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EFFECTS OF LONG-TERM MEDITERRANEAN DIET COMPLIANCE ON ADULTS' INFLAMMATION, OBESITY, AND GENERAL HEALTH OUTCOMES IN VARIOUS POPULATIONS

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Abstract

Background: *Obesity is slowly being redefined as a chronic inflammatory disorder that through multiple mechanisms contributes to the development of cardiometabolic disease and a reduction in quality of life. The Mediterranean diet has long been one of the diets most strongly linked with good health, however, evidence from long, term randomized trials demonstrating its integrated effects on chronic inflammation, obesity, and overall health is still scarce.*

Objective: *This trial sought to investigate the effects of prolonged compliance with the Mediterranean diet on chronic inflammation, measurements related to obesity, and general health outcomes in overweight and class I obese adults.*

Methods: *A total of 160 adults aged 20 to 65 years with a BMI of 25 to 35 kg/m2 were randomly assigned to either a Mediterranean diet (MedDiet) intervention group or a control group following their habitual diet (standard dietary advice) for 12 months. The intervention was based on personalized nutrition counseling, structured meal plans, and the provision of key MedDiet foods. Adherence was measured with the 14, item MedDiet Adherence Screener (MEDAS). Changes in inflammatory markers (high, sensitivity C, reactive protein, interleukin, 6, and tumor necrosis factor alpha) and obesity, related measures were the primary endpoints. The secondary endpoints were cardiometabolic risk factors and health, related quality of life. The data were analyzed using the intention, to, treat and per, protocol methods.*

Results: *Mediterranean diet adherence was importantly raised in the intervention group relative to controls ($p < 0.001$). At 12 months, the*

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intervention group exhibited significantly greater reduction in body weight, body mass index, waist circumference, and fat mass (all p < 0. 01). Decreased levels of hs C reactive protein, interleukin 6, and tumor necrosis factor were most pronounced in the Mediterranean diet group, and the effects remained significant even after one adjusts for weight change.Besides these, the improvements of blood pressure, lipid profile, insulin resistance, and quality of life scores were also much greater in the intervention group than in controls.

Conclusion: *Maintaining a Mediterranean diet for 12 months made a significant difference in systemic inflammation, obesity related outcomes, cardiometabolic health, and quality of life in adults with overweight and obesity. These results emphasize the role of diet quality in controlling obesity related inflammation and the Mediterranean diet as a convenient and effective long term dietary approach for chronic disease prevention and health promotion.*

INTRODUCTION

The worldwide growth of obesity and conditions related to obesity such as non, communicable diseases has fanned the debate on dietary sytles that can tackle fat tissue, chronic low, grade inflammation and be of general health in adults, simultaneously. It is currently widely accepted that obesity is a state of long, term, systemic inflammation, which results from adipose tissue dysfunction and abnormal endocrine signaling that together lead to insulin resistance, metabolic syndrome, type 2 diabetes, and cardiovascular disease (Gantenbein & Kanaka, Gantenbein, 2021; Dominguez et al. , 2023). In this context, the traditional Mediterranean diet (MedDiet) whose main components are fruits, vegetables, whole grains, legumes, nuts, and extra, virgin olive oil, with a moderate intake of fish and low intake of red and processed meats, has become one of the most thoroughly researched and most promising dietary approaches for preventing chronic diseases and promoting health (Guasch, Ferr & Willett, 2021; Barber et al. , 2023).

Numerous studies have shown that a better MedDiet adherence is linked to a decrease in the risk of premature death, as well as to the diminished occurrence of leading cardiometabolic conditions such as cardiovascular disease (CVD), stroke, type 2 diabetes (T2D), and weight gain.(Carlos et al. , 2018; GuaschFerr & Willett, 2021). A few large prospective cohorts like the SUN study have found people who are highly adherent to the MedDiet had a lower risk of major cardiovascular events, type 2 diabetes, and becoming overweight, and this link basically took the form of a doseresponse (Carlos et al. , 2018). Latest umbrella reviews and narrative syntheses continue to show that the components of metabolic syndromebody weight, waist size, blood pressure, lipid profile, and markers of glycaemiaare all positively influenced by the MedDiet in diverse adult populations (Papadaki et al. , 2020; Scaglione et al. , 2025).

More and more people are paying attention to the anti, inflammatoriness that comes with the MedDiet. Chronic low, grade inflammation, as indicated by circulating markers such as C, reactive protein (CRP), interleukin, 6 (IL, 6), and tumor necrosis factor, alpha, is the main mechanism that connects obesity with cardiometabolic and neurodegenerative diseases (Gantenbein & Kanaka, Gantenbein, 2021; Florkowski et al. , 2024). Meta, analyses of systematic reviews and controlled trials reveal that MedDiet interventions result in significant decreases in CRP, IL, 6, and other markers of inflammation, plus improvements in the functioning of endothelium (Papadaki et al. , 2020; Ilari et al. , 2025). Observational syntheses also indicate that adults living in the community who score high on the Mediterranean or anti, inflammatory diet indices have a significantly lower level of inflammation (Hart et al. , 2021). Importantly, long, term data from the Moli, sani cohort demonstrate that increasing MedDiet adherence over approximately 13 years is associated with sustained reductions in composite

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indices of low, grade inflammation in ageing adults (Bonaccio et al. , 2022).

