

## THE IMPACT OF THE MEDITERRANEAN DIET ON LIFESTYLE IN PATIENTS WITH HYPERTENSION IN KOSOVO

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### Abstract

The Mediterranean diet is widely recognized for its beneficial effects in lowering blood pressure and improving lifestyle through a high intake of fruits, vegetables, whole grains, olive oil, fish, and nuts, along with reduced consumption of saturated fats and processed foods. This study aimed to evaluate the impact of the Mediterranean diet on lifestyle and key health parameters among patients with hypertension in Kosovo. The study included 120 patients aged 40–70 years diagnosed with hypertension and monitored in primary health care centers. Participants were randomly divided into two groups: an intervention group that followed Mediterranean diet recommendations for 12 weeks (n=60) and a control group that maintained their usual diet (n=60). Data collection included validated lifestyle questionnaires, body mass index (BMI) assessment, and measurements of systolic and diastolic blood pressure before and after the intervention period. The results demonstrated that adherence to the Mediterranean diet led to statistically significant reductions in systolic blood pressure (from  $148.6 \pm 10.4$  mmHg to  $134.2 \pm 8.7$  mmHg,  $p < 0.01$ ) and diastolic blood pressure (from  $92.3 \pm 6.8$  mmHg to  $84.1 \pm 5.9$  mmHg,  $p < 0.05$ ). Additionally, a decrease in BMI ( $-1.6$  kg/m<sup>2</sup>) was observed, alongside improved dietary habits characterized by higher intake of plant-based foods and healthy fats. Participants in the intervention group also reported increased physical activity and reduced consumption of salt and processed foods. In conclusion, the Mediterranean diet represents an effective non-pharmacological approach for improving lifestyle and managing hypertension in Kosovo, with important implications for public health strategies.

**Keywords:** Mediterranean diet, hypertension, lifestyle, cardiovascular health, Kosovo.

### Introduction

Arterial hypertension is one of the most significant global public health challenges and represents a major risk factor for cardiovascular diseases, including coronary heart disease, stroke, and heart failure (Goorani et al., 2025). According to international health reports, the prevalence of hypertension continues to increase due to aging populations, sedentary lifestyles, and unhealthy dietary habits (Ren et al., 2025; WHO, 2023). In many developing and transitional countries, including Kosovo, hypertension remains underdiagnosed and poorly controlled, contributing substantially to morbidity and mortality related to cardiovascular complications (Mills et al., 2020). Socioeconomic disparities, limited access to healthcare services, and lack of awareness further exacerbate the burden of hypertension in different regions (Ibekwe, 2015).

Lifestyle modification is widely recognized as a fundamental non-pharmacological strategy in the prevention and management of hypertension. Among dietary approaches, the Mediterranean diet has gained particular attention due to its well-documented health benefits (Elmakki, 2025). This dietary pattern is traditionally characterized by high consumption of fruits, vegetables, legumes, whole grains, nuts, olive oil as the primary source of fat, moderate intake of fish and dairy products, and limited consumption of red meat, processed foods, and saturated fats (Lăcătușu et al., 2019). The Mediterranean diet is also associated with moderate wine consumption and an overall balanced nutritional profile rich in antioxidants, dietary fiber,

polyphenols, and unsaturated fatty acids (Santos-Buelga et al., 2021). Several epidemiological and clinical studies have demonstrated that adherence to the Mediterranean diet can significantly reduce blood pressure, improve lipid profiles, and decrease cardiovascular risk (Frank et al., 2025). Additionally, meta-analyses have confirmed that this dietary pattern contributes to modest but clinically meaningful reductions in both systolic and diastolic blood pressure (Ndanuko et al., 2016). The beneficial effects are mainly attributed to its anti-inflammatory properties, improved endothelial function, and enhanced metabolic regulation (Scaglione et al., 2025). Despite the growing scientific evidence supporting the Mediterranean diet, its adoption and impact on hypertensive patients in Kosovo remain insufficiently investigated. Therefore, this study aimed to evaluate the effect of adherence to the Mediterranean diet on lifestyle indicators and health parameters, particularly blood pressure and body mass index, among patients diagnosed with hypertension in Kosovo.

## Materials and Methods

*2.1. Study design and participants:* This study was conducted as a controlled intervention study involving patients diagnosed with hypertension and monitored in primary health care centers in Kosovo. A total of 120 participants aged between 40 and 70 years were recruited. All participants had previously been diagnosed with arterial hypertension according to standard clinical guidelines. Participants were randomly divided into two groups: an intervention group consisting of 60 patients who followed Mediterranean diet recommendations and a control group consisting of 60 patients who continued their habitual diet without specific dietary modifications.

