GSC Biological and Pharmaceutical Sciences
eISSN: 2581-3250 CODEN (USA): GBPSC2
Cross Ref DOI: 10.30574/gscbps
Journal homepage: https://gsconlinepress.com/journals/gscbps/

(RESEARCH ARTICLE)

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Effects of aflatoxin-contaminated food on organs of experimental animals

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GSC Biological and Pharmaceutical Sciences, 2025, 32(02), 162-174

Publication history: Received on 05 July 2025; revised on 12 August 2025; accepted on 14 August 2025

Article DOI: https://doi.org/10.30574/gscbps.2025.32.2.0321

Abstract

Aflatoxins, highly toxic secondary metabolites mainly produced by *Aspergillus flavus*, are a major food safety concern in warm, humid regions. This study investigated the occurrence of aflatoxins in food crops and assessed their toxic effects on vital organs of albino rats in Ekiti State, Nigeria. A total of 240 samples comprising maize, rice, and groundnut were collected from 16 Local Government Areas and analyzed using ELISA. Fungal isolation and molecular identification revealed a high prevalence of *Aspergillus flavus*; the primary producer of aflatoxins; accounting for 16.75% of total isolates. Concentrations of aflatoxin B_2 in the food samples reached up to 88.22 ppb, exceeding internationally accepted safety limits. Experimental animals (albino rats) were grouped and exposed to aflatoxin-producing *A. flavus*, with some groups treated using 100 mg/kg of *Asparagus africanus* extract or 200 mg ketoconazole. Histopathological and biochemical analyses revealed significant damage to the liver, kidney, and lung tissues in aflatoxin-exposed rats, including hepatic congestion, renal sclerosis, and pulmonary epithelial hyperplasia. However, treatment with *A. africanus* extract showed marked protective effects, comparable to ketoconazole, restoring normal histological architecture and reducing inflammation and tissue degeneration. These findings highlight the health risks of consuming aflatoxin-contaminated food and the therapeutic potential of *Asparagus africanus* in mitigating aflatoxin-induced organ damage. The study emphasizes the urgent need for improved food storage, aflatoxin monitoring, and integration of plant-based interventions in public health management.

Keywords: Aflatoxin; Aspergillus flavus; Biomarker indices; Histopathology; *Asparagus africanus*; Food contamination; Albino rats

1. Introduction

Fungi are ubiquitous plant pathogens and are the major spoilage agents of foods and feedstuffs (Makun *et al.* 2010, Esan *et al.,* 2020). The infection of plants by various fungi not only results in reduction in crop yield and quality with significant economic losses, but contamination of grains with fungal poisonous secondary metabolites called mycotoxins (Fan *et al*., 2023). Aflatoxins are family of toxins produced by certain fungi found on agricultural crops such as maize (corn), peanuts, cottonseed, and nuts etc. (Cassel *et al.,* 2012, Alshannaq and Yu, 2017). Aflatoxin-producing fungi can contaminate crops in the field, at harvest, and during storage (Garcia-Cela, *et al*., 2019). The ingestion of such mycotoxin contaminated grains by animals and human beings has enormous public health significance because these toxins are: nephrotoxic, immunotoxic, teratogenic and mutagenic (Benkerroum, 2020). They are capable of causing acute and chronic effects in man and animals ranging from death to disorder of central nervous, cardiovascular and pulmonary systems and intestinal tract (Awuchi, 2022).

The priority of the world is on Food security (Porter *et al*., 2014). Due to the population of the world, there is high demand for food, yet the global food supply is being challenged by several factors such as changes in the patterns of spatial and temporal distribution of water available for agriculture, temperature patterns and frequency of adverse

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weather conditions and geographical distribution of pests and diseases (Millar and Roots, 2012). Food production requires continued innovation and resilience in farming systems, including better preparedness and improved risk management. In addition, food production must be achieved sustainably, that is, without affecting agricultural land and natural ecosystems for future generations (Hoffmann, 2011).

Cereals, including wheat, maize (corn) and rice, are the major staple foods required by the world's population, for both human and animal consumption. It is imperative that cereal production meets the demands of our growing world population, which is estimated to reach 9 billion by 2050 (Porter *et al*.\, 2014). Worldwide, cereal production has failed to meet consumption needs due to loss contamination of crops during storage and effects of pests attack is estimated at around 10% to 30% annually (Chelladurai *et al*., 2010). In many developing countries losses of 10-15% in stored products including cereals and legumes are caused by insect and microbial activities (Neethirajan *et al*., 2017). Twenty-five million tons of cereals are lost during different postharvest stages including storage and post-production in Nigeria, Australia, USA, and West Asia. The main biotic factors influencing cereals loss during storage are insects, moulds, birds and rats (Baloch, 2018).

Aflatoxins are a class of mycotoxins produced primarily by *Aspergillus flavus* and *Aspergillus parasiticus*, fungi that thrive in warm and humid environments, especially during storage of agricultural commodities such as maize, groundnuts, rice, and animal feeds (Eskola et al., 2020). Among the aflatoxins, aflatoxin B_1 (AFB_1) is considered the most potent and toxic. It is classified as a Group 1 human carcinogen by the International Agency for Research on Cancer due to its strong association with hepatocellular carcinoma (IARC, 2020). The ingestion of contaminated food or feed leads to systemic toxicity, primarily targeting the liver, but also affecting the kidneys, spleen, gastrointestinal tract, and immune system.

