

# The Health Impact of Fungi Associated with Seed Nuts and Dried Fruits in Local Markets of Erbil City

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**Abstract**—Due to high nutritional value, nuts have been consumed by humans all over the world, moreover some nuts are included in the animal's feed. A number of fungi associated with seed nuts are widely documented. These fungi produce different metabolites with poisonous and/or carcinogenic effects.

In the current study, eight types of nuts seeds and dried fruits were examined. Samples are intended for human consumption, including walnuts, almonds, peanuts, dried grapes, dried figs, cashew, green seeds, and dried berries. By washing method was followed (W/V= 10g/ 50ml sterilized distilled water). Fungal isolates were *Asp. niger*, *Alternaria sp.*, *Geotrichum*, *Cladosporium sp.*, *Stemphylium*, *Rhizopus sp.*, *Asp. fumigatus*, *Asp. flavus*, *Asp. nidulans*, *Mucor sp.* yeast and white mycelia. *Aspergillus* spp were predominant followed by *Cladosporium sp.* while the dried fig showed the highest number of isolates followed by dried grapes (40, 26 respectively). The isolated fungi include a number of the most fungal allergens and mycotoxin producers.

**Keywords:** nut seeds, dray fruits, fungi, mycotoxin, Erbil.

## INTRODUCTION

Nuts are very nutritious, whether they are eaten raw or roasted. They have a high fat, protein, carbohydrates, vitamins, amino acids and several minerals. They are consume either raw or after processing as well as, different nuts are used in industry or as a part of feed. [1]

Fungi may contaminated nuts and dried fruits during the field period or during the packaging and storage period, as well as the transportation and marketing. [2] These fungi develop quickly on nuts and dried fruits in poor storge environment, their total count and diversity are highly related with the chemical composition of the substrate. Abbas et al (2019) recorded 16 fungal isolates from different nuts and dried fruits in Karachi-Pakistan, and most of them were mycotoxin producers and agents of allergy.[3] In addition to causing food to spoil, a variety of fungi, including *Alternaria*, *Aspergillus*, *Fusarium*, *Mucor*, *Rhizopus*, *Penicillium*, *Candida* and others, can grow in these food stuffs and when consumed, cause a

number of health problems, including mycoses, which can range in severity, especially in patients with weakened immune systems. [4] Mycotoxicosis is a harmful health condition that is frequently brought on by fungus contamination. It can have severe symptoms include acute poisoning, liver illness, cancer, and neural tube anomalies. [5] As of right present, there are more than 500 identified mycotoxins, and the count keeps growing. Mycotoxins are secondary metabolites that fungi make as a byproduct of fungal spoilage in agricultural goods. They can be formed at any point in the food chain, including before, during, and after harvest. [6]

There is a long history of linking mycotoxins to outbreaks of foodborne illness in both people and animals. However, the discovery of aflatoxins has only highlighted the importance of mycotoxins for the health of humans and animals in the last 60 years. Since then, hundreds more hazardous substances have been found through both field research and lab studies. However, most of these compounds occur at low concentration and with minimum impact to health.

Aflatoxin A, fumonisins, deoxynivalenol, patulin, ochratoxin A, aflatoxins, and zearalenone are the principal mycotoxins that are important to both human and animal health. The most prevalent sources of these mycotoxins are cereals and nuts; however, they can also be found in certain other goods like coffee. [7]

This study was created to assess the fungal load in dried fruits and nuts sold by local vendors in various parts of Erbil city, keeping in mind the risks of fungal growth in food items, especially those that are sold openly in local markets.

Materials and Methods

## SAMPLES COLLECTION

Fifty samples of dried fruits and nuts were collected from different parts of Erbil city in December 2023. Each 100g sample was kept apart in nylon bags at 4oC so that none of them became wet. Samples include walnuts, almonds, peanuts, dried grapes, dried figs, cashews, green seeds, and dried berries.

Culturing and identification:

By washing method (W/V= 10g/ 50ml sterilized distilled water) was used, after shaking vigorously for 2 minutes, 1ml of washing water was transferred to a sterilized disposable Petri dish. A 15ml of warm sterilized Sabouraud's dextrose agar medium was poured in the Petri dish and mixed with water samples via rotary movement. The culture medium was supplemented by Chloramphenicol (15 mg/L) to prevent bacterial growth. Three duplicates were prepared for each sample, after that they were kept in nylon bags and in lab environment.

The cultures were checked daily from the third day over a period of 4 weeks. The observed developing fungal growths were directly transferred to Sabouraud's dextrose agar to prepare a pure culture. The identification was conducted via macroscopic and microscopic characteristics based on [8, 9]

Fungal community analysis:

In order to identify the predominant taxa, the occurrence% and frequency % was calculated via the following equations:

$O\% = (\text{No. of times fungal appear} / \text{No. of collected samples}) \times 100$

$F\% = (\text{No. of fungal isolates} / \text{No. of total fungal isolates}) \times 100$  [10]

## RESULTS AND DISCUSSION

Fungi were recorded in all examined samples (100%) with variable level of contamination. A total of 12 isolates were recognized in the 8 types of samples named *Aspergillus niger*, *Alternaria*, *Geotrichum*, *Cladosporium*, *Stemphylium*, *Rhizopus*, *Asp. fumigatus*, *Asp. flavus*, *Asp. nidulans*, *Mucor*, yeast (unidentified) and white mycelia. (Figure:1)

