg in Jos East, 1.37g/kg in Pankshing, and 0.97g/kg in Shendam. The mean concentrations did not differ significantly from one another. Additionally, Table-6 demonstrated that the average AfB1 concentration in bambara nuts was 0.80g/kg in the Jos East local government, 0.35g/kg in the Pankshing local government, and 1.78g/kg in the Shendam local government. However, there was no significant difference in the mean AfB1 concentration in bambara nuts between Jos East and Pankshing local government areas at (p0.05) level of probability. There was, however, a significant difference in the mean AfB1 concentration in bambara nuts between Pankshing and Shendam local government areas as well as between Jos East and Shendam at ($p>0.05$) level of probability. Aflatoxin levels in bambara nuts averaged 0.27g/kg in Jos East, 1.75g/kg in Pankshing, and 1.56g/kg in Shendam local government districts, according to Table-6. At the level of probability ($p>0.05$), there was no discernible variation in the mean concentrations between the three local government regions. It was interesting to observe that the mean AfB1 concentration in soyabeans in Pankshing local government area of Plateau State was 2.38g/kg. This shows that the activities of toxigenic fungus in Pankshing were responsible for the high mean concentration AfB1, which indicated worry for the safety of crop consumers. This mean concentration was greater above the EU allowed limits of 2g/kg. This outcome may also be attributable to ideal storage conditions that allowed the toxigenic fungi to grow. Consumers run the danger of developing aflatoxicosis.

The findings in Table-7 displayed the AfB1 content of soyabeans, cowpeas, and bambara nuts bought from three Nasarawa State local government areas. According to local governments, the mean AfB1 concentration in soyabeans was 0.18g/kg in Akwanga, 0.35g/kg in Keffi, and 0.25g/kg in Lafia. The mean concentration of AfB1 in soybeans did not significantly differ across the three local government regions at the level of probability ($p>0.05$).The average levels of total aflatoxin in soybeans were 0.23g/kg in Akwanga, 2.42g/kg in Keffi, and 0.85g/kg in Lafia, according to Table 7's data. The findings demonstrated that the mean Total Aflatoxin concentrations in the three local government regions varied significantly. AfB1 in cowpea had a mean concentration of 0.75 g/kg in Akwanga, 2.01g/kg in Keffi, and 0.33g/kg in Lafia local government areas, according to the results in Table 7. There were no mean differences at the level of probability ($p>0.05$). AfB1 concentration between Akwanga and Lafia, while at the level of probability (p0.05), there were differences in the mean AfB1 concentration between Keffi and Akwanga and between Keffi and Lafia. Cowpea had a mean total aflatoxin concentration of 0.89g/kg in Akwanga, 0.66g/kg in Keffi, and 1.60 g/kg in Lafia, according to Table-7's findings. The three local government regions did not significantly differ from one another in terms of the mean Total Aflatoxin concentration in cowpea ($p>0.05$ level of probability). According to Table 7's findings, the average AfB1 concentration in bambara nuts was 5.21g/kg in Akwanga, both 0.55g/kg and 0.19g/kg in Lafialocal government districts. At the (p0.05) level of probability, there were significant differences in the mean AfB1 concentration of bambara nuts between Akwanga and Keffi and Akwanga and Lafia.The mean AfB1 content of bambara nuts did not significantly differ between Keffi and Lafia, though.

According to Table-7, the average amount of aflatoxin in bambara nuts was 5.42g/kg in Akwanga, 12.3g/kg in Keffi, and 2.27g/kg in Lafia. According to the findings, there were appreciable variations in the three local government regions' mean total aflatoxin concentrations at the (p0.05) level of probability. The average AfB1 concentration in bambara nuts was found to be 5.21g/kg in Akwanga Local Government Area of Nasarawa State, exceeding by more than double the EU Permissible Limits of 2g/kg. As a result, bambara nut consumers may face health issues.

Table-1: Aflatoxin content of Soyabeans from four States of North-Central Nigeria.

Aflatoxin concentration (μg/kg)					
State	AFB_1	AFB_2	AFG_1	AFG_2	Total
Niger	1.48^{c}	0.16^{ab}	3.49^{ab}	1.50^{a}	6.63^{a}
Kogi	0.14^{a}	0.02^{a}	6.27^{b}	0.85^{a}	7.28^{a}
Plateau	0.95^{ab}	0.56^{b}	2.20^{a}	10.26^{b}	13.97^{a}
Nasarawa	0.29^{ab}	0.04^{a}	4.27^{ab}	1.05^{a}	5.65^{a}

Means followed by the same superscripts within the same column are not significantly different according to Duncan Multiple Range Test ($p>0.05$). Means followed by different superscripts within the same column are significantly different according to Duncan Multiple Range Test ($p\leq0.05$)

Table-2: Aflatoxin concentration of Cowpea four States of North-Central Nigeria.

