Part D. Chapter 4: Food Sources of Saturated Fat

Introduction

The recommendation to limit consumption of saturated fat has been one of the most consistent recommendations in the *Dietary Guidelines for Americans (Dietary Guidelines)* since the first edition was published in 1980. Guidance has been informed by a large body of consistent, high-quality evidence on the role of saturated fat in the development and progression of cardiovascular disease. The *Dietary Guidelines* recommendation for reducing saturated fat intake has been affirmed by several Dietary Guidelines Advisory Committees, each of which reviewed evidence on saturated fat intake and health that was current at the time.

The *Dietary Guidelines for Americans, 2020-2025* contains a key recommendation to limit saturated fat intake to less than 10 percent of calories per day starting at age 2 years.[1] The 2005 edition of the *Dietary Guidelines* was the first to include this quantitative limit for saturated fat intake and stated that most fats should come from monounsaturated (MUFA) and polyunsaturated fatty acids (PUFA).[2] The 2010 edition was the first to specify that saturated fatty acids should be replaced with MUFA and PUFA based on systematic reviews conducted by the 2010 Dietary Guidelines Advisory Committee.[3,4] The 2015–2020 edition of the *Dietary Guidelines* reiterated this recommendation,[5] based on evidence reviewed by the 2015 Committee that found that replacing saturated fats with unsaturated fats is associated with reduced risk of cardiovascular disease.[6] The *Dietary Guidelines for Americans, 2020–2025* carried forward previous quantitative recommendations for limiting saturated fat and replacing it with unsaturated fats, particularly PUFA, and highlighted the importance of consuming a healthy dietary pattern. Because the 2020–2025 edition included infants and young children from birth to 24 months, it also clarified that the quantitative saturated fat recommendation applies starting at age 2. Despite the consistency of the saturated fat recommendation over time, less than 20 percent of U.S. individuals ages 1 year and older[a] currently meet it.[7]

This chapter provides key background information about food sources of saturated fat and cardiovascular disease, including the evolution of the evidence base that led to current recommendations for a quantitative intake limit on saturated fat. This Committee is the first to formally evaluate food-based comparisons of saturated fat to inform guidance. This chapter presents the results of a systematic review examining the potential impacts on cardiovascular disease-related endpoints (i.e., cardiovascular disease morbidity and mortality) and intermediate outcomes (i.e., cardiovascular disease risk factors, including blood lipids and blood pressure) when food sources of saturated fat are substituted or replaced with a range of comparator food sources. The chapter also integrates and discusses the results of this systematic review and provides the Committee's advice to the Departments for developing the *Dietary Guidelines for Americans, 2025-2030.*

[a]No quantitative limit on saturated fat exists for individuals younger than age 2 years, but data were analyzed for the population ages 1+ years. For more information on data analysis, see **Part D. Chapter 1: Current Dietary Intakes and Prevalence of Nutrition-Related Chronic Health Conditions**.

Evolving Evidence on Saturated Fat and Health

Evidence for the deleterious effects of saturated fat on total blood cholesterol and low-density lipoprotein cholesterol (LDL-C) is well-established.[8-10] This evidence is supported by randomized controlled trials (RCT), many of which used crossover designs with multiple treatment arms and involved manipulating saturated fat vs. unsaturated fat intake while holding other dietary parameters as constant as possible between arms (e.g., calories, amount of total dietary fat, fiber).[11] This reductionist approach typically used a food vehicle such as muffins and allowed for a direct assessment of the impact of type of fat (e.g., saturated), controlling for other potential confounders. Collectively, these studies and others provided evidence to support recommendations to lower saturated fat intake and to keep total saturated fat intake in the diet below 10 percent of energy intake.

Reducing intake of saturated fat often involves substituting or replacing food sources of saturated fat with other foods. When a food source of saturated fat is substituted or replaced with another food, the impact can be complex—i.e., it can involve more than simply reducing saturated fat intake—depending on the replacement food and the nutrients and dietary components it contains. For example, relative to red meat and dairy, beans, peas, and lentils are not only lower in saturated fat, but also contain fiber. Higher fiber intake is associated with cardiovascular disease benefits.[12,13] As another example, relative to red meat and dairy, seafood and fish are not only lower in saturated fat, but also higher in omega-3 fats. Higher omega-3 fat intake from seafood/fish is associated with cardiovascular disease benefits.[14,15] As a third example, relative to red meat and dairy, eggs are lower in saturated fat but higher in dietary cholesterol, which has been associated (albeit inconsistently) with increased cardiovascular disease risk.[16-18]

Seminal work has been done using substitution models to examine data from observational studies on saturated fat intake compared with intake of MUFA, PUFA, *trans* fatty acids, and carbohydrates on cardiovascular disease mortality and morbidity outcomes.[19,20] These studies indicate that higher saturated fat intake is associated with higher cardiovascular disease morbidity and mortality. These studies also indicate that substituting saturated fat with an isocaloric intake of:

- *trans* fat is associated with even higher cardiovascular disease morbidity and mortality;
- carbohydrates from refined starches and added sugars is associated with similar cardiovascular disease morbidity and mortality; and
- MUFA, PUFA, or carbohydrates from whole grains is associated with lower cardiovascular disease morbidity and mortality.

A 2017 Presidential Statement from the American Heart Association on Dietary Fats and Cardiovascular Disease had similar conclusions about the associations with cardiovascular disease mortality and morbidity outcomes when saturated fat is replaced with various nutrients.[21] Thus, although current studies have isolated the effects of individual fatty acids or other nutrients on cardiovascular disease mortality and morbidity outcomes, as well as effects on blood lipids, foods contain various fatty acids and other nutrients, so a focus on food sources of saturated fat is more appropriate for dietary guidance.

