

## SCIENTIFIC STATEMENT

# Food and Health: Nutrition for Prevention and Management of Cardiovascular Disease: 2026 ACC Scientific Statement

A Report of the American College of Cardiology

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**ABSTRACT**

Nutrition is a foundational determinant of cardiovascular health and a central component of the prevention and management of cardiovascular disease, type 2 diabetes, obesity, chronic kidney disease, and cardiovascular-kidney-metabolic syndrome. Suboptimal dietary patterns remain among the leading modifiable causes of morbidity and mortality worldwide. Contemporary evidence supports a shift in nutrition guidance from isolated nutrients toward whole foods and dietary patterns that emphasize overall dietary quality, food choice, and degree of processing. This American College of Cardiology Scientific Statement reviews current evidence regarding nutrition and cardiovascular health, including macronutrients, micronutrients, dietary patterns, ultra-processed foods, and emerging nutrition-based interventions. Evidence from randomized controlled trials, prospective cohort studies, and mechanistic investigations consistently supports replacing saturated fats with unsaturated fats, increasing consumption of dietary fiber and whole grains, reducing consumption of sodium and ultra-processed foods (particularly sugar-sweetened beverages and processed meats), and greater adherence to healthy dietary patterns to lower cardiovascular risk. Mediterranean, DASH (Dietary Approaches to Stop Hypertension), vegetarian, and other plant-rich dietary patterns demonstrate favorable effects on blood pressure, lipids, glycemic control, and body weight, and are consistently associated with lower rates of cardiovascular disease and mortality. Translation of nutrition science into clinical practice requires integration of dietary counseling, medical nutrition therapy, Food Is Medicine programs, public policy initiatives, and clinician education. Collectively, current evidence supports dietary patterns centered on minimally processed plant foods while limiting ultra-processed foods, particularly those high in refined starches, added sugars, sodium, or unhealthy fats, and emphasizing healthy sources of fats and proteins to reduce cardiovascular risk and improve population health.

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## INTRODUCTION

The American College of Cardiology (ACC) has a long history of developing documents to complement clinical practice guidelines. Among these documents, scientific statements represent a novel approach to inform clinicians about areas where scientific evidence is new and evolving or where data are more limited. Nutrition is foundational to the prevention and management of

cardiovascular disease (CVD) and related comorbidities; however, due to limitations in education, time, and actionability, nutritional interventions remain underutilized. This ACC scientific statement provides an overview of the current evidence for optimal nutrition and strategies for clinicians to employ in discussing food and health with patients.

To accomplish this work, the ACC convened a writing committee in April 2026 via a confidential conference call

**TABLE 1** Summary of Consensus Recommendations

### Impact of nutrition on common CVD comorbidities

- Diabetes, obesity, CKD, and CVD are commonly interconnected through the CKM syndrome. Nutrition is central to prevention and management of CKM syndrome, emphasizing cardioprotective dietary patterns characterized by plant-forward eating, lower sodium intake, and minimally processed foods.

### Nutrition and social drivers of health

- Diet quality is shaped by social, structural, and individual factors, including the availability, affordability, accessibility, and utilization of nutritious food in one's environment.

### Nutrition-based RCTs

- RCTs with hard clinical endpoints are the gold standard for establishing causality, but they are often infeasible in nutrition research. Consequently, dietary recommendations are based on the totality of evidence, including short-term nutrition RCTs, prospective cohort studies, and mechanistic studies, which together provide strong support for healthy dietary patterns for CVD prevention.

### Macronutrients

- CVD risk is influenced more by food source, nutrition quality, and degree of processing than relative proportion of protein, fat, and carbohydrate. High-fiber, whole-grain carbohydrates should be emphasized in place of added sugars and refined grains; similarly, plant-based sources of protein should be emphasized over animal-based sources for CVD prevention.
- Replacing saturated fats with unsaturated fats reduces LDL-C and lowers cardiovascular risk. Unsaturated fats from liquid plant oils, nuts, seeds, and fish should be primary sources of dietary fat.

### Micronutrients, fiber, and long-chain omega-3 PUFAs

- Reduce sodium intake by limiting processed foods and increase potassium intake through potassium-rich plant foods; consider replacement of regular salt with potassium-based salts to manage BP when appropriate.
- Choose fiber-rich foods, including legumes, whole grains, fruits, vegetables, nuts, and seeds, in place of refined grains and other low-fiber foods high in added sugars and refined starches.
- Long-chain omega-3 fatty acids are best obtained through regular fish consumption as part of a healthy dietary pattern, whereas routine omega-3 supplementation is not recommended for primary prevention of CVD.

### Ultra-processed foods

- Current evidence supports a dietary pattern emphasizing minimally processed, plant-derived foods while limiting consumption of SSBs, processed meats, and other UPFs that are high in refined starches, added sugars, sodium, or unhealthy fats to reduce the risk of cardiometabolic diseases.

### Nonfood dietary components

- Alcohol should not be initiated for cardiovascular benefits. Despite observational evidence linking low to moderate intake with lower rates of CHD, causality is uncertain, and the overall balance of evidence does not support regular alcohol use for health benefits.
- Moderate intake of filtered coffee or tea (2-5 standard cups; 8 oz [240 mL]; up to 400 mg caffeine per day) is safe for most adults, and regular intake is associated with lower risk of cardiometabolic disease.
- Evidence on long-term metabolic and cardiovascular effects of non-nutritive sweeteners is inconclusive; water and other unsweetened beverages should be the preferred choices.

### Clinical translations of current nutritional evidence

- There is strong evidence supporting plant-forward dietary patterns for prevention and management of CVD, type 2 diabetes, and overweight or obesity.
- For people with diabetes, low-carbohydrate dietary patterns are an effective option for improving glycemic control and may facilitate weight loss. When adopted, emphasis should be placed on plant-based sources of protein and unsaturated fats for overall cardiometabolic health.
- IF may be an effective strategy for weight loss and improving short-term metabolic outcomes in some individuals. However, evidence is limited for its long-term health benefits.
- GLP-1 RAs provide substantial cardiometabolic benefits, including weight loss and reductions in cardiovascular risk. However, maintaining a high-quality diet remains important, and nutritional counseling should emphasize adequate intake of protein, fiber, vitamins, and minerals to preserve overall nutritional status.

### Food Is Medicine programs

- There is increasing interest in providing nutritious food as a clinical intervention, often through "Food Is Medicine" programs. These programs improve diet quality, and evidence is building that they improve clinical outcomes as well.
- Evidence-based nutrition education should be incorporated into FIM programs to enhance their long-term adherence and benefits.

### 2025-2030 DGA

- The 2025-2030 DGA are broadly aligned with current evidence supporting minimally processed foods and reduced intake of UPFs, especially SSBs. However, recommendations regarding higher protein targets and greater emphasis on full-fat animal foods are not fully aligned with current evidence supporting replacement of saturated fats with unsaturated fats, particularly from plant sources.

BP = blood pressure; CHD = coronary heart disease; CKD = chronic kidney disease; CKM = cardiovascular-kidney-metabolic; CVD = cardiovascular disease; DGA = Dietary Guidelines for Americans; FIM = Food Is Medicine; GLP-1 RA = glucagon-like peptide-1 receptor agonist; IF = intermittent fasting; LDL-C = low-density lipoprotein cholesterol; PUFA = polyunsaturated fatty acid; RCT = randomized controlled trial; SSB = sugar-sweetened beverage; UPF = ultra-processed food.

attended only by writing committee members and ACC staff. A review of seminal publications and outstanding questions was facilitated. Key randomized trials, prospective cohort studies (PCS), meta-analyses, and clinical guidelines were selected based on their methodological quality and impact on the field. Writing assignments were configured according to each committee member's area of expertise. E-mail correspondence was used to provide critical review of contributed content. Differences were resolved by consensus among the writing committee. A summary of consensus recommendations is found in [Table 1](#). The committee's work was supported only by the ACC without any commercial input. Writing committee members were all unpaid volunteers. In accordance with ACC's Policy on Relationships With Industry and Other Entities, relevant disclosures for the writing committee and comprehensive disclosures for external peer reviewers can be found in [Appendixes 1 and 2](#).

## DEFINITIONS AND CLASSIFICATIONS

**DASH (Dietary Approaches to Stop Hypertension):** An evidence-based eating plan developed by the National Heart, Lung, and Blood Institute to promote cardiovascular health. The DASH plan emphasizes daily and weekly targets for fruits, vegetables, whole grains, fat-free or low-fat dairy, fish, poultry, beans, nuts, and seeds while limiting intake of sodium, fatty meats, full-fat dairy, and refined sugars.

**Macronutrients:** Essential compounds required for normal physiologic function; these include protein, carbohydrates, and fats.

**Mediterranean diet:** An eating pattern characterized by high intake of olive oil, fruits, nuts, vegetables, and whole grains; moderate intake of fish and poultry; low intake of dairy products, red meat, processed meats, and sweets; and wine in moderation, consumed with meals.

**Micronutrients:** Vitamins and minerals that are essential for physiologic purposes, needed in small amounts, and typically not endogenously produced.

**Plant-forward eating:** A flexible diet that prioritizes fruits, vegetables, whole grains, and legumes, in addition to other plant-based foods, allowing small amounts of meat, fish, or dairy.

**Ultra-processed foods (UPFs):** Edible items that are prepared using substances generally unavailable outside of industrial kitchens, which are either extracted from whole foods or synthesized in laboratories. These are designed to be convenient, durable, and hyperpalatable.