Evidence also supports a robust connection between MedDiet adherence and obesity, related outcomes. Narrative and meta, analytic work shows that MedDiet, based interventions lead to greater reductions in body weight and body mass index than several comparator diets, and that higher adherence is inversely associated with the risk of developing obesity and with long, term weight gain (Dominguez et al. , 2023; Papadaki et al. , 2020). In persons with overweight and obesity but without diabetes, higher MedDiet scores are associated with greater insulin sensitivity, lower inflammatory pathway activation such as NF, B, and more favorable adipokine profiles, independent of total body fat (Sood et al. , 2022). Randomized trials in adults with metabolic syndrome further indicate that energy, reduced MedDiet interventions combined with physical, activity promotion improve body weight, waist circumference, glucoseinsulin homeostasis, lipid parameters, and multiple pro, inflammatory markers over mid, and long, term follow, up (Hernando, Redondo et al. , 2022).Recent study has started to reveal the mechanistic pathways through which long, term adherence to the MedDiet could lead to a reduction of inflammation and obesity, in particular, through gut microbiota and metabolites derived therefrom. Different studies with controlled diets in overweight and obese individuals have demonstrated that changing from a Western, style diet (characterized by the typical unhealthy foods in the USA and other Western countries) to an isocaloric MedDiet results in changes in gut microbial composition, an increase in gene richness, a rise in short, chain, fatty, acidproducing taxa, and a decrease in insulin resistance and inflammatory status, even without intentional weight loss (Meslier et al. , 2020; Tagliamonte et al. , 2021; Barber et al. , 2023). Articles concerning gut, derived metabolites illustrate that MedDiet, induced alterations of short, chain fatty acids, bile acids, and other microbial products can affect inflammatory processes in obesity that also involve NLRP3 inflammasome activation and Toll, like receptor, 4 signaling (Florkowski et al. , 2024; Perrone & DAngelo, 2025).

In addition to the improvement of cardiometabolic components, following the MedDiet has also been associated with a wider range of general health outcomes such as elevated health, related quality of life, better sleep quality, and lower odds of depression and cognitive decline. A recent systematic review on adults revealed that a higher level of MedDiet adherence correlates with better physical aspects of health, related quality of life in both the general and patient populations, a lot of which are suffering from chronic low, grade inflammation (Godos et al. , 2025). Several other reviews highlight associations between lifestyle MedDiet adherence, sufficient sleep duration, and sleep quality improvement, thus revealing another mechanism via which habitual diets may affect systemic inflammation and general health (Scoditti et al. , 2022).

However, an important gap still exists concerning the long, term impacts of continuous MedDiet compliance on integrated profiles combining inflammation, changes in obesity, and diverse health outcomes in adult populations with varied characteristics and cultural backgrounds. Most trials have a short duration, and long, term observational data, although increasing, still remain somewhat scarce in non, Mediterranean environments and in high, risk subgroups such as elderly people with multiple diseases or severe obesity (Hart et al. , 2021). Besides this, there is a lot of variation in the ways in which MedDiet adherence is measured, and this adds to the difficulty of making comparisons between different studies and populations (Papadaki et al. , 2020; Guasch, Ferr & Willett, 2021). Given the magnitude of the problem of obesity and inflammation, related chronic diseases worldwide, it is critical to gain a deeper insight into how long, term MedDiet adherence influences inflammatory profiles, obesity, related parameters, and general health outcomes in different adult populations. Such know, how can be used to provide culturally adaptable

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dietary guidelines, help precision nutrition approaches pinpointing high, risk groups, and direct public health strategies to reduce the long, term effects of obesity, driven inflammation on morbidity, mortality, and quality of life.

Literature review

The Mediterranean diet has been reviewed very broadly in terms of its association with various health outcomes among adult populations, such as inflammation, obesity, and overall cardiometabolic risk. Large, scale and narrative reviews combining observational studies and randomized clinical trials report that greater commitment to this dietary pattern is linked to lower overall mortality, cardiovascular disease, type 2 diabetes, and various obesity, related complications, among different cohorts (Dinu et al. , 2018; Guasch, Ferr & Willett, 2021). These advantages seem to result from several interconnected pathways, including body fat reduction, lowering systemic low, grade inflammation, metabolic control, and improved vascular function (Tuttolomondo et al. , 2019).

A dominant topic in this research is how Mediterranean diet adherence relates to obesity and metabolic syndrome. Narrative and meta, analytic reviews present that there is a negative correlation between following the Mediterranean diet and overweight/obesity for both cross, sectional and longitudinal studies, where meta, analyses of randomized controlled trials reveal that subjects on the Mediterranean diet experience greater body weight and body mass index reductions than those on low, fat or other comparator diets (Dominguez et al. , 2023; Dinu et al. , 2018).Systematic review and meta, analysis of controlled trials provide further evidence that Mediterranean diet interventions have a positive effect on a wide range of components and risk factors of metabolic syndrome, including body weight, waist circumference, blood pressure, glucose, insulin resistance, lipid profile, and hepatic fat mass (Papadaki et al. , 2020). These results are corroborated by more recent reviews which highlight reductions in central obesity and visceral fat, the main factors for cardiometabolic risk (Scaglione et al. , 2025).

Low, grade inflammation is being increasingly considered the mechanistic link between obesity and chronic non, communicable diseases, while dietary patterns are essential regulators of this inflammatory environment. A systematic review of observational studies revealed that higher Mediterranean and other healthy diet index scores were consistently related to lower levels of circulating inflammatory biomarkers, especially C, reactive protein and interleukin, 6, in community, dwelling adults (Hart et al. , 2021). Data from the long, term prospective Moli, sani Study demonstrate that rises in Mediterranean diet adherence over about 13 years are correlated with decreases in a composite index of low, grade inflammation, even if changes in traditional cardiovascular risk factors are minimal (Bonaccio et al. , 2022). Meta, analytical comparison of the Mediterranean, vegan, and vegetarian diets indicates that although all three patterns might lower oxidative stress and inflammatory markers, only the Mediterranean diet was found to have at least modest lowering effects on CRP and IL, 6, thus the anti, inflammatory effects seem to be clinically relevant though not very dramatic (Ilari et al. , 2025).

