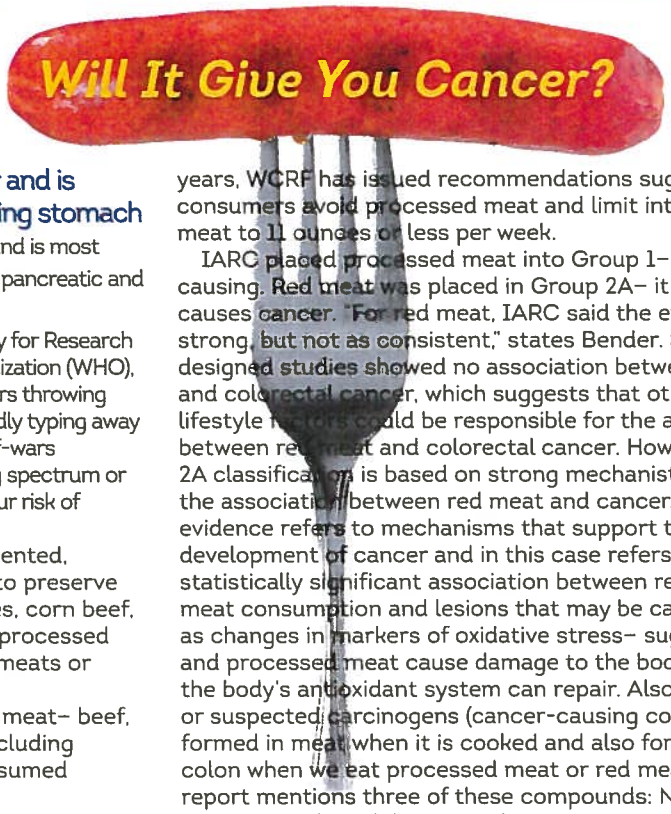
BY MARIE SPANO, MS, RD, CSCS, CSSD

THE RED MEAT DILEMMA: Will It Give You Cancer?



Processed meat causes colorectal cancer and is associated with an increased risk of developing stomach cancer. Red meat probably increases risk of cancer and is most closely associated with an increased risk of colorectal, pancreatic and prostate cancer.

This news, from a report by the International Agency for Research on Cancer (IARC), a branch of the World Health Organization (WHO), created a media circus with vegetarians and meat lovers throwing nasty virtual punches while gritting their teeth and madly typing away on their keyboards. Steer clear of the emotional tug-of-wars attempting to steer you to one side of the meat-eating spectrum or the other, and you'll find out how this study fits into your risk of developing cancer.

Processed meat has been salted, cured, fermented, smoked or been through other processes used to preserve the meat and enhance flavor. Hot dogs, sausages, corn beef, beef jerky and canned meat are all examples of processed meat. Processed meats may also include other meats or meat byproducts such as blood.

Red meat is unprocessed mammalian muscle meat– beef, pork, veal, lamb, mutton, horse or goat meat, including minced or frozen meat. Red meat is usually consumed cooked.

The Study

The IARC (part of the World Health Organization, aka WHO) Working Group looked at more than 800 epidemiological studies on processed meat, red meat and cancer from many countries with diverse ethnicities and diets. "They relied on the strongest population-based studies with the best designs for their evaluation," states Alice G. Bender, MS, RDN, associate director of nutrition programs, American Institute for Cancer Research (AICR).

No study can completely rule out the possibility that other dietary factors associated with diets high in processed and red meat contribute to colorectal cancer. However, the large amount of data and consistent associations of colorectal cancer with consumption of processed meat across studies in different populations means it is unlikely that chance, bias and confounding variables influenced the results of this report. "Confounding factors known for links to cancer risk include BMI, smoking, physical activity, age, gender, alcohol use, NSAID use; [NSAIDs are nonsteroidal anti-inflammatories such as ibuprofen] while dietary fiber and dairy products are linked with lower risk," states Karen Collins, MS, RDN, CDN, FAND, nutrition advisor to the American Institute for Cancer Research.

