Global Scientific Review
A Peer Reviewed, Open Access, International Journal
www.scienticreview.com
Volume 1, February 2022 ISSN (E): 2795-4951

Microbiological quality (yeast and mold) of dried fruits in Kabul, Afghanistan: A laboratory study

Murtaza Jafari*,[1] and Maryam moetamedi *,[2]

[1] Head of Research Center, Cheragh Medical Institute and Hospital, Kabul, Afghanistan. Pharm D, Hospital Pharmacist.

[2] Quality Assurance Laboratory Technicians, Nutrition and Education International (NEI), Kabul, Afghanistan, Pharm D.

Abstract

Introduction: Food safety is one of the most important issues in the world. Consumption of healthy food products leads to improvement in major functions in the body. Dried fruits are one of the most widely consumed food products in Afghanistan, and millions of tons of these products are still exported annually.

Objectives and Methods: The aim of this study was to evaluate fungal contamination in dried fruits in food markets in Kabul. This study is an experimental study conducted in NEI laboratories on 14 samples of dried fruits in food markets in Kabul.

Results: In this study, more than 14 samples of dried fruits available in food markets in Kabul, in NEI laboratories from December 6, 2020 to April 20, 2021, only one of these samples was free of any fungal contamination, 4 samples Less than 100 CFUs, 6 samples between 100 and 200 CFUs, and only 3 specimens with more than 200 CFUs were infected with the fungus (yeast and mold).

Conclusion: The presence of microbial contaminants in food products is extremely dangerous, which can have several toxic effects on the body. Fungi can produce dangerous toxins, even carcinogenic effects, for consumers of these food products by producing various toxins. Although according to the results of this study, the level of microbial contamination is within the acceptable range of FDA (1000 CFU), but still need to control these products to improve public health.

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Key words: Dried fruits, Yeast and Mold Contamination

Introduction

Safety in food production is a global issue, that affecting on human health. A healthy diet is one that is prepared without harmful microorganisms and in a clean and hygienic environment. These foods should also contain important nutrients for the body. The presence of pathogenic microorganisms in food products leads to various diseases in the body.[10, 3]

Unfortunately, in poor and tertiary countries, such as Afghanistan, which do not follow health issues and the majority of its people do not have access to healthy food, the incidence of infectious diseases is very high. By controlling the quality of food in the country, it is possible to get which food products contain microorganisms. Dried fruits of Afghanistan are one of the most important exports of this country to other countries of the world; millions of tons of dried fruits are exported from this country annually. Almonds, walnuts and pistachios are among the most important dried fruits for export in this country. Although the consumption of dried fruits in the country during Eid (Eid al-Fitr and Eid al-Adha) and New Year is high, many people use dried fruits. Due to the contamination of these fruits with microorganisms and its use by people, it leads to diseases such as: abdominal pain, diarrhea and nausea, the main cause of which can be the presence of pathogenic microorganisms in dried fruits. Although several laboratories in Afghanistan are conducting laboratory tests on food products and evaluating the quality of these products, this study was conducted using data from the Institute of Nutrition and Education International (NEI) in Kabul of Afghanistan.

The number of eukaryotes on Earth is about 8.7 million, of which 7% are 611,000 fungi species. Of these, only 600 types of fungi are dangerous to humans and cause various diseases. It is a special fruit salad in Malaysia that is widely used by the people of this country. This salad of dried mango fruit is dried at 60 degrees Celsius for 1-2 hours, and by adding other ingredients to this salad, it can be used in seasons of the year when this fruit is not the time. In a 2018 study, by Lani, et al,2018, surveyed the top of this salad to assess the value of the food. In this study, using the culture medium, Potato Dextrose Agar (PDA) and dealing with 10% tartaric acid, the samples were

incubated for 120 hours at a temperature of 25. Although the growth rate of microorganisms decreases with drying of fruits and reduction of water activities in food products, but in this study, drying of fruits was still a suitable growth environment for microorganisms.[1]

In a laboratory study of commercially dried and home-dried dried fruits conducted by Ntuli, et al. In 2016, using a culture medium (PDA) at a temperature of 25 for 5 days, the contamination rate the microbe was in the range of $2{,}0.10^2$ to $8{,}7.10^5$ CFU.[10]

The following formulas can be used to calculate the CFU:

$$\text{CFU}=\frac{A\ colonies(\ average)}{B\ volume\ plated\ (ml)}.DF \qquad \text{CFU}=\frac{A\ colonies(\ average)}{B\ volume\ plated\ (ml)}.1/CF$$

dilution and concentration factors.[4]