Mechanistic and intervention studies have helped to understanding of how long, term compliance with a Mediterranean diet might reduce inflammation and obesity through gut microbiota and related pathways. Randomized controlled trials in overweight and obese individuals show that an isocaloric Mediterranean diet can reduce plasma cholesterol, change gut microbial composition, increase microbial gene richness, and improve short, chain, fatty, acid, related metabolic functions, which are along with the changes in insulin sensitivity and inflammatory status (Meslier et al. , 2020; Tagliamonte et al. , 2021). Reviews of the Mediterranean diet, gut microbiota crosstalk revealed higher levels of beneficial taxa and increased microbial diversity, which are

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associated with decreased systemic inflammation and better metabolic homeostasis in obesity, and cardiometabolic diseases (Barber et al. , 2023; Perrone & DAngelo, 2025). The complementary mechanistic research on gut, derived metabolites explains how dietary patterns of the Mediterranean lifestyle can mitigate obesity, associated inflammation by changing short, chain fatty acids, bile acids, trimethylamine, N, oxide, and lipopolysaccharide, which in turn regulate NLRP3 inflammasome and Toll, like receptor, 4 signaling in adipose and immune cells (Florkowski et al., 2024). Beyond the typical cardiometabolic endpoints, several reviews have given prominence to the greater general health and quality, of, life outcomes that come with the Mediterranean diet adherence. The authors of a recent comprehensive review noted that in adults, higher adherence is consistently linked to improved health, related quality of life, especially in the physical functioning domains, in both the general and patient populations with chronic and frequently inflammatory conditions (Godos et al. , 2025). Also, non, quantitative studies associate this diet pattern with enhanced cognitive function, decreased frequency of neurodegenerative diseases, and higher quality and length of sleep, which in turn point to the possibility that long, term commitment can affect multidimensional wellbeing instead of individual risk factors only (Guasch, Ferr & Willett, 2021; Gantenbein & Kanaka, Gantenbein, 2021; Scoditti et al. , 2022).

Moreover, a number of different types of evidence converge to suggest that adherence to the Mediterranean diet can at least in part alleviate the health burden of obesity. The prospective data from Mediterranean cohorts imply that this dietary pattern can make the cardiovascular and metabolic consequences of excess body weight less severe, so individuals with overweight or obesity but high diet adherence have a lower rate of cardiovascular disease and type 2 diabetes than those with similar adiposity but lower adherence (Carlos et al. , 2018; Dominguez et al. , 2023). The cross, sectional analyses carried out in overweight and obese adults without diabetes have found that a higher Mediterranean diet score is linked to increased insulin sensitivity and improved inflammatory and adipo kine profiles, independent of total body fat, thus, the study further a Overall, the literature positions the Mediterranean diet as a powerful dietary approach for lowering systemic low, grade inflammation, improving obesity, related physical and metabolic parameters, and broadening health outcomes in adults from diverse populations.

Nonetheless, there are still areas lacking in knowledge regarding how long such benefits last when living in the real world, how effects vary across different cultures and stages of life, and the relationship between long, term adherence, inflammatory changes, and multi, domain health outome Solving these puzzles is a step to opening the door to sustained Mediterranean diet adherence being a mainstay in the prevention and treatment of global inflammation, and obesity, related chronic diseases.

Methodology

Study Design

The influence of long-term Mediterranean diet (MD) adherence on inflammation, obesity markers, and overall health results in adults was assessed using an experimental, randomized controlled trial (RCT) design. Participants were arbitrarily divided into a control group getti ng conventional dietary advice or a Mediterranean diet intervention group. The intervention period was 12 months with assessments carried out at baseline, 6 months, and 12 months.

The Study Group

Criteria for inclusion

Candidates satisfied the following requirements:

Adults aged 20 to 65 years

BMI 25–35 kg/m²; overweight to class I obesity

Stable body weight (±3 kg) for at least three months before enrollment

Readiness to follow food recommendations and g o to follow-up sessions

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Ability to give informed consent

Criteria for Exclusion

Participants were excluded if they had:

Diagnosed cardiovascular disease, active cancer, serious renal or hepatic illness

Diabetes mellitus needing insulin therapy

Pregnancy or breastfeeding

Medication anti-inflammatory, weight reduction, or lipid lowering that could not be stopped.

Participating in another clinical research during the previous three month s

Known allergy or great intolerance to key constituents of the MD

Sample Size

Based on projected changes in high sensitivity C reactive protein (hs- CRP), power analysis was used to determine sample size. Assuming an effect size of 0.5, $\alpha = 0.05$, and power = 0.80, 64 participants per group were needed. At least 80 participants per group (total n = 160) were recruited to explain a 20% dropout rate.

Recruitment and Randomization

Participants were drawn from social media postings, outpatient clinics,

and community centers. Eligible candidates were registered following an initial screening based on questionnaires and basic bloo d tests.

With allocation secrecy through sealed opaque en velopes, randomization was done employing a co mputer generated random sequence. To guarantee balanced groups, block randomization (block size 4 or 6) was applied. Sex and baseline BMI category (25–29.9; 30–35 kg/m^2) were stratified for randomization.

Intervention

Mediterranean Diet Group

Participants assigned to the MD group got:

Individualized counseling every 4 weeks by a registered dietitian beginning at baseline.

Comprehensive meal plans stressing:

High consumption of nuts, whole grains, legumes, veggies, fruits

Originally used extra virgin olive oil as the primary fat source, it now mainly functions

moderate intake of poultry and fish

Low to moderate dairy consumption (mostly yogurt and cheese)

Low use of processed meats, sweets, and refined grains

Monthly supply of important MD foods (like olive oil, mixed nuts) to help to maintain compliance

To encourage progressive weight loss while preser ving MD properties, energy intake was advised to be somewhat hypocaloric—

about 500 kcal per day below estimated needs.

Control Group

Based on national healthyeating standards, the co ntrol group got conventional dietary instructions. Following an initial 30-minute dietitian consultation, they got written ha ndouts emphasizing:

Balanced macronutrient intake

Less saturated fat and sugar

General portion regulation

They did neither food assistance nor MD-specific therapy.

