



## Inclusion of red meat in healthful dietary patterns

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### ABSTRACT

Dietary patterns are an important concept in dietary recommendations. The Western pattern is most commonly defined as a diet characterized by high intakes of refined grains, sugar and red meat, and has been shown to be associated with increased risks for certain types of cancer, coronary heart disease, diabetes, and obesity. However, isolating the independent effects of individual foods on health outcomes is central to helping individuals choose foods to build healthier dietary patterns to which they can adhere. Red meat is a popular source of high quality protein and provides a variety of essential nutrients that improve overall diet quality. It is also a source of saturated fatty acids, which observational evidence suggests are associated with heart disease, although recent data challenge this. Several studies have shown that lean red meat can be successfully included in recommended heart-healthy dietary patterns without detriment to blood lipids. Furthermore, increased dietary protein has been shown to promote healthy body weight and composition, in part by increasing satiety, and to improve vitality and stamina.

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### 1. Introduction

The U.S. Department of Health and Human Services and the U.S. Department of Agriculture (USDA) have jointly issued Dietary Guidelines at an interval of every 5 years since 1980. The next Dietary Guidelines are slated for publication in 2015 (U.S. Department of Health and Human Services, 2014). The current Dietary Guidelines Advisory Committee (DGAC) recommends limiting saturated fatty acid [SFA] intake to <10% of kcal (emphasizing replacement with monounsaturated fatty acids [MUFA] and polyunsaturated fatty acids [PUFA]) and limiting dietary cholesterol to <300 mg per day, supporting a whole diet or dietary pattern approach to achieve these targets (U.S. Department of Health and Human Services, 2010). The Western dietary pattern is typically described as a diet characterized by high intakes of refined grains, sugar, red meat and other animal products, and fat, and has frequently been shown to be associated with negative health outcomes such as increased risk for certain types of cancer (Abid, Cross, & Sinha, 2014; Alexander, Mink, Cushing, & Scurman, 2010; Alexander, Morimoto, Mink, & Cushing, 2010; Alexander, Weed, Cushing, & Lowe, 2011; Fung et al., 2003; Michaud et al., 2001), coronary heart disease (Bernstein, Sun, Hu, Stampfer, Manson, & Willett 2010; Clifton, 2011; Hu et al., 2000), diabetes (Aune, Ursin, & Veierod, 2009; Fung, Schulze, Manson, Willett, & Hu, 2004; Lutsey, Steffen, & Stevens, 2008; Pan et al., 2011; Song, Manson,

Buring, & Liu, 2004), and obesity (O'Keefe & Abuannadi, 2010). The World Cancer Research Fund/American Institute for Cancer Research Project stated that there was convincing evidence of a causal relationship between red meat and processed meat consumption and colorectal cancer (World Cancer Research Fund & American Institute for Cancer Research, 2011). However, that conclusion has been controversial. The association is relatively modest and in a range where it is difficult to rule out bias and confounding as alternate explanations. These issues led to the decision by the 2010 DGAC to conduct another review that included only prospective cohort studies in humans published since 2000 (U.S. Department of Health and Human Services, 2010). The DGAC reported inconsistent positive associations between colorectal cancer and certain animal protein products, mainly red and processed meat, and concluded that, in general, studies showed no consistent findings with regard to the quantity and type of meat or meat product and colorectal cancer. Furthermore the report stated that the studies examined often had little information on other factors, such as the way meat is cooked, which might be expected to affect the association. It is also important to consider that observational studies cannot reliably separate the relationships of the disease under study with individual components of a dietary pattern because of interrelationships among correlated dietary variables (Maki, Slavin, Rains, & Kris-Etherton, 2014). The contribution that red meat has toward SFA intake and possible adverse effects on health outcomes are also often misunderstood, particularly as the availability and consumption of lean cuts of red meat have increased. Furthermore, the contribution made by lean red meat as a source of high quality protein and essential nutrients is frequently overlooked (McAfee et al., 2010). It is therefore important to

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disentangle the effects on health outcomes of the individual foods, such as red meat, from that of the other components of a Western dietary pattern in order to identify more healthful dietary patterns. This review presents the case for the benefits of lean red meat, with an emphasis on lean beef, as a high-protein, nutrient-rich, popular food, which can be incorporated into dietary patterns recommended for improved health.

## 2. Consumer preferences for red meat

The definition of red meat vs. white meat is not universal, but beef, pork, mutton, and veal are generally classified as red meat. Beef is the predominate red meat consumed in several developed nations (e.g., U.S., Canada and Australia) (McNeill & Van Elswyk, 2012). Overall meat consumption is on the rise in developed nations worldwide (Daniel, Cross, Koebnick, & Sinha, 2011). While there has been a shift toward increased poultry consumption in the U.S., red meat still represents the largest proportion of meat consumed (Daniel et al., 2011), but it is anticipated that this may change in coming years. Research from the Mintel Group indicates that 90% of U.S. consumers report eating some kind of red meat at least once per month, but that ~39% of beef and other red meat consumers ate less in 2013 than they did in 2012, and 25% of pork consumers claimed to have eaten less pork in 2013 than in 2012. In contrast, only 10% of beef and other red meat eaters reported eating more, and only 13% of pork consumers are eating more (Mintel Group, 2014). Global food analysts note that trends motivating consumers to cut fat and cholesterol intake are the dominant factors affecting the red meat market (Mintel Group, 2014).