## ABBREVIATIONS

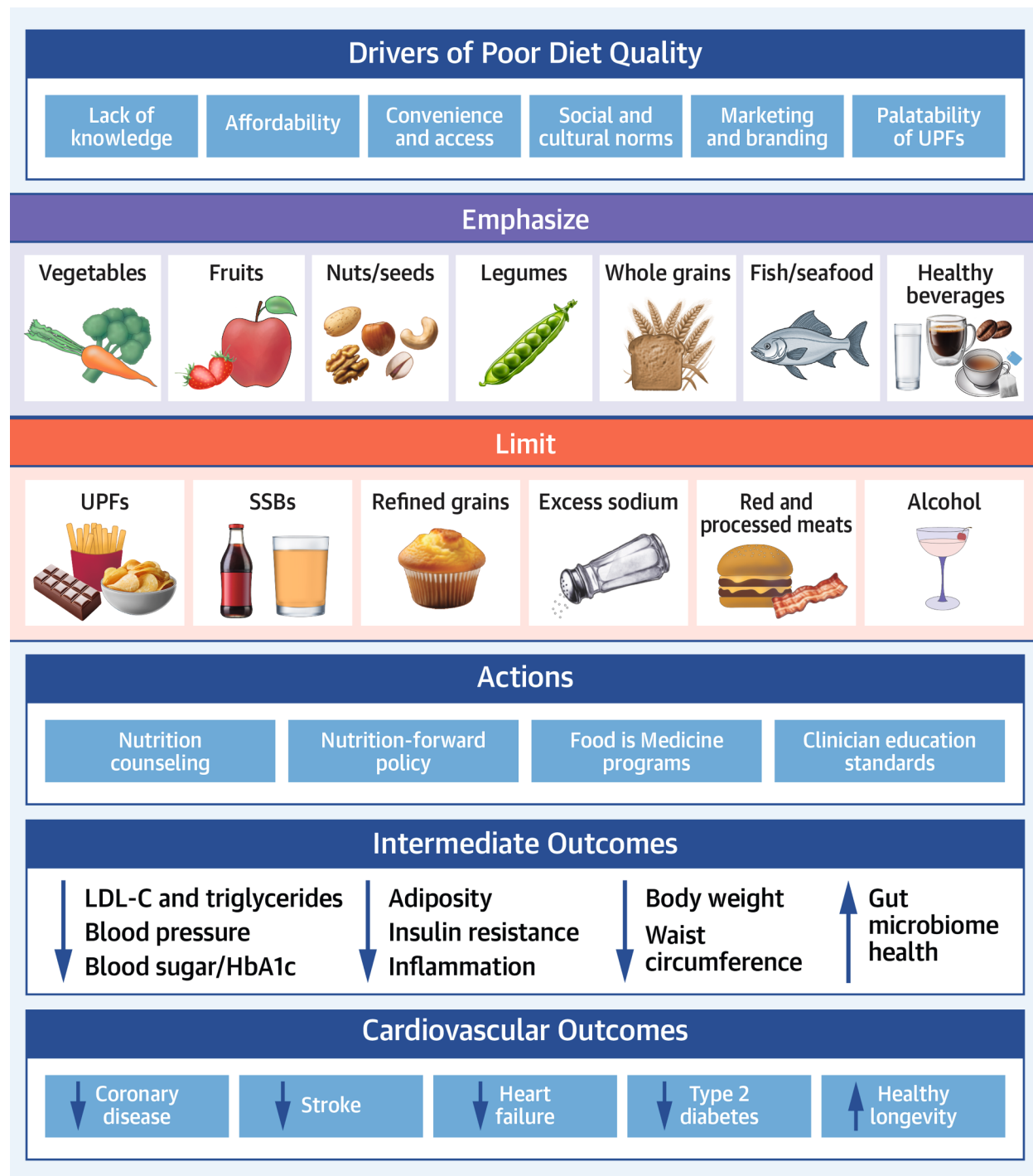
| Abbreviation | Meaning/Phrase                           |
|--------------|------------------------------------------|
| AF           | atrial fibrillation                      |
| BP           | blood pressure                           |
| CHD          | coronary heart disease                   |
| CKD          | chronic kidney disease                   |
| CVD          | cardiovascular disease                   |
| DASH         | Dietary Approaches to Stop Hypertension  |
| DGA          | Dietary Guidelines for Americans         |
| FIM          | Food Is Medicine                         |
| GLP-1 RA     | glucagon-like peptide-1 receptor agonist |
| IF           | intermittent fasting                     |
| LDL-C        | low-density lipoprotein cholesterol      |
| MNT          | medical nutrition therapy                |
| PCS          | prospective cohort studies               |
| PUFA         | polyunsaturated fatty acid               |
| RCT          | randomized controlled trial              |
| RDN          | registered dietitian nutritionist        |
| SSB          | sugar-sweetened beverage                 |
| T2D          | type 2 diabetes                          |
| UPF          | ultra-processed food                     |

## BACKGROUND

### Role of nutrition in CVD prevention and management

In the past several decades, CVD mortality has declined markedly in the United States and other high-income countries, largely due to improvements in risk factors and treatment. However, these gains have slowed in recent years, with evidence of stagnation and modest increases in CVD mortality, driven in part by the rising prevalence of obesity, diabetes, and hypertension.<sup>1</sup> Globally, the burden of atherosclerotic CVD has continued to increase despite declining mortality, particularly in low- and middle-income countries undergoing rapid urbanization and nutrition transitions. CVD remains the leading cause of death worldwide, accounting for approximately 20 million deaths annually.<sup>2</sup>

Suboptimal diet has been identified as a key risk factor for CVD, and diet and lifestyle modification is widely considered a cornerstone strategy for both primary and secondary prevention ([Central Illustration](#)).<sup>3</sup> The concept of a “heart-healthy” diet has evolved substantially over time. While early dietary guidelines emphasized reducing total and saturated fat to lower serum

**CENTRAL ILLUSTRATION** Impact of Nutrition on Cardiovascular Outcomes

Hu FB, et al. JACC. 2026;■(■):■-■.

HbA1c = hemoglobin A1c; LDL-C = low-density lipoprotein cholesterol; SSB = sugar-sweetened beverages; UPF = ultra-processed food.

cholesterol, subsequent guidance put greater emphasis on fat quality by recommending replacing saturated fat with polyunsaturated fat to reduce coronary risk. The discovery of the harmful effects of industrial *trans* fat on blood cholesterol and CVD risk led to the virtual elimination of these fats from the food supply in the United States and other developed countries by 2018.<sup>4</sup> More recently, the focus has shifted from individual nutrients to overall dietary patterns, with strong evidence supporting the role of healthy eating patterns such as Mediterranean and DASH-style dietary patterns rich in fruits, vegetables, whole grains, nuts, legumes, and unsaturated fats for CVD prevention. Both the 2025-2030 Dietary Guidelines for Americans (DGA)<sup>5</sup> and the 2026 American Heart Association (AHA) dietary guidance<sup>6</sup> strongly recommend reducing the consumption of UPFs and instead choosing minimally processed foods. These developments underscore a shift from nutrient-centric approaches to more holistic, food- and pattern-based strategies that better reflect advances in the understanding of the complex relationship between diet and CVD risk.

#### Impact of nutrition on common CVD comorbidities

Diabetes mellitus is associated with an increased risk of cardiovascular morbidity and mortality, encompassing a broad spectrum of conditions such as coronary artery disease, heart failure, stroke, atrial fibrillation (AF), and peripheral arterial disease. Conversely, about one-third of patients presenting with CVD have concomitant diabetes, which is frequently unknown at the time of initial clinical presentation.<sup>7</sup> Obesity further amplifies cardiometabolic risk, serving as a major contributor to type 2 diabetes (T2D), while diabetes remains a leading cause of both CVD and chronic kidney disease (CKD). The emerging construct of cardiovascular-kidney-metabolic syndrome underscores the bidirectional interplay among these conditions, which substantially increases overall cardiovascular mortality.<sup>8,9</sup> Accordingly, systematic screening for diabetes in patients with CVD—and vice versa—is essential for risk stratification.

Nutritional interventions are the cornerstone of management of cardio-kidney-metabolic syndrome. Patients should be counselled to adopt cardioprotective dietary patterns that promote weight reduction and metabolic health. The Mediterranean dietary pattern has consistently demonstrated cardiovascular benefits and remains one of the most well-supported dietary approaches for preventing major cardiovascular events.<sup>10</sup> In addition, the DASH diet is associated with lower CVD incidence and improved blood pressure (BP) regulation.<sup>11</sup> For patients with CKD, a plant-dominant low-protein diet is

increasingly recognized for its role in mitigating progression while managing cardiovascular risk.<sup>12</sup>

Sodium intake should be restricted, with consideration of potassium-enriched salt alternatives in appropriate patients. In patients without advanced CKD, substituting regular salt with potassium-enriched salt substitutes significantly reduces the risk of stroke and major adverse cardiovascular events<sup>13</sup>; however, caution is required in patients with advanced CKD due to hyperkalemia risk.<sup>14</sup> Risk of hyperkalemia should also be considered in patients on potassium-sparing diuretics. This nuanced approach marks a shift toward precision nutrition in cardiovascular care. Furthermore, minimizing UPFs has emerged as an important recommendation based on growing evidence linking higher UPF consumption to increased risk of cardiometabolic diseases.<sup>15</sup> Collectively, these modifications provide a comprehensive dietary strategy for improving cardiometabolic health and reducing the risk of cardiovascular events in high-risk individuals.

#### Consensus recommendation: impact of nutrition on common comorbidities

- Diabetes, obesity, CKD, and CVD are commonly interconnected through the cardio-kidney-metabolic syndrome. Nutrition is central to prevention and management of cardio-kidney-metabolic syndrome, emphasizing cardioprotective dietary patterns characterized by plant-forward eating, lower sodium intake, and minimally processed foods.

#### Relationship between nutrition and social drivers of health

Decades of research demonstrate that dietary patterns in the United States vary systematically by social drivers of health, including income, education, neighborhood environment, and access to health care.<sup>16</sup> Although some differences are modest, the overall consistency of these associations underscores the central role of social context in shaping nutritional intake and, ultimately, cardiovascular risk.<sup>17</sup>

Food security provides a useful framework for understanding these relationships and is commonly described across four domains: availability, access, utilization, and stability.<sup>18</sup> Availability refers to the presence of nutritious foods within one's environment, including the density of grocery stores, as well as foods offered in schools, workplaces, and homes. Access encompasses the financial, physical, and cognitive resources required to obtain nutritious foods, including income, transportation, and participation in nutrition assistance programs. Utilization reflects the ability to select, prepare, and consume healthy foods, incorporating nutrition literacy, cooking skills, and access to time and functional

kitchen equipment. Stability refers to the consistency of these domains over time, recognizing that fluctuations in income, employment, or benefits can disrupt dietary quality. Additional factors, including frailty, further modify these domains. Frailty may impair the ability to shop for, prepare, and consume food, while also altering physiologic nutrient requirements.<sup>19</sup> As a result, frailty is associated with both reduced dietary quality and increased risk of malnutrition.

#### Consensus recommendation: nutrition and social drivers of health

- Diet quality is shaped by social, structural, and individual factors, including the availability, affordability, accessibility, and utilization of nutritious food in one's environment.

