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HEART-HEALTHY EATING: DIETARY APPROACHES TO PREVENTING AND MANAGING CARDIOVASCULAR DISEASE

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Abstract

Cardiovascular disease (CVD) remains the leading cause of mortality globally, with dietary factors playing a critical role in both its development and prevention. This comprehensive review examines evidence-based dietary approaches for preventing and managing cardiovascular disease, focusing on three primary dietary patterns with established cardiovascular benefits: the Mediterranean diet, the Dietary Approaches to Stop Hypertension (DASH) diet, and plant-based diets. The study explores the scientific evidence supporting each dietary pattern, their specific components that confer cardiovascular protection, and their effects on various cardiovascular risk factors. Additionally, it addresses the growing concerns about ultra-processed foods and examines the controversial role of low-carbohydrate and ketogenic diets in cardiovascular health. With the global burden of diabetes reaching 589 million adults in 2024 and projected to increase to 853 million by 2050, understanding the relationship between diet and cardiometabolic health has never been more critical. This review provides practical dietary recommendations for cardiovascular disease prevention and management, emphasizing that dietary approaches should be individualized, culturally appropriate, and sustainable for long-term adherence.

INTRODUCTION

Cardiovascular disease (CVD) continues to be the leading cause of morbidity and mortality worldwide, accounting for approximately one-third of all deaths globally (Tsao et al., 2022; Roth et al., 2020). Despite advances in medical therapies and interventions, the burden of CVD remains substantial, with an estimated 17.9 million deaths annually attributed to cardiovascular causes (Roth et al., 2020). This burden is particularly concerning given the rising prevalence of cardiometabolic risk factors such as diabetes, hypertension, and obesity across populations.

According to the International Diabetes Federation (IDF) Diabetes Atlas, approximately 589 million adults (aged 20-79 years) are living with diabetes worldwide as of 2024—representing one in nine adults. This number is projected to rise dramatically to 853 million by 2050, indicating a looming crisis in cardiometabolic health. Furthermore, diabetes was responsible for 3.4 million deaths in 2024—

equivalent to one death every 9 seconds—and caused at least USD 1 trillion in health expenditure, representing a 338% increase over the past 17 years.

Diet plays a pivotal role in both the development and prevention of CVD. The relationship between dietary patterns and cardiovascular health has been extensively studied over the past several decades, with substantial evidence supporting the beneficial effects of certain dietary approaches. The landmark Seven Countries Study, initiated by Ancel Keys in the 1950s, was among the first to identify the relationship between dietary patterns, specifically the Mediterranean diet, and reduced cardiovascular risk (Keys et al., 1984; Menotti & Puddu, 2015). Since then, numerous epidemiological studies, clinical trials, and meta-analyses have further elucidated the complex relationships between dietary components and cardiovascular outcomes.

Major cardiovascular guidelines, including those from the American College of Cardiology/American Heart Association (ACC/AHA) and the European Society of Cardiology (ESC), emphasize the importance of dietary modifications as a cornerstone of cardiovascular disease prevention (Arnett et al., 2019; Visseren et al., 2021). These guidelines advocate for heart-healthy dietary patterns characterized by high consumption of fruits, vegetables, whole grains, legumes, and nuts; moderate consumption of fish and lean poultry; and limited intake of red meat, processed foods, and added sugars.

This review aims to provide a comprehensive examination of evidence-based dietary approaches for preventing and managing cardiovascular disease, with a focus on three primary dietary patterns that have demonstrated cardiovascular benefits: the Mediterranean diet, the Dietary Approaches to Stop Hypertension (DASH) diet, and plant-based diets. Additionally, we will explore the evidence regarding ultra-processed foods and examine the controversial role of low-carbohydrate and ketogenic diets in cardiovascular health. By synthesizing the current evidence, this review seeks to provide practical dietary recommendations for cardiovascular disease prevention and management.

