

RESEARCH ON INCIDENCE OF ACRYLAMIDE IN THERMALLY PROCESSED FOODS

CERCETĂRI PRIVIND INCIDENTA ACRILAMIDEI IN PRODUSE ALIMENTARE PRELUCRATE TERMIC

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Abstract. Acrylamide is a substance well known, industrial synthesized and used since the late nineteenth century. Toxicological profile include toxic effects to the reproductive system, neurotoxicity, genotoxicity and significant carcinogenic potential. This substance has sparked the interest of ecotoxicologists and the whole medical world in 2002 when it was detected in foods eaten by students from the University of Stockholm. The amide of acrylic acid is formed in various chemical ways from carbohydrates and amino acids from plant-based foods by frying, baking, gratin, processes involving exposure to high temperatures. The experiment detailed in this article attempts to assess the content of acrylamide in foods excessive consumed by children and adolescents. We analyzed 25 samples of potato chips, popcorn, biscuits, cookies, cocoa, coffee, cakes, all in various assortments. For statistical correlations between acrylamide and components of the nutritional declaration, it was used Spearman rank coefficient calculation, retaining as significant correlation coefficients with significance level of $p < 0.05$.

Key words: acrylamide (ACR), asparagine, acrolein, nutrition declaration, fatty acids

Rezumat. Acrilamida este o substanță cunoscută, sintetizată și utilizată industrial încă de la sfârșitul secolului al XIX-lea. Profilul său toxicologic include efecte toxice la nivelul aparatului reproducător, neurotoxicitate, genotoxicitate și un semnificativ potențial carcinogenic. Această substanță a stârnit interesul ecotoxicologilor și întregii lumi medicale, în 2002, când a fost decelată în produse alimentare consumate de studenții de la Universitatea din Stockholm. Amida acidului acrilic se formează pe diferite căi chimice din glucide și aminoacizi din alimente de origine vegetală prin prăjire, coacere, gratinare, procedee ce presupun expunere la temperaturi ridicate. Experimentul detaliat în acest articol încearcă să evalueze conținutul în acrilamidă al unor produse alimentare consumate excesiv de copii și adolescenți. S-au analizat 25 probe de chipsuri, popcorn, biscuiți, fursecuri, cacao, cafea, prăjituri, toate în diverse sortimente. Pentru stabilirea unor corelații statistice între valorile acrilamidei și a componentelor din declarația nutrițională, s-a utilizat calcularea coeficienților de rang Spearman, reținând ca fiind semnificativi coeficienții de corelație cu prag de semnificație $p < 0,05$.

Cuvinte cheie: acrilamidă (ACR), asparagină, acroleină, declarație nutrițională, acizi grași

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INTRODUCTION

Acrylic acid amide is a chemical substance of low molecular weight, the structure of which can be found in the two centers of unsaturation (Pelluchi, 2007). Although its toxicity is well known, acrylamide is synthesized from the nineteenth century and continue to find more and more uses in industrial scale, mostly by polymer his polyacrylamide, considering that not a danger to the environment and, especially for humans (Bergmark, 1992; Calleman C.J., 1994; Mencinicopschi, 2005, FAO/WHO, 2002). Only in 2002 a study conducted at the University of Stockholm highlights acrilamidei presence in the French fries in hazardous concentrations for life, drawing attention to the real risk to public health (IARC, 1994, WHO, 2006). Soon, it proved that acrylamide is formed in foods vegetable thermally processed. These vegetable products occurs acrylamide containing amino acids (asparagine, in particular), ozide reducing or poliglucide (starch).

The main way of training of acrilamidei in foodstuffs is considered Maillard reaction, starting from amino acids and carbohydrate, but cannot be ignored nor the possibilities of obtaining from the acrylic acid, acroleina resulting from the hydrolysis of the fatty acids, even the glycogen synthesis of meat products etc. (Burlacu, 2009).

Since the range of foods, especially the so-called category of "substitution foods, foods that have replaced a table (biscuits, popcorn, chips, etc.), a "food to relax" (which is bored or watching an action movie, concert, parties, etc.) or "light food" (convenient to purchase food) is very wide and varied and is likely to be task acrylamide risk, the work of this aim to draw the attention of the relevant mode on the danger to which they are exposed especially the age classes: vulnerable children and young people who have not ensured be wholesome food before evening.

