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Review

Mediterranean Diet and Metabolic Syndrome

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Abstract: Metabolic syndrome (MetS) is a major health issue defined by central obesity and at least two more of the following factors: high triglycerides, low high-density lipoprotein (HDL) cholesterol, high blood pressure, and high fasting glucose. Managing MetS involves lifestyle changes, with the adherence to a Mediterranean diet (MeDi) playing a crucial role. MeDi, emphasizing the consumption of whole grains, fruits, vegetables, legumes, nuts, and olive oil, has been linked to a reduced risk of type 2 diabetes and improved glucoregulation. A randomized controlled trial showed that a low-carb MeDi resulted in a 30% lower relative risk of developing type 2 diabetes compared to a low-fat diet. Additionally, meta-analytic data highlighted a strong inverse relationship between adherence to the MeDi and the incidence of diabetes. Furthermore, the MeDi's anti-inflammatory properties help manage obesity-related low-grade chronic inflammation, crucial for weight management and the improvement of quality of life. The improvement of lipid profiles, reductions in low-density lipoprotein and total cholesterol, and an increase in HDL cholesterol were also found to be linked to MeDi adherence. However, despite its benefits, adherence to the MeDi varies widely, often being low to moderate in many Mediterranean populations. Improving adherence through physician advice and patient education is crucial for maximizing the MeDi's potential to prevent and manage diabetes and diabetes-related complications.

Keywords: mediterranean diet; metabolic syndrome; diabetes; arterial hypertension; dyslipidemia

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1. Introduction

Metabolic syndrome (MetS) is an emerging health problem which has been defined in different ways throughout history by different health organizations.

Today, the criteria for MetS slightly vary across different guidelines. The World Health Organization was one of the first to present a formal definition of MetS in 1998. Their criteria focus on glucose intolerance or diabetes mellitus, either insulin resistance or hyperinsulinemia, and the presence of two or more of the following conditions: hypertension, elevated plasma triglycerides, low high-density lipoprotein (HDL) cholesterol, central obesity, and microalbuminuria [1]. In 2001, the National Cholesterol Education Program's Adult Treatment Panel III (ATP III) took a slightly different approach by emphasizing the role of abdominal obesity and requiring the presence of any three of the following five risk factors: increased waist circumference by population and country, elevated triglycerides, decreased HDL cholesterol, elevated blood pressure (BP), and elevated fasting blood glucose (FBG) [2]. The MetS definition according to the American Heart Association (AHA) and the National Heart, Lung, and Blood Institute (NHLBI) recommendations from 2005 aligns partially with ATP III, setting the waist circumference of ≥102 cm for men and ≥88 cm for women, while the fasting blood glucose level was set to ≥100 mg/dL [3].

Finally, the International Diabetes Federation (IDF) defined the criteria for MetS as follows: central obesity combined with any two of the four factors—raised BP (systolic BP ≥ 130, diastolic BP ≥ 85 mmHg or treatment of previously diagnosed hypertension); raised triglyceride level: ≥1.7 mmol/L (150 mg/dL); reduced HDL cholesterol: <1.03 mmol/L (40 mg/dL) in males and <1.29 mmol/L (50 mg/dL) in females (or specific treatment for these lipid abnormalities); and raised FBG (≥5.6 mmol/L (100 mg/dL)), or a previous type 2 diabetes mellitus (T2DM) diagnosis [4].

The IDF states that a modest calorie restriction within a healthy lifestyle, an increase in physical activity in moderation, and changes in diet as to lower the overall intake of saturated fat, increase fiber, and, when necessary, lower salt intake are encouraged as the primary management strategies of MetS [4]. The Mediterranean diet, or MeDi, has been studied more than any other eating plan in the world. The term "Mediterranean diet" was first used to describe the general eating patterns of people living in the Mediterranean basin in the early 1960s, primarily in Crete, Southern Italy, and most of the remainder of Greece [5].

