T.C.

YEDİTEPE UNIVERSITY

INSTITUTE OF HEALTH SCIENCES

DEPARTMENT OF NUTRITION AND DIETETICS

DETERMINATION OF FUMONICAL VALUES OF OUTDOOR CORN SAMPLES

MASTER THESIS

İLGAR ŞAMİLOV

İSTANBUL, 2018

T.C.

YEDİTEPE UNIVERSITY

INSTITUTE OF HEALTH SCIENCES

DEPARTMENT OF NUTRITION AND DIETETICS

DETERMINATION OF FUMONICAL VALUES OF OUTDOOR CORN SAMPLES

MASTER THESIS

İLGAR ŞAMİLOV

SUPERVISOR

Assist. Prof. Dr. İSKENDER KARALTI

İSTANBUL, 2018

TEZ ONAYI FORMU

Kurum : Yeditepe Üniversitesi Sağlık Bilimleri Enstitüsü

Program : Beslenme ve Diyetetik Yüksek Lisans

Tez Başlığı : Açıkta Satılan Mısır Örneklerinde Fumonisin Değerlerinin Belirlenmesi

Tez Sahibi : İlgar ŞAMİLOV

Sınav Tarihi : 16.08.2018

Bu çalışma jurimiz tarafından kapsam ve kalite yönünden Yüksek Lisans Tezi olarak kabul edilmiştir.

	Unvanı, Adı-Soyadı (Kurumu)	İmza
Jüri Başkanı:	Doç. Dr. Cenk SESAL (Marmara Üniversitesi)	
Tez danışmanı:	Dr. Öğr. Üyesi İskender KARALTI (Yeditepe Üniversitesi)	
Üye:	Dr. Öğr. Üyesi Hülya DEMİR (Yeditepe Üniversitesi)	
Üye:		
Üye:		

ONAY

Bu tez Yeditepe Üniversitesi Lisansüstü Eğitim-Öğretim ve Sınav Yönetmeliğinin ilgili maddeleri uyarınca yukarıdaki jüri tarafından uygun görülmüş ve Enstitü Yönetim Kurulu'nun 31./08./2018 tarih ve 2018/15-01 sayılı kararı ile onaylanmıştır.

İmza

Prof. Dr. Bayram YILMAZ

DECLARATION

I hereby declare this thesis is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree except where due acknowledgment has been made in the text.

Date

Signature

Name Surname

ACKNOWLEDGEMENTS

I would like express my special thanks to my advisor Assist. Prof. Dr. İskender KARALTI, shared his valuable knowledge with me for 2 years and I will never forget the importance of his every word enrich my life and to expert dietitian Tuğçe YAVUZ for her support throughout my thesis work and I present my endless thanks to the valuable deprivation that supports me in every aspect of my life.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS AND ABBREVATIONS

AFB_1	Aflatoxin B_1
AFB_2	Aflatoxin B_2
AFG_1	Aflatoxin G_1
AFG_2	Aflatoxin G_2
ELISA	Enzym Linked Immuno Assay
EU	European Union
HACCP	Hazard Analysis Critical Control Points
mL	Mililiter
kg	kilogram
gr	gram
µg	microgram
Nm	Nanometer
ppb	Parts Per Billion
ppm	Parts Per Million
USA	United States of America
WHO	World Health Organization
FDA	Food and Drug Administration
µL	Microliter
IARC	International Agency for Research on Cancer

ABSTRACT

Şamilov İ. (2018). Determination of Fumonical Values of Outdoor Corn Samples, Yeditepe University, Institute of Health Science, Department of Nutrition and Dietetics, Master Thesis. Istanbul

Fumonisins are metabolites produced by various Fusarium species. Fumonisins are highly toxic to humans. Fumonisins, which are considered carcinogenic to humans, are found in cereal products, especially corn, which are susceptible to mold and mycotoxin formation. This study was carried out in order to determine whether corn offered for sale in certain segments of Istanbul is risky in terms of public health due to fumonisin. The presence of fumonisin in 40 corn samples collected from various regions was tested by ELISA. Accordingly, it has been determined that the amount of fumonisin in all the collected samples is in accordance with the limit determined by the Turkish Food Codex.The lowest amount of fumonis is 5.7 ppb; the highest amount of fumonis was determined as 29.3 ppb. The average was 13.4 ppb. The presence of mycotoxin can be high in corn due to Fusairum mold. This situation causes serious product losses and causes risky situations in terms of human health. No mold was isolated in culture studies from corn samples. This is in direct proportion to the results. The aim of ensuring the safety of food, the production of healthy and reliable food, and the necessary rules and measures must be taken in the stages of production, transport, storage, distribution and consumption of food. Food safety management systems have been established to ensure the sustainability of healthy and reliable food production, competition and competition. The TSE 13001 standard established by the Turkish Standards Institute is based on HACCP principles. The HACCP system ensures the production of high quality and safe food products at every prosesting international standard, from production to consumption.

Keywords: Fumonisin, ELISA, corn, mycotoxins

ÖZET

Şamilov İ. (2018). Açıkta Satılan Mısırların Fumonisin Değerlerinin Belirlenmesi, Yeditepe Üniversitesi, Sağlık Bilimleri Enstitüsü, Beslenme ve Diyetetik ABD, Yüksek Lisans Tezi, İstanbul

