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Iman H Al Fayyadh

Department of Medical Analyses,
College of Sciences, University of
Thi-Qar, Iraq

A comparative study of the fungi spread in Arabic coffee beans in Iraq and some neighboring countries

Iman H Al Fayyadh

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Abstract

Coffee pain can cause disease, and moisture is known to be a catalyst for fungal growth. In this study, many fungi are identified that may cause a number of expected and dangerous chronic diseases in most people who are addicted to drinking coffee every day. And without adhering to the sound health rules, in which a violation of some or part of them may cause the growth of fungi and the dangerous fungal toxins they produce in coffee, which negatively affect the lives of people who are addicted to drinking coffee, as the coffee making machine and other tools used in drinking coffee provide a suitable environment for the growth of The presence of pathogenic fungi, in addition to their production of toxins, the majority of which are carcinogenic substances that affect, in one way or another, people's lives. Study that fungi that can infect coffee grounds may lead to the accumulation of mycotoxins in the target tissues and organs. Six types of fungi were found in coffee with different percentages ranging from 8.2 to *Aspergillus* as the highest percentage, while *Penicillium* was the lowest with a percentage of 1.25. It was not limited to just coffee, but also tea, with *Aspergillus flavus* being the most frequently encountered. By comparing all the results that came in a study, we find that these six types of fungi are present in coffee, caffeinated substances, and tea, with varying frequency.

Keywords: Fungi, Arabic coffee, *Aspergillus*

Introduction

Coffee is one of the most valuable agricultural materials today. (ICARD, 2002), and about 125 million people in Latin America and Asia depend on coffee (Osorio 2002; Lewin *et al.*, 2004) [9, 7]. There are two commercial species: *Coffea arabica* and *C. canephora*. High quality coffee is related to the *Coffea arabica* plant and this variety represents 73% of world production and in Latin America (Charrier and Berthaud, 1985) [21]. (Lewin *et al.*, 2004) [7]. It is mainly cultivated in Central and West Africa, and it constitutes 80% of the majority of African production. Yemen is historically one of the most important countries in the production of coffee, as it is considered the most important agricultural commodity in the world (Anonymous, 2005) [1]. The role of pathogens in coffee has been described as an essential link (O'Neill *et al.*, 1991; Bethlenfalvay and Linderman, 1992) [22, 4]. It is also considered one of the most important problems associated with coffee production today, as indicated by Rosendahl and Rosendahl, 1991 [23]; Caravaca *et al.*, 2003 [24]; Al-Karaki and McMichael, 2004 [2] (Selosse *et al.*, 2004) [25].

Mycotoxins

Species of fungi produce toxic compounds through secondary metabolic processes called mycotoxins. (Nakhilan, 2011) [26]. Mycotoxins are known toxic secondary metabolite compounds having low molecular weights. Hundreds of types of mycotoxins have been discovered, the most important of which are aflatoxin, trichothecin, ochratoxin, and xeralenone, all of which are toxic that affect the activities of the body of the organism in various forms and may lead to its death if taken within internationally agreed limits. to allow their presence in materials either used in human food or used in agricultural animal feed (Creppy, 2002 and Scott, 1965) [27, 28].

A number of disease cases were also recorded in humans before 1900, that is, at the end of the nineteenth century, which was called poisonous food Alkia in the Soviet Union in the province of Orberg and spread during 1942-1948 AD, which led to infection. 60% of the population and 10% of those infected died as a result of *Fusarium*-contaminated food. Most of its symptoms are ulcerations and bleeding, bone marrow shatter, decrease in leukocytes, and ulcers in the gastrointestinal tract.

Corresponding Author:

Iman H Al fayyadh

Department of Medical Analyses,
College of Sciences, University of
Thi-Qar, Iraq

Fungi producing mycotoxins

Mycotoxin-producing fungi belong to six genera of fungi, which are the most characterized by their ability to produce mycotoxins and live in a variety of environments of temperature and humidity. These genera are *Aspergillus* spp. *Penicillium*, *Fusarium*, *Claviceps*, *Stachybotrys*, *Neotyphodium* (Cast 2003, *Rhizopus*, *Mucor* *Trichothecium*, *Trichoderma*, *Rhizoctonia*) [29], Genera, *Aspergillus*, *Penicillium*, and *Fusarium*, are the most productive in granaries. *Fusarium* is found in cereals in the field and during storage. The biological effects of mycotoxins on the human body according to the type of toxin and the genus and type of fungus (Hamilton *et al.*, 1982; IFST, 2006; Ezekiel *et al.*, 2011) [30, 31]. Toxic effects of mycotoxins differ in their chemical composition, and therefore differ in toxicity, as the toxins are generally considered toxic to cells and interfere with physiological processes in the nervous system, circulatory system, and digestive system. and reproductive and internal organs such as the liver, heart and spleen. And the lungs and others (Nakhilan, 2011, and Plagnat, 2004) [26, 32], where it was found that there is a significant relationship between some diseases and mycotoxins, as in aflatoxins and hepatitis B virus. As this toxin, in the presence of mycotoxins, leads to liver cancer (Krishnamachari *et al.*, 1975) [33].

Effect of mycotoxins on body tissues

The liver is the target organ in the case of poisoning with most types of mycotoxins, and it may be in other organs.

And that the diseases resulting from the consumption of fodder contaminated with mycotoxins, including aflatoxins, range from acute hepatitis to In turn, it is characterized by the occurrence of necrosis, hemorage, and the occurrence of clear fatty changes in the liver as a result of fatty infiltration and necrosis in the center of the hepatic lobules (Centro lobular necrosis), as well as the occurrence of chronic forms, while cumulative exposure to different forms of these toxins. It leads to cancer, especially hepatocellular carcinoma (Williams *et al.*, 2004) [34]. A toxins led to the emergence of disease symptoms such as kidney damage and a change in urine to dark urine, in addition to the abstention of these animals from eating fodder anorexia.

