

# Controversial Dietary Patterns: A High Yield Primer for Clinicians



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## ABSTRACT

In cardiology clinic visits, the discussion of optimal dietary patterns for prevention and management of cardiovascular disease is usually very limited. Herein, we explore the benefits and risks of various dietary patterns, including intermittent fasting, low carbohydrate, Paleolithic, whole food plant-based diet, and Mediterranean dietary patterns within the context of cardiovascular disease to empower clinicians with the evidence and information they need to maximally benefit their patients.

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## INTERMITTENT FASTING

Intermittent fasting is an umbrella term for various fasting regimens, including time-restricted feeding, alternate-day fasting, and the 5:2 (5 days normal eating and 2 days fasting) diet, all of which incorporate short-term fasts as a means of decreasing calories for weight loss or improving health.<sup>1,2</sup> Human studies investigating intermittent fasting are limited in number and duration, with most data derived from animal studies.<sup>3,4</sup>

In a review of randomized controlled trials (RCTs) comparing intermittent fasting with continuous energy restriction in adults with overweight or obesity, both interventions were associated with modest amounts of weight loss without significant differences between the 2 strategies.<sup>5</sup> Improvements in lipids and fasting glucose with intermittent fasting were modest and similar to those observed with continuous energy restriction, suggesting that weight loss contributed to the improvements in cardiometabolic risk factors.<sup>5</sup> The most recent RCT was a 12-week study comparing time-restricted feeding (eating 12 PM–8 PM) to consistent meal-timing (3 structured meals per day) in men and women aged 18 to 64 years with elevated body mass index (27–43 kg/m<sup>2</sup>). There were no significant differences between groups with regard to weight loss, lean mass, hemoglobin (Hb)A1c, fasting glucose, fasting insulin, and total energy intake.<sup>6</sup> Of note, however, is the potential concern that blood sugar variations when pursuing intermittent fasting (hypoglycemia with fasting and hyperglycemia with eating) might lead to microvascular and macrovascular complications with pre-existing diabetes.<sup>7</sup>

### Bottom Line

Studies suggest that intermittent fasting may be helpful for weight loss, but no more than continuous energy restriction. At the current time, there is a paucity of evidence to specifically recommend intermittent fasting.<sup>8</sup>

## LOW-CARBOHYDRATE AND KETOGENIC DIETS

Low-carbohydrate diets, very low-carbohydrate diets, and ketogenic diets typically restrict intake of carbohydrates to about 20% or less of total dietary energy per day and emphasize higher intakes of fat (up to 80% of total calories). In true ketogenic diets, initially utilized for seizure control in pediatric patients, ketone bodies become the primary energy source for the brain. In these diets, protein intake must be kept to 1.5 g/kg (or less) of body weight, as several amino acids are glucogenic and thus, would reverse ketosis.

Although animal food-based very low-carbohydrate/ketogenic diets are promoted for weight loss and reversal of diabetes, no long-term RCTs exist. In addition, the risk of nutrient imbalances, adverse lipid effects (eg, low-density lipoprotein [LDL] cholesterol elevation), and other health consequences have raised concerns over their use.<sup>9</sup>

Over a span of 2–6 months, in overweight/obese patients with diabetes, hypocaloric low-carbohydrate, higher-fat diets lead to greater weight loss vs hypocaloric higher-carbohydrate, lower-fat diets, as well as improvements in glycemia and triglycerides. However, data show that additional weight loss benefits of very low-carbohydrate diets are not maintained beyond 6 months.<sup>9</sup> Very low-carbohydrate diets also exclude most fruits, legumes, and whole grains; foods associated with reduced cardiometabolic and cancer risks.<sup>9</sup> Accordingly, animal food-based very low-carbohydrate/ketogenic diets have been associated with increased mortality from cardiovascular disease, cancer, and all causes.<sup>9–11</sup>