In this respect it had in view, detection acrilamidei, the substance of which the toxicological profile includes neurotoxicity, carcinogenicity, mutagenicity, reproductive toxic effects etc. in as many samples of snacks, crackers, chips, snaksuri, popcorn, pastries, cake, salted and roasted seeds etc.

MATERIAL AND METHOD

The experimental model has included 20 samples of food products obtained through a thermal processing, food category of the most known and used because of the convenience of buying and excessive advertising.

The samples from which have been analyzed acrylamide have been collected from various kinds of chips (Lays, Extra DEEP Chio, Chio Chips salt etc.), popcorn (Star Popcorn salt), biscuits (East Harmony, Alexia, Sandwich crackers taste lemon), coffee (Tchibo, Espresso instant coffee decaffeinated Gourmet Selection), cocoa (Dr Oetker), sweets (cakes confectionery).

The content of acrylamide was analyzed by gas chromatography using the system of extraction of acrylamide, fats, proteins, and electrolytes to observe correlations between the values of acrylamide and the values of fats, proteins and electrolytes.

RESULTS AND DISCUSSIONS

Quantification of acrylamide of thermally processed food samples are presented in table 1.

Table 1

Acrylamide concentrations in samples

Sample	Product name	Acrylamide [µg%]
P1	Lay's	0.017
P2	Chio Exxtra DEEP	0.099
P3	Popcorn Star	0.001
P4	Chio Sare Chips	0.11
P5	Krax Grill Paprika	0.012
P6	Tortilla Chips	0.75
P7	Lay's Maxx DEEP RIDGED	0.058
P8	Krax Original Bacon	0.012
P9	Biscuiți Armonia Estului	0.076
P10	Biscuiți Sandwich with lemon flavor	0.009
P11	Alexia – Cocoa flavor	0.058
P12	Biscoff	0.090
P13	Petit Beurre	0.0089
P14	Cocoa Oetker	0.09981
P15	Coffee Tchibo	0.007813
P16	Instant coffee decaffeinated "Gourmet Selection"	0.0091
P17	Instant coffee Espresso	0.0121
P18	Coffee Dallmayr Prodomo	0.02601
P19	Turmeric powder Kotanyi	-
P20	Ground cinnamon Kotanyi	-

From studying these data shows that the highest concentrations of acrylamide were recorded in chips of sorts Tortilla (sample 7 - 0.75 mg%), Chio Salt (sample 4 - 0.11 mg%), Chio Exxtra DEEP (sample 2-0099 mg %) and cocoa powder Oetker (sample 14 - 0.0998 mg%).

To establish correlations between concentrations of acrylamide and components of carbohydrate, protein, electrolyte and the presence of fibers or use systematic methods were used value-processing, nonparametric, namely calculating the Spearman correlation coefficients for significance threshold $p < 0.05$.

Increasing the concentration of acrylamide is associated with high content of fatty acids and other fats.

Revealed a direct correlation significant between the amount of acrylamide and energy value of foods expressed both in kJ and in kcal ($R = 0.8289$, $p = 0.02$) increase in concentration in acrylamide being associated significantly with increased energy value of products food rations 30g.

There was also a significant correlation directly between acrylamide concentration and lipid content in the portion of 30g ($R = 0.8289$, $p = 0.02$) and reference consumption of fat percentage ($R = 0.8074$, $p = 0.03$).

It also found a correlation significant inverse between the concentration of acrylamide and consumption of fatty acids reference% / 30g portion ($R = -0.7667$, $p = 0.04$). Another significant inverse correlation has been established between the concentration of acrylamide in carbohydrate content and portion size of 30g ($R = -0.8289$, $p = 0.02$) (Bohosevici, 2016).

CONCLUSIONS

1. In the process of formation of acrylamide there is a significant correlation between its concentration and increased direct energy value of foods studied.

2. It finds a correlation between the concentration of acrylamide reverse significant and fatty acid content.

3. A significant inverse correlation was also between acrylamide concentration and carbohydrate content.

4. The results show that potato chips and French fries contain acrylamide most abundant followed by biscuit, popcorn and coffee.

5. Variations in concentrations of acrylamide on the categories of products are due to both the concentrations of different acrylamide precursors (amino acids and reducing sugars) which depend on the variety of potato and cereal used as raw materials, as well as the technology parameters (temperature, the duration of the heat treatment, pH, the type of oil used etc.)

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