

Acrylamide in Nutrition

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Introduction

Acrylamide is formed in certain types of food during the thermal process by the Maillard reaction which asparagine, a non-essential amino acid for human, reacts with reducing sugar at temperatures above 120°C [1]. Swedish scientists have carried out extensive studies to elucidate the acrylamide formation mechanism in some foods cooked at high temperatures in 2002 [1,2]. Later, numerous scientific studies continued to elucidate the mechanisms of acrylamide formation. Some cooking methods such as baking, frying and overcooking etc. produce acrylamide in foods. However, boiling is not a way to produce acrylamide in food.

European Food Safety Authority (EFSA) Scientific Committee has reported the distribution of acrylamide levels in foods in 2010 [3]. While potato crisps, French fries and coffee are the top ranks among the highest amounts of acrylamide-containing foods, the other processed foods such as cereal-based foods for infants are among the lowest food items. When sorted by food categories: mean acrylamide level of French fries sold as ready to eat is 338 µg/kg, mean acrylamide level of French fries from fresh potatoes is 325 µg/kg, mean acrylamide level of potato crisps from fresh potatoes is 758 µg/kg, mean acrylamide level of potato crisps from potato dough is 435 µg/kg [3]. When evaluated in homemade food category, mean acrylamide level of potato fries in the oven is 690 µg/kg, mean acrylamide level of deep-fried fries is 198 µg/kg and mean acrylamide level of unspecified potato products for home cooking is 270 µg/kg [3]. The mean acrylamide level of soft bread is low level as 30 µg/kg, mean acrylamide level of breakfast cereals is 138 µg/kg, mean acrylamide level of biscuits, crisp bread, crackers etc. are 333 µg/kg. When acrylamide levels of coffee and coffee substitutes are evaluated, the average acrylamide level of roasted coffee, instant coffee, coffee substitutes, unspecified coffee were found to be 256 µg/kg, 1123 µg/kg, 1350 µg/kg and 441 µg/kg, respectively. The mean acrylamide level of baby food, biscuits-rusks and other processed cereal based foods of young children and infants, were found to be 69 µg/kg, 86 µg/kg and 31 µg/kg [3].

Acrylamide in foods may vary depending on nutrition habits of nations or countries and culinary cultures [3,4]. Dietary acrylamide sources and the mean of dietary acrylamide intake were evaluated by dietary habits plus smoking status, alcohol consumption, physical activity and body mass index (BMI) using open-ended 24 hour dietary recalls as part of EPIC study in ten countries. According this EPIC study, in the western and southern regions of Europe, acrylamide intake has been supplied mostly from crisps, bread, rusks, while in the northern regions of Europe it has been provided firstly from coffee and secondly other fried potato products [5]. In the same study, when life style factors such as alcohol consumption and smoking have been compared, alcohol consumption has been declared to be associated with intake of acrylamide in both men ($p=0.002$) and women ($p=0.03$). Smoking status was associated with intake of acrylamide in women ($p<0.001$). BMI, physical activity and education were not found to be associated with acrylamide intake in both of gender [5].

Acrylamide was classified as probable carcinogen (2A group) by International Agency for Research on Cancer [6]. Experimental animal studies showed that acrylamide has neurotoxic effects [7]. Acrylamide could be toxic chemical for human body when it has been taken at the high levels [8]. It is converted to glycidamid which is reactive by CYP2E in human metabolism. The average acrylamide intake was estimated to be 0.3-0.8 µg/kg body-weight/day for human [9].

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