Fumonisinler, çeşitli Fusarium türleri tarafından üretilen metabolitlerdir. Fumonisinler insanlar için yüksek derecede toksik etkilidirler. İnsanlar için kanserojen olarak kabul edilen fumonisinler küflenmeye ve mikotoksin oluşumuna yatkın tahıl ürünlerinde, özellikle mısırlarda bulunmaktadır. Bu çalışma, İstanbul'da belli kesimlerde satışa sunulan mısırların fumonisin yönünden halk sağlığı açısından riskli olup olmadıklarını saptamak amacıyla yapılmıştır. Çeşitli bölgelerden toplanan 40 adet mısır örneklerinde fumonisin varlığı ELISA ile test edilmiştir. Buna göre toplanan örneklerin hepsinde fumonisin miktarının Türk Gıda Kodeksi tarafından belirlenen limite uygun olduğu tespit edilmiştir. En düşük fumonisin miktarı 5.7 ppb; en yüksek fumonisin miktarı ise 29.3 ppb saptanmıştır. Ortalama ise 13.4 ppb olduğu gözlemlenmiştir. Mısırda Fusairum küfü nedeni ile mikotoksin varlığı yüksek olabilmektedir. Bu durum ciddi ürün kayıplarına neden olduğu gibi, insan sağlığı açısından riskli durumların ortaya çıkmasına neden olmaktadır. Mısır örneklerinden yapılan kültür çalışmalarında hiçbir şekilde küf izole edilmemiştir. Bu durum da sonuçlar ile doğru orantılıdır. Gıdaların güvenliği, sağlıklı ve güvenilir gıdaların üretiminin sağlanması amacı ile gıdaların üretimi, taşınma, depolanma, dağıtım ve tüketim aşamalarında gerekli kurallara uyulması ve önlemlerin alınması gerekir. Sağlıklı ve güvenilir gıda üretimi, rekabet ve rekabetin sürdürülebilirliğinin sağlanması amacıyla gıda güvenliği yönetim sistemleri oluşturulmuştur. Türk Standartları Enstitüsü (TSE) tarafından oluşturulan TSE 13001 standardı HACCP prensiplerine dayalıdır. HACCP sistemi, üretimden tüketime kadar her proseste uluslararası standartlarda kaliteli ve güvenli gıda üretiminin gerçekleştirilmesini sağlamaktadır.

Anahtar Kelimeler: Fumonisin, ELISA, mısır, mikotoksinler

I. INTRODUCTION AND PURPOSE

It is known that fumonisins are highly toxic to humans and considered as carcinogenic to humans (1). This study was carried out in order to determine whether corn presented to the public in different parts of Istanbul is risky in terms of public health by comparing the values of fumonisin.

I. 1. GENERAL INFORMATIONS

I. 1. 1. Mycotoxins

Mycotoxin is formed by the combination of the myco (fungus) toxin (poison) words, meaning fungus. Mycotoxins are brought to the foliage by mushrooms (molds); it can lead to poisoning and death in animals that eat mycotoxin-containing feed or feedstuffs and in people who consume mycotoxin-containing foods. Some of the mycotoxins important for human and animal health are given in Table 1 (2).

Mushrooms producing mycotoxins can be transported by wind and air currents, including the various layers of the atmosphere (3,4). The level of mycotoxin contamination may vary from season to season, from year to year, depending on climatic conditions, product type and geographical location. It has been reported that one quarter of the world's crops are contaminated with mycotoxin (3)

Table I. 1. Mycotoxins in food and animal feed

aflatoxins	ochratoxin	zearalenone	PR toxin	slaframin
citrinin	patulin	trichothecenes	sporidesm	penicillic acid
kojic acid	fumonisin	rugulosus	citreoviridin	alternariol
tenuazonic acid	rubratoxin	sikloklorotin	luteosikrin	oxalic acid

The clinical picture that develops due to mycotoxin ingestion is called "mycotoxicosis". This clinical picture, however, is a condition that is very difficult to define and is characterized by one or more often multiple illnesses. The symptoms seen in mycotoxicosis may vary depending on the severity, effects, type of illnesses seen, the type of mycotoxin exposed in general, the presence of more than one mycotoxin, as well

as personal characteristics such as body weight, physical and nutritional status. The various effects of some mycotoxins and the diseases they cause are summarized in table 2 (4).

Table I. 2. Various Effects of Some Mycotoxins and Diseases Caused by Some Mycotoxins

Mycotoxin	Producer Type	Effect	Diseases Caused by
Aflatoxin B1	Aspergillus	Carcinogenicity Teratogenicity	Primary liver cancer in human
Citrinin	Penicillium	Nephrotoxicity	Turkey-X disease
α-Siklopiyazonik acid	Aspergillus Penicillium	Neurotoxicity	---
Ergo Toxins(ergotamine)	Aspergillus Claviceps	Vasoconstriction Neurotoxicity	Ergotizm
FumonisinB1	Fusarium	Carcinogenicity	St Anthony Fire in human encephalomalacia in horses
ochratoxinA	Aspergillus	Neurotoxicity Carcinogenesis	Pulmonary edema in pigs
Patulin	Penicillium	Nephrotoxicity Mutagenicity	Nephropathy in Pigs and Poultry----------
Penitreme A	Penicillium	Antibacterial Neurotoxicity	Lupinosis in sheep
Fomopsin A	Penicillium	Hepatotoxicity	Koyunlarda lupinozis
Sporidesm A	Phomopsis	Hepatotoxicity	Alimentary toxic aleukia (ATA)
Trichothecenes (T-2 toxin)	Pithomyces	Photosensitivity Dermatoxicity Hematopoietic Effect	Hyperstrogenism in pigs, Vulvovaginitis and abortions
Zearalenone	Fusarium	Estrogenism	
	Fusarium	Reproductive Disorders	

Aflatoxin A mysterious illness in the spring and summer of 1960 is mainly the secondary metabolites of certain strains of A. flavus and A. parasiticus fungi, although they can also be produced by aflatoxins, A. nomius and A. tamarii fungi in the northern

and southern regions of the UK. Aflatoxin B1 (AFB1) and AFB2 give blue fluorescence under ultraviolet light and AFG1 and AFG2 give green fluorescence (5). The major aflatoxins AFB1, AFB2, AFG1, and AFG2, with toxins with similar structures. Although these toxins are present in varying amounts in various nutrients and seeds, AFB1 is usually the most efficient one.

Aflatoxins can be divided into two groups according to their chemical structure, difurokumarocyclopentanone and difurokumarolactone. AFB1, AFB2, AFB2a, AFM1, AFM2, AFM2a and aflatoxicol in the group of difurokumarocyclopentanone; In the difurokumarolactone group, there are AFG1, AFG2, AFG2a, AFGM1, AFGM2, AFGM2a and AFB3.

Aflatoxins are common contaminants of corn, peanuts, walnuts, Brazilian peanuts, flaxseeds, other foods with high carbohydrate content, and even plants and spices(4,6). Food can be contaminated at any stage from planting to harvesting, harvesting, transportation, poor storage conditions, production conditions, and even shelf life of the product used as ready food, in short, from planting to consumption (6,7).