#### CURRENT RECOMMENDATIONS FOR NUTRITION IN CVD

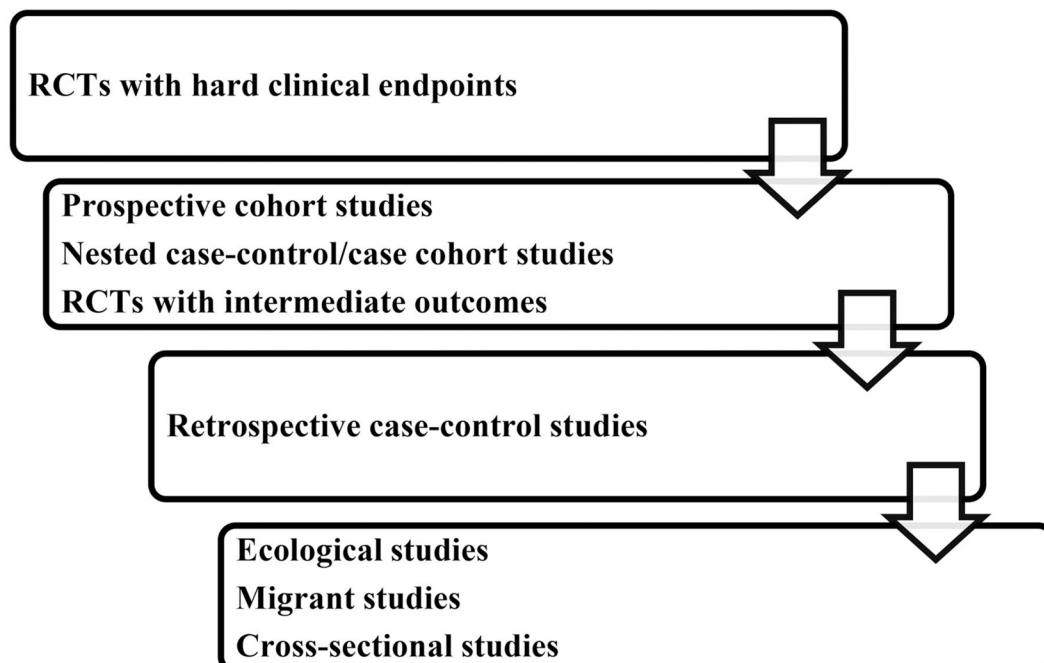
##### Inherent challenges in nutrition-based randomized controlled trials

Randomized controlled trials (RCTs) provide the strongest evidence for causal inference for specific dietary interventions. The highest level of evidence (Level A) used by the ACC and AHA to rate the quality of scientific evidence for clinical practice guidelines is based on one or more high-quality clinical trials or systematic reviews of RCTs.<sup>20</sup> Likewise, in the nutrition

field, dietary guidance is based on well-conducted systematic reviews of high-quality RCTs<sup>21</sup> as well as PCS (Figure 1).<sup>22</sup>

Unlike pharmacologic studies that evaluate an isolated compound, nutrition RCTs evaluate a nutrient(s), bioactive component(s), a single food, multiple foods often similarly classified but nutritionally different (eg, vegetables), or dietary patterns (ie, complex food matrices), creating unique challenges because increasing or decreasing one or more dietary components impacts the nutrient profile. Unlike drugs, foods cannot be evaluated against a true placebo and usually replace other foods, making substitution effects central to interpretation of dietary interventions. There are many other challenges including the baseline health and nutritional status of participants (eg, micronutrient status or circulating nutrient biomarkers), habitual diet, or both. In addition, the delivery of the dietary intervention, the control condition, and blinding (at least single blind) must be carefully considered. As with all clinical trials, important design issues are study duration, frequency of intervention, burden to the participants, adherence to the study protocol, and the ethics related to the study design and implementation.<sup>21,22,24</sup> In particular, reduced compliance or dropout rates can be high, especially if the dietary intervention is implemented for long periods or is very demanding.

**FIGURE 1** Hierarchy of Study Designs in Nutritional Epidemiology



The goal of randomized dietary interventions is to generate rigorous, high-quality evidence that can inform clinical practice and dietary guidelines.<sup>21</sup> However, large and long-term nutrition RCTs that evaluate hard clinical outcomes such as myocardial infarctions or cancer are prohibitively costly and thus typically infeasible. Consequently, most nutrition RCTs rely on intermediate risk factors and validated biomarkers as primary outcomes. Findings from multiple nutrition RCTs with intermediate outcomes together with PCS provide a strong evidence base for developing clinical recommendations and dietary guidelines.<sup>23</sup> Study design resources for the conduct of high-quality nutrition RCTs are available.<sup>21,25</sup>

#### Consensus recommendation: nutrition-based RCTs

- RCTs with hard clinical endpoints are the gold standard for establishing causality, but they are often infeasible in nutrition research. Consequently, dietary recommendations are based on the totality of evidence, including short-term nutrition RCTs, PCS, and mechanistic studies, which together provide strong support for healthy dietary patterns for CVD prevention.

#### Macronutrients: protein, fats, and carbohydrates

Macronutrient-based dietary guidance has traditionally emphasized the relative proportions of fat, carbohydrate, and protein. However, the physiologic effects of a macronutrient depend largely on what it replaces, and a growing body of evidence indicates that cardiovascular risk is more strongly determined by food source, nutrition quality, and degree of processing than by macronutrient quantity alone.<sup>26-28</sup>

Dietary fatty acids can be classified into saturated, monounsaturated, polyunsaturated (omega-6 and omega-3), and *trans* fatty acids, each characterized by distinct chemical structures, major food sources, and biological effects (Figure 2). There is consistent evidence from RCTs and large cohort studies that replacing sources of saturated fat with sources of polyunsaturated fat, and to a lesser extent monounsaturated fat, lowers low-density lipoprotein cholesterol (LDL-C) levels and lowers risk of coronary heart disease (CHD) (Figure 3).<sup>29</sup> Replacing animal fats (eg, butter, lard, and beef tallow) and tropical oils (eg, coconut, palm, and cocoa butter) that are high in saturated fat with nontropical plant oils (eg, canola oil, soybean oil, and olive oil) that are rich in unsaturated fats is associated with lower CHD risk.<sup>30</sup> However, replacing saturated fat with carbohydrates from refined starches and added sugars is not significantly associated with CHD risk (Figure 3). A recent meta-analysis further supports the association between total polyunsaturated fatty acid (PUFA) intake and lower risk

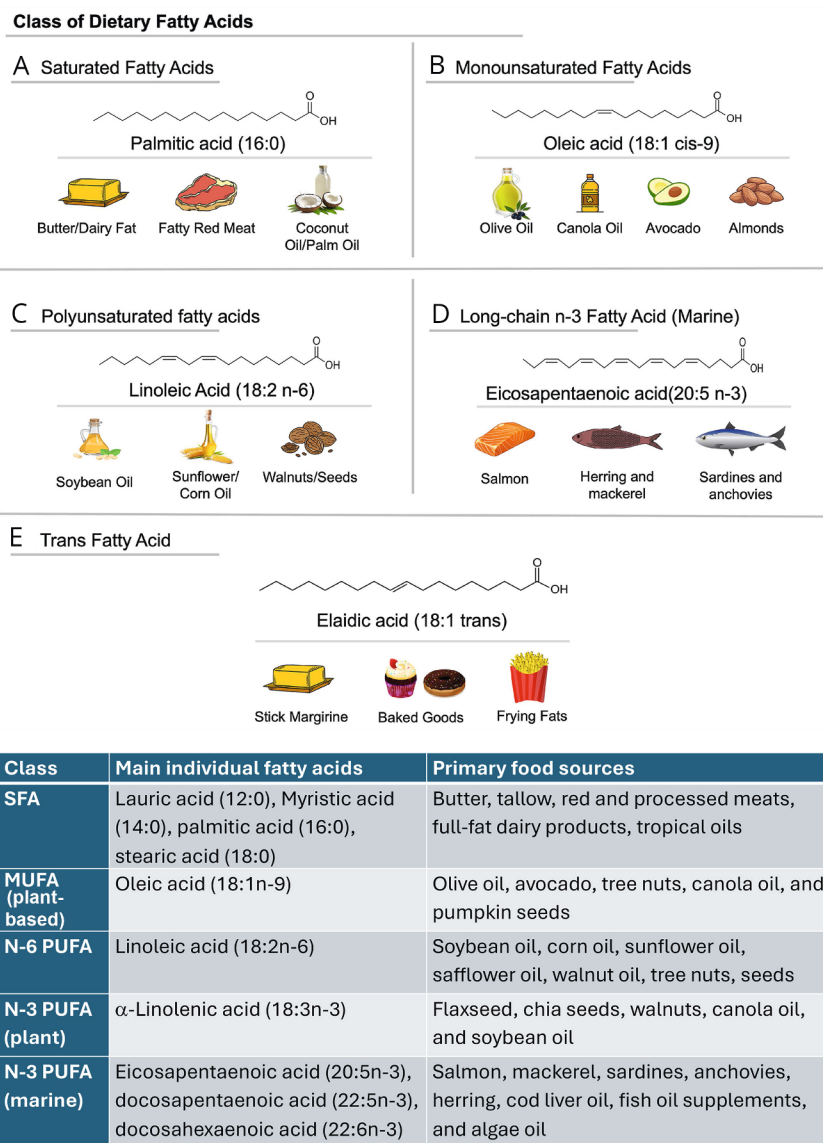
of CHD, but the association with stroke remains mixed.<sup>31</sup> Replacing 5% of calories from saturated fatty acids with an equivalent number of calories from PUFAs is associated with 19% to 27% reduction in all-cause mortality, based on individual studies.<sup>32,33</sup> *Trans* fatty acids from partially hydrogenated vegetable oils raise LDL-C and increase risk of CHD.<sup>29</sup> Although largely eliminated from the U.S. food supply, industrial *trans* fats remain a significant public health concern in many low- and middle-income countries.

Carbohydrate quality is also an important determinant of cardiometabolic health. Whole grains (containing the bran, germ, and endosperm; such as whole wheat, oats, brown or black rice, barley, rye, and quinoa) are rich in fiber, vitamins, minerals, and other bioactive compounds. There is consistent evidence from large cohort studies and RCTs that higher consumption of whole grains and dietary fiber is associated with a lower risk of obesity, diabetes, and CVD.<sup>35</sup> In contrast, added sugars, especially sugar-sweetened beverages (SSBs), are consistently associated with a higher risk of obesity, diabetes, and CVD. Therefore, dietary recommendations should emphasize high-fiber, minimally processed carbohydrate foods and limit added sugars, particularly SSBs.<sup>36</sup>

Dietary protein sources differ substantially in their associations with CVD, cancer, and mortality. Large PCS have demonstrated that higher intake of animal protein sources, especially red and processed meats, is associated with increased all-cause and cardiovascular mortality, whereas higher intake of plant protein is associated with reduced risk.<sup>37,38</sup> Substitution analyses suggest that replacing animal protein with plant protein lowers mortality risk, supporting the importance of protein source rather than total protein intake.