In developing countries, where climate conditions and storage practices favor fungal growth, aflatoxin contamination is a significant public health and agricultural concern. It is estimated that over 4.5 billion people globally are exposed to aflatoxins through contaminated food, with children, pregnant women, and livestock being the most vulnerable (Mahato et al., 2019). Animal models have been widely employed to evaluate the toxicological effects of aflatoxins due to their physiological similarities with humans. Studies have shown that aflatoxin exposure causes weight loss, immune suppression, organ swelling, hemorrhage, oxidative stress, and histopathological changes such as liver necrosis and bile duct proliferation (García-Cela et al., 2021).

Although various mitigation strategies such as biological control agents, binders, and improved storage have been introduced, the problem persists due to limited implementation, particularly in rural and economically disadvantaged regions (Mwakinyali et al., 2019). Therefore, understanding the organ-specific impacts of aflatoxins in experimental models is essential to support intervention strategies, improve feed safety, and protect public health. This study aims to investigate the histological and biochemical effects of aflatoxin-contaminated food on key organs of experimental animals, thereby contributing to the growing body of evidence necessary for aflatoxin regulation and risk assessment.

2. Materials and methods

2.1. Study location

The study area covered the sixteen (16) Local Government Areas of Ekiti State, Nigeria. The geographical location of Ekiti State is on Longitude 7^{o} 36' N Longitude 5^{o} 13' E of the Nigerian map, with population of about 3,331,885 (Nigeria Bureau of Statistics, 2020).

2.2. Collection of food samples

A total of 240 dried samples of Local Rice: 'Igbemo rice' (Igbemo curtiva), Maize (*Zea mays*) and Groundnut (*Arachis hypogaea* L) weighing 250g each were randomly collected in all the 16 Local Governments Areas of Ekiti State in a sterile ziplock bag and were kept in the refrigerator until use.

2.3. Animals used in experiments

Albino rats (*Ratus norvegicus*) weighing between 98 g and 135 g were used for the experiment. They were housed in cages and maintained on standard rat pellets (Ladokun feeds, Ibadan, Nigeria), and given tap water *ad libitum* at the animal house of The Federal Polytechnic Ado Ekiti. The rats were maintained at normal laboratory conditions of temperature (25 ± 2 °C), relative humidity of 65 ± 0.5 % with free access to standard commercial diets and clean tap water *adlabium* until the end of the experiment.

2.4. Isolation of fungi associated with food samples

2.4.1. Preparation of medium

The PDA used was prepared according to manufacturer's specification (39g dissolved in 1000 ml of water). The agar was weighed into a sterile beaker of 500ml capacity and distilled water was measured using measuring cylinder. The mixture was sterilized in an autoclave at 121 ^{o}C for 15 minutes after which it was allowed to cool to 45 ^{o}C and Chloramphenicol was added to inhibit the growth of bacteria. In an aseptic condition, the Figures were poured and allowed to set.

2.4.2. Inoculation of Figures

Ten (10) grains of Local Rice (Igbemo cultivar), Maize (*Zea mays*) and Groundnut (*Arachis hypogaea* L) were randomly selected from the samples already in ziplock bag and subjected to surface sterilization with 0.1% sodium hypochlorite solution for 2 minutes. The selected samples were rinsed with distilled water (the aim is to remove contaminant from the environment). The samples were picked with sterile forceps onto already prepared Figures (direct plating method) aseptically and incubated at room temperature (25^{o}C) for 3 days (72 hours). The Figures were observed for growth thereafter. Pure culture of fungal colonies obtained were sub-cultured on freshly prepared PDA Figures and incubated aerobically at 25 ^{o}C for 3 days (72 hours) for subsequent characterization and taxonomic identification**.** As a control, a Figure with only Potato Dextrose Agar (PDA) was incubated at 25 °C for 3 days (Toma and Abdulla, 2013).

2.4.3. Molecular characterization of fungal isolates

Molecular identification was done by ITS4rDNA gene as described by Al-Hindi *et al.* (2018).

2.4.4. Inoculation of test organism

The fungal isolates were subculture on PDA for 72 hours (3days). A 10mL of 1%Tween 80 solution was dispensed on the surface of Figure and sterile wire loop was used to dislodge the fungi into a sterile beaker. The solution was filtered using sterile gauze. The suspension concentrations were quantified with heamocytometer and kept for use.

One gram (1 g) of the extract was weighed into a sterile beaker and 9 mL of 1%Dimethylsulphide (DMSO). Different concentrations were prepared ranging from 300 mg/kg to 50 mg/kg and were kept in the refrigerator at 4^{o}C until use.

Twenty (20) albino rats of the same sex were used for this study. The albino rats were grouped into four of five animals.

- Group 1: non inoculated animals
- Group 2: inoculated animals with *Aspergillus flavus*
- Group 3 inoculated animals with *Aspergillus flavus* + 100mg/kg body weight of the plant extract
- Group 4 inoculated animals with *Aspergillus flavus* + Ketoconazole 200 mg .

2.5. Preparation of tissue homogenate supernatant

The rats were anaesthetized in a glass jar containing cotton wool soaked in diethylether. The animals were dissected. The liver, heart and kidney were removed, homogenized and centrifuged and supernatant used for analyses. Blood was collected into EDTA sample bottle. This was thereafter centrifuged at 10,000rpm for 10 minutes to obtain the plasma used for analysis.

2.6. Histological examination

Histological sections were prepared according to the method of Agrawal *et al.* (2021). Organs such as liver, lung and kidney were extracted from the experimental animals for the histological section.