The main characteristics of the MeDi are the high consumption of whole grain cereals (i.e., pasta and bread), legumes, nuts, fruits, vegetables, and extra virgin olive oil, with a reduced intake of sweets, processed foods, and red meat [6]. The consumption of dairy products (mostly yogurts and light cheeses), poultry, and alcohol (in particular red wine) in moderation is also associated with it [6]. Based on previous studies, the MeDi is the most successful diet among several for reducing obesity-related illnesses [7].

In a recent umbrella review, the MeDi has been associated with multiple health benefits—the overall risk of cardiovascular diseases (CVD), myocardial infarction, coronary heart disease, overall cancer incidence, T2DM, neurodegenerative diseases, and mortality were found to be reduced [8]. According to the findings of the ATTICA study, a 20-year prospective study conducted on Greek volunteers in 1998, an 8% decrease in the incidence of CVD over a period of 20 years was linked to every unit increase in baseline MeDi Score. Subjects in the highest tertile of the baseline MeDi Score showed a 44% reduction in 20-year CVD risk (relative risk: 0.56, 95% confidence interval: 0.32, 0.97) as compared to those in the lowest tertile [9].

This review aims to summarize the current scientific evidence to elucidate the relationships between the MeDi and each component of the MetS—obesity, dyslipidemia, diabetes, and arterial hypertension.

2. Mediterranean Diet and Obesity

Balanced hypocaloric diets in combination with exercise remain the cornerstone of weight reduction programs [10]. Calorie (energy) restriction should be tailored to each individual and should consider past dieting attempts, physical activity, comorbidities, and nutritional habits [11].

Besides weight reduction per se, preventing/managing comorbidities and enhancing the quality of life for people with obesity are equally important parts of the treatment regimen and objectives. Obesity-related low-grade chronic inflammation (LGCI; a driver towards obesity-related complications) induction is associated with adipose tissue macrophages (ATMs) hyperplasia and hypertrophy, loss of tissue homeostasis (shift in adipokine production from adiponectin to leptin/MCP-1), type 1 inflammatory response characterized by IFN-γ development, and a shift in ATM polarization from an M2 (anti-inflammatory) to an M1-like (pro-inflammatory) state, and consequently, the extensive secretion of pro-inflammatory cytokines (e.g., IL-6, IL-1β, IL-12, MCP-1, and TNF-α) [12,13]. One should bear in mind that the latter pro-inflammatory cytokines seem to be orexigenic, thereby promoting further fat accumulation and increasing energy intake, which initiates/maintains the obesity–LGCI vicious circle [12].

Thus, thinking about a diet's anti-inflammatory potential and its impact on obesity-related LGCI, in addition to its hypocaloric determinant, is of utmost importance [12]. Furthermore, it is well established that both overall dietary patterns and individual food groups independently affect inflammatory biomarkers [12,14]. Based on the effect of individual food parameters on inflammation (more precisely, levels of IL-1β, IL-6, TNF-α, C-reactive protein (CRP), IL-4, and/or IL-10) the overall food parameter-specific inflammatory effect scores, ranging from −1 to +1 are assigned—for example, garlic (−0.412) has a strong anti-inflammatory effect score, while total fat (+0.298) shows a notable pro-inflammatory effect [14]. When it comes to diet, inflammatory potential is represented by Shivappa's Dietary Inflammatory Index (DII), which ranges from 7.98 (maximally pro-inflammatory) to −8.87 (maximally anti-inflammatory). The MeDi poses a strong anti-inflammatory potential, with a DII score of −3.98 [14]. The DII is calculated by comparing an individual's intake of specific foods and nutrients to global averages, standardizing it into Z-scores. These Z-scores are converted into centered percentiles, which are then multiplied by each food's known inflammatory effect score. The overall DII score is the sum of these values, with positive scores indicating a pro-inflammatory diet and negative scores reflecting an anti-inflammatory diet [14]. To clarify, the highest DII scores are associated with the higher yearly weight change, a higher risk of experiencing a relevant weight gain, an increase in waist circumference and waist-to-hip ratio, LGCI, and metabolic alterations [15,16]. The role of DII in CVD, MetS, and mortality has already been well reviewed [17].

