

The Effect of Mycotoxins on Human Health

Roba.S.Momena¹, Rehab T. Dhafer², Abdullah S. Hawsawi², Fahad H. Alzahrani², Aedh S. Alghamdi³, Fatimah J. Saleh⁴, Hassan M. Al-Aqeeli², Mahmoud H. Abdalwasi², Abbas M. Nasurullah², Haleemah A. AL- Bayaby², Fares A. Alqahtani², Jawaher T. AL-Harbi⁵, Ghaydaa.A.Mazhar¹, Ayman.H.Abdulraheem⁶, Amal.A.Althobity¹, Abdulrahman.A.Alsobhi⁷, Arwa M.Bogdadi⁸, Ayoub K. Althobaiti⁹

¹Laboratory specialist at king Abdulaziz Hospital

²Laboratory Technician at Blood Bank in Dammam

³Laboratory Specialist at Blood Bank in Dammam

⁴Laboratory Technician at Region Laboratory in Dammam

⁵Laboratory Specialist at Regional in Riyadh

⁶Laboratory specialist in the forensic medicine department at the forensic medical services center in Mecca region

⁷Laboratory technician at Al-Nour specialized Hospital

⁸Laboratory specialist at Genreal sarat obaidah Hospital

⁹Laboratory specialist at king Faisal Hospital

Abstract

The aim of the current study is, what are mycotoxins, what are the risks of mycotoxins on human health, where are mycotoxins found in nature, and what are the health effects of mycotoxins on humans. the questionnaire was created electronically via the Google Drive program, and then it was distributed via mobile phone on the social networking program (WhatsApp)? Using e-mail for all participants to respond to the questionnaire. 650 questionnaires were distributed to all mobile groups, and 600 questionnaires were received on the researcher's e-mail. (The target group is residents of the holy city of Mecca, aged 25-55 years).

Keywords: *effect of mycotoxins, on human health.*

Introduction

A mycotoxin (Greek μύκης mykes, "mushroom" and τοξικόν toxikon, "poison") is a toxic secondary metabolite produced by organisms of the kingdom Fungi and capable of causing illness and death in both humans and other animals. The term "mycotoxins" is usually reserved for toxic chemical products produced by fungi that easily colonize crops. A single mold species may produce many different mycotoxins, and several species may produce the same mycotoxin(1). Most fungi are aerobic (use oxygen) and are found almost

everywhere in very small quantities due to the small size of their spores. Consume organic matter anywhere there is adequate humidity and temperature. When conditions are right, the fungi multiply into colonies and mycotoxin levels become high. The cause of mycotoxin production is not yet known. It is not necessary for the growth or development of fungi. Because mycotoxins weaken the recipient host, fungi may use them as a strategy to improve the environment for further fungal spread. The production of toxins depends on the surrounding internal and external environments, and these substances vary

greatly in their toxicity, depending on the affected organism, its sensitivity, metabolism and defense mechanisms. Fungi produce a wide range of chemical compounds, some of which are useful in industry, such as making types of cheese, and others are important from a health standpoint, such as antibiotics resulting from some types of fungi and many others. Some fungi also produce compounds that are highly toxic to animals and humans, and some of them may cause Cancerous tumors. It is worth mentioning that mycotoxins have been known for a long time, but serious studies did not begin until the early sixties of this century. There are types of mycotoxins such as: Aflatoxins are a type of mycotoxin produced by *Aspergillus* species of fungi, such as *A. flavus* and *A. parasiticus*. The umbrella term aflatoxin refers to four different types of mycotoxins produced, namely B1, B2, G1, and G2. Aflatoxin B1, the most toxic, is a potent carcinogen and is directly linked to adverse health effects, such as liver cancer, in many animal species. Aflatoxins are largely associated with commodities produced in tropical and subtropical regions, such as cotton, peanuts, spices, pistachios, and corn. Ochratoxin is a mycotoxin that comes in three secondary metabolite forms, A, B, and C. It is produced by both *Penicillium* and *Aspergillus* species. The three forms differ in that Ochratoxin B (OTB) is the non-chlorinated form of Ochratoxin A (OTA) and that Ochratoxin C (OTC) is the ester form of Ochratoxin A. *Aspergillus ochraceus* is found as a contaminant of a wide range of goods including beverages such as beer and wine. *Aspergillus carbonarius* is the main species found in grape fruit (2), which releases the toxin during the juice-making process. Citrinin is a toxin that was first isolated from *Penicillium citrinum*, but has been identified in more than a dozen species of *Penicillium* and several species of *Aspergillus*. Some of these species are used for human food production such as cheese (*Penicillium camemberti*), sake, miso, and soy sauce (*Aspergillus oryzae*). Citrinin is associated with rice yellow disease in Japan and acts as a nephrotoxicant in all animal species tested. Although they are associated with many human foods (wheat,