Though the IARC report may seem like earth shattering news, scientists from the World Cancer Research Fund (WCRF), an international nonprofit charity that includes several organizations including the AICR, write a number of reports as part of an ongoing initiative called the Continuous Update Project (CUP). "CUP reports are continuously updated and their conclusions on processed meat and colorectal cancer are based on cell studies, animal research, short-term human clinical studies of biomarkers and adenomas (benign polyps that are the starting point of the vast majority of colorectal cancers) AND longer-term observational population studies," says Collins. For several years, WCRF has issued recommendations suggesting consumers avoid processed meat and limit intake of red meat to 11 ounces or less per week.

IARC placed processed meat into Group 1– it is cancer causing. Red meat was placed in Group 2A– it probably causes cancer. "For red meat, IARC said the evidence was strong, but not as consistent," states Bender. Several well-designed studies showed no association between red meat and colorectal cancer, which suggests that other diet and lifestyle factors could be responsible for the association between red meat and colorectal cancer. However, the Group 2A classification is based on strong mechanistic evidence for the association between red meat and cancer. Mechanistic evidence refers to mechanisms that support the development of cancer and in this case refers to a statistically significant association between red or processed meat consumption and lesions that may be cancerous as well as changes in markers of oxidative stress– suggesting red and processed meat cause damage to the body beyond which the body's antioxidant system can repair. Also, several known or suspected carcinogens (cancer-causing compounds) are formed in meat when it is cooked and also formed in the colon when we eat processed meat or red meat. The IARC report mentions three of these compounds: N-nitroso compounds (NOC), heterocyclic aromatic amines (HAA) and polycyclic aromatic hydrocarbons (PAH).

Heme iron in processed and red meat leads to the formation of NOC in the colon. In addition, nitrites, amines and amides are precursors to the formation of NOCs in the body. In fact, an estimated 45-75 percent of our total exposure to NOCs comes from our body's production of these compounds. NOCs, as well as PAHs, are also formed when meat is processed, including curing and smoking. HAAs and PAHs are formed when meat is cooked. Cooking meat on high temperatures as done during grilling, barbecuing and frying leads the greatest production of these chemicals. When fat and juices from meat drip onto fire, resulting in flames, PAHs develop and adhere to the meat like shellac. HAAs are formed when amino acids, sugars and creatine react at high temperatures. HAAs and PAHs must be metabolized by specific enzymes (a process called bioactivation) before they can damage DNA. Yet the activity of these enzymes varies between people and therefore, one's risk of developing cancer due to HAA and PAH exposure depends on how they metabolize these compounds.

Though considered mechanistic evidence for the relationship between processed and red meat and the development of cancer, these compounds are not unique to processed and red meat. NOCs are found in smoked fish, the malt in beer and whiskey production, pickled vegetables and foods stored under humidity leading to fungi that generate nitrosamines. PAHs are also found in air pollution. In addition, PAHs and HAAs are formed in fish and poultry (chicken, turkey, ducks, geese) cooked over high temperatures.

Is There a Difference Between Grass-Fed Beef Jerky and a Hot Dog?

Natural, uncured bacon, sausage and other processed meats that do not contain added nitrites or nitrates are still

possible that those who consume high BCAA content diets may have a relative deficiency of tryptophan in the diet.

Both tryptophan and 5-HTP have been reported to improve sleep onset. However, have they been shown to have weight-loss effects acting as serotonin precursors? Well, enough so that many "obesity specialists" recommend a 5-HTP/carbidopa combination to complement phentermine (a stimulant drug) for their patients.[8] Carbidopa prevents the conversion of 5-HTP to 5-HT before it gets to the brain.[9] In the report, one case was described where a patient lost 24 percent of initial bodyweight in six months using the 5-HTP/carbidopa combination without phentermine.

Of course, tryptophan and 5-HTP are typically taken as dietary supplements. So, it is gratifying to see published trials using randomized subjects. 5-HTP, taken at a modest dose of 900 milligrams per day, resulted in significant weight loss compared to the placebo group in a setting of a recommended caloric guideline, or eating ad lib (without restrictions).[10] Further, there was a reduction in carbohydrate intake and reported earlier satiety (feeling full when eating). In type 2 diabetics, who are reported to have decreased brain serotonin activity, 5-HTP supplementation (750 mg/day) with no caloric restrictions resulted in weight loss, and reduced carbohydrate and fat intake.[11] Clearly, there is value to supplementing the diet to support serotonin and melatonin production, and availability for people seeking to lose weight.