These differences are biologically plausible. Animal-derived foods contain multiple constituents and metabolites that may contribute to risk of cardiometabolic disease and cancer. These include heme iron, which promotes oxidative stress and has been linked to increased mortality and cancer risk<sup>39</sup>; saturated fatty acids, which increase LDL-C and promote atherosclerosis<sup>40</sup>; and dietary cholesterol and oxidized sterols, which have been shown to promote endothelial dysfunction and plaque formation.<sup>20</sup> Emerging evidence also suggests that gut microbiome-dependent metabolism of carnitine and choline to trimethylamine N-oxide may contribute to atherosclerosis and cardiovascular risk in both mechanistic and clinical studies.<sup>41,42</sup> Other proposed mechanisms include the nonhuman sialic acid N-glycolylneuraminic acid, present in mammalian meat, which may promote chronic inflammation.<sup>43</sup>

Animal protein is also enriched in branched-chain amino acids and methionine, which may activate nutrient-sensing pathways such as mechanistic target of

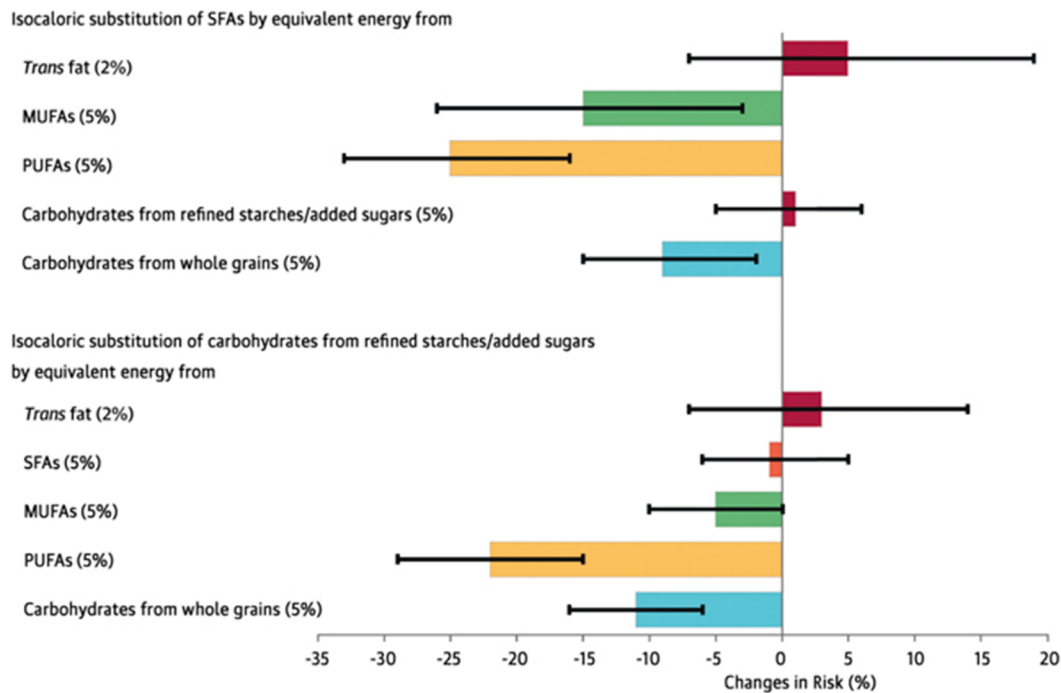
**FIGURE 2** Common Dietary Sources of Polyunsaturated and Saturated Fatty Acids

Representative structures and major food sources are shown for (A) saturated fatty acids, (B) monounsaturated fatty acids, (C) polyunsaturated fatty acids, (D) long-chain n-3 fatty acids, and (E) trans fatty acids. Palmitic, oleic, linoleic, eicosapentaenoic, and elaidic acids are shown as representative fatty acids for each class, respectively. Food sources shown are illustrative and may contain mixtures of multiple fatty acids. Adapted with permission from Sun and Hu (2026).<sup>34</sup> MUFA = monounsaturated fatty acid; PUFA = polyunsaturated fatty acid; SFA = saturated fatty acid.

rapamycin and contribute to insulin resistance and accelerated aging.<sup>44,45</sup> Postprandial endotoxemia, reflecting increased absorption of lipopolysaccharide, has also been observed following high-fat, animal-based meals and may contribute to systemic inflammation.<sup>46</sup>

Processing and preparation further modify risk. Processed meats often contain sodium, nitrates, and nitrites, which are associated with hypertension and the

formation of carcinogenic N-nitroso compounds.<sup>39</sup> High-temperature cooking methods such as grilling, frying, and broiling generate heterocyclic amines and polycyclic aromatic hydrocarbons, which are mutagenic and carcinogenic.<sup>47,48</sup> In addition, advanced glycation end products and lipid oxidation products formed during cooking promote oxidative stress, inflammation, and endothelial dysfunction.<sup>49</sup>

**FIGURE 3** Replacement of Saturated Fat With Other Types of Fat or Carbohydrates

Association with risk of cardiovascular disease in the Nurses' Health Study and Health Professionals Follow-Up Study. Multivariable adjustment. Adapted with permission from Li et al.<sup>30</sup> MUFA = monounsaturated fatty acids; PUFA = polyunsaturated fatty acids; SFA = saturated fatty acids. Footnote: The food examples shown should be interpreted as illustrative rather than universal. In the United States and many other countries, partially hydrogenated oils have been largely phased out, and these foods are generally no longer major sources of industrial trans fatty acids, although they may remain important sources in regions where partially hydrogenated oils are still used.

### Consensus recommendations: macronutrients

- CVD risk is influenced more by food source, nutrition quality, and degree of processing than relative proportion of protein, fat, and carbohydrate. High-fiber, whole-grain carbohydrates should be emphasized in place of added sugars and refined grains; similarly, plant-based sources of protein should be emphasized over animal-based sources for CVD prevention.
- Replacing saturated fat with unsaturated fats reduces LDL-C and lowers cardiovascular risk. Unsaturated fats from liquid plant oils, nuts, seeds, and fish should be primary sources of dietary fat.

### Micronutrients (sodium and potassium), fiber, and long-chain omega-3 PUFA

#### Sodium

High-sodium diets increase hypertension, CKD, CHD, and stroke risk and are a leading dietary cause of deaths globally.<sup>50,51</sup> Evidence supports a causal relationship between sodium intake and hypertension, with individual variability in salt sensitivity documented.<sup>52</sup> The Chronic Disease Risk Reduction (CDRR) intake for sodium is

2,300 mg/d for adults; intake below this level has been shown to reduce chronic disease risk. Average sodium consumption in the United States is >3,400 mg/d, with 95.8% of men and 77.8% of women exceeding the CDRR intake for sodium.<sup>53,54</sup> Most dietary sodium in the United States comes from processed, packaged, or restaurant foods with top sources including pizza, breads, processed meats, soups, burgers, tacos, burritos, and savory snacks.<sup>55</sup> Sodium intake should be limited to <2,300 mg/d and ideally <1,500 mg/d for most adults.<sup>56,57</sup> RCT data have shown clinically significant reductions in systolic BP with low- and very low-sodium diets, averaging 6 to 8 mm Hg lower in systolic BP compared with high-sodium diets.<sup>57</sup>

#### Potassium

Due to low dietary consumption, potassium is identified as a nutrient of public health concern, with only 28% of individuals in the United States meeting the adequate intake for potassium.<sup>58</sup> The adequate intake for potassium was updated in 2019 and varies by age, sex, and health status.<sup>53</sup> Increased potassium intake reduces BP among individuals with hypertension and is associated with a lower risk of stroke.<sup>59</sup> Increased potassium intake

is also associated with lower cardiovascular event risk (ie, coronary revascularization, myocardial infarction, or stroke) based on a pooled analysis of 6 prospective studies.<sup>60</sup> Potassium is widely available in food sources, particularly fruits, vegetables, legumes, and dairy products. Substitution of regular salts with potassium-enriched salt substitutes has been shown to lower BP and reduce major cardiovascular events.<sup>13,61</sup>

### Fiber

Dietary fiber is another nutrient of public health concern, with only 6% of individuals meeting the recommended intake in the United States (25 and 38 g/d for women and men aged 19-50 years, respectively).<sup>58</sup> Current daily average fiber intake is 15 and 17 g/d for women and men in the United States. High-fiber diets are typically composed of fruits, vegetables, whole grains, beans/lentils, and other plant-based foods like nuts/seeds. Increased fiber intake, particularly viscous fiber, is associated with reduced BP, blood sugar, total cholesterol, and LDL-C, as well as lower risk of incident CHD, stroke, and both CVD-related and all-cause mortality.<sup>35,58,62-64</sup> The anti-inflammatory properties of fiber are thought to be mediated through alterations in gut microbiome and increased production of short chain fatty acids.<sup>65</sup> High-fiber diets also assist with satiety and weight management. The optimal intake of dietary fiber depends on sex and age among other factors, but most health benefits are likely achieved with intakes of  $\geq 25$  g/d, with additional health benefits above this goal.<sup>35</sup>

### Long-chain omega-3 PUFAs

Omega-3 PUFAs, particularly eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) from fatty fish, have favorable effects on triglyceride levels, inflammation, and other cardiovascular risk factors.<sup>66</sup> PCS found that dietary patterns containing regular consumption of fish were associated with modestly lower risks of CHD and cardiovascular mortality,<sup>67,68</sup> although this benefit cannot be attributed to omega-3 fatty acids alone. However, fish oil supplementation alone has generally not been shown to reduce CVD risk in otherwise healthy adults.<sup>6</sup> There is limited evidence that high-dose EPA therapy may reduce cardiovascular events in selected high-risk individuals with elevated triglyceride levels,<sup>69</sup> but some trials have reported an increased risk of AF with omega-3 supplementation.<sup>70</sup>

### Consensus recommendations: micronutrients, fiber, and omega-3 fatty acids

- Reduce sodium intake by limiting processed foods and increase potassium intake through potassium-rich

plant foods; consider replacement of regular salt with potassium-based salts to manage BP when appropriate.

- Choose fiber-rich foods, including legumes, whole grains, fruits, vegetables, nuts, and seeds, in place of refined grains and other low-fiber foods high in added sugars and refined starches.
- Long-chain omega-3 fatty acids are best obtained through regular fish consumption as part of a healthy dietary pattern, whereas routine omega-3 supplementation is not recommended for primary prevention of CVD.

### UPFs and food additives

UPFs are increasingly recognized as contributors to cardiometabolic risk. Common examples include SSBs, packaged snacks, candies, processed meats, instant noodles, and many ready-to-eat meals. Defined by industrial formulation and inclusion of additives, UPFs are a heterogeneous category, and health effects vary across food types. The strongest evidence links specific types of UPFs, particularly SSBs and processed meats, with increased CVD, mortality, and adverse metabolic outcomes.<sup>71-73</sup> Mechanistic contributors include excess sodium, added sugars, refined starches, and potentially food additives such as emulsifiers, which may disrupt gut microbiota and promote inflammation.<sup>74</sup>

A short-term randomized controlled feeding study demonstrated that diets high in UPFs increase caloric intake and weight gain independent of macronutrient composition,<sup>73</sup> highlighting the importance of food structure and processing beyond traditional nutrient metrics. However, not all UPFs have the same health effects. Industrial processing that preserves much of the food matrix without adding excess sodium, refined grains, sugar, or saturated fat to the final product may have minimal negative health effects.<sup>75</sup> Some UPFs, including certain whole grain breads, yogurts, and breakfast cereals, have been associated with lower risks of T2D and CVD, highlighting the considerable heterogeneity within the UPF category and the importance of considering overall nutritional quality in addition to the degree of processing.<sup>76</sup>

Environmental contaminants may also contribute. Some animal products can serve as vectors for bioaccumulated toxins including persistent organic pollutants, heavy metals, and other industrial contaminants, which have been associated with metabolic disorders and CVD.<sup>77,78</sup> Emerging evidence also suggests that microplastics and nanoplastics may accumulate in food systems and human tissues, with potential vascular and inflammatory effects that may increase the risk of CVD.<sup>79</sup> In contrast, minimally processed plant protein sources—including legumes, whole grains, nuts, and seeds—are

consistently associated with improved cardiometabolic outcomes. These foods provide fiber, unsaturated fatty acids, and phytochemicals that reduce LDL-C, improve insulin sensitivity, and lower inflammation.<sup>27,80</sup>

#### Consensus recommendation: UPFs

- Current evidence supports a dietary pattern emphasizing minimally processed, plant-derived foods while limiting consumption of SSBs, processed meats, and other UPFs that are high in refined starches, added sugars, sodium, or unhealthy fats to reduce the risk of cardiometabolic diseases.