The MeDi represents the greatest body of literature on the treatment and prevention of obesity, as well as other non-communicable diseases and mortality [18]. In their systematic review and dose–response meta-analysis of prospective cohort studies, Lofti et al. conclusively showed that adherence to the MeDi is linked to a reduced risk of developing obesity and becoming overweight, as well as a decrease in 5-year weight gain [19]. These results are in concordance with the results of one of the biggest prospective cohort studies, the EPIC-PANACEA project, that included 373,803 individuals [20]. Recently, a 20-year follow up on MeDi adherence and its impact on the body mass index (BMI) has been published (ATTICA cohort study). The MeDi Score was linked to a reduction in BMI and mean BMI (ranging from 0.05 to 0.13 kg/m^2 and 0.08–0.09 kg/m^2, respectively), while adherence to a Mediterranean-type diet was associated with a 90% reduction in the risk of remaining overweight or obese over a 20-year period [21]. Multiple systematic reviews and meta-analyses of RCTs have reported that the MeDi leads to greater reductions in body weight and BMI compared to other diets [22–25]. Osorio Conles et al. demonstrated the MeDi's protective effect (supplemented with almonds) on obesity-related white adipose tissue dysfunction as well as LGCI [26]. Furthermore, high MeDi adherence subjects with MetS and non-alcoholic fatty liver disease experienced greater reductions in body weight; waist circumference, in systolic and diastolic BP; and intrahepatic fat contents in a multicenter prospective randomized experiment with 128 participants [27].

What is even more important is that, as obesity in children and adolescents has become a major global epidemic [28,29], the effect of a nutritional intervention with the MeDi in obese children exhibiting at least one MetS component showed improvements in BMI and the glucose and lipid profile in comparison to the standard diet in a study from Velázquez-López et al. [30]. In addition, a recent systematic review and meta-analysis by

Larruy-García et al. further supports these claims as it highlights the protective effect of MeDi adherence on unwanted obesity outcomes in children and adolescents [31].

Finally, besides obesity per se and the spectrum of obesity-related metabolic complications, MeDi adherence was also positively related to improvement in psychological well-being and depression levels [32]. Multiple longitudinal and cross-sectional studies have shown that following a MeDi and an increase in physical activity can greatly enhance the mental health status and decrease depression symptoms. The reason for these observations may be because this kind of dietary pattern is rich in nutrients like omega-3 fatty acids, polyphenols, or vitamins which are essential in regulating inflammatory processes as well as neurotransmitters that have an effect on human beings intellectually [33]. Furthermore, according to the study from Gallardo-Alfaro et al. with 5739 participants, those with a more severe metabolic syndrome exhibited pro-inflammatory food patterns, greater rates of sedentary behavior and depression risk, and lower levels of physical activity. On the other hand, individuals with a less severe metabolic syndrome displayed the opposite patterns, such as increased levels of physical activity, a decreased likelihood of depression and sedentary behavior, and an anti-inflammatory food pattern. The study also found that eating more red and processed meat, consuming less nuts, and not following a MeDi were all linked to higher levels of metabolic syndrome severity [34].

3. Mediterranean Diet and Dyslipidemia

The American College of Cardiology/American Heart Association endorses the MeDi in their 2018 Guideline on the Management of Blood Cholesterol, which included lifestyle counseling based on Dietary Approaches to Stop Hypertension (DASH) and MeDi concepts [35].

Research indicates that the MeDi beneficially impacts lipid profiles and reduces dyslipidemia. These advantages are primarily due to its low levels of saturated fats and high intake of unsaturated fats, especially from sources like extra-virgin olive oil, nuts, seeds, and whole grains [36]. Prospective studies and randomized controlled trials have demonstrated that adherence to this diet lowers low-density lipoprotein (LDL) cholesterol and total cholesterol levels, while increasing HDL cholesterol [36]. Specific dietary components such as water-soluble fibers, omega-3 and omega-6 fatty acids, and phytosterols play crucial roles in these effects by reducing cholesterol absorption and synthesis [36]. Furthermore, key components like polyphenols and fibers increase the production of beneficial short-chain fatty acids via gut microbiota interaction, reducing cholesterol and LDL levels [37]. Low carbohydrate diets also improve lipid profiles by increasing omega-3 PUFA and beneficial gut bacteria, while decreasing triglycerides [37].