A Food Sources Approach

The 2020 Committee's systematic review concluded that strong and consistent evidence from RCT demonstrates that replacing saturated fat with unsaturated fats, especially PUFA, in adults significantly reduces total and LDL-C.[22] It also concluded that strong evidence demonstrates that replacing saturated fat with PUFA in adults reduces the incidence of coronary heart disease events and cardiovascular disease mortality. However, it concluded that in adults, limited evidence was available regarding whether replacing saturated fatty acids with MUFA confers overall cardiovascular disease endpoint health benefits. The Committee noted that a major source of uncertainty was the co-occurrence of saturated fatty acids and MUFA within food sources of animal fat, obscuring the ability to infer a conclusion for saturated fat compared to MUFA.

The 2025 Committee decided to approach this topic from a food perspective, rather than from a nutrient perspective, to help a greater proportion of the U.S. population achieve the recommendation for less than 10 percent of energy from saturated fat. Public comments and recommendations from the 2020 Committee requested that this Committee examine the issue of food sources of saturated fat.[23] Further, as the current edition of the *Dietary Guidelines* notes, saturated fat is commonly found in higher amounts in high-fat meat, full-fat dairy products (e.g., whole milk, ice cream, cheese), butter, coconut oil, and palm kernel and palm oil. Such foods higher in saturated fat can be replaced or substituted in the diet with a wide range of foods and food groups. As noted earlier, the specific food consumed in place of a food source higher in saturated fat involves concomitant changes in the other nutrients found in those foods.

Specifying a comparator food is a necessary step in developing the hypothesis and design of single-food dietary intervention trials and nutrition feeding studies. In contrast, observational epidemiologic analyses examining single foods can be performed regardless of whether the comparator food is specified. However, even if the comparator food is not specified, participants who consume less of the exposure food of interest are still assumed to be consuming similar quantities of other food(s) in its place. Therefore, the estimates from analyses that do not specify the comparator food are, by default, estimating the relative risk of the exposure food of interest vs. an unspecified weighted average of "everything else in the diet" and cardiovascular disease risk.[24] This lack of specificity does not impact the internal validity of the results, but does become problematic when the findings are interpreted and synthesized with other studies that have differences in the composition of foods and beverages comprising "everything else," i.e., different background diets. Therefore, defining and modeling the comparator food that is substituted for the exposure food of interest (e.g., fish vs. red meat) serves to improve the interpretation of effect estimates generated in observational analyses and reduces heterogeneity to facilitate the synthesis of evidence across a large, global, and diverse body of evidence.[25] As such, food-level substitution analyses have continued to build on previous studies of saturated fat and saturated fat-containing foods in observational cohorts, and the epidemiologic evidence from food substitution analyses was included in this systematic review.[24]

Throughout this chapter, the term "substitute" is used when the evidence came primarily from substitution analyses of PCS. "Replace" is used when evidence came primarily from trials.

Setting the Review Criteria

The systematic review presented in this chapter directly addresses the relationship between cardiovascular disease risk when comparing the main food sources of saturated fat (i.e., dairy; meat; and plant sources higher in saturated fat, primarily palm oil, coconut oil, and cocoa butter) with other foods that include: similar foods with different amounts of saturated fat (e.g., lower-fat versions of dairy and meat), foods with primarily unsaturated fats (e.g., food sources higher in MUFA/PUFA such as nuts, fish, and oils higher in unsaturated fats), food sources of carbohydrate or protein (e.g., beans/peas/lentils, vegetables, grains), and different food sources of saturated fat (e.g., milk compared to yogurt). Because mixed dishes and other food products frequently contain food sources of saturated fat as ingredients (e.g., butter in baked goods), these foods and food groups were beyond the scope of this review.

The systematic review question addresses the outcome of cardiovascular disease risk. Per the protocol, that was defined broadly as cardiovascular disease mortality; morbidity; and cardiovascular disease intermediate outcomes, including blood lipids and blood pressure. Therefore, when conclusion statements were developed, they were written to reflect the outcomes examined in the studies reviewed. When no grade was assignable, the outcome was typically listed as “cardiovascular disease” because it was not necessary to differentiate among morbidity, mortality, or intermediate outcomes.

When dairy and meat were the intervention/exposure, many of the studies that met inclusion criteria were prospective cohort studies (PCS) that conducted substitution analyses and estimated the effects on cardiovascular disease morbidity and mortality. Among the smaller number of RCT that met inclusion criteria for this question, most examined plant sources higher in saturated fat as the intervention/exposure and the most frequently examined outcomes were cardiovascular disease intermediate outcomes, which for the purposes of this review included only blood lipids (LDL-C, HDL-C, and triglycerides), blood pressure (systolic blood pressure and diastolic blood pressure), and hypertension. Whereas there is a strong established mechanism for saturated fat influencing blood lipids, specifically LDL-C, there is no similarly strong mechanistic link with blood pressure. Therefore, the graded conclusion statements often focus only on blood lipids, and in many cases only on LDL-C. Blood pressure did not change in response to food sources of saturated fat compared to various comparators in any of the conclusions.

Summary

Since the first edition of the *Dietary Guidelines* was published in 1980, each edition has consistently recommended limiting consumption of saturated fat. More than 80 percent of the U.S. population ages 1 year and older exceeds the quantitative saturated fat limit of 10 percent of calories per day.[7] Consistent with the food focus of the *Dietary Guidelines*, this chapter takes an approach that builds on the foundation of past recommendations regarding food sources of saturated fat intake. Foods that differ in saturated fat content also often differ in other nutrients and dietary components that have important and established cardiometabolic effects. Substantial efforts will be required to shift saturated fat intakes into better alignment with recommendations, and choice of the replacement food is an important consideration.