2.7. Statistical analysis

The results of the various analyses were expressed as mean+ standard deviation. One-way analysis of variance (ANOVA) was used to test for variability using SPSS 25 where necessary, Duncan multiple range test was also used.

3. Results

The number of samples taken from each of Ekiti State's 16 Local Government Areas (LGA) is displayed in Table 1. In each Local Government, 15 samples of Maize, Rice (Igbemo cultivar), and Groundnut were gathered from various places.

Ado, Ikere, Efon, and Ikole are only a few LGAs that are comprised of a single town. Some of these LGA's streets were used in place of towns.

Eleven (11) general of isolates were obtained from the samples. These isolates were found in all the samples. *Aspergillus flavus* has the highest number of occurrence which is 31 among the aflatoxin producing fungi while *Fusarium* has the least value of 2. On the On the other hand, among the non aflatoxin producing fungi, *Rhizopus* spp has the height value of 47 while *Neurospora* spp. has the least value as seen in Table 2.

Three of the four isolates were identified molecularly as *Aspergillus flavus*, while one was *Trichoderma vridie*, according to Table 3 molecular identification of four isolates with various accession numbers.

The photomicrograph of rat liver fed with convetional feedmil and water (control), inoculated with test organism, treated with *Asparagus africanus* and Ketoconazole**.** stained with Haematoxylin and Eosin as shown in Figures 1A, 1B 1C and 1D respectively. Figures 2A, 2B, 2C and 2D are photomicrograph of rat kidney of experimental animal fed with convetional feedmil and water inoculated with test organism, treated with *Asparagus africanus* and Ketoconazole**.** Photomicrograph of and lung of rat fed with convetional feedmil and water inoculated with test organism and treated with *Asparagus africanus* are shown in Figures 3A, 3B. 3C and 3D.

Table 1 Various Local Governments and number of food samples collected

No	Local Government	Maize sample	Rice sample	Groundnut sample	Total
1	Ado	5	5	5	15
2	Ikere	5	5	5	15
3	Gbonyin	5	5	5	15
4	Ijero	5	5	5	15
5	Ise /Orun	5	5	5	15
6	Ido/Osi	5	5	5	15
7	Ekiti East	5	5	5	15
8	Ekiti south	5	5	5	15
9	Irepodun/ Ifelodun	5	5	5	15
10	Efon	5	5	5	15
11	Moba	5	5	5	15
12	Ilejemeje	5	5	5	15
13	Emure	5	5	5	15
14	Oye	4	5	5	15
15	Ikole	5	5	5	15
16	Ekiti West	5	5	5	15
240					

Table 2 Frequency of occurrence of fungal isolates from food samples collected

Isolates	(X) Occurrence	% Frequency
Aspergillus flavus	31	16.75
Aspergillus niger	12	6.49
Penicillium citrinum.	15	8.12

Rhizoous stolonifera	48	25.41
Mucor mucedo	30	16.22
Botrytis cinerea.	19	10.27
Aspergillus parasiticus	17	9.19
Aspergillus fumigatus	10	5.41
Fusarium oxysporium	2	1.08
Neurospora crassa	1	0.54
Total	**185**	**100.00**

Table 3 Molecular identification of isolates

Isolate	Strain	Accession Number	E-value	ITS4 rDNA identity (%)	Isolates' Identity
B2	*Aspergillus flavusT13*	MN179300.1	0.0	90.73	*Aspergillus flavus*
B3	*Aspergillus flavus* Egy3	LC368455.1	0.0	89.56	*Aspergillus flavus*
B4	*Trichoderma viridie*	MN497567.1	0.0	71.19	*Trichoderma viridie*
B6	*Aspergillus flavus*	MK493826.1	0.0	75.91	*Aspergillus flavus*

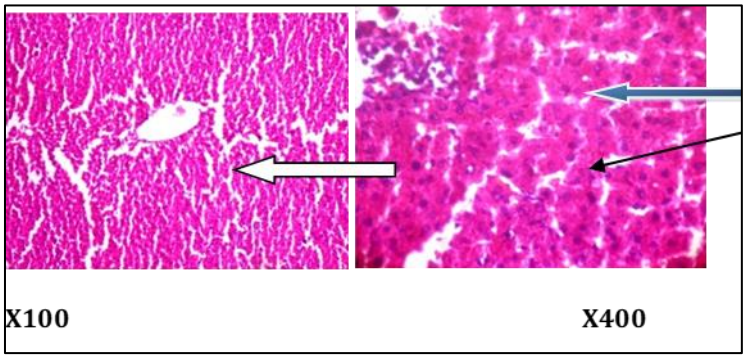

Figure 1A Photomicrograph of rat liver fed with convectional feed mill (control) stained by Haematoxylin and Eosin showing normal central venules without congestion (white arrow), the parenchyma of the liver show focal araes without inflmmatory cells (black arrow), the morphology of the hepatocytes appear normal (blue arrow), the sinusoids appear normal and not infiltrated (slender arrow)

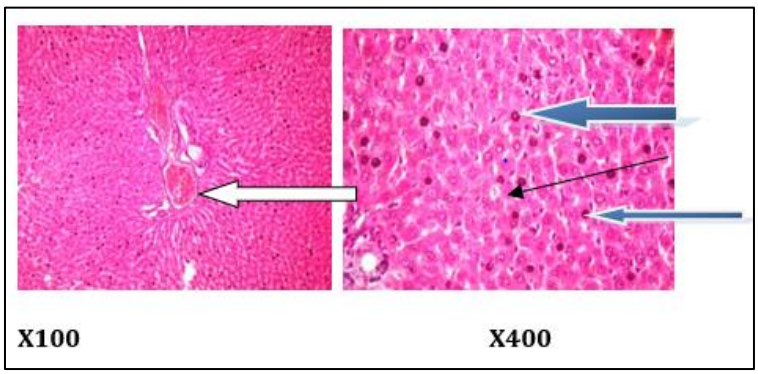

Figure 1B Photomicrograph of rat liver inoculated with test organism stained by Haematoxylin and Eosin showing portal vein with congestion (white arrow), some of the hepatocytes show piknotic nuclei (blue arrow), the sinusoids appear normal and not infiltrated (slender arrow)