The Mediterranean Diet: A Time-Tested Approach

Historical Perspective and Definition

The Mediterranean diet emerged from observations of dietary patterns in Mediterranean countries, particularly Greece, Italy, and Spain, during the mid-20th century. The Seven Countries Study, led by Ancel Keys, was instrumental in bringing attention to the cardiovascular benefits of this dietary pattern after observing lower rates of coronary heart disease in Mediterranean populations compared to those in Northern Europe and the United States (Keys et al., 1984; Menotti & Puddu, 2015).

The traditional Mediterranean diet is characterized by:

- High consumption of olive oil (the primary source of fat)
- Abundant intake of plant foods (fruits, vegetables, legumes, nuts, and whole grains)
- Moderate consumption of fish and seafood
- Limited intake of dairy products (primarily cheese and yogurt)
- Low consumption of red meat and processed meats
- Moderate wine consumption, typically with meals
- Minimal intake of processed foods and added sugars

Beyond its nutritional components, the Mediterranean diet also encompasses cultural elements such as conviviality, shared meals, and physical activity (de la Torre-Moral et al., 2021). This holistic approach to eating and lifestyle has contributed to its sustainability and long-term health benefits.

Scientific Evidence Supporting Cardiovascular Benefits

The Mediterranean diet has been extensively studied for its cardiovascular benefits, with strong evidence from both observational studies and randomized controlled trials.

Observational Studies

Numerous prospective cohort studies have demonstrated associations between adherence to the Mediterranean diet and reduced cardiovascular risk. The Greek EPIC study found that greater adherence to the Mediterranean diet was associated with a 25% reduction in total mortality and a 33% reduction in coronary heart disease mortality (Trichopoulou et al., 2003). Similarly, the STABILITY trial, which included participants from 39 countries with stable coronary heart disease, found that higher Mediterranean diet scores were associated with lower risk of major adverse cardiovascular events (Stewart et al., 2016).

Recent evidence also suggests potential benefits of the Mediterranean diet in specific populations and conditions. For instance, a study using the Boston Birth Cohort found that higher Mediterranean diet adherence was associated with reduced risk of preeclampsia, particularly among Black women (Minhas et al., 2022).

Randomized Controlled Trials

The Lyon Diet Heart Study was one of the first major randomized controlled trials to demonstrate the cardioprotective effects of a Mediterranean-type diet. This secondary prevention trial found a 50-70% reduction in recurrent cardiac events among participants following a Mediterranean diet compared to those following a prudent Western-type diet (de Lorgeril et al., 1999).

The Prevención con Dieta Mediterránea (PREDIMED) study, a landmark primary prevention trial, provided robust evidence of the Mediterranean diet's cardiovascular benefits. This multicenter trial randomized 7,447 participants at high cardiovascular risk to one of three diets: Mediterranean diet supplemented with extra-virgin olive oil, Mediterranean diet supplemented with mixed nuts, or a control diet (advice to reduce fat intake). After a median follow-up of 4.8 years, both Mediterranean diet groups showed approximately a 30% reduction in the primary composite endpoint of myocardial infarction, stroke, or death from cardiovascular causes (Estruch et al., 2018).

The PREDIMED study also demonstrated beneficial effects of the Mediterranean diet on various cardiovascular risk factors and conditions, including:

- Type 2 diabetes: 52% reduction in incidence among participants without diabetes at baseline (Salas-Salvado et al., 2011)
- Heart failure: favorable effects on biomarkers of heart failure, including brain natriuretic peptide and oxidized LDL (Fito et al., 2014)
- Hypertension: reduced systolic and diastolic blood pressure (Martinez-Gonzalez et al., 2015)
- Inflammation: reduced levels of inflammatory markers such as C-reactive protein and interleukin-6 (Llorente-Cortes et al., 2010)

Key Components and Mechanisms of Cardioprotection

Several components of the Mediterranean diet contribute to its cardioprotective effects through various mechanisms:

Olive Oil

Extra-virgin olive oil is a cornerstone of the Mediterranean diet and provides numerous cardiovascular benefits. A meta-analysis of prospective cohort studies found that olive oil consumption was associated with a 19% reduction in cardiovascular disease risk and a 17% reduction in all-cause mortality (Xia et al., 2022). The cardioprotective effects of olive oil are attributed to its high content of monounsaturated fatty acids and various bioactive compounds, including polyphenols, which have antioxidant, anti-inflammatory, and endothelial-protective properties.