#### Nonfood dietary components

##### Alcohol

The relationship between alcohol consumption and cardiovascular health remains controversial. While observational cohort studies have consistently suggested that low to moderate alcohol consumption may be associated with a lower risk of CHD, the causality of these associations remains uncertain.<sup>81</sup> There is consistent evidence that alcohol intake increases BP in a dose-dependent manner, and even low levels of consumption may raise the risk of hypertension and AF.<sup>6</sup> Heavy alcohol use and binge drinking are consistently associated with adverse cardiovascular outcomes and increased mortality. Alcohol also increases the risk of several cancers, including cancers of the breast, colorectum, liver, esophagus, oral cavity, pharynx, and larynx, with no clearly established safe threshold.<sup>82</sup> Therefore, individuals who do not drink alcohol should not start drinking for health reasons; for those who choose to drink, intake should be limited.

##### Caffeine

Caffeine is the most widely consumed psychoactive substance worldwide. Although caffeine can acutely increase BP in nonhabitual users, tolerance can develop with regular consumption. There is consistent evidence from large cohort studies that moderate coffee consumption (2-5 cups/d) is associated with a lower risk of T2D, CVD, stroke, AF, and heart failure.<sup>83</sup> Regular consumption of tea has also been associated with a lower risk of CVD in PCS.<sup>84</sup> Interestingly, in a randomized trial of patients with AF undergoing elective cardioversion, daily consumption of  $\geq 1$  cup of caffeinated coffee was associated with a 39% lower risk of recurrent AF compared with avoidance of coffee and caffeine.<sup>85</sup> These benefits are likely attributable not only to caffeine itself but also to other bioactive compounds in coffee and tea, such as polyphenols. However, unfiltered coffee (such as French press, boiled, Turkish, and espresso coffee) raises LDL-C because of its cafestol content.<sup>86</sup> Substantial

interindividual variability exists in responses to caffeine due to differences in genetics, age, pregnancy status, medication use, and underlying health conditions.<sup>86</sup> Overall, current evidence suggests that moderate consumption of filtered coffee, providing up to about 400 mg of caffeine per day, is safe for most adults and can be included as part of a healthy dietary pattern.<sup>86</sup>

##### Non-nutritive sweeteners

To reduce added sugar intake, non-nutritive sweeteners are commonly used as alternatives. The World Health Organization does not recommend their routine use for long-term weight control, largely based on observational studies reporting positive associations between beverages containing non-nutritive sweeteners and risk of obesity, diabetes, and CVD.<sup>87</sup> However, these associations are likely influenced by reverse causation and residual confounding because individuals at higher cardiometabolic risk are more likely to choose products containing non-nutritive sweeteners. While experimental studies have raised concerns that certain sweeteners may adversely affect glucose metabolism, appetite regulation, and the gut microbiome, evidence has been inconsistent and may vary across different types of sweeteners.<sup>88</sup> In addition, small RCTs and substitution analyses from cohort studies suggest that replacing SSBs with beverages containing non-nutritive sweeteners can provide modest benefits for body weight and metabolic health. Nonetheless, water and other unsweetened beverages remain the preferred choice for long-term health.<sup>36</sup>

#### Consensus recommendations: nonfood dietary components

- Alcohol should not be initiated for cardiovascular benefits. Despite observational evidence linking low to moderate intake with lower rates of CHD, causality is uncertain, and the overall balance of evidence does not support regular alcohol use for health benefits.
- Moderate intake of filtered coffee or tea (2-5 standard cups; 8 oz [240 mL] per day) appears to be safe for most adults, and regular intake is associated with a lower risk of cardiometabolic diseases.
- Evidence on long-term metabolic and cardiovascular effects of non-nutritive sweeteners is inconclusive; water and other unsweetened beverages should be the preferred choices.

#### CLINICAL TRANSLATIONS OF CURRENT NUTRITION EVIDENCE

Because dietary patterns capture the complex interactions among various foods and nutrients—as well as the cumulative effects of the overall diet—research focusing on these eating patterns offers greater understanding of dietary effects than just evaluating individual

components.<sup>89</sup> Advances in nutritional research from RCTs and PCS have provided a strong scientific framework for dietary pattern recommendations to prevent CVD, diabetes, and obesity. Importantly, the benchmarks for healthy dietary patterns were established by comparing them to an average Western diet typically characterized by poor quality.

### Cardiovascular disease

Based on a systematic review conducted by the Advisory Committee for the 2025-2030 DGA, dietary patterns characterized by higher intakes of vegetables, fruits, legumes, nuts, whole grains; unsaturated relative to saturated fats and lower sodium; and lower intakes of red and processed meats, refined grains, and sugar-sweetened foods and beverages were associated with a lower risk of CVD, including clinically meaningful improvements in blood lipids and BP.<sup>90</sup> The evidence supporting these dietary patterns was graded as strong. The healthy dietary patterns that share these characteristics include the Healthy U.S.-Style Eating Pattern, which aligns with DASH, a Mediterranean-style eating pattern, and a healthy vegetarian/vegan eating pattern. Although they vary modestly in type and amount of animal products and dietary fats included (eg, greater emphasis on seafood and olive oil in the Mediterranean dietary pattern and low-fat dairy and a variety of liquid vegetable oils in the DASH diet), they share core features that promote cardiovascular health.

Kahleova et al<sup>91</sup> summarized evidence from systematic reviews and meta-analyses of dietary patterns and cardiometabolic health and found that greater adherence to healthy dietary patterns, particularly the Mediterranean and DASH diets, was consistently associated with lower risks of CVD, CHD, stroke, and cardiovascular mortality. Vegetarian dietary patterns were also associated with a lower risk of CHD. In addition to reducing cardiovascular risk, these dietary patterns were associated with favorable effects on major cardiometabolic risk factors, including BP, blood lipids, glycemic control, inflammation, and body weight, supporting their role in both the prevention and management of CVD.

The strongest evidence supporting the cardiovascular benefits of the Mediterranean diet comes from RCTs (Figure 4). In both the PREDIMED (Prevención con Dieta Mediterránea) primary prevention trial<sup>92</sup> and the COR-DIOPREV (Coronary Diet Intervention With Olive Oil and Cardiovascular Prevention) secondary prevention trial,<sup>93</sup> Mediterranean diets enriched with extra-virgin olive oil or nuts significantly reduced major cardiovascular events compared with low-fat control diets. Together, these landmark studies provide robust evidence supporting the Mediterranean diet for the prevention and management of CVD.

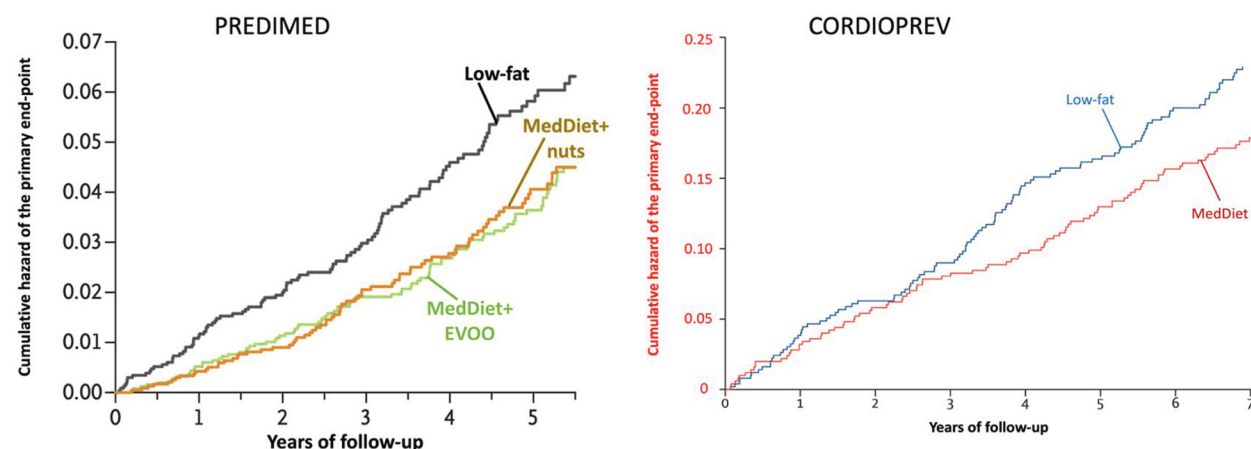
### Diabetes

There is strong evidence that adherence to a Mediterranean diet is associated with a lower risk of T2D.<sup>95</sup> A systematic review and dose-response meta-analysis of 24 PCS and 1 RCT (with 991,878 participants and 68,325 T2D cases and a mean follow-up of 12.2 years) found that greater adherence to the Mediterranean diet was associated with a lower risk of T2D (HR: 0.92; 95% CI: 0.90-0.94; moderate certainty evidence). In particular, the PREDIMED randomized trial found that participants assigned to a Mediterranean diet supplemented with extra-virgin olive oil or nuts had a significantly lower incidence of T2D than those assigned to a control low-fat diet.<sup>96</sup>

Dietary carbohydrate intake is a key determinant of glycemic control, and both the quantity and quality of carbohydrates are important. Systematic reviews and meta-analyses consistently show that lower carbohydrate dietary patterns improve glycemic control in people with diabetes, and thus, reducing overall carbohydrates has been recommended for hyperglycemia and can be implemented within a variety of healthy dietary patterns tailored to individual needs and preferences.<sup>97,98</sup> In addition, reducing glycemic index (GI) and glycemic load (GL) further improves glycemic control. A systematic review and meta-analyses found that low GI/GL diets reduced hemoglobin A1c by 0.31% (95% CI: -0.42 to -0.19%) compared with higher GI/GL diets among individuals with diabetes.<sup>99</sup>

The effects of carbohydrate-restricted diets on cardiometabolic risk factors are inconsistent. Very low-carbohydrate diets can promote rapid short-term weight loss.<sup>100</sup> However, a Cochrane systematic review reported that low-carbohydrate weight-reducing compared with balanced calorie-restricted diets resulted in small to little difference in body weight change over 3 to 6 months (mean difference, -1.26 kg; 95% CI: -2.44 to -0.09) and over 1 to 2 years (mean difference, -0.33 kg; 95% CI: -2.13 to 1.46).<sup>101</sup> Although the effects on LDL-C varied across studies, many RCTs have reported increases in LDL-C, particularly with very low-carbohydrate diets such as ketogenic diets high in saturated fat.<sup>102</sup>