The table of toxicity with aflatoxins is called "aflatoxicosis". Humans can be exposed directly to aflatoxins through products obtained from occupational exposures, or especially from animals fed with contaminant feed. Because the results obtained from determinations made on the meat, milk, eggs and some organs of small and large animals such as poultry, small poultry, even a small amount of AFB1 can be passed on to milk and eggs, especially liver and other tissues. In cheese made from contamine milk, cheese was found to be 3-3.5 times more aflatoxin than the milk made because it is a more concentrated product. In fats, aflatoxin is passed by 0.5-0.7 times as much as it is made.

Unidentifiable cause of an epidemic should be suspicious of aflatoxicosis if the condition is so obvious that it can not be missed and the syndromes are associated with certain types of food, low therapeutic response with antibiotics or other medications, and seasonal epidemic (7).

There are significant differences in acute and chronic toxicity of aflatoxins according to interspecific, individual and sex. To date, no animal species has been found that are completely resistant to toxicity. The maximum levels permitted by the American Food and Drug Administration (FDA) for aflatoxin contamination in some foods are shown in Table 3 (4).

Table I. 3. Accepted maximum levels (ppb) for aflatoxin contamination by the American Food and Drug Administration (FDA)

Substrate	Maximum Level (ppb)
Human food and some kind of animal feed	20
Milk 0.5	0.5
Livestock animal feed 300	300
Pig feed (for meat) 200	200
Milking cow, pig and poultry feed	100

I.1.2. Fumonisins and Fumonisin Formation

Fumonisins are nongenotoxic carcinogens responsible for the etiopathogenesis of different diseases in various species. The optimum conditions for their production are moisture, a temperature of about 20 ° C and a temperature of 11-13 weeks. They were formed by esterification of the 2-amino-12,16-dimethyl polyhydroxyieocosane skeleton with propane-1,2,3-tricarboxylic acid at positions C14 and C15 (8).

I.1.3. Species and Varieties of Fumonisins

Fumonisins are mycotoxins that can be synthesized by fusarium fungi (9,10,11). The toxins produced by Fusarium species are thought to cause toxicity in humans. Fumonisin species collected from literature studies are listed below(1,12,13,14,15).

- *Fusarium verticillioides*
- *F. napiforme*
- *F. annulatum*
- *F. succaiase*
- *F. beoiforme*
- *F. dlamin*
- *F. anthophilum*
- *F. moniliforme*

- *F. proliferatum*
- *F. nygamai*

The fumonisins, known as leukoencephalomalacia, have been found to have resulted in years of research and there are seven known types known as A1, A2, B1, B2, B3, B4 and C1.(16,17). The most abundant fumonisin in the environment is fumonisin B1 (FB1), and it is suggested that this toxin species may be associated with esophageal cancer in humans. This toxin has proven toxic and carcinogenic to the liver. They are also known to be nephrotoxic, immunodepressant and embryo toxic for experimental animals (18). These mycotoxins are found in natural or processed corn varieties, especially used as feedstuffs for human beings and animals (19).

FB1 is not fragmented in a majority of the processing types. Dry milling of corn causes FB1 to break down bran, seed and flour. This is also the case with corn slurry. However, FB1 concentration decreases in wet moist mill processes and corn starch production; because FB1 is water soluble. For many reasons, FB1 can not be removed from food (20).

FB1, discovered in 1988, is the most fumonisin found in nature. It is a natural contagious source of corn and maize in many parts of the world (USA, Canada, South Africa, Nepal, Australia, Thailand, Philippines, Indonesia, Mexico, France, Italy, Poland and Spain) There. It is known that FB1 led to great losses in agricultural products during the studies (19,21,22).

There is no regulation for corn FB1 residue levels by European Union (EU). However, some levels are known in general terms. Mean residue levels in various regions related to FB1 found in corn and maize; 0,07-38,5 mg / kg in Latin America, 0,004-330 mg / kg in North America, 0,007-250 mg / kg in maize in Europe and 0,008-16 mg / kg in corn products, 0 , 02-8,85 mg / kg, and Asia 0.01 to 15 mg / kg. The amounts of residues detected in various countries related to fumonisins are given in Table 2 (23).

Table I. 4. Fumonisin levels in corn and corn products detected in various countries

Name of Country	Fumonisin level (mg/kg)
USA	0,08
Switzerland	0,03

Netherlands	0,006-7,1
South Africa	14-440
Canada	0,017-0,089

Fumonisins are mycotoxins prepared by a large number of Fusarium species fungi, mainly F. verticillioides and F. proliferatum; the fungi begin to produce toxins, especially at a temperature of 20 ° C and a relative humidity of> 60%(2,18,23). Fumonisins generally reproduce in corn and prepare mycotoxin (2,18,23).

I.1.4. The Effect of Fumonisin on Human and Animal Health

When the product, food and feedstuffs that are contaminating with mycotoxins are consumed by humans and animals, four types of toxic effects are emerging, acute, chronic, mutagenic and teratogenic, depending on the type of dose received, duration of exposure, toxin response, mechanism of action and defense mechanism (24,25).

Fumonisins in the food chain are a major threat to human and animal nutrition. These low-molecular-weight compounds act as receptors for important molecules in metabolism; affect nucleic acids, protein synthesis, enzymes, hormone activity.

Fumonisins have been reported to cause some important changes in lipid metabolism. Fumonisins affect the sphingolipid mechanism, which plays an important role as a structural component in the membranes of animal and plant cells. The phytotoxic mechanism has been described as affecting ribosome functions, inhibiting protein biosynthesis, and damaging the cell because of physical destruction of the cell membrane (25, 26).

FB1 is one of mycotoxins that has been proven to be hepatotoxic, nephrotoxic, and hepatocarcinogenic in "Group 2B" rats. It has also been described by the International Agency for Research on Cancer (IARC) as "possible human carcinogenesis". Fumonisins have been associated with leukoencephalomalacia in horses, pulmonary oedema syndrome in pigs, renal diseases (nephrosis) in mice, toxicity in embryos and pulmonary edema in poultry, liver poisoning, immune system disorders and diarrhea (27,28,29,30).

