Palestrica of the third millennium – Civilization and Sport
Vol. 18, no. 2, April-June 2017, 75–80

Estimates of dietary acrylamide exposure among Romanian kindergarten children

Estimări ale expunerii la acrilamidă dietetică în rândul copiilor din grădinițele din România

Dana Manuela Sîrbu, Daniela Curşeu, Lucia Maria Lotrean, Monica Popa
"Iuliu Haţieganu" University of Medicine and Pharmacy, Department of Hygiene, Cluj-Napoca, Romania

Abstract

Background. Acrylamide is one of the contaminants resulting from thermal processing of food products which is known to cause cancer in animals and adversely affect health in humans.

Aims. The aim of this paper is to estimate the daily intake of acrylamide (AA) in a child community and identify/quantify the major sources of dietary exposure.

Methods. A cross-sectional study was performed in one kindergarten from Cluj-Napoca, Romania, which comprised 78 children aged 4 to 6. Information regarding their food consumption in kindergarten was collected by means of food records performed 10 days/month in 6 different months (3 months in spring and three months in autumn), leading to 60 days for the assessment period.

Results. Calculated based on mean acrylamide concentrations in foods and mean consumed food amounts, the total dietary acrylamide exposure among kindergarten children evidenced a mean of 41.65 µg/day (2.22 µg/kg body weight/day) and could increase up to 136.15 µg/day (7.27 µg/kg body weight/day) for a consumer at a high percentile of the distribution (95th to 97.5th). The major foods contributing to the mean level of total dietary exposure were cereals (representing 31.1%), especially white bread (10.7%) and cream of wheat flour (9.2%), and vegetables (30.8 % of total exposure) with potatoes being the major contributor (13.9% of total exposure). The other food groups (meat, fish, meat products, sweets, oil and fats and dairy) represented one third of the mean level of daily acrylamide exposure (contributing 37.7%).

Conclusions. The results underline the importance of increasing awareness with regard to food selection and preparation techniques of food products for children in order to decrease their exposure to acrylamide.

Key words: acrylamide, dietary intake, children, dietary assessment

Rezumat

Premize. Acrilamida este unul dintre contaminanții care rezultă din prelucrarea termică a produselor alimentare, despre care se ştie că provoacă cancer la animale şi afectează negativ sănătatea oamenilor.

Obiective. Scopul acestei lucrări este de a estima aportul zilnic de acrilamidă (AA) într-o comunitate de copii şi de a identifica/cuantifica principalele surse de expunere alimentară.

Metode. A fost realizat un studiu transversal într-o grădiniță din Cluj-Napoca, care a inclus 78 de copii cu vârsta cuprinsă între 4 şi 6 ani. Informațiile privind consumul lor alimentar în grădiniță au fost colectate prin intermediul unor înregistrări ale consumului alimentar efectuate 10 zile/lună în 6 luni diferite (3 luni de primăvară şi 3 luni de toamnă), ceea ce a condus la 60 de zile pentru perioada de evaluare.

Rezultate. Calculată pe baza concentrațiilor medii de acrilamidă în alimente şi a cantităților medii de alimente consumate, expunerea totală a acrilamidei la copiii din grădiniță are o valoare medie de 41,65 µg/zi (2,22 µg/kg greutate corporală/zi) şi poate creşte până la 136,15 µg/zi (7,27 µg/kg greutate corporală/zi) pentru un consumator la un percentil ridicat al distribuției (de la 95 la 97,5). Alimentele principale care au contribuit la media nivelului expunerii totale la alimente au fost cerealele (reprezentând 31,1%), în special pâinea albă (10,7%) şi sosul făcut din făină (9,2%) şi legumele (30,8% din expunerea totală), cartoful fiind contribuabilul major (13,9% din expunerea totală). Celelalte grupe de alimente (carne, peşte, produse din carne, dulciuri, uleiuri şi grăsimi şi produse lactate) reprezintă o treime din nivelul mediu al expunerii zilnice la acrilamidă (contribuind cu 37,7%).

Concluzii. Rezultatele subliniază importanța creşterii nivelului de conştientizare în ceea ce priveşte selecția alimentelor şi tehnicile de preparare a produselor alimentare pentru copii, pentru a reduce expunerea lor la acrilamidă.

Cuvinte cheie: acrilamidă, aport alimentar, copii, evaluare dietetică.

