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REVIEW ARTICLE
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EXPLORING THE PROS AND CONS OF KETOGENIC, VEGETARIAN AND MEDITERRANEAN DIETS ON MULTIFACETED HEALTH BIOMARKERS: A COMPREHENSIVE REVIEW

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Abstract

Background: This review article critically examines the impact of the Ketogenic, Vegetarian, and Mediterranean diets on multifaceted health biomarkers. By keeping in mind the growing interest in diverse dietary patterns, the study utilizes existing literature to provide a comprehensive overview of the advantages and disadvantages associated with these fad diets.

Methodology: A systematic literature review was conducted to gather relevant studies exploring the effects of Ketogenic, Vegetarian, and Mediterranean diets on multifaceted health biomarkers. Searches were performed on reputable databases, including Google Scholar and PubMed. The search strategy included keywords such as “Ketogenic diet,” “Vegetarian diet,” “Mediterranean diet,”.

Results: The Ketogenic diet exhibited specific benefits in weight management and therapeutic applications but raised concerns regarding nutrient deficiencies and adherence challenges. The Vegetarian diet demonstrated advantages in chronic disease prevention and environmental sustainability but faced drawbacks related to potential nutrient gaps and protein intake. The Mediterranean diet showcased positive effects on heart health, cognitive function, and anti-inflammatory markers, with challenges including sourcing difficulties and higher costs.

Conclusion: In conclusion, this review provides a comprehensive understanding of the pros and cons associated with the Ketogenic, Vegetarian, and Mediterranean diets concerning multifaceted health

biomarkers. The present review contributes valuable insights to the existing body of knowledge, aiding individuals, healthcare professionals, and policymakers in making informed decisions about dietary choices and their impact on overall health.

Keywords: Keto Diet, Epilepsy, Mediterranean Diet, Cognitive Health, Vegetarian Diet, Weight Loss, Diabetes, FAD Diets

1. Introduction

In recent years, the spotlight on diverse diets has intensified, with the vegetarian, ketogenic, and Mediterranean diets gaining substantial attention. This article seeks to offer a comprehensive comparative analysis of these dietary approaches, shedding light on their respective benefits and drawbacks. The critical role of diet in overall health is well-established, influencing weight maintenance, chronic disease prevention, and longevity (1). Scientific research consistently underscores the pivotal role of nutrition in various aspects of human health and well-being (2). Dietary habits intricately impact physiological functions, from energy metabolism to immune response and cellular repair mechanisms. Furthermore, dietary choices are crucial for the prevention as well as management of chronic diseases, including cardiovascular disorders, diabetes, and certain cancers (3). The intricate relationship between diet and mental health is gaining recognition. Nutritional deficiencies or imbalances have been associated with mood disorders, cognitive decline, depression, and anxiety (4). This emphasizes the holistic impact of nutritional intake on overall health. The ketogenic diet, is known by its low-carbohydrate, moderate protein and high fat approach, induces a metabolic state known as ketosis (5). It has shown promise in therapeutic contexts such as epilepsy management and weight loss (6). The metabolic shift to utilizing ketone bodies as an alternative fuel source may have implications for neurological health and weight management (7). However, uncertainties surround its long-term effects on cardiovascular health and overall sustainability. Individuals with specific health conditions, like kidney disease, are advised against this diet, requiring close monitoring of nutrient intake and electrolyte balance. While the vegetarian diet stands out for its emphasis on plant-based foods while excluding meat and, in some cases, animal-derived products (8). Noteworthy benefits include a reduced risk of cardiovascular diseases, lower blood pressure, and better weight management (9). The diet's nutritional richness in fiber, antioxidants, and phytonutrients contributes significantly to these health advantages (10). However, a carefully planned vegetarian diet is crucial to avoid potential nutrient deficiencies. However, the Mediterranean diet, focusing on whole grains, legumes, fruits, vegetables, and healthy fats like olive oil, mirrors traditional dietary patterns in Mediterranean regions. Extensive research attributes numerous health benefits to this dietary model, including the reduced chances of cardiovascular diseases and improved cognitive function (11). However, challenges in sourcing and preparing certain foods, higher cost compared to other diets, and individual variations in response to the diet should be considered.

2. Ketogenic Diet

The ketogenic diet, that is commonly known as Keto diet, gained a significant popularity in the recent years. It is a low-carbohydrate (5%), high-fat (75%), and moderate protein (20%) dietary approach that is designed to create a metabolic state known as ketosis, within the body and changes its primary source of energy (glucose) to the ketones, that are produced due to the breakdown of fats in liver (6). Initially this diet was utilized for weight loss, but later on, it has shown efficacy in managing the medical conditions like type 2 diabetes and epilepsy (12). By restricting carbohydrates, body utilizes its stored fat, as the main energy source, leading to weight loss and other potential health benefits. The ketogenic diet has potential health benefits, as well as it also comes with major drawbacks as mentioned in the Figure 1.