On the contrary, the results of a study by Flatscher et al. indicate that adherence to MeDi was associated with neither lipid levels nor with incident dyslipidemia [38]. However, even though this study included a large number of participants and three follow-ups in a span ranging from 5 to 10 years, data from follow-up examinations were exclusively utilized, as the dietary assessment was not conducted at baseline [38].

When observing a specifically high-risk population such as familial hypercholesterolemia, Antoniazzi et al. found a significant inverse relationship between adherence to the MeDi core and elevated levels of LDL cholesterol, apolipoprotein B, and high sensitive CRP [39]. Furthermore, in individuals at high cardiovascular risk, a year-long intervention with a traditional MeDi significantly improved several HDL functions, according to one of the largest and longest randomized controlled trial (n = 296, duration 1.13 ± 0.21 years) of its kind. This study had a low-fat diet comparator, and a comprehensive assessment of HDL functions. However, the study included a mainly elderly population (average age 66 years), and some data on HDL enzymatic proteins and size were not reported, which can be a confounding factor in comprehending the interactions. Despite these issues, the MeDi, particularly when enriched with virgin olive oil, enhanced HDL's cholesterol efflux capacity, metabolic function, antioxidant and anti-inflammatory properties, as well as vasodilatory capacity [40].

The Lyon Diet Heart Study—a randomized, single-blind secondary prevention trial published in 1999—was one of the earliest trials to show how powerful the MeDi can be in the prevention of CV complications. It showed that the MeDi significantly reduced the rates of cardiovascular complications, including cardiac death, nonfatal myocardial infarction, and a composite outcome that included both. The study also found that major traditional risk factors, such as high blood cholesterol and BP, were independently associated with recurrence [41].

The CORDIOPREV study, a randomized clinical trial at Reina Sofia University Hospital in Córdoba, Spain, compared a MeDi to a low-fat diet in preventing major cardiovascular events in patients with established coronary heart disease. The study involved 1002 patients, with 500 in the low-fat diet group and 502 in the MeDi group. The primary endpoint was a composite of major cardiovascular events, with the MeDi being superior in secondary prevention. The effects were more evident in men, with primary endpoints occurring in 16.2% of men in the MeDi group versus 22.8% of men in the low-fat diet group [42].

The ATTICA study, conducted in Athens between 2001 and 2002, examined the added benefit of MeDi combined with statin application using a cohort of 3042 participants, free of CVD at the start [43]. Over a decade, adherence to the MeDi, measured using the MeDi Score, was tracked along with statin use. By the 10-year follow-up, results showed that those with the highest adherence to the MeDi had a 29.3% lower risk of developing CVD compared to those with the lowest adherence, regardless of statin use [43]. Notably, individuals with hyperlipidemia on statins but poor dietary habits faced a 75% higher risk of CVD than those with normal lipid levels who followed healthy diets. Therefore, according to the ATTICA study, the MeDi significantly reduced CVD risk independently of various factors such as age, gender, family history, diabetes, smoking, hypertension, and physical activity [43]. These findings support integrating the MeDi into CVD prevention strategies for both the general population and those on statins.

4. Mediterranean Diet and Blood Pressure

High BP, as a significant risk factor for CVD such as stroke, ischemic heart disease, heart failure, hypertensive heart disease [44], and kidney disease [45], underscores the importance of adopting a healthy lifestyle, particularly dietary modifications, for its prevention and management [46,47]. Among the most effective dietary interventions for lowering BP are the DASH diet [48] and the MeDi [49–51]. Greater adherence to a MeDi has also been found to be associated with a 10% reduction in CVD incidence or mortality [52].

A study conducted in Australia by Davis et al. involved 166 men and women aged over 64 years, who were allocated to either a MeDi or their habitual diet for 6 months. As the MeDi emphasized plant foods and extra-virgin olive oil while limiting red meat and processed foods, the study showed a significant reduction in systolic BP of 1.3 mmHg at 3 months and 1.1 mmHg at 6 months compared to the control group with their habitual diet [53].