Received: 2017, April 17; *Accepted for publication:* 2017, May 3
Address for correspondence: Lucia Lotrean, Cezar Petrescu Str. No. 6, Cluj-Napoca, Romania
E-mail: llotrean@umfcluj.ro
Corresponding author: Lucia Maria Lotrean, llotrean@umfcluj.ro Pasteur Str., No 6, Cluj-Napoca, Romania

Introduction

Acrylamide (AA) is known as an important organic compound used in the production of polacrylamides in chemical industry. It is a component of tobacco smoke and in 2002, researchers at the Swedish National Food Administration and Stockholm University reported its production as a result of high-temperature cooking (120^{0}C or higher) in a variety of fried and oven-baked plant-based foods which are high in carbohydrates (***, 2005).

The main route of acrylamide formation in heated food is the Maillard reaction, which also forms color and flavor. Upon heating, free asparagine reacts with reducing sugars or other carbonyl compounds to form acrylamide. Formation from wheat gluten is also possible, but it is not enough investigated (4). Concentrations are likely to represent a balance of complex competing processes of formation and destruction of AA. Most AA is accumulated during the final stages of baking, grilling or frying processes as the moisture content of the food falls and the surface temperature rises, with the exception of coffee where levels fall considerably at later stages of the roasting process. AA seems to be stable in the large majority of the affected foods, again with the exception of ground coffee for which levels can decline during storage over months (***, 2005; Sirbu, 2007; Borda & Alexe, 2011).

Neurotoxicity, adverse effects on male reproduction, developmental toxicity and carcinogenicity were identified as possible critical endpoints for AA toxicity from experimental animal studies (***, 2005; ***, 2015).

Today, AA is classified as a "probable human carcinogen" (IARC Group 2A) by the International Agency for Research on Cancer (*** 1994; ***, 2015; Rice, 2005). Dutch cohort studies have shown a significant increase in risk for ovarian and endometrial cancers (daily dietary exposure to 21 µg acrylamide or 0.32 µg/kg body weight/day) and a marginally significant increase in risk for renal cell cancer (daily dietary exposure to 21.8 µg acrylamide or 0.30 µg/kg body weight) (Hogervorst et al., 2007; Hogervorst et al., 2008).

Typically, dietary intake or exposure assessments estimate the intake of chemical contaminants by combining data from measurements of this chemical compound in various foods with data on dietary patterns in a particular region or community. In this regard, special attention should be given to specific vulnerable groups, such as infants and young children (***, 2010) (1). As their bodies are developing and they generally consume more food than adults, on a body weight basis, children are at particular risk of illness from exposure to chemical hazards including acrylamide in food (Miller, 2003). Unacceptably high exposures can be avoided when the levels of hazardous substances in food are monitored.

Hypothesis

This study aims to estimate the mean acrylamide dietary exposure per day among preschool children in Cluj-Napoca, Romania, and to identify which food categories contribute significantly to acrylamide exposure among the study sample.

Material and methods

a) Period and place of the research

A cross-sectional study was performed in one kindergarten from Cluj-Napoca, Romania. The study was approved by the management of the kindergarten.

Information regarding the food offered to the children during their program in the kindergarten (breakfast, lunch, snacks) was collected by means of food records performed 10 days/month in 6 different months (3 months in spring and three months in autumn), leading to 60 days for the assessment period.

b) Subjects and groups

The study focused on daily food consumption in the kindergarten included in the study, which comprised 78 children aged 4 to 6.

c) Tests applied

Data were drawn from food lists containing information about the food products purchased and used daily by the kindergarten canteen in order to prepare the daily menu. The daily food intake of one person for different products from different food groups was calculated by dividing the purchased quantity of each food product to the number of portions of food that were prepared daily. The daily mean consumption over the investigated period for each child was calculated by summing the values obtained for each day/person and dividing the result to the number of days of the investigation (***, 2001; Ionut et al., 2001; Coulston & Boushey, 2008).

The body weight of the children was obtained from their medical records. The mean body weight (bw) of the children was 18.73 kg (16.03 kg the lowest value and 21.43 kg the highest value).

d) Statistical processing

The mean dietary acrylamide exposure was calculated by applying a deterministic model using average food consumption levels and average AA concentrations in the relevant food products.