ONE CASE WAS DESCRIBED WHERE A PATIENT LOST 24 PERCENT OF INITIAL BODYWEIGHT IN SIX MONTHS USING THE 5-HTP/CARBIDOPA COMBINATION WITHOUT PHENTERMINE.

HEALTHY BODY AND A GOOD NIGHT'S SLEEP

The body is designed to function autonomously (without direction) when it is healthy. Part of good health is supporting the mass and function of healthy tissue (e.g., skeletal muscle, brown fat). When the serotonin pathways are active, they can aid not only in reducing excess calorie intake, but also stimulate brown fat activity. Melatonin is involved in a myriad of functions, but even before birth, it plays a role in the creation of brown and beige fat. These thermogenic fats, through the actions of uncoupling protein that separate energy production from calorie burning, can aid greatly in fat loss and maintaining a lean physique. Brown fat is designed to do what people try to accomplish with ephedrine/caffeine or DNP. Though both serotonin and melatonin can be supplemented through increasing tryptophan or 5-HTP, as well as taking melatonin orally, the actions at specific sites in the brain are key to gaining the complete benefits. Part of accomplishing this involves developing good sleep hygiene–regular and sufficient sleep times, avoiding bright lights prior to sleep and maintaining a quiet and cool room.

REFERENCES

Wakame Seaweed (Fucoxanthin) Burns Fat!

There are foods that most of us are never exposed to due to cultural or geographic limitations. When a food is consumed only by people in a certain region or culture, it allows researchers to see if different health aspects are present. It does not mean that the food, or cultural practice, causes the difference; just that there might be something present to look at more closely.

Wakame is called "brown seaweed" in the United States, and is a staple food ingredient in many Southeastern Asian regions. Though no single factor accounts for the difference, it is clear that the Western diet– you know the one ... cheeseburger, fries and a large diet soda– has played a role in the prevalence of obesity in the United States. Asian cultures avoided the obesity "contagion" until the United States was kind enough to export fast food.

Analysis of wakame revealed a carotenoid (the same class of chemical as vitamin A, astaxanthin, beta-carotene, etc.) called fucoxanthin that has been shown to affect a number of responses in animal studies, that suggest it may be an effective fat-loss agent for humans. Two recent reviews on fucoxanthin describe many of these effects.[1,2] Again, much of this relies on animal or "test tube" studies.

Fucoxanthin has repeatedly been shown to prevent or reduce the fat gain of rodents placed on high-fat diets; reduce "fatty liver," which is associated with insulin resistance and metabolic syndrome; improve insulin sensitivity; reduce inflammation in fat tissue; lower inflammatory cytokine (messenger signals) release from fat; increase enzymes associated with fat burning; and increase UCP-1 in white fat, which causes the fat cell to "waste" fat calories as heat. This is sometimes referred to as "beige fat," as white fat (which normally stores fat) acts like brown fat, which burns fatty acids and glucose to generate heat. All of these mechanisms are separate avenues of research for fat-loss drugs.

A pharmacokinetic study reported fucoxanthin is converted into the presumably active metabolite fucoxanthinol by intestinal and liver cells, reaching a maximal concentration in blood at four hours post-ingestion, with a seven-hour half-life.[3] This is different from the rodent results, so it does emphasize the need for further human trials before any safety, efficacy and dosing recommendations can be given. Only a single human trial published in 2010 has been reported, though the findings were very promising.[5] Among obese non-diabetic women, some with fatty liver disease (NASH), supplementation with a pomegranate oil and brown seaweed extract containing 2.4 milligrams of fucoxanthin was associated with an average loss of 11 pounds in 16 weeks, with significant losses in body and liver fat; liver enzymes and inflammatory markers were also lower. Further, resting energy expenditure was higher in those receiving the fucoxanthin supplement.