The PREDIMED (Prevención con Dieta Mediterránea) study, involving 7477 participants at high risk for CVD, evaluated the impact of two variations of the MeDi compared to a control low-fat diet without calorie or salt restrictions on key cardiovascular outcomes. Participants were randomly assigned to either a control group or one of the two MeDi groups. The control group received education on a low-fat diet, while the MeDi groups received nutritional education and free provisions of either extra virgin olive oil or nuts. Following a median follow-up of 3.8 years, both MeDi interventions demonstrated greater reductions in BP compared to the control diet. Notably, significant reductions in diastolic BP persisted after adjusting for multiple variables [49].

Filippou et al. conducted a randomized controlled trial comparing the effects of the DASH diet versus the MeDi under conditions of salt restriction in adults with high normal BP or grade 1 hypertension [50]. They concluded that, when combined with salt restriction, the MeDi was superior in lowering office systolic BP. Moreover, both the MeDi and DASH diet achieved greater reductions in BP compared to salt restriction alone [50].

Ndanuko et al. performed a meta-analysis including 17 randomized controlled trials to evaluate the effects of the DASH diet, Nordic diet, and MeDi on BP in adults [54]. Their findings indicated that these healthy dietary patterns significantly reduced systolic BP by 4.26 mmHg and diastolic BP by 2.38 mmHg [54].

Additionally, a recent umbrella review of the meta-analyses of randomized controlled trials and observational studies examined the association between dietary factors and hypertension risk, as well as changes in BP. The review concluded that dietary patterns like the DASH and MeDi, which advocate for sodium restriction and moderate alcohol intake, are recommended for individuals with arterial hypertension [55]. The findings of the key studies listed above are summarized in Table 1.

Table 1. Key findings of studies on Mediterranean diet and blood pressure.

Study	Design	Diet	Key Findings
Davis et al., 2017. [53]	RCT	MeDi vs. habitual diet	Significant reduction in systolic BP with MeDi
PREDIMED study [49]	RCT	MeDi vs. LF/LS	Superior BP reduction with MeDi
Filippou et al., 2023. [50]	RCT	MeDi + LS vs. DASH + LS vs. LS	MeDi reduced BP more than salt restriction alone or in combination with DASH
Ndanuko et al., 2016. [54]	Meta-analysis	MeDi, DASH, and Nordic	DASH, Nordic diet, and MeDi significantly lowered systolic BP and diastolic BP
Aljuraiban et al., 2024. [55]	Umbrella review	All diet patterns	DASH and MeDi with further restriction of sodium and moderate alcohol intake are advised

Abbreviations: RCT—randomized controlled trial; MeDi—Mediterranean diet; BP—blood pressure; PREDIMED—Prevención con Dieta Mediterránea; LF—low fat; LS—low sodium; DASH—Dietary Approaches to Stop Hypertension.

5. Mediterranean Diet and Diabetes Mellitus Type 2

The IDF has affirmed that while the exact cause of T2DM is yet to be full understood, individuals with unhealthy dietary habits, a sedentary lifestyle, excess weight, and a family history of diabetes are at significant risk for developing this condition [56]. Regarding dietary factors in T2DM, dietary patterns have garnered considerable attention recently, with earlier research highlighting a negative correlation between adherence to the MeDi and the onset of diabetes [57,58].

The MeDi, renowned for its high fat content including significant amounts of magnesium, nuts, and olive oil, demonstrates potential benefits in reducing the risk of diabetes [59,60]. Strong adherence to the MeDi is associated with a substantial decrease in diabetes risk, suggesting its clinical relevance for public health initiatives aimed at the primary prevention of T2DM [61]. Previous studies have highlighted the multiple advantages of Mediterranean lifestyle interventions involving low-fat or low-carbohydrate diets for individuals with T2DM [23,62,63]. For instance, a randomized controlled trial comparing a MeDi (low-carbohydrate) with a low-fat diet aimed at preventing T2DM reported a 30% lower relative risk with the MeDi [64].