Due to the lack of acrylamide determination in national food, information on AA levels in food items was obtained from databases reported by the European Food Safety Authority (EFSA) based on 43,419 analytical results from food commodities collected and analyzed since 2010 and reported by 24 European countries and six food associations - including 206 samples from Romania (***, 2015) - and by The Joint FAO/WHO Expert Committee on Food Additives (based on national occurrence data on acrylamide reported by 31 countries, including 22 European countries some of which from Central and Eastern Europe) (4). The analytical determination of AA in food products reported in these two databases was performed by high-performance liquid chromatographic (HPLC) or gas chromatographic (GC) separation methods (***, 2015).

Starting from the general equation (1) for assessing dietary exposure to chemical substances, recommended by the literature (***, 2008; Kim et al., 2015), the estimated daily dietary AA intake was calculated for the main food categories: animal food (dairy, meat/poultry/fish and eggs), vegetable food groups (vegetables, fruits, cereals and pulses), sweets and dietary fats, according to the equation (2).

Dietary Exposure = Σ (Daily Food Intake × Chemical Concentration in Food) (1)

DI_{AA} = DFI X $Conc_{AA}$ /1000 (2)

DI_{AA} is the estimated daily AA intake in µg/day

DFI is the individual mean daily food intake in g/day

$Conc_{AA}$ is the mean AA concentration per food item in µg/kg

1000 for converting *kg* in *g* of food.

Chronic exposure to AA was assessed at individual level by multiplying the mean daily consumption for each food by the corresponding mean occurrence level, summing up the respective intakes throughout the diet, and finally dividing the results by the individual's body weight.

Total daily intake of AA (TDI_{AA}) summed up individual data across all food items and was expressed in µg/day as well as in µg/kg body weight/day.

Results

In Tables I, II and III the descriptive statistics for DFI (mean food intake in g/day), DI_{AA} (daily intake in µg/day) and TDI_{AA} (total daily exposure to acrylamide) data are given by food and by food subgroup.

Table I summarizes the results obtained for estimated acrylamide exposure from animal foods. The mean concentration of AA in animal food is 7.08 µg/day, but it could increase in some products according to the cooking technique, so the high percentile 95^{th} to 97.5^{th} corresponds to 33.28 µg/day. The main source of AA (77.68%) is represented by meat (fried or oven-roasted chicken and pork), fish (breaded fried fish) and some meat products.

Table II summarizes the results obtained for estimated acrylamide exposure from plant-based food groups (vegetables and fruits, cereals and pulses).

The mean value of AA is 25.79 µg/day, while the high percentile 95^{th} to 97.5^{th} is 67.29 µg/day. The main sources are: cereals 11.41 µg/day (21.77 µg/day for the high percentile 95^{th} to 97.5^{th}), potatoes 5.8 µg/day (19.31 µg/day for the high percentile 95^{th} to 97.5^{th}), fried, boiled or canned vegetables - 5.05 µg/day (11.48 µg/day for the high percentile 95^{th} to 97.5^{th}), and fruits (baked or canned) - 2.0 µg/day (11.75 µg/day for the high percentile 95^{th} to 97.5^{th}).

Table III gives the acrylamide exposure characteristics by daily intake of sweets and dietary oils and fats. The mean AA intake values for these food groups ranged between 8.78 and 35.58 µg/day (at the high percentile 95^{th} to 97.5^{th}), 5.55 - 16.9 µg/day for sweets with the highest values for sugar (2.89 - 9.87 µg/day), and from 3.28 to 18.68 µg/day for dietary oils and fats.

Table IV presents AA exposure per day as well as per kg of body weight for the main food groups from the children's diet, based on an average child weight of 18.73 kg. The mean exposure per day was estimated to be 41.65 µg/day, while depending on the cooking technique the amount could increase to 136.15 µg/day at high (95^{th} to 97.5^{th}) percentiles. This means that the mean exposure per kg of body weight was 2.22 µg/kg bw/day, while high exposure corresponding to the high (95^{th} to 97.5^{th}) percentiles was 7.26 µg/kg bw/day.

