FDA Action Plan and Perspective on Acrylamide in Food

Terry Troxell, Ph.D.
FDA
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Why is acrylamide in food a concern?

- Acrylamide is a neurotoxicant and potential carcinogen.
- Found in a wide range of foods, including dietary staples and formed through traditional cooking.
- Formed during food processing and at home.
- Related to flavor-producing Maillard reactions.
- Formed from nutrients in food (asparagine and sugars, like glucose).
FDA Response to Acrylamide: Overview

- FDA agrees with WHO-FAO consultancy – acrylamide in food is a ‘major concern’
- FDA considers acrylamide in food a high priority
- FDA has developed a comprehensive action plan with the input of its Food Advisory Committee and the public
FDA Response to Acrylamide: Overview

• FDA has invested extensive resources to develop the science to support appropriate policy
  – LC/MS/MS method with LOD 10 ppb
  – Tested a wide variety of foods
  – Prepared exposure assessment
  – National Center for Toxicological Research (NCTR) initiated extensive toxicological testing
  – National Center for Food Safety and Technology (NCFST) studying formation and ways to reduce levels
Action Plan: Overall Goals

- Through scientific investigation and risk management decision making, prevent and/or reduce potential risk of acrylamide in foods to the greatest extent feasible.
- Provide all the essential elements for risk analysis, i.e., risk assessment, risk communication, and risk management.
Action Plan: Major Goal Areas

- Analytical methods
- Mechanisms of formation and reduction approaches
- Dietary exposure assessment (levels in foods)
- Toxicology/epidemiology -- risk assessment
- Leadership to develop science/technology
- Inform & educate public and processors
Acrylamide formation strategies

• Strategies suggested to control acrylamide levels in food
  • Reduce/remove precursors (asparagine, sugars) from food
  • Disrupt acrylamide-producing reaction
  • Remove formed acrylamide from food
Factors affecting acrylamide formation

• Food composition
  – Amino acids, sugars
  – pH
  – Moisture

• Processing conditions
  – Temperature
  – Time
  – BUT temperature of the food is critical
Consumer cooking and time

- 0 Minutes: (0 ppb)
- 15 Minutes: (11 ppb)
- 30 Minutes: (1326 ppb)
- 45 Minutes: (4885 ppb)

Baked (Oil Coating)
Some foods have little or no acrylamide, such as infant formula, baby cereal, fish and chicken, and condensed and liquid milk.

Other foods have acrylamide, but in variable amounts.
Examples of variability within selected food groups
Examples of variability within selected food groups

![Graph showing variability of acrylamide in different food types](image-url)
Lot to lot variability in potato chips
Acrylamide food levels - summary

- Acrylamide was detected in a variety of foods and at a variety of levels.
- In some foods, no acrylamide was detected.
- FDA has found variability between food categories and within food categories, as well as between different brands.
- The variability in levels of acrylamide in similar foods suggests that there are ways to make products that will minimize acrylamide formation.
FDA Exposure Assessment of U.S. Consumers to Acrylamide

- Eight of the tested food types consistently comprise 83% of the exposure: restaurant and oven-baked French fries, brewed coffee, breakfast cereal, potato chips, cookies, toast, and soft bread.
- Each of the eight food types contributes 5 percent or more to total acrylamide exposure.
Exposure Assessment of U.S. Consumers to Acrylamide

- No one food accounts for the majority of the mean population acrylamide intake.
- Some foods with lower acrylamide values contribute appreciably to the overall mean population acrylamide intake because they are commonly consumed.
Toxicology Action Highlights

Toxicology Issues

- Bioavailability
  - Food versus water
- High-dose vs very low-dose exposures
- Animal vs. Human
Toxicology Action Highlights

• FDA-NCTR Studies (Est. Start Date)
  – Describe *in vitro* and *in vivo* DNA adducts from glycidamide (GA) (Summer 2002)
  – Measure Hb adducts of acrylamide (AA) and GA in rodent exposures (Fall 2002)
  – Toxicokinetic studies of AA & GA (Summer 2003)
  – Role of CYP 2E1 in AA metabolism and formation of GA-DNA adducts (October 2003)
  – Determine mutagenicity of AA and GA *in vivo* (Fall 2003 +)
Toxicology Action Highlights

• FDA Studies (Est. Start Date)
  – Neonatal mouse carcinogenicity bioassay of AA and GA carcinogenicity (Fall 2003)
  – Chronic carcinogenicity bioassays of AA and GA (Fall 2003)
  – Developmental neurotoxicity studies (Fall 2003)

• Some other studies
  – AA workers (coal processing) epidemiology study
  – Population-based data on AA exposure using NHANES (CDC, Jan. 03)
  – Development of PBPK model for AA/GA (ILSI sponsored industry, academia and government partnership)
**Consumer message**

- FDA’s current dietary message for acrylamide is to: “Eat a balanced diet, choosing a variety of foods that are low in trans fat and saturated fat, and rich in high-fiber grains, fruits, and vegetables.”

- The FDA believes there are not enough scientific data to justify changing the message at this time.
Consumer message

- Advice must be carefully constructed so as not to expose consumers to greater risk, e.g.,
  - Potential for undercooking given advice not to overcook
  - Potential for omitting important staples of the diet, such as bread and cereals resulting in potentially greater risk from less fiber and beneficial nutrients

- Advice must provide consumers with effective scientifically based risk communication to prevent disease and promote health