



Quantification of Aflatoxins in Exported Raisin and Pistachio of Afghanistan

Abdul Mohammad Aziz¹ and Mohammad Dawod Shirzad^{2*}

¹Faculty of Chemistry, Kabul University, Kabul, Afghanistan

²Faculty of Environment, Kabul University, Kabul, Afghanistan

*Corresponding Author: Mohammad Dawod Shirzad, Faculty of Environment, Kabul University, Kabul, Afghanistan.

DOI: 10.31080/ASMI.2024.08.1376

Received: March 11, 2024

Published: April 25, 2024

© All rights are reserved by **Abdul Mohammad Aziz and Mohammad Dawod Shirzad.**

Abstract

The main purpose of this study is to determine the amount of aflatoxins of raisins and pistachios in order to prepare as acceptable materials exported to other countries of the world. The amount of aflatoxins acceptable to the world is characterized by these substances. It is also included in a table in this article. In this table the food items are described in accordance with the international norms of the world countries.

Similarly, the amount of aflatoxins has been technically measured in them. Also, the amount of aflatoxins allowed in fruits and foods is provided in a table as a whole.

In this research paper, aflatoxins in 17 pistachio samples and 20 samples of red raisins have been obtained.

The export of national traders from Kabul customs has been under investigation of aflatoxins quantity and their quantitative results are stabilized and in a table of insertion and dependence of their samples with the amount of aflatoxins they have been explained by graphs and in tables and finally in a syntactic export to the world countries has been revealed.

Keywords: Aflatoxins; Mycotoxins; Carcinogenic; Mutagenic; *Aspergillus parasiticus*; *Aspergillus flavus*

Introduction

This research paper contains of two parts as follow:

- Theoretical research
- Experimental research

In theoretical part data on properties of aflatoxins has been collected and the mechanism of the toxicity of aflatoxins has explained as well.

The second part of this paper is the experimental research that indicates the amount of aflatoxins in different kinds of raisin and pistachio samples of Afghanistan. The quantification research on about 37 samples of raisin and pistachio from Afghan national businessmen exported packs in Kabul custom office has been carried out. The quantitative results have detected and shown in the

table also the relation of the samples number with the amount of aflatoxins in those samples has described in the graphical image. Therefore, the exportation way of these materials to other countries in the world has explained well.

After comprehensive investigation of the research, results, discussion, and the conclusion which contains another part of this research paper, has been added in this research paper.

Aflatoxins are poisonous materials that belongs to mycotoxins and produced by two kinds of fungi named *Aspergillus parasiticus* and *Aspergillus flavus*. Mycotoxins discharge strong poisonous materials called fungus.

Aflatoxins have been derived from three words A, fla and toxin. In this expression A shows the type, fla is taken from *Funjies Flavus* and toxin refers to poison and in total it makes Aflatoxin.

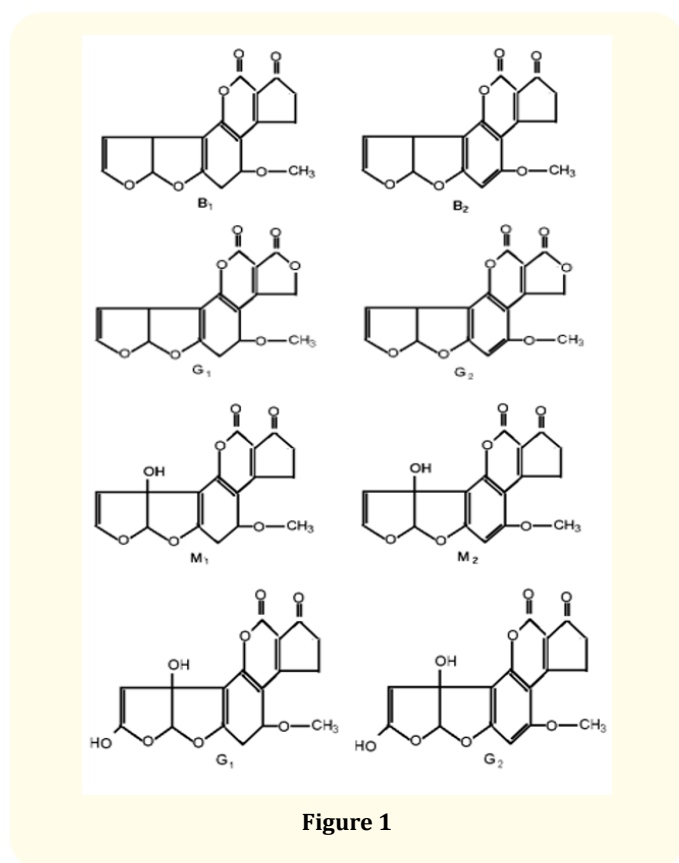
Mycotoxin are one type of chemical compounds that fanjies (one special type of mushrooms) produce it during the growth in food products such as bean, almond, flax seeds and etc.