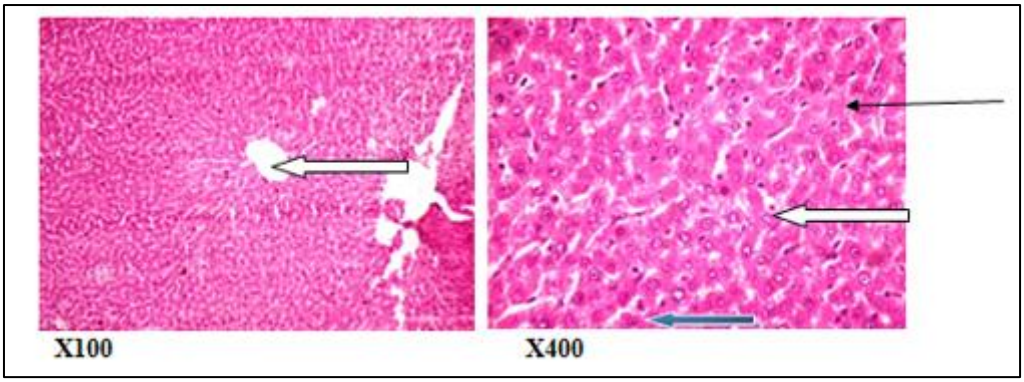

Figure 1c Photomicrographs of rat liver treated with *A. africanus* stained by Haematoxylin and Eosin showing normal central venules without congestion (white arrow), the morphology of the hepatocytes appear normal (blue arrow), the sinusoids appear normal and not infiltrated (slender arrow),no pathological lesion seen.

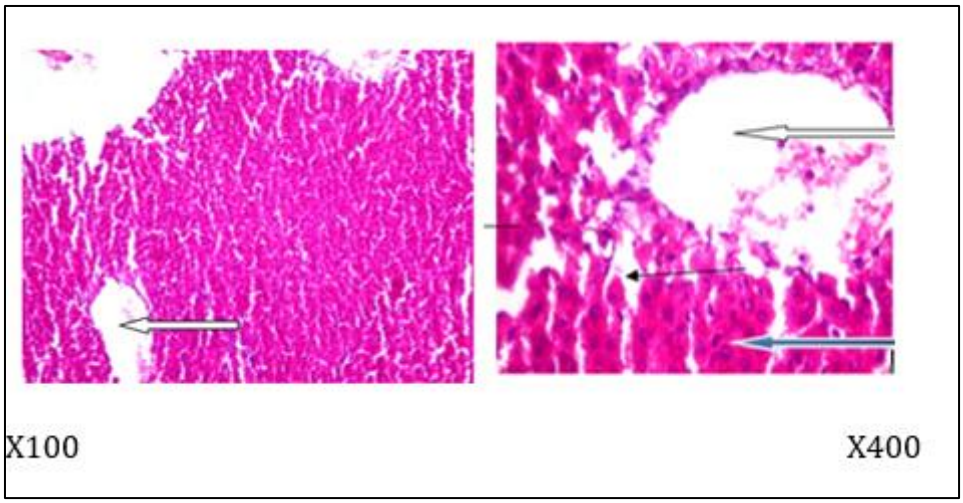

Figure 1D Photomicrographs of rat liver treated with ketoconazole (200mg**)** and stained with Haematoxylin and Eosin showing normal central venules without congestion (white arrow) and mild congestion seen in few portal veins (black arow), the morphology of the hepatocytes appear normal (blue arrow), the sinusoids is mildly infiltrated by inflammatory cells (slender arrow)

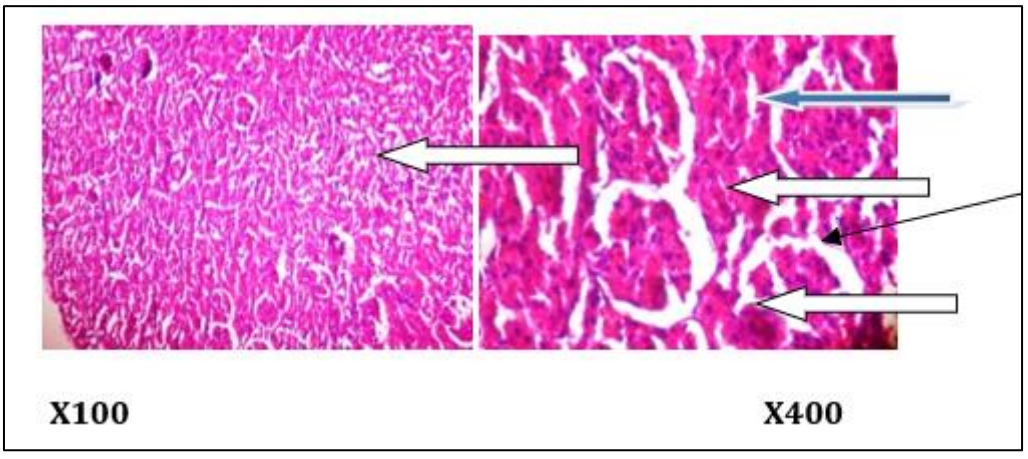

Figure 2A Photomicrographs of rat kidney fed with convectional feed mill (control) stained by Haematoxylin and Eosin showing normal architecture as seen in lower magnification x100, the renal cortex show normal glomeruli with normal mesengial cells and capsular spaces (white arrow), the renal tubules appear normal (blue arrow), the interstitial spaces appear normal (slender arrow)