Given its role as a traditional food ingredient, fucoxanthin appears to be a product that can be reasonably included in a healthy person's diet if they wish to try to receive the benefits suggested by the existing literature. Based upon the rodent pharmacokinetic data, it appears that fucoxanthin's metabolites may accumulate with regular use, so it may not be necessary to use high doses, though the results may take weeks to months to be realized.[4] ■

References
1. Muradian K, Vaiserman A, et al. Fucoxanthin and lipid metabolism: A mini-review. Nutr Metab Cardiovasc Dis 2015 Jun 3. Epub, ahead of print.
2. Gammone MA, D'Orazio N. Anti-obesity activity of the marine carotenoid fucoxanthin. Mar Drugs 2015 13 2196-214.
3. Hashimoto T, Ozaki Y, et al. Pharmacokinetics of fucoxanthinol in human plasma after the oral administration of kombu extract. Br J Nutr 2012 107 1566-9.
4. Hashimoto T, Ozaki Y, et al. The distribution and accumulation of fucoxanthin and its metabolites after oral administration in mice. Br J Nutr 2009 Jul 102 242-8.
5. Abidov M, Ramazanov Z, et al. The effects of Xanthigen in the weight management of obese premenopausal women with non-alcoholic fatty liver disease and normal liver fat. Diabetes Obes Metab 2010 12 72-81.

considered processed meats. Though it's possible these are safer choices, they are still relatively new to the market and therefore we do not know if processing meat with natural sources of nitrates, like those from celery, act differently in the body than traditionally processed nitrate-preserved meat. Grains and leafy vegetables are the main source of nitrates, which are reduced to nitrites by bacteria in the mouth. However, vitamins C and E as well as plant-based compounds called polyphenols, found in fruits and vegetables, inhibit your body's production of NOCs. Some meat processors add vitamin C during processing, yet it isn't clear if added vitamin C has any affect on NOC formation in the gut after consuming red or processed meat.

Understanding Your Risk

Along with processed meats, smoking, UV light (which includes the LED lights used to set gel nails), alcohol and mineral oil (found in many lotions and beauty products) are all Group 1 carcinogens. "IARC's classifications reflect the strength of evidence behind them, not the level of risk," states Bender. Just because a compound is carcinogenic, this does not mean it causes cancer "at all times, under all circumstances. Some may only cause cancer in people who have a certain genetic makeup. Some of these agents may lead to cancer after only a very small exposure, while others might require intense exposure over many years," according to the American Cancer Society. Many factors influence the development of cancer including age, gender, family history and other lifestyle factors (tobacco and alcohol use, weight, diet, physical activity).

Risk of colon cancer with consumption of processed meat over the course of a lifetime is about 5 percent. However, one study cited in the IARC report found that small amounts of processed meats eaten daily– 50 grams or one small hot dog– increases risk for colorectal cancer by 18 percent (to a total of about 6 percent) compared to not eating processed meat. "In some studies, participants who eat diets highest in red/processed meat experience a risk for colon cancer nearly double that of those eating the lowest amounts of red/processed meat," says Bender. How does this compare to smoking? "According to the CDC, smoking cigarettes multiplies a person's risk for cancer by as much as 20 times when compared to a non-smoker. And smoking increases the risk of many cancers, and increases the risk of dying from cancer," states Bender.

Decreasing Your Risk of Colorectal Cancer

Though risk of dying from colorectal cancer seems small compared to deaths due to smoking, there are about 2.5 cases of colorectal cancer for each death from this disease. "Colorectal cancer is the third most common cancer in the U.S., and we can prevent about HALF of these cases through the combination of five lifestyle choices: **1)** reach and maintain a healthy weight, **2)** make physical activity a daily habit by aiming for at least 30 minutes each day, **3)** drink alcohol only in moderation (if at all), **4)** fill up on fiber-rich foods, **5)** limit red meat and avoid processed meat," states Collins. Screening for colorectal cancer is also very important since it will detect cancer early so treatment can begin right away.

The AICR recommends avoiding all processed meat and limiting red meat intake to a more liberal amount than suggested by the WCRF– 18 oz. of cooked red meat per week. "Since no safe level of processed meat consumption has been identified, the choice of how to use this information is individual. For someone who wants to know that they are doing all they can to reduce their risk of this cancer, then keeping use to very infrequent occasions is the answer. For someone who has been eating bacon, hot dogs, sausage and other processed meats on a daily basis, then reducing consumption is important, even if they aren't willing to completely give up these choices," says Collins. Consider substituting other sources of protein for processed meats including beans, peas, eggs, cottage cheese, tofu and tempeh. Eat fresh sliced chicken or turkey instead of deli meats and fresh pork belly or fresh pork over bacon. Vegetarian sausages can take the place of bacon, chorizo or salami, while beans can replace sausage in casseroles, soups and other dishes. Newer plant-based meat alternatives offer a wide range of textures and tastes, but they do not taste anything like traditional processed or red meat.

