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Animal-based and plant-based protein-rich foods and cardiovascular health: a complex conundrum

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Dietary protein is integral to human health, but controversies swirl around the cardiovascular health effects of consuming animal-based compared with plant-based protein-rich foods. This important nutrition and health issue is complicated by whether the relative effects of animal-based compared with plant-based protein-rich foods are assessed within the context of self-chosen, Western-style eating patterns typically consumed in the United States or healthier eating patterns recommended by government and health policy organizations. Other complicating factors include epidemiologic design features [e.g., observational cohort studies compared with randomized controlled trials (RCTs)] and the types of protein-rich foods and food products consumed.

The vast majority of Americans self-choose unhealthy Western-style eating patterns, which are inconsistent with 2015–2020 Dietary Guidelines for Americans (DGA) recommendations and contain excess saturated fats (>10% of energy intake per day) and sodium. Red meats are often described as unhealthy foods due to their saturated fat and sodium contents. Importantly, red meats inconsistently contribute to greater saturated fat and sodium intakes, with wide variability among meat products, ranging from lean, unprocessed meat (e.g., trimmed pork tenderloin: 1 g saturated fat and 48 mg sodium per 3-oz portion) to fatty, processed meat products (e.g., pork sausage: 39 g saturated fat and 775 mg sodium per 3-oz portion). Regarding dietary protein, on average, US adults consume more protein from animal sources (46% of total protein intake) than from plant (30%) and dairy (16%) sources (1). Consuming protein predominantly from animal sources may be viewed favorably (e.g., greater nutrient density and protein quality) or unfavorably (e.g., higher saturated fat and sodium intakes). Pertinent to cardiovascular health, the 2015–2020 DGA states that "strong evidence from mostly prospective cohort studies . . . has shown that eating patterns that include lower intakes of [red] meats as well as processed [red] meats and processed poultry are associated with reduced risk of cardiovascular disease (CVD) in adults" (2). This statement does not distinguish between types of red meats, extent of processing, nonprotein components of foods, the alternative (control) food used for testing, or the overall health-promoting properties of the cohorts' diets. All of these factors may affect associations between animal-based and plant-based protein-rich foods and CVD risk factors (3). The need for more research regarding the impact of consuming red meats on CVD is highlighted by meta-analysis results showing that higher unprocessed red meat intake did not predict coronary heart disease (RR per 100 g/d: 1.00; 95% CI: 0.81, 1.23), but higher processed meat intake did (RR per 50 g/d: 1.42; 95% CI: 1.07, 1.89) (4). From a compositional and nutritional perspective, all meats are not the same, and lumping them all together belies the complex conundrum between red meat intake and cardiovascular health.

Whereas observational research predominantly informed 2015–2020 DGA recommendations to consume less red meat to reduce long-term outcomes such as CVD onset and mortality (2), results from randomized controlled feeding trials are well suited to investigate cause-and-effect relations among protein-rich food sources and CVD risk factors, which are easier to measure in the short term (3, 5). In the current issue of the Journal, Bergeron et al. (6) provide novel insights on the relative effects of consuming red meat, white meat, and nonmeat protein sources, each for 4 wk, on atherogenic lipoprotein measures, including lipoprotein particles. The predominant protein sources tested in this RCT were unprocessed, lean red meat; unprocessed, lean white (poultry) meat; and nonmeat sources (legumes, nuts, grains, and isoflavone-free soy products). These protein sources were tested when the diets contained either low saturated fat (7% of total energy) or high saturated fat (14% of total energy), with the saturated fat contents of the diets manipulated predominantly by using dairy products with different fat contents. Consuming the red and white meat diets, compared to the nonmeat diet, resulted in higher fasting-state concentrations of total cholesterol, LDL cholesterol, and non-HDL cholesterol, along with higher plasma apolipoproteins (apo) B and apoA1. The higher LDL cholesterol was associated with higher large LDL cholesterol particle size but no differences in small and medium LDL cholesterol particle sizes. The concentrations and sizes of these compounds were not different between the red and white meat diets. These results prompted Bergeron et al. (6) to conclude

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that "the estimated impact of red meat [and] white meat . . . on CVD risk as reflected by their effects on LDL cholesterol and apoB concentrations may be attenuated by the lack of their effects on smaller LDL particles that are most strongly associated with CVD." Collectively, these results support recommendations for Americans to increase intakes of healthy plant-based, protein-rich foods to help reduce CVD risk, based on plasma lipid and lipoprotein effects. Comparable results and conclusions were drawn from a recent meta-analysis of RCTs—specifically that "high-quality plant protein sources (legumes, soy, nuts, and other plant protein sources) resulted in more favorable changes in total and low-density lipoprotein cholesterol in comparison with red meat" (7).

