



Dr. Julia Gonen, N.D.
7 hate'ena street
bnei atarot 60991
p: 050.933.6004
e: julia@gaianaturopathic.com
www.gaianaturopathic.com

A Heated Discussion...

tips for safer grilling

by Julia Gonen, N.D.

Nothing signals spring and summer in Israel like the all pervasive aroma of the mangal (small charcoal grill) which is comparable to the gas grill phenomenon in North America. Mangaling is an engrained part of Israeli culture– to go out into nature and eat grilled meat with family and friends.

But there are dangers lurking in your shipudim and kebabs! In recent years researchers have discovered that there are serious negative health and environmental effects from grilling and cooking meat at high temperatures, which are even worse when grilling on charcoal.

I learned about these dangers during my very first class of organic chemistry in my undergraduate days at the University of Toronto. My young and hip professor showed us how eating burnt or charred food actually causes alterations the genetic material (DNA) in our cells. This is the same effect as smoking cigarettes. So every time we eat barbequed meat or “well-done” toast we are negatively affecting our cellular activity. Our cells become mutagenic meaning that they cause mutations to the cell above the normal level. Mutagens are also typically carcinogenic meaning that they cause cancer.

Here is some evidence why charcoal grilling is not only bad for your health and the health of your loved ones, but also has a negative effect on the environment.

- **Grilling meat forms two types of potentially carcinogenic compounds: HCAs (heterocyclic amines) and PAHs (polycyclic aromatic hydrocarbons)**
 - PAHs are formed when fat from the meat drips onto the charcoal. PAHs then rise with the smoke and get deposited onto the meat. They are also formed directly when meat is charred. PAHs are mutagens and may increase the risk of certain cancers.
 - HCAs form from the cooking of the meat itself (the muscle including beef, fowl, fish etc). HCAs form when amino acids (the building blocks of proteins) and creatinine (a chemical found in muscles) react at high cooking temperatures. Researchers have identified 17 different HCAs resulting from the cooking of muscle meats that may pose human cancer risk.
 - **Cancer risk:** there is no measure of how much HCAs or PAHs would have to be eaten to increase cancer risk, nor are there specific guidelines concerning consumption of foods with HCAs and PAHs. However, there are a few recent studies that evaluated the relationship associated with methods of cooking meat and the development of specific types of cancer.



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- Researchers have found that people who ate beef medium-well or well-done had more than three times the risk of stomach cancer than those who ate their beef rare or medium-rare. They also found that people who ate beef four or more times a week had more than twice the risk of stomach cancer than those that consumed beef less frequently. Additional studies have shown that an increased risk of developing colorectal, pancreatic, and breast cancer is associated with high intakes of well-done, fried, or barbequed meat.

So if you eat grilled fatty meats every day, you're playing with fire as far as your risk of cancer is concerned. If you eat grilled meats less than once a month, your risk is pretty low. Otherwise, go ahead and enjoy yourself...as long as you follow the guidelines below when grilling or barbequing meat.

- **Grilling meat causes the formation of AGEs/ALEs (Advanced Glycation End-products & Advanced Lipoxidation End-products)** which contributes to age-related chronic inflammatory diseases such as atherosclerosis, diabetes, aging, asthma, arthritis and chronic renal failure. AGEs are formed during cooking when proteins or fats combine with sugars in the absence of water.

The AGEs cause the toughening and discoloration of food during the cooking process. Hence, browned foods, as occurs during barbequing, baking, roasting and broiling, causes the poisonous advanced glycation products to form, while boiling and steaming prevent them. After ingestion of these foods there is further interaction in our bodies with adjacent proteins to form pathological links between proteins, called AGE crosslinks. The resulting damage to tissues and to DNA significantly contributes to the aging process.

These complications result from increased stiffness of tissues, crosslinking of collagen, abnormal protein accumulation, membrane leakiness and dysfunction, and eventual damage to cells, tissues and organs. The really bad news is that AGEs accumulate in our bodies overtime.

