

COMMENTARY



On Meat, Butter, and Fudge

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ABSTRACT

Was the *Annals of Internal Medicine* recently acting as a mouthpiece for meat-industry propaganda? Five papers underpinned recommendations on meat consumption; their central deceit was to review only randomized controlled trials and cohort studies, which, in research on the associations between common foods and disease outcomes, are nearer to the bottom than the top of the evidence hierarchy. Despite concluding that their own recommendations were “weak and based on low certainty evidence”, the authors were happy to recommend that there is “No need to reduce red or processed meat consumption for good health.” What we actually know is that: red meat consumption is an order of magnitude higher now than through most of human history; red meat is a probable, and processed meat is a definite, human carcinogen; saturated fat increases risk of heart disease; and vegans and vegetarians have better lipid profiles, lower risk of chronic disease, and greater longevity than meat eaters. There are other consequences of meat consumption too, including: altered sexual development; widespread antimicrobial resistance; and disrupted planetary health, including depletion of aquifers, groundwater pollution, and increased greenhouse gases. The pseudoscience presented in the *Annals of Internal Medicine* appears to have been written solely to create doubt and confusion in the wider population. Scientists and journals should hold themselves to a higher standard.

The Mad Hatter, looking at his watch, asks what day it is. Alice tells him it is the Fourth:

“Two days wrong!” sighed the Hatter. “I told you butter wouldn’t suit the works!” he added, looking angrily at the March Hare.

“It was the best butter,” the March Hare meekly replied.

Alice’s Adventures in Wonderland

Lewis Carroll

On 1 October 2019, we were subjected to the unexpected and unedifying spectacle of a hitherto solid respectable Journal—*Annals of Internal Medicine*—acting as a mouthpiece for propaganda from the meat industry. Oh, perhaps not so solid and respectable after all: they had already done this in 2016 with the same first author but at that time he was attempting to cast doubt on the problem of the relationship between sugar and health. How did this happen and what can we learn from it?

A group of individuals calling themselves NutriRECs decided to examine, on their own terms, some of the data on meat consumption and human health and then undertake the further step of making

recommendations about meat intake on the basis of their interpretation of this subset of the available data. There are five papers in the *Annals of Internal Medicine* described as reviews. There is a sixth paper that then derives recommendations on meat consumption.

The core of NutriRECs’ deceit is to review only randomized controlled trials and cohort studies, which, despite their value in drug trials and other settings, in research on the associations between common foods and disease outcomes, are nearer to the bottom than the top of the evidence hierarchy because of their multiple inherent biases. The method these authors use—the GRADE approach (1)—is entirely appropriate for assessing trials and cohort studies and, thus, it is not surprising, given the restrictions they placed on their own choice of dietary data, they identified serious flaws in the evidence. Yet, despite the fact that they themselves acknowledge that their recommendations are “weak and based on low certainty evidence”, they were still happy to recommend, disingenuously, that there is “No need to reduce red or processed meat consumption for good health.”

For the purposes of understanding possible causes and making recommendations regarding the relationship between common foods and disease, these study designs do indeed provide very low-quality data: duration of studies is usually too short; there are no biomarkers or other reliable methods to assess the accuracy of self-reported food consumption, which is known to be poor, or to monitor the substantial problems with compliance in any nutrition study lasting more than a few weeks or months; and none of the participants is blind to the intervention. In short, intervention trials and cohort studies involving common dietary elements and disease outcomes are highly problematic.

And then there is the failure to consider:

1. the deep and wide data that explore—both in humans and animals—meat constituents and their mechanisms that are deleterious to human health: e.g., N-nitroso compounds (2), cooking-related carcinogens (3), iron (4, 5), degradation of protein (6), saturated fat (7), L-carnitine (8), feed-related contaminants (9), and a reduced intake of plant foods (7). Choosing from among this list of probably highly correlated constituents does not inform prevention strategies but it does add to the richness of our understanding of the many ways in which meat is harmful to health;
2. the history of changes in human meat consumption; and
3. what cattle raising is doing to the climate and the environment, consequences that themselves have an adverse impact on human health.