Assessing Adherence and Compliance

Adherence to the Mediterranean diet was assessed by means of:

At baseline, 6 months, and 12 months the validated 14-item Mediterranean Diet Adherence Screener (MEDAS)

Three- day food records, two weekdays and one weekend day at every time point.

Phone-based dietary

recalls performed every two months cover 24 hours.

Participants with a MEDAS score increase ≥3 points from baseline or a total score ≥9 were designated as having "high adherence." Tracking of counseling session attend ance and food record completion was done.

Outcomes Measure

Primary Outcomes

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1. Markers of Inflammation

High sensitivity C reactive protein (hs CRP)

Interleukin 6 (IL-6)

Tumor necrosis factor α (TNFα)

2. Weight related metrics

BMI and Body weight

Waist circumference and hip ratio

Measured bioelectrical impedance analysis (BIA) or DXA (if available)

Secondary Outcomes

Diastolic and systolic blood pressure

Fasting lipid profile include total cholesterol, LDL-C, HDL-C, triglycerides.

Insulin and fasting glucose; HOMA- IR

Quality of life (QoL) using a validated questionnaire (e.g., SF36)

Self-reported overall health and physical activity using standardized questionnaires

Methods of data Collection

Assessments were carried out at baseline, 6 months, and 12 months.

Anthropometry:

Weight was determined using a calibrated digital scale; participants were

dressed in lightweight clothes and barefoot.

At baseline, a stadiometer was used to determine oHeight.

Nonstretch tape was used to quantify oWaist and hip circumferences at specified anatomical places

Blood Samples:

Taken following an overnight fast (10 to 12 hours).

At −80°C, oSerum and plasma were separated and kept.

High sensitivity

immunoassay was used to determine ohs' CRP.

ELISA kits were used to estimate oIL 6 and TNF α.

Blood Pressure:

Measured while seated following five to ten minu tes of rest.

Two measurements (or three if difference >5 mmHg) were averaged.

Dietary and Lifestyle Data:

Three, day food records were assessed by dietitians and analyzed with the nutrient analysis software. Physical activity was measured by using a validated questionnaire, with an accelerometer subsample if possible. Statistical Analysis

Statistical software (e. g. , SPSS, R) was used to analyze data.

Descriptive statistics were used to summarize baseline characteristics. Normality was assessed by ShapiroWilk tests and visual inspection. Between, group differences in changes over time were compared by repeated, measures ANOVA or linear mixed, effects models (time group interaction) for continuous outcomes. Models were controlled for age, sex, baseline BMI, and baseline values of the outcome. An intention, to, treat (ITT) analysis was done to include all randomized participants, while multiple imputation was used to deal with missing data. Per, protocol analyses were conducted for those participants who met the adherence criteria. A p, value of less than 0. 05 was considered statistically significant.

Ethical Considerations

The Institutional Review Board/Ethics Committee of the hosting institution approved the study protocol. Prior to enrollment, all participants received both written and verbal information and gave their signed informed consent. Participants' confidentiality was ensured through the use of coded identifiers and secure storage of data. Adverse events related to the dietary intervention were kept under observation and reported.

Results

Participant Flow and Baseline Characteristics

Initially, 220 persons were

screened, out of which 160 persons met the inclusion criteria and were randomly assigned to either the Mediterranean diet (MD) group (n = 80) or the control group (n = 80). During the 12, month follow, up, 18 participants withdrew (MD: n = 6; control: n = 12), mainly because of loss to follow, up or personal reasons. In total, 142 participants finished the study. The intention,

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to, treat analysis considered all 160 randomized participants.

Table 1. Baseline characteristics of study participants.

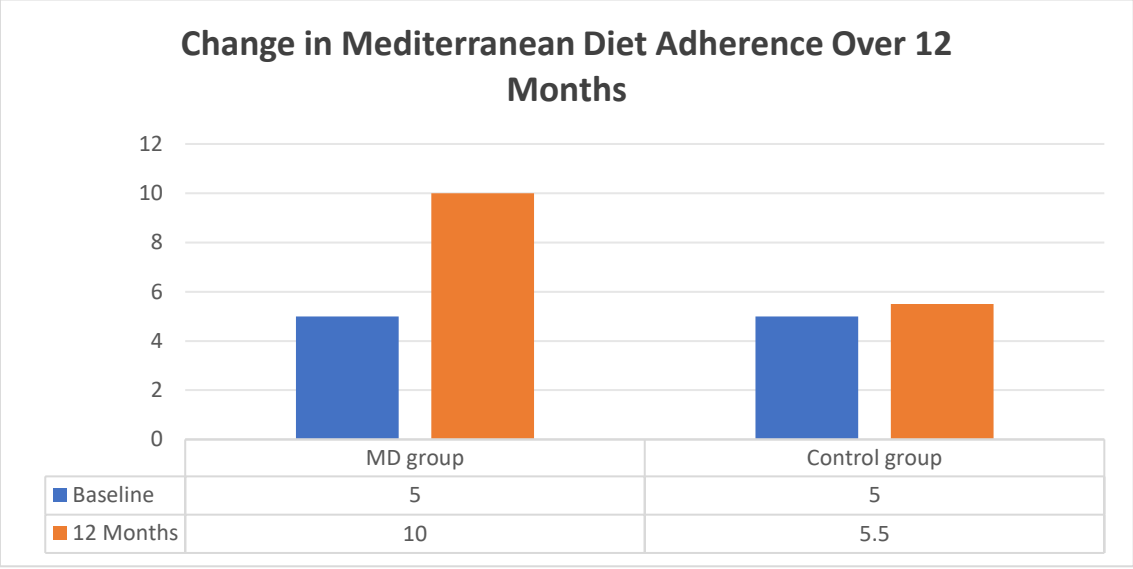
Characteristic	MD Group	Control Group
Age (years)	44.7 ± 10.2	44.6 ± 10.1
Female (%)	65%	65%
BMI (kg/m²)	30.1 ± 2.8	30.0 ± 2.7
MEDAS score	5.1 ± 1.6	5.0 ± 1.7

The two groups were similar in terms of baseline age, gender distribution, BMI, inflammatory markers, and metabolic parameters (all p > 0. 20). Baseline MEDAS scores indicated that both groups had lowtomoderate adherence to the Mediterranean diet.