In Table IV and Fig. 1, food groups are also expressed as percent of total AA exposure (TDI_{AA}). Cereals and pulses (18.2% - 31.1% of TDI_{AA}) and vegetables and fruits (30.8% - 31.2% of TDI_{AA}) are the main contributor food groups to AA exposure in children. These are followed by meat, fish and meat products (13.2 % - 20.7% of TDI_{AA}), sweets (13.2% - 12.4% of TDI_{AA}), oils and fat (7.9% - 13.7% of TDI_{AA}) and dairy products (3.4 % - 3.6% of TDI_{AA}). Eggs account for low percentages (0.4 - 0.2 % of TDI_{AA}).

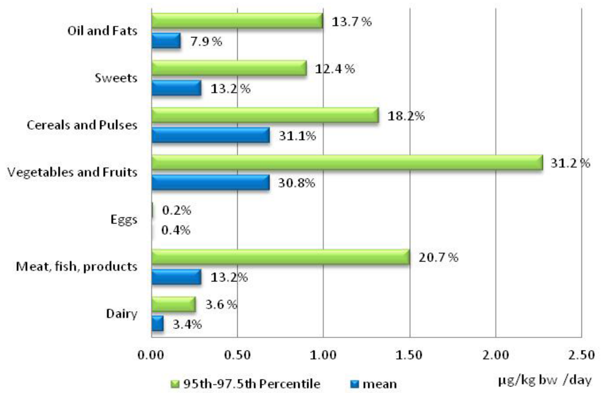

Fig. 1 – Food group contributors to estimated AA exposure (mean value and high percentile of distribution – expressed as % of TDI_{AA}).

Table I

Mean daily food intake (DFI) and estimated daily exposure (DI_{AA}) to acrylamide from animal food groups.

Food category	DFI Mean food intake (g/day)	$Conc_{AA}$* (µg/kg) Mean	$Conc_{AA}$* (µg/kg) P95th - 97.5th	DI_{AA} (µg/day) Mean	DI_{AA} (µg/day) P95th - 97.5th
Dairy	**232.1**			**1.4**	**4.87**
Milk	169.4	6	21	1.01	3.55
Yogurt	44.2	6	21	0.26	0.92
Cheese	18.5	6	21	0.11	0.38
Meat/poultry/fish	**130**			**5.5**	**28.13**
Chicken (fried, oven-roasted)	50.0	42	217	2.1	10.86
Chicken (nuggets)	13.0	42	217	0.55	2.82
Pork (oven-roasted, boiled)	31.5	42	217	1.32	6.83
Fish (breaded, fried)	2.0	64	179	0.13	0.35
Organs (liver, fried)	11.0	42	217	0.46	2,39
Meat products (sausages, ham, salami)	22.5	42	217	0.95	4.88
Eggs	**10.0**	18	28	**0.18**	**0.28**
DI_{AA} from animal food				**7.08**	**33.28**

*$Conc_{AA}$ (µg/kg) as mean and high distribution percentile (95^{th} to 97.5^{th}) (***, 2015) (4)

Table II

Mean daily food intake (DFI) and estimated daily AA exposure (DI_{AA}) from plant-based foods.

Food category	DFI Mean food intake (g/day)	$Conc_{AA}$* (µg/kg) Mean	$Conc_{AA}$* (µg/kg) P95th - 97.5th	DI_{AA} (µg/day) Mean	DI_{AA} (µg/day) P95th - 97.5th
Vegetables and fruits				12.85	42.54
Potatoes	**120.8**			**5.8**	**19.31**
French fries	8.0	308	971	2.46	7.77
Baked (with peel)	6.0	147	696	0.88	4.18
Boiled (without peel)	106.8	23	69	2.46	7.37
Vegetables (fried/boiled/canned)	**75.5**				
Cabbage	14.4				
Carrots	26.4				
Parsley	5.2				
Cauliflower	2.3				
Celery	6.4				
Eggplant	0.7	67**	152**	**5.05**	**11.48**
Green beans	3.5				
Frozen mixed vegetables	1.3				
Onion	6.7				
Garlic	0.8				
Pepper	5.3				
Spinach	2.5				
Fruits (baked/canned)	**37.2**				
Apples	36.5	54**	316**	**2.0**	**11.75**
Plums (from compote)	0.7				
Cereals and pulses				12.94	24.75
Cereals	**161.64**			**11.41**	**21.77**
White breads	106.4	42	156	4.47	16.59
Biscuits	3.34	201	810	0.67	2.7
Wheat flour (cream)	13.5	284	-	3.83	-
Corn flour	4.5	133	-	0.59	-
Crackers	2.0	231	590	0.46	1.18
Breakfast cereals	3.5	117	367	0.40	1.28
Rice	8.6	83	-	0.71	-
Pasta	19.8	13	-	0.26	-
Pulses	**6.7**			**1.53**	**2.98**
Dry beans	2.5	40	179	0.1	0.45
Peas	4.2	349	617	1.43	2.53
TDI_{AA} from the vegetable food group				**25.79**	**67.29**