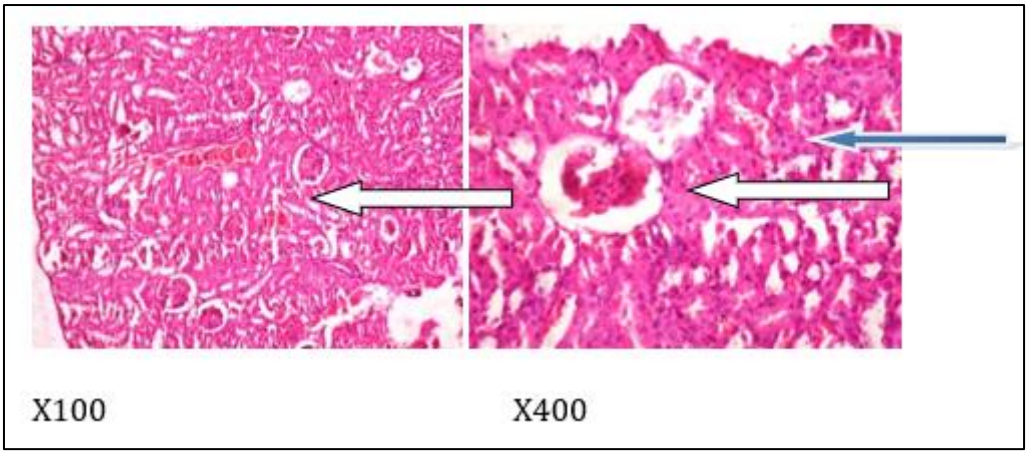

Figure 2B Photomicrographs of rat kidney inoculated with test organism and stained with haematoxylin and eosin reveal poor architecture, severe sclerotic glomeruli (white arrow), in the renal cortex, normal (blue arrow) renal tubules, and minor vascular congestion in the interstitial spaces (slender arrow)

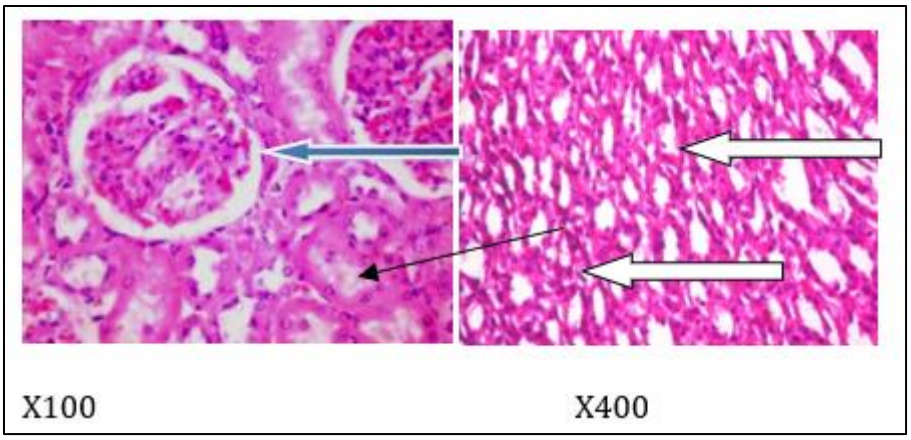

Figure 2C Photomicrographs of rat kidney treated with *A.africanus* stained with Haematoxylin and Eosin showing poor architecture, the renal cortex show few glomeruli with sclerosis (black arrow) and other glomeruli showing normal mesengial cells and capsular spaces (white arrow), the renal tubules appear normal (blue arrow), the interstitial spaces shows vascular congestion (slender arrow)

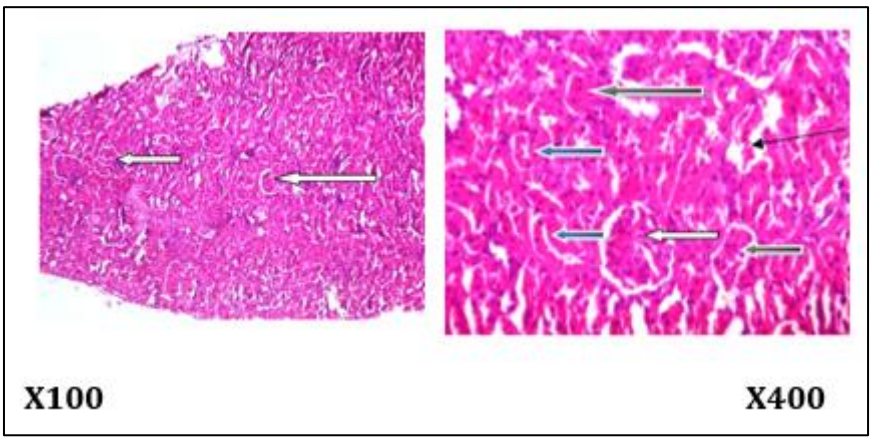

Figure 2D Photomicrographs of rat kidney treated with ketoconazole (200mg) stained by Haematoxylin and Eosin showing poor architecture, the renal cortex show few glomeruli with sclerosis (black arrow) and other glomeruli showing normal mesengial cells and capsular spaces (white arrow), the renal tubules appear normal (blue arrow), the interstitial spaces shows mild to moderate vascular congestion (slender arrow).