Several PCS have suggested that the health effects of lower-carbohydrate diets depend on the food sources used to replace carbohydrates, with plant- and animal-based low-carbohydrate diets showing different associations with cardiovascular events and all-cause mortality. A UK Biobank study found that adherence to a low-carbohydrate, high-fat diet was associated with higher LDL-C and apolipoprotein B levels and increased cardiovascular events.<sup>103</sup> An analysis of 198,473 participants from 3 large cohorts found that the multivariable-adjusted HR for CHD for individuals with

**FIGURE 4** Cumulative Hazard of the Cardiovascular Primary Endpoint in the PREDIMED (Primary Prevention, Including 7,447 Participants) and CORDIOPREV (Secondary Prevention, Including 1,002 Participants) Trials

Reproduced with permission from Hu et al.<sup>94</sup> CORDIOPREV = Coronary Diet Intervention With Olive Oil and Cardiovascular Prevention; PREDIMED = Prevención con Dieta Mediterránea.

the highest scores for low-carbohydrate diet (ie, lower carbohydrate content) compared to those with the lowest scores was 1.05 (95% CI: 1.01-1.10). For animal low-carbohydrate diets, the HR was 0.94 (95% CI: 0.90-0.99). In addition, the HRs for an unhealthy low-carbohydrate diet were 1.14 (95% CI: 1.09-1.20) and 0.85 (95% CI: 0.82-0.89) for a healthy low-carbohydrate diet.<sup>104</sup> Both the healthy low-carbohydrate and low-fat diets were linked to a more favorable CHD risk profile (ie, lower triglycerides, higher high-density lipoprotein cholesterol, and lower high-sensitivity C-reactive protein levels) compared with unhealthy versions of these diets. In the ARIC (Atherosclerosis Risk In Communities) study, an animal-based low-carbohydrate diet was associated with higher total mortality (HR: 1.18; 95% CI: 1.08-1.29), whereas a plant-based low-carbohydrate diet was associated with lower mortality (HR: 0.82; 95% CI: 0.78-0.87).<sup>105</sup>

#### Dietary strategies for weight management

Weight management is a cornerstone for CVD prevention in individuals with overweight and obesity. Evidence-based dietary guidance consistently recommends adjusting energy intake and expenditure to achieve and maintain a healthy body weight to promote cardiovascular health.<sup>6</sup> A comprehensive weight loss approach is recommended that includes an energy-adjusted dietary pattern coupled with increased physical activity ( $\geq 150$  minutes of moderate-intensity aerobic activity per week, plus muscle-strengthening exercises on  $\geq 2$  days),<sup>106</sup> and behavior modification; when clinically indicated,

pharmacotherapy or bariatric procedures are also recommended.<sup>107</sup>

Beyond continuous energy restriction, intermittent fasting (IF) has emerged as a popular dietary strategy designed to decrease calorie intake and reduce body weight. Major IF approaches include time-restricted eating, alternate day fasting, and whole day fasting. Many studies have evaluated the effects of IF compared with continuous energy restriction, some of which were not energy-reduced diets (eg, ad libitum diets and nonintervention diets). Their effects have been evaluated in systematic reviews including meta-analyses,<sup>108-111</sup> an umbrella analysis,<sup>112</sup> and a network meta-analysis<sup>113</sup>; collectively, the studies report mixed results. The evidence demonstrates either similar weight loss of IF compared with continuous energy restriction,<sup>108-110,112</sup> short-term ( $<6$  months) but not long-term ( $>12$  months) benefits of IF,<sup>114</sup> benefits of IF only on fat mass and waist circumference at 10-12 months,<sup>111</sup> or benefits of IF only for alternate day fasting.<sup>113</sup>

The network meta-analysis of 99 RCTs (and 6,582 adults) by Semnani-Azad et al<sup>113</sup> evaluated 3 IF strategies (alternate day fasting, time-restricted eating, and whole day fasting) compared with continuous energy restriction and reported that all IF and continuous energy restriction diet strategies reduced body weight when compared with an ad libitum diet for 3 to 52 weeks. However, alternate day fasting was the only IF diet strategy that demonstrated a benefit of body weight reduction (mean difference,  $-1.29$  kg (95% CI:  $-1.99$  to  $-0.59$ ) compared with continuous energy restriction. Alternate day fasting

showed a greater, although modest, body weight reduction versus both time-restricted eating and whole day fasting (mean difference,  $-1.69$  kg [95% CI:  $-2.49$  to  $-0.88$  kg] and  $-1.05$  kg [95% CI:  $-1.90$  to  $-0.19$  kg], respectively).

A Cochrane meta-analysis of 22 studies with 1,995 participants reported little to no difference in adverse events of IF compared with continuous energy restriction in studies that lasted up to 12 months, but noted the evidence is very uncertain.<sup>110</sup> In adults with T2D, IF has been shown to improve glycemic control, body weight, and other cardiometabolic risk factors. Although further research is needed to understand the long-term health effects of IF, it can be considered as an alternative to continuous energy restriction for weight management and improving metabolic health, particularly in individuals with overweight, obesity, or T2D.

#### **Nutrition in the era of glucagon-like peptide-1 receptor agonists**

Glucagon-like peptide-1 receptor agonist (GLP-1 RA)-based therapies produce substantial weight loss through multiple mechanisms including central regulation of appetite and food reward, enhanced satiety, delayed gastric emptying, and reduced energy intake.<sup>115,116</sup> These therapies improve clinical outcomes in selected patients with established CVD (including those with prior acute coronary syndromes or myocardial infarction), obesity-related heart failure with preserved ejection fraction, or moderate–severe obstructive sleep apnea.<sup>117–121</sup> A recent PCS of nearly 100,000 individuals with T2D in the Million Veteran Program found that adherence to a healthy lifestyle and use of GLP-1 RAs were independently associated with a lower risk of major adverse cardiovascular events.<sup>122</sup> Participants who combined healthy lifestyle habits with GLP-1 therapy experienced the greatest reduction in cardiovascular risk, highlighting the complementary and synergistic benefits of integrating lifestyle modification with pharmacologic treatment in CVD risk reduction.

The widespread use of GLP-1 RAs is changing food preferences and dietary intakes. Diet quality should be emphasized to maximize health benefits in the setting of reduced total energy intake, although evidence remains limited on the intensity, duration, and role of nutrition therapy for individuals on GLP-1 RAs.<sup>123</sup> Risk factors for malnutrition and sarcopenia (ie, eating disorders, food insecurity, older age, existing relative sarcopenia) should be reviewed prior to GLP-1 RA initiation and nutrition counseling can be used to manage gastrointestinal side effects, minimize loss of muscle mass, and ensure adequate nutrient intake including protein and micronutrient considerations in addition to achieving weight loss targets.<sup>121,123–125</sup> Because these agents reduce energy

intake and are associated with loss of lean body mass, adequate protein intake and resistance exercise are essential to preserve muscle mass and function. Attention to overall diet quality and micronutrient adequacy is also important, particularly during rapid weight loss. Current nutritional guidance includes fluid intake of 2 to 3 liters per day (or more where appropriate), a practical recommendation of 60–75 grams of protein per day (up to 1.5 g/kg ideal body weight),  $\geq 21$  grams of fiber per day for women and 30 grams of fiber per day for men, while focusing on increasing nutrient-dense foods and minimizing refined carbohydrates, added sugars, processed meats, and savory snacks.<sup>121,125,126</sup> Eating behaviors also play a critical role during GLP-1 RA therapy. These include consuming smaller portion sizes, scheduling small meals regularly, hydrating adequately, and minimizing fried or greasy foods and alcohol intake.<sup>121</sup> Multivitamin supplementation can be considered on an individual basis, while emphasizing healthy foods as the primary nutrition source.<sup>121,125,126</sup> Ongoing nutrition monitoring is recommended during treatment with GLP-1 RAs.<sup>121,125</sup> Multidisciplinary teams can include registered dietitian nutritionists (RDNs) and behavioral therapists where appropriate.<sup>124</sup>

#### **Consensus recommendations: clinical translations of current nutritional evidence**

- There is strong evidence supporting plant-forward dietary patterns for prevention and management of CVD, T2D, and overweight or obesity.
- For people with diabetes, low-carbohydrate dietary patterns are an effective option for improving glycemic control and may facilitate weight loss. When adopted, emphasis should be placed on plant-based sources of protein and unsaturated fats for overall cardiometabolic health.
- IF may be an effective strategy for weight loss and improving short-term metabolic outcomes in some individuals. However, evidence is limited for its long-term health benefits.
- GLP-1 RAs provide substantial cardiometabolic benefits, including weight loss and reductions in cardiovascular risk. However, maintaining a high-quality diet remains important, and nutritional counseling should emphasize adequate intake of protein, fiber, vitamins, and minerals to preserve overall nutritional status.

#### **Nutrition-based interventions and dietary guidelines for cardiovascular health**

##### **"Food Is Medicine"**

Over the previous few decades, there have been increasing attempts to engage health care in using healthy diets more systematically to support chronic

disease prevention and treatment. These efforts generally fall into two categories. The first is increasing nutrition education in medical training. The second is increasing patient access to healthy food through a connection point with the health system, a model frequently referred to as “Food Is Medicine” (FIM). FIM is defined as provision of healthy food resources to prevent, manage, or treat specific clinical conditions in coordination with the health care sector.<sup>127</sup> The most common criteria for enrollment in these programs is a diagnosis of or high risk for a diet-sensitive chronic disease (such as diabetes, heart failure, or hypertension), a high-risk pregnancy, or food insecurity.

There are three common FIM program models: medically tailored meals (which generally provide ready-to-eat meals, tailored to dietary requirements), medically tailored groceries (which generally provide raw ingredients that must be prepared at home, also tailored to dietary requirements), and produce prescription programs (which generally provide only fruits and vegetables). These programs can be delivered in many ways, including with home delivery, pickup at a community site (such as a food pantry), or a debit card or paper voucher that can be redeemed online or at a grocery store, farmers market, or other food vendor. Increasingly, these programs are being delivered on flexible spending cards as a covered health insurance benefit, like the Medicare flex card. The appropriate program model depends on patient comorbidities and other barriers to healthy dietary intake, with more expensive models (such as home-delivered, medically tailored meals) appropriate for populations with a higher burden of disease and greater frailty, and less expensive models (such as a produce prescription debit card for both fresh and frozen fruits and vegetables) appropriate for populations with a lower disease burden and greater capacity to prepare meals.