Aflatoxin concentration (μg/kg)					
State	AFB_1	AFB_2	AFG_1	AFG_2	Total
Niger	0.61^{a}	0.03^{a}	1.56^{a}	0.60^{a}	2.80^{a}
Kogi	1.15^{a}	0.10^{a}	4.60^{ab}	0.21^{a}	6.06^{a}
Plateau	1.09^{a}	0.04^{a}	1.90^{a}	0.86^{a}	3.89^{a}
Nasarawa	1.41^{ab}	0.00^{a}	3.28^{ab}	0.22^{a}	4.91^{a}

Means followed by the same superscripts within the same column are not significantly different according to Duncan Multiple Range Test ($p>0.05$). Means followed by different superscripts within the same column are significantly different according to Duncan Multiple Range Test ($p\leq0.05$)

Table-3: Aflatoxin concentration of Bambara nuts from four States of North-Central Nigeria.

Aflatoxin concentration (μg/kg)					
State	AFB_1	AFB_2	AFG_1	AFG_2	Total
Niger	0.61^{a}	0.03^{a}	1.56^{a}	0.60^{a}	2.80^{a}
Kogi	1.15^{a}	0.10^{a}	4.60^{ab}	0.21^{a}	6.06^{a}
Plateau	1.09^{a}	0.04^{a}	1.90^{a}	0.86^{a}	3.89^{a}
Nasarawa	1.41^{ab}	0.00^{a}	3.28^{ab}	0.22^{a}	4.91^{a}

Means followed by the same superscripts within the same column are not significantly different according to Duncan Multiple Range Test ($p>0.05$). Means followed by different superscripts within the same column are significantly different according to Duncan Multiple Range Test ($p\leq0.05$).

Table-4: Aflatoxin content of Soyabeans, Cowpea and Bambara Nuts purchased from three LGAs of Niger State.

Aflatoxin concentration (µg/kg.)															
LGA	Soybeans					Cowpea					Bambara nuts				
	AFB_1	AFB_2	AFG_1	AFG_2	Total	AFB_1	AFB_2	AFG_1	AFG_2	Total	AFB_1	AFB_2	AFG_1	AFG_2	Total
Wushishi	0.45^{a}	0.25^{a}	0.56^{a}	0.00^{a}	2.52^{a}	0.45^{a}	0.02^{a}	6.97^{b}	0.16^{a}	7.60^{a}	0.14^{a}	0.01^{a}	1.60^{a}	0.34^{a}	2.09^{a}
Lapai	0.81^{ab}	0.04^{a}	1.25^{a}	0.86^{ab}	2.96^{a}	0.51^{a}	0.15^{a}	4.57^{ab}	1.00^{a}	6.23^{a}	0.51^{a}	0.07^{a}	0.59^{a}	2.46^{a}	3.63^{a}
Bosso	2.33^{b}	0.17^{a}	6.08^{a}	2.57^{b}	11.15^{b}	0.55^{a}	0.47^{a}	0.68^{a}	2.12^{a}	3.82^{a}	1.12^{ab}	0.05^{a}	1.93^{a}	0.07^{a}	3.17^{a}

Means followed by the same superscripts within the same column are not significantly different according to Duncan Multiple Range Test ($p>0.05$). Means followed by different superscripts within the same column are significantly different according to Duncan Multiple Range Test ($p\leq0.05$).

Table-5: Aflatoxin concentration in Soyabeans, Cowpeas and Bambara Nuts purchased from three LGAs of Kogi State.

Aflatoxin Concentration (µg/kg)															
LGA	Soybeans					Cowpea					Bambara nuts				
	AFB_1	AFB_2	AFG_1	AFG_2	Total	AFB_1	AFB_2	AFG_1	AFG_2	Total	AFB_1	AFB_2	AFG_1	AFG_2	Total
Yagba West	0.08^{a}	0.02^{a}	0.40^{a}	0.17^{a}	0.67^{a}	0.46^{a}	0.05^{a}	0.30^{a}	0.23^{a}	1.04^{a}	0.93^{ab}	0.18^{b}	5.36^{a}	0.15^{a}	6.62^{a}
Okene	0.13^{a}	0.00^{a}	9.47^{c}	0.27^{a}	9.87^{ab}	1.66^{a}	0.12^{a}	0.49^{a}	1.81^{a}	4.08^{ab}	1.81^{b}	0.06^{ab}	3.26^{a}	0.19^{a}	5.32^{a}
Ajaokuta	0.28^{ab}	0.03^{a}	16.77^{b}	3.02^{b}	20.1^{b}	0.92^{a}	0.03^{a}	4.74^{b}	1.14^{a}	6.83^{b}	0.26^{a}	0.00^{a}	5.78^{a}	0.36^{a}	6.40^{a}

Means followed by the same superscripts within the same column are not significantly different according to Duncan Multiple Range Test ($p>0.05$). Means followed by different superscripts within the same column are significantly different according Duncan Multiple Range Test ($p\leq0.05$)

Table-6: Aflatoxin concentration in Soyabeans, Cowpeas and Bambara Nuts purchased from three LGAs of Plateau State.