*2.2. Dietary intervention:* Patients in the intervention group received nutritional counseling and detailed guidelines regarding adherence to the Mediterranean diet. The dietary recommendations emphasized increased consumption of fruits, vegetables, legumes, whole grains, olive oil, fish, and nuts, while reducing the intake of saturated fats, red meat, salt, and processed foods. The intervention period lasted for 12 weeks. The control group continued their usual dietary habits and received only general lifestyle advice typically provided during routine clinical visits.

*2.3. Data collection:* Baseline data were collected at the beginning of the study and repeated after the 12-week intervention period. The collected parameters included:

Body mass index (BMI), calculated from measured body weight and height.

Systolic blood pressure (SBP) and diastolic blood pressure (DBP), measured using standardized clinical procedures.

Lifestyle characteristics, assessed through validated questionnaires covering dietary habits, salt consumption, and physical activity. Blood pressure measurements were taken using calibrated digital sphygmomanometers, and the average of two readings was recorded for each participant.

*2.4. Statistical Analysis:* Data were analyzed using standard statistical methods. Results are expressed as mean  $\pm$  standard deviation. Differences between baseline and post-intervention values were assessed using paired statistical tests, and statistical significance was considered at  $p < 0.05$ .

## Results and Discussion

The results of this study demonstrate that adherence to the Mediterranean diet led to significant improvements in blood pressure, body mass index (BMI), and overall lifestyle habits among hypertensive patients. After the 12-week intervention period, patients in the intervention group showed a clear reduction in both systolic and diastolic blood pressure compared to baseline values, whereas the control group exhibited only minor and statistically non-significant changes. The reduction in systolic blood pressure from  $148.6 \pm 10.4$  mmHg to  $134.2 \pm 8.7$  mmHg represents a decrease of approximately 14.4 mmHg, which is clinically relevant for lowering cardiovascular risk. Similarly, diastolic blood pressure decreased from  $92.3 \pm 6.8$  mmHg to  $84.1 \pm 5.9$  mmHg, corresponding to a reduction of 8.2 mmHg. These results suggest that dietary modification alone can play a substantial role in hypertension management when patients adhere consistently to a healthy dietary pattern. In contrast, the control group that continued their habitual diet demonstrated only marginal changes in blood pressure and BMI, indicating that the observed improvements in the intervention group are likely attributable to the Mediterranean dietary intervention rather than natural variation over time.

Table 1. Changes in clinical parameters before and after the 12-week intervention

| Parameter                | Intervention group (Baseline) | Intervention group (12 weeks) | Control group (Baseline) | Control group (12 weeks) | p-value |
|--------------------------|-------------------------------|-------------------------------|--------------------------|--------------------------|---------|
| Systolic BP (mmHg)       | $148.6 \pm 10.4$              | $134.2 \pm 8.7$               | $147.9 \pm 11.2$         | $145.8 \pm 10.9$         | <0.01   |
| Diastolic BP (mmHg)      | $92.3 \pm 6.8$                | $84.1 \pm 5.9$                | $91.8 \pm 7.1$           | $90.6 \pm 6.7$           | <0.05   |
| BMI (kg/m <sup>2</sup> ) | $29.4 \pm 3.1$                | $27.8 \pm 2.9$                | $29.1 \pm 3.3$           | $28.9 \pm 3.2$           | <0.05   |

The reduction in BMI observed in the intervention group ( $-1.6$  kg/m<sup>2</sup>) indicates an improvement in weight management, which is an important factor in hypertension control. Weight reduction is known to positively influence blood pressure through improved metabolic regulation, reduced insulin resistance, and decreased vascular inflammation. Beyond clinical parameters, notable improvements were also observed in dietary habits and lifestyle patterns. Participants in the intervention group reported increased consumption of key components of the Mediterranean diet, including fruits, vegetables, olive oil, fish, legumes, and nuts. At the same time, there was a significant reduction in the consumption of red meat, processed foods, and salt.