Although Bergeron et al.'s (6) results show that consuming lean, unprocessed red and white meats resulted in higher concentrations of atherosclerotic lipids and lipoprotein, compared to the nonmeat protein sources, does this mean that the red and white meats are unhealthy? Several lines of evidence from RCTs are important to consider. Among all published RCTs (as of July 2017), consuming red meat compared with a variety of plant-based and animal-based alternative foods did not differentially affect total cholesterol, LDL cholesterol, apoB, or apoA1, along with HDL cholesterol or blood pressure (5, 7). Inconsistences among published RCTs regarding the relative impact of red meat on CVD risk factors are due, in part, to the foods that are used for comparison (7). Independent of the predominant protein source, subjects' lipid and lipoprotein profiles typically improve upon adopting controlled, healthier diets, compared to their self-chosen, unrestricted diets, which supports that unprocessed red, white, and other meats may be consumed with healthy eating patterns (5, 7).

Moving forward, importantly, the 2015–2020 DGA recommends adopting healthy eating patterns that may contain "a variety of protein foods, including seafood, lean meats and poultry, eggs, legumes (beans and peas), and nuts, seeds, and soy products" (2). These nutrient-dense, protein-rich foods may be consumed in culturally suitable ways within the framework of multiple healthy eating patterns, including US style, Mediterranean style, and vegetarian style (2). The DGA does not include recommendations on the relative amounts of specific animal- and plant-based protein-rich foods to consume but combines them into "meats, poultry, eggs" and "nuts, seeds, soy products" clusters within the "protein foods" food group (2). Discussions about meats and health will, and should, continue, with research similar to Bergeron et al.'s (6) constructively contributing new information. Debates pitting meats against protein-rich plant foods seem less useful to consumers than helping both omnivores and vegetarians understand the health properties of the foods they choose to consume and educating them to include a variety of suitable protein-rich foods within healthy eating patterns.

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References

1. Pasiakos SM, Agarwal S, Lieberman HR, Fulgoni VL 3rd. Sources and amounts of animal, dairy, and plant protein intake of US adults in 2007–2010. Nutrients 2015;7(8):7058–69.
2. US Department of Health and Human Services and US Department of Agriculture. [Internet]. 2015–2020 Dietary Guidelines for Americans. 8th ed. December 2015. Available from: http://health.gov/dietaryguidelines/2015/guidelines/.
3. Richter CK, Skulas-Ray AC, Champagne CM, Kris-Etherton PM. Plant protein and animal proteins: do they differentially affect cardiovascular disease risk? Adv Nutr 2015;6(6):712–28.
4. Micha R, Wallace SK, Mozaffarian D. Red and processed meat consumption and risk of incident coronary heart disease, stroke, and diabetes mellitus: a systematic review and meta-analysis. Circulation 2010;121(21):2271–83.
5. O'Connor LE, Kim JE, Campbell WW. Total red meat intake of ≥0.5 servings/d does not negatively influence cardiovascular disease risk factors: a systemically searched meta-analysis of randomized controlled trials. Am J Clin Nutr 2017;105(1):57–69.
6. Bergeron N, Chiu S, Williams PT, King S, Krauss RM. Effects of red meat, white meat and non-meat protein sources on atherogenic lipoprotein measures in the context of low vs. high saturated fat intake: a randomized controlled trial. Am J Clin Nutr 2019;110(1):24–33.
7. Guasch-Ferre M, Satija A, Janiszewski M, Emlen E, O'Connor LE, Campbell WW, Hu FB, Willett WC, Stanpfer MJ. Meta-analysis of randomized controlled trials of red meat consumption in comparison with various comparison diets on cardiovascular risk factors. Circulation 2019;139(15):1828–1845.