Plant Foods

The abundant consumption of fruits, vegetables, legumes, nuts, and whole grains in the Mediterranean diet provides a rich source of dietary fiber, antioxidants, and phytochemicals. These components contribute to cardiovascular health through multiple mechanisms, including:

- Improvement in lipid profiles (reduced LDL cholesterol and triglycerides)
- Reduction in blood pressure
- Enhancement of endothelial function
- Modulation of inflammation and oxidative stress
- Beneficial effects on gut microbiota composition and function

The gut microbiota has emerged as an important mediator of the relationship between diet and cardiovascular health. Plant foods in the Mediterranean diet provide prebiotic fibers that promote the growth of beneficial gut bacteria, which in turn produce short-chain fatty acids with anti-inflammatory and metabolic benefits (Cronin et al., 2021). Additionally, the Mediterranean diet may reduce the production of trimethylamine N-oxide (TMAO), a gut microbiota-derived metabolite associated with increased cardiovascular risk (Witkowski et al., 2020).

Fish and Omega-3 Fatty Acids

Regular consumption of fish, particularly fatty fish rich in omega-3 polyunsaturated fatty acids (eicosapentaenoic acid [EPA] and docosahexaenoic acid [DHA]), is associated with reduced cardiovascular risk. Omega-3 fatty acids exert cardioprotective effects through multiple mechanisms, including anti-inflammatory actions, improvement in lipid profiles, reduction in platelet aggregation, and antiarrhythmic effects.

Wine and Alcohol

Moderate wine consumption, typically with meals, is a traditional component of the Mediterranean diet. Observational studies suggest that moderate alcohol intake, particularly wine, may be associated with reduced cardiovascular risk compared to abstention or heavy consumption. However, this relationship is complex and influenced by genetic factors, drinking patterns, and other lifestyle variables. Current

guidelines do not recommend initiating alcohol consumption for cardiovascular benefits due to potential risks and the availability of other effective preventive strategies.

The DASH Diet: Targeting Hypertension and Beyond

Development and Principles

The Dietary Approaches to Stop Hypertension (DASH) diet was developed specifically to address hypertension, a major risk factor for cardiovascular disease. Unlike the Mediterranean diet, which evolved from traditional cultural practices, the DASH diet was designed through systematic clinical research funded by the National Heart, Lung, and Blood Institute.

The DASH diet emphasizes:

- High consumption of fruits and vegetables (8-10 servings per day)
- Inclusion of low-fat dairy products (2-3 servings per day)
- Whole grains, poultry, fish, and nuts
- Limited intake of red meat, sweets, and sugar-sweetened beverages
- Reduced sodium intake

While sharing some similarities with the Mediterranean diet, the DASH diet places more emphasis on low-fat dairy products and typically includes less olive oil and wine.

Evidence for Blood Pressure Reduction and Cardiovascular Benefits

The efficacy of the DASH diet in reducing blood pressure was first demonstrated in the landmark DASH trial published in 1997 (Appel et al., 1997). This multicenter, randomized controlled feeding trial compared three dietary patterns: a control diet typical of American consumption, a diet rich in fruits and vegetables, and the DASH diet. After eight weeks, the DASH diet reduced systolic blood pressure by an average of 5.5 mmHg and diastolic blood pressure by 3.0 mmHg more than the control diet, with more pronounced effects observed in participants with hypertension.

The subsequent DASH-Sodium trial examined the combined effects of the DASH diet and sodium reduction (Sacks et al., 2001). This trial demonstrated additive blood pressure-lowering effects when sodium restriction was combined with the DASH diet, with the largest reductions observed in participants following the DASH diet with the lowest sodium intake (1,500 mg/day).