Our closest primate relatives are occasional consumers of meat (the chimpanzee, *Pan troglodytes*, and bonobo, *Pan paniscus*) or vegetarian (the gorilla, *Gorilla gorilla*); good evidence shows that some of our hominin cousins (*Australopithecus bahrelghazali*, *Paranthropus robustus*, and *Australopithecus sediba*) were largely plant eaters (10–12). Nonetheless, humans have a long history of meat consumption (13). As the ice made its most recent major retreat 10,000–12,000 years ago, humans had already become highly skilled hunters with a taste for meat (14). This resulted in the devastation and even extinction of megafauna and birds on many islands and across all continents except Africa (15).

With the transition to a pastoral lifestyle in different parts of the world, many humans, nomadic and settled, learned to raise meat and milk animals. Meat consumption was essentially only celebratory in ancient Greece (16). In traditional European

agricultural societies, meat was eaten at most once a week and total consumption was rarely more than 5–10 kg/person/year (14). Today, consumption in rich countries is unprecedented: more than 100 kg/person/year (17). Meat consumption rose dramatically after the invention of refrigeration, which allowed storage and long-distance transportation and, again later, with policy changes and the development of confined animal feeding operations (CAFOs), initially in the US and, more recently, elsewhere.

More than 30% of the earth's total land surface is dedicated to raising livestock; this is mostly permanent pasture but 33% of the world's arable land is used for growing cattle feed (18). More than 40% of the total land area of the US is committed in this way (19). Livestock account for about 20% of the terrestrial animal biomass—perhaps four times the biomass of humans (18).

Changing from a predominantly plant-based diet with animal protein as a modest supplement to a diet where more than 25% of total energy is derived from animal products has had consequences for human health. What, using the appropriate methods, do we know about the health consequences of a high intake of meat?

1. Red meat is associated with an elevated risk of colorectal cancer and is a probable human carcinogen (20).
2. Processed meat is associated with an elevated risk of colorectal cancer and is a definite human carcinogen (20).
3. Saturated fat is associated with an elevated risk of coronary heart disease (21).
4. Vegans and vegetarians have better lipid profiles, lower risk of cardiovascular disease and several cancers, and greater longevity than meat eaters (22–25).
5. Other consequences include:
 - a. accelerated human sexual development, a result of consumption of meat and fat directly influencing growth rates and adipose accumulation or arising from exogenous or naturally occurring growth hormones in meat (26, 27);
 - b. hunger following the diversion of high-value legumes and grains to feed cattle (more than 97% of global soymeal production is fed to livestock (18));
 - c. higher risks of infected food from animals raised in CAFOs (28, 29). In this regard, pigs can act as a point source and “mixing vessel” for the recombination of epidemic influenza strains: use of multiple animal vaccines in a

factory farm has been shown to result in the emergence of a virulent strain after recombination of two attenuated strains (30).

- d. widespread antimicrobial resistance as a result of antibiotic use to promote the growth of livestock (31, 32);

The consequences for the health of the planet and thus, indirectly, for human health include:

1. depletion of aquifers (18) (producing 1 kg of meat protein requires more than 110 000 liters of water (33));
2. groundwater pollution (34);
3. production of 37% of anthropogenic methane (18) (with, over the short term, 86 times the global warming potential of CO₂ (35)) and 65% of anthropogenic nitrous oxide (9) (almost 300 times the potential of CO₂);
4. production of 64% of anthropogenic ammonia emissions, a substantial contributor to acid rain and acidification of ecosystems (18).

Rainforest destruction to raise livestock and the production of greenhouse gases by livestock together contribute more to climate change than fossil fuels used for transport (18).

The inability or unwillingness to concentrate on the wider picture, the deliberate fudging of the appropriate way to analyze data (this is using the March Hare's "best butter"), and the resulting misleading recommendations are not intended to convince scientists, who clearly understand the nature of the relationship between meat and health (36–38) and, for that matter, sugar and health (39–41). This pseudoscience is presented solely to create doubt and confusion in the wider population (42).

Industry will do what it needs to do to push as much of its product on the world as it can. Industry will do what it needs to do to obfuscate the relationship between its products and human and planetary health; they have done it with tobacco, fossil fuels, glyphosate and other biocides, sugar, and now meat. Can alcohol (for which the optimal consumption level is zero drinks per week (43)) be far behind as a target for this kind of misinformation?

Industry will do what it needs to do but this does not give scientists and journals a license to be complicit.

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