Question

1. What is the relationship between food sources of saturated fat consumed and risk of cardiovascular disease?[26]

Conclusion Statements

What is the relationship between food sources of saturated fat consumed and risk of cardiovascular disease?

Approach to Answering Question: Systematic Review

The conclusion statements presented in this section resulted from the Committee's detailed comparison of specific foods sources of saturated fat vs. other specific food sources, as described in the "Setting the Review Criteria" section of this chapter's Introduction.

The conclusion statements are organized by directionality (i.e., whether or not there is a difference in cardiovascular disease risk), whether the conclusion statement was graded or a grade was not assignable, and by life stage. Within those categories, conclusion statements are further organized by saturated fat exposure (i.e., dairy, meat, or plant sources higher in saturated fat).

During synthesis, comparators were grouped based on the following:

- Similar foods with different amounts of saturated fat: Examples include lower-fat versions of milk, meat, and cheese.
- Food sources of carbohydrate and/or protein: Examples include beans, peas, and lentils; vegetables; and grains; considered broadly as plant-based foods (that included predominantly whole plant foods) or parsed into plant sources of protein, vegetables, or whole grains, as evidence permitted.
- Food sources of unsaturated fatty acids: Examples include plant-based oils and spreads (such as olive oil and olive-oil based spreads), vegetable oils higher in unsaturated fat (such as olive oil, soybean oil, corn oil, safflower oil, sunflower oil), nuts, fish, and avocado.
- Different food sources of saturated fat: Examples include milk compared to yogurt and cocoa butter compared to palm olein.

Conclusion Statements that Identified Decreased Cardiovascular Disease Risk When Food Sources of Saturated Fat are Substituted or Replaced: Adults and Older Adults

Butter and Dairy Products Compared to Food Sources of Unsaturated Fatty Acids

Butter Compared to Plant-Based Oils and Spreads with Predominantly Unsaturated Fatty Acids

Replacing butter with plant-based oils and spreads, with predominantly unsaturated fatty acids, by adults and older adults decreases LDL-C levels but does not affect HDL-C or triglyceride levels. This conclusion statement is based on evidence graded as strong. (Grade: Strong)

Substituting butter with plant-based oils and spreads, with predominantly unsaturated fatty acids, by adults and older adults may be associated with a decreased risk of cardiovascular disease morbidity and mortality. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

Dairy Compared to Food Sources of Unsaturated Fatty Acids

Substituting dairy with food sources of unsaturated fatty acids by adults and older adults may be associated with a lower risk of cardiovascular disease. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

Meat Compared to Dairy Sources of Saturated Fat

Substituting processed meat and red meat with dairy by adults and older adults is associated with a lower risk of cardiovascular disease morbidity. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Meat Compared to Plant-Based Food Sources

Red Meat Compared to Plant Sources of Protein

Substituting processed or unprocessed red meat with plant sources of protein (such as beans, peas, lentils, nuts, seeds, or soy) by adults and older adults is associated with lower risk of cardiovascular disease morbidity. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Red Meat Compared to Whole Grains

Substituting processed or unprocessed red meat with whole grains by adults and older adults is associated with lower risk of cardiovascular disease morbidity. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Red Meat Compared to Vegetables

Substituting processed or unprocessed red meat with vegetables by adults and older adults is associated with lower risk of cardiovascular disease morbidity. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Plant Sources Higher in Saturated Fat Compared to Vegetable Oils Higher in Unsaturated Fat

Replacing plant sources higher in saturated fat, including coconut oil, cocoa butter, and palm oil, with vegetable oils higher in unsaturated fat, by adults and older adults decreases LDL-C and has no effect on blood pressure. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Conclusion Statements that Identified No Difference in Cardiovascular Disease Risk: Adults and Older Adults

Dairy Sources of Saturated Fat Compared to Other Dairy Sources of Saturated Fat

Dairy with Different Amounts of Total Fat

Substituting higher-fat dairy with lower-fat dairy by adults and older adults is not associated with a difference in risk of cardiovascular disease morbidity. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

Comparing One Form of Dairy to Another Form of Dairy

Substituting or replacing one form of dairy (including milk, yogurt, cheese, butter,[b] and buttermilk) with another form of dairy by adults and older adults is not associated with a difference in risk of cardiovascular disease. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Meat Sources of Saturated Fat Compared to White Meat

Lean, Unprocessed Red Meat Compared to Lean, Unprocessed White Meat

Replacing consumption of lean, unprocessed red meat with lean, unprocessed white meat by adults and older adults may not affect blood lipids or blood pressure. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

Processed or Unprocessed Red Meat Compared to White Meat

Substituting processed or unprocessed red meat with white meat by adults and older adults is not associated with risk of cardiovascular disease morbidity. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Meat Sources of Saturated Fat Compared to Other Animal-Based Foods

Processed or Unprocessed Red Meat Compared to Fish or Seafood

Substituting processed or unprocessed red meat with fish or seafood by adults and older adults may not be associated with risk of cardiovascular disease morbidity. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

Processed or Unprocessed Red Meat Compared to Eggs

Substituting processed or unprocessed red meat with eggs by adults and older adults is not associated with risk of cardiovascular disease morbidity. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

White Meat Compared to Fish or Seafood

Substituting white meat with fish or seafood by adults and older adults is not associated with risk of cardiovascular disease morbidity. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

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[b]Butter is not included within the current Dairy and Fortified Soy Alternatives Food Group but was grouped with other forms of dairy for this conclusion statement due to its common origin from cow's milk.