Cancerous disease and liver and kidney disease that are caused by toxins are specially at the result of toxin (B1), that is why international community now focused on demolishing this toxin and started putting some sanctions on import and export of goods.

Literature Review

Chemical, physical and structural properties of Aflatoxins.

Some of the explanatory formulas of Aflatoxins are as follow [1].



Aflatoxins have the ability of toxicity and creating cancer and other disease and this is done through different aflatoxins. The property of creating disease of aflatoxins is explained as follow:

$Af G_2 < Af B_2 < Af G_1 < Af B_1$ [2].

This negative effects of aflatoxins in the following series LD- 50 in the past was seen in new born ducks. In the structure of aflatoxins Dihydrofpran has hybrid relation. The reflection of aflatoxins in a high volume in the with the wave of 365cm stands in Light rays in the manner that the reflection of B₁ and B₂ are blue but G₁ and G₂ are seen as green. The bellow table shows physical properties of Aflatoxins.

Aflatoxins	Chemical Formula	Molecular MassMW (g/mol)	Reflections	Melting Degree
B ₁	C ₁₇ H ₁₂ O ₆	312.28	Blue	262 – 269° C
B ₂	C ₁₇ H ₁₂ O ₆	314.29	Blue	286 – 289° C
G ₁	C ₁₇ H ₁₂ O ₇	328.28	Green	244 – 248° C
G ₂	C ₁₇ H ₁₄ O ₇	330.29	Green- Blue	237 – 240° C
M ₁	C ₁₇ H ₁₂ O ₇	328.28	Blue- Purple	299° C
M ₂	C ₁₇ H ₁₂ O ₇	330.29	Purple	293° C
B ₂ A	C ₁₇ H ₁₄ O ₇	330		240° C
G ₂ A	C ₁₇ H ₁₄ O ₈	346		190° C

Table 1: Bellow shows some of physical properties of Aflatoxins [3,4,6].

Aflatoxin reactions happen in different conditions and the reactant materials in different conditions could be seen in different, because probability of such reactions of non-toxin materials may cause toxin in many materials.

Researches that took place on the amount of aflatoxins in foods, nuts and other food materials in different countries has shown the amount of toxins in the foods are divided in different groups as follow [7-9].

