

## Acrylamide content in common Spanish culinary preparations and exposure from household, catering and industrial settings

**Lucía González-Mulero\***, Marta Mesías, Francisco J. Morales and Cristina Delgado-Andrade

Institute of Food Science, Technology and Nutrition (ICTAN-CSIC), Madrid, Spain

\*[l.gonzalez@ictan.csic.es](mailto:l.gonzalez@ictan.csic.es)

In recent years, eating habits in developed countries have undergone significant changes due to economic and sociocultural aspects. Among other factors, new urban lifestyles, lack of time and culinary habits of the youngest generations have increased the consumption of foods obtained from caterers, company canteens, institutional catering, restaurants and other food supply services [1]. Moreover, 'fast food' options have become firmly established among certain population groups, at the expense of fresh food [2]. In many cases, these food preparations are based on a protein source combined with cereals or potato subjected to culinary operations such as roasting, toasting, baking, or frying, which can result in the development of the Maillard reaction and consequently in the formation of acrylamide [3]. Acrylamide is a chemical process contaminant whose exposure increases the risk of developing certain types of cancer in all age groups [3]. In 2017, the European Regulation 2158/2017 established mitigation measures and benchmark levels for the reduction of the presence of acrylamide in the main sources of exposure to this contaminant, including potato-based products, cereal-based products and coffee and substitutes, in addition to infant foods [4]. The large variety of foods consumed by European populations makes it necessary to consider other food matrixes as possible sources of this contaminant. In this sense, in 2019, the European Commission issued further recommendations to monitor the presence of acrylamide in other foodstuffs [5], in order to consider the adoption of possible risk management measures, complementing those already provided by the previous Regulation. On the other hand, several studies have shown that the handling and the type of cooking have a significant influence on the formation of acrylamide. This fact leads to the need to consider different culinary environments where food is prepared to establish real values of exposure to this contaminant. In view of these considerations, the aim of the present study was to establish the range of acrylamide exposure from common culinary preparations within Spanish diets, considering household, industrial and catering settings, and taking into account recent changes in Spanish patterns of food consumption.

Eleven types of processed foods commonly consumed in Spain were selected for analysis and classified according to the main food matrix, into potato-based food (French fries and Spanish omelette), cereal-based food ('torrijas' and sponge cake) and foods based on cereal mix with meat, fish or vegetables (breaded fillet, ham & cheese fillet, pizza, puff pastry pie, patties, 'migas' and croquettes). Samples of each food group were prepared and collected from three different settings (domestic, catering and food industrial) to evaluate the influence of the food preparation setting on acrylamide formation. Dishes were weighed, and the acrylamide content was analysed by Liquid Chromatography–Electrospray Ionisation–Tandem Mass Spectrometry (LC-IE-MS/MS). Exposure was estimated considering the weight of a regular portion.

Results revealed that the highest concentrations of acrylamide were observed in chips (French fries), especially those prepared at home, which corroborates this food product as the main source of acrylamide in the diet. Although at lower levels, acrylamide was also present in the other food samples considered, which underscores the need to control its content in foods not yet addressed in EU food quality regulations. The lowest acrylamide values were observed in industrially processed foods, which involved a lower contribution to acrylamide exposure, although without significant differences, in comparison to catering services and food preparation in the household. These results probably reflect the existence of stricter control of the culinary process in the industrial environment, possibly associated with the implementation of the mitigation measurements required by the European regulation concerning this sector. The highest levels recorded for households and catering services highlights the need for tighter monitoring of food cooking processes in these settings and the promotion of mitigation measures to control acrylamide formation in foods. These actions will help reduce the amounts of acrylamide in processed foods and alleviate the risk associated with exposure to this contaminant from common culinary preparations in Spain.

**Acknowledgments:** This research was funded by the Spanish Ministry of Science and Innovation (Spain): project ACRINTAKE (RTI2018–094402-B-I00, MCIU/AEI/FEDER, UE).

### References:

- [1] C.A. Monteiro, J.C. Moubarac, R.B. Levy, D.S. Canella, M.L.D.C. Louzada, G. Cannon, *Public Health Nutrition*, 21 (2018) 18.
- [2] C. Delgado-Andrade, *Clinical Chemistry and Laboratory Medicine*, 52 (2014) 53.
- [3] EFSA (European Food Safety Authority), *EFSA Journal*, 13 (2015) 4104.
- [4] European Commission, *Official Journal of European Commission*, L304 (2017) 24.
- [5] European Commission, *Official Journal of European Commission*, L290 (2019) 31.