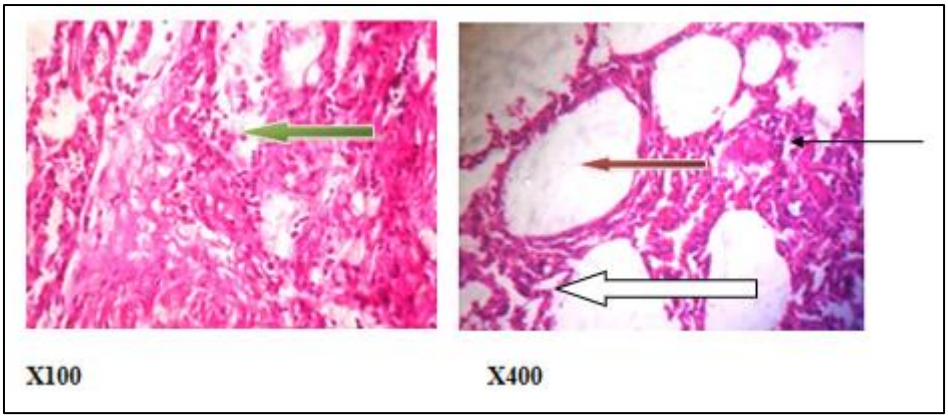

Figure 3A Photomicrographs of rat lung (control) stained by haematoxylin and eosin showing normal bronchiole (black arrow), mild alveolar dilatation seen (red arrow), the intra aveolar spaces show area of fibrosis (green arrow and white arrow) and moderately infiltrated by inflammatory cells (slender arrow)

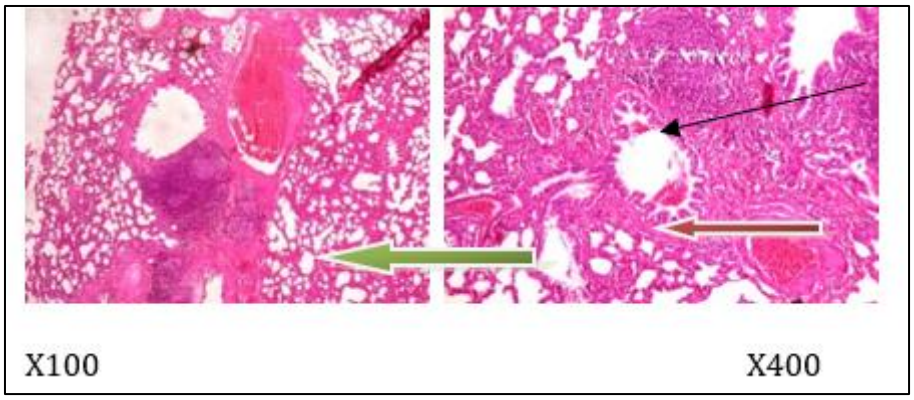

Figure 3B Photomicrographs of rsat lung inoculated with test organism stained by haematoxylin and eosin vessels with thick wall (green arrow), the intra aveolar spaces show severe epithelial hyperplasia with moderate infiltration of inflammatory cells (slender arrow) and the alveolar epithelium appear normal (red arrow)

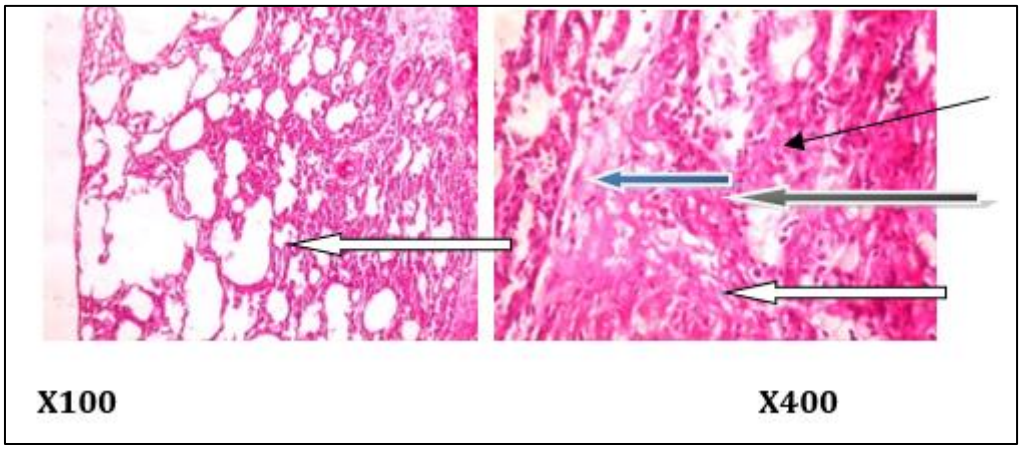

Figure 3C Photomicrographs of rat lung treated with *A. africanus* stained with haematoxylin and eosin showing normal bronchiolar lymphocytes (white arrow), there is mild vascular congestion (blue arrow), the intra aveolar spaces appear normal cells (slender arrow) and the alveolar epithelium appear normal (red arrow).