Evidence that FIM programs improve dietary quality is consistent, especially when implemented in ways that meet patient needs and preferences. A recent systematic review identified 14 RCTs of FIM interventions for non-communicable disease in the United States, 12 of which focused on patients with cardiometabolic disease.<sup>128</sup> Although most of these studies were early-stage RCTs (not efficacy testing in real-world settings, effectiveness testing, or implementation/dissemination stages), broadly they indicated inconsistent impacts on clinical outcomes. Since the publication of that systematic review, additional randomized studies have been conducted. For example, among 180 Black adults with elevated BP or hypertension, patients randomized to online ordering of DASH-sodium groceries in collaboration with a dietitian reduced systolic BP by 3.4 mm Hg (95% CI: −5.9 to −0.8 mm Hg;  $P=0.009$ ) and diastolic BP by 2.4 mm Hg (95% CI: −4.2 to −0.5 mm Hg), compared

with a control group receiving patient education materials and a nonrestricted financial stipend.<sup>129</sup> In another RCT of patients with a recent hospitalization for heart failure, food supplementation was feasible and well-accepted by patients, but failed to improve clinical outcomes.<sup>130</sup> In a recently conducted RCT among patients with heart failure living in the Navajo Nation, a culturally tailored, DASH-based medically tailored meal intervention reduced all-cause hospitalizations by 52% and heart failure hospitalizations by 71% compared with usual care.<sup>131</sup>

There is an ongoing need to determine which interventions are right for which patients at what time in their disease trajectory and for how long. However, increasing data from real-world studies suggest that FIM interventions can improve health outcomes and reduce utilization and costs when implemented at scale.<sup>132-134</sup> From the perspective of health care, FIM programs are often divided into two categories: those in which health care leads implementation and staffing, and those in which health care refers patients (through, for example, a “prescription” or a formal referral) to community organizations that are responsible for staffing and delivering the interventions. Examples of the former include food pantries located on-site in clinical settings, embedding Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) into clinical settings, or produce prescription cards offered by the health system. Examples of the latter include referrals to community-based or national medically tailored meal providers, or referrals to community food banks.

There are numerous challenges to broader dissemination of FIM interventions, including ensuring that food provided is palatable, culturally responsive, consistent with healthy dietary patterns, and appropriate for a patient’s specific comorbidities. In addition, there is uneven reimbursement for these programs across communities, health insurers, and health systems, with some states able to offer food and nutrition benefits through Medicaid 1115 or in lieu of service, some Medicare Advantage plans offering benefits for certain patient populations, and some commercial insurers opting to provide benefit coverage.

### Medical nutrition therapy

Although FIM programs improve access to healthy foods, individualized medical nutrition therapy (MNT) remains essential to support sustained behavior change and improve clinical outcomes for individual patients. The effectiveness of FIM programs can be enhanced by access to high-quality MNT. MNT refers to individualized, evidence-based nutrition intervention delivered by RDs<sup>135</sup> that supports the use of dietary strategies to prevent and manage chronic diseases. Beyond FIM, MNT

is a critical component of nutrition care for individuals at increased cardiometabolic risk. RDN-delivered MNT has consistently been shown to improve glycemic control, body weight, BP, and lipid profiles and is recommended as a core component of care for diabetes and other cardiometabolic diseases.<sup>97,136</sup>

Despite these benefits, access to MNT remains limited because of shortages of RDNs in some communities, inadequate referrals from health care providers, and insufficient insurance reimbursement for services. Although artificial intelligence (AI)-enabled MNT may expand access to MNT, there is still limited evidence of its efficacy in comparison to more traditional models with RDN-delivered counseling.<sup>137</sup>

#### Consensus recommendations: FIM programs

- There is increasing interest in providing nutritious food as a clinical intervention, often through FIM programs. These programs improve diet quality, and evidence is building that they improve clinical outcomes as well.
- Evidence-based nutrition education should be incorporated into FIM programs to enhance their long-term adherence and benefits.

#### 2025-2030 DGAs: addressing the confusion in clinical practice

While many recommendations in the recently released 2025-2030 DGA<sup>5</sup> are well supported by existing evidence, others remain controversial because of limited supporting evidence.<sup>138-140</sup> Recommendations to prioritize whole and minimally processed foods and limit UPFs, particularly SSBs and refined grains, are consistent with recent dietary guidance for cardiovascular health.<sup>141</sup> However, the report generated considerable debate regarding the substantially increased protein recommendation and the recommendation to prioritize “healthy fats,” which include olive oil as well as butter and beef tallow, despite retaining the recommendation to limit saturated fat intake.<sup>142,143</sup> Moreover, the emphasis on full-fat dairy and the inverted food pyramid that prominently features animal protein foods represent a marked departure from long-standing evidence-based guidance for cardiovascular health.<sup>144</sup> These recommendations have generated considerable debate among scientists and may create confusion among clinicians and the public.<sup>34,139,145</sup> This underscores the need for practical guidance on counseling patients about healthy dietary patterns. Recognizing these evidence gaps can help clinicians to provide scientifically sound dietary advice. Clinicians should promote evidence-based dietary patterns, such as the Mediterranean and DASH diets, and encourage patients to choose whole, minimally processed foods; read food

labels; limit added sugars, sodium, and saturated fat; and replace SSBs and processed snacks with healthier alternatives. Dietary counseling should be individualized, with the goal of improving overall diet quality while reducing the consumption of UPFs, particularly sugary beverages, refined grains, and processed meats.

#### Dietary protein recommendations

The 2025-2030 DGA recommend prioritizing high-quality protein at every meal and increasing protein intake to 1.2 to 1.6 grams of protein per kilogram of body weight per day, approximately 1.5 to 2.0 times the current Recommended Dietary Allowance (RDA) (0.8 g/kg body weight) for adults.<sup>146</sup> These recommendations are based primarily on a systematic review and meta-analysis of 30 RCTs that evaluated the effects of higher (1.2-1.6 g/kg body weight) versus lower protein diets (0.8-1.0 g/kg body weight) on weight-related outcomes (fat loss, preservation of lean mass, or improved weight-loss maintenance) in persons with overweight or obesity.<sup>147</sup> Although the majority of the studies reported improvements in at least one weight-related outcome, a high evidence grade was only assigned for small improvements in body fat. The rationale for including protein at each meal is to support muscle protein synthesis across life stages. These recommendations remain controversial because they are based largely on studies of weight management in individuals with overweight or obesity and, thus, may not be generalizable to the broader population. An Agency for Healthcare Research and Quality review found insufficient evidence that the protein requirement should routinely be increased based on age, health, or other lifestyle factors.<sup>148</sup> In addition, current evidence does not support recommending a uniform distribution of protein intake across meals to improve clinical outcomes.<sup>149</sup> Although higher protein intake may be appropriate for selected populations, current evidence supports an important role of protein sources, with plant protein generally associated with more favorable cardiometabolic outcomes. As discussed in the previous text, replacing red and processed meats with plant protein sources is consistently associated with lower risks of CVD, T2D, and mortality. PCS indicate that dietary patterns containing nonfried fish and seafood are associated with modestly lower risks of CVD.<sup>67,68</sup>

#### Dietary fat recommendations

The recommendation to limit saturated fat to <10% of total daily calories is consistent with previous editions of DGAs. However, simultaneously recommending full-fat dairy, butter and beef tallow, and greater consumption of animal protein foods is difficult to reconcile with this

target, as these foods are major sources of saturated fat. Although the 2025 Dietary Guidelines Advisory Committee concluded that evidence is insufficient to show that full-fat dairy increases the risk of cardiovascular morbidity or all-cause mortality, or that replacing full-fat dairy with low-fat dairy actively reduces these risks,<sup>150</sup> one consistent feature of a dietary pattern for cardiovascular health is that low-fat or fat-free dairy products are recommended rather than full-fat dairy products.<sup>6</sup> Moreover, dietary patterns that have higher unsaturated to saturated fat ratios (as would be the case when replacing full-fat dairy with nonfat and low-fat dairy) are associated with beneficial cardiovascular health. Finally, the omission from the 2025-2030 DGA recommendations for liquid plant oils high in unsaturated fats is concerning given the robust evidence that replacing saturated fat with unsaturated fats from plant oils was associated with a lower risk of CVD and total mortality.<sup>151,152</sup>

The recommendation to emphasize full-fat dairy (3 servings per day) in the 2025-2030 DGA remains controversial. Although some expert groups have concluded that regular fat and low-fat dairy products have similar associations with CVD risk,<sup>153</sup> evidence suggests that these associations vary by dairy product and the replacement food.<sup>34</sup> Full-fat milk has been associated with higher CHD risk, whereas cheese appears to be neutral or modestly protective.<sup>154</sup> Replacing dairy fat with polyunsaturated or vegetable fats is associated with lower CVD risk, whereas replacing dairy with red or processed meat is associated with increased CVD risk and mortality.<sup>34,155</sup> Substituting nuts and legumes for dairy products is also associated with a reduced risk of total and CVD mortality.<sup>156</sup> In addition, full-fat dairy products such as whole milk, cheese, and butter increase LDL-C levels compared with liquid vegetable oils.<sup>34</sup> Overall, current evidence does not support recommending full-fat dairy products or butter over low-fat dairy products and liquid plant oils for cardiovascular health.

Lactose intolerance is common in the United States and globally, particularly among Asian, African, Latin American, and Indigenous populations, which limits dairy consumption. Dietary guidance should therefore accommodate cultural preferences and lactose intolerance by including alternative sources of protein, calcium, and vitamin D including fortified plant-based beverages (eg, soy, oat, and almond milk).

#### Consensus recommendation: 2025-2030 DGA

- The 2025-2030 DGA are broadly aligned with current evidence supporting minimally processed foods and reduced intake of UPFs, especially SSBs. However,

recommendations regarding higher protein targets and greater emphasis on full-fat animal foods are not fully aligned with current evidence supporting replacement of saturated fats with unsaturated fats, particularly from plant sources.

## EVIDENCE GAPS AND FUTURE DIRECTIONS

### Strengthening the evidence base for nutrition and cardiovascular health

Despite substantial advances in nutritional sciences, important gaps remain in our understanding of the role of diet and nutrition for CVD prevention and management (Table 2). A major challenge is that large-scale, long-term RCTs of dietary interventions are often infeasible due to cost and compliance issues. Consequently, long-term PCS play a critical role by capturing habitual dietary exposures over decades, evaluating chronic disease outcomes that are impractical to study in trials, and assessing the cumulative effects of diet across the life course in diverse populations. Advances in dietary assessment methods, omics technologies, AI and machine learning methods, and the inclusion of global diverse populations will further strengthen the evidence base from cohort studies. AI may play a role in improving dietary assessment, identifying dietary patterns, predicting individual metabolic responses, and facilitating causal inference.<sup>157</sup> Synthesizing evidence from carefully conducted cohort studies, controlled feeding studies, large RCTs, and pragmatic trials when feasible, will be critical for developing dietary guidelines that are both scientifically rigorous and also relevant to real-world applications.<sup>158</sup>

### Dietary patterns and emerging dietary approaches

Although substantial evidence supports dietary patterns such as the Mediterranean and DASH diets in cardiometabolic health, questions remain regarding the adaptation of these patterns to diverse populations, cultures, health conditions, and socioeconomic status. Further studies are also needed to understand the long-term cardiovascular effects of emerging dietary approaches, including low-carbohydrate diets, ketogenic diets, IF, and plant-based alternatives to animal foods, in cardiometabolic disease prevention and management. Further research should also identify specific dietary strategies that are most effective for specific individuals and clinical populations for improving cardiometabolic health.