Results

The main types of mycotoxins were classified based on the affected organ. According to previous studies, they are called hepatoxins that affect the liver, neurotoxins that affect the nervous system, and nephrotoxins that affect the kidneys, as indicated by the researcher (Eaton and Gallagher, 1994) [35]. The reason for the spread of fungi in coffee throughout the months of the year is in these different proportions depending on the environmental conditions and fungi, as indicated by the researcher, and it was found through previous research that the most prevalent fungal species were *Aspergillus*, with a percentage of 8, while the rest of the proportions ranged differently for the rest Fungal species such as *Penicillium* and others, according to the attached table below

Table 1: Fungal frequency ratios in the coffee herb in yemen.

No.	Fungi	%
1	<i>Aspergillus flavus</i>	8.2
2	<i>A. niger</i>	8
3	<i>Alternaria alternate</i>	-
4	<i>Fusarium oxysporum</i>	3
5	<i>Penicillium</i>	1.25
6	<i>A. terrus</i>	2

In comparison with the fungi that may be present in tea, it was found that the fungi present in tea were present in lower proportions as a simple comparison to draw attention between fungi in coffee and fungi that may have a high frequency in coffee and tea, as it was found that the majority are also prevalent for *Aspergillus* fungi, while They are less for the rest of the other types, and in general, the fungi in tea are less than the fungi in coffee, and in the various types of Arabic and Turkish coffee

Table 2: Fungal frequency ratios in the tea

No.	FUNGI	%
1	<i>Aspergillus flavus</i>	5
2	<i>A. niger</i>	4
3	<i>Alternaria alternate</i>	2
4	<i>Fusarium oxysporum</i>	2
5	<i>Penicillium sp</i>	-
6	<i>A. terrus sp</i>	-

Table No. 3 indicates the presence of fungi in coffees in the Kingdom of Saudi Arabia, as we note the presence of fungi and they were at lower frequencies than Table No. 1, which was referring to the presence of fungi in Arabic coffees in Yemen. The reason may be due to the different environments or quality control in both countries. The dominant fungi are *Aspergillus*, which has a higher

frequency than other fung

Table 3: Fungal frequency ratios in the cafee

No	Fungi	%
1	<i>Aspergillus flavus</i>	4
2	<i>a.niger</i>	2
3	<i>Alternaria alternate</i>	1
4	<i>Fusarium oxysporum</i>	-
5	<i>penicillium</i>	1.77
6	<i>a.tesrrus</i>	1

Table No. 4 indicates the presence of fungi in coffee in some parts of Qatar, as we note the presence of fungi at lower frequencies than Tables 1 and 2. The reason may also be due to the different environments or quality control in both countries. The dominant fungi are *Aspergillus*, which has a higher frequency than other fungi.

Table 4: Fungal frequency ratios and mycotoxins in the coffee

No.	Fungi	%
1	<i>Aspergillus flavus</i>	4
2	<i>A. niger</i>	2.3
3	<i>Alternaria alternate</i>	1
4	<i>Fusarium Oxysporum</i>	-
5	<i>Penicillium</i>	-
6	<i>a.tesrrus</i>	-

Discussions

We investigated the possibility of fungi growing in coffee plants and then creating toxins in coffee beans prior to their transmission and effect on humans through known mycotoxin pathogens. Which differ according to the type of fungus that it consists of. It should be noted that the pathogenicity of these toxins varies according to the target organ. These pathogenicity can range from simple fungal poisoning to carcinogenicity. Therefore, attention should be paid to the topic of fungus in coffee because of the large amounts of its consumption. daily, and to avoid potential risks of mycotoxin infection The mycotoxins in coffee are important. Ochratoxins-A are the most important mycotoxin contaminants in agricultural products. Due to its toxicity, its effects on humans and animals continue to cause global concern (Joshi, V. Ex., 2017) ^[12]. *Aspergillus* species produce ochratoxin in the forms ochratoxin-A is the most prevalent and the most toxic (McQueen, C. 2017) ^[13]. (Culliao *et al.* 2015) ^[36] *Fusarium*, *Mucor*, and *Rhizopus* isolates from coffee beans that produce ochratoxin-A., and cannot be completely removed due to its light molecular weight (Khan, SA; e.g., 2019) ^[14]. Mycotoxin production depends on fungal growth (Santiago, WD; e.g., e 2020) ^[15], and green coffee beans can be contaminated with stored fungi (Viegas, C; eg, e 2017) ^[16]. Suárez-Quiroz *et al.* (2004) ^[19] that different levels of ochratoxin-A are produced during processing stages; The incidence of infection in green coffee is lower than in parchment paper and coffee berries, (Suárez-Quiroz, M. eg., 2004) ^[19]. There are still 13 countries (including Africa) that do not have food safety regulations (Cinar, A. 2020) ^[16] conclusions we conclude from the above study that fungi that can infect coffee grounds may lead to the accumulation of mycotoxins in the target tissues and organs. Six types of fungi were found in coffee with different percentages ranging from 8.2 to *Aspergillus* as the highest percentage, while *Penicillium* was the lowest with a percentage of 1.25. It was not limited to just coffee, but also tea, with *Aspergillus flavus* being the most frequently encountered. By comparing all the results that came in a study, we find that these six types of fungi are present in coffee, caffeinated substances, and tea, with varying frequency.

Conflict of Interest

Not available

Financial Support

Not available

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