

## **Meat cooking and the production of carcinogens**

HOW TO PREVENT THEM WHILE ENJOYING A DELICIOUS MEAL

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Humans have been hunters and gatherers for thousands of years with fairly stable nutritional habits. In some cultures, as much as 50-80% of the food was based on game meat with the rest consisting of unprocessed plant-derivatives such as roots, fresh fruit, nuts and wild vegetables. It was not until humans developed the ability to cultivate various plants and to domesticate what were once exclusively wild animals that human nutrition began to fundamentally change. From this point forward, the intake of calories was, for the most part, balanced with variations in favor of meat or plant derived foods according to local peculiarities and what would become cultural norms. Meat and fat remained the dominant source of calories for most societies that lived in cold climates, and plant derived foods played a dominant role in most societies that lived in temperate and warm climates, with minimal food processing on either end. This emphasis on the consumption of whole foods as a matter of course changed in the last few hundred years with the rapid evolution of food processing. With this ability to process and in many cases, to adulterate, natural foods came the so-called diseases of civilization: diabetes, cardiovascular disease, stroke, hypertension, cancer etc. Processing of the foods was conducted for a variety of reasons, the most important being improved digestion and better preservation. Whole foods are more difficult to digest due to their significant fiber content. Humans lack the enzymes to digest such foods since, for the longest time of our existence, we depended primarily on meat and fat, two substances that we are very well equipped to digest. Foods containing abundant fiber pack fewer calories per gram, and take longer to digest by fermentation. Fermentation takes place in the large intestine (colon) with the assistance of the intestinal bacteria and yeast organisms that normally reside in the colon, and it is here that the benefits of food processing derive their value. With respect to preservation, anyone who has picked fresh fruits or left meat, eggs or dairy products out of the refrigerator for too long understands the finite shelf life of natural foods. Without the use of preservatives, including refrigerators, we would have to eat the foods we plucked from the earth or poached from the bush immediately; otherwise, the food would spoil.



Because we live in an age of food abundance, we find it difficult to empathize with a humanity that lived so close to the land that the slightest change in environmental conditions could devastate food supplies and lead to famine. The ability to preserve foods through various processing techniques therefore became a way of insuring society against unforeseen disruptions in its food supply, and as food processing evolved, the demand for greater 'elasticity' in the supply of food increased. With the dawn of the industrial revolution, people began to migrate from

the rural countryside into larger towns and cities, abandoning their farms for factory jobs. As people began to locate themselves further and further from their sources of sustenance, modes of food transportation, preservation and storage had to evolve in order to compensate for these radical demographic shifts. Central to this process of preservation, which made transportation and storage of the foods produced possible, were advancements made in the field of chemistry. Through the use of thousands of industrial chemicals (mostly derivatives of oil, otherwise known as petrochemicals), what were once easily identifiable whole foods became increasingly difficult to label as such. Famous



food products such as the Twinkie are, in fact, impossible to envision as ever having existed in nature (and rightfully so). Furthermore, even whole foods like tomatoes are artificially preserved in order to keep them from spoiling during the long road from harvest to consumption, and in some cases are artificially ripened so that they appear fully formed once they arrive at the super market. Indeed, fresh produce is subject to a great degree of spraying with various chemicals that protect the color, the skin turgor (make them look fresh) and even hasten the maturation process of the food as it moves from the factory to the supermarket.

One of the unintended consequences of all this food processing has been the elimination of important and vital nutrients such as vitamins, minerals, trace elements and the natural bacteria that we depend on for intestinal health and proper digestion. To make things worse, the dramatic increase of earth's population, increasing mechanization of agricultural procedures, increased utilization of fertilizers and topsoil depletion created a looming disaster. In the process, the quality of the foods produced today is what we now call "empty calories". This means we consume calories but not the vital elements that are essential for good health. According to some scientific studies, natural foods today are so depleted of their essential nutrients that we need to eat more fruits, vegetables and other plants in order to obtain all the essential vitamins and other vital nutrients that we used to get 60 years ago with far fewer calories. Such nutrients mixed with the rest of the foods worked in harmony to present to us a meal that was healthy. Today however, this is not the case.

Cooking meat for example is a process that generates a significant amount of carcinogens known as heterocyclic amines (HCAs). Consumption of meat in the past was less harmful than today because of the protective benefits of healthy natural foods rich in antioxidants and phenols that people consumed in addition to whatever meat products they ate. Consuming meat in today's food landscape is a lot more dangerous and life threatening than several years ago. Our diets are primarily full of prepackaged highly processed foods that increase the oxidative stress to our bodies, in contrast to naturally occurring foods. Natural foods (herbs, spices, aromatic plants etc.) which, are rich in natural antioxidants and other phenolic compounds not only make food more palatable but also much safer. Humans learned over thousands of years that certain plants and herbs are good for our health and have been using them along with meat consumption. Most of us believe that aromatic spices and herbs were used for their culinary benefits. It is clear that when we apply such aromatic ingredients to our cooking, it turns whatever materials we cook into a very delicious meal. This however is only a part of the benefits we obtain from herbs and spices. The biggest benefit however is the protective effects such herbs and spices exert on other foods and especially on meat (antioxidant effects), protecting from cooking byproducts such as the carcinogens HCAs which are produced when meat is heated during the cooking process.



According to a recent report by the National Cancer Institute, cooking certain meats at high temperatures creates chemicals that are not present in uncooked meats. A few of these chemicals may increase cancer risk. For example, heterocyclic amines are the carcinogenic chemicals formed from the cooking of muscle meats such as beef, pork, fowl, and fish. HCAs form when amino acids (the building blocks of proteins) and creatine (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.