Fumonisin B1 causes diseases such as leukoencephalomalacia in horses and pigs (ELEM) (31) and swine lung edema (PPE) (Harrison et al., 1990; Ross et al., 1991) in pigs.

It is also reported that FB1 is carcinogenic in horses and in some parts of Africa people are reported to be linked to cancers of food borne(32). It is observed that decrease performance and immune response in calf. The effects of FB1 in poultry species are well defined. FB1 effects are in chicks; poor performance, increased organ weights, decreased immunoreactivity, and organ lesions (33,34,35). It causes toxic effects similar to the effects on chicks in turkey poultry and ducklings (34).

One of the most important reasons for contamination from mycotoxins is storage conditions. In this study, it is observed that the number of fodder samples contaminated with fumonisin increases especially during heavy rainfall periods. That is, although FB1 is detected in 19 of the 20 samples taken in the first three months of the year and 18 in 20 of the samples taken in the last three months, 9 of the 20 samples taken in the spring, and 20 samples taken in the summer are FB1 detected. When the literature is evaluated, it will be seen that the frequencies and ratios of fumonisins among countries with different climatic conditions vary. Therefore, it is important to assess the factors that contribute to this development and to take measures against it at the national level.

The consumption of high-contaminated corn is thought to be closely related to the frequency of laryngeal cancer encountered in humans in these regions. The factors responsible for the reproduction and development of the fungi that produce fumonisin are not fully known; therefore, the frequency with which these toxins are found varies with countries and different climatic conditions (36).

I.1.5. Corn Cultivation and Usage Areas

Corn (Zea mays Linnaeus) is an important plant for our country in terms of its contributions to human and animal nutrition through its nutrients, the benefits it brings to the soil and the basic raw material source for the industrial sector. Corn has been successfully produced in many countries around the world as a grain crop, a popular plant used in the construction of silage. With the expansion of breeding practices and areas of use, corn production has spread rapidly throughout the world. In our country, wheat and

corn, which has the widest planting area after harvest, is corn, which is produced as the main crop and second crop in irrigable fields (37)

Corn, a cereal, grown in significant quantities in our country, especially in the Black Sea Region, is a nutrient that has the proper medium for the growth of mycotoxins and mycotoxins. The corn that can be consumed freshly (boil and grill) is also served in corn custard, corn flour, corn flour, corn chips, popcorn, etc. Various products of the food industry such as corn starch, edible oil, alcohol and high fructose corn syrup are also included in the composition of various foods. Corn is consumed extensively in some parts of our country especially in the form of corn flour for use in making bread. However, due to changing eating habits, a rapid increase in the consumption of corn-based foods (maize preserves, cornflakes, etc.). Despite the presence of an important mycotoxin, the legal limits that determine maximum levels of fumonisin in our country have only been published in 2008. The maximum limits are 4000 μg / kg for unprocessed corn, 1000 μg / kg for maize based products, 800 μg / kg for corn-based breakfast cereals and cookies, 200 μg / kg for baby foods, according to the Communiqué on Maximum Limits of Contaminants in Foodstuffs Turkish Food Codex (2008/26) / kg and 2000 μg / kg in corn flour (38).

II. MATERIAL VE METHOD

II.1. MATERIAL

The corn specimens were assembled in such a way that they would be 50 gr from the open markets of various districts of Istanbul. A total of 40 samples were collected. Sterile packages were brought to the laboratory under sterile conditions and kept at 2-8 ºC until the day of operation

II.2. METHOD

The study was carried out in Yeditepe University Department of Nutrition and Dietetics and Faculty of Medicine Medical Microbiology Laboratory. The following tools / tools have been used;

- Laminar Cabin: To process samples without contaminants.
- Shaker incubator: For homogenization of samples.
- Elisa washer (Biotech 50): For washing in Elisa.
- Elisa Reader (Beckman): For reading Elisa results.
- Fume oven: For the preparation of chemicals.

Micro Incinerator: For cultivation on sterile conditions.

II.2. 1. Fumonisin Reaction with Elisa Method

The amount of fumonisin in the collected samples was determined by elisa method using AgraQuant Fumonisin (0.25-5.0 ppm) kit. This kit is a competing direct enzyme-binding immunosorbent assay. Fumonisin, which is liberated by 70% methanol, is detected by wells coated with enzyme-conjugate. The procedure recommended by the manufacturer was followed. First of all, the samples were prepared in accordance with the following procedure to be used in ELISA method.

- The samples were weighed as 20 gr individually for analysis (Figure II. 1) .

Figure II. 1: The samples were weighed as 20 gr individually for analysis

- Then the mixture of Methanol-distilled water in the fume oven was prepared at 70/30 ratio. This was added to the sample as 100 ml on each sample (Figure II.2).

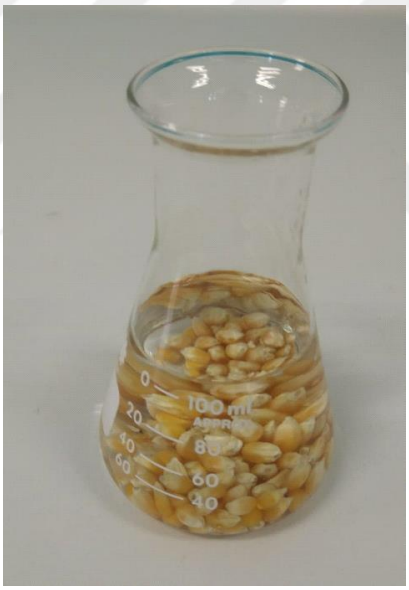

Figure II. 2: Preparation phase of corn samples

- The samples were then shaken in a 3 min shaker incubator (Figure II. 3).

Figure II. 3: Shaking the samples

- In the next step, samples were filtered using Whatman No: 1 filter paper (Figure II. 4).

Figure II. 4: Filtering proces for samples

50 µl of the final eluate was used in the ELISA test.

In order to study the Elisa test, the kit components were first brought to room temperature (Figure 5). As the standards in the kit are ready for direct use, without dilution.