White Meat Compared to Plant-Based Foods

Substituting white meat with plant-based foods by adults and older adults is not associated with risk of cardiovascular disease morbidity. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Palm Olein Compared to Vegetable Oils Higher in Unsaturated Fat

Replacing palm olein with vegetable oils higher in unsaturated fat by adults and older adults may not affect blood lipids. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

Relationships for Which Conclusion Statements Could Not Be Drawn: Adults and Older Adults

Dairy Sources of Saturated Fat

Higher-Fat Dairy Compared to Lower-Fat Dairy

A conclusion statement cannot be drawn about the relationship between higher-fat dairy consumption, compared to their lower-fat versions, by adults and older adults and blood lipids, blood pressure, and cardiovascular disease mortality because there is not enough evidence available. (Grade: Grade Not Assignable)

Dairy Products Compared to Food Sources of Carbohydrate and Protein

A conclusion statement cannot be drawn about the relationship between consumption of dairy compared to food sources of carbohydrates and protein by adults and older adults and risk of cardiovascular disease because of substantial concerns with consistency in the body of evidence. (Grade: Grade Not Assignable)

Meat Sources of Saturated Fat Compared to Other Meat Sources

Red Meat with Different Amounts of Saturated Fat

A conclusion statement cannot be drawn about the relationship between consumption of red meat with different amounts of saturated fat by adults and older adults and risk of cardiovascular disease because there is not enough evidence available. (Grade: Grade Not Assignable)

White Meat with Different Amounts of Saturated Fat

A conclusion statement cannot be drawn about the relationship between consumption of white meat with different amounts of saturated fat by adults and older adults and risk of cardiovascular disease because there is no evidence available. (Grade: Grade Not Assignable)

Processed Red Meat Compared to Unprocessed Red Meat

A conclusion statement cannot be drawn about the relationship between consumption of processed red meat compared to unprocessed red meat by adults and older adults and risk of cardiovascular disease because there is not enough evidence available. (Grade: Grade Not Assignable)

Processed White Meat Compared to Unprocessed White Meat

A conclusion statement cannot be drawn about the relationship between consumption of processed white meat compared to unprocessed white meat by adults and older adults and risk of cardiovascular disease because there is no evidence available. (Grade: Grade Not Assignable)

Meat Sources Compared to Plant-Based Foods

Unprocessed Meat Consumption Compared to Plant-Based Foods

A conclusion statement cannot be drawn about the effects of unprocessed meat consumption compared to plant-based foods by adults and older adults on blood lipids or blood pressure because of substantial concerns with consistency of the comparator, directness, risk of bias, and precision in the body of evidence. (Grade: Grade Not Assignable)

Meat Sources of Saturated Fat Compared to Plant Sources of Saturated Fat

A conclusion statement cannot be drawn about the relationship between consumption of meat sources of saturated fat compared to plant sources of saturated fat by adults and older adults and risk of cardiovascular disease because there is no evidence available. (Grade: Grade Not Assignable)

Dairy Compared to Meat

A conclusion statement cannot be drawn about the relationship between replacing dairy with meat consumption by adults and older adults and blood lipids, blood pressure, and cardiovascular disease mortality because there is not enough evidence available. (Grade: Grade Not Assignable)

Plant Sources Higher in Saturated Fat

Plant Sources Higher in Saturated Fat Compared to Food Sources of Carbohydrate or Protein

A conclusion statement cannot be drawn about the relationship between consumption of plant sources higher in saturated fat, compared to food sources of carbohydrate or protein, by adults and older adults and risk of cardiovascular disease because there is not enough evidence available. (Grade: Grade Not Assignable)

Plant Sources Higher in Saturated Fat Compared to Different Food Sources of Saturated Fat

A conclusion statement cannot be drawn about the relationship between consumption of plant sources higher in saturated fat, compared to a different food source of saturated fat (including dairy, meat, or another plant source of saturated fat), by adults and older adults and risk of cardiovascular disease because there is not enough evidence available. (Grade: Grade Not Assignable)

Relationships for Which Conclusion Statements Could Not Be Drawn: Children and Adolescents

Dairy Sources of Saturated Fat

A conclusion statement cannot be drawn about dairy sources of saturated fat and different comparators consumed by children and adolescents and the relationship with blood lipids or blood pressure because there is not enough evidence available. Comparators considered included similar food sources with

different amounts of total fat; food sources of unsaturated fat, carbohydrate, or protein; or a different food source of saturated fat. (Grade: Grade Not Assignable)

Meat Sources of Saturated Fat

A conclusion statement cannot be drawn about meat sources of saturated fat (including red meat, processed meat, and white meat) and different comparators consumed by children and adolescents and the relationship with blood lipids or blood pressure because there is no evidence available. Comparators considered included similar food sources with different amounts of total fat; food sources of unsaturated fat, carbohydrate, or protein; or a different food source of saturated fat. (Grade: Grade Not Assignable)

Plant Sources Higher in Saturated Fat

A conclusion statement cannot be drawn about plant sources higher in saturated fat (such as palm oil, coconut oil, or cocoa butter) and different comparators consumed by children and adolescents and the relationship with blood lipids or blood pressure because there is no evidence available. Comparators considered included similar food sources with different amounts of total fat; food sources of unsaturated fat, carbohydrate, or protein; or a different food source of saturated fat. (Grade: Grade Not Assignable)

View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/food-sources-saturated-fat_cardiovascular-disease.

Integration

To help integrate and summarize evidence across its 31 conclusion statements, the Committee grouped conclusion statements into categories based on the direction of effects on health outcomes (i.e., interventions/exposures that have a beneficial effect on cardiovascular disease risk compared to their comparators and interventions/exposures that do not differ in their effects on cardiovascular disease outcomes compared to their comparators) and whether the conclusion statement was graded or a grade was not assignable. This organization reflects the order in which the conclusions statements were presented in the preceding section.

Despite ongoing efforts to address potential differences that may exist in findings across age groups, all conclusions that the Committee found sufficient evidence to grade focused on adults and older adults.