Consumer preferences for leaner cuts of red meat, driven by dietary guidance in recent decades instructing the increased consumption of lean meats and trimming excess fat from meats, have resulted in changes in meat production and merchandising that produce meats with 80% less external fat (McNeill, Harris, Field, & Van Elswyk, 2012; Savell et al., 2005). Currently, approximately two-thirds of the beef sold retail in the U.S. meets the government guidelines for lean (McNeill et al., 2012). Despite the increased availability of lean cuts, there continue to be misconceptions among consumers and nutrition professionals about the fat content and healthfulness of red meat. A high proportion of U.S. dietitians were reported to regard beef as a greater source of SFA than pork, poultry, and dairy products (McNeill et al., 2012), despite the fact that dairy products are the largest contributor to SFA intake in the American diet (U.S. Department of Health and Human Services, 2010). The perception of the healthiness of beef among European consumers appears to be more favorable (Van Wezemael, Verbeke, de Barcellos, Scholderer, & Perez-Cueto, 2010).

The versatility of red meat as an entree or an ingredient in recipes, coupled with the wide variety of types of red meat available, increases the ease with which people following different dietary patterns, including those currently recommended by health organizations, can include red meat (Eckel et al., 2013; U.S. Department of Health and Human Services, 2010). The flexibility that this variety offers as well as the large number of people who already report enjoying red meat as part of their regular diets, would be expected to enhance compliance with healthful dietary patterns that incorporate lean red meat, compared to dietary advice that discourages consumption of red meat. Epidemiologic studies have shown that individuals attempting to follow a predominantly plant-based diet have improved compliance when incorporating lean beef (Fung et al., 2010; Jenkins et al., 2009). Clinical trial evidence also supports the usefulness of lean red meat for improving long-term dietary compliance as demonstrated in a 76-week crossover study of subjects with mild-to-moderate hypercholesterolemia who consumed lean red meat (beef, veal and pork) or lean white meat (poultry and fish) (Davidson, Hunninghake, Maki, Kwiterovich, & Kafonek, 1999; Hunninghake et al., 2000). When consuming the lean red meat diet, subjects more consistently achieved their weekly meat intake goals (6 oz of lean meat per day, 5–7 days per week, consuming at least 80%

of their meat from the assigned meat category) compared with when consuming lean white meat (Hunninghake et al., 2000).

## 3. Red meat and cardiovascular health

The root of most of the restrictions proposed for red meat consumption stems from red meat as a source of SFA, which has historically been believed to increase the risk for heart disease (Keys et al., 1966). However, the relationship between SFA intake and risk for heart disease is complex, and recent evidence challenges earlier conclusions (Astrup et al., 2011; Baum et al., 2012; Chowdhury et al., 2014; Siri-Tarino, Sun, Hu, & Krauss, 2010a, 2010b). A meta-analysis demonstrated that in 20 observational studies, relative risk for coronary disease with SFA was 1.03 (95% confidence interval 0.98 to 1.07) when the top and bottom tertiles of consumption were compared (Chowdhury et al., 2014). Not only does the observational evidence regarding the association between SFA and heart disease appear to be inconsistent, but also the methods for evaluating evidence and the reliance on certain types of evidence for making dietary recommendations have been called into question (McAfee et al., 2010). A review of evidence-based dietary guidance suggested that advisory committees have often excluded valid evidence and ignored key outcome variables when examining the association between SFA intake and cardiovascular disease such that many current conclusions and recommendations do not reflect the full body of available evidence (Hoenselaar, 2012). Another recent review explained the limitations of observational data, such as imprecise exposure quantification, collinearity among dietary exposures, displacement/substitution effects, healthy/unconsumer bias, residual confounding, and effect modification, and made the argument that dietary recommendations should not be supported solely, or primarily, by data from prospective cohort studies (Maki et al., 2014).

When considered in its totality, the science reflects that red meat is not a unique contributor to SFA, and further that other dietary risk factors may play an even larger role in diet-related disease risk. The relationship between SFA and heart disease depends to a large degree on the comparator. Replacing SFA with MUFA or PUFA may be beneficial, but replacing SFA with some other dietary components, such as refined carbohydrates, may increase the risk (Baum et al., 2012). Research suggests that *trans* fatty acid intake (Hoenselaar, 2012; Mozaffarian, Aro, & Willett, 2009), diets with a high glycemic index (Jakobsen et al., 2010), and high dietary salt may be more significant risk factors for heart disease than dietary SFA (Aaron & Sanders, 2013; Mozaffarian et al., 2009). Furthermore, recent investigations suggest that increased consumption of refined carbohydrates is associated with cardiovascular risk (Baum et al., 2012; Flock, Fleming, & Kris-Etherton, 2014; Siri-Tarino et al., 2010a, 2010b). Results from a recent pooled analysis of cohort studies suggested that, when compared calorie-for-calorie, there was a significantly greater relative risk for coronary heart disease with intake of carbohydrate than SFA (Jakobsen et al., 2009). An examination of the dietary intakes of Americans since the inception of the Dietary Guidelines shows that intakes of refined grains and sugars have increased, and that there has been a shift away from beef consumption, perceived to be less healthy, and toward increased poultry consumption, while total caloric intake from protein has remained relatively constant (Fig. 1) (U.S. Department of Health and Human Services, 2010). Although the intent of the Dietary Guidelines was not to achieve a reduction in SFA by increasing carbohydrate intake, particularly refined carbohydrates, this has been the unfortunate result of the implementation of these recommendations.

A broader understanding of the fatty acid profile of lean red meat is important to understand its relationship with cardiovascular health. Fifty-four percent of the fatty acids in beef are MUFA or PUFA. Of the SFA in beef, nearly one-third are stearic acid (18:0) which has a neutral effect on total cholesterol (–C) and low-density lipoprotein (LDL)-C (Denke, 1994; Hunter, Zhang, & Kris-Etherton, 2010; U.S. Department

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