2.1 Benefits of a Ketogenic Diet:

2.1.1 Weight Loss and Improved Body Composition:

The ketogenic diet promotes weight loss and improves body composition by enhancing fat burning through shifting the primary source of energy from glucose to ketones within the body. (6). By limiting carbohydrate availability for fuel, the body enters ketosis, leading to significant fat loss while preserving muscle mass, resulting in a favorable body composition. This metabolic shift is believed to enhance weight loss by promoting fat burning. A systematic review and meta-analysis by Bueno *et al.,* (13) examined 13 randomized-controlled-trials (RCTs) and concluded that the keto diet was more effective for the purpose of short term weight loss as compared to diet that is low in fats. However, long-term adherence to the diet was challenging, leading to limited evidence on its sustained weight loss effects. Similarly, Gibson *et al.,* (7) conducted a review of 12 RCTs and found that the keto diet is beneficial for the purpose of weight loss as compared to low-fat diets in the short term. However, there was no significant difference between the two diets in the long term.

2.1.2 Therapeutic Effects Related to Certain Medical Conditions:

Beyond weight loss, the keto diet has shown potential therapeutic effects for various medical conditions. One of the most well-known applications is in the treatment of epilepsy, particularly in children. A study by Neal *et al.,* (14) found that the keto diet reduced seizure frequency in children with drug-resistant epilepsy, suggesting it as an effective adjunctive therapy. Moreover, emerging evidence suggests that the keto diet can be beneficial for other neurological disorders, like Parkinson's disease and Alzheimer's disease. A review by Gasior *et al.,* (15) highlighted the potential neuroprotective effects of the keto diet, attributing them to the greater production of ketone bodies, that ultimately serve as an alternative energy source for the brain. Additionally, the keto diet has shown promise in managing certain metabolic disorders such as type 2 diabetes. A study by Saslow *et al.,* (16) demonstrated that individuals with type 2 diabetes who followed a keto diet have greater improvements in blood glucose levels as compared to those on a low fat diet.

2.1.3 Increased Satiety and Reduced Cravings:

The keto diet's high-fat content may contribute to increased satiety and reduced cravings, which can aid in weight loss efforts. A study by Gibson *et al.,* (7) reported that participants on the keto diet experienced reduced hunger compared to those on low-fat diets. This effect may be attributed to the higher fat and protein intake, as both macronutrients are known to promote satiety. Furthermore, he suggested that the keto diet's restriction of carbohydrates, particularly refined sugars, may help reduce cravings for sweet and high-carbohydrate foods potentially contributing to better adherence to the diet (13).

2.2 Drawbacks of a Ketogenic Diet:

2.2.1 Nutrient Deficiencies:

By severely restricting carbohydrate consumption, individuals following the keto diet may miss out on essential nutrients commonly found in carbohydrate-rich foods. Several studies have highlighted specific nutrient deficiencies associated with the keto diet. For instance, a study by Masood *et al.,* (17) found that individuals following a long-term keto diet were at risk of inadequate intake of vitamins B1, B3, B5, B7, and E, as well as minerals such as selenium, magnesium, and potassium. These deficiencies can lead to various health issues, including fatigue, muscle weakness, and impaired cognitive function. Due to restricted food groups, such as fruits, whole grains, and legumes, a ketogenic diet also leads to less fiber intake, that can cause digestive issues, and the exclusion of certain fruits and vegetables may result in insufficient vitamin and mineral intake (18).

2.2.2 Potential Adverse Effects:

During the adaptation phase, individuals may experience adverse effects like "keto flu" (fatigue, dizziness, gastrointestinal discomfort). The mechanism behind the keto flu is believed to involve the

body's adjustment to using ketones as a primary fuel source instead of glucose. As the body adapts to this metabolic shift, electrolyte imbalances and dehydration can occur, leading to the symptoms mentioned above (19). Additionally, long-term adherence to the keto diet has been associated with an increased risk of developing dyslipidemia, which refers to abnormal levels of cholesterol and triglycerides in the blood. A study by O'Neill and Raggi, (20) found that individuals following a keto diet for an extended period had significantly higher levels of LDL cholesterol (the "bad" cholesterol) and lower levels of HDL cholesterol (the "good" cholesterol). The low-fiber content may contribute to constipation (7).

2.2.3 Difficulty in Adhering to Strict Macronutrient Ratios:

Achieving and maintaining a state of ketosis requires precise control over the intake of carbohydrates, proteins, and fats (21). This may be particularly challenging for individuals with busy lifestyles or those who struggle with dietary restrictions. The strict macronutrient ratios of the keto diet may also limit food choices and make social situations challenging (22). Eating out or attending gatherings where carbohydrate-rich foods are prevalent can be problematic for individuals following the keto diet (23). Furthermore, it is essential to consult with the healthcare professional or registered dietitian before embarking on a restrictive dietary approach such as the keto diet. Strict adherence to high-fat, low-carbohydrate ratios can be challenging, limiting food choices and making long-term adherence difficult for some individuals (24).