Favorable Differences in Cardiovascular Disease Health Outcomes Found When Substituting/Replacing Food Sources of Saturated Fat

For the 8 conclusion statements related to favorable cardiovascular disease health outcomes in adults and older adults, 1 had evidence graded as strong, 5 had evidence graded as moderate, and 2 had evidence graded as limited.

The association between the replacement of butter with other oils and spreads with predominantly unsaturated fatty acids and lower LDL-C was graded as strong, which is consistent with previous

evidence.[8-10,27] The evidence for the association between substituting butter with plant-based oils and spreads with predominantly unsaturated fatty acids and lower cardiovascular disease morbidity and mortality was graded as limited, due to concerns with consistency in the findings and generalizability.

The evidence underlying the following conclusion statements was graded as moderate:

- Substituting processed meat and red meat with dairy products and lower risk of cardiovascular disease morbidity.
- Substituting processed or unprocessed red meat with any of the plant-based food groups examined (plant sources of protein, whole grains, or vegetables) and lower risk of cardiovascular disease morbidity.
- Replacing plant sources higher in saturated fat, such as coconut oil, cocoa butter, and palm oil, with vegetable oils higher in unsaturated fat and lower LDL-C.

The association between substituting dairy with food sources of unsaturated fatty acids, which included oils (e.g., olive oil) and other food sources of MUFA/PUFA, such as nuts and fish, was graded as limited.

No Differences in Cardiovascular Disease Health Outcomes Found When Substituting/Replacing Food Sources of Saturated Fat

Five conclusion statements that found no relationships between different food sources of saturated fat and differences in cardiovascular disease outcomes in adults and older adults had evidence graded as moderate, and 4 additional conclusion statements had evidence graded as limited. The evidence underlying the following conclusion statements was graded as moderate:

- No association between substituting or replacing one form of dairy with another form of dairy on risk of cardiovascular disease (this included comparisons between milk, yogurt, cheese, butter, and buttermilk).
- No association between substituting processed or unprocessed red meat with white meat or eggs on cardiovascular disease morbidity.
- No association between substituting white meat with plant-based foods or fish/seafood on cardiovascular disease morbidity.

The evidence underlying the following conclusion statements was graded as limited:

- No association between substituting higher-fat dairy with lower-fat dairy and cardiovascular disease morbidity.
- No association between substituting processed or unprocessed red meat with fish or seafood and cardiovascular disease morbidity.
- No association between substituting lean, unprocessed red meat with lean, unprocessed white meat and blood lipids and blood pressure.

- No effect of replacing palm olein with vegetable oils higher in unsaturated fatty acids such as olive oil and blood lipids.

Food Sources of Saturated Fat and Cardiovascular Disease Health Outcomes for Which a Conclusion Statement Could Not Be Drawn

Conclusion statements could not be drawn for 11 of the food sources of saturated fat comparisons in adults and older adults. These include 2 conclusion statements related to dairy consumption, 6 related to meat consumption, 2 related to consumption of plant sources higher in saturated fat, and 1 comparison between dairy and meat. Unlike the conclusion statement for the association between substituting processed meat and red meat with dairy and lower risk of cardiovascular disease morbidity, which was graded as moderate, a conclusion statement could not be drawn for the association between replacing dairy with meat and blood lipids, blood pressure, and cardiovascular disease mortality.

Relationships for which a conclusion statement could not be drawn for any cardiovascular disease outcome in adults and older adults included consumption of:

- Dairy compared to food sources of carbohydrates and protein.
- Red meat or white meat with different amounts of saturated fat.
- Processed red meat or processed white meat compared to unprocessed red meat or unprocessed white meat.
- Meat sources of saturated fat compared to plant sources of saturated fat.
- Plant sources higher in saturated fat compared to food sources of carbohydrate or protein.
- Plant sources higher in saturated fat compared to a different food source of saturated fat.

For children and adolescents, no conclusion statements could be drawn about the relationship between consumption of food sources of saturated fat and risk of cardiovascular disease because there was not enough evidence.

Discussion

The *Dietary Guidelines* recommends limiting saturated fat intake to less than 10 percent of daily calories (starting at age 2 years) and replacing saturated fat with PUFA, but prior Committees did not explicitly address whether specific foods should be consumed to replace saturated fat-containing foods. Given the diversity of foods in U.S. diets with widely variable amounts of saturated fat and other nutrients and dietary components (e.g., fiber, added sugars), and the importance of recommending replacement foods for substitution to inform dietary guidance, this Committee reviewed the implications of evidence from food-specific comparisons and cardiovascular disease risk. Evaluating food-specific comparisons with cardiovascular disease risk also facilitates investigation of the potential heterogeneity when comparing a food of interest (e.g., red meat) to potential practical or experimental replacement foods.

Food sources of saturated fat in the U.S. diet include both animal- and plant-based foods. Common animal-based food sources of saturated fat include processed and unprocessed red and white meat, milk and other dairy products, and butter. In this systematic review, dairy was often considered as a broad category that encompassed milk, yogurt, and cheese. While dairy and dairy products were often further differentiated as total, whole-fat, or lower-fat versions, the lower-fat versions were not well-defined (e.g., 2% vs. 1% vs. skim/fat-free). Plant sources higher in saturated fat include palm oil, coconut oil, and cocoa butter. Another plant source of saturated fat that was examined was palm olein, an industrial oil that is derived from palm oil with a lower melting point, higher oleic acid content, and lower saturated fat content than palm oil.[28-30] This Committee's systematic review examined substitution or replacement of these food sources of saturated fat with similar foods with different amounts of saturated fat, foods with primarily unsaturated fats, food sources of carbohydrate or protein, and different food sources of saturated fat.