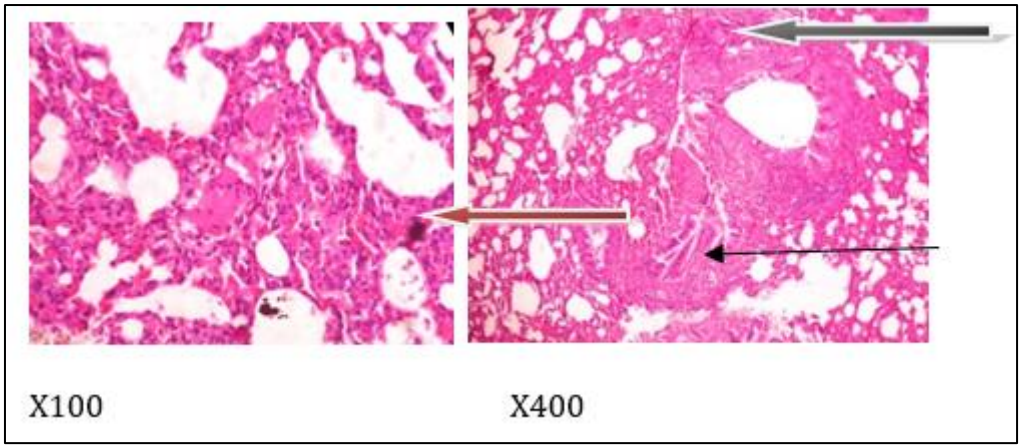

Figure 3D Photomicrographs of rat lung treated with Ketoconazole (200mg) stainedy haematoxylin and eosin showing normal bronchioles (black arrow), the intra aveolar spaces is moderately infiltrated by inflammatory cells and moderate epithelial hyperplasia (slender arrow) there are moderately dilated alveoli seen (red arrow)

4. Discussion

A total of 240 food samples (Rice "igbemo" curtiva, Maize and Groundnut) were analyzed for aflatoxin content and isolation of aflatoxin producing fungi from the 16 Local Government area of Ekiti State.

Fungal species isolated from rice were *Aspergillus flavus, Aspergillus parasiticus, Aspergillus niger, Botrytis cinerea*. The result obtained is in agreement with the result of Taligoola *et al.* (2010) who reported that *Aspergillus flavus, Aspergillus parasiticus, Aspergillus niger* were isolated from rice form Libya. Similarly, this conforms to those of Amanloo *et al. (*2014) who reported that *Aspergillus flavus, Aspergillus parasiticus, Aspergillus niger, Aspergillus fumigatus,* and *Rhizopus* sp were isolated from rice from Iran. Also, these are consistent with those of the study conducted by Asrani *et al*. (2019) who found that *Aspergillus flavus, Aspergillus parasiticus* and *Aspergillus niger* are the major fungi in cereals. Chen *et al.* (2013) stated that *Aspergillus flavus* and *Aspergillus parasiticus* are seldomly found in rice which does not conform to the result of this research work which may be as a result of the difference in environment, cultivation system and handling (Kebede *et al.,* 2016).

Fungal genera isolated from groundnut were *Penicillium* sp, *Rhizoous* sp, *Mucor* sp and *Aspergillus* spp. This conforms to the findings of Hamed *et al.,* (2019) that the most common fungi in nuts are *Aspergillus* spp., *Cladosporium* spp., *Penicillium* spp., and *Aspergillus flavus*. Also, Madilo *et al.* (2023) identified *Aspergillus flavus, Aspergillus niger, Aspergillus tamanii, Penicillium citrinum, Rhizopus stolonifer* in roasted groundnut sold in Bauchi State of Nigeria. Similarly, this is in agreement with the study of Aleiro and Ibrahim (2014) who observed *Mucor* spp, *Aspergillus* spp, *Penicillium* spp, *Curvularia* spp, *Fusarium* spp and *Rhizopus* spp in dried vegetable sold in Central Market in Sokoto, Sokoto State. This conforms to those of] *et al*. (2013) who reported that *Penicillium* spp and *Rhizopus* spp were found in peanuts. Also, this is consistent with the study of Akinnibosun and Osawaru (2015) who found that *Neurospora* spp, *Trichoderma* spp, *Aspergillus niger, Aspergillus flavus, Mucor* spp, *Rhizopus* spp, *Penicillium* spp and *Fusarium* spp in peeled and unpeeled groundnut sold in Benin.

Fungal genera isolated from maize were *Mucor* sp, *Aspergillus* sp, *Botrytis* sp, *Rhizopus stolonifer* sp*, Penicillium* sp, and *Aspergillus flavus.* This is in agreement with the result of Muthomi *et al.* (2012) who reported that maize samples had a higher contamination by *Aspergillus* spp. The reason for the high contamination by *Aspergillus* spp may be their high ability to colonize substrates that is rich in carbohydrate. This also conforms to those of Abubakar and Sule (2019) who reported that *Penicillium* sp and *Rhizopus* sp were isolated in maize from Cameroon. Similarly, this is in line with the result of Rosemary *et al.* (2013) who reported that the following fungal species: *Penicillium* sp., *Rhizopus* sp., *Aspergillus* sp. and *Mucor* sp were isolated in maize from Enugu State of Nigeria.

This study showed the presence of 185 isolates belonging to eleven (11) different genera identified from stored foods obtained from Ekiti State, Nigeria. Among the genera, *Aspergillus* had the highest number of occurence (70) followed by *Rhizopus* (48), *Botrytis* (19) and *Penicillium* (15). In all analyzed samples, the prevalent fungal genus was *Aspergillus* spp. which could have been as a result of their ubiquity character. This finding was in conformity with that of Nyirahakizimana *et al.* (2013) who reported that the genera *Aspergillus* was the major genera that affects nuts and seeds.