Although no long-term RCTs of very low-carbohydrate/ketogenic diets exist, recent data from prospective cohort studies have provided insight into the long-term effects of these diets. A meta-analysis of combined data from the Atherosclerosis Risk in Communities (ARIC) study and 7 multinational prospective cohort studies (n = 432,179) reported that both low-carbohydrate intake (<40% daily energy intake) and high-carbohydrate intake (>70% daily energy intake, a bulk of which is refined carbohydrates) were associated with higher risk of mortality (20% and 23%, respectively).<sup>12</sup> The lowest risk of mortality was reported when calories from carbohydrates accounted for 50%–55% of daily energy intake.<sup>12</sup> However, the source of the remaining macronutrients (protein and fat) in the diet may also make a difference. When animal-based protein or animal-based fat was substituted for carbohydrate, the risk of mortality increased. Conversely, when plant-based protein or plant-based fat was substituted for carbohydrate, the risk of mortality was decreased.<sup>12,13</sup>

### Bottom Line

Very low-carbohydrate/ketogenic diets induce weight loss in the short term (<6 months), but not in the long term. Moreover, although triglycerides are improved, LDL cholesterol may increase. In addition, data from prospective cohort studies have raised concerns about the long-term health consequences of low-carbohydrate diets, including increased cardiovascular disease and cancer mortality.<sup>9,13</sup> Overall, the use of these diets in the majority of patients is not supported by current evidence.<sup>9,13</sup>

## CLINICAL SIGNIFICANCE

- There is a lack of understanding of dietary patterns that are beneficial in cardiovascular disease, and physicians are providing their patients with varied and disparate information.
- Patients are often left unclear about what to eat and how to improve their health.
- This paper discusses intermittent fasting, low carbohydrate, Paleolithic, whole food plant-based diet, and Mediterranean dietary patterns within the context of cardiovascular disease to empower clinicians with the evidence and information they need to maximize benefit their patients.

## THE PALEOLITHIC OR PALEO DIET

The Paleolithic (Paleo) diet is a low-carbohydrate diet that mimics the dietary patterns of hunter-gatherers. While there is a wide variation in the macronutrient distribution within the Paleo diet, the diet is typically high in protein (19%-35% of energy), moderate in fat (28%-58% of energy), and low in carbohydrates (22%-40% of energy).<sup>14</sup> In general, the diet avoids the consumption of processed foods, dairy, grains, other starches (starchy vegetables and legumes), and sugar; and emphasizes fruits, vegetables, mushrooms, nuts, roots, pasture-raised and grass-fed meats, eggs, fish, and shellfish.<sup>15</sup>

Some very small studies suggest an improvement in lipid profiles, blood pressure, and other cardiovascular risk factors with the Paleo diet, as compared with other dietary patterns.<sup>16-18</sup> However, these data were later scrutinized, leaving controversy on whether lipid lowering occurs with a Paleo diet.<sup>19</sup> Some studies have also suggested that the Paleo diet is associated with lower levels of oxidative stress and inflammation when compared with traditional Western and fast-food diets.<sup>20</sup> In a recent look at 18,210 Mediterranean cohort participants from the *Seguimiento Universidad de Navarra* (SUN) cohort study, participants' diets were assessed using the previously published PaleoDiet score and were stratified into quintiles accordingly. After a 12.2-year follow-up period, an inverse association was noted between the PaleoDiet score and cardiovascular disease. Avoidance of ultra-processed foods appeared to have a key role in the inverse association.<sup>21</sup> While clinical studies demonstrate overall weakly positive effects on lipid profiles, cardiovascular risk factors, and inflammation, it is important to note that specific components of the diet, which vary considerably among studies, likely influence these metrics. Moreover, much of the research on this topic is limited by very small sample sizes (ie, 20 or fewer subjects) and widely disparate results, often due to comparison with an unclear or unspecified heart-healthy diets. Although the more recent cohort study from Spain demonstrated lower cardiovascular disease rates with a higher PaleoDiet score, this benefit appears to have been due to the removal of ultra-processed foods and not clearly from addition of other components of a Paleo diet. As such, the available data must be interpreted with caution.