Overall, the Committee's systematic review findings indicate a general lack of cardiovascular disease benefit for substitution or replacement within animal sources of saturated fat. Additionally, systematic review findings indicate a cardiovascular disease benefit when substituting or replacing butter with plant-based oils and spreads with predominantly unsaturated fatty acids, substituting dairy with food sources of unsaturated fatty acids, and substituting red meat with plant sources of protein, whole grains, or vegetables. These findings highlight the importance of evaluating dietary exposures at the food level and suggest that consuming foods lower in saturated fat may be related to decreased cardiovascular disease risk through their lower saturated fat content, as well as the other nutritional exposures within those foods, such as beneficial dietary factors (e.g., fiber, antioxidants).

One of this Committee's strongest findings was that replacing butter with plant-based oils and spreads higher in unsaturated fat improves lipid profiles for lower cardiovascular disease risk, which was based on evidence graded as strong. The evidence included 12 RCT and feeding studies comparing butter with MUFA- and PUFA-rich vegetable oils and spreads; importantly, this excludes vegetable-based spreads containing industrial artificial *trans* fats. In 2015, the U.S. Food and Drug Administration ruled that partially hydrogenated oils, the major source of artificial *trans* fat in the food supply, are no longer Generally Recognized As Safe (GRAS). Partially hydrogenated oils are no longer added to foods.[31] Additionally, this Committee concluded that LDL-C is lower when plant sources higher in saturated fat are replaced with vegetable oils higher in unsaturated fat. This conclusion was based on moderate evidence and was reached despite various plant sources higher in saturated fat and varying vegetable oils used as the comparator.

This Committee also synthesized a large body of evidence for the substitution of processed and unprocessed red meats with various individual foods and food groups. The primary plant-based food comparators for meat were plant sources of protein (i.e., beans, peas, lentils, nuts, seeds, and soy); whole grains; and vegetables. Decreasing red meat while increasing plant sources of protein, whole grains, or vegetables, were each related to lower long-term risks of cardiovascular disease. The three conclusions were all based on evidence graded as moderate. Notable in this set of comparisons was that the plant-based comparators are all sources of dietary fiber in addition to being low in saturated fat. Other factors that may differ for plant-based comparators vs. red meats include higher phytochemical and antioxidant

levels. While these comparisons were made primarily in PCS, and therefore suggest association and not causation, the plausibility of greater causal inference is supported by the mechanistic evidence for cardiovascular disease benefits from the higher fiber content and possibly other components specific to plant-based foods.[13,32]

During evidence synthesis, the total, processed, and unprocessed red and white meat were considered separately against each comparator in relation to cardiovascular disease risk. In most cases, the trends for associations across all three categories were consistent, such that the Committee generally did not draw separate conclusions for processed vs. unprocessed red or white meat. Two conclusion statements do distinguish between processed vs. unprocessed red and white meat, but both were determined to be Grade Not Assignable.

Benefit was observed when processed meat and red meat were substituted with the dairy food group—another food source of saturated fat—although data were sparse to evaluate whether this relationship could be generalized across all dairy or whether it is specific to individual products such as milk, cheese, or yogurt. This was based on evidence graded as moderate.

In contrast, no benefit for cardiovascular disease risk was identified when red meat was substituted or replaced with other food sources of saturated fat, including white meat or eggs, based on evidence graded as moderate. Similarly, no cardiovascular disease risk or benefit was identified for substituting red meat with fish/seafood, which was based on evidence graded as limited. Finally, no impact on cardiovascular disease risk was identified when substituting or replacing within types of dairy foods or within types of unprocessed lean meats. These conclusions were based on evidence graded as limited (for substituting higher-fat dairy with lower-fat dairy and replacing lean, unprocessed red meat with lean, unprocessed white meat) or moderate (substituting or replacing one form of dairy with another form of dairy). Notable for this set of comparisons between one type of animal-based foods and another was that the magnitude of saturated fat differences was smaller between comparator groups than the magnitude of saturated fat differences between animal- and plant-based foods, and given that animal-based foods are not a source of certain nutrients and bioactive components (e.g., fiber, phytochemicals, antioxidants), this was not a factor in comparisons between these foods.

Evidence for the numerous other pairwise comparisons of foods with and without saturated fat was sparse. Further, few dietary interventions or PCS addressing these comparisons have been conducted in other life stages, therefore no conclusion statements were developed specifically for infants and young children, children and adolescents, or individuals during pregnancy or postpartum. Additionally, evidence for adults included studies that enrolled participants across the adult age span, including older adults, but did not allow for drawing separate conclusions for older adults in any of the questions reviewed.

The evidence that was graded as moderate or limited was subject to several limitations, which are discussed in detail in the full systematic review report.[26] Generalizability was a major issue for this body of evidence, with few studies reporting race/ethnicity and socioeconomic position or including diverse populations with regard to these variables.

In summary, these findings reinforce the recommendations of prior Committees for a quantitative limit on saturated fat intake by reducing intakes of foods higher in saturated fat. This is the first Committee to formally evaluate food-level comparisons of foods with higher or lower levels of saturated fat to inform potential guidance for which foods across the dietary pattern could be increased when saturated fat-containing foods are reduced, for cardiovascular disease risk reduction. Indeed, evidence indicates that when reducing butter, processed and unprocessed red meat, and dairy, substitution or replacement with a wide range of plant-based food sources, including plant-based protein foods, whole grains, vegetables, or MUFA- and PUFA-rich vegetable oils and spreads, is associated with cardiovascular disease risk reduction. Therefore, these findings support recommendations to replace saturated fat-containing foods specifically with plant sources rich in MUFA, PUFA, and fiber, rather than other animal sources of saturated fat, for reduction in cardiovascular disease risk.