### UPFs and food quality

Although numerous epidemiologic studies have linked higher intake of UPFs and increased risks of obesity,

**TABLE 2** Research Gaps and Future Directions in Nutrition and Cardiovascular Health

| Domain                                        | Key Evidence Gaps                                                                                                                                                                             | Future Directions                                                                                                                                                                                                                        |
|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Strengthening the Evidence Base               | Long-term randomized trials of dietary interventions are often infeasible due to cost, adherence, and methodological challenges.                                                              | Integrate evidence from prospective cohort studies, controlled feeding studies, randomized trials, pragmatic trials, implementation science, and emerging causal inference methods to strengthen dietary recommendations.                |
| Dietary Patterns and Emerging Approaches      | Limited evidence on the long-term cardiovascular effects of emerging dietary approaches and their applicability across diverse populations.                                                   | Evaluate long-term adherence and health outcomes of various dietary patterns (eg, low-carbohydrate, ketogenic, intermittent fasting, plant-based, and culturally adapted dietary patterns) in diverse populations and clinical settings. |
| Ultra-Processed Foods and Food Quality        | Lack of a universally accepted definition of ultra-processed foods and uncertainty regarding the relative contributions of food processing, nutrient composition, additives, and food matrix. | Develop improved classification systems and investigate how food processing, nutritional quality, and food structure independently and jointly influence cardiometabolic health.                                                         |
| Precision Nutrition and Biological Mechanisms | Limited understanding of interindividual variability in dietary responses and underlying biological pathways.                                                                                 | Leverage metabolomics, proteomics, microbiome profiling, wearable technologies, and AI-enabled methods to improve dietary assessment, identify biomarkers, and develop personalized nutrition strategies.                                |
| Nutrition and Cardiometabolic Therapies       | Limited evidence on how dietary interventions should be combined with contemporary therapies such as GLP-1 RAs.                                                                               | Determine optimal dietary approaches that can be followed long-term to maximize weight loss, preserve lean mass, improve medication adherence, reduce side effects, and enhance long-term cardiovascular outcomes.                       |
| Implementation and Clinical Translation       | Persistent gaps in the integration of nutrition into health care systems and public health practice.                                                                                          | Expand nutrition assessment and counseling in clinical care, strengthen evidence for Food Is Medicine interventions, and evaluate scalable implementation strategies.                                                                    |
| Food Environment and Health Equity            | Social and environmental barriers limit adoption of healthy dietary patterns and contribute to disparities in cardiovascular health.                                                          | Evaluate policies and programs that improve food environments, reduce food insecurity, and increase equitable access to healthy foods across populations.                                                                                |

GLP-1 RA = glucagon-like peptide-1 receptor agonist.

diabetes, and CVD, many important questions remain. There is currently no universally accepted definition of UPFs, and existing classification systems may not consistently distinguish foods according to their nutrition quality or health effects. Because UPFs represent a highly heterogeneous category, with products differing substantially in nutrient composition, food matrix, additives, and nutrition quality, not all of them have equivalent effects on cardiometabolic health. Future studies should examine the independent and joint contributions of food processing, food matrix, nutrient composition, and specific additives to cardiometabolic health.

#### Precision nutrition and biological mechanisms

Advances in metabolomics, proteomics, microbiome research, AI, and other technologies such as wearable devices have created opportunities to improve dietary assessment and better understand the biological pathways linking diet and cardiometabolic health. Objective biomarkers can complement and overcome limitations of self-reported dietary data, improve disease predictions, and provide new insights into individual variability in response to dietary interventions.<sup>159</sup> Although these approaches may facilitate more effective and personalized nutrition recommendations for disease prevention and management, current evidence remains limited. Future studies should evaluate personalized nutrition approaches' clinical effectiveness, cost-effectiveness, and

implementation across diverse populations and health care settings.<sup>160</sup>

#### Integrating nutrition with cardiometabolic therapies such as GLP-1 RAs

Further research is needed to determine how dietary interventions can be integrated with contemporary cardiometabolic therapies such as GLP-1 RAs to optimize body composition, preserve muscle mass during weight loss, and enhance long-term cardiometabolic outcomes. Real-world evidence is needed to examine nutrition interventions that can help to reduce side effects and enhance long-term medication adherence to maximize the benefits of both lifestyle factors and medications when needed.<sup>161,162</sup>

#### IMPLEMENTATION AND TRANSLATION INTO CLINICAL PRACTICE AND POLICIES

Implementation of evidence-based dietary recommendations in clinical and public health settings remains a major challenge. Further efforts should focus on integrating nutrition assessment and counseling into routine clinical practice, expanding access to RDNs and other nutrition professionals, and strengthening the evidence base for FIM interventions.<sup>163</sup> Research should identify scalable and cost-effective implementation strategies that integrate nutrition care with routine clinical practice. Meanwhile, it is important to implement and

evaluate policies and programs aimed at improving food environments, including school meals, nutrition assistance programs, food labeling, taxation, and incentives for purchasing and consuming healthy foods, that can help support and sustain healthier dietary choices. Efforts to improve cardiovascular health should also address several major barriers of FIM implementations, including inadequate reimbursement, food insecurity and disparities in access to healthy foods, and insufficient nutrition education and training for physicians and other health care professionals.<sup>164</sup>

## CONCLUSIONS

Healthy diets remain a cornerstone of CVD prevention and management across the cardio-kidney-metabolic continuum. Cumulative evidence from RCTs, prospective cohorts, and mechanistic studies supports health benefits of several dietary strategies: replacing saturated fats with unsaturated fats; increasing intake of fiber-rich plant foods such as whole grains, legumes, nuts, and seeds; reducing sodium intake and consumption of UPFs, particularly SSBs and processed meats; choosing healthy sources of protein; and following established healthy

dietary patterns. Recent advances in precision nutrition, FIM programs, and obesity pharmacotherapies, including GLP-1 RAs, provide unprecedented opportunities to improve nutrition care and personalized dietary recommendations. More research and continued efforts are needed to strengthen the evidence base for dietary guidelines and clinical recommendations, improve nutrition education for health care professionals, integrate nutrition into routine clinical care, and address social drivers of health to improve the food environment and equitable access to healthy foods.

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**KEY WORDS** ACC scientific statement, cardiovascular disease, Dietary Guidelines for Americans, Mediterranean diet, nutrition, plant-forward diet, prevention

## APPENDIX 1. AUTHOR RELATIONSHIPS WITH INDUSTRY AND OTHER ENTITIES (RELEVANT): FOOD AND HEALTH: NUTRITION FOR PREVENTION AND MANAGEMENT OF CARDIOVASCULAR DISEASE: 2026 ACC SCIENTIFIC STATEMENT

| Committee Member          | Employment                                                                                                                                                                                                                                                            | Consultant                                                                             | Speakers Bureau | Ownership/ Partnership/ Principal | Personal Research | Institutional, Organizational, or Other Financial Benefit | Expert Witness                                                                                                          |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|-----------------|-----------------------------------|-------------------|-----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| Frank B. Hu, <i>Chair</i> | Harvard T.H. Chan School of Public Health—Frederick J. Stare Professor of Nutrition and Epidemiology; Chair, Department of Nutrition; Faculty Affiliate in the Department of Epidemiology; Harvard Medical School, Brigham and Women's Hospital—Professor of Medicine | None                                                                                   | None            | None                              | None              | None                                                      | None                                                                                                                    |
| Branko Beleslin           | University of Belgrade—Full Professor of Internal Medicine and Cardiology; Head, PhD Program Investigations in Cardiovascular Medicine; University Clinical Centre of Serbia—Head, Department of Functional Cardiovascular Diagnostics and Hemodynamics               | None                                                                                   | None            | None                              | None              | None                                                      | None                                                                                                                    |
| Michael J. Blaha          | Johns Hopkins University—Director of Clinical Research, Ciccarone Center for the Prevention of Cardiovascular Disease; Professor of Medicine, Cardiology and Epidemiology; Director, Cardiometabolic Clinic; Program Director, Preventive Cardiology Fellowship       | <ul style="list-style-type: none"> <li>• Eli Lilly</li> <li>• Novo Nordisk*</li> </ul> | None            | None                              | None              | None                                                      | <ul style="list-style-type: none"> <li>• Plaintiff, cholesterol, 2024*</li> <li>• Plaintiff, diabetes, 2024*</li> </ul> |
| Penny M. Kris-Etherton    | Penn State University—Distinguished Professor of Nutrition; Evan Pugh University Professor of Nutritional Sciences                                                                                                                                                    | <ul style="list-style-type: none"> <li>• Humann®*</li> </ul>                           | None            | None                              | None              | None                                                      | None                                                                                                                    |
| Hilary K. Seligman        | University of California, San Francisco—Professor, Departments of Medicine and Epidemiology and Biostatistics                                                                                                                                                         | None                                                                                   | None            | None                              | None              | None                                                      | None                                                                                                                    |
| Kim Allan Williams Sr     | University of Louisville—Professor of Medicine; Chair, Department of Medicine, Legacy Foundation of Kentuckiana Endowed Chair in Health Equity                                                                                                                        | None                                                                                   | None            | None                              | None              | None                                                      | None                                                                                                                    |

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\*Significant relationship.

ACC = American College of Cardiology.

APPENDIX 2. REVIEWER RELATIONSHIPS WITH INDUSTRY AND OTHER ENTITIES (COMPREHENSIVE):  
FOOD AND HEALTH: NUTRITION FOR PREVENTION AND MANAGEMENT OF CARDIOVASCULAR  
DISEASE: 2026 ACC SCIENTIFIC STATEMENT

| Reviewer                 | Employment                                                                                                                                                                          | Consultant                                                                                          | Speakers<br>Bureau | Ownership/<br>Partnership/<br>Principal | Personal<br>Research | Institutional,<br>Organizational, or<br>Other Financial<br>Benefit | Expert<br>Witness |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|--------------------|-----------------------------------------|----------------------|--------------------------------------------------------------------|-------------------|
| Alison L. Bailey         | West Virginia University Heart and Vascular Institute—<br>Vice Chair, Department of Cardiology                                                                                      | <ul style="list-style-type: none"><li>• Bristol<br/>Myers<br/>Squibb*</li><li>• Medtronic</li></ul> | None               | None                                    | None                 | None                                                               | None              |
| Alice H.<br>Lichtenstein | Tufts University—Stanley N. Gershoff Professor of<br>Nutrition Science and Policy; Senior Scientist and<br>Leader, Diet & Chronic Disease Prevention for Healthy<br>Aging Directive | None                                                                                                | None               | None                                    | None                 | None                                                               | None              |
| Pamela B.<br>Morris      | Medical University of South Carolina—Professor of<br>Medicine, Cardiology; Paul V. Palmer Chair of<br>Cardiovascular Disease Prevention                                             | None                                                                                                | None               | None                                    | None                 | None                                                               | None              |