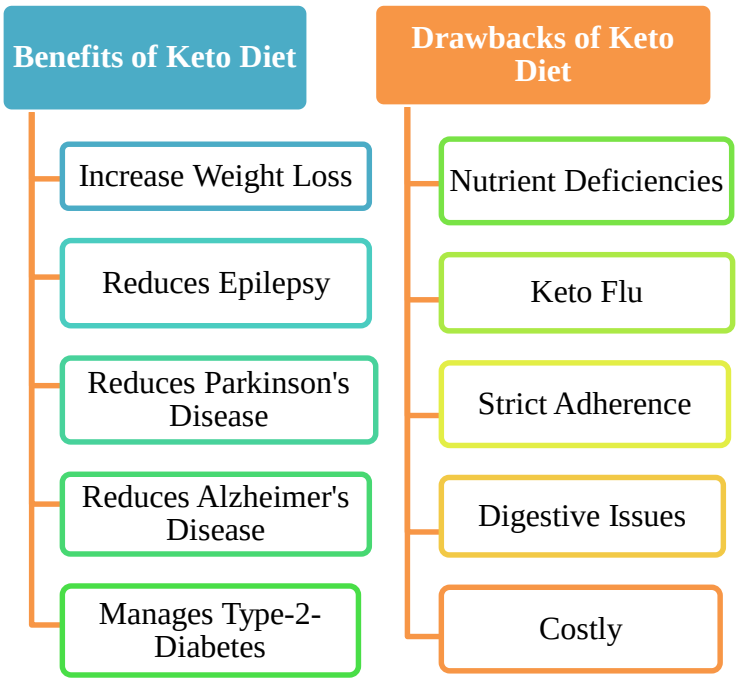

Figure 1. Benefits and Drawbacks Associated with Ketogenic Diet

3. Vegetarian Diet

The Vegetarian Diet, is characterized by the exclusion of poultry, meat, and seafood in the diet, while emphasizing plant-based foods like fruits, vegetables, grains, legumes, nuts, and seeds, has gained popularity for its potential health benefits and environmental sustainability (25). This dietary choice encompasses variations such as lacto-vegetarian, ovo-vegetarian, and vegan, each with unique food allowances. It has both health benefits as well as drawbacks, mentioned in the Figure 2.

3.1 Lacto-Vegetarian Diet

Lacto-vegetarianism involves excluding meat, poultry, fish, and eggs from the diet, while still including dairy products. This dietary choice allows for the consumption of milk, cheese, yogurt, and

other dairy-derived foods (26). Lacto-vegetarian diets can provide essential nutrients such as calcium, vitamin D, and vitamin B12, which are abundant in dairy products (27).

3.2 Ovo-Vegetarian Diet

Ovo-vegetarianism, on the other hand, excludes poultry, fish, meat, and dairy products, but allows for the inclusion of eggs in the diet. Eggs constitute an essential source of high-quality protein and are rich in nutrients like vitamins B12 and D, omega-3 fatty acids, and choline (28). Ovo-vegetarian diets provide a suitable alternative for individuals who abstain from dairy products but still aim to meet their nutritional needs.

3.3 Pesco-Vegetarian Diet

Pesco-vegetarians, although considered a form of vegetarianism, differ from traditional vegetarians by including fish and seafood in their diet while excluding other types of meat and poultry. This dietary choice is often adopted for its perceived health benefits, mainly attributed to the consumption of fatty fish and its omega-3 fatty acid content (29, 30).

3.4 Vegan Diet

Veganism, at its core, eliminates all animal-based products from the diet, including meat, poultry, fish, dairy products, eggs, and even honey. Vegan diets have been associated with physiological and environmental benefits, showing potential advantages in reducing body weight, blood pressure, and risk of certain chronic diseases (9). However, careful attention must be paid to ensure adequate intake of essential nutrients, such as iron, vitamin B12, zinc, and omega-3 fatty acids (31).

3.5 Benefits of a Vegetarian Diet

3.5.1 Lower Risk of Chronic Diseases

Numerous studies associate vegetarian diets with a decreased risk of chronic illnesses such as heart disease, diabetes, and certain cancers (32, 33). Several studies have shown that adopting a vegetarian diet can significantly reduce the risk of developing cardiovascular diseases. A meta-analysis of observational studies demonstrated that vegetarians have a 25% lower risk of heart disease compared to non-vegetarians (34). A vegetarian diet, especially one low in saturated fats and cholesterol, and high in fiber, fruits, vegetables, whole grains, and plant-based proteins, contributes to improved lipid profiles, reduced blood pressure, and decreased oxidative stress associated with cardiovascular health (33). Hypertension, a major risk factor for cardiovascular disease, is prevalent worldwide. Vegetarian diets, particularly those rich in fruits, vegetables, legumes, and whole grains, have consistently shown to lower the levels of blood pressure. In another RCT, vegetarian diets led to a significant reduction in both systolic and diastolic blood pressure, enhancing overall cardiovascular health (35). High potassium, magnesium, and fiber content in plant-based foods, coupled with reduced sodium intake, contribute to the blood pressure-lowering effects of vegetarian diets (36). Vegetarian diets have also demonstrated a protective effect against type 2 diabetes. A large prospective cohort study found that individuals following a vegetarian diet had a fifty percent reduced risk of developing type-2-diabetes compared to those consuming meat (37). Plant-based diets, rich in whole grains, legumes, fruits, vegetables, and nuts, provide excellent sources of dietary fiber, antioxidants, and plant compounds, which contribute to improved glycemic control and insulin sensitivity (38). Obesity is a significant risk factor for chronic diseases, including cardiovascular disease and type 2 diabetes. Vegetarian diets have shown promise in reducing body weight and mitigating the risk of obesity. A systematic review and meta-analysis concluded that individuals following a vegetarian diet that have a reduced body mass index (BMI) compared to non-vegetarians (39). While the evidence regarding the relationship between vegetarian diets and cancer risk reduction remains mixed, some studies have suggested a potential protective effect. A systematic review and meta-analysis of cohort studies showed a lower risk of certain cancers, such as colorectal and gastrointestinal cancers, among vegetarians (40). The high intake of fruits, vegetables, fiber, and phytochemicals in vegetarian diets is thought to play a