*$Conc_{AA}$ (µg/kg) as mean and high distribution percentile (95th to 97.5th) (***, 2015) (4)

** Conc $_{AA}$ is given for the whole vegetable and fruit group because of the available information in the literature

(-) = Information not available in the literature

Table III

Mean daily food intake (DFI) and estimated daily exposure (DI_{AA}) to acrylamide from sweets ant dietary fats

Food category	DFI Mean food intake (g/day)	$Conc_{AA}$* (µg/kg) Mean	$Conc_{AA}$* (µg/kg) P95th - 97.5th	DI_{AA} (µg/day) Mean	DI_{AA} (µg/day) P95th - 97.5th
Sweets	**64.6**			**5.55**	**16.9**
Sugar, white, granulated	33.7	86	293	2.89	9.87
Honey	1.7	86	293	0.15	0.49
Syrup	2.4	86	293	0.20	0.7
Waffles	2.3	201	810	0.46	1.86
Muffins/sponge cake	18.1	66	219	1.19	3.96
Nesquik Chocolate Flavour	0.7	104	-	0.07	-
Plum jam	1.2	89	-	0.10	-
Chocolate	4.5	104	-	0.47	-
Dietary oils and fats	**60.2**			**3.28**	**18.68**
Vegetable oil	25.0	131	747	3.28	18.68
Butter/margarine	14.5	-	-	-	-
Cream	20.7	-	-	-	-
TDI_{AA} from sweets and fats				**8.78**	**35.58**

*$Conc_{AA}$ (µg/kg) as mean and high distribution percentile (95th to 97.5th) (***, 2015) (4)

(-) = Information not available in the literature

Table IV

Food group contributors to total daily exposure to acrylamide (TDI_{AA})

Food category	DI_{AA} Mean			DI_{AA} 95^{th} – 97.5^{th} percentile		
	µg/day	µg/kg bw/day	% of TDI_{AA}	µg/day	µg/kg bw/day	% of TDI_{AA}
Dairy	1.4	0.075	3.4	4.87	0.26	3.6
Meat, fish, products	5.5	0.293	13.2	28.13	1.50	20.7
Eggs	0.18	0.009	0.4	0.28	0.01	0.2
Vegetables/fruits	12.85	0.686	30.8	42.54	2.27	31.2
Potatoes	5.8	0.31	13.9	19.31	1.03	14.2
Cereals/pulses	12.94	0.690	31.1	24.75	1.32	18.2
White bread	4.47	0.238	10.7	16.59	0.885	12.2
Wheat flour	3.83	0.204	9.2	-	-	-
Sweets	5.5	0.293	13.2	16.9	0.90	12.4
Oil and fats	3.28	0.175	7.9	18.68	1.00	13.7
TDI_{AA}	**41.65**	**2.22**	100	**136.15**	**7.27**	100

TDI_{AA} = Total AA daily exposure

Discussions

This study focuses on the estimation of acrylamide in the diet of Romanian kindergarten children aged 4-6, because of its possible influences on their nutrition and health. Several studies worldwide have started to assess this issue, but little information is available with regard to this issue in Romania (Kim, 2015; ***, 2008; Vogt et al., 2012; ***, 2010; ***, 2015) (3). Total diet studies are designed to assess chronic dietary exposure to food chemicals (AA) actually ingested by population subgroups (***, 1992; ***, 2008). The majority of total diet studies worldwide use the point estimate (deterministic) approach to assess mean dietary exposure for a whole population. Estimates for specific population subgroups (e.g. infants or young children) can also be determined if food consumption data are available.