The DiRECT trial—open-label, cluster-randomized trial conducted at 49 primary care practices in Scotland and the Tyneside region of England—aimed to provide a weight management program (intervention) or best-practice care by guidelines (control). The participants were aged 20–65 years, diagnosed with T2DM within the past six years, with a body-mass index of 27–45 kg/m^2, and were not receiving insulin. The intervention included withdrawal of antidiabetic and antihypertensive drugs, total diet replacement, stepped food reintroduction, and structured support for long-term weight loss maintenance. The co-primary outcomes were weight loss of 15 kg or more and the remission of diabetes, defined as glycated hemoglobin of less than 6.5% after at least 2 months without any antidiabetic medications. For the study, 306 people were recruited from the intervention and control groups between 25 July 2014 and 5 August 2017, with 149 participants per group. Diabetes remission was achieved in 46% of participants in the intervention group and 4% of participants in the control group (odds ratio 19.7, 95% CI 7.8–49.8; $p < 0.0001$). Weight loss of 15 kg or more was achieved in 24% of participants in the intervention group and none in the control group ($p < 0.0001$). Quality of life was also improved in the intervention group [65].

The study conducted by Salas SJ et al. from the PREDIMED cohort including 418 non-diabetic participants investigated the effects of two MeDi interventions versus a low-fat diet on the incidence of diabetes. The participants were randomly assigned to education on a low-fat diet (control group) or one of two MeDis, supplemented with either free virgin olive oil (1 L/week) or nuts (30 g/day). After a median follow-up of 4.0 years, DM rates were reduced by 51 and 52% by the adherence to MeDis supplemented with virgin olive oil or mixed nuts compared with a control diet consisting of advice on a low-fat diet. Another interesting finding from the aforementioned study is that only 6.3% of participants in the MeDis groups developed diabetes if they attained $\geq$4 goals compared with 15.0% of those who reached <4 goals ($p = 0.02$). This evidence reinforces the importance of the MeDi in managing metabolic health and preventing diabetes-related complications [42].

Jannasch et al.'s 2017 meta-analysis demonstrated a robust inverse relationship between adherence to the MeDi and diabetes incidence [57]. Furthermore, adherence to the MeDi has been linked to improvements in glucoregulation, blood lipid profiles, and overall metabolic health [66,67]. Toi et al. conducted an umbrella review, synthesizing evidence on diet interventions and dietary factors in T2DM prevention, highlighting that high adherence to the MeDi and DASH diet, as well as interventions improving diet quality, significantly reduces T2DM risk, particularly in high-risk populations [68].

Studies comparing the MeDi with low-fat diets over four years have shown that the MeDi, particularly when low in carbohydrates, leads to more favorable improvements in glycemic control, coronary risk factors, and delays the need for antihyperglycemic medications in overweight patients newly diagnosed with T2DM [69]. Moreover, research indicates that a MeDi supplemented with olive oil and nuts reduces the incidence of CVD in individuals with T2DM [70].

Based on the comprehensive evidence presented, the MeDi stands out as the nutritional strategy with the highest level of supporting evidence in the literature, offering substantial benefits to patients with T2DM.

6. Mediterranean Diet in Real World Setting

In all of the studies mentioned above, it is undoubted that a MeDi pattern is favorable; but what is the reality of MeDi adherence?

A systematic review on the adherence to a MeDi in a general adult population in Mediterranean countries by Obeid et al. included 50 studies and found that the majority of studies (35 studies) reported low to moderate adherence to the MeDi, while only one study has shown high adherence [71]. A study on 2768 participants from Dalmatia found only 23% of the participants adhered to the MeDi, with an adherence of only 12% among younger participants [72]. When we speak about special populations of patients, the situation does not seem to be better—an adherence of 8.3% to the MeDi was found in Dalmatian chronic kidney disease hypertensive participants [73].

The reasons for the low adherence to the MeDi are complex and multifactorial. The systematic review by Tsofliou et al. examined multifactorial barriers and factors that favor adherence to the MeDi. Barriers include difficulties in accessing suitable food, high food costs, low income, gender, age, and education. Factors that facilitate adherence to the MeDi include perceptions of improved diet quality, health benefits, and positive outcomes [74].

