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Հայաստանի ազգային  
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**ՏԵՂԵԿԱԳԻՐ**



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4' 2017



NATIONAL AGRARIAN UNIVERSITY OF ARMENIA

# INTERNATIONAL SCIENTIFIC CONFERENCE

On November 2 through 3 of 2017 the international scientific conference on “Current Problems of Agricultural Development in the Republic of Armenia” was held.

The conference, which is already a tradition, was held for the 17th time. The representatives of higher educational institutions and research institutes of Armenia took part in the conference. V.I. Aranchiy, Rector of Poltava State Agrarian Academy had a report on the topic of “Conceptual Foundations for Providing Sustainable Innovative Development in Agricultural Enterprises in a Market Economy” in the plenary session.

The conference was held in the following sections:

- Plant and vegetable growing
- Edaphology and agriculture
- Viticulture, pomiculture and plant protection
- Animal husbandry
- Veterinary science
- Mechanization of agriculture
- Land resources management, land planning and amelioration
- Technology of Agricultural Products' Processing
- Agrarian Economics
- Humanities

The conference program included 165 papers and the majority of them is recommended for publication.



YEREVAN 2017  
2-3 NOVEMBER



## ИССЛЕДОВАНИЕ ТЕХНОЛОГИЧЕСКОГО ПРОЦЕССА ПРИГОТОВЛЕНИЯ ВИНА ИЗ ТОПИНАМБУРА

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Приведены результаты исследований, касающихся переработки очищенных и измельченных клубней топинамбура водной экстракцией, кислотной гидролизацией и сгущением пищевой жидкости для получения углеводород содержащей среды.

Представлен новый метод производства натурального вина из топинамбура, основанный на брожении углеводород содержащей среды.

UDC: 631.95:633.11

## DIETARY EXPOSURE OF AFLATOXIN B1 VIA CONSUMPTION OF CEREALS IN YEREVAN

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**Keywords:** Mycotoxins, aflatoxin B1, dietary exposure assessment, semi-quantitative food frequency questionnaire (SFFQ), cereal crops

Many studies have indicated that 25% of crops produced in the world are contaminated with different species of mold and microscopic fungi (Kouadio, 2013). Mycotoxins are fungal metabolites that can be produced in crops and other food commodities both in pre- and post-harvest periods and usually are not eliminated during food processing (Raad et al., 2007). They are considered to be the most important chronic dietary risk factor which is higher than synthetic contaminant, plant toxins, food additives, etc. (Raad et al., 2007; Bennett and Klich, 2003). The most frequently detected mycotoxins in food and especially in cereal crops are aflatoxins (AFs) which are secondary metabolites produced mainly by two species of the fungal genus *Aspergillus*: *A. flavus* and *A. parasiticus* (EFSA, 2007; Tam et al., 2006). AFs are mutagenic, carcinogenic, teratogenic and genotoxic and can cause acute and chronic toxicity in humans (EFSA, 2013). There are four types of Aflatoxins: B1, B2, G1 and G2 which were detected in cereal crops (van Egmond et al., 2007). However, aflatoxin B1 (AFB1) is the most frequently detected one and was included in Group 1 as a human carcinogen (WHO IARC, 2002; Jager, 2013). That is why for many countries it is essential to protect food from these contaminants and assess the exposure to humans (EFSA, 2013). It should be stressed that the issue of mycotoxin contamination of food is typical to Armenia, too, as the country imports most of its cereals (FAO, 2005).

Our previous investigation has indicated that contamination level of AFB1 in cereal crops such as rice, buckwheat, maize and wheat sold in markets of the city of Yerevan ranged from 1.06 to 3.11 µg/kg, though the maximum acceptable limits did not exceed in the samples (Pipoyan et al., 2016). It was the first attempt to carry out exposure assessment of AFB1.

The goal of this research is to assess dietary exposure of an adult urban population of Yerevan to AFB1 through consumption of cereal crops such as rice, buckwheat, maize and wheat.

The cereal consumption data was obtained by conducting a semi-quantitative food frequency questionnaire (SFFQ) with individual foods for estimating average dietary exposure (FAO/WHO, 2005; EFSA, 2009). The survey lasted for four months from February to June 2016 in twelve districts of the city of Yerevan. In this research the adult population from 18 - 65 years old was included.

The food frequency questionnaire included a structured list of twelve individual foods including rice, buckwheat, maize and wheat. For each food, the respondent was asked to estimate the average number of times the food was consumed as well as the average portion size of consumption. The SFFQ included six options for consumption frequency: “every day”, “three times a week”, “once a week”, “once a month”, “not consumed”, and “other”. The consumption portion also included six options: “small plate”, “middle sized plate”, “large plate”, “deep plate/bowl”, “small bowl”.

Afterwards, the survey data was entered into SPSS software (IBM SPSS Statistics Version 22) and statistical analyses were carried out.

The concentrations of AFB1 in cereal crops were obtained from our previous study. The ELISA method was used to determine AFB1 concentrations in rice, buckwheat, maize and wheat. LOD of the method has been estimated to be 0.001mg/kg (Pipoyan et al., 2016). According to Global Environmental Monitoring Scheme (GEMS/Food-Euro, 1995) if fewer than 60% of results are less than the LOD, then the result can be estimated by setting all n/d (not detected) and less than LOD values equal to LOD/2. Taking into consideration this fact, LOD = 0.5 was chosen for further calculations.