### Bottom Line

Based on data from small studies of short duration, the Paleo diet may improve some cardiovascular risk factors (although there is much debate about its ability to improve lipids). At this time, due to the paucity of rigorous and comprehensive data, this diet is not recommended.

## WHOLE FOOD PLANT-BASED DIET

A whole food plant-based diet consists primarily of minimally processed plant foods such as vegetables, fruits, whole grains, pulses (edible seeds such as beans, lentils, and peas), and nuts.<sup>22</sup> In RCTs, prospective cohorts, and case series, this dietary pattern has: 1) reduced angina and

cardiac events;<sup>22</sup> 2) improved various health metrics in subjects with type 2 diabetes, compared with an American Diabetes Association diet;<sup>23</sup> 3) led to greater weight loss compared with omnivorous, pesco-vegetarian, or semi-vegetarian dietary patterns;<sup>24</sup> 4) reduced LDL cholesterol (by an average of 22.9 and 12.2 mg/dL in prospective studies and RCTs, respectively),<sup>25</sup> 5) reduced C-reactive protein compared with the American Heart Association diet in subjects with stable coronary artery disease;<sup>26</sup> 6) reduced blood pressure;<sup>22</sup> 7) reduced production of intestinal metabolite trimethylamine N-oxide, which has been associated with cardiovascular disease events;<sup>27</sup> and 8) improved myocardial perfusion in combination with exercise, stress management, and social support compared with usual care.<sup>28</sup>

It should be noted that even moderate increases in healthful plant-based foods are associated with improved health metrics. Prospective cohort studies demonstrate that replacing small amounts of animal-based protein with the same amount of plant-based protein is associated with increased longevity and reduced cardiovascular events.<sup>29</sup> A recent long-term prospective cohort study reported that primarily eating a plant-centered, nutritionally rich diet that incorporated even small amounts of animal products (eg, low-fat dairy products, non-fried fish, and non-fried poultry) lowered incident cardiovascular risk by 52%. Furthermore, an increase in plant-centered diet quality over 13 years was associated with a 61% lower risk of incident cardiovascular disease in the subsequent 12 years.<sup>30</sup>

Prospective cohort studies also demonstrate that greater consumption of a healthful plant-based diet is associated with a decreased coronary heart disease risk, whereas greater consumption of an animal-based diet is associated with an increased coronary heart disease risk.<sup>31</sup> In addition, an a priori designed post hoc analysis of the *Prevención con Dieta Mediterránea* (PREDIMED) RCT revealed that consuming more plant-based foods was associated with a lower risk of all-cause mortality.<sup>32</sup> Furthermore, in a small RCT, serum LDL cholesterol and apolipoprotein B levels were higher after consuming red or white meat vs plant protein.<sup>33</sup> Accordingly, many healthful dietary patterns share the commonality of being predominantly plant based,<sup>22</sup> providing dual benefit through the consumption of more healthful foods and fewer harmful ones.

A whole food plant-based diet is largely consistent with the dietary pattern advised in the American College of Cardiology's primary prevention guidelines.<sup>34</sup> Furthermore, a whole food plant-based diet may reduce health care costs<sup>35</sup> and more favorably impact the environment (on which life depends) as compared with an animal-based diet.<sup>36</sup> For example, producing 1 kg of beef generates 45 to 650 kg of carbon dioxide (CO<sub>2</sub>), whereas producing 1 kg of plant protein (eg, tofu) generates 10 kg of CO<sub>2</sub>.<sup>37</sup>

### Bottom Line

Adopting a whole food plant-based diet is associated with numerous health benefits, particularly with respect to

cardiovascular risk factors, and eating at least a plant-prevalent diet is important.

## MEDITERRANEAN DIET

Mediterranean diets include abundant plant-based foods, with low to moderate amounts of meat, dairy products, eggs, and wine, and favor olive oil as the primary source of fat.<sup>38</sup> In coining the term “Mediterranean diet,” Ancel Keys used as a point of reference the southern Italian village of Nicotera, where the typical diet reportedly derived 23% of energy from fat.<sup>39</sup> More modern Mediterranean diets and recent research studies have supplemented the diet with extra-virgin olive oil, nuts, or margarine, leading to a diet higher in fat, most of which is unsaturated.