vital role in cancer prevention through antioxidant and anti-inflammatory mechanisms (41). Vegetarian diets, particularly those low in animal protein, have been associated with improved renal health. In individuals with chronic kidney disease, vegetarian diets have shown to slow the progression of the disease and reduce the risk of end-stage renal disease (42). The rich nutrient profile, reduced intake of saturated fats, while higher intake of plant based antioxidants and phytochemicals in vegetarian diets may contribute to this effect.

3.5.2 Higher Intake of Fiber, Vitamins, and Minerals

The diverse range of plant-based foods in a vegetarian diet provides ample fiber, vitamins, and minerals. This aids in digestion, prevents constipation, and reduces the risk of obesity and colon cancer (43). One of the primary advantages of a vegetarian diet is its higher intake of dietary fiber. A large body of evidence suggests that a diet rich in fiber offers substantial health benefits. Vegetarian diets, particularly those emphasizing fruits, vegetables, legumes, and whole grains, have consistently been associated with increased fiber intake (32). High-fiber diets have been linked to a range of positive outcomes, including improved digestive health, management of body weight, and the prevention from chronic diseases such as colorectal cancer (44). Moreover, soluble fibers found in fruits, vegetables, and legumes act as prebiotics, promoting the growth of beneficial bacteria in the gut, which may improve gut health and reduce the risk of gastrointestinal diseases (45). The increased fiber content of vegetarian diets also contributes to weight management. Vegetarian diets, with their emphasis on plant-based protein sources (e.g., legumes), whole grains, and fiber-rich fruits and vegetables, may aid in weight loss or maintenance (39). The higher intake of fiber in vegetarian diets has been linked to a reduced risk of chronic diseases. Fiber aids in maintaining healthy blood lipid profiles and glycemic control, reducing the risk factors for cardiovascular disease and diabetes (46). Furthermore, fiber promotes regular bowel movements, contributing to the prevention of colorectal cancer (47). Vegetarian diets are generally abundant in vitamins, which are essential for various bodily functions. Fruits, vegetables, whole grains, nuts, and seeds staples in vegetarian diets are excellent sources of essential vitamins such as vitamin C, folate, beta-carotene, and vitamin E (48). These nutrients play critical roles in immune function, antioxidant protection, and the maintenance of healthy skin, eyes, and other tissues. Adopting a vegetarian diet also ensures adequate mineral intake. Plant-based diets typically contain abundant minerals such as potassium, magnesium, and calcium. These minerals are crucial for maintaining proper bodily functions and preventing chronic diseases. For instance, high potassium and low sodium intake a characteristic of vegetarian diet has been associated with improved blood pressure control, reducing the risk of hypertension and cardiovascular disease (49). Additionally, calcium-rich plant-based foods, such as leafy greens and fortified plant-based milk alternatives, contribute to optimal bone health (50).

3.5.3 Environmental Sustainability

Beyond personal health, adopting a vegetarian diet contributes to environmental sustainability by reducing deforestation, greenhouse gas emissions, and water pollution associated with meat production (51). A vegetarian diet significantly reduces greenhouse gas emissions compared to a meat-based diet. Livestock agriculture, especially the production of beef and lamb, is a major contributor to greenhouse gas emissions. Raising animals for meat production requires large quantities of feed, water, and energy, leading to the release of substantial amounts of carbon dioxide, methane, and nitrous oxide. Meat production necessitates extensive land use, contributing to deforestation and habitat destruction. Livestock farming requires substantial grazing areas and cultivable land for animal feed production (52). By adopting a vegetarian diet, individuals can help reduce the demand for animal agriculture and free up land resources for other purposes, such as reforestation or sustainable crop cultivation. The production of meat, particularly beef, requires significant amounts of water. Water is needed for animal hydration, irrigation of feed crops, and cleaning livestock facilities (53). Adopting a vegetarian diet reduces water consumption by minimizing the need for large-scale irrigation and animal agriculture. Deforestation, primarily driven

by the expansion of livestock agriculture, contributes to biodiversity loss and exacerbates climate change (54). Embracing a vegetarian diet helps protect and conserve biodiversity by reducing the demand for animal-based products that contribute to environmental degradation