Number	Country	Group	Type of the Material	Permitted amount of Aflatoxins	Remarks
1	Belgium	One	All food Items	4ppb	European committee norms
2	Czech Republic	One	Groundnut	5ppb	
3	Finland	One	Nuts and nut products	4ppb	
4	France	One	All food items	4ppb	
5	Germany	One	Groundnuts and foods	5ppb	
6	Logzaborg	One	All food items	5ppb	
7	Maldives	One	Groundnuts	5ppb	
8	Holland	One	Groundnuts and other food items	5ppb	
9	Norway	One	All food items	5ppb	
10	Poland	One	All food items	5ppb	
11	South Africa	One	All food items	5ppb	
12	Sri Lanka	One	Groundnuts and its products	5ppb	
13	Sweden	One	All food items	5ppb	
14	Switzerland	One	Nuts and its products	5ppb	
15	Russia	One	All food items	5ppb	
16	UK	One	Nuts and its products	5ppb	European committee norms
17	Yugoslavia	One	Groundnuts	5ppb	
18	Colombia	Two	Groundnuts	10ppb	
19	Danmark	Two	Groundnuts and foods	10ppb	European committee norms
20	Japan	Two	Groundnuts	10ppb	
21	Singapore	Two	Groundnuts and oil	10ppb	
22	US	Two	All foods	10ppb	
23	Australia	Third	Groundnuts and its products	15ppb	
24	Canada	Third	Groundnuts and its products	15ppb	
25	Urdu	Third	All foods	15ppb	Export Norms
26	Hong Kong	Third	All foods	15ppb	European Committee norms
27	New Zealand	Third	Groundnut and food	15ppb	
28	Greece	Fourth	All foods	20ppb	European Committee norms
29	Ireland	Fourth	All foods	20ppb	Export norms
30	Israel	Fourth	All foods	20ppb	
31	Kenya	Fourth	Ground nuts	20ppb	
32	Philippines	Fourth	Ground nuts	20ppb	
33	Thailand	Fourth	Food oil	20ppb	
34	Zimbabwe	Fifth	Groundnut	25ppb	
35	Austria	Fifth	All foods	50ppb	
36	Brazil	Fifth	Flour and Groundnuts	50ppb	Export Norms

37	Italy	Fifth	Foods	50ppb	World health organization norms
38	China	Fifth	Groundnuts	50ppb	
39	India	Fifth	All foods	60ppb	

Table 2: Groups and countries based on amount of aflatoxins [10].

Experimental, Analysis and research on amount of toxins in raisins and pistachio

Research process

To analyze the amount of aflatoxins the Chromatography method has been used which is done with Fluorometer.

Needed materials and ingredients

- **Ingredients:** To find out about amounts of aflatoxins in Afghan fruits besides the dry fruits such as raisin, pistachio the following materials has been used:
 - Metail Alcohol 40% (CH₃-CH₂- OH 40%)
 - Salt (Na Cl)
 - Filtration paper to divided and purify the materials
 - Distilled water that is used for making solution and washing dishes
- **Materials:** There were many materials used in this research but the most important ones are mixer and fluorometer.

Process of testing aflatoxins in in pistachio, raisins (0-50ppb aflatoxin in one gram).

In this research the following reactions has been implemented

- Measuring the samples
- Preparing Fluorometer
- Sampling for ...
- Diluting the materials
- Chromatography

Comparative analysis of aflatoxin in pistachio and raisin

Comparative analysis of aflatoxins in raisin

Raisin is a fruit which contains 60%-70% carbohydrate (sweets) and it is a good food for funguses; therefore if raisin is not stored in a good place it will soon be food of funguses and there will be more aflatoxins. As mentioned earlier for measuring the amount of aflatoxins 20 samples were chosen from raisins of class two and three, in five of the samples the amount of aflatoxin was less than 4ppb and in six samples it was 5-10 ppb while in 9 other samples it was 10- 20 ppb aflatoxin.

Fruits that are under research	Number	Sample Number	The amount of Aflatoxin	Number of groups of countries that number of aflatoxins are accepted					Remarks
				1	2	3	4	5	
Red raisin	3	1	11 ppb	A	A	A	A	R	
Red Raisin	3	2	7 ppb	R	A	A	A	R	
Red Raisin	3	3	12 ppb	R	R	A	A	A	
Red raisin	3	4	18 ppb	R	R	R	A	A	
Red raisin	3	5	2 ppb	A	A	A	A	A	
Red Raisin	3	6	2 ppb	A	A	A	A	A	
Red Raisin	3	7	1 ppb	A	A	A	A	A	
Red Raisin	3	8	16 ppb	R	R	R	A	A	
Red raisin	3	9	2 ppb	A	A	A	A	A	
Red raisin	3	10	11 ppb	R	R	A	A	A	
Red Raisin	3	11	9 ppb	R	A	A	A	A	
Red Raisin	3	12	4.8 ppb	A	A	A	A	A	
Red Raisin	2	13	0.13 ppb	A	A	A	A	A	