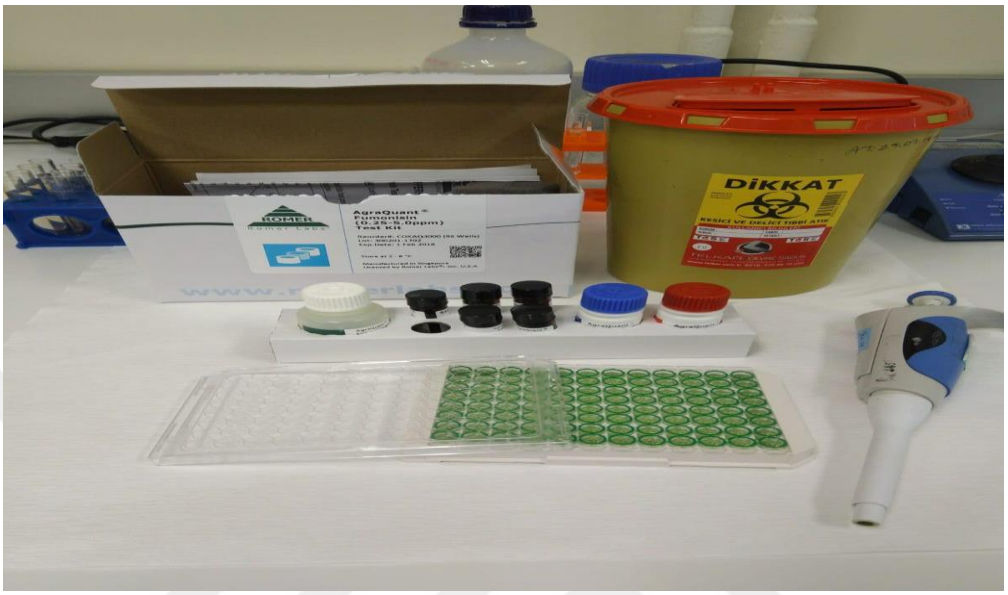

Figure II. 5: Appearance of fumonisin kit components

The following procedure was used for the Elisa test.

- In the first step, the samples were diluted 1:20. For example, 50 µL sample; A dilution of 950 µL of water was made.
- The dilution plate was pipetted with 100 µL of the diluted samples and standards with 200 µL of conjugate. The plate was then shaken carefully.
- In the next step, 100 µL was transferred from the dilution plate to the antibody-coated plate with the help of a multi-channel pipette.
- The plate was incubated for 10 min at room temperature.
- At the end of the incubation, the plate was washed 5 times in an automatic elisa washer. This device minimizes false positives caused by contamination between samples and manual washing.
- In the next step, 100 µL substrate was added to all wells by automatic pipetting.

- incubation dor 5 min at room temperature and darkness.
- In the final step, 100 μL stop solution is added and Elisa completes the test.
- The elisa plate was then elisa read on a 450 nm filter (with a 630 reference filter) and absorbance values were taken. The fumonisin values of the samples were quantitatively determined by drawing a standard curve graph using the instrument's program.

II.2. 2. Culture Method

Sabouraud 4% Dextrose Agar (SDA) (Merck, Germany) was used for the culture method. Corn samples were plated on SDA medium and left for 7-10 days in incubation. Each colony breeding at the end of the incubation was passed through the SDA and left for 7-10 days of incubation. The colonies obtained at the end of incubation and the preparations prepared with lactophenol cotton blue were evaluated under the microscope.

III. RESULTS

Forty different corn samples sold in different regions of Istanbul were tested for their fumonisin content by ELISA method. The corns tested were evaluated according to the Communiqué on Maximum Limits of Contaminants in the Turkish Food Codex Food Items. None of the 50 g corn samples collected showed the presence of fumonisin above the limits specified in the notification (4000 µg / kg) (Table 3).

Table III. 1. Fumonisin values of corn collected in various regions of Istanbul

Sample No	Results (µg/20 gr)	Results (µg/kg)
1	0.1147	5.735
2	0.13	6.5
3	0.1147	5.735
4	0.1147	5.735
5	0.1147	5.735
6	0.191	9.55
7	0.135	6.75
8	0.1147	5.735
9	0.432	21.6
10	0.1147	5.735
11	0.366	18.3

12	0.586	29.3
13	0.151	7.55
14	0.152	7.6
15	0.155	7.75
16	0.136	6.8
17	0.315	15.75
18	0.34	17
19	0.276	13.8
20	0.479	23.95
21	0.386	19.3
22	0.276	13.8
23	0.286	14.3
24	0.286	14.3
25	0.277	13.85
26	0.378	18.9
27	0.313	15.65
28	0.398	19.9

29	0.326	16.3
30	0.3	15
31	0.286	14.3
32	0.313	15.65
33	0.278	13.9
34	0.27	13.5
35	0.291	14.55
36	0.337	16.85
37	0.321	16.05
38	0.265	13.25
39	0.396	19.8
40	0.256	12.8

IV. DISCUSSION AND CONCLUSION

40 corn samples for sale in various regions of Istanbul were tested by ELISA for the content of fumonisin and evaluated according to the Communiqué on Maximum Limits of Contaminants in Turkish Food Codex Foods. The results of the corn samples tested in the study were negative. The values found in our research are suitable for fumonisin.

Studies conducted by different researchers found that fumonisin was present at a high rate of corn. The presence of FB1 in corn raw materials used in feed production in Konya province was investigated. As a result of the study, 63% of the analyzed samples had an average of 0.952 ± 0.204 ppm FB1 and it was stated that the determined quantities would not cause any adverse effects on animal and human health. There is no seasonal evaluation in this study. Such a similarity can be explained by the fact that the regions where the samples are collected are close to each other as climate (39).

In another study, fumonisin was investigated in maize and corn products in the market in Istanbul. In 25% of the analyzed samples, FB1 was detected in the range of 0.25-2.66 ppm, and 0.55 ppm FB2 was detected in only one of the samples (40).