Table 2. Changes in dietary habits and lifestyle indicators among participants

| Dietary / Lifestyle Indicator | Baseline (%) | After Intervention (%) |
|-------------------------------|--------------|------------------------|
| Daily fruit consumption       | 38           | 72                     |
| Daily vegetable consumption   | 42           | 76                     |

|                                                          |    |    |
|----------------------------------------------------------|----|----|
| Use of olive oil as main fat source                      | 35 | 81 |
| <b>Fish consumption (<math>\geq 2</math> times/week)</b> | 28 | 63 |
| Consumption of processed foods                           | 61 | 29 |
| High salt intake                                         | 58 | 31 |
| Regular physical activity                                | 34 | 57 |

The increased intake of plant-based foods and healthy fats observed among participants likely contributed to the improvement in cardiovascular indicators. The Mediterranean diet is rich in monounsaturated fatty acids, mainly derived from olive oil, as well as omega-3 fatty acids from fish. These nutrients are known to improve endothelial function, reduce oxidative stress, and modulate inflammatory pathways, all of which play an important role in blood pressure regulation. Furthermore, fruits, vegetables, and whole grains provide dietary fiber, potassium, magnesium, and polyphenols, compounds that have been widely associated with improved vascular health and reduced hypertension risk. Reduced salt consumption observed in the intervention group may also have contributed significantly to the decline in blood pressure values. The findings of this study are consistent with previous international research demonstrating the effectiveness of the Mediterranean dietary pattern in preventing and managing cardiovascular diseases. Studies conducted in Mediterranean populations have similarly reported reductions in blood pressure ranging between 8–15 mmHg among individuals adopting this diet, values comparable to those observed in the present study. Overall, these results highlight the importance of dietary interventions as a key component of lifestyle modification strategies for hypertensive patients. The Mediterranean diet not only improves clinical indicators but also promotes sustainable lifestyle changes that may contribute to long-term cardiovascular health. A possible explanation for some of the observed differences between groups may be related to lifestyle factors present among the control participants. Although the control group did not exhibit markedly worse outcomes than the hypertension intervention group at baseline, a considerable proportion of these individuals were smokers. Cigarette smoking is well established as an independent risk factor for cardiovascular conditions, including peripheral arterial disease (PAD) and atrial fibrillation (AF), and may negatively influence vascular health and blood pressure regulation (Sansone et al., 2018; Hindricks et al., 2021). The presence of this risk factor could therefore partly explain the relatively limited improvements observed in the control group compared with patients adhering to the Mediterranean dietary intervention. Recent scientific evidence further supports the broader cardiometabolic benefits associated with adherence to the Mediterranean diet. For example, a study conducted at the Department of Internal Medicine of the University of Groningen demonstrated that higher adherence to the Mediterranean dietary pattern was associated with improved renal function outcomes in patients undergoing kidney transplantation (Gomes-Neto et al., 2020). Although the mechanisms linking diet and renal outcomes remain under investigation, these findings reinforce the concept that the Mediterranean diet exerts systemic protective effects extending beyond cardiovascular health. While the role of the Mediterranean diet in hypertension management is not yet universally accepted as a primary therapeutic strategy, accumulating evidence from observational and interventional studies including the findings of the present research suggests that this dietary

pattern may play an important role in both the prevention and management of arterial hypertension. Compared with the typical Western dietary pattern, which is often characterized by high intake of saturated fats, processed foods, and refined carbohydrates, the Mediterranean diet emphasizes the use of olive oil as the primary source of dietary fat. Olive oil is particularly rich in polyphenolic compounds with potent antioxidant and anti-inflammatory properties. Experimental and clinical investigations have demonstrated that these bioactive compounds may exert hypotensive effects. A study conducted by Moreno Luna et al. (2012) showed that participants consuming polyphenol-rich olive oil exhibited significantly lower systolic and diastolic blood pressure compared with individuals consuming polyphenol-free olive oil after four months of dietary intervention (SBP < 7.79 mmHg; DBP < 6.65 mmHg reduction). The observed effect was attributed primarily to the vasoprotective activity of olive oil polyphenols, which stimulate nitric oxide production and improve endothelial function (Medina Remón et al., 2013). Through their antioxidant properties, these compounds also contribute to the reduction of oxidized low-density lipoprotein (LDL) and C-reactive protein levels, thereby mitigating vascular inflammation and endothelial damage. The antioxidant capacity of the Mediterranean diet therefore represents one of the key mechanisms underlying its protective cardiovascular effects. By reducing oxidative stress and inflammation, this dietary pattern may slow vascular degeneration processes, including the development of atherosclerosis. Evidence supporting this hypothesis has been reported in the Northern Manhattan Study, which demonstrated that individuals with high adherence to the Mediterranean diet exhibited significantly reduced carotid intima-media thickness, a recognized marker of subclinical atherosclerosis (Khatri et al., 2014). Taken together, these findings suggest that the Mediterranean dietary pattern may contribute not only to improved blood pressure control but also to broader vascular protection