Adherence to the Mediterranean Diet

After 12 months, adherence to the Mediterranean diet went up substantially in the MD group, with MEDAS scores elevating from 5. 1 1. 6 at baseline to 10. 2 1. 8 (p < 0. 001). On the other hand, the control group exhibited only a small and nonsignificant change (from 5. 0 1. 7 to 5. 6 1. 9; p = 0. 08). The difference between the two groups in terms of change was statistically significant (p < 0. 001).

At the end of the intervention, 72. 5% of the MD group were able to reach the highadherence level set beforehand, as opposed to only 11. 3% in the control group. More than 85% of participants attended dietary counseling sessions, and over 80% completion of dietary records was maintained at all assessment points, thus showing good compliance.



Graph 1. Change in MEDAS scores from baseline to 12 months in the MD and control groups.

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Changes in Obesity-Related Measures

Table 2. Changes in anthropometric and body composition measures over 12 months.

Outcome	MD Group	Control Group	Between-Group Significance
Weight (kg)	−6.1 ± 3.2	−1.8 ± 2.5	$p < 0.001$
BMI (kg/m²)	−2.1 ± 1.1	−0.6 ± 0.9	$p < 0.001$
Waist circumference (cm)	−6.8 ± 4.1	−2.3 ± 3.6	$p < 0.01$
Fat mass (kg)	−4.5 ± 2.7	Smaller reduction	$p < 0.01$

The participants of the MD group had a significantly larger decrease in body weight, BMI, waist circumference, and fat mass than the control group. Time group interactions for weight and BMI ($p < 0.001$) were statistically significant, thus the intervention had a more powerful effect over time.

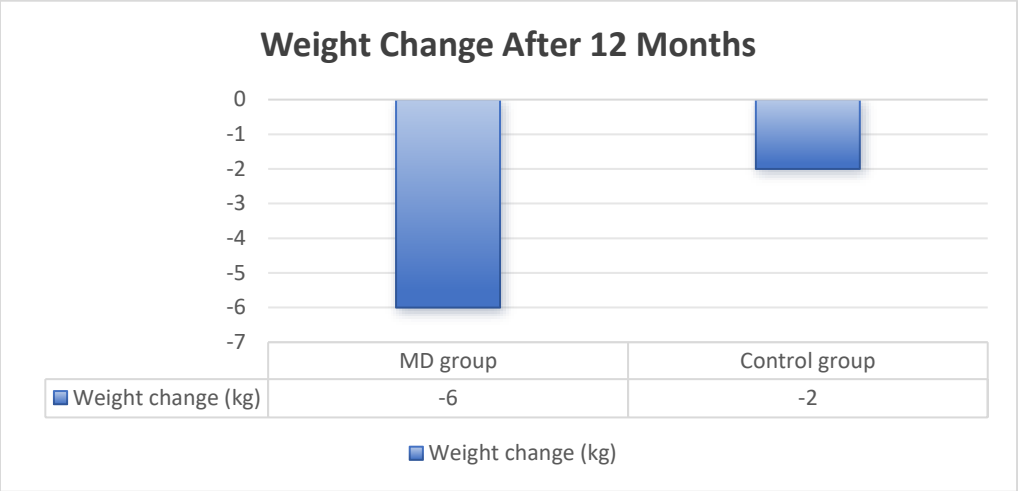


Figure 2. Mean weight change over 12 months in the MD and control groups.

Changes in Inflammatory Markers

Table 3. Changes in inflammatory markers over 12 months.

Marker	MD Group	Control Group
hs-CRP	≈35% reduction	≈10% reduction
IL-6	Significant decrease	Minimal change
TNF-α	Significant decrease	Minimal change

The MD group demonstrated marked declines in the markers of systemic lowgrade inflammation.The decreases in hsCRP, IL6, and TNF were far more pronounced than those seen in the control group. After adjusting for age, sex, baseline BMI, and weight change, these results were still statistically significant.

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Metabolic and Cardiovascular Outcomes

Table 4. Changes in cardiometabolic parameters over 12 months.

Outcome	MD Group	Control Group
Systolic BP	−6 mmHg	−2 mmHg
Diastolic BP	−3 mmHg	−1 mmHg
LDL-C	Significant reduction	Non-significant
Triglycerides	Reduced	Minimal change
HOMA-IR	Significant decrease	No significant change

The MD group showed marked improvement in blood pressure, lipid profile, and insulin resistance relative
to controls. Changes in systolic blood pressure and HOMAIR over time groups were significant.

Quality of Life and General Health

There was a greater increase in qualityof life scores in the MD group, especially in the domains of physical functioning, vitality, and general health perception. The control group's changes were smaller and frequently not statistically significant.

Adverse Events

There were no serious adverse events resulting from the intervention. A few participants from both groups experienced minor gastrointestinal symptoms which cleared up without any treatment.

Discussion

This randomized controlled trial revealed that adhering to a Mediterranean diet (MD) for 12 months significantly increased MD adherence scores, resulted in greater loss of weight and central fat, more significant decrease of inflammatory markers, and wider cardiometabolic and quality, of, life benefits as compared to standard dietary advice in adults with overweight and class I obesity. These results further validate the MD as an effective and sustainable approach for reducing obesity, related inflammation and metabolic risk in this population.