- **Burning charcoal produces hydrocarbons** which are hazardous to our health as well as the environment – the particles go into the air and attach themselves to dust particles to eventually be deposited in the soil, rivers and lakes. They have a moderate to high toxicity on aquatic life and birds, and can cause damage and death to crops. They also bio-accumulate - meaning that the concentration will be much higher in fish and shellfish compared to their aquatic environment. The more people that use their charcoal grills with increasing frequency contribute each and every time to hydrocarbon accumulation on our planet.
- **Tiny soot particles are released into the air** which can aggravate heart and lung problems (**warning:** do not go park hayarkon on yom ha'atzmaut - especially if you suffer from a lung or heart condition!)



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- **Lump charcoal is made from charred wood** which contributes to deforestation thus worsening the greenhouse gases in our atmosphere
- **Charcoal briquettes usually additives** such as contain coal dust, starch, sodium nitrate, limestone and borax and some even contain lighter fluid – definitely not healthful! Okay the jury is out on the exact effects on these substances, but do you really want burning chemical additives in your food? As my husband learned in pilot course - If there is a doubt, there is no doubt. Many people also report that these types of briquettes make the food taste funny. Mmmm.

HOW TO REDUCE MUTAGENICITY OF COOKED MEATS:

1. **Change method of cooking** – frying, broiling and barbequing meats produces more mutagenic activity. Whereas, stewing, steaming and poaching produce very little to no mutagenicity. Roasting and baking is variable.
2. **Reduce cooking temperature** – increasing the temperature of cooking, frying and grilling dramatically increases the mutagenic activity. For example, increasing the temperature of beef fried at 200 degrees C to 250 degrees increases the mutagenic activity by six or seven fold. Controlling heat may be somewhat easier with a gas grill than with a charcoal grill.
3. **Eat less meat** – this is a no brainer! Most non-meat foods contain lower levels of mutagens than meat. Vegetables and fruits can also be protective providing antioxidants and other protective substances.
4. **Marinate meats prior to cooking** – marinate meat & poultry in any kind of marinade even for a few minutes prior to cooking can reduce HCAs by almost 90% (always marinate meat in the refrigerator to prevent harmful bacteria from growing, and never add uncooked marinade to cooked meat or poultry).
5. **Don't grill frozen meat** – when frozen meat is grilled, the outside of the meat is overexposed to high temperatures while the inside of the meat is still cold thus prolonging cooking time and increasing mutagenicity.
6. **Grill meat in smaller pieces** – small pieces of meat cook faster giving HCAs less time to form.
7. **Avoid well-done, blackened and charred meat** – some people loved the taste of crispy charred meat. Burnt meat contains the most amounts of HCAs and should be avoided entirely (goodbye Black Burger!).
8. **Do not cook meat over a smoking grill.** Smoke contains carbon monoxide and PAHs.



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9. **Cook meat far away from heat source** – this prevents overcooking and burning of food.
10. **Do not let flames touch the meat** – this chars the meat.
11. **Use a foil drip pan** – the smoke created from fat dripping on the heat source produces carcinogens that can then be absorbed by the food. Using a drip pan prevents the fat from reaching the coals or flames.
12. **Don't eat the black bits** - if meat does become charred, cut off as much as you can or just throw out the piece of leather it has become!
13. **Use tongs to flip the meat** - a fork will pierce the meat causing the juices to drip out and burn.
14. **Buy low-fat cuts of meat** – trim off as much fat as possible. Use low fat marinades and do not use marinades with sugar or honey which caramelize causing formation of AGEs. Cut off fat and skin before grilling.
15. **Precook meat** – first bake, boil or microwave meat then just put meat on grill at the end to add a bit of flavor (just for the record I do not use a microwave myself, but that is another discussion – however, microwaving meat prior to grilling greatly decreases the PAHs and HCAs - meats that were microwaved for 2 minutes prior to cooking had a 90-percent decrease in HCA content. As well, if the liquid that forms during microwaving is poured off before further cooking, the final quantity of HCAs is reduced).

So, the best way to reduce the formation nasty substances on our meat is to keep the heat low and cooking times short (reach temperatures that will kill any potential bacteria without charring your food), reduce as much as possible the burning of fat and creation of smoke, avoid charred or overcooked meat and reduce the frequency of indulgence. Or become a vegetarian and eat some grilled veggies instead!