A transition to a Mediterranean-style diet typically improves plasma lipids and blood pressure<sup>40,41</sup> and thus, has benefits for cardiovascular disease prevention. In the PREDIMED primary prevention RCTs, a Mediterranean diet supplemented with either extra-virgin olive oil or nuts led to an approximate 30% reduction in risk of major cardiovascular events (the main outcome) compared with an untreated control group whose members were given dietary advice to eat low fat.<sup>42</sup> Concerning components of the primary outcome, the Mediterranean diet led to a significant reduction in incident stroke, but had no effect on myocardial infarction or cardiovascular disease mortality; likewise, all-cause mortality was unaffected.<sup>42</sup> By contrast, in the secondary prevention RCT Lyon Diet Heart study, a Mediterranean diet supplemented with an alpha-linolenic-acid-rich margarine reduced cardiac deaths and nonfatal myocardial infarctions in myocardial infarction survivors.<sup>43</sup> A limitation of Mediterranean diets often noted is their lack of effectiveness for weight loss, an important consideration given that excess body weight is a common problem and a major risk factor for many serious health conditions.<sup>44,45</sup> However, notably, any energy-restricted diet will help achieve weight loss.

Many prospective cohort studies have suggested that individuals who adhere to the Mediterranean diet have longer life spans.<sup>46</sup> A recent meta-analysis of prospective cohort studies relating consumption of a Mediterranean diet and mortality outcomes in those with history of cardiovascular disease found hazard ratios of 0.91 (95% confidence interval, 0.82-1.01; n = 4) for cardiovascular disease mortality for each 2-unit increment in a score of adherence to the Mediterranean diet and 0.85 (95% confidence interval, 0.78-0.93; n = 8) for all-cause mortality, suggesting that increasing compliance with this dietary pattern improves survival even in those with prior cardiovascular disease.<sup>47</sup>

In a post hoc analysis of the PREDIMED study, the lowest mortality was noted in those who consumed a Mediterranean diet with the most “pro-vegetarian” pattern.<sup>32</sup> The PREDIMED-Plus study is an ongoing RCT comparing an energy-restricted Mediterranean diet plus increased physical activity and behavioral support to an ad libitum Mediterranean diet in 6874 individuals with overweight/obesity

and metabolic syndrome for outcomes of cardiovascular disease and weight control. Preliminary data from this study show improvement in dietary adherence in the intervention arm.<sup>48</sup> Assessment of healthful “pro-vegetarian” food patterns at baseline in this cohort also demonstrated an association with reduced cardiometabolic risk.<sup>49</sup>

## Bottom Line

Mediterranean diets place an emphasis on eating more fruits, vegetables, legumes, whole grains, nuts, and unprocessed foods, and there is a prominence of fatty fish high in omega-3 fatty acids and olive oil. A Mediterranean diet pattern is associated with improvements in cardiovascular risk and risk factors compared with either low-fat or Western-style diets.

## DIETARY APPROACHES TO STOP HYPERTENSION (DASH) DIET

The Dietary Approaches to Stop Hypertension (DASH) diet, compared with a traditional Western diet, includes more fruits, vegetables, low-fat dairy, nuts, legumes, fish, and fiber, and includes less red and processed meat, sweets, and saturated fat. In a seminal RCT lasting 8 weeks, the DASH diet significantly lowered systolic and diastolic blood pressure, by 5.5 mm Hg and 3.0 mm Hg, respectively, compared with a traditional Western diet. Moreover, in study participants with hypertension (n = 133), the effect of the DASH diet was even more pronounced: systolic and diastolic blood pressure were lowered by 11.4 mm Hg and 5.5 mm Hg, respectively.<sup>50</sup>

Following this success, additional study of the DASH diet and modifications to the DASH diet were pursued.<sup>40,51-53</sup> Accordingly, a randomized crossover study evaluated the impact of a DASH diet with 3 tiers of sodium intake (low, intermediate, and high) on blood pressure, vs a traditional Western diet with the same 3 tiers of sodium intake.<sup>51</sup> At each tier of dietary sodium, the DASH diet was associated with lower blood pressure compared with control. Overall, of the examined combinations, it appears that a low sodium DASH diet may be optimal for blood pressure control.