Beyond its established efficacy in blood pressure reduction, the DASH diet has demonstrated broader cardiovascular benefits. A comprehensive umbrella review of systematic reviews and meta-analyses found that the DASH diet was associated with improved cardiometabolic outcomes, including reduced risk of cardiovascular disease, coronary heart disease, stroke, and type 2 diabetes (Chiavaroli et al., 2019). Additionally, the Multi-Ethnic Study of Atherosclerosis reported that higher adherence to the DASH diet was associated with a lower risk of heart failure (Campos et al., 2019).

Recent research has also explored the effects of the DASH diet on cardiovascular outcomes beyond blood pressure. A randomized controlled trial by Henzel et al. (2021) found that an intensive lifestyle intervention incorporating the DASH diet led to regression of high-risk coronary plaque in patients with nonobstructive coronary disease, suggesting direct beneficial effects on atherosclerosis.

Implementation and Adaptations

The DASH diet has been implemented in various settings and adapted to different populations. Kucharska et al. (2018) demonstrated that individualized nutritional therapy based on the DASH diet led to significant reductions in blood pressure, body weight, and improvements in metabolic parameters in overweight/obese patients with primary hypertension.

For practical implementation, the DASH diet can be adapted to various cultural preferences and dietary habits while maintaining its core principles. Filippou et al. (2022) reviewed approaches to salt restriction in both the DASH and Mediterranean diets, providing practical strategies for reducing sodium intake while preserving palatability and adherence.

In heart failure management, the DASH diet has been integrated into comprehensive dietary approaches. Wickman et al. (2021) proposed a precision nutrition perspective that incorporates DASH principles while addressing the specific nutritional needs and restrictions of heart failure patients, such as sodium and fluid management.

Plant-Based Diets: From Vegetarian to Flexitarian Approaches

Spectrum of Plant-Based Diets

Plant-based diets encompass a spectrum of dietary patterns that emphasize foods derived from plants while limiting or excluding animal products. This spectrum includes:

- Vegan diets: Exclude all animal products, including meat, dairy, eggs, and honey
- Lacto-ovo vegetarian diets: Exclude meat and fish but include dairy products and eggs
- Pescatarian diets: Include fish but exclude other meats

- Flexitarian or semi-vegetarian diets: Predominantly plant-based but include small amounts of animal products

Plant-based diets can vary considerably in their nutritional quality depending on food choices. Satija et al. (2017) distinguished between healthful and unhealthful plant-based diets based on the types of plant foods consumed. Healthful plant-based diets emphasize whole grains, fruits, vegetables, nuts, legumes, and vegetable oils, while unhealthful plant-based diets may include refined grains, fruit juices, potatoes, sugar-sweetened beverages, and sweets.

Cardiovascular Benefits and Mechanisms

A growing body of evidence supports the cardiovascular benefits of plant-based diets. A meta-analysis by Jabri et al. (2021) found that vegetarian diets were associated with a 16% reduction in ischemic heart disease risk and a 7% reduction in all-cause mortality compared to non-vegetarian diets.

The Adventist Health Study-2, a large prospective cohort study, found that vegetarian dietary patterns were associated with lower all-cause mortality compared to non-vegetarian diets, with the most favorable outcomes observed for pesco-vegetarians (Orlich et al., 2013). In the same cohort, vegetarian diets were associated with more favorable cardiovascular risk factors, including lower BMI, blood pressure, and fasting blood glucose (Matsumoto et al., 2019).

More recently, the CARDIA study found that young adults with higher adherence to a plant-centered diet had a lower risk of cardiovascular disease during 32 years of follow-up (Choi et al., 2021). Notably, this study assessed plant-centered diets rather than strict vegetarianism, suggesting that a predominantly plant-based approach may confer cardiovascular benefits even with some inclusion of animal products.