In a study in Italy, FB1 and FB2 residues were investigated in corn and corn based foods. In maize-based dishes, the highest fumonisin contamination level (6,100 μg / g) was determined in raised corn. FB1 levels in other maize varieties ranged 0.042-3.760 μg / g. FB1 was determined at 0.060-0.079 μg / g in all milk samples tested. These findings have shown that fumonis exposure to humans is very high in Italy when corn-based foods are eaten (41).

In another study, 193 maize samples were investigated by fumonisins in USA in 1990 by thin layer chromatography. FB1 was detected in 15% of corn samples (42).

Although colonies of Fusarium are present at product , fumonisin does not always reproduce. The factors that promote fumonisin development are not fully explained. However, the drought situation after warm and rainy periods is especially important for this breeding. Likewise, the presence of insects in the urine is a helpful factor.

A comprehensive risk assessment for fumonisin is of utmost importance for human and animal health. Contamination of corn and corn based products with fumonisins is seen in many countries.

The aim of ensuring the safety of food, the production of healthy and reliable food, and the necessary rules and measures must be taken in the stages of production, transport, storage, distribution and consumption of food. Food safety management systems have been established to ensure the sustainability of healthy and reliable food production, competition and competition. The TSE 13001 standard established by the Turkish Standards Institute (TSE) is based on HACCP principles. The HACCP system ensures the production of quality and safe food products at every production stage, from production to consumption.

Studies on fumonisin in our country have been limited in number, and quantities of fumonisin present in raw materials used in foodstuffs and in foodstuffs, especially in feedstuffs, have not yet been determined to cause harmful effects. Looking at the risks in terms of human and animal health, more work on this issue should be made and more measures taken by the relevant ministries.

REFERENCES

1. Doğan, A., Tuzcu, M., Fumonisinler. *Kafkas Üniversitesi Veterinerlik Fakültesi Dergisi*, 2001; 7 (2), 237-244.
2. Kaya S.,Mikotoksinler, Veteriner Hekimliğinde Toksikoloji. *Medisan Yayın Serisi*: 2002;(53), 537-602. Ankara.
3. Steyn PS, Stander MA. Mycotoxins with Special Reference to the Carcinogenic Mycotoxins: Aflatoxins, Ochratoxins and Fumonisins. In: Ballantyne B, Marrs TC, Syversen TLM, eds. *General and Applied Toxicology*. 2nd Edition. United Kingdom: Macmillan Reference Ltd, 1999: 2145-76.
4. Steyn PS, Stander MA. Mycotoxins with Special Reference to the Carcinogenic Mycotoxins: Aflatoxins, Ochratoxins and Fumonisins. In: Ballantyne B, Marrs TC, Syversen TLM, eds. General and Applied Toxicology. 2nd Edition. *United Kingdom: Macmillan Reference Ltd,* 1999: 2145-76.
5. Hendrickse RG. Of sick turkeys, kwashiorkor, malaria, perinatal mortality, heroin addicts and food poisoning: research on the influence of aflatoxins on child health in the tropics. *Ann Trop Med Parasitol* 1997; 91 (7): 787-93.
6. Vidyasagar T, Sujatha N, Sashidhar RB. Determination of aflatoxin B1-DNA adduct in rat liver by enzyme immunoassay. *Analyst* 1997; 122: 609-13.
7. Busby WF Jr, Wogan GN. Aflatoxins. In: Edwards F, ed. Chemical Carcinogens. *York: Maple Press Co,* 1984: 945-1136.
8. Smith JS, Thakur RA. Occurance and fate of fumonisins in beef. In: Jackson L, ed. Fumonisins in Food. *New York: Plenum Press.* 1996: 39-55.
9. Leeson, S., Diaz, G., Summers, J.D., Fumonisins in "Poultry Metabolic Disorders and Mycotoxins". *University Books.* 1995; p.:299-309. Guelp, Canada.
10. Thiel, P. G., Marasas, W.F.O., Sydnham, E. W., Shephard G. S., Gelderblom, W.C.A.The implications of naturally occurring levels of fumonisins in corn for human and animal health. *Mycopathologia.* 1992; 117: 3–9.
11. Hussein, H.S., Brasel, J.M.Toxicity, metabolis and impact of mycotoxinson humans and animals, *Toxicology.* 2001; (167), 101-134.

12. Voss, K. A., Norred, W. P., Plattner R. D., Bacon C. W. Hepatotoxicity and renal toxicity in rats of corn samples associated with field cases of equine leukoencephalomalacia. *Food Chem. Toxicol*. 1989; (27)89–96.

13. Leeson, S., Diaz, G., Summers, J.D., Fumonisins in "Poultry Metabolic Disorders and Mycotoxins". *University Books.* 1995; p.:299-309. Guelp, Canada.

14. Thiel, P. G., Marasas, W.F.O., Sydnham, E. W., Shephard G. S., Gelderblom, W.C.A.The implications of naturally occurring levels of fumonisins in corn for human and animal health. *Mycopathologia.* 1992; 117: 3–9.

15. Chen j., Mirocha, C.J., Xie, W., Hogge., l., Olson, D. Production of the mycotoxin fumonisin B1 by Alternaria alternata f.splycopersici. *Appl. Environ.Microbiol.* 1992; 3928-3931.

16. Cawood, M.E., Gelderblom, W.C., Vleggaar, R., Behrend, Y., Thıel, P.G., Marasas W.F. Isolation of the fumonisin mycotoxins: A quantitative approach, *J. Agricul. Food Chem.* 1991, 39: 1958-1962.

17. Akar, F., Sarı, M., Akbaş L., Sekkin, S., Kum, C. Aydın ili ve çevresinden sağlanan mısır örneklerinin fumonisin B1 ile kirlenme durumu üzerine çalışmalar. *Bornova Vet.Kont.Ara. Enst. Derg.* 1999; 24: 15-19.

18. Nair, M.G. Fumonisins and human health. *Annals of Tropical Paediatrics.* 1998; 18: 47 –52.

19. Dombrınk-Kutzman, M.A., Dvorak, T.J. Fumonisin content in masa and tortillas from Mexico. *J.Agri.Food Chem.* 1999; 47: 622-627.

20. Norred, W.P., Voss, K.A., Rıley, R.T., Meredıth, F.I., Bacon, C.W., Merrıll, A.H.Jr. Mycotoxins and health hazards: toxicological aspects and mechanism of action of fumonisins. *Toxicological Sciences.* 1998; 23: 160 –164.