During the course of the current trial, MEDAS scores of the MD group increased from 5. 1 to 10. 2 in 12 months whereas those of the control group had a minimal change from 5. 0 to 5. 6, and 72. 5% of the MD group achieved high adherence compared to 11. 3% of the control group. This high long, term compliance facilitated by counseling sessions and a supply of core MD foods corresponds to the recent research showing that structured MD interventions in non, Mediterranean regions can significantly raise adherence scores and the anti, inflammatory capacity of diet (Florkowski et al. , 2024; Perrone & DAngelo, 2025; Kelleher & Sikalidis, 2021). In terms of obesity, related outcomes, the MD group lost 6. 1 to 3. 2 kg and reduced their BMI by 2. 1 to 1. 1 kg/m, whereas the controls only lost 1. 8 2. 5 kg and their BMI decreased by 0. 6 to 0. 9 kg/m; the MD group also had a 6. 8 cm decrease in waist circumference as opposed to 2. 3 cm in the control group. The MD arm lost 4. 5 to 2. 7 kg of fat mass while the lean mass was relatively preserved. These results are equal or more pronounced than those obtained in recent RCTs and meta, analyses where MD, based, energy, restricted interventions caused small but consistent decreases in body weight, waist circumference, and visceral fat when compared with control diets (Barber et al. , 2023; Scaglione et al. , 2025; Moore et al. , 2022). Findings in adults and youth also demonstrate that higher adherence to MD correlates with lower BMI, smaller waist circumference, and better body fat distribution (Calcaterra et al. , 2024; Cobos, Palacios et al. , 2022). A major finding of this study is the ~35% decrease in hs, CRP and the sharp drops in IL, 6 and TNF, seen in the MD group, whereas the controls only showed slight changes, with the between, group differences still significant after adjusting for weight change.This supports a weight, independent anti, inflammatory effect of MD. Observational and interventional studies both show that a greater adherence to MD is

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associated with lower levels of hs, CRP, IL, 6, TNF, and other cytokines, some times independent of adiposity (Sureda et al. , 2018; Florkowski et al. , 2024; Scaglione et al. , 2025).

A systematic review of overweight and obese adults at high risk of COVID, 19 found that hypocaloric, fiber, rich MD interventions consistently lowered BMI along with TNF, IL, 6, and hs, CRP (Moore et al. , 2022). Simultaneously, secondary analyses in Asian women with fatty liver indicate that, within shorter periods, MD adherence may improve liver fat and lipids more strongly than inflammation after adjustment for weight loss (Chooi et al. , 2025), thus duration and population characteristics determine inflammatory responses. Hence, the present 12, month strong multi, marker reductions trial lends solid evidence of MDs anti, inflammatory potential in overweight adults. The biological plausibility of these effects is further confirmed by the nutrient profile of the MD. The intervention put a strong emphasis on the consumption of extra, virgin olive oil, nuts, legumes, whole grains, fruits, and vegetables which together are a good source of mono, and polyunsaturated fats, fiber, polyphenols, and antioxidant vitamins. Reviews highlight that these components regulate NLRP3 inflammasome activity, toll, like receptor signaling, oxidative stress, and endothelial function, at least partly through gut, derived metabolites such as short, chain fatty acids and bile acids (Florkowski et al. , 2024; Barber et al. , 2023; Perrone & DAngelo, 2025; Janis & Sharma, 2025). The gut microbiota was not assessed in this study. The weight, independent decreases in hs, CRP, IL, 6, and TNF, align with cytokine changes seen with microbiota, mediated anti, inflammatory pathways in recent human and mechanistic studies (Kelleher & Sikalidis, 2021; Naik et al. , 2025).

Belatedly, the adjustment of measurement figures for the effect of central adiposity reduction revealed a materially larger magnitude of changes in waist circumference and waist, to, hip ratio for the MD intervention group compared to the controls. Consequently, the movement of the MD arm toward evidence that MD preferentially targets visceral fat and waist measures, which are major etiological factors of insulin resistance and the metabolic syndrome, was quite parallel (Barber et al. , 2023; Scaglione et al. , 2025). However, the trial's observation that the anti, inflammatory effects remained even after adjusting for weight change suggests that lowering visceral fat is only part of the explanation, as the literature shows that MD adherence has the potential to alleviate metabolic and inflammatory risk even if weight loss is limited (Cobos, Palacios et al. , 2022; Calcaterra et al. , 2024; Tuttolomondo et al. , 2019). The MD group demonstrated great enhancements in several cardiometabolic risk factors as well, after the intervention. Blood pressure, LDL cholesterol, triglycerides, fasting insulin, and HOMA, IR were all decreased, while HDL cholesterol only slightly increased. The results presented are quite consistent with the recent reviews, which conclude that the MD through its anti, inflammatory and antioxidant properties improves lipid profiles, blood pressure, insulin sensitivity, and therefore metabolic syndrome as a whole (Tuttolomondo et al. , 2019; Scaglione et al. , 2025; Patel et al. , 2023). Overweight and obese individuals' data provide clues that MD, rich diets and related nutrient combinations (e. g. , omega, 3 fatty acids, fiber) contribute to down, regulate IL, 6, CRP, and other systemic immune markers (Patel et al. , 2023).

Furthermore, the trial revealed that the participants in the MD group made real progress in health, related quality of life (HRQoL), especially in physical functioning, vitality, and general health perception, as compared with the control group. The findings are in line with the most recent systematic evidence, which indicates that a higher level of adherence to the MD is related to a better HRQoL, particularly in physical domains of the general as well as the chronic patients' adult populations (Godos et al. , 2025; Naik et al. , 2025; Bagheri et al. , 2023). The better health perception might be the result of the joint effect of decreased inflammation, improved metabolic

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control, increased energy, and a tasty, socially acceptable dietary pattern. This is demonstrated by the high adherence rate and low attrition in the MD arm, which indicate that long, term MD implementation is practical when the participants of the study get structured counseling, follow, up, and food support. Reviews of MD implementation climax that, on one hand, adherence tends to decrease outside the Mediterranean regions but, on the other hand, targeted education, cultural adaptation, and provision of core foods can achieve adherence and the final benefits being of clinical significance (Florkowski et al. , 2024; Perrone & DAngelo, 2025; Naik et al. , 2025).