Aflatoxin concentration (µg/kg)															
LGA	Soyabeans					Cowpeas					Bambara nuts				
	AFB_1	AFB_2	AFG_1	AFG_2	Total	AFB_1	AFB_2	AFG_1	AFG_2	Total	AFB_1	AFB_2	AFG_1	AFG_2	Total
Jos East	0.12^{a}	1.08^{a}	1.30^{a}	2.07^{a}	1.14^{a}	0.91^{a}	0.09^{a}	5.84^{a}	0.25^{a}	1.77^{a}	0.80^{a}	0.00^{a}	0.00^{a}	0.29^{a}	0.27^{a}
Pankshing	2.38^{b}	0.29^{a}	3.03^{a}	0.29^{a}	1.50^{a}	1.00^{a}	0.00^{a}	4.37^{a}	0.10^{a}	1.37^{a}	0.35^{a}	0.00^{a}	6.57^{a}	0.07^{a}	1.75^{a}
Shendam	0.58^{a}	0.43^{a}	2.63^{a}	35.32^{b}	9.64^{b}	0.67^{a}	0.05^{a}	2.82^{a}	0.32^{a}	0.97^{a}	1.78^{ab}	0.11^{a}	2.40^{a}	1.93^{a}	1.56^{a}

Means followed by the same superscripts within the same column are not significantly different according to Duncan Multiple Range Test ($p>0.05$). Means followed by different superscripts within the same column are significantly different according Duncan Multiple Range Test (≤0.05).

Table-7: Aflatoxin concentration of Soyabeans, Cowpea and Bambara Nuts purchased from three LGAs of Nasarawa State.

Aflatoxin concentration (µg/kg)															
LGA	Soyabeans					Cowpea					Bambara nuts				
	AFB_1	AFB_2	AFG_1	AFG_2	Total	AFB_1	AFB_2	AFG_1	AFG_2	Total	AFB_1	AFB_2	AFG_1	AFG_2	Total
Akwanga	0.18^{a}	0.05^{a}	0.59^{a}	0.11^{a}	0.23^{a}	0.75^{a}	0.06^{a}	1.77^{a}	0.97^{b}	0.89^{a}	5.21^{b}	0.00^{a}	0.21^{a}	0.00^{a}	1.36^{ab}
Keffi	0.35^{a}	0.07^{a}	8.39^{b}	0.64^{a}	2.42^{b}	2.01^{b}	0.11^{a}	0.54^{a}	0.00^{a}	0.66^{a}	0.19^{a}	0.00^{a}	12.02^{b}	0.09^{a}	3.08^{b}
Lafia	0.25^{a}	0.01^{a}	1.36^{a}	1.78^{b}	0.85^{ab}	0.33^{a}	0.09^{a}	5.86^{ab}	0.14^{a}	1.60^{a}	0.55^{a}	0.00^{a}	1.38^{a}	0.34^{ab}	0.57^{a}

Means followed by the same superscripts within the same column are not significantly different according to Duncan Multiple Range Test ($p>0.05$). Means followed by different superscripts within the same column are significantly different according to Duncan Multiple Range Test ($p\leq0.05$)

Conclusion

In general, the mean concentrations of AfB_1 and Total Aflatoxin in majority of the local government areas and States were below the 2µg/kg benchmark of the EU. This maybe because the environmental conditions of storage of these grains didn't encourage the growth of toxigenic fungi. In other words, the occurrence and prevalence of the causal fungi were generally below the level of concern. However, a few hot spots have also been recorded in all the crops, Akwanga (Nasarawa State) recorded the highest concentration of AfB_1 in bambara nut had 5.21µg/kg, followed by Keffi (Nasarawa State) 2.42µg/kg in soyabeans, Pankshing (Plateau State) 2.38µg/kg (soyabeans), Bosso (Niger State) 2.33µg/kg in (soyabeans), Keffi and Akwanga (Nasarawa) 2.01µg/kg each in cowpea. That these mean concentrations of the toxin were higher than the EU permissible limit suggests that more work be done to fully ascertain the authenticity of these results because it portends an unpleasant unhealthy future for consumers of these stable grains and cash crops. As a result, the health of livestock and humans who consume these grains in these three states and local government areas may be at risk. In addition, Total aflatoxin concentration in the crops appears to be higher than the permissible limit 4µg/kg of the EU but lower than the FDA standard of 20µg/kg but are of no health consequence for consumers. Subsisting farming and storage practices in Bosso, Pankshing and Nasarawa should be improved to reduce the environmental conditions that predispose the grains to fungal attack. Other than that, the level of contamination of *Aspergillus spp* with leguminous grains has not reached epidemic levels. Agricultural Extension services should be available to farmers to educate them on how to sanitize there, crops, field before planting and stores as well by allowing proper drying of the grains in the field before storage.

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