3.6 Drawbacks of a Vegetarian Diet

3.6.1 Potential Nutrient Deficiencies

Vegetarians may face challenges in obtaining sufficient iron and vitamin B12, primarily found in animal-based foods. Attention to consuming iron-rich plant foods paired with vitamin C sources is crucial. Supplementation or fortified foods may be necessary for meeting vitamin B12 requirements (31, 32, 55). Iron deficiency is a common concern for individuals following a vegetarian diet. Plant-based iron, known as non-heme iron, is less easily absorbed by the body compared to heme iron found in animal sources. Research indicates that vegetarians, particularly vegans who exclude all animal products, may have lower iron stores and an increased risk of iron deficiency anemia. Iron plays a vital role in oxygen transport, and its deficiency can lead to fatigue, decreased cognitive function, and impaired immune response (56). Vitamin B12 deficiency is another significant concern associated with vegetarian diets, especially for those who exclude all animal products. Vitamin B12 is primarily found in animal-derived foods and plays a crucial role in red blood cell production, neurological function, and DNA synthesis. Individuals following vegetarian diets, particularly vegans, may need to rely on fortified plant-based foods or supplementation to ensure adequate vitamin B12 intake, Vitamin B12 deficiency can lead to megaloblastic anemia, neurological impairments, and an increased risk of cardiovascular disease (31). Omega-3 fatty acids are essential for optimal brain function, heart health, and reducing inflammation. While vegetarian diets can provide an ample amount of the precursor alpha-linolenic acid (ALA) found in plant-based sources like flaxseeds, chia seeds, and walnuts, they may be lacking in the active forms of omega-3s, namely eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). These active forms are predominantly found in fatty fish. Limited conversion of ALA to EPA and DHA in the body may put vegetarians, especially strict vegans, at risk of inadequate omega-3 fatty acid intake, which could lead to suboptimal health outcomes (57). Vegetarian diets, particularly those excluding dairy products, may be lower in calcium and vitamin D. Calcium is vital for bone health, while vitamin D plays a crucial role in calcium absorption. Plant-based sources such as tofu, dark leafy greens, and fortified plant-based milk alternatives can contribute to calcium intake. However, the absorption of plant-based calcium may be hindered due to the presence of certain compounds, such as phytates and oxalates. Furthermore, vitamin D is primarily obtained through exposure to sunlight, making vegetarian diets that limit sun exposure or rely solely on plant-based sources potentially insufficient in vitamin D (58).

3.6.2 Challenges in Meeting Protein Needs

Protein intake can be a concern, especially for vegans who exclude all animal products. Careful planning is essential to ensure an adequate intake of plant-based protein sources such as legumes, beans, tofu, and whole grain. To overcome this, it is essential for vegetarians to consume a varied diet and ensure adequate protein complementarity. Certain vegetarian subgroups, such as vegans, need to pay particular attention to their protein intake to meet their daily requirements s (59). Obtaining an adequate quantity and quality of protein is another potential drawback of a vegetarian diet. While plant-based sources such as legumes, grains, nuts, and seeds can provide ample protein, they often lack certain essential amino acids (60). Low protein intake in vegetarian diets can increase the risk of nutrient deficiencies, particularly vitamin B12, iron, zinc, and calcium. Plant-based sources of these nutrients often have lower bioavailability compared to animal sources. Proper planning and food choices are necessary to prevent deficiencies. For instance, vitamin B12 supplementation or fortified foods may be necessary for vegetarians. A study by Pawlak, (9) emphasized the importance of monitoring nutrient status in vegetarian individuals to prevent deficiencies.

Figure 2. Pros and Cons of Vegetarian Diet

4. Mediterranean Diet

The Mediterranean diet has gained worldwide recognition for its health benefits and ability to promote longevity. Originating from the Mediterranean region, this dietary pattern has been linked to a reduced risk of chronic diseases such as diabetes, CVD, and certain types of cancer. The Mediterranean diet draws inspiration from the traditional eating habits of people residing in countries bordering the Mediterranean Sea. This region includes nations such as Greece, Italy, Spain, Portugal, and southern France. Dating back thousands of years, the Mediterranean diet has been shaped by geographical diversity, cultural practices, and historical influences. A defining characteristic of the Mediterranean diet is the abundant intake of plant-based foods. This includes vegetables, fruits, whole grains, legumes, nuts, and seeds. A variety of plant-based foods ensures the ingestion of minerals, vitamins, antioxidants, and dietary fiber, contributing to overall health and disease prevention (61). Emphasizing a plant-based approach, it encourages the consumption of fruits, vegetables, whole grains, legumes, nuts, seeds, and moderate amounts of dairy products, fish, and poultry. Red meat and processed foods are limited, and olive oil stands out as the primary source of added fat (62). Olive oil represents a significant source of dietary fat in the Mediterranean diet. Rich in monounsaturated fats and antioxidants, such as polyphenols, olive oil provides numerous health benefits. Studies have shown that olive oil consumption is associated with reduced risk of heart disease, inflammation, and cancer (63). The Mediterranean diet emphasizes moderate consumption of fish and poultry, with fish being preferred over red meat. Fish, especially fatty fish like salmon and sardines, is an excellent source of omega-3 fatty acids, known for their anti-inflammatory properties and benefits for brain health (64). Moderate dairy consumption, typically in the form of cheese and yogurt, is a part of the Mediterranean diet. Dairy products provide essential nutrients like calcium, protein, and vitamins, contributing to bone health and overall nutrition (65). In contrast to the typical Western diet, the Mediterranean dietary pattern emphasizes limited consumption of red meat and sweets. Instead, these items are reserved for occasional indulgences rather than prominent features of daily meals. This restriction promotes a lower intake of saturated fats and added sugars, which are associated with increased risk of chronic diseases (62). Although not essential to the diet, moderate consumption of wine, especially red wine, is commonly associated with the Mediterranean diet. It also has both health benefits as well as drawbacks, mentioned in the Figure 3 and 4.