You can also prepare red meat so it contains fewer potential carcinogens. Leaner cuts of red meat including loin and round drop less fat into flames, leading to less smoke and therefore fewer PAHs. Choose low, slow and moist cooking methods, such as meat marinated and placed in a slow cooker, over high, dry heat. Low temperatures will decrease the formation of HAAs.

It is important to keep in mind that "avoiding processed meat and consuming red meat only in moderation is one important part of reducing risk of colorectal cancer– but this alone does not define healthy eating," states Collins. According to a study published in the *Journal of the American Medical Association*, eating a primarily plant-based diet that includes fish may be your best bet for preventing colorectal cancer. In this study, pesco-vegetarians– vegetarians who also include fish in their diet– had a 43 percent lower risk of colorectal cancer than non-vegetarians, while milk and egg eating vegetarians had an 18 percent lower risk, and vegans– those who consume no animal foods– had a 16 percent lower risk. Researchers believe fish may provide an additional benefit due to its high content of the omega-3 fatty acids EPA and DHA, which are unique to fish and algae.

The IARC report reiterates advice that the World Cancer Research Fund and health experts have been recommending for years– avoid processed meat and limit your consumption of red meat. Now it's up to you as a consumer to decide what you plan on doing with this information. ■

REFERENCES

International Agency for Research on Cancer Group 1: Carcinogenic to humans. http://www.cancer.org/cancer/cancercauses/othercarcinogens/generalinformationaboutcarcinogens/known-and-probable-human-carcinogens
The Skin Cancer Foundation's official position on UV light and manicure safety. http://www.skincancer.org/media-and-press/press-release-2013/nail-lamps
What are the key statistics about colorectal cancer? AICR. http://www.cancer.org/cancer/colonandrectumcancer/detailedguide/colorectal-cancer-key-statistics
Tricker AR. N-nitroso compounds and man: sources of exposure, endogenous formation and occurrence in body fluids. Eur J Cancer Prev 1997. 6(3):226-68
Bartsch H, Ohshima H, Pignatelli B. Inhibitors of endogenous nitrosation. Mechanisms and implications in human cancer prevention. Mutat Res 1988. 202(2):307-24
Dietrich M, Block G, Pogoda JM, Buffler P, Hecht S, Preston-Martin S. A review: dietary and endogenously formed N-nitroso compounds and risk of childhood brain tumors. Cancer Causes Control. 2005. 16(6):619-35
Dubrow R, Darefsky AS, Park Y, Mayne ST, Moore SC, Kilfoy B, Cross AJ, Sinha R, Hollenbeck AR, Schatzkin A, Ward MH. Dietary Components Related to N-Nitroso Compound Formation: A Prospective Study of Adult Glioma. Cancer Epidemiol Biomarkers Prev 2010. 19(7):1709-1722
Animal Foods. World Cancer Research International Fund. http://www.wcrf.org/int/research-we-fund/cancer-prevention-recommendations/animal-foods
Santarelli RL, Pierre F, Corpet DE. Processed meat and colorectal cancer: a review of epidemiologic and experimental evidence. Nutr Cancer 2008. 60(2):131-144
Smith JSI, Ameri F, Gadgil P. Effect of marinades on the formation of heterocyclic amines in grilled beef steaks. J Food Sci 2008. 73(6):T100-5
Kim HJ, Lim SY, Lee JS, Park S, Shin A, Choi BY, Shimazu T, Inoue M, Tsugane S, Kim J. Fresh and pickled vegetable consumption and gastric cancer in Japanese and Korean populations: a meta-analysis of observational studies. Cancer Sci 2010. 101(2):508-16
Catsburg CE, Gago-Dominguez M, Yuan JM, Castelao JE, Cortessis VK, Pike MC, Stern MC. Dietary sources of N-nitroso compounds and bladder cancer risk: findings from the Los Angeles bladder cancer study. Int J Cancer 2014. 134(1):125-35