BfR MEAL Study
What's in your food

German Federal Institute for Risk Assessment

Results of the first German Total Diet Study - Levels of acrylamide in typically consumed foods

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The Maillard Reaction

Thermal processing is a treatment step of foods to preserve and improve salubriousness and sensory proprieties. The Maillard reaction describes chemical reactions of foods that undergo thermal processing methods such as frying, roasting or baking. Foods such as potatoes which contain asparagine, reducing sugars and that are heated at high temperatures (≤120ºC) may develop acrylamide (AA).

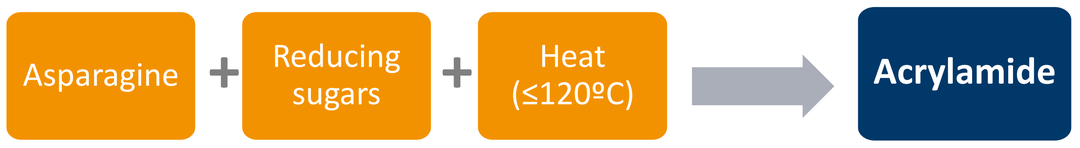

Fig. 1. The Maillard reaction

Vegetable crisps with highest acrylamide levels

Acrylamide was analyzed in 230 foods in the first German Total Diet Study.

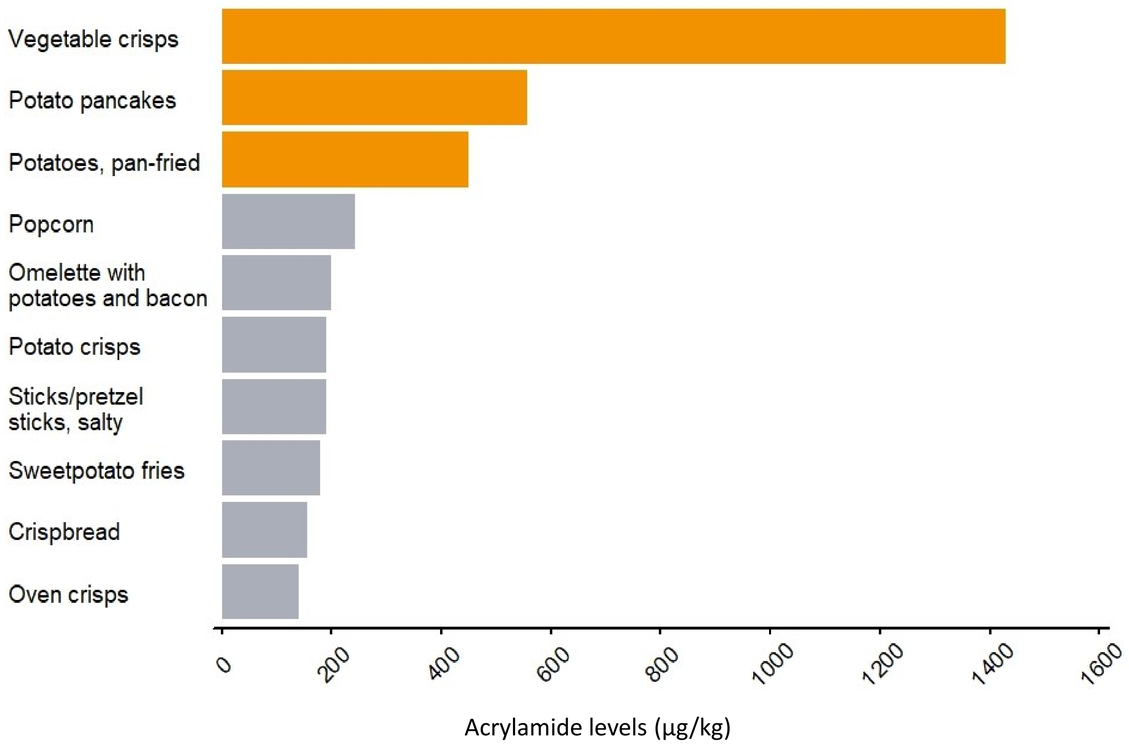

Fig. 2. 10 highest mean levels of AA in the analysed MEAL foods [µg/kg].
If more than one preparation method or browning degree was investigated, the most preferred by consumers was used for the mean calculation.
For popcorn, all three preparation methods (griller, oven and stove) were included due to lack of information regarding the most used one in Germany.

French fries cooked in the oven had less acrylamide

Some foods such as French fries, were tested with different browning degrees (BDs) and cooking methods.

Browning degree (BD)		Consumer´s preference[1] (N=2,003)	Cooking method	AA levels (µg/kg)
1		20,4 %	Oven	25
			Deep-fryer	28
			Air-fryer	30
2		61,9 %	Oven	91
			Deep-fryer	345
			Air-fryer	430
3		16,4 %	Oven	835
			Deep-fryer	1,600*
			Air-fryer	1,500*

Table 1. AA levels [µg/kg] (UB) in French fries according to different browning degrees and cooking methods.
The BDs were prepared with increasing cooking times and categorized from 1 to 5 (lowest to highest). Consumer´s preferences for browning degree 4 and 5 in French fries were not included due to lack of relevance (<1%).

* The EU benchmark (EU 2017/2158) for AA in French fries is 1,000 µg/kg.

Take-away messages

- Potato products such as potato pancakes (Rösti/Kartoffelpuffer) and pan-fried potatoes (Bratkartoffeln) contained high levels of AA.
- Snack foods such as popcorn, potato crisps and pretzel sticks were amongst the foods with higher levels of AA.
- French fries prepared in the deep-fryer or in the air-fryer at BD3 contained high levels of AA and were above the EU benchmark.
- French fries prepared in the oven showed lower levels of AA compared to other cooking methods.

Find out more about the results of the MEAL study in our **Public Use File**:
www.bfr-meal-studie.de/de/public-use-file.html

Take a virtual tour of the BfR´s MEAL kitchen:

[1] Hackethal, Christin, *et al.* „*Filling data gaps to refine exposure assessments by consideration of specific consumer behavior.*" Deutsche Lebensmittel-Rundschau. 2023. 119:277-288.