Committee's Advice to the Departments

Based on its systematic reviews of food sources of saturated fat and risk of cardiovascular disease, the Committee has the following advice to the Departments as they develop the *Dietary Guidelines for Americans, 2025-2030*:

- This Committee reaffirms current guidance in the *Dietary Guidelines for Americans, 2020-2025* to limit foods and beverages higher in saturated fat and to limit total saturated fat intake to less than 10 percent of calories per day starting at age 2 by replacing it with unsaturated fat, particularly PUFA. This Committee recommends enhancing this guidance to indicate that replacement with MUFA and PUFA should focus on plant-based sources, because the systematic review on food sources of saturated fat and risk of cardiovascular disease found cardiovascular disease benefit when substituting or replacing food sources of saturated fat with foods that are not significant sources of saturated fat, such as plant sources of protein, whole grains, vegetables, and vegetable oils higher in unsaturated fat.
- Align with advice from **Part D. Chapter 3: Beverages** that there should be no change in recommendations for consumption of dairy. Although the conclusion statement for substituting higher-fat dairy with lower-fat dairy showed no association with cardiovascular disease morbidity, the evidence was graded as limited. Until further definitive studies are conducted, it is prudent to support the current *Dietary Guidelines* recommendation to consume fat-free or low-fat milk, yogurt, and cheese. Infants should not consume cow milk before age 12 months to replace human milk or infant formula. Plain cow milk (whole milk) can be offered beginning around age 12 months. Fat-free or low-fat milk can be offered beginning at age 2 years.
- Encourage dietary patterns that emphasize plant-based foods, such as plant-based proteins, whole grains, and vegetables. Substitution or replacement of meat with plant-based foods, such as plant-based proteins (beans, peas, lentils, nuts, seeds, soy), whole grains, or vegetables is associated with favorable cardiovascular disease outcomes.

- Reaffirm current guidance to lower consumption of butter and replace butter with vegetable oils higher in unsaturated fatty acids. As indicated by the systematic reviews, some of the strongest evidence was for replacing butter with plant-based oils and spreads with predominantly unsaturated fatty acids leading to lower LDL-C blood levels.
- Promote replacement of plant sources higher in saturated fat, such as coconut oil, cocoa butter, and palm oil, with vegetable oils higher in unsaturated fats. Palm oil and coconut oil are often used in food processing applications.[33] The Committee recommends efforts to minimize consumption of highly processed foods that contain these sources of saturated fat.

References

1. U.S. Department of Agriculture, U.S. Department of Health and Human Services. *Dietary Guidelines for Americans, 2020-2025. 9th Edition.* 2020. DietaryGuidelines.gov.
2. U.S. Department of Health and Human Services, U.S. Department of Agriculture. *Dietary Guidelines for Americans, 2005. 6th Edition*. 2005. https://www.dietaryguidelines.gov/sites/default/files/2019-05/2005%20DG%20for%20Americans.pdf
3. Dietary Guidelines Advisory Committee. *Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans, 2010 to the Secretary of Agriculture and the Secretary of Health and Human Services*. 2010. https://www.dietaryguidelines.gov/sites/default/files/2019-05/2010DGACReport-camera-ready-Jan11-11.pdf
4. U.S. Department of Agriculture, U.S. Department of Health and Human Services. *Dietary Guidelines for Americans, 2010. 7th Edition.* 2010. https://www.dietaryguidelines.gov/sites/default/files/2019-05/DietaryGuidelines2010.pdf
5. U.S. Department of Health and Human Services, U.S. Department of Agriculture. *2015–2020 Dietary Guidelines for Americans 8th Edition.* . 2015. http://health.gov/dietaryguidelines/2015/guidelines/.
6. Dietary Guidelines Advisory Committee. *Scientific Report of the 2015 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Health and Human Services and Secretary of Agriculture*. 2015. https://odphp.health.gov/sites/default/files/2019-09/Scientific-Report-of-the-2015-Dietary-Guidelines-Advisory-Committee.pdf
7. Cruz CM, DeSilva D, Beckman K, et al. Federal Data Analysis Report for the 2025 Dietary Guidelines Advisory Committee: Current Intakes of Nutrients and Dietary Components. 2024;doi:https://doi.org/10.52570/DA.DGAC2025.DA03
8. Hegsted DM, McGandy RB, Myers ML, Stare FJ. Quantitative effects of dietary fat on serum cholesterol in man. *Am J Clin Nutr*. Nov 1965;17(5):281-95. doi:https://doi.org/10.1093/ajcn/17.5.281
9. Keys A, Anderson JT, Grande F. Serum cholesterol response to changes in the diet: IV. Particular saturated fatty acids in the diet. *Metabolism*. Jul 1965;14(7):776-87. doi:https://doi.org/10.1016/0026-0495(65)90004-1
10. Katan MB, Zock PL, Mensink RP. Effects of fats and fatty acids on blood lipids in humans: an overview. *Am J Clin Nutr*. Dec 1994;60(6 Suppl):1017S-1022S. doi:https://doi.org/10.1093/ajcn/60.6.1017s
11. Lichtenstein AH, Appel LJ, Vadiveloo M, et al. 2021 Dietary Guidance to Improve Cardiovascular Health: A Scientific Statement From the American Heart Association. *Circulation*. Dec 7 2021;144(23):e472-e487. doi:https://doi.org/10.1161/CIR.0000000000001031
12. Threapleton DE, Greenwood DC, Evans CE, et al. Dietary fibre intake and risk of cardiovascular disease: systematic review and meta-analysis. *BMJ*. Dec 19 2013;347:f6879. doi:https://doi.org/10.1136/bmj.f6879
13. Fu L, Zhang G, Qian S, Zhang Q, Tan M. Associations between dietary fiber intake and cardiovascular risk factors: An umbrella review of meta-analyses of randomized controlled trials. *Front Nutr*. 2022;9:972399. doi:https://doi.org/10.3389/fnut.2022.972399