Red Raisin	3	14	11 ppb	R	R	A	A	A	
Red Raisin	3	15	13.5 ppb	R	R	R	A	A	
Red Raisin	3	16	16 ppb	R	R	R	A	A	
Red Raisin	3	17	11 ppb	R	R	A	A	A	
Red Raisin	3	18	7.8 ppb	R	A	A	A	A	
Red Raisin	3	19	9.6 ppb	R	A	A	A	A	
Red Raisin	3	20	9 ppb	R	A	A	A	A	

Table 3: Result of the research of measuring Aflatoxins in twenty samples of red and green raisin.

Note: In this Table A shows acceptance and R shows rejection based on norms of European community.

Analyses and comparison of Aflatoxins in Pistachio

As table (4) shows the amount of Aflatoxins, in 17 samples of pistachio aflatoxins are being measured, that one sample has less

than 4ppb and three other samples have less than 10ppb and 13 other samples have 10-26ppb aflatoxin. Therefore the amount of Aflatoxins in pistachio is more than raisin.

Food Under Research	Type Number	Sample Number	Amount of Aflatoxin in ppb	Number of group of the countries that accepts the amount of aflatoxin in fruits					Remarks
				1	2	3	4	5	
Unshelled Pistachio	2	1	12 ppb	R	R	A	A	A	
Pistachio with shell	2	2	8 ppb	R	R	R	A	A	
Pistachio with shell	2	3	12 ppb	A	A	A	A	A	
Pistachio with shell	2	4	10 ppb	A	A	A	A	A	
Pistachio with shell	2	5	8 ppb	A	A	A	A	A	
Pistachio with shell	2	6	8 ppb	R	R	R	A	A	
Pistachio with shell	2	7	3 ppb	A	A	A	A	A	
Unshelled Pistachio	2	8	25 ppb	R	R	A	A	A	
Unshelled Pistachio	2	9	16 ppb	R	A	A	A	A	
Unshelled Pistachio	2	10	11 ppb	A	A	A	A	A	
Unshelled Pistachio	2	11	11 ppb	R	R	R	R	A	
Unshelled Pistachio	2	12	14 ppb	R	R	R	A	A	
Unshelled Pistachio	2	13	17 ppb	A	A	A	A	A	
Unshelled Pistachio	2	14	10 ppb	A	A	A	A	A	
Unshelled Pistachio	2	15	10 ppb	R	R	A	A	A	
Unshelled Pistachio	2	16	10 ppb	R	A	A	A	A	
Unshelled Pistachio	2	17	19 ppb	A	A	A	A	A	

Table 4: Result of measuring aflatoxins in 17 sample of pistachio.

Note: In this table A refers to acceptance and R refers to Rejection based on accepted norms of European community.

Discussions and Conclusion

The permitted amount of Aflatoxins in Europe in nuts, pistachio, almond, dry fruits and processed foods that are directly consumed by people is 2-4ppb; therefore from 20 samples of raisin only six of them had less than 4ppb aflatoxin that is acceptable for European community 10 sample has got 10-5 ppb Aflatoxin that is

acceptable in US and Canada and four other sample has got 10-26 ppb Aflatoxin that is acceptable in India. These samples are shown in table (1 and 2).

The graph bellow shows the different properties of effected raisin that has been taken from different food processed system in Kabul.

