

Project name: Aflatoxin contamination of various nuts and the development of ways to detoxify them

Relevance:

Aflatoxins are classified by the World Health Organization (WHO) as teratogenic, mutagenic, carcinogenic, and invisible poisons. The domestic market of nuts is formed due to import deliveries, the volume of which reaches more than 70% (38 countries, 10.22232 tons for 2021). According to the data provided by the State Revenue Committee of the Ministry of Finance of the Republic of Kazakhstan for 2021, nuts are imported to Kazakhstan from 38 countries, which amounted to 10.22232 tons. The peak of imports of nuts to Kazakhstan falls on 2018 (513.10742 tons), which in monetary terms is 440.39622 thousand US dollars. In the period from 2019 to 2021, there is an expected decline in imported nuts due to the epidemiological situation in the world. Industrial cultivation of nuts in Kazakhstan began only in 2016-2017 (Turkestan and Almaty regions).

The frequency of occurrence of aflatoxin B₁ in samples of various nuts around the world is increasing. Analyzing the studies of scientists from Turkey, Iran, Pakistan, Brazil, Saudi Arabia, Italy, Algeria, the United States, it is necessary to regularly carry out more stringent monitoring and food safety systems to control aflatoxin.

Geographical origin may influence the risk of contamination, on this basis in order to protect human health, countries should increase their monitoring of aflatoxins in nuts coming from countries with a favorable environment for the growth of aflatoxigenic molds or with less stringent regulations.

The Republic of Kazakhstan is not an exception on this issue. In the Republic of Kazakhstan, problems of contamination of food products with aflatoxins were dealt with by Professor Maikanov B.S. and his scientific school. The climatic conditions of the Republic of Kazakhstan use the optimal possibility of infection of various nuts. As evidenced by the above results of our research. It should be noted that there is no observation of regular and identified studies, they find sporadic nature, and nut detoxification issues are affected by aflatoxins B₁, in an open sample.

Detoxification issues as relevant are well reflected in foreign sources. In general, reducing the risk of aflatoxin contamination requires an integrated approach in which contamination is controlled at all stages of production on a “field to table” basis. This approach involves targeted breeding, increasing crop resistance to fungus attack, and the use of biological control methods, supplemented by post-harvest measures such as proper drying and proper storage of the crop. part of the economic benefit.

In the last years, nuts have been a constant attribute of the human diet, in addition, nuts are present as fillers and food additives in confectionery products (cakes, chocolate, ice cream). The proposed methods of detoxification will be fundamentally different from foreign and domestic counterparts in their innovativeness. It should also be noted that the tests will be carried out both in vivo and with food. A feature of domestic methods of detoxification is its relative cheapness and availability.

We found that nuts are not examined for aflatoxin B₁, both at the customs zone and at the trade points. Looking at import monitoring, the main importation of nuts is carried out by smuggling in small batches, bypassing customs posts (road, rail and air transport). In the Republic of Kazakhstan, in the literature available to us, we did not find a study on the detoxification of plant products. Therefore, it is extremely important to control and regulate the level of aflatoxin B₁, in grown and imported nuts.

Goal: Development of techniques for detoxification of various nuts with aflatoxin B₁ contamination in accordance with the results of their veterinary and sanitary assessment.

Expected results: The degree of aflatoxin B₁ contamination was determined in nuts grown in Almaty and Zhambyl regions. According to the results of our research, there are

separately taken large walnut farms in the Almaty region: Integration-Turgen LLP (Enbekshikazakh district) is only 20 hectares. The main direction is the cultivation of hazelnuts (export to Italy for Nutella products), young trees 2-3 years old, the yield from one hazelnut tree is up to 10-15 kg and the sale of walnut seedlings, they are also working on adapting the Italian type of hazelnut, which externally differs in larger size and light red skin. KH "Manshuk" started their production activities recently (40 hectares), KH "Green farm" (200 hectares) and small court personal subsidiary plots. For many walnut farms in recent years in the Republic of Kazakhstan were not entirely barren. In this regard, samples of nuts were taken at the large markets "Sayahat", "Optovka", "Altyn Orda" in Almaty, where imported nuts are mainly sold and grown on the territory of the Turkestan region (walnut in the shell, peeled peanuts and in the shell, badam). In total, 113 samples of various nuts (walnuts with shells, peanuts, badam) of the harvest of 2021 and 2022 grown in Almaty and Zhambyl regions were examined: - according to organoleptic indicators (smell, taste, appearance of the kernel, the presence of pests and mold, the number of dry, underdeveloped kernels, contamination), all the studied nuts belonged to the highest grade (according to state standard), except for some samples taken at the Auyl Bereke market in Taraz, moldiness was observed in the shell of walnuts and badam and peanuts; - moisture content of the studied nuts from two areas averaged from 8.79 ± 0.001 to $10.27 \pm 0.005\%$; - the concentration of aflatoxin B₁ in the nuts of the Almaty region varied from 0.00002 ± 0.0010 to 0.002 ± 0.0011 mg/kg, which did not exceed the MPC; - excess of the concentration of aflatoxin B₁ in samples of walnuts in the markets of Taraz city (Zhambyl region) from 0.003 ± 0.0010 to 0.005 ± 0.0011 mg/kg.