The randomized crossover OmniHeart study investigated the health impact of altering the macronutrient composition of a DASH diet. Specifically, decreasing the percentage of carbohydrate in the diet through replacement with either protein (50% of which was from plant origin) or with unsaturated fat (primarily monounsaturated fat) improved a variety of health metrics.<sup>40</sup> Another randomized crossover study of the DASH diet investigated the impact of varying both the diet’s percentage of carbohydrates and the glycemic index of those carbohydrates on blood pressure, among other measures.<sup>52</sup>

The PREMIER Clinical Trial randomized individuals with blood pressure >120/80 mm Hg (n = 810) to 1 of 3 arms: 1) a control arm (consisting of one 30-minute advice session), 2) an intensive behavioral intervention arm (consisting of 18 face-to-face sessions covering specific advice

**Table 1** Evidence in Support of Dietary Recommendations

Dietary Pattern	Key Publications (First Author, Ref.)	Brief Description of the Study	Key Conclusion(s)
Intermittent fasting	Lowe et al <sup>6</sup>	A 12-week randomized clinical trial comparing time-restricted feeding (eating between 12 PM and 8 PM) and consistent meal timing (structured 3 meals per day) in men and women 18-64 years of age with BMI 27-43 kg/m <sup>2</sup> .	There was no significant difference in weight loss between the groups. On secondary analyses, no difference between blood lipids or hemoglobin A1c, among other metrics, was found.
Very low-carbohydrate and ketogenic diets	Kirkpatrick et al <sup>9</sup>	Randomized clinical trial of 4 popular diets, including a low-carbohydrate diet and a low-fat vegetarian diet in premenopausal women with BMI 27-40 kg/m <sup>2</sup> .	At 1-year follow-up, weight changes in the low-carbohydrate and low-fat vegetarian groups were not significantly different.
Paleolithic diet	De la O et al <sup>21</sup>	18,210 participants in a Mediterranean cohort from the <i>Seguimiento Universidad de Navarra</i> (SUN) cohort study were assessed using the previously published PaleoDiet score and stratified into quintiles based on their score.	After a 12.2-year follow-up period, an inverse association was noted between the PaleoDiet score and CVD. Avoidance of ultra-processed foods appeared to have a key role in the inverse association.
Whole food plant-based diet	Song et al <sup>29</sup>	PCS of US health care professionals from the Nurses' Health Study and Health Professionals Follow-up Study (n = 131,342 with 3,540,791 person-years of follow-up).	1. In subjects with one or more unhealthy lifestyle factors, substituting plant for animal protein was associated with reduced mortality. Specifically, replacing 3% of calories from processed red meat, unprocessed red meat, and egg with plant-protein was associated with a lower hazard for all-cause mortality: 0.66 (95% CI, 0.59-0.75), 0.88 (95% CI, 0.84-0.92), and 0.81 (95% CI, 0.75-0.88), respectively. 2. ACC/AHA primary prevention guidelines emphasize diets that promote increased intake of fruits, vegetables, whole grains, nuts, legumes, plant-based protein, lean animal protein, as well as fish and poultry.
	2019 ACC/AHA Guideline on the Primary Prevention of Cardiovascular Disease <sup>34</sup>	Guidelines based on various levels of evidence including from systematic reviews, meta-analyses, prospective cohorts, and randomized controlled trials.	
Mediterranean diets	Estruch et al <sup>42</sup>	RCT including 7447 asymptomatic individuals at high cardiovascular risk, testing cardiovascular effects of a MeDiet supplemented with either extra-virgin olive oil or nuts vs control.	A MeDiet supplemented with either extra-virgin olive oil or nuts led to an approximate 30% reduction in risk of major adverse cardiovascular events, driven predominantly by cerebrovascular risk reduction, compared with an untreated control group after nearly 5 years.
	Martínez-González et al <sup>32</sup>	A priori defined post hoc analysis of the PREDIMED RCT.	In the context of a MeDiet pattern, the more plant-based or "provegetarian" the diet, the lower the risk of all-cause mortality.
	Rosato et al <sup>57</sup>	Meta-analysis of 21 cohort studies and 5 case-control studies (29 publications) reporting quantitative associations between adherence to Mediterranean diet and incident CVD.	Highest category of a MeDiet score compared with lowest was associated with lower RRs of total CVD at 0.81 (95% CI, 0.74-0.88), CHD at 0.70 (95% CI, 0.62-0.80), and stroke at 0.73 (95% CI, 0.59-0.91).
DASH	Chiavaroli et al <sup>54</sup>	Umbrella review and pooled analysis of meta-analysis and systematic reviews consisting of: 1) 3 systematic reviews and meta-analyses of 15 PCS (n = 942,140). 2) 4 systematic reviews and meta-analyses of 31 controlled trials (n = 4414).	1) The DASH diet was associated with decreased in relative risk of stroke by 0.81 (95% CI, 0.72-0.92), incident CVD by 0.80 (95% CI, 0.76-0.85), CHD by 0.79 (95% CI, 0.71-0.88), and diabetes by 0.82 (95% CI, 0.74-0.92) in prospective cohort studies. 2) DASH diet decreased systolic blood pressure by -5.2 mm Hg (95% CI, -7.0 to -3.4), hemoglobin A1c by -0.53% (95% CI, -0.62, -0.43), and body weight by -1.42 kg (95% CI, -2.03 to -0.82) and was associated with other biomarker improvements in controlled trials.
DASH	Soltani et al <sup>55</sup>	A meta-analysis of 17 prospective studies (13 publications) examined for a potential relationship between the degree of adherence to a DASH diet and cause-specific and all-cause mortality.	With a DASH diet adherence score ranging from 8 to 40, each 5-point increase was associated with a lower hazard of CVD 0.96 (95% CI, 0.95-0.98, I <sup>2</sup> = 82.4%, n = 12), stroke mortality 0.97 (95% CI, 0.96-0.98, I <sup>2</sup> = 0.00%, n = 2), and all-cause mortality 0.95 (95% CI, 0.94-0.96, I <sup>2</sup> = 91.6%, n = 14)

