



Beware the Barbeque - Carcinogens and Cooking

Canadians have a love affair with the Barbeque. After all, what's more Canadian than throwing a good steak on the Barbie? Well, the science is out (and has been for a long time). So there's no burying our heads in the sand anymore.

Some of our favourite tastes are linked to by-products of cooking that are bad, bad, bad for us. When food is cooked, especially at high temperatures, by-products can form that pose a threat to health. Among the most notorious are heterocyclic amines (**HCAs**), polycyclic aromatic hydrocarbons (**PAHs**), advanced glycation end-products (**AGEs**) and acrylamide. Let's see what's cooking.

Heterocyclic amines

HCAs are chemicals created when meat, poultry, fish and eggs are subjected to grilling, frying or barbequing. High temperatures and longer cooking generate more of these compounds. Indirect heat methods, such as stewing, steaming or poaching, produce far fewer HCAs. Roasting produces intermediate amounts. Does cooking vegetables produce these chemicals? No, because the formation of HCAs involves the condensation of creatinine (found exclusively in muscle tissue) with amino acids (the building blocks of protein). In 2005, HCAs were officially added to the NIH's (National Institutes of Health) list of cancer-causing agents. HCAs increase our risk of developing a variety of cancers, including colorectal, stomach, pancreatic and breast cancers.

Polycyclic aromatic hydrocarbons

PAHs are chemicals formed by the incomplete burning of carbon-containing substances in food or fat heated above 392 degrees F (200 degrees C). PAHs are present in grilled or charred meat and in poultry and fish, especially where fat drips onto the heat source, such as a barbecue and fumes rise or fat spatters back onto the food. PAHs can also form in toasted grains and in anything fried in oils. Like HCAs, PAHs are known to be mutagenic (they damage DNA). Lung, skin and genitourinary cancers are linked to PAH intake.

Advanced glycoxidation end-products

AGEs are harmful end-products created when food is heated to high temperatures and also when fat is oxidized. Foods most concentrated in AGEs are broiled, grilled and fried meats. AGEs also arise when cola ingredients, coffee, caramel and baked goods are browned at temperatures of 310 degrees F (155 degrees C) or higher. Browned, caramelized foods appeal to our tastes and the food industry purposely uses the Maillard (browning) reaction to sell products. There is considerable evidence that AGEs impair immune system function, accelerate aging and contribute to the progression of diabetes, cardiovascular disease, stroke, kidney disease, eye diseases, nerve diseases and Alzheimer's disease.

Acrylamide

In 2002, Swedish researchers discovered that a compound known as acrylamide forms when certain high carbohydrate foods are subjected to temperatures of 248 degrees F (120 degrees C) or higher, especially for a longer period of time. Canadian scientists learned that acrylamide most frequently develops when the amino acid asparagine reacts with naturally occurring sugars such as glucose. This occurs during the later stages of baking, roasting or frying when foods start to dry out a little and the surface temperature rises. The most concentrated food sources of acrylamide are potato chips, other baked or fried salty snacks and French fries, as potatoes are particularly high in asparagine.

Other food sources of acrylamide include crackers, crisp breads, pretzels, breads (especially toasted), cold cereals that have been toasted and other foods processed at high temperatures, such as coffee and cocoa. Acrylamide was evaluated by the International Agency for Research on Cancer and classified as "probably carcinogenic to humans." In 2002, the European Commission's Scientific Committee on Food (SCF) recommended that dietary acrylamide levels be reduced.

When in doubt, go back to classic types of cooking like baking, poaching and broiling. Or do what I do – eat your meat really, really red (blue rare! Yum! Local, organic meats only, of course!)

Carcinogen-free cooking

1. Keep your intakes of HCAs, PAHs, AGEs and acrylamide as low as possible.
2. Sell or give away your barbecue.
3. When cooking, boil or steam foods because temperatures reach only that of boiling water, (100° C).
4. Allow raw plant foods to occupy more and more space on your plate.