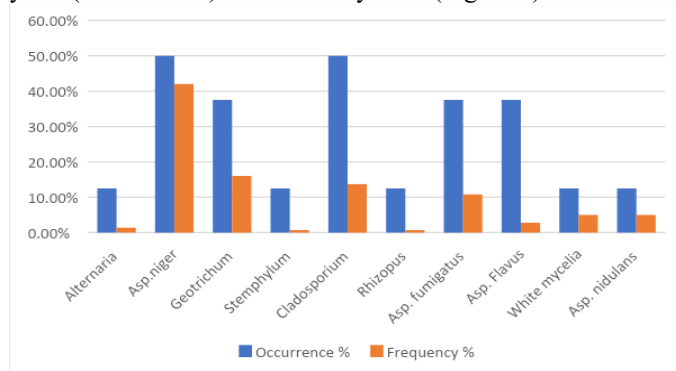


Figure 1: The isolated fungi from seed nuts & their occurrence % & frequency %.

With eight genera, the class Hyphomycetes is the most common by 5 genera named Aspergillus, Alternaria, Stemphylium, Cladosporium, and Geotrichum), followed by Zygomycetes by Rhizopus. Of the five hyphomycetes, Aspergillus had the highest frequency and occurrence. The previous studies in Erbil city concerned to food stuff or other substrate showed same taxonomic distribution. [11] In soil recorded the same distribution [12].

Hyphomycetes as well as Aspergillus created a predominant level in artificial environment as in the natural one. A study

created by Al-Bader et al (2018), Aspergillus was one of the most occurrences and frequent genera among the 410 colony-forming units that were counted from the filters of air-conditioned units in five hospitals. A 76% of CFU belong to the Hyphomycetes group. [13] A studies on airborne fungi in Erbil city created the same finding. [14,15]

From other side of view, the richness index (fungi/sample) showed a variable value. Fungal community composition is generally influenced by the water content and chemical structure of the substrate as well as the storage environment. [16] Other results explained that the highest number of CFU developed in dry fig followed by dry grapes samples (40, 26 respectively). Both types of samples stand out from the rest due to their softness and semi-available sugar.

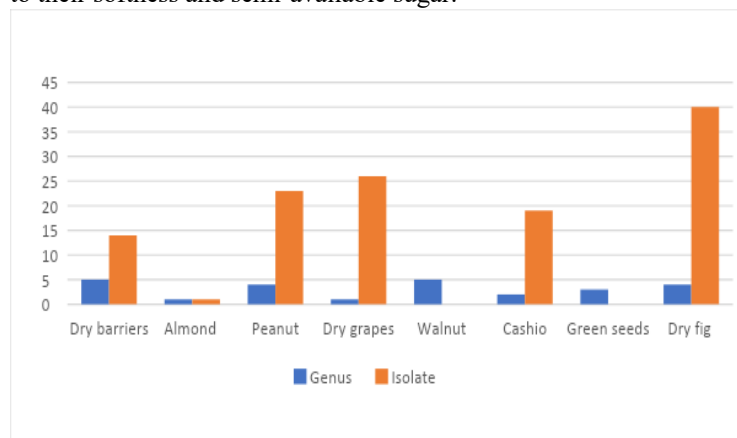


Figure 2: The number of fungi isolates from the eight materials

A global intensive analysis was conducted to determine the potential health effects of fungal isolates from nuts and dry fruits. The toxins producer's fungi were investigated in several types of edible nuts and dried fruits. [17]

In Hawraman region-Kurdistan, Sharaf and Hamza [18] screened the mycotoxins secreted by several fungal isolates from walnuts.

The isolated fungi in the current study cause a potential health harm, *Asp. niger* and *Asp. flavus* were recorded as mycotoxin producers. [19] *Aspergillus fumigatus*, a frequent nuts contamination that is especially prevalent in preserved edible seeds produces several mycotoxins that can affect the health of consumers. [20] The fungus is an opportunistic pathogen that can also cause invasive aspergillosis, it secretes the fumagillin, the toxin that may cause a high death rate in immunocompromised patients. [21] The *Asp. nidulans* was reported as a producer of polyketide-derived mycotoxin, sterigmatocystin. [22]

The health impact and generation of mycotoxin in the remaining isolates was also investigated. Among the most common mycotoxigenic fungus taxa, *Alternaria* has over 70 known metabolites. The toxicity of *Alternaria* mycotoxins was evident in their mutagenicity, carcinogenicity, and inhibition of enzymes activity. etc. [23]

*Cladosporium* is one of the most common and wide-spread saprobic hyphomycetes, it is not known to produce significant mycotoxin byproducts, but it is one of the highest active fungal allergens. [24] *Rhizopus* sp. is rapid growth member of

zygomycetes, several and strains have been reported to produce either the pharmaceutically active rhizoxins or the highly toxic rhizonins A and B. [25]

#### CONCLUSION

Nowadays, shifts in global food production and consumption patterns have made it more important than ever for food safety systems to assess consumption risks in addition to contaminant presence. With scientific backing, these hazards can be controlled to reduce adverse impacts on the customer and ensure that they receive the necessary education for health prevention. More attention should be paid to fungal contamination in this area, particularly with regard to nuts and dried fruits. These hallucinogenic foods are contaminated by fungi, which can spread illnesses and could be fatal.

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