ACC/AHA = American College of Cardiology/American Heart Association; ANS = artificial and non-nutritive sweeteners; BMI = body mass index; CHD = coronary heart disease; CI = confidence interval; CVD = cardiovascular disease; DASH = Dietary Approaches to Stop Hypertension; HDL-C = high-density lipoprotein; LDL-C = low-density lipoprotein cholesterol; MeDiet = Mediterranean diet; PCS = prospective cohort studies; RCT = randomized controlled trial; RR = risk ratio; SSB = sugar-sweetened beverages.

on weight loss, exercise, and limiting alcohol intake, but not on the DASH diet), and 3) the intensive behavioral intervention plus a DASH diet.<sup>53</sup> While both intervention groups experienced a reduction in blood pressure compared with control, the addition of the DASH diet to the intensive behavioral arm resulted in no additional significant lowering of blood pressure.

Nevertheless, the benefit of a DASH diet has been reinforced by recent publications.<sup>54,55</sup> An umbrella review of

systematic reviews and meta-analyses found that the DASH diet was associated with 1) lower incident cardiovascular disease, coronary heart disease, and stroke in prospective cohort studies; and 2) decreased systolic and diastolic blood pressure, body weight, LDL cholesterol, and HbA1c in controlled trials.<sup>54</sup> A separate meta-analysis of 17 cohort studies investigated the relationship between the degree of adherence to a DASH diet and mortality. Using a scoring system that ranged from 8 to 40, with higher scores