4.1 Benefits of a Mediterranean Diet

4.1.1 Reduced Risk of Chronic Diseases

The Mediterranean diet is strongly associated with a reduced risk of heart disease and stroke. It emphasis on vegetables, fruits, whole grains, olive oil, and moderate consumption of poultry and fish, that is linked to reduced blood pressure, decreased inflammation, and improved control of LDL cholesterol levels (63). Multiple large-scale observational studies and clinical trials have

demonstrated that adhering to a Mediterranean dietary pattern is associated with a reduced risk of cardiovascular disease. The PREDIMED study, a landmark trial involving over 7,000 participants, found that a Mediterranean diet supplemented with extra-virgin olive oil or nuts significantly reduced the incidence of major cardiovascular events (62). Adherence to the Mediterranean diet has been linked to a decreased risk of type 2 diabetes. A systematic review and meta-analysis of prospective studies concluded that this dietary pattern was associated with a 19% reduction in the risk of developing diabetes (64). Furthermore, a Mediterranean diet supplemented with extra-virgin olive oil has demonstrated beneficial effects on glycemic control in individuals with type 2 diabetes (65). The Mediterranean diet's rich content of fruits, vegetables, whole grains, and olive oil has been associated with a reduced risk of certain types of cancer, including breast, colorectal, and gastric cancers (66). Studies attribute this effect to the presence of various bioactive compounds in plant-based foods, which possess anti-carcinogenic properties.

4.1.2 Improved Cognitive Function and Mental Health

Studies suggest a positive correlation between adherence to the Mediterranean diet and improved cognitive function, as well as a lower risk of cognitive decline and neurodegenerative diseases like Alzheimer's. Additionally, the diet may contribute to better mental health by reducing the risk of depression and enhancing overall well-being (67). Research has consistently shown that adherence to the Mediterranean diet is associated with a reduced risk of cognitive decline and improved cognitive function among various age groups. A study conducted by Valls-Pedret *et al.,* (68) examined the effects of a Mediterranean diet supplemented with extra-virgin olive oil or mixed nuts on cognitive function among elderly individuals at high cardiovascular risk. The results showed a significant improvement in cognitive function, particularly in attention and memory domains, compared to a control group that followed a low-fat diet. Similarly, a systematic review by Psaltopoulou et al., (67) analyzed studies investigating the relationship between the Mediterranean diet and cognitive function. The review concluded that adherence to the Mediterranean diet was consistently associated with better cognitive performance, reduced risk of cognitive impairment, and decreased rates of Alzheimer's disease. The Mediterranean diet is rich in nutrients that have been associated with improved cognitive function and mental health. One of these nutrients is omega-3 fatty acids, primarily found in fatty fish such as salmon, mackerel, and sardines. Omega-3 fatty acids are essential for brain health and have been linked to improved cognitive function and a reduced risk of depression. A study conducted by McNamara et al. (69) demonstrated that supplementation with omega-3 fatty acids improved attention and working memory in children with ADHD. Moreover, a systematic review by Grosso *et al.,* (70) suggested that higher omega-3 fatty acid intake was associated with a reduced risk of depressive symptoms. Another important component of the Mediterranean diet is monounsaturated fats, abundant in olive oil. Monounsaturated fats have been found to have neuroprotective effects and enhance cognitive function. The Mediterranean diet also provides an array of vitamins and minerals, important for cognitive function and mental health. For instance, the growth and function of the brain are influenced by B vitamins, such as folate, B6, and B12. Moreover, a systematic review by Skarupski *et al.,* (71) suggested that reduced B vitamin levels have been linked to a higher risk of depression. Antioxidants, found abundantly in fruits and vegetables, are crucial in reducing oxidative stress and inflammation, which can negatively impact cognitive function and mental health. The Mediterranean diet, with its high intake of fruits and vegetables, provides a rich source of antioxidants. A study by Pelletier *et al.,* (72) found that higher adherence to the Mediterranean diet was linked to a lower risk of depressive symptoms in older persons. Similarly, a systematic review and meta-analysis by Lassale *et al.,* (73) provided evidence that a lower risk of depression was linked to a Mediterranean diet. The results revealed that individuals with higher adherence to the Mediterranean diet had a significantly lower risk of developing depression.