Cognitive barriers include the lack of knowledge about the diet, its details, and its health effects. Facilitators include perceptions of improved diet quality, naturalness, and positive outcomes. Sensory and hedonic barriers focus on the taste, smell, and pleasure of the recommended foods, while motivational factors such as self-efficacy, self-regulation, and willingness to change play a role. Socio-cultural barriers include family and living circumstances, education, lifestyle, and climate. Cultural differences, such as traditional eating habits, can be a barrier, while changes in these habits can be a facilitator. A cold climate can be a barrier, while a warm climate can be a facilitator [74].

There are many studies that thoroughly analyze the level of MeDi adherence in general populations (even per gender, age, and countries/regions). The body of evidence reporting on adherence levels in subpopulations are lacking. Although extrapolation from subsets may be performed, based on speculations, the authors would not like to comment on this due to the under-powered nature of the statements from a statistical point of view. Studies (both in Mediterranean and non-Mediterranean countries) primary aimed to determine MeDi adherence in subpopulations such as patients with atherogenic dyslipidemia, arterial hypertension, T2DM, overweight/obesity, and MetS are much needed. For now, due to heterogeneity and firm direct findings, we can only logically speculate that the level of adherence is even lower in the latter diseases than in the general or “healthy” population we presented.

It can be extensively debated why this traditional dietary pattern is marginalized; the reasons could be a fast way of life, food price, trends, false information through media, more trending diets promising fast results, so called Westernization, or others. Physicians have a crucial role in advising high-risk patients, and their expertise on the MeDi is extremely valuable.

In light of that, there is a study conducted by the European Society of Hypertension (ESH) Working Group on Diabetes and Metabolic Risk Factors which conducted a 30-item survey including 70 representatives of ESH Excellence Centres to evaluate the assessment and management of patients with hypertension and obesity [75]. Among other questions, they also included questions on MeDi. Unsurprisingly, 87% of hypertensiologists advised their patients to sticks to the “MeDi” in general. But when asked more specifically, 72% advised their patients to regularly eat chicken, turkey, or rabbit instead of veal, pork, beef, or sausage. Of the study population, 9% advise <2 servings of fish (100–150 g) or seafood (200 g) per week, 7% advise <2 servings (200 g each) of vegetables per day, 12% advise <1 or >3 servings (80 g each) of fruit per day, 3% advise 2 servings (100–150 g) of red meat/hamburgers/other meat products, and 3% advise >3 servings of commercial sweets/pastries per week [75].

Furthermore, when analyzing the potential aspects in MeDi adherence, 6874 men and women with metabolic syndrome and no CVD, aged from 55 to 75, participated in a randomized trial conducted in Spain. They were randomized in the following two groups: one that supported an energy-unrestricted MeDi, physical exercise, and behavioral support, and another that promoted an energy-reduced MeDi. They discovered that an energy-reduced MeDi and physical exercise led to a considerably higher increase in diet adherence at 12 months when compared to advice to follow an energy-unrestricted MeDi. The energy-reduced MeDi group also showed improvements in cardiovascular risk variables, energy consumption, and food quality [76]. It would appear that energy-restriction promotes MeDi adherence, probably due to calorie restriction causing a reduction in long-term cravings for fats, sweets, and starches while increasing cravings for fruits and vegetables, as shown in the study by Anton et al. [77].

While the MeDi remains the primary dietary recommendation due to its well-established health benefits, the Atlantic and Nordic diets may serve as viable alternatives for individuals who find adherence to the MeDi particularly difficult due to cultural, geographical, or practical reasons. These alternative diets share key similarities with the MeDi, such as a focus on whole foods, fish, and healthy fats, making them reasonable options for improving metabolic health when adherence to the MeDi is not feasible.

To conclude, more studies are needed to improve our insight in the areas of education needing improvement and understanding behavioral patterns. Consequently, more actions are needed such as the formal education of physicians on nutrition, behavioral patterns, and lifestyle management.

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