The estimate of mean dietary exposure to AA in the study sample was 2.22 µg/kg bw per day and for consumers at the high (95^{th} - 97.5th) percentile the estimate of dietary exposure was 7.27 µg/kg bw per day. The European Food Safety Authority (EFSA) reports mean and 95th percentile dietary AA exposures in different countries based on several surveys performed among different age groups, which are estimated at 0.4 to 1.9 µg/kg body weight (bw) per day and 0.6 to 3.4 µg/kg bw per day, respectively (***, 2015). It can be seen that the mean dietary exposure in our sample was slightly higher than the values reported by EFSA (2.22 µg/kg bw per day vs 1.9 µg/kg bw per day), while dietary exposure at the high percentiles ($P95^{th}$ - 97.5^{th}), which appears in the case of more intense cooking time and temperature, was double the values reported by EFSA (7.27 µg/kg bw per day vs 3.4 µg/kg bw per day) (***, 2015).

The Environmental Protection Agency in USA proposes the reference dose <0.002 mg/kg bw/day for oral intake of acrylamide (2). The mean exposure of our study sample was lower than this value, but for consumers at the high (95^{th} - 97.5th) percentile the estimate of dietary exposure was more than three times higher.

The main groups of food products contributing to the mean level of acrylamide exposure are vegetal food with 1.376 µg AA/kg bw/day (61.9% of TDI_{AA}), with quite equal contributions of cereals and pulses (0.690 µg/kg bw/day), and vegetables and fruits (0.686 µg/kg bw/day). The main representatives of this group are: potatoes (13.9% of TDI_{AA}), white bread (10.7% of TDI_{AA}) and wheat flour cream (9.2% of TDI_{AA}). Bread is frequently and widely consumed (106.4 g/day), accounting for 4.47 µg AA/day (representing 10.7% of TDI_{AA}), followed by wheat flour cream with 3.83 µg AA/day. These data indicate that for frequent consumers, cream of wheat may be a substantial source of exposure to AA in the diet (0.204 µg/kg bw/day representing 9.2% of TDI_{AA}).

In the case of intense cooking time and temperature (at a high percentile of the distribution - 95th to 97.5^{th} percentile), the highest values are registered for vegetables and fruits (especially potatoes, where a 3 times higher value is found).

Many ready-to-eat cereals are toasted, roasted or fried, and the majority of ready-to-eat cereals contain measurable levels of AA (117-367 µg/kg). In our study, the daily food intake for ready-to-eat cereals was only 3.5 g/day with a DI_{AA} between 0.40-1.28 µg/day. These data indicate that some ready-to-eat cereals can be a substantial source of exposure to AA in the diet if daily consumption is higher.

With regard to animal food groups, it can be observed that dairy products and eggs are not important sources of AA, but meat and fish provide 13.2-20.7% of the mean daily AA intake (0.293-1.5 µg/kg bw/day).

Sweets contribute 0.293 µg/kg bw/day of AA, representing 13.2% of the TDI_{AA}, while fats contribute 0.175 µg/kg bw/day, representing 7.9 % of the TDI_{AA}.

The study is subject to limitations. In our study, the food record method was applied only to diet from the canteen (the morning meal, lunch and one snack), food consumption data missing from the family environment (snacks and dinner), so we can say that the data obtained by us cannot be applied to the whole day. Moreover, the mean content of food products is based on literature data and was not determined by chemical methods in the sample of food from the kindergarten. On the other hand, given that waste at the kindergarten or individual level is not taken into account, food record data tend to slightly overestimate consumption.

Conclusions

1. The study estimates AA exposure from food intake during meals at kindergarten in Romanian children.
2. The results underline the importance of increasing awareness with regard to food selection and preparation techniques of food products for children in order to decrease their content in AA.
3. Future studies should try to monitor AA presence in different types of foods according to their preparation technique, as well as exposure of different population groups to AA in Romania.

Conflicts of interest

The authors have no conflict of interest.

Acknowledgement

This work was supported by a grant of the Romanian National Authority for Scientific Research and Innovation, CNCS - UEFISCDI, project number PN-II-RU-TE-2014-4-2631.

References

Borda D, Alexe P. Acrylamide levels in food. Ro J Food Sci. 2011; 1 (1): 3–15.

Coulston AM, Boushey C. Nutrition in the Prevention and Treatment of Disease. 2nd ed. Elsevier, 2008.

Hogervorst JG, Schouten LJ, Konings EJ, Goldbohm RA, van den Brandt PA. A prospective study of dietary acrylamide intake and the risk of endometrial, ovarian, and breast cancer. Cancer Epidemiol Biomarkers Prev.. 2007; 16(11):2304-2313. DOI:10.1158/1055-9965.EPI-07-0581.