4.1.3 Anti-inflammatory Effects

The Mediterranean diet's general health advantages are attributed to its high content of anti-inflammatory foods, such as fruits, vegetables, whole grains, and olive oil. Since chronic inflammation is connected to a number of chronic diseases, including diabetes, heart disease, and some types of cancer, reducing inflammatory markers is essential. (63). The benefits of the Mediterranean diet in reducing inflammation have been the subject of numerous researches. In one trial, Estruch et al. (62) looked at how a Mediterranean diet intervention affected inflammation in people who are more likely to develop cardiovascular disease. In comparison to a control group that had a low-fat diet, the researchers discovered that those who followed a Mediterranean diet supplemented with extra-virgin olive oil and almonds had considerably lower levels of inflammatory markers, such as CRP and IL-6. The Mediterranean diet emphasizes the consumption of fatty fish, such as salmon, mackerel, and sardines, which are rich sources of omega-3 fatty acids. Because they function as precursors for the anti-inflammatory compounds resolvins and protectins, these fatty acids have strong anti-inflammatory properties. Calder (74) conducted a study that demonstrated the advantages of omega-3 fatty acids in mitigating inflammation and enhancing a range of chronic inflammatory ailments, such as rheumatoid arthritis and cardiovascular disease. Fruits, vegetables, and herbs abound in the Mediterranean diet and are excellent providers of antioxidants. Antioxidants, which include carotenoids, polyphenols, vitamins C and E, and others, help counteract damaging free radicals and lessen oxidative stress, which is intimately related to inflammation. Higher adherence to the Mediterranean diet was linked to lower markers of inflammation and oxidative stress, according to a study by Tuttolomondo et al., 75. One of the main sources of monounsaturated fats, particularly oleic acid, is olive oil, a mainstay of the Mediterranean diet. It has been demonstrated that monounsaturated fats have anti-inflammatory qualities. Dietary fiber from whole grains, legumes, fruits, and vegetables is abundant in the Mediterranean diet. A healthy gut microbiota is facilitated by the growth of beneficial gut bacteria, which is encouraged by fiber. Consequently, this aids in reducing inflammation and regulating the immunological response. Following a Mediterranean diet pattern was linked to a more favorable gut microbiota profile, which in turn decreased markers of systemic inflammation, according to a study by De Filippis et al. (76). Numerous phytochemicals, which are naturally occurring substances in plants with anti-inflammatory qualities, are found in the Mediterranean diet. These consist of resveratrol, curcumin, and flavonoids.

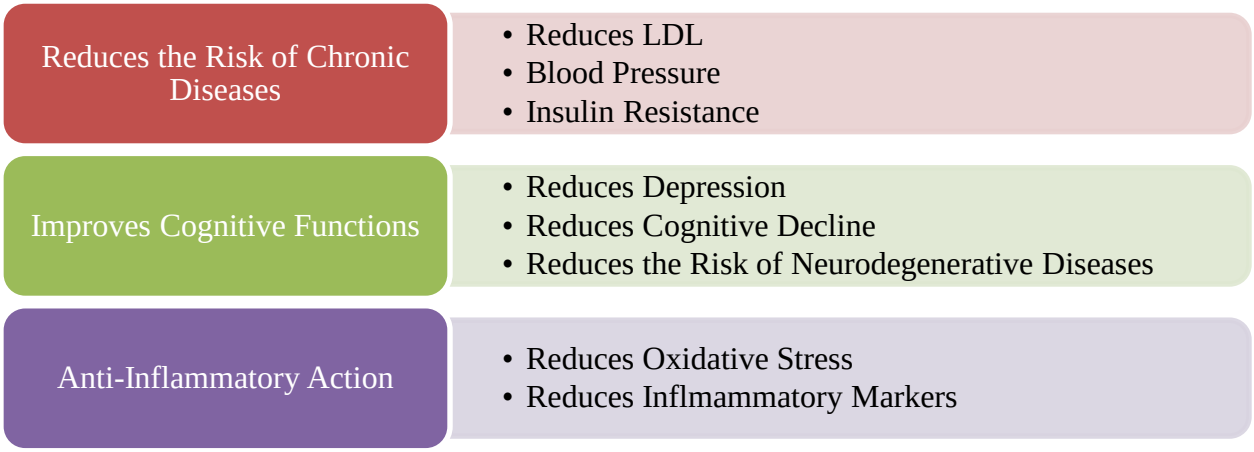

Figure 3. Health Benefits of a Mediterranean Diet

4.2 Drawbacks of a Mediterranean Diet

4.2.1 Potential Challenges in Sourcing and Preparing Foods

Despite its numerous benefits, a Mediterranean diet may pose challenges, particularly for individuals residing in regions with limited access to diverse and fresh produce. Sourcing and preparing certain ingredients, as well as the time-intensive nature of some Mediterranean dishes, may present obstacles for those with time constraints or limited culinary skills (77). The Mediterranean diet emphasizes the