**Table 2** Nutritional Recommendations for Patients

Dietary Pattern	Level of Evidence Available and Included in this Paper	Recommendations for Patients
Intermittent fasting	Prospective cohort studies, RCT, and reviews	Studies suggest that intermittent fasting models may be helpful for weight loss, but not significantly more so than continuous energy restriction. At this time, there is a paucity of evidence available to support recommending intermittent fasting.
Very low-carbohydrate and ketogenic diets	RCTs, systematic reviews, and meta-analyses	Animal-based low-carbohydrate diets are not recommended. Although leading to short-term weight loss in some, these diets 1) are no more effective than other weight-loss diets long term, 2) may increase LDL-C concentrations, and 3) skew the diet away from healthful foods, such as fruits and whole grains.
Paleolithic diets	Very small studies, systematic reviews	The Paleo diet is not recommended. While there is short term data showing improvement in lipids, weight loss, and oxidative stress, the studies have very few patients and varying dietary composition.
Whole food plant-based diets	Prospective cohort studies, RCTs, systematic reviews, and meta-analysis	Adults should consume a healthy diet that emphasizes the intake of fruits, vegetables, whole grains, nuts, and legumes.
Mediterranean diets	Prospective cohort studies, systematic reviews, meta-analyses, and RCTs	MeDiets place an emphasis on eating more fruits, vegetables, beans, whole grains, nuts, and unprocessed foods, and there is a prominence of fatty fish high in omega-3 fatty acids and olive oil. A MeDiet improves cardiovascular health compared with a Western diet and a MeDiet may be most beneficial when plant-based foods predominate.
DASH diet	Umbrella review, randomized controlled trials, meta-analysis, and prospective cohort studies.	The DASH diet is beneficial in the prevention of CVD, as well as in blood pressure and lipid lowering. A DASH diet may reduce CVD and all-cause mortality.

ANS = artificial and non-nutritive sweeteners; CVD = cardiovascular disease; DASH = Dietary Approaches to Stop Hypertension; LDL-C = low-density lipoprotein cholesterol; RCT = randomized controlled trial; MeDiet = Mediterranean diet.

indicating greater adherence to a DASH diet, each 5-point increase was associated with a 4% reduction in cardiovascular disease mortality, a 3% reduction in stroke mortality, and a 5% reduction in all-cause mortality.<sup>55</sup>

Similarly, an analysis of the EPIC-Norfolk prospective cohort study (n = 23,655) examined the relationship between adherence to the DASH diet and incident cardiovascular disease over an average follow-up of 12.4 years.<sup>56</sup> In multivariate analysis, participants in the highest quintile of DASH adherence experienced lower risk of stroke (20%), cardiovascular disease (12%), cardiovascular disease mortality (28%), and all-cause mortality (13%) compared with the lowest quintile of DASH adherence.

## Bottom Line

Compared with a traditional Western diet, the DASH diet is associated with significant reductions in blood pressure. Moreover, greater adherence to a DASH diet is associated with lower cardiovascular disease and all-cause mortality.

## CONCLUSIONS

There is an urgent need for evidence-based nutrition information to help guide dietary counseling. Accordingly, the authors believe that sufficient evidence exists to recommend promoting whole food plant-based diets, Mediterranean, or DASH dietary patterns while cautioning against very low carbohydrate/ketogenic diets and Paleolithic diets (Tables 1<sup>6,9,21,29,32,34,42,54,55,57</sup> and 2). In view of the limited data on intermittent fasting, further research is recommended, although early data suggest it may be helpful for weight loss. Although changes toward a plant-based diet are also associated with improved health metric, following a completely plant-based diet is associated with most robust

cardiovascular and overall health outcomes. Of course, all dietary patterns are more impactful with long-term adherence; however, optimizing long-term adherence to healthful dietary patterns is an issue in need of further study and discussion.

Despite much misinformation, healthful dietary patterns continue to share much in common. They are high in fruits, vegetables, whole grains, beans and legumes, and nuts, and some include modest quantities of lean meats (including poultry), fish, low-fat dairy products, and liquid oils. Further, they are generally devoid of highly processed foods (including added sugars) from any source.

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