The nuts cultivated on the territory of the South Kazakhstan region (Turkestan region) include walnuts in shell, peanuts, badam, pistachios, Turkestan region is a favorable region for growing nuts. To date, the largest walnut farms in the region are located in the Kazygurst district: the Kalen peasant farm, the Sarapxana rural district (6 ha), the Turbat rural district, the Baidibek Ata peasant farm (2 ha), Аққым". The rural district "Kakpak" with the peasant economy "Tolegen" (2.73 ha), "Tazabek" (2 ha), "Aldan" (3 ha), "Dauei ata" (2.6 ha). In Tulkibasovsky district: Zhambyl village, Zhambyl LLP (30 ha), Sansyzbay farm (6 ha). In the Saryagash region: Silk Alley Winery LLP (60.0 ha), Saryagash zher syyy farm (100 ha). In Saryagash Zher syyy LLP, the entire crop is sent for sale to the Turkestan and Zhambyl regions, and is also exported to Kyrgyzstan. Intermediary-entrepreneurs have opened reception points at the central markets of the districts, they buy in bulk for 400-700 tenge, depending on the quality. Then the products are processed, cleaned and sold for 1400-1800 tenge to large shopping centers and confectionery shops of the region or other regions.

Also, samples of nuts were taken at the wholesale markets "Aina", "Kyrgy" in Shymkent. In the Kyzylorda region, walnut crops are mainly grown in personal subsidiary farms (PSPs). According to the data of the Kyzylorda Regional Territorial Inspectorate, no large producers of nuts were registered in the KGI AIC of the Ministry of Agriculture of the Republic of Kazakhstan, in connection with this, samples of nuts were taken at the large wholesale market "Eski Bazaar". Basically, nuts sold to the markets are imported from the Turkestan region, and imported from Uzbekistan. When determining the degree of contamination with aflatoxin B₁ and the quality indicators of nuts (harvest of 2021 and 2022) grown in the South Kazakhstan and Kyzylorda regions, a total of 122 samples of various nuts were examined (walnut with shell, badam, walnut without shell, peanuts) it was established: - according to organoleptic indicators (smell, taste, appearance of the kernel, the presence of pests and mold, broken kernels), all the studied nuts from the two areas belonged to the highest grade (according to state standard). - the

moisture content of the studied nuts from two areas averaged from 6.08 ± 0.001 to $8.2 \pm 0.003\%$.
- samples of walnuts in the shell from the South Kazakhstan (Turkestan) region were contaminated with aflatoxin B₁: from the city of Shymkent from 0.0390 ± 0.0012 to 0.045 ± 0.0018 mg / kg, Tulkibas region 0.0193 ± 0.0012 , Lenger 0.0322 ± 0.0012 mg/kg, Sairam from 0.0158 ± 0.0018 mg/kg and from Shymkent city from 0.0390 ± 0.0012 to 0.045 ± 0.0018 mg/kg and Turkestan city from 0.0200 ± 0.0012 mg/kg.

When determining the degree of contamination with aflatoxin B₁ and the quality indicators of imported nuts, it was established: A total of 248 samples of various nuts were examined, from large cities of the Republic of Kazakhstan such as Astana, Almaty, Shymkent, Kyzylorda, Taraz and Turkestan - according to organoleptic indicators (smell, taste, appearance, kernels, the presence of pests and mold, broken kernels) all imported nuts were of the highest and first grade, except for some dry, underdeveloped and damaged (8.00%) and moldy (1.00%) samples of inshell walnuts from China;

- the presence of broken kernels with mechanical damage (20.00%) and moldiness (2.00%) in selected samples of inshell walnuts from Chile (20.00%); the presence of dry, underdeveloped and damaged kernels in samples of hazelnuts produced in Russia (8.00%), walnuts in shell and almonds from Uzbekistan (10.00%);

- excess of the mass fraction of moisture in the walnut in the shell produced in China and Chile, Uzbekistan $15.73 \pm 0.003\%$, almonds produced in China, the USA and Iran $11.92 \pm 0.002\%$;

- the excess of the concentration of aflatoxin B₁ in samples of walnuts in shell and without from China, Chile and Uzbekistan (markets of Nur-Sultan, Taraz) was over 0.045 ± 0.001 mg/kg;

- exceeding the concentration of aflatoxin B₁ in samples of pistachios produced in Turkey and Iran (markets in Nur-Sultan, Almaty) over 0.045 ± 0.003 mg/kg;

- excess of the concentration of aflatoxin B₁ in samples of almonds produced in Iran over 0.045 ± 0.003 mg/kg.