consumption of fresh vegetables and fruits, lean proteins, legumes, whole grains, and healthy fats, such as olive oil. While these foods are generally accessible, there can be challenges when it comes to sourcing and preparing certain items, especially for individuals residing in areas with limited access to fresh seafood, whole grains, or a wide variety of fruits and vegetables. Moreover, the inclusion of uncommon ingredients, such as fresh herbs and spices, might pose challenges in finding them throughout the year or in regions with limited agricultural diversity. Furthermore, adhering to the Mediterranean diet often involves home-cooking and meal preparation. Many traditional Mediterranean dishes require time-consuming procedures, which may discourage individuals with busy lifestyles or limited culinary skills (78). These challenges in obtaining and preparing specific foods may hinder some individuals from adhering to a Mediterranean dietary pattern.

4.2.2 Higher Cost

The emphasis on fresh, high-quality ingredients, such as olive oil, fish, and fruits, can contribute to a higher cost compared to other dietary patterns. This financial aspect may act as a barrier for individuals on a tight budget, potentially limiting their ability to fully adopt the Mediterranean diet (79). The possibility of increased expenses as compared to alternative eating regimens is another disadvantage of the Mediterranean diet. The emphasis on fresh produce, high-quality olive oil, and lean proteins can contribute to an increase in overall food costs. High-income individuals may not face significant challenges in affording these dietary components, but for those with limited financial resources, adopting a Mediterranean diet may be financially burdensome (80). The affordability of specific foods within a Mediterranean diet can thus be a barrier for many individuals seeking to adhere to this eating pattern.

4.2.3 Individual Variations in Response

While the Mediterranean diet showcases a plethora of health benefits, individual responses may vary. Some individuals may not experience the same improvements in health markers, necessitating additional modifications to address specific health conditions. Recognizing the potential for individual variations is crucial in understanding the diet's effectiveness (63). While the Mediterranean diet is generally regarded as a healthy eating plan, there are individual variations in response to this dietary pattern. Some individuals may experience difficulties in achieving desired health outcomes or may not find the diet as suitable for their personal needs or preferences (81). Factors such as genetics, metabolism, pre-existing health conditions, or cultural backgrounds may impact an individual's response to the Mediterranean diet. For instance, certain individuals may require modifications to the diet due to dietary restrictions, such as gluten-free or lactose-free considerations.

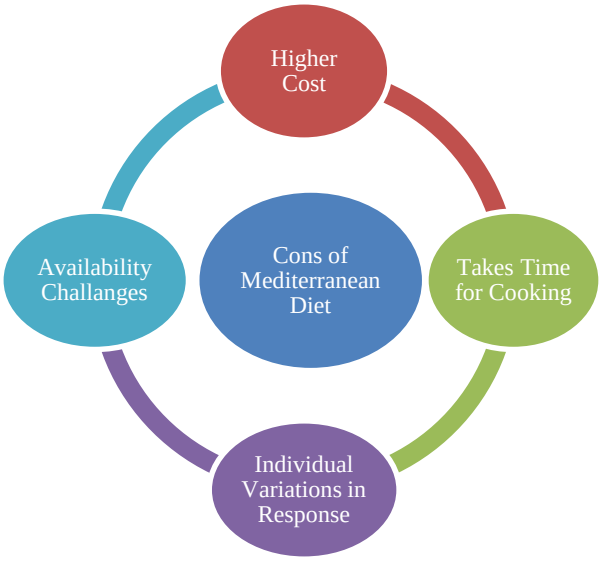

Figure 4. Drawbacks of a Mediterranean Diet

Conclusion

In conclusion, every diet (vegetarian, ketogenic, and Mediterranean) offers an own mix of advantages and disadvantages. Numerous health advantages of a vegetarian diet include a lower chance of developing chronic illnesses; however, careful preparation may be necessary to guarantee sufficient nutrient intake. Although the ketogenic diet is beneficial for lowering blood sugar and losing weight, it may not be easy to follow for the long run and may have certain health hazards. For instance, someone with a strong ethical belief in animal rights may be more inclined towards a vegetarian diet, while someone with epilepsy may benefit from a ketogenic diet under medical supervision. It is crucial to consult with a healthcare professional or registered dietitian to tailor a diet plan that meets individual needs and promotes overall health and well-being. The Mediterranean diet is regarded as a sustainable and well-balanced way of eating because of its focus on whole foods and moderate amounts of good fats. It also has numerous other health benefits. When choosing a diet, it is important to consider individual preferences, goals, and health conditions. Looking to the future, further research is needed in all three diets to explore their long-term effects on health outcomes. Understanding the potential areas for improvement in each diet can lead to advancements in nutritional guidelines and recommendations. In conclusion, choosing a diet should be a thoughtful and personalized decision based on individual preferences, goals, and health conditions. Each diet has its own benefits and drawbacks, and it is crucial to consult with healthcare professionals for guidance. Continued research in each diet can further refine nutritional recommendations and improve the overall understanding of their effects on health.

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