

Red Meat and Cancer: Defining the Risk

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The possible link between red meat intake and risk of cancer is the subject of much research and media interest. The scientific literature on this subject is extensive, the popular press coverage can be intense, and sorting out facts from speculation and hypothesis can be confusing. Some estimates suggest that dietary factors can account for approximately 1/3 of all cancer deaths each year (Doll and Peto, 1981; American Cancer Society, 2007). These numerous and complex factors may yield both positive and negative risk and continue to be of great interest to the research community and the general public.

This review will attempt to provide an update of the current scientific evidence and considerations relative to red meat and cancer. It focuses primarily on epidemiological research. Epidemiology is the study of factors affecting disease occurrence in a population (Langseth, 1996). An overview of a systematic assessment of the totality of the evidence from the epidemiological literature related to meat and cancer will be provided. The epidemiological literature is extensive, the findings are complex, and the association of meat consumption and cancer risk is not consistent. It may be fair to say that the most consistent finding is the inconsistency of the data.

Examination of the literature yields evidence ranging from “no relationship” to “insufficient” to “possible” to “probable,” but most cases lack a strong and convincing causal relationship. This type of inconsistency has led to division of scientific camps and has resulted in varied interpretations of the same existing literature. Both scientists and consumers must be careful to not over- or underinterpret the results and conclusions being reported.

An independent, comprehensive review, “An Examination of Epidemiologic Studies of Red Meat Intake and

Cancer,” was conducted by Exponent, a leading scientific consulting firm with expertise in epidemiology (Exponent Inc., 2008). This review (finalized September 2007) found that the available evidence did not support a conclusive causal relationship between red meat and any of the cancers studied (breast, prostate, kidney, pancreatic, stomach, and colorectal).

In this scientific review, Exponent evaluated 12 exposure variables (total meat, red meat, processed meat, animal fat, animal protein, cooking methods, doneness of meat, heterocyclic amines, nitrosamines, polycyclic aromatic hydrocarbons, dietary patterns, and genetics) against each of 6 cancer sites: colorectal, prostate, pancreatic, stomach, breast, and kidney.

To provide an unbiased critical interpretation and evaluation of the existing epidemiological literature on red meat and cancer, Exponent comprehensively searched the literature to identify all available epidemiological studies of interest, synthesized the results of the relevant individual studies, and assessed the evidence for and against causality using the well-established Bradford-Hill criteria (Hill, 1965).

In this systematic assessment, more than 14,000 studies on meat and cancer were identified, and more than 500 met the eligibility criteria and were evaluated. Only epidemiological studies on human populations were included. And of these, evaluation of causality was based solely on cohort and case-control studies and meta and pooled analyses of these studies.

When analyzing these studies (~500), Exponent reviewed the methodological considerations in the studies, including potential for various types of bias. These include the following: publication bias, self-reported food intake bias, and bias due to confounding factors.

A dilemma for studying the relationship between meat and a health issue such as cancer is dependent on the interpretation of the data and importance assigned to numerous dietary variables and other potential confounders. Major challenges arise as one seeks to disentangle these many factors, which may or may not be related to the perceived effect of dietary meat. Very few of the reported studies between meat and cancer are clear-cut, and this seems to hold true across multiple cancer sites. Inconsis-

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tency of the data and responses continue to raise questions as to what is the real effect versus an effect due to chance or confounded by other variables. Additionally, the etiology of the cancers evaluated is largely undefined. Uncontrolled confounding by unidentified factors could likely affect the findings in original studies, meta-analysis, and pooled analysis.

Numerous and complex variables illustrate why results often may appear to be inconsistent and why red meat may, or may not, be associated with potential risks and benefits. There are additional questions to ask as one interprets reviews and individual epidemiological studies of red meat and cancer.

Considerations

- ◆ Nutrients vs. foods vs. total diet patterns
 - Is one dealing with overconsumption of meat or underconsumption of other food groups or nutrients?
 - The intake of protective factors may offset possible adverse effects.
- ◆ Levels of intake
 - Are reported levels of intake at, near, or above recommended levels? Are these reported levels realistic?
 - Some epidemiological studies show an effect but only at extreme intake levels.
- ◆ Ranges of intakes reported in epidemiological studies (quartiles, quintiles, etc.)
 - Are responses linear, dose-related, what is the shape of the entire trend curve?
 - Are responses only observed at the extreme levels of intake but not at moderate or recommended levels?
 - Need to examine the middle-intake levels where most people live...diet-wise.
- ◆ Trim level of red meat
 - Has the study used the most up-to-date nutrient values?
- ◆ Has the role of genetics and individual variability in response been considered
 - Effects how a person activates/deactivates/metabolizes potential mutagenic compounds.
- ◆ Impact of meat preparation/cooking methods
 - Potential risks can be minimized or eliminated.
- ◆ Consider actual meat intake levels
 - Current average intakes of red meat are quite modest; Americans are not overconsuming red meat.

◆ Consider the most consistent (and convincing) risk factors

- Obesity and lack of exercise.

Despite the vast amount of literature that has examined the possible relationship between meat and cancer, inconsistencies remain, and a review of the literature continues to reveal that associations are not universal between types of cancer and are not consistently observed in all studies.

Although some epidemiological studies may suggest a possible risk associated with some types of meat and types of cancer, under certain conditions, other studies do not support this. The continuing inconsistency of the degree and strength of response would argue that any true effect of meat is likely to be small, or perhaps even the result of an unbalanced consumption of food groups among higher meat consumers.

Diet, as it relates to chronic diseases such as cancer, is an ever-expanding area of research. New methods of genotyping large populations, and refined methods for more accurately assessing diet and meat specific intake, will enhance the interpretation of future studies of diet and cancer. It is important to continually reevaluate patterns of associations between meat and cancer and work to disentangle the many confounders related to dietary meat intake so that any true relationship can be identified and any subset of individuals at potential risk can be identified and properly advised.

Finally, the continuing importance of dietary variety, balance, and moderation should be stressed along with the importance of consumption of potential protective factors in the total diet (including fruits, vegetables, fiber, and nutrients such as vitamin D), combined with maintenance of optimal body weight and a physically active lifestyle.

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