21. Voss, K.A., Chamberlaın, W.J., Bacon, C.W., Herbert, R.A., Walters, D.B., Norred, W.P. Subchronic feeding study of the mycotoxin fumonisin B1 in B6C3F1 mice and Fischer 344 rats. *Fundamental Appl. Toxicol*. 1995; 24 :102 – 110.

22. Sweeney, M.J., Dobson, A.D.W. Molecular biology of mycotoxins biosynthesis. *FEMS Microbiol. Lett.*, 1999; 175: 149-153.

23. EHC.Environmental Health Criteria 219: fumonisin B1, International Programme on Chemical Safety (IPCS; UNEP, ILO and WHO*). Eds. W.H.O.Marasas, J.D. Miller, Riley, R.T. and A. Visconti. WHO, Geneva*, 2000; p.:150.

24. Pitt, J.I.Toxigenic fungi: Which are Important? *Medical Mycology.*2000; 38: 17-22.

25. Galvano, F., Piva, A., Ritieni, A. ve Galvano, G. Dietary Strategies to Counteract the Effects of Mycotoxins: A Review. *Journal of Food Protection.* 2001; 64: 120-131.

26. Miller, J.D. Factors That Affect the Occurrence of Fumonisin. Environmental *Health Perspectives.* 2001; 109 (2): 321-324.

27. Glenn, A.E. Mycotoxigenic Fusarium species in animal feed. *Animal Feed Science and Technology*, 2007;137: 213-240.

28. Humpf, H.U., ve Voss, K.A. Effects of thermal food processing on the chemical structure and toxicity of fumonisin mycotoxins. *Molecular Nutrition & Food Research*, 2004; 48: 255-269.

29. Marasas, W. F. 0., Kellerman, T. S., Gelderblom, W. C. A., Coetzer, J. A. W., Thiel, P. G. ve van der Lugt, J. J. Leukoencephalomalacia in a horse induced by fumonisin B, isolated from Fusarium moniliforme. *Onderstepoort Journal of Veterinary Research*, 1988; 55: 197-203.

30. Ross, P.F., Nelson, P.E., Richard, J.L., Osweiler, G.D., Rice, L.G., Plattner, R.D. ve Wilson, T.M. Production of fumonisins by Fusarium moniliforme and Fusarium proliferatum isolates associated with equine leukoencephalomalacia and a pulmonary edema syndrome in swine. *Applied and Environmental Microbiology*, 1990; 56: 3225-3226.

31. Marasas, W.F.O., Kellerman, T. S., Gelderblom, W.C.A., Coetzer, J.A.W., Thıel, P. G., Vanderlugt, J. J. Leukoencephalomalacia in a horse induced by fumonisin B1 isolated from Fusarium moniliforme. Onderstepoort J. *Vet. Res.*1988; 55:197–203.

32. Sydenham, E. W., Thıel, P. G., Marasas, W.F.O., Shephard, G. S., Vanschalkwyk, D. J., Koch, K. R. Natural occurrence of some Fusarium mycotoxins in corn from

low and high esophageal cancer prevalence areas of the Transkei, Southern Africa. *J. Agric. Food Chem.*1990; 38: 1900–1903.

33. Lı, Y.C., Ledoux, D.R., Bermudez, A.J., Rottınghaus G.E. The effects of fumonisin B1 and moniliformin on antibody production and bacterial clearance in broiler chicks. *Poul. Sci*. 1997; 76:129.

34. Bermudez, A. J., Ledoux, D. R., Rottınghaus, G. E. Effects of Fusarium moniliforme culture material containing known levels of fumonisin B1 in ducklings. *Avian Dis.* 1995; 39:879– 886.

35. Javed, T., Bennett, G. A., Rıchard, J. L., Dombrınkkurtzman, M.A., Cote, L. M., Buck, W. B. Mortality in broiler chicks on feed amended with Fusarium proliferatum culture material or with purified fumonisin B1 and moniliformin. *Mycopathologia*. 1993; 123:171–184.

36. Çevik A., Ankara Bölgesi Kanatlı Karma Yemlerinde Fumonisin B1 Varlığının Araştırılması, *Doktora Tezi,* 2006; Ankara.

37. Voss, K.A., Smith, G.W. ve Haschek, W.M. Fumonisins: Toxicokinetics, mechanism of action and toxicity. Animal Feed Science and Technology. 2007; 137: 299- 325.

38. Anonim. Türk Gıda Kodeksi Gıda Maddelerindeki Bulaşanların Maksimum Limitleri Hakkında Tebliğ (2008/26). *Resmi Gazete* 17.05.2008. Sayı: 26879, Ankara.

39. Bayezit, M. (2003). Doktora tezi. Selçuk Üniversitesi Sağlık Bilimleri Enstitüsü Veteriner Farmakoloji ve Toksikoloji Ana Bilim Dalı, *Doktora Tezi.*,2003, Konya.

40. Omurtag, G.Z. Determination of fumonisin B1 and B2 in corn and Corn-Based Products in Turkey by High-Performance Liquid Chromatography, *J.Food Prot.,* 2001; 64: 1072-1075.

41. Doko, M.B., Vıscontı, A. Occurrence of fumonisins B1 and B2 in corn and corn-based human foodstuffs in Italy. *Food Addit Contam.*Jul-Aug; 1994;11:433-9.

42. Lı, Y.C., Ledoux, D.R., Bermudez, A.J., Rottınghaus G.E. The effects of fumonisin B1 and moniliformin on antibody production and bacterial clearance in broiler chicks. *Poul. Sci*. 1997; 76:129.