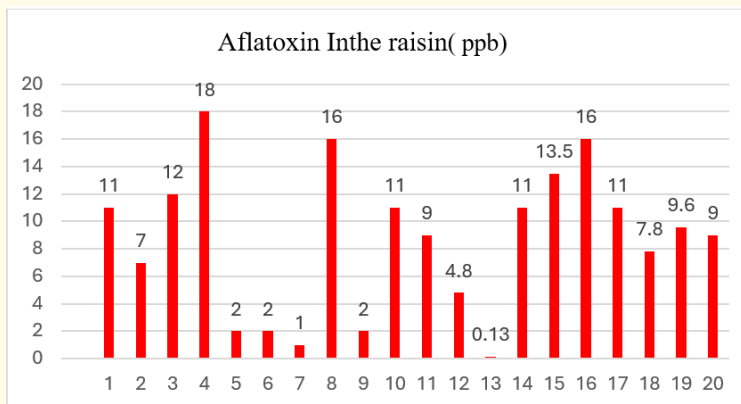


Figure 2: Shows the relation of Aflatoxin with sample raisin.

Raisin type two and type three were studied where in five sample there were less than 4ppb and in six other there were 5-10ppb aflatoxin which has got good quality. While in 9 other samples there were 10-20ppb Aflatoxin which will cause problems.

The above graph clearly shows that: our products considering table (II-1) on good to be exported to countries like China and Russia and approximately 10% of dry fruits and nuts that we produce could be exported to US, and European Union.

The bellow chart shows the effected properties of pistachio that has been taken from different food processing systems in Kabul and research has been conducted on.

As it has been considered that in 17 sample of pistachio that was under research there has been 3-26 ppb Aflatoxins.

The amount of Aflatoxins increases in pistachio if it is not processes on time. The pistachio in the tree will be damaged by the in-

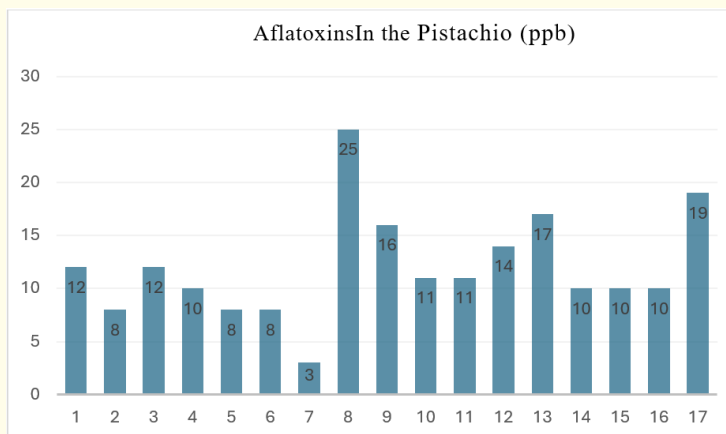


Figure 3: Shows the relation of Pistachio and Aflatoxins.

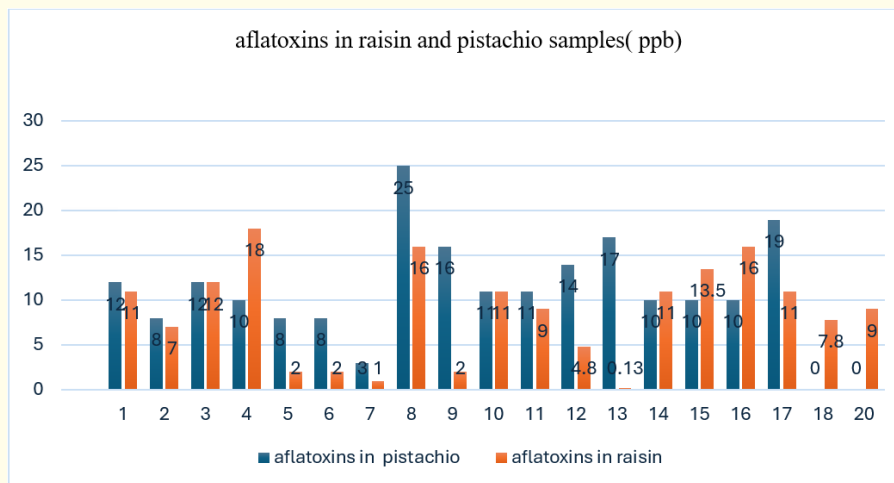


Figure 4: Comparison of Aflatoxins between Raisin and Pistachio.

sects and birds and therefore once they are processed the amount of Aflatoxins increases.