Several mechanisms contribute to the cardiovascular benefits of plant-based diets:

Dietary Fiber

Plant-based diets are naturally high in dietary fiber, which has been associated with numerous cardiovascular benefits. Smith and Tucker (2011) reviewed clinical trials on cereal fiber and found consistent beneficial effects on insulin sensitivity, blood pressure, and lipid profiles. Additionally, dietary fiber promotes satiety and may aid in weight management (Howarth et al., 2001), an important factor in cardiovascular risk reduction.

Plant Proteins and Phytochemicals

Plant proteins, particularly from legumes, nuts, and whole grains, have favorable effects on lipid profiles compared to animal proteins. Additionally, plant foods contain various phytochemicals with antioxidant and anti-inflammatory properties that may contribute to cardiovascular protection.

Reduced Saturated Fat and Absence of Dietary Cholesterol

Plant-based diets are typically lower in saturated fat and devoid of dietary cholesterol (in vegan diets), which may contribute to improved lipid profiles. A meta-analysis by Yokoyama et al. (2014) found that vegetarian diets were associated with lower blood pressure compared to omnivorous diets, with more pronounced effects observed for vegan diets.

Anti-Inflammatory Effects

Plant-based diets may reduce systemic inflammation, a key contributor to atherosclerosis. Shah et al. (2018) conducted a randomized controlled trial comparing a vegan diet to the American Heart Association-recommended diet in patients with coronary artery disease and found that the vegan diet led to greater reductions in high-sensitivity C-reactive protein, a marker of inflammation.

Metabolic Benefits

Plant-based diets have demonstrated beneficial effects on metabolic parameters. In the Adventist Health Study-2, vegetarian dietary patterns were associated with a lower prevalence of metabolic syndrome compared to non-vegetarian diets (Rizzo et al., 2011). Similarly, in the SUN cohort, a provegetarian food pattern was associated with reduced risk of overweight and obesity (Gomez-Donoso et al., 2019).

Nutritional Considerations and Practical Implementation

While plant-based diets offer numerous cardiovascular benefits, attention to nutritional adequacy is essential, particularly for more restrictive patterns such as vegan diets. Craig et al. (2021) provided guidelines for the safe and effective use of plant-based diets, addressing potential nutritional concerns such as protein, vitamin B12, iron, zinc, calcium, omega-3 fatty acids, and vitamin D.

For practical implementation, a flexitarian or semi-vegetarian approach may be more acceptable and sustainable for many individuals. The PREDIMED study found that a provegetarian food pattern (not necessarily strict vegetarianism) was associated with reduced mortality (Martinez-Gonzalez et al., 2014), suggesting that even modest shifts toward more plant foods can yield health benefits.

Specific plant foods with notable cardiovascular benefits include:

- Fruits and vegetables: A meta-analysis of 26 cohort studies found that higher fruit and vegetable intake was associated with lower cardiovascular mortality, with the strongest associations observed for leafy green vegetables, citrus fruits, and berries (Wang et al., 2021)
- Whole grains: A dose-response meta-analysis found that three servings (90g) of whole grains per day was associated with a 19% reduction in cardiovascular disease risk (Aune et al., 2016a)
- Nuts: Regular nut consumption has been consistently associated with reduced cardiovascular risk, with a meta-analysis finding that one serving of nuts per day was associated with a 29% reduction in coronary heart disease risk (Aune et al., 2016b)

Ultra-Processed Foods: A Modern Cardiovascular Threat

Definition and Prevalence

Ultra-processed foods are industrial formulations made predominantly from substances extracted from foods (e.g., oils, fats, sugar, starch), derived from food constituents (e.g., hydrogenated fats, modified starch), or synthesized in laboratories (e.g., flavor enhancers, colors). The NOVA classification system, developed by researchers at the University of São Paulo, categorizes foods into four groups based on the extent and purpose of processing, with ultra-processed foods comprising the fourth group (Monteiro et al., 2018).