Kişisel Bilgiler

Adı	İLGAR	**Soyadı**	ŞAMİLOV
Doğum Yeri	Baku/ Azerbaijan	**Doğum Tarihi**	09.06.1989
Uyruğu	Azerbaycanlı	**TC Kimlik No**	99986512560
E-mail	Dr.ilqar@hotmail.com	**Tel**	+994503098889

Öğrenim Durumu

Derece	Alan	Mezun Olduğu Kurumun Adı	Mezuniyet Yılı
Doktora			
Yüksek Lisans			
Lisans	Tıp fakültesi	**Azerbaycan Tıp Üniversitesi**	2011
Lise	-		

[#] Başarılmış birden fazla sınav varsa(KPDS, ÜDS, TOEFL; EELTS vs), tüm sonuçlar yazılmalıdır

Bildiği Yabancı Dilleri	Yabancı Dil Sınav Notu (#)
İngilizce	
Rusça	

İş Deneyimi (Sondan geçmişe doğru sıralayın)

Görevi	Kurum	Süre (Yıl - Yıl)
Asistan doktor	A.Aliyev adına Devlet Doktorları Geliştirme Enstitüsü	2013-2015
		-

Bilgisayar Bilgisi

Program	Kullanma becerisi
Microsoft Office; Word, Excel, Powerpoint, Access, Outlook.	iyi

*Çok iyi, iyi, orta, zayıf olarak değerlendirin

Diğer (Görev Aldığı Projeler/Sertifikaları/Ödülleri)

1. " 4. Ulusal Sağlıklı Yaşam Sempozyumu" 12-15 Şubat 2015. Acıbadem Üniversitesi, İstanbul / Türkiye.
2. "Yeme Bozuklukları Diyetisyeni Kursu" 12-15 Şubat 2015. Acıbadem Üniversitesi, İstanbul / Türkiye.
3. "Metabolik-Bariatrik Cerrahide Beslenme Yaklaşımı ve Bariatrik Cerrahi Diyetisyenliği Kursu" 06-07 Mart 2015. Medipol Üniversitesi, İstanbul / Türkiye.
4. "Azərbaycan Urologiya və Andrologiya Assosiasiyalarının IX Simpoziumu" Konuşmacı. Konu – "Kronik Böbrek Yetmezliğinde Beslenmenin Önemi" 05-07 haziran 2015. Qafqaz Resort Hotel, Gabala / Azerbaycan
5. "Moleküler Beslenme Sempozyumu" 15 Ekim 2016. İstanbul / Türkiye

6. “7. Ulusal Obezite Kongresi” 8-11 Aralık 2016. Steigenberger Hotel, İstanbul / Türkiye.
7. “Multidisipliner Tedavi Kursu” 8-11 Aralık 2016. Steigenberger Hotel, İstanbul / Türkiye.
8. “Bariatrik Cerrahi Diyetisyenliği Kursu” 8-11 Aralık 2016. Steigenberger Hotel, İstanbul / Türkiye.
9. “Spor Beslenmesi Eğitim Semineri” 25 Aralık 2016. Burhan Felek Milli Takımlar Kamp Merkezi, İstanbul / Türkiye.
10. “Beslenmede Bilinç ve Psikoloji” 26 Aralık 2016. Yeni Yüzyıl Üniversitesi, İstanbul / Türkiye.
11. “Sağlık Kariyeri Günleri 2” 21 Ocak 2017. İstanbul / Türkiye.
12. “Hastalıklarda Beslenme Sempozyumu Karbonhidrat Sayımı” 9-10 Şubat 2017. Gazi Üniversitesi, Ankara / Türkiye.
13. “Diyabette Güncel Yaklaşımlar Sempozyumu” 16 Mart 2017. Yeditepe Üniversitesi, İstanbul / Türkiye.
14. “Türkiyede Nutri-Genetikin 15. Yılı Sempozyumu” 19 Mart 2017. Mövenpick Hotel, İstanbul / Türkiye.
15. “6. Ulusal Sağlıklı Yaşam Sempozyumu 1. Yaşam İçin Beslenme ve Spor Kongresi” 24-27 Mayıs 2017. Hilton İstanbul Bosphorus Hotel, İstanbul / Türkiye.
16. “Obezite Diyetisyenliği Kursu” 24-27 Mayıs 2017. Hilton İstanbul Bosphorus Hotel, İstanbul / Türkiye.
17. “Sporcu Diyetisyenliği Kursu” 24-27 May 2017. Hilton İstanbul Bosphorus Hotel, İstanbul / Türkiye.
18. “Besin Destekleri ve Nutrigenetik Sempozyumu” 17-18 Mart 2018. Acıbadem Universiteti Kerem Aydınlar Kampüsü, İstanbul / Türkiyə.
19. “Spor Beslenmesinde Güncel Yaklaşımlar Sempozyumu” 23-24 Mart 2018. Renaissance Istanbul Polat Bosphorus Hotel, İstanbul / Türkiyə.
20. “Ulusal Sağlıklı Yaşam Sempozyumu – ProbioClass – Beslenme & Prebiyotik & Probiyotik Bahar Okulu” 12-15 Aprel 2018, Acıbadem Universiteti Kerem Aydınlar Kampüsü, İstanbul / Türkiyə.
21. “1. GAPS günleri. GAPS, Bağırsak ve Psikoloji & Fizyoloji Sendromu Konferansı” 16 Aprel, İstanbul Universiteti Çapa Tibb Fakultəsi, İstanbul / Türkiyə.
22. “İleri Nutrigenetik ve GentestDiet Yetkili Uygulayıcı Eğitimi” 19-21 May 2018, Acıbadem Üniversitesi Kerem Aydınlar Kampüsü, İstanbul / Türkiye.
23. “Azərbaycan Urologiya və Andrologiya Assosiasiyalarının IX Simpoziumu”
    Konu – “Xroniki Böyrək Çatışmazlığında Qidalanmanın Əsasları” 05-07 iyun 2015. Qafqaz Resort Hotel, Gabala / Azerbaycan
24. “Obezite ve Malnütrisyon Sempozyumu”
    Konu – “Çocuk ve Adölesanlarda Obezite” 08 Aprel 2018, İstanbul Wish More Hotel, İstanbul / Türkiye.
25. “4-cü Beynəlxalq Bariatrik-Metabolik Cərrahi Konqresi”
    Konu– “Post Bariatrik Dövrdə Qidalanmaya Bağlı Problemlər və Həlli” 20-21 Aprel 2018, Azerbaycan Tıp Üniversitesi Tedris Cərrahiyyə Klinikası, Bakü / Azerbaycan