Possible Modulation of Acrylamide Through Cooking Practices

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Browning Foods Protects Health by Producing Beneficial Antioxidants

- Professor Shibamoto addressed the chemical formation of antioxidants during the Maillard browning reaction.
- Antioxidants produced during the browning reaction are well known to be health protective concerning diseases associated with oxidative damage and stress:
  - Cancer
  - Atherosclerosis
  - Diabetes
  - Inflammation
  - Arthritis
  - Immune deficiency
  - Aging
Antioxidant Effects of Maillard Reaction Products

- Many studies of model systems and foods have shown that Maillard Reaction Products (MRPs) have antioxidant effects. For example:


MRPs Are Shown to Provide Additional Health Benefits

- In addition to antioxidant effects, studies show that MRPs also provide other beneficial health effects:
  - Some MRPs have anti-carcinogenic effects
  - Some MRPs have anti-mutagenic effects
- Other MRP protective mechanisms include:
  - Induction of detoxification enzymes
Anti-Carcinogenic Effects of MRPs


Anti-Mutagenic Effects of MRPs


MRPs Aid Detoxification By Enhancing Expression of GST Enzymes

- Many studies have established that glutathione-S-transferase (GST) is the primary detoxification enzyme for acrylamide.
- A 2002 study by Hofmann’s group in Germany showed that a browning reaction product, Nε–carboxymethyllysine (CML), enhances the expression of GST in rats and in Caco-2 intestinal cells.
  - **Experimental design:**
    - Casein-linked CML was fed to rats for 10 days at two doses.
    - CML also was given by supplementing the rats’ diet with bread crust such that they received a moderate dose of CML.
- **Results:**
  - Both animal experiments showed an inductive effect of casein-CML and of bread crust on GST activity in the kidneys.
  - Cell culture results confirmed these inductive effects on GST.
- **Significance:** While the browning reaction creates acrylamide, it also creates a beneficially protective chemical – CML – that results in increased detoxification of the acrylamide found in browned foods.