14. Harris WS, Tintle NL, Imamura F, et al. Blood n-3 fatty acid levels and total and cause-specific mortality from 17 prospective studies. *Nat Commun*. Apr 22 2021;12(1):2329. doi:https://doi.org/10.1038/s41467-021-22370-2
15. Bonaccio M, Ruggiero E, Di Castelnuovo A, et al. Fish intake is associated with lower cardiovascular risk in a Mediterranean population: Prospective results from the Moli-sani study. *Nutr Metab Cardiovasc Dis*. Oct 2017;27(10):865-873. doi:https://doi.org/10.1016/j.numecd.2017.08.004
16. Zhao B, Gan L, Graubard BI, Mannisto S, Albanes D, Huang J. Associations of Dietary Cholesterol, Serum Cholesterol, and Egg Consumption With Overall and Cause-Specific Mortality: Systematic Review and Updated Meta-Analysis. *Circulation*. May 17 2022;145(20):1506-1520. doi:https://doi.org/10.1161/circulationaha.121.057642
17. Zhong VW, Van Horn L, Cornelis MC, et al. Associations of Dietary Cholesterol or Egg Consumption With Incident Cardiovascular Disease and Mortality. *JAMA*. Mar 19 2019;321(11):1081-1095. doi:https://doi.org/10.1001/jama.2019.1572
18. Carson JAS, Lichtenstein AH, Anderson CAM, et al. Dietary Cholesterol and Cardiovascular Risk: A Science Advisory From the American Heart Association. *Circulation*. Jan 21 2020;141(3):e39-e53. doi:https://doi.org/10.1161/cir.0000000000000743
19. Wang DD, Li Y, Chiuve SE, et al. Association of Specific Dietary Fats With Total and Cause-Specific Mortality. *JAMA Intern Med*. Aug 1 2016;176(8):1134-45. doi:https://doi.org/10.1001/jamainternmed.2016.2417
20. Li Y, Hruby A, Bernstein AM, et al. Saturated Fats Compared With Unsaturated Fats and Sources of Carbohydrates in Relation to Risk of Coronary Heart Disease: A Prospective Cohort Study. *J Am Coll Cardiol*. Oct 6 2015;66(14):1538-1548. doi:https://doi.org/10.1016/j.jacc.2015.07.055
21. Sacks FM, Lichtenstein AH, Wu JHY, et al. Dietary Fats and Cardiovascular Disease: A Presidential Advisory From the American Heart Association. *Circulation*. Jul 18 2017;136(3):e1-e23. doi:https://doi.org/10.1161/cir.0000000000000510
22. Snetselaar L, Bailey R, Sabate J, et al. *Types of Dietary Fat and Cardiovascular Disease: A Systematic Review*. 2020. *USDA Nutrition Evidence Systematic Reviews*. https://doi.org/10.52570/NESR.DGA
23. Dietary Guidelines Advisory Committee. *Scientific Report of the 2020 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Agriculture and the Secretary of Health and Human Services*. 2020. doi: https://doi.org/10.52570/DGAC2020
24. Ibsen DB, Laursen ASD, Wurtz AML, et al. Food substitution models for nutritional epidemiology. *Am J Clin Nutr*. Feb 2 2021;113(2):294-303. doi:https://doi.org/10.1093/ajcn/nqaa315
25. Stern D, Ibsen DB, MacDonald CJ, Chiu YH, Lajous M, Tobias DK. Improving nutrition science begins with asking better questions. *Am J Epidemiol*. 2024 Nov 4: 193(11):1507-1510. doi:https://doi.org/10.1093/aje/kwae110
26. Gardner C, Hoelscher DM, Tobias D, et al. *Food Sources of Saturated Fat and Cardiovascular Disease: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR24
27. Rosqvist F, Niinisto S. Fats and oils - a scoping review for Nordic Nutrition Recommendations 2023. *Food Nutr Res*. 2024;68doi:https://doi.org/10.29219/fnr.v68.10487
28. Cheng C, Wang D, Xia H, et al. A comparative study of the effects of palm olein, cocoa butter and extra virgin olive oil on lipid profile, including low-density lipoprotein subfractions in young healthy Chinese people. *Int J Food Sci Nutr*. May 2019;70(3):355-366. doi:https://doi.org/10.1080/09637486.2018.1504009
29. Lucci P, Borrero M, Ruiz A, et al. Palm oil and cardiovascular disease: a randomized trial of the effects of hybrid palm oil supplementation on human plasma lipid patterns. *Food Funct*. Jan 2016;7(1):347-54. doi:https://doi.org/10.1039/c5fo01083g
30. Sun G, Xia H, Yang Y, et al. Effects of palm olein and olive oil on serum lipids in a Chinese population: a randomized, double-blind, cross-over trial. *Asia Pac J Clin Nutr*. 2018;27(3):572-580. doi:https://doi.org/10.6133/apjcn.032017.12
31. U.S. Food and Drug Administration (FDA). Trans Fat. https://www.fda.gov/food/food-additives-petitions/trans-fat

32. Satija A, Hu FB. Plant-based diets and cardiovascular health. *Trends Cardiovasc Med*. Oct 2018;28(7):437-441. doi:https://doi.org/10.1016/j.tcm.2018.02.004
33. Hormenu T, Salifu I, Paku JE, et al. Tropical oils consumption and health: a scoping review to inform the development of guidelines in tropical regions. *BMC Public Health*. Sep 10 2024;24(1):2468. doi:https://doi.org/10.1186/s12889-024-19949-x