rice, corn, barley, oats, rye, and foods colored with Monasco), their full importance to human health is not known. Citrinin can also act synergistically with Ochratoxin A to decrease RNA synthesis in rat kidneys. Ergot poisoning is a compound produced as a toxic mixture of alkaloids in ergot by pinworm species, which are common pathogens of various grass species. Ingestion of ergot spores from infected grains, usually in the form of bread produced from contaminated flour, causes ergotism, a human disease known historically as St. Anthony's Fire. There are two forms of ergotism: gangrenous, affecting blood supply to the extremities, and spastic, affecting the central nervous system. Modern methods of grain cleaning have greatly reduced ergotism as a human disease. However, it remains an important veterinary problem. Ergot alkaloids have been used pharmaceutically. Patulin is a toxin produced by *P. expansum*, *Aspergillus*, *Penicillium*, and *Paecilomyces* fungal species. *P. expansum* is particularly associated with a range of moldy fruits and vegetables, especially moldy apples and figs. They are destroyed by the fermentation process and are not even found in apple drinks, such as apple juice. Although patulin has not been shown to be carcinogenic, it has been reported to damage the immune system in animals. In 2004, the European Community set limits for patulin concentrations in food products. It currently stands at 50 µg/kg in all fruit juice concentrations, at 25 µg/kg in solid apple products used for direct consumption, and at 10 µg/kg for baby apple products, including apple juice. Fusarium toxin is produced by more than 50 species of fungi and has a history of infecting developing grains such as wheat and corn. They include a group of mycotoxins, such as fumonisins, which affect the nervous systems of horses and can cause cancer in rodents. trichothecenes, which is closely associated with chronic and fatal toxic effects in animals and humans; and zearalenone, which is not associated with any fatal toxic effects in animals or humans. Some other major types of Fusarium toxins include: beauvercin and enniatins, butenolide, equisetin, and fusarins. Some of the health effects found in animals and humans include death, specific diseases or

health problems, and weakened immune systems without specificity to toxins, allergens or irritants. Some mycotoxins are harmful to other microorganisms such as other fungi or even bacteria. Penicillin is one example. It has been suggested that mycotoxins in stored animal feed are the cause of rare stereotypical sex changes in chickens that cause them to look and act male. Mycosis is a term used for poisoning associated with exposure to mycotoxins. Mycotoxins have the potential to cause acute and chronic health effects through ingestion, skin contact, inhalation, and entry into the bloodstream and lymphatic system. They inhibit protein synthesis, damage pharyngeal systems, prevent particle clearance from the lung, and increase sensitivity to bacterial endotoxin. Symptoms of mycotoxin poisoning depend on the type of mycotoxin. Concentration and length of exposure; As well as the age, health, and gender of the exposed person. Synergistic effects associated with several other factors such as genetics, diet, and interactions with other toxins have been poorly studied. Therefore, it is possible that vitamin deficiency, calorie deprivation, alcoholism, and infectious disease status have compound effects with mycotoxins.(3)

Material and Methods:

The study started in (the holy city of Mecca in Saudi Arabia), began writing the research and then recording the questionnaire in May 2023, and the study ended with data collection in October 2023. The researcher used the descriptive analytical approach that uses a quantitative or qualitative description of the social phenomenon (The effect of mycotoxins on human health). This kind of study is characterized by analysis, reason, objectivity, and reality, as it is concerned with individuals and societies, as it studies the variables and their effects on the health of the individual, society, and consumer, the spread of diseases and their relationship to demographic variables such as age, gender, nationality, and marital status. Status, occupation (4), And use the Excel 2010 Office suite histogram to arrange the results using: Frequency tables Percentages