Using the values of the average daily intake of cereal crops and AFB1 concentrations, exposure assessment was calculated using the following equation:

$$E = \frac{C \times DI}{BW}$$

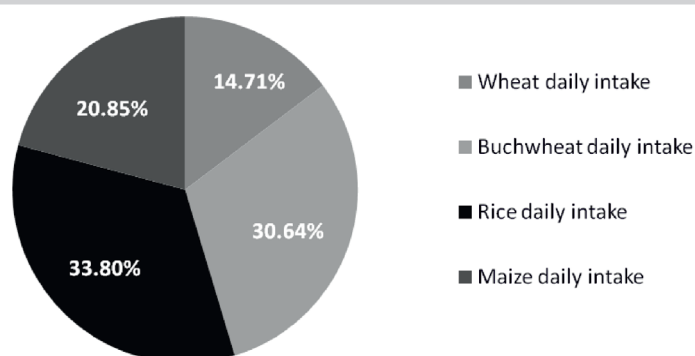
Where E is the daily exposure to AFB1 calculated in ng/ kg bw /day, C is the concentration of AFB1 in the determined samples calculated in µg/kg, DI is the daily intake of cereals measured in grams and BW is the average body weight (75 kg).

Overall, 1412 people took part in the survey from all twelve districts of Yerevan. Participants included 614 men and 798 women. Average Daily Intakes were calculated for cereals separately (Table 1).

**Table 1. Average Daily Intake Values for Cereal Crops Calculated in Grams**

Cereals	Average Daily Intake per Year
Rice	33.6
Buckwheat	30.4
Maize	20.7
Wheat	14.6

From the statistical analyses it was calculated that the most commonly consumed products were rice and buckwheat. Rice constitutes approximately 33.80 % and buckwheat constitutes 30.64 % of average daily cereal crop consumption for an adult urban population (Figure).



**Figure. The Share of Rice, Buckwheat, Maize and Wheat in Average Daily Cereal Crop Consumption for an Adult Urban Population (in Percentages)**

The sum of cereal crops exposure is 1.52 ng/ kg b.w./day (Table 2), which is 1.5 times higher than the toxicological reference value of AFB1 defined by Scientific Committee on Food (SCF) and Expert Committee on Food Additives (JECFA) which is 1 ng/kg b.w./day (0.001 µg/kg bw/day) (Leblanc, 2005).

**Table 2. AFB1 Exposure Assessment in ng/kg b.w./day**

Cereals	Exposure
Rice	0.644
Buckwheat	0.592
Maize	0.138
Wheat	0.146
<b>Total</b>	<b>1.52</b>

Taking into consideration all of the above, it is possible to note that the daily intake of AFB1 via consumption of cereal crops, in particular rice, buckwheat, maize and wheat, consumed by Yerevan population exceeds the toxicological reference value for AFB1. Hence, the intake of AFB1 through cereal crops poses potential health risks and can leave various toxic effects. The results of this research are going to be included in our further dietary studies.

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## ԵՐԵՎԱՆԻ ԶԱՊԱԲՈՒՄ ՀԱՏԻԿԱՅԻՆ ԲՈՒՅՄԻ ՕԳՏԱԳՈՐԾՄԱՆ ԱՐԴՅՈՒՆՔՈՒՄ ԱՆԼԱՏՈՔՍԻՆ Բ1-Ի ԱՋԴԵՑՈՒԹՅԱՆ ՓՆԱՔԱՏՈՒՄԸ

Դ.Ա. Պիպոյան, Ա.Ս. Հովհաննիսյան, Ս.Ա. Ստեփանյան, Է.Ա. Դռեջյան  
ՀՀ ԳԱԱ Էկոլոգամոնոսֆերային հետազոտությունների կենտրոն

Միկոտոքսինների ազդեցության գնահատումը շատ կարևոր է, քանի որ դրանք ունեն քաղցկեղածին, տերատոգեն (հրեշածին), մուտագեն և այլ հատկություններ: Քաղցկեղածին հատկություններով առավել վտանգավոր է աֆլատոքսին Բ1-ը, որը հաճախ հայտնաբերվում է հատիկային մշակաբույսերում: Մարդու օրգանիզմի վրա դրանց ազդեցության գնահատման համար երևանցիների միջև հարցում է անցկացվել բրնձի, հնդկաձավարի, ցորենի, ծավարի և եգիպտացորենի սպառման վերաբերյալ, ինչի հիման վրա հաշվարկվել է աֆլատոքսին-Բ1-ի միջին օրական թույլատրելի քանակությունը, որը կազմել է 1,52 մգ/կգ մ.զ./օր, ինչը 1,5 անգամ գերազանցում է Պարենի անվտանգության գիտական կոմիտեի կողմից սահմանված թունաբանական շեմը (1 մգ/կգ մ.զ./օր):

## ОЦЕНКА СОДЕРЖАНИЯ АФЛАТОКСИНА Б1 В ЗЕРНОВЫХ, ПОТРЕБЛЯЕМЫХ НАСЕЛЕНИЕМ ЕРЕВАНА

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Известно, что микотоксины обладают канцерогенными, тератогенными, мутагенными и прочими вредными свойствами, поэтому так важна оценка их воздействия на организм человека. Чрезвычайно сильным канцерогеном является афлатоксин Б1, чаще всего обнаруживаемый в зерновых. Для оценки его воздействия на организм человека проведен опрос среди ереванцев о частоте потребления ими риса, гречневой крупы, пшеничного зерна и кукурузы, и на основе полученных данных рассчитано среднесуточное потребляемое количество афлатоксина Б1. Выявленный показатель 1,52 нг/кг массы тела/день в полтора раза превышает токсикологический порог, установленный Научным комитетом по безопасности пищевых продуктов.