Hogervorst JG, Schouten LJ, Konings EJ, Goldbohm RA, van den Brandt PA. Dietary acrylamide intake and the risk of renal cell, bladder, and prostate cancer. Am J Clin Nutr. 2008; 87(5):1428-1438.

Ionuţ C, Popa M, Calfa C, Sirbu D, Curşeu D, Ionut V, Laza V, Năsui B. Food and nutrition hygiene-practical notions: Chpt. 13. Dietary Assessment Methods (in Romanian). Ed Med Univ Iuliu Haţieganu, Cluj-Napoca 2001, 194-218.

Kim C, Lee J, Kwon S, Yoon HJ. Total Diet Study: For a Closer-to-real Estimate of Dietary Exposure to Chemical Substances . Toxicol Res. 2015; 31(3): 227–240. DOI:10.5487/TR.2015.31.3.227.

Miller MD, Marty MA, Arcus A, Brown J, Morry D, Sandy M. Differences between children and adults: implications for risk assessment at California EPA. Int J Toxicol. 2002; 21(5): 403-418. DOI:10.1080/10915810290096630.

Rice JM. The carcinogenicity of acrylamide. Mutat Res 2005;580;(1-2):3-20. DOI:10.1016/j.mrgentox.2004.09.008.

Sîrbu D. Siguranţa alimentelor şi sănătatea umană. Ed Med Univ „Iuliu Haţieganu" Cluj-Napoca. 2007, 92-94.

Vogt R, Bennett D, Cassady D, Frost J, Ritzand B, Hertz-Picciotto I. Cancer and non-cancer health effects from food contaminant exposures for children and adults in California: a risk assessment. Environ Health. 2012;11:83 http://www.ehjournal.net/content/11/1/83. DOI: 10.1186/1476-069X-11-83.

***. EFSA Panel on Contaminants in the Food Chain. Scientific Opinion on Acrylamide in Food. EFSA J. 2015;13(6):4104

***. European Food Safety Authority Results on acrylamide levels in food from monitoring year 2008. EFSA J. 2010; 8(5):1599.

***. International Agency for Research on Cancer (IARC). Acrylamide. IARC monographs on the evaluation of carcinogenic risks to humans, some industrial chemicals, vol.60. Lyon: Intern Ag Res Cancer.1994, 389-433.

***. Romanian Ministry of Health, Order no. 65. Legislative measure regarding the medical care of preschool children, school children and students. Published in the "Monitorul Oficial", Part I no. 777 of December 5, 2001.

***. WHO. Dietary exposure assessment of chemicals in food. Report of a Joint FAO/WHO Consultation. Geneva: WHO; 2008, 1-80.

***. WHO. Assessment of dietary intake of chemical contaminants. Global Environment Monitoring System Food Contamination Monitoring and Assessment Programme Geneva: WHO; 1992.

***. WHO/FAO. Summary and conclusions of the sixty-fourth meeting of the Joint FAO/WHO Expert Committee on Food Additives (JECFA). WHO/FAO; 2005.

Websites

(1) European Food Safety Authority (EFSA). Update on acrylamide levels in food from monitoring years 2007 to 2010. EFSA J 2012; 10(10):2938-2976. Available online at: www.efsa.europa.eu/efsajournal. Accessed in February 2017

(2) U.S. EPA. Toxicological review of acrylamide (CAS No. 79-06-1) in support of summary information on the Integrated Risk Information System (IRIS) (Report No. EPA/635/R-07/008F). Washington, DC: U.S. Environmental Protection Agency; 2010. Available online from: http://www.epa.gov/iris/toxreviews/0286tr.pdf#page=217. Accessed in February 2017

(3) WHO. GEMS/Food total diet studies. Report of the 3rd international workshop on total diet studies, Paris, France, 14–21 May 2004. Geneva, Switzerland: WHO; 2005 Available online from: http://www.who.int/foodsafety/chem/en/). Accessed in February 2017

(4) WHO/ FAO. Safety evaluation of certain contaminants in food – FAO/JECFA Monographs 8, WHO Food Additives Series: 63. WHO/FAO; 2011. Available online from: http://www.inchem.org/documents/jecfa/jecmono/v63je01.pdf. Accessed in February 2017