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List of publications and patents published under this project: (with links to them):

1. Tursynkhan D. Ontustik Kazakhstan ondiriletin aflatoxin B₁" lastangan zhangaktardy veterinariyalyk sanitariyalyk bagalau//Materials of the International scientific and practical conference "Seifullin readings-18: "Youth and Science-A look into the future" - Volume I (part III) – Nur-Sultan. – 2022. – P.24-26 <https://kazatu.edu.kz/webroot/js/kcfinder/upload/files/%D0%BD%D0%B0%D1%83%D0%BA%D0%B0%D0%A1%D0%A718/%D0%A2%D2%B1%D1%80%D1%81%D1%8B%D0%BD%D1%85%D0%B0%D0%BD%20%D0%94.%20%D0%A2%D0%B5%D0%B7%D0%B8%D1%81.%20%D3%A8%D0%B7%D0%B3%D0%B5%D1%80%D1%82%D1%96%D0%BB%D0%B3%D0%B5%D0%BD.pdf>

2. Smagulova A.S. Veterinary and sanitary assessment of walnuts imported from China//Materials of the International scientific and practical Conference "Seifullin readings-18: "Youth and Science-A look into the future" -, Volume I (part III) – Nur-Sultan. – 2022. – p.76 <https://kazatu.edu.kz/webroot/js/kcfinder/upload/files/%D0%BD%D0%B0%D1%83%D0%BA%D0%B0/%D0%A1%D0%A718/%D0%A1%D0%BC%D0%B0%D0%B3%D1%83%D0%BB%D0%BE%D0%B2%D0%B0%20%D0%90%D1%8F%D0%BD%D0%B0%20%D1%82%D0%B5%D0%B7%D0%B8%D1%81.pdf>

3. Auzhanova A.E. Aflatoxin contamination of imported nuts//Materials of the International scientific and practical Conference "Seifullin readings-18: "Youth and Science-A look into the future" -, Volume I (part III) – Nur-Sultan. – 2022. – pp.67-68 [https://kazatu.edu.kz/webroot/js/kcfinder/upload/files/%D0%BD%D0%B0%D1%83%D0%BA%D0%B0/%D0%A1%D0%A718\(2\)/%D0%90%D1%83%D0%B6%D0%B0%D0%BD%D0%BE%D0%B2%D0%B0%20%D0%90.%20%D1%82%D0%B5%D0%B7%D0%B8%D1%81.pdf](https://kazatu.edu.kz/webroot/js/kcfinder/upload/files/%D0%BD%D0%B0%D1%83%D0%BA%D0%B0/%D0%A1%D0%A718(2)/%D0%90%D1%83%D0%B6%D0%B0%D0%BD%D0%BE%D0%B2%D0%B0%20%D0%90.%20%D1%82%D0%B5%D0%B7%D0%B8%D1%81.pdf)

4. Auteleyeva L.T., Smagulova A. Fatty acid composition of walnuts from China // "Seifullin readings-18 (2): "SCIENCE of the XXI CENTURY - THE ERA of TRANSFORMATION" -, Volume I (part II) – Astana – 2022. – p.251.-254 [https://kazatu.edu.kz/webroot/js/kcfinder/upload/files/%D0%BD%D0%B0%D1%83%D0%BA%D0%B0/%D0%A1%D0%A718\(2\)/%D0%90%D1%83%D1%82%D0%B5%D0%BB%D0%B5%D0%B5%D0%B2%D0%B0%20%D0%9B.%D0%A2%2C%20%D0%A1%D0%BC%D0%B0%D0%B3%D1%83%D0%BB%D0%BE%D0%B2%D0%B0%20%D0%90.%D0%A1.pdf](https://kazatu.edu.kz/webroot/js/kcfinder/upload/files/%D0%BD%D0%B0%D1%83%D0%BA%D0%B0/%D0%A1%D0%A718(2)/%D0%90%D1%83%D1%82%D0%B5%D0%BB%D0%B5%D0%B5%D0%B2%D0%B0%20%D0%9B.%D0%A2%2C%20%D0%A1%D0%BC%D0%B0%D0%B3%D1%83%D0%BB%D0%BE%D0%B2%D0%B0%20%D0%90.%D0%A1.pdf)

5. Smagulova A. "On the problems of contamination of various nuts with aflatoxin B₁ in the Republic of Kazakhstan// International Scientific Symposium "Unified Health - A Look into the future", Almaty, 2022 <https://nscedi.kz/wp-content/uploads/2022/11/07.11.2022-Sbornik-simpozium.pdf>

Information for potential users: Large nut farms of the Republic of Kazakhstan and the CIS. Food safety laboratories of the markets of the Republic of Kazakhstan, the Kazakhstan Association of Producers and Processors of Nuts and Berries and large suppliers of nuts.

Additional information:

Celebration of the World Food Safety Day on 7th of June, 2022, a scientific and methodological seminar was held on the topic: "Safety and quality of various nuts" for specialists of food safety laboratories (plant products) of the Asem, Artem, Alem markets and for large suppliers nuts of Nur-Sultan. The results of the workshop are published on the official website of the Codex Alimentarius Commission (Rome, Italy) <https://www.fao.org/fao-who-codexalimentarius/news-and-events/news-details/en/c/1538955> and on the website of the University of NPJSC "KATU named after S. Seifullin"https://kazatu.edu.kz/ru/news/ucenyekatu-na-straze-pisevoj-bezopasnosti_20220608101747