Examples of ultra-processed foods include:

- Packaged snacks and desserts
- Reconstituted meat products (e.g., nuggets, fish sticks)
- Instant noodles and soups
- Ready-to-heat meals
- Carbonated soft drinks and sweetened beverages
- Many breakfast cereals

The consumption of ultra-processed foods has increased dramatically in recent decades, particularly in high-income countries but increasingly in middle- and low-income countries as well. These foods often displace minimally processed, nutrient-dense foods in the diet, contributing to poor nutritional quality.

Cardiovascular Risks and Mechanisms

Growing evidence links ultra-processed food consumption to adverse cardiovascular outcomes. In the Framingham Offspring Study, each daily serving of ultra-processed food was associated with a 7% increase in cardiovascular disease risk (Juul et al., 2021). Similarly, the SUN cohort found that higher consumption of ultra-processed foods was associated with increased all-cause mortality (Rico-Campa et al., 2019).

Several mechanisms may explain the adverse cardiovascular effects of ultra-processed foods:

Poor Nutritional Composition

Ultra-processed foods are typically high in calories, added sugars, saturated and trans fats, and sodium, while being low in fiber, protein, and micronutrients. This unfavorable nutritional profile contributes to various cardiovascular risk factors, including obesity, dyslipidemia, hypertension, and insulin resistance.

Hyperpalatability and Overconsumption

Ultra-processed foods are designed to be highly palatable, often leading to overconsumption. A randomized controlled trial by Hall et al. (2019) found that participants consumed approximately 500 more calories per day when presented with an ultra-processed diet compared to an unprocessed diet, resulting in weight gain over just two weeks.

Food Additives and Processing Contaminants

Ultra-processed foods contain various additives (e.g., emulsifiers, preservatives, artificial sweeteners) and may contain contaminants formed during processing (e.g., acrylamide, heterocyclic amines). Some of these substances have been associated with adverse metabolic effects, inflammation, and disruption of the gut microbiota, potentially contributing to cardiovascular risk.

Displacement of Healthful Foods

High consumption of ultra-processed foods typically displaces more healthful, minimally processed foods in the diet. This displacement effect results in lower intake of beneficial nutrients and bioactive compounds found in whole foods, further contributing to cardiovascular risk.

Recommendations for Reducing Ultra-Processed Food Consumption

Given the mounting evidence linking ultra-processed foods to adverse cardiovascular outcomes, reducing their consumption is an important dietary strategy for cardiovascular health. Practical recommendations include:

- Emphasizing whole, minimally processed foods as the foundation of the diet
- Reading food labels to identify ultra-processed foods (long ingredient lists with unfamiliar substances are a red flag)

- Cooking meals at home using basic ingredients when possible
- Gradually replacing ultra-processed snacks with whole food alternatives (e.g., fruits, nuts, plain yogurt)
- Being mindful of beverage choices, particularly sugar-sweetened beverages
- Planning meals and snacks in advance to reduce reliance on convenient ultra-processed options

Low-Carbohydrate and Ketogenic Diets: Weighing the Evidence

Definitions and Variations

Low-carbohydrate diets restrict carbohydrate intake to varying degrees, typically while increasing protein and/or fat consumption. These diets exist on a spectrum:

- Moderate low-carbohydrate diets: Typically 26-45% of calories from carbohydrates
- Low-carbohydrate diets: Typically 10-25% of calories from carbohydrates
- Very-low-carbohydrate ketogenic diets (VLCKD): Typically <10% of calories from carbohydrates (<50g/day), leading to nutritional ketosis

Ketogenic diets are characterized by severe carbohydrate restriction, moderate protein intake, and high fat consumption, resulting in the production of ketone bodies (acetoacetate, beta-hydroxybutyrate, and acetone) that serve as alternative fuel sources for the brain and other tissues.