Figure 4 comparative graph of amount of aflatoxins in raisin and pistachio samples.

This shows that: The amount of aflatoxins in raisin is more than amount of aflatoxins in pistachio; therefore Afghan dry fruits need more consciousness in terms of processing. We need to use better technology, processing, and storing techniques so that we have toxin free fruits.

Based on research, discussions and conclusion following results are concluded.

Conclusion

- Raisin has got more toxins comparing to pistachio as the amount of aflatoxin in raisin was higher than pistachio
- The amount of aflatoxin in pistachio that has peel is lesser than the unpeeled one as the peel saves it.
- Heating and moistness will increase the amount of aflatoxins in raisin therefore if you are washing raisin you should dry it completely.

- Fruits and nuts that stay long in fields have got more aflatoxins.
- The amount of aflatoxins that is higher than the standard norms of European union causes disease like liver cancer.
- Raisin is more contaminated with Asparajelous comparing to pistachio.
- The amount of Aflatoxins in foods depends in the physical and chemical properties and the methods of being processed, and stored.

Recommendations

- To avoid having aflatoxins and other toxins in food we need to have professional people in this field. It is recommended that even those who are storing these materials should have professional background.
- To avoid toxins it is recommended that the fruits and materials in provinces should be researched on. The farmers should be prescribed medicines for their fields and the should be trained. Raising awareness among farmers is another recommendation.

Bibliography

1. Bircan., *et al.* "Aflatoxin levels in dried figs, nuts and paprika for export from Turkey". *International Journal of Food Science and Technology* 43 (2008): 1492-1498.
2. Alvito., *et al.* "Occurrence of aflatoxins and ochratoxin A in baby foods in Portugal". *Food Analytical Methods* 3 (2010): 22-30.
3. Ariño., *et al.* "Aflatoxins in bulk and pre-packed pistachios sold in Spain and effect of roasting". *Food Control* 20 (2009): 811-814.
4. Blesa., *et al.* "Limited survey for the presence of aflatoxins in foods from local markets and supermarkets in Valencia, Spain". *Food Additives and Contaminants* 21 (2004): 165-171.
5. Burdaspal., *et al.* "A survey of aflatoxins in pistachios in the Community of Madrid, Spain". *Alimentaria* 364 (1998): 106-113.
6. Burdaspal., *et al.* "A survey of aflatoxins in peanuts and pistachios. Comparison with some data published in 1989 in Spain". *Alimentaria* 297 (2005): 151-156.
7. Candlish., *et al.* "A limited survey of aflatoxins and fumonisins in retail maize-based products in the UK using immunoassay detection". *Mycotox Research* 16 (2000): 2-8.
8. Cano-Sancho., *et al.* "Survey of patulin occurrence in apple juice and apple products in Catalonia, Spain, and an estimate of dietary intake". *Food Additives and Contaminants: Part B* 2 (2009): 59-65.
9. Cano-Sancho., *et al.* "Occurrence of aflatoxin M1 and exposure assessment in Catalonia (Spain)". *Revista Iberoamericana de Micología* 27 (2010): 130-135.
10. Cano-Sancho., *et al.* "Quantitative dietary exposure assessment of the Catalonian population (Spain) to the mycotoxin deoxynivalenol". *Food Additives and Contaminants: Part A* 28 (2011): 1098-1109.