Research conducted by the National Cancer Institute (NCI) as well as by Japanese and European scientists, indicates that heterocyclic amines are created within muscle meats during most types of high temperature cooking. Recent studies have further evaluated the relationship associated with methods of cooking meat and the development of specific types of cancer. One study conducted by researchers from NCI's Division of Cancer Epidemiology and Genetics found a link between individuals with stomach cancer and the consumption of cooked meats. The researchers assessed the diets and cooking habits of 176 people diagnosed with stomach cancer and 503 people without cancer. The researchers found that those who ate their 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 consuming 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 barbecued meats.

Four factors influence HCAs formation: type of food, cooking method, temperature, and time. HCAs are found in cooked muscle meats; other sources of protein (milk, eggs, tofu, and organ meats such as liver) have very little or no HCAs in natural form or when cooked. Temperature is the most important factor in the formation of HCAs. **Frying, broiling, and barbecuing produces the largest amounts of HCAs because the meats are cooked at very high temperatures.** One study conducted by researchers showed a threefold increase in the content of HCAs when the cooking temperature was increased from 200° to 250°C (392° to 482°F). Oven roasting and baking are done at lower temperatures, so lower levels of HCAs are likely to form, however, gravy made from meat drippings does contain substantial amounts of HCAs. Stewing, boiling, or poaching are done at or below 100°C (212°F); cooking at this low temperature creates negligible amounts of the chemicals. Foods cooked a long time ("well-done" instead of "medium") by other methods will also form slightly more of the chemicals. You will be shocked when you read the table below. (The Cancer Project – [www.cancerproject.org](http://www.cancerproject.org) )

**The table below presents the production of HCAs according to the cooking method**

FOOD PREPARATION	HCAs ng/100g produced
Chicken Breast (Skinless, boneless, grilled, well done)	14,300 ng/100g
Steak, grilled, well done	810 ng/100g
Pork, Barbecued	470 ng/100g
Salmon, grilled w/ skin	166 ng/100g
Hamburger, grilled, well done	130 ng/100g

I was certainly stunned when I saw that chicken is the biggest offender in the production of HCAs. I was always under the impression that the so innocent looking grilled skinless chicken breast was the healthiest food of them all. I never thought I would be so wrong ever!!! Well done skinless grilled chicken breast produces 18 times more of these carcinogens in comparison to the second worst offender, none other than the so frequently bad-mouthed grilled stake. A well-done grilled chicken breast makes a well-done beef stake look like the healthiest food on the planet. Not so fast though, since both are bad for you **if not cooked properly**. Beef may be the least evil but evil non-the less. According to researchers, 20 ng/100 g of meat is the highest acceptable level and a well-done beef stake provides 810 ng/100g of meat. So, what is one to do? Should we all abandon meat? Of course not! Meat has been a very important part of our diet for thousands of years and most probably will continue to be so for many years to come. In addition, most of us cannot see our selves eating vegetables only and no meat. What we need to learn to do is to cook meat properly at lower temperatures and find ways to add natural herbs and spices either in the form of a marinade, as part of the cooking process and during the serving of food.

Salt, spices and herbs are all natural food-taste and aroma enhancers. We frequently tend to consider herbs and spices as one of the same. This is true in terms of their utility but not so true in terms of their origin and mode



of use. Spices are aromatic seasonings from the bark, buds, roots, seeds, berries or fruit of various plants and trees. Common spices include cinnamon, which comes from bark; cloves from buds; ginger from a root; cumin from seeds; black peppercorns from berries; and paprika from the fruit of a plant. Herbs, however, only come from the leaf of a plant. Familiar herbs include mint, basil, oregano, bay leaves, rosemary, thyme, parsley, sage and chives. In the last several years, these food additives have been the subjects of research. It has been found that in addition to the pleasant taste and aroma benefits of spice and herbs, there are significant health

benefits to be had. Spices and herbs offer many health benefits in addition to flavoring food. They contain a number of phytochemicals, trace elements, vitamins and many antioxidants which help our body fight damaging reactive oxygen species that cause oxidative stress, disease and even premature aging and death. Spices and herbs contribute to lowering sodium intake – even completely eliminate salt - when used to flavor food in place of salt. Spices and herbs carry even higher antioxidant content than fruits and vegetables. They provide anti-inflammatory protective benefits against many chronic diseases including heart disease, cancer, diabetes and Alzheimer's disease. **The benefits of combining multiple spices and herbs are often greater than the benefit of any single one.** One research study found that turmeric and black pepper together decreased breast cancer risk by reducing the number of cancer stem cells. Herbs and spices added to salads increase the antioxidant content of the primary ingredients of the salad (vegetables or fruits).

When cooking using fresh herbs and spices is best, but dried ones may be more convenient and practical in today's fast paced lifestyles. Fresh herbs have higher antioxidant levels than the dried versions. Fresh garlic, for example, has one and a half times more antioxidants than garlic powder and the same is true for fresh parsley, rosemary etc. If you have no choice than to use only dried herbs and spices, replace dried herbs and spices in your kitchen each year to maximize their flavor and health benefits. Not only will your cuisine taste good when flavored with spices and herbs, it will be healthy too. Though the research is still inconclusive in terms of which and how much of a specific herb or spice to include in your diet, be courageous and try new seasonings as frequently as you can.



Finally, we should breakaway from the fast-paced lifestyles that we are all accustomed to and try to spend some time in the kitchen, learning again how to cook with natural whole foods using a crockpot. While cooking, do not forget to open a nice bottle of red wine and have some real and healthy fun. This is best when the entire family takes part in the process from the purchase of the ingredients to the final serving and feasting around the family table. Such experience could be one of the most valuable experiences you could provide to your young children. Just try it!

To your health!

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