

THE NATURAL RADIOACTIVITY OF SOME FOODSTUFF
FROM MOLDOVA

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INTRODUCTION

This work is a contribution to the national programme for the supervision of the food radioactivity and provides data on natural radionuclides in wheat, maize and potatoes.

These foodstuffs are major part of Romanian population diet (32%) therefore they are being cultivated on over half an area of main crops in Romania.

MATERIALS AND METHODS

During 1984-1994 there were taken from the territory of districts Suceava, Botosani, Neamt, Iasi, Bacau, Vaslui, Vrancea and Galati, samples of wheat grains, corn and potatoes. We made up 900 average samples which represented about 30% from all the area of these crops in Moldova.

The taking of samples (in the harvest time) and their analysis were carried out by standardized methods in Romania. The samples of 1 Kg of grain respectively peeled potatoes were dried, calcinated and wet ashed. Arising acid extracts were utilized for the assay of natural radioelements: uranium-238, thorium-232, radium-226, polonium-210 and potassium-40. Uranium-238 and thorium-232 were calculated after determining the content of natural uranium and thorium by the method based on their separation and purification on a strong basic anion exchange resin and spectrophotometric measurement in the form of their Arsenazo III complex. Radium-226 was determined through its decay descendent radon-222, and by alpha rays measurement in a scintillating chamber. The assay of polonium-210 was done by electrochemical deposition and alpha counting of polonium-210 deposited on the nickel disc in a low background ZnS (Ag) scintillation counter. Potassium-40 was found by calculation after the photometric dosing in flame emission mixture of potassium natural isotopes.

RESULTS AND DISCUSSION

Natural radioactivity levels due to uranium-238, radium-226 polonium-210, thorium-232 and potassium-40 which were determined in wheat grains, maize and potatoes are presented in Table 1.

There is no significant difference between the yearly determinations values in the investigating period of eleven years

with but few exceptions. The samples prelevated in 1984-1987 have had increased values for uranium-238 and radium-226. We suppose that the intensive use of chemical fertilizers in that period is responsible for this. During the eighties, a mean quantity of 40 Kg P₂ O₅ per hectare was used in Romania for wheat, and about 150 Kg P₂ O₅ per hectare for potatoes (1,2). The measurements of the uranium-238 and radium-226 content performed in our country, showed values of up to 580 Bq/Kg fertilizer respectively 351 Bq/Kg fertilizer for the superphosphate (1,3).

Table 1. The activity concentrations (mean and limits) of the natural radionuclides in some foodstuffs

Food product	²³⁸ U mBq/Kg	²²⁶ Ra mBq/Kg	²¹⁰ Po mBq/Kg	²³² Th mBq/Kg	⁴⁰ K Bq/Kg
Wheat (grains)	39 6.1-84.5	155 10-455	135 11-370	12.3 1.6-33.2	79 35-152
Maize	32 2.4-69.8	72 10-268	89 10-372	8.2 0.8-18.9	68 30-115
Potatoes (peeled)	24 6.1-115	30 9-120	51 15-138	1.7 0.4-2.05	121 35-285

One can see from our data the high variability of natural radioelements values in the samples of food products, very likely due to the various activities of the soil in the sampling zones (4).

Potatoes from Suceava, Botosani and Neamt districts, showed somewhat higher local activities for all the five nuclides with the highest uranium-238 content.

The values are generally comparable to those found in the other zones of Romania and are situated between the variation limits of concentration values determined and reported for the other countries in areas of normal natural radioactivity (1,5,6, 7,8).

The annual ingestion of natural radioelements per capita was assessed for each of the three food-products, taking into account the yearly average consumption. Yearly average consumption of food products per capita in natural units represents the quantities of food products effectived for human consumption irrespectively of the consumption type (gross or processed), of supply source (food stores, free market, consumption from own resources of agricultural producers, etc) as well as the consumption place (households, restaurants, canteens, etc) (2,9).

The relative contributions of three major dietary categories to the total diet intake are listed in Table 2.

In the previous studies (8,9) there were determined natural radioelements in samples of different food products (representing components of human diet), menus and drinking water. The annual ingestions of natural radioelements was calculated and were used in Table 2 for the data comparing. One observes that the cereals products and the potatoes have the greatest contribution to ingestion of radium-226 and polonium-210.

Table 2. The annual ingestion of natural radionuclides (Bq y^{-1}) (region Moldova - Romania)

Food product	^{238}U	^{226}Ra	^{210}Po	^{232}Th
Wheat *	1.69	7.21	9.65	0.62
Maize *	1.42	3.02	6.80	0.43
Potatoes	1.31	1.30	2.64	0.09
Total dietary ingestion in Moldova (8,9)	6.2-11.2	12.4-20.7	24.8-40.1	1.6-4.4

* - Cereals products in equivalent flour

CONCLUSIONS

1. The natural radioactivity of the analysed foodproducts generally varied in the order: wheat grain maize potatoes excluding potassium-40, which was higher in potatoes.

2. The contribution of wheat and maize(equivalent flour) and potatoes, which are the main components of Moldavian diet, to the total dietary intake of natural radionuclides is over 60 %.

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