Weight Loss and Metabolic Effects

Low-carbohydrate and ketogenic diets have gained popularity primarily for weight loss and management of certain metabolic conditions. Several meta-analyses have compared low-carbohydrate diets to low-fat diets for weight loss:

- Bueno et al. (2013) found that VLCKDs achieved greater weight loss and improvements in certain cardiovascular risk factors (triglycerides, HDL cholesterol) compared to low-fat diets over 12 months or longer
- Mansoor et al. (2016) reported greater weight loss and HDL increases with low-carbohydrate diets, but also noted greater increases in LDL cholesterol
- Sackner-Bernstein et al. (2015) found that low-carbohydrate diets were more effective than low-fat diets for weight loss and reducing predicted cardiovascular risk

The mechanisms by which low-carbohydrate diets promote weight loss include:

- Increased satiety and reduced spontaneous food intake (Johnstone et al., 2008)
- Potential metabolic advantages through reduced insulin secretion
- Higher energy expenditure, though this remains controversial
- Simplification of dietary choices, potentially leading to reduced total calorie intake

Beyond weight loss, ketogenic diets have shown promise for specific medical conditions, including epilepsy (D'Andrea Meira & Romao, 2019), certain neurodegenerative disorders (Pinto et al., 2018), and type 2 diabetes (Hallberg et al., 2018). A systematic review by Tinguely et al. (2021) concluded that ketogenic diets can effectively reduce HbA1c, fasting glucose, and the need for diabetes medications in patients with type 2 diabetes. Similarly, a meta-analysis by Choi et al. (2020) found that ketogenic diets improved glycemic control and other metabolic parameters in patients with obesity or overweight, with or without type 2 diabetes.

Cardiovascular Concerns and Controversies

Despite potential benefits for weight loss and certain metabolic parameters, concerns remain regarding the long-term cardiovascular effects of low-carbohydrate and ketogenic diets, particularly those high in saturated fat.

Several studies have reported increases in LDL cholesterol with ketogenic diets. A randomized controlled feeding trial in healthy, young, normal-weight women found that a ketogenic diet increased LDL cholesterol by 44% compared to a control diet (Buren et al., 2021). Similarly, Retterstol et al. (2018) observed significant increases in LDL cholesterol with a low-carbohydrate, high-fat diet in normal-weight young adults.

The cardiovascular effects of low-carbohydrate diets likely depend on several factors:

Macronutrient Composition

The specific foods used to replace carbohydrates (i.e., the types of proteins and fats) may influence cardiovascular outcomes. Low-carbohydrate diets emphasizing plant proteins and unsaturated fats may have more favorable cardiovascular effects compared to those high in animal proteins and saturated fats.

Individual Variability

Genetic factors, baseline metabolic health, and other individual characteristics may influence responses to low-carbohydrate diets. Some individuals may experience adverse lipid changes with high saturated fat intake, while others may be less susceptible.

Duration and Sustainability

Short-term studies may not capture the long-term cardiovascular effects of low-carbohydrate diets. Additionally, the sustainability of these diets in real-world settings is a critical consideration for long-term health outcomes.

Overall Dietary Quality

The quality of foods consumed within a low-carbohydrate framework is important. Diets based on processed meats, full-fat dairy, and limited plant foods may have different effects than those incorporating non-starchy vegetables, nuts, seeds, and fatty fish.

Given these considerations, Goldberg et al. (2021) emphasized that ketogenic diets are "not for everyone" and outlined potential contraindications, including certain medical conditions, pregnancy, and individuals with elevated LDL cholesterol. The National Lipid Association's scientific statement on low-carbohydrate diets concluded that these diets are effective for short-term weight loss and may improve triglycerides and HDL cholesterol but may also increase LDL cholesterol in some individuals (Kirkpatrick et al., 2019).