(5). A questionnaire is a remarkable and helpful tool for collecting a huge amount of data, however, researchers were not able to personally interview participants on the online survey, due to social distancing regulations at the time to prevent infection between participants and researchers and vice versa (not coronavirus participation completely disappearing from society). He only answered the questionnaire electronically, because the questionnaire consisted of ten questions, all of which were closed. The online approach has also been used to generate valid samples in similar studies in Saudi Arabia and elsewhere (6)

Results and discussion:

The percentage of those who agreed to participate in the research questionnaire was 98.9% and those who refused was 1.1%. The percentage of participants' ages was from 25-55 years as follows: 25-34 (44.3%), and from 35-44 years of age it was (also the same percentage), while those from 45- 55 years (the percentage was 11.4%). Their gender was as follows: 44.3% male and 55.7% female. Their nationalities are as follows: the percentage of Saudis was 87.4%, and non-Saudis were 12.6%. As for educational status, it was as follows: student 15.9%, government employee 45.5%, private sector employee 15.9%, self-employed 5.5%, housewife 14.8%, career worker 2.4%. As for the distribution of the questionnaire to the participants and their responses to it, their answers (yes or no) were as follows: The first question: Are mycotoxins secondary metabolic compounds produced by many fungi that are capable of causing disease in humans? Yes 100% and no 0%. The second question: Is the production of mycotoxins limited to several types of fungi, as there are more than 100 types of pathogenic fungi that have the ability to produce toxic compounds that cause pathological effects in humans? Yes 94.3% and No 5.7%. The third question about which of the most famous fungal toxins is Aflatoxin? Yes 88.6% No 11.4%. The fourth question: What is the advantage of mycotoxins being their ability to resist heat to a degree? It

is difficult for these toxins to be destroyed by traditional heat treatments used in cooking and manufacturing processes? Yes 85.1% and no 14.9%. The fifth question: Do mycotoxins have a cumulative effect that does not appear quickly, but rather appears after 10-20 years of eating food contaminated with them? Yes 70.5% and no 29.5%. The sixth question: Do mycotoxins differ depending on the type of growing mushroom, the food material, and the availability of conditions in terms of temperature, humidity, oxygen, and pH? Yes 93.1% and No 6.9%. Question 7: Most fungi are aerobic (use oxygen)? Yes 72.7% and no 27.3%. The eighth question is about mycotoxins. Are they a comprehensive group of toxins that can grow in nuts - grains - spices - dried fruits - coffee beans? Yes 83.3% and no 17%. The ninth question: It has been proven that some fungal toxins, including aflatoxin, which is one of the most important fungal toxins, lead to liver cancer, as it was found that there is a relationship linking some diseases and aflatoxin toxins, and one of these diseases is viral liver disease? Yes 82.8% and no 17.2%. The last question about the ways to avoid the risk of mycotoxins is: buying nuts as fresh as possible, ensuring that food is stored appropriately, and not keeping food for long periods? Yes 94.3% and no 5.7%. (figure.No.1).

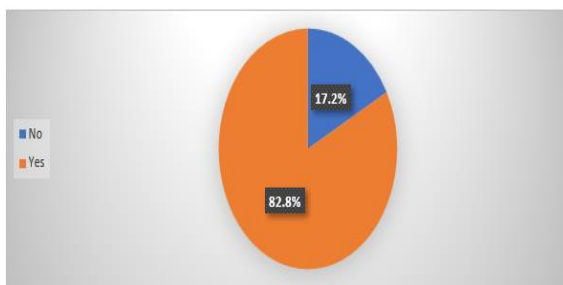


Figure No.1: Opinions and trends of participants researching the effects of mycotoxins on humans.

Conclusion:

Mycotoxins have economic and health effects on humans, in addition to contaminating animal and plant products, which in turn should not be

used in animal feed because they are contaminated with mycotoxins.

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