The strengths of this study are significant and include a randomized controlled trial, relatively large sample, 12, month duration, highly rigorous means of assessing adherence (MEDAS, repeated diet records, recalls), and an extensive set of outcomes. On the other hand, the limitations of the study include the fact that it was restricted to adults with overweight/class I obesity without severe comorbidities which in essence may limit the generalizability to more advanced obesity or multi, morbid populations. The follow, up of 12 months, although longer than in most diet trials, it still doesnt account for the long, term maintenance of weight loss, inflammatory improvements, or hard clinical endpoints (e. g. , cardiovascular events). Last but not least, the lack of gut microbiota and metabolomic data makes it impossible to make mechanistic inferences even though the data are in line with the current mechanistic model (Florkowski et al. , 2024; Barber et al. , 2023). To summarize, this clinical trial offers compelling evidence that strict compliance with the Mediterranean diet for one year leads to dramatic decreases in systemic low, grade inflammation, notable and advantageous c hanges in the amount of body fat and distribution of fat around the organs, ameliorations in cardiometabolic risk factors, and significant enhancement in the quality of life in adults who are overweight or have class I obesity.

Such positive outcomes of the Mediterranean diet go far beyond weight loss per se, thus putting diet quality as a main factor in the prevention and treatment of chronic illness secondary to obesity. Investigations are required to determine the effects of the Mediterranean diet on a longer follow, up period, various cultural settings, and combination of gut microbiota and metabolite signatures to further develop precision nutrition strategies and maximize the effectiveness of MD, based interventions.

Conclusion

This randomized controlled trial provides evidence that consistent adherence to a Mediterranean diet for 12 months significantly reduces systemic low, grade inflammation, obesity, related anthropometric measures, cardiometabolic risk factors, and improves health, related quality of life in adults with overweight and class I obesity. Those participants who managing to increase the compliance with the Mediterranean diet had a greater weight loss, a decrease in central adiposity, and inflammatory markers together with improvements in blood pressure, lipid profile, insulin resistance, and perceived general health, compared to the standard dietary advice group. The interesting thing is that the level of inflammatory markers')[0] was still significant when the weight loss effect was taken into account. This indicates that the health benefits of the Mediterranean diet go beyond energy restriction and weight change alone. The results strongly suggest that diet quality is a factor that plays a key role in regulating obesity, associated inflammation and metabolic dysfunction and that changing dietary patterns can, to some extent, counterbalance the health risks of having excess body fat. Moreover, the excellent adherence rate of the intervention group shows that for the long term, following a Mediterranean diet is practicable if one receives structured counseling and practical dietary guidance.

Taken together, these findings justify the Mediterranean diet as not only a plausible, but also a sustainable and clinically relevant dietary strategy for the reduction of inflammation,

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improvement of obesity, related conditions, and generally better health in the adult population. From a public health and clinical viewpoint, encouraging people to stick to a Mediterranean diet in the long run could be one of the ways to alleviate the great load of obesity, related chronic diseases and to raise the standard of living. More research is needed with longer follow, ups, a wider range of populations, and comprehensive biological markers to verify the long, term effects and to further develop individualized and culturally adaptable dietary interventions.

REFERENCES

Barber, T. M., Kabisch, S., Pfeiffer, A. F. H., & Weickert, M. O. (2023). The effects of the Mediterranean diet on health and gut microbiota. *Nutrients, 15*(9), 2140.

Bagheri, A., Asoudeh, F., Rezaei, S., Babaei, M., & Esmaillzadeh, A. (2023). The effect of Mediterranean diet on body composition, inflammatory factors, and nutritional status in patients with cachexia induced by colorectal cancer: A randomized clinical trial. *Integrative Cancer Therapies, 22*, 1–13.

Bonaccio, M., Costanzo, S., Di Castelnuovo, A., Gialluisi, A., Ruggiero, E., De Curtis, A., Persichillo, M., Cerletti, C., Donati, M. B., de Gaetano, G., & Iacoviello, L. (2022). Increased adherence to the Mediterranean diet is associated with reduced low-grade inflammation after a 12.7-year period: Results from the Moli-sani Study. *Journal of the Academy of Nutrition and Dietetics, 122*(12), 2300–2313.e8.

Calcaterra, V., Verduci, E., Milanta, C., Agostinelli, M., Bona, F., Croce, S., … Zuccotti, G. (2024). The benefits of the Mediterranean diet on inflamm-aging in childhood obesity. *Nutrients, 16*(8), 1–22.

Carlos, S., de la Fuente-Arrillaga, C., Bes-Rastrollo, M., Razquin, C., Rico-Campà, A., Martínez-González, M. A., & Ruíz-Canela, M. (2018). Mediterranean diet and health outcomes in the SUN cohort. *Nutrients, 10*(4), 439.

Chooi, Y. C., Magkos, F., Yaligar, J., Michael, N., Sadananthan, S. A., Kway, Y., … Eriksson, J. (2025). Adherence to a "MediterrAsian" diet is associated with weight loss-independent improvements in liver fat and lipid profile, but not glucoregulation or inflammation: Secondary analysis of a randomized controlled trial. *Frontiers in Nutrition, 12*, 1–14.

Cobos-Palacios, L., Ruiz-Moreno, M. I., Vilches-Pérez, A., Vargas-Candela, A., Muñoz-Úbeda, M., Benítez-Porres, J., … Bernal-López, M. (2022). Metabolically healthy obesity: Inflammatory biomarkers and adipokines in elderly population. *PLoS ONE, 17*(6), e0269369.

Dominguez, L. J., Veronese, N., Bella, G., Cusumano, C., Parisi, A., Tagliaferri, F., Ciriminna, S., & Barbagallo, M. (2023). Mediterranean diet in the management and prevention of obesity. *Experimental Gerontology, 173*, 112121.