For individuals choosing to follow low-carbohydrate diets, Kirkpatrick and Willard (2022) recommend:

- Regular lipid monitoring
- Emphasis on unsaturated rather than saturated fats
- Inclusion of non-starchy vegetables and berries
- Consideration of a more moderate carbohydrate restriction if adverse lipid changes occur

Practical Dietary Recommendations for Cardiovascular Health

Core Principles Across Dietary Patterns

Despite differences among the dietary patterns discussed, several core principles for cardiovascular health emerge:

1. **Emphasize plant foods**: All evidence-based heart-healthy diets prioritize vegetables, fruits, whole grains, legumes, nuts, and seeds.
2. **Choose healthful fats**: Replace saturated and trans fats with unsaturated fats (mono- and polyunsaturated), particularly from sources like olive oil, avocados, nuts, and fatty fish.
3. **Limit added sugars and refined carbohydrates**: Minimize consumption of sugar-sweetened beverages, sweets, and refined grain products.
4. **Reduce sodium intake**: Limit processed foods high in sodium and use herbs, spices, and other flavorings in place of salt when cooking.
5. **Moderate protein intake**: Choose predominantly plant proteins (legumes, nuts, seeds) and fish, with limited amounts of other animal proteins.
6. **Minimize ultra-processed foods**: Prioritize whole, minimally processed foods whenever possible.
7. **Practice portion control**: Even healthful foods can contribute to weight gain and metabolic disturbances when consumed in excess.

Individualization and Cultural Considerations

While evidence-based dietary patterns provide a useful framework, individual needs, preferences, and cultural considerations are essential for successful dietary change. Factors to consider include:

- **Personal health status**: Existing medical conditions, medications, and specific nutritional needs may necessitate dietary modifications.
- **Food preferences and cultural traditions**: Dietary recommendations should respect and incorporate cultural food traditions when possible.
- **Food access and socioeconomic factors**: Practical recommendations must consider financial constraints and food availability.
- **Cooking skills and time constraints**: Successful dietary changes often require practical strategies for meal planning and preparation.

Integration with Overall Lifestyle

Diet is one component of a comprehensive approach to cardiovascular health. The American Heart Association's "Life's Essential 8" framework (Lloyd-Jones et al., 2022) integrates diet with other key factors for cardiovascular health:

1. Eat better
2. Be more active
3. Quit tobacco
4. Get healthy sleep
5. Maintain a healthy weight
6. Control cholesterol
7. Manage blood sugar

8. Manage blood pressure

Dietary changes are more likely to be successful when implemented as part of a broader lifestyle approach that includes regular physical activity, stress management, adequate sleep, and social support.

CONCLUSION

The evidence strongly supports the role of dietary patterns in preventing and managing cardiovascular disease. The Mediterranean diet, DASH diet, and plant-based diets all offer scientifically validated approaches to reducing cardiovascular risk, with somewhat different emphases but many shared principles. These dietary patterns contrast sharply with typical Western diets high in ultra-processed foods, added sugars, and unhealthy fats, which contribute to the global burden of cardiovascular disease.

The choice among evidence-based dietary patterns should be guided by individual preferences, cultural considerations, and specific health needs. Regardless of the specific approach, the transition toward more plant-based, minimally processed foods and away from ultra-processed options represents a common thread in cardiovascular-protective eating patterns.

While low-carbohydrate and ketogenic diets may offer benefits for weight loss and certain metabolic conditions, concerns remain regarding their long-term cardiovascular effects, particularly for versions high in saturated fat. Individuals following these diets should be monitored for adverse lipid changes and other potential cardiovascular effects.

As the global burden of diabetes continues to rise—affecting 589 million adults worldwide in 2024 and projected to reach 853 million by 2050—the importance of dietary approaches for cardiometabolic health has never been more critical. The integration of evidence-based dietary patterns into clinical practice and public health strategies represents a powerful tool for addressing the global epidemic of cardiovascular disease.

Future research should continue to refine our understanding of dietary patterns and cardiovascular health, with particular attention to long-term outcomes, individual variability in responses, and strategies to improve adherence and implementation across diverse populations. Additionally, the growing field of precision nutrition holds promise for more personalized dietary recommendations based on genetic, metabolic, and microbiome profiles.

Ultimately, the most effective dietary approach for cardiovascular health is one that is evidence-based, culturally appropriate, and sustainable for the individual—creating a foundation for lifelong heart-healthy eating habits.

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