Similarly, this is in agreement with the study of Kumari and Ghosh, (2018) who reported that *Aspergillus flavus and Aspergillus niger* were the most visible and frequent fungi in Almonds from Japan. Mukhtar *et al.* (2019) reported that various fungi were isolated from fruits in Utako market, Abuja, Nigeria. *Aspergillus niger, Aspergillus parasitics, Aspergillus fumigatus, Rhizoous stolonifer, Mucor mucedo* and *Alternaria* spp in decreasing order. Similarly, Al-Hindi *et al.* (2017) showed that the fungal genera *Aspergillus, Penicillium, Fusarium and Rhizopus* were isolated from agar wood where *Aspergillus flavis, Aspergillus parasitics and Aspergillus niger* are the dominant fungi. His results also indicated that the most commonly isolated fungal genera were in the following descending order: *Aspergillus*, *Penicillium*, *Fusarium* and *Rhizopus*. Similarly, *Aspergillus* spp., *Penicillium* spp., and *Mucor* spp. were shown to be connected with dried cocoa beans during storage, according to research by Fagbohun (2015). Additionally, According to research by Kumari and Ghosh (2018), *Aspergillus flavus*, *Rhizopus oryzea*, and *Rhodosporidium toruloides* are the most common fungi found in West Bengal connected with stored food grains which correlates with this research.

The identity of the isolates which was determined by molecular characterization shows that they hire similarities to strains of isolates in the *Aspergillus* and *Trichoderma* genus except for two that did not show any result. The species determination was confirmed by PCR with the primers specific for the ITS-rDNA region sequencing. Out of the 6 isolates (B2, B3, B4, B6, B5, B1), B2, B3, and B6 were *Aspergillus flavus,* B4 was *Trichoderma viridie,* B5 and B1 did not show any visible result. The prevalence of *Aspergillus flavus* in the stored foods was above 50%, which is very high, and indicates the possible high level production of aflatoxin in food samples under study (Afzal *et al.,* 2022). Also, Al-Hindi *et al.* (2017) detected among *Aspergillus* genera, *A. flavus* and *A. ochraceus* based on their morphology and confirmed by PCR using specific primers in his research on isolation and characterization of mycotoxigenic fungi in agarwood which is in line with this research.

The study of histopathology of organs of animals administered with ethanolic extract of the plant showed normal liver with mild congestion of the hepathocytes while the kidney also showed fluid accumulation around the interstitial spaces. The lung of the rat showed mild infiltration of the intral aveolar spaces. The result of this work is similar to El-Ishaq *et al.,* (2020) in which the histopathology result showed that kidneys appeared normal, while livers were congested with mildly swollen hepatocytes and occasional binucleation.

The histolopathology result of animals administered with aqueous extract showed that the liver appeared normal without congestion of the hepathocytes. The kidney appeared normal with mild vascular congestion and the lung had normal bronchioles. There are no histopathological harmful effects observed on all the organs.

Liver and kidney are two important organs that play a key role in the body's numerous metabolic processes (Uchenna *et al.,* 2023). Liver dysfunction was evident with significant increase in the studied liver function biomarkers of the *Aspergillus flavus* induced rats. The photomicrograph of the liver showed portal vein with congestion while some of the hepatocytes showed piknotic nuclei and the sinusoids appear normal and not infiltrated (Miglio *et al*., 2013). On administration of *Asparagus africanus*, the morphology of the hepathocytes were normal and the sinosoids were no longer infiltrated. The kidney was mildly infliterated, poor architecture and vascular congestion before treatment. On treatment, there was reduction of the negative effects on the organs. This results correlates with El-Ishaq *et al.* (2020). The lung of the animal showed severe epithelial hyperplasia and moderate inflammatory cells but after treatment there were changes in the cells of the lung. The organs of animals administered with ketoconazole were mildly affected. This reaction is similar to the animals given *Asparagus africanus*.

5. Conclusion

This study demonstrated a high prevalence of aflatoxin contamination in commonly consumed food crops such as maize, rice, and groundnut across Ekiti State, with aflatoxin B_2 being the most frequently detected and concentrations reaching up to 88.22 ppb; well above international safety limits. Experimental exposure in albino rats confirmed significant biochemical and histopathological damage to the liver, kidneys, and lungs, as evidenced by elevated enzyme biomarkers and disrupted tissue structures. However, treatment with *Asparagus africanus* extract at 100 mg/kg showed notable protective effects, comparable to ketoconazole, by reducing biomarker levels and restoring normal organ architecture. These findings underscore the serious health risks posed by aflatoxin-contaminated food and support the potential use of medicinal plant extracts as a natural therapeutic approach in managing mycotoxicosis.

Compliance with ethical standards

Acknowledgments

I wish to express my profound gratitude to the Tertiary Education Trust Fund (TETFund) for providing the financial support and resources that made this research project possible. The funding received under the TETFund Research Grant Intervention was instrumental in facilitating field sample collection, laboratory analyses, and other critical aspects of the study. Your commitment to advancing research and academic excellence in Nigerian tertiary institutions is deeply appreciated.

I also extend my sincere thanks to the management of The Federal Polytechnic, Ado-Ekiti, for their encouragement and administrative support throughout the course of this project. My appreciation goes to the members of the research committee, colleagues, and technical staff who offered valuable insights, guidance, and assistance at various stages of the work.

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of ethical approval

Ethical clearance was obtained from the Research Committee of Federal Polytechnic, Ado-Ekiti prior the commencement of the study.

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