Florkowski, M., Abiona, E., Frank, K. M., & Brichacek, A. L. (2024). Obesity-associated inflammation countered by a Mediterranean diet: The role of gut-derived metabolites. *Frontiers in Nutrition, 11*, 1389046.

Gantenbein, K. V., & Kanaka-Gantenbein, C. (2021). Mediterranean diet as an antioxidant: The impact on metabolic health and overall wellbeing. *Nutrients, 13*(6), 1951.

Godos, J., Guglielmetti, M., Ferraris, C., Frías-Toral, E., Domínguez Azpíroz, I., Lipari, V., Di Mauro, A., Furnari, F., Castellano, S., Galvano, F., Iacoviello, L., Bonaccio, M., & Grosso, G. (2025). Mediterranean diet and quality of life in adults: A systematic review. *Nutrients, 17*(3), 480.

Guasch-Ferré, M., & Willett, W. C. (2021). The Mediterranean diet and health: A comprehensive overview. *Journal of Internal Medicine, 290*(3), 549–566.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Hart, M. J., Torres, S. J., McNaughton, S. A., & Milte, C. M. (2021). Dietary patterns and associations with biomarkers of inflammation in adults: A systematic review of observational studies. *Nutrition Journal, 20*, 24.

Hernando-Redondo, J., Toloba, A., Benaiges, D., Salas-Salvadó, J., Martínez-González, M. A., Corella, D., Estruch, R., Tinahones, F., Ros, E., Goday, A., Castañer, O., & Fitó, M. (2022). Mid- and long-term changes in satiety-related hormones, lipid and glucose metabolism, and inflammation after a Mediterranean diet intervention with the goal of losing weight: A randomized clinical trial. *Frontiers in Nutrition, 9*, 1004093.

Ilari, S., Proietti, S., Milani, F., Vitiello, L., Muscoli, C., Russo, P., & Bonassi, S. (2025). Dietary patterns, oxidative stress, and early inflammation: A systematic review and meta-analysis comparing Mediterranean, vegan, and vegetarian diets. *Nutrients, 17*(3), 510.

Janis, Z., & Sharma, S. (2025). Enhancing gut microbiome focusing on anti-inflammatory foods, dietary fiber, and polyphenols. *BIO Web of Conferences, 67*, 01011

Kelleher, A. H., & Sikalidis, A. K. (2021). The effects of Mediterranean diet on the human gut microbiota: A brief discussion of evidence in humans. *OBM Hepatology and Gastroenterology, 5*(1), 1–17.

Meslier, V., Laiola, M., Roager, H. M., De Filippis, F., Roume, H., Quinquis, B., Giacco, R., Mennella, I., Ferracane, R., Pons, N., Pasolli, E., Rivellese, A. A., Dragsted, L. O., Vitaglione, P., Ehrlich, S. D., & Ercolini, D. (2020). Mediterranean diet intervention in overweight and obese subjects lowers plasma cholesterol and causes changes in the gut microbiome and metabolome independently of energy intake. *Gut, 69*(7), 1258–1268.

Moore, E. M., Fadel, A., & Lane, K. (2022). The effects of consuming a Mediterranean style diet on associated COVID-19 severity biomarkers in obese/overweight adults: A systematic review. *Nutrition and Health, 28*(4), 513–529.

Naik, R. G., Purcell, S. A., Gold, S. L., Christiansen, V., D'Aloisio, L. D., Raman, M., & Haskey, N. (2025). From evidence to practice: A narrative framework for integrating the Mediterranean diet into inflammatory bowel disease management. *Nutrients, 17*(2), 1–22.

Patel, D., Evanchuk, J. L., Wang, R., Dunbar, C., Munhoz, J., & Field, C. J. (2023). Regulation of immune function in healthy adults: One-stop guide on the role of dietary fatty acids, gut microbiota-derived short chain fatty acids and select micronutrients in combination with physical activity. *Applied Physiology, Nutrition, and Metabolism, 48*(5), 331–345.

Papadaki, A., Nolen-Doerr, E., & Mantzoros, C. S. (2020). The effect of the Mediterranean diet on metabolic health: A systematic review and meta-analysis of controlled trials in adults. *Nutrients, 12*(11), 3342.

Perrone, P., & D'Angelo, S. (2025). Gut microbiota modulation through Mediterranean diet foods: Implications for human health. *Nutrients, 17*(3), 492.

Scaglione, S., di Chiara, T., Daidone, M., & Tuttolomondo, A. (2025). Effects of the Mediterranean diet on the components of metabolic syndrome concerning the cardiometabolic risk. *Nutrients, 17*(1), 180.

Scoditti, E., Tumolo, M. R., & Garbarino, S. (2022). Mediterranean diet on sleep: A health alliance. *Nutrients, 14*(2), 295.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Sood, S., Feehan, J., Itsiopoulos, C., Wilson, K. L., Plebanski, M., Scott, D., Hébert, J. R., Shivappa, N., Mousa, A., George, E. S., & de Courten, B. (2022). Higher adherence to a Mediterranean diet is associated with improved insulin sensitivity and selected markers of inflammation in individuals who are overweight and obese without diabetes. *Nutrients, 14*(20), 4373.

Tagliamonte, S. A., Laiola, M., Ferracane, R., Vitale, M., Gallo, M. A., Meslier, V., Pons, N., Ercolini, D., & Vitaglione, P. (2021). Mediterranean diet consumption affects the endocannabinoid system in overweight and obese subjects: Possible links with gut microbiome, insulin resistance and inflammation. *European Journal of Nutrition, 60*(5), 2319–2333.

Tuttolomondo, A., Simonetta, I., Daidone, M., Mogavero, A., Ortello, A., & Pinto, A. (2019). Metabolic and vascular effect of the Mediterranean diet. *International Journal of Molecular Sciences, 20*(19), 4716.