Although drying of fresh fruits can prevent the growth of microorganisms in these food products, the process of drying fruits is of particular importance 5. Generally, two basic methods are used to dry fruits (solar drying and conventional air drying), but with the advancement of science and technology, advanced equipment with new effective and accurate methods can be used. The main methods of drying fruits in a technological way can be called vacuum drying, Freeze-drying, dielectric drying, infrared drying, Low-pressure SSD, Osmotic dehydration and Supercritical carbon dioxide drying methods.[12]

In a study conducted in Iran by Karshenas and Maghsoudloo in 2015, in order to evaluate and compare the growth of mold and yeast in almonds coated with acetic acid, aloe vera and chitosan during 4 months of storage, they found that coated almonds With aloe vera and chitosan, they had the lowest growth rates of yeast and mold. [6] In a study conducted in Karachi, Pakistan, over 84 samples of dried fruits to assess fungal infection, the highest rate of fungal infection from A. niger was about 25.8%. [8]

In a study conducted on more than 80 samples taken in Isfahan, Iran, in dried fruits of almond, hazelnut, pistachio and walnut to identify aflatoxin poison, this toxin is extremely dangerous and its carcinogenicity has been proven. The presence of this poison was also identified.[11] The presence of mycotoxins in dried fruits has also been proven by laboratory experiments.[9] Aflatoxins are dangerous toxic compounds, there are about 20 types of aflatoxins, of which type B1 is the strongest and most carcinogenic. These toxins have carcinogenic properties and the ability to bind to the

Volume 1, February 2022 ISSN (E): 2795-4951

DNA of the nucleus and mitochondria of liver cells. [7] In a study conducted in the city of Kerman, Iran, more than 35 samples of dried fruits available in the food markets of this city, and after cultivation in PDA environment, the existence of fangs has been proven.[1]

In a similar study conducted in Mazandaran, Iran, in order to evaluate the fungal infections of dried fruits, the amount of these infections was more than normal. [2]

Objectives And Methods

The main purpose of this study is to investigate the level of microbial contamination by mold and yeast in dried fruits in food markets in Kabul.

The above study is an experimental study that was performed on 14 samples of dried fruits available in food markets in Kabul, Afghanistan and evaluated in the laboratories of the NEI Institute. The collected samples were tested in the above laboratories for 6 months, from 6-Dec 2020 to 20-Apr 2021.

Martials and Equipment

- Micro pipets
- Pipette tips
- Medias (TPC)
- Distilled water
- Gloves/mask
- Flame
- Fumes- hood

Procedure

- 39 gram of Potato Dextrose Agar was weighted per liter of a solution and poured into a narrow mouth flask. The media and distilled water stirred by heating on a hot surface plate.
- The media transferred to an autoclavable bottle and put the lid of the bottle loose tightened on it.
- All the necessary items such as pipet tips, petri dishes autoclaved on 121°C with a 5 bar pressure for 15 mins.

- After completion of the sterilization the bottle of molten agar placed in a 50°C water bath to cool to 50°C.
- Working quickly to avoid cooling of the agar to 42°C.
- The sample shook and pipetted 1 mL of each of the samples one by one and poured into the base of correctly labeled petri dishes.
- About 15-20mL of molten agar poured into each of the petri dishes or plates.
- Each plate gently swirled to mix the 1 mL of diluted sample into the 15-20 mL of agar.
- The plate leaved without moving for at least 13 minutes to allow the agar to set.
- The samples placed in incubator set on 37C for 24 hours.
- The samples checked after 24 hours for growth of microorganisms or colonies.

Results:

In this study, over 14 samples of dried fruits available in food markets of Kabul city, laboratory tests in AI laboratories, the presence of yeasts and molds were proved.

Of the 14 samples, only one sample was free of yeast and mold, 4 samples were less than 100 CFU, 6 samples were in the range of 100 to 200 CFU, and only 3 samples more than 200 CFU had yeast and mold contamination.

The sample in which no microbial contamination of yeast and mold was received is related to processed raisins. Examples of dried fruits such as almonds kernel, dried apricot, pistachios kernel and walnut kernel contained 60, 30, 20 and 34 CFU, respectively. Examples of raisins, pistachios, walnut kernel, dried apricots, mulberry and pine nuts also contained 100, 120, 140, 125 and 100 CFU, respectively.

Samples containing more than 200 CFUs containing yeast and mold are unprocessed raisins and processed raisins (220 to 240 CFU).

The following chart (chart: 1), shows the contamination of dried fruits (14samples) by yeast and mold:

Volume 1, February 2022 ISSN (E): 2795-4951

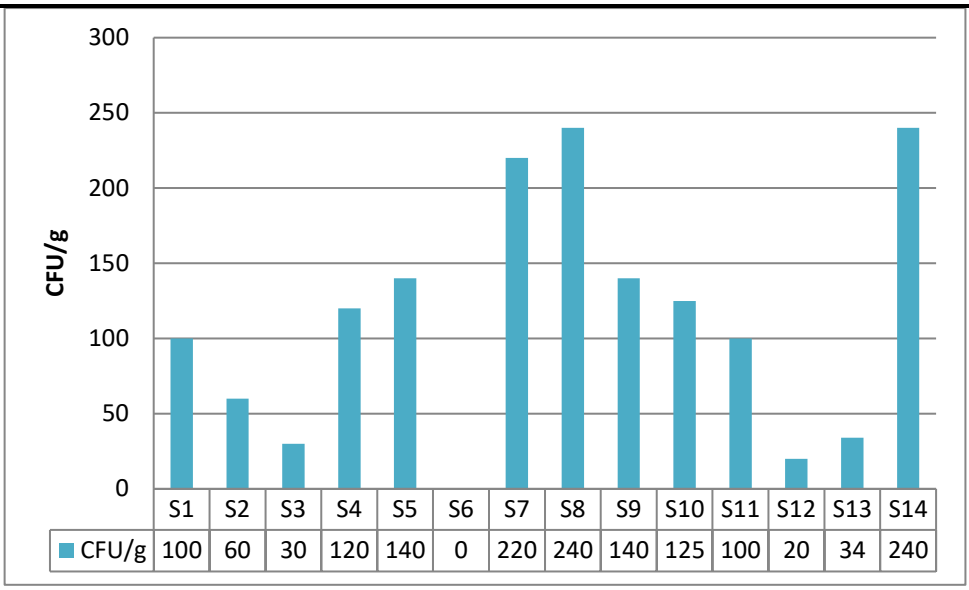

Chart (1): *The level of contamination of dried fruits by mold and yeast*

As can be seen in the chart above, the highest level of yeast and mold contamination is related to the eighth and fourteenth samples with 240 CFU contamination in raisins and the lowest level of contamination is related to processed raisins. In the following table (Table No. 1), the names of the samples, the amount of microbial contamination (mold and yeast), the method tested and the names of the samples are listed:

Table (1): The Characteristics of Samples

ID	Name of samples	CFU/g	Test method	ID	Name of samples	CFU/g	Test method
1	Raisin	100	BAM of FDA	8	Raisin	240	BAM of FDA
2	Almond Kernel	60	BAM of FDA	9	Dried Apricot	140	BAM of FDA
3	Dried Apricot	30	BAM of FDA	10	Mulberry	125	BAM of FDA
4	Pistachio	120	BAM of FDA	11	Pine nuts	100	BAM of FDA
5	Walnut Kernel	140	BAM of FDA	12	Pistachios kernel	20	BAM of FDA
6	Processed Raisin	0	BAM of FDA	13	Walnut Kernel	34	BAM of FDA
7	Unprocessed Raisin	220	BAM of FDA	14	Raisin	240	BAM of FDA

*BAM- Bacteriological Analytical Manual, *FDA- Food and Drug Administration

Discussion

Due to the climatic, geographical and economic differences in Afghanistan with other countries, the country is in the third world and the existence of several years of wars in this country, the low health situation in this country, but also the level of microbial contamination by Yeasts and molds in dried fruits in Kabul are not so dangerous, but there is an urgent need for evaluation and control.

The amount of microbial contamination by yeasts and molds in dried fruits is within the acceptable range of FDA.

Conclusion

In this study, in the NEI laboratories in Kabul, more than 14 samples of dried fruits in food markets in Kabul, in order to evaluate the presence of microbial contamination (yeast and mold), the presence of these microorganisms was proven.

According to the findings in this study, the highest rate of microbial contamination by yeast and mold was observed in unprocessed raisins (240 CFUs) and the lowest rate of yeast and mold contamination was observed in processed raisins (without yeast and mold). Considering these results, it can be concluded that by processing dried fruits and other food products in a safe manner, these food products can be free from microorganisms.

Although the level of microbial contamination by yeasts and molds in dried fruits in food markets in Kabul, Afghanistan, is within the acceptable range of FDA, there is still a need to control these products.

The acceptable range of yeasts and molds in dried fruits is provided by the FDA for yeasts less than 1000 CFU and for molds less than 10,000 CFU, with the highest microbial contamination by yeasts and molds in this study being 240. CFU is obtained.

Disclaimer: None.

Conflict of Interest: None.

Source of Funding: NEI and CMI Research Center.

Ethical approval: In this study, no human and animal studies have been performed and all the procedures included in this study are in accordance with the **NON-DISCLOSURE AGREEMENT** (NDA) document from the NEI

Acknowledgements

The Scientific Research Center of Cheragh Institute of Higher Medical Education expresses its appreciation and gratitude to the Nutrition and Education International (NEI), Kabul, Afghanistan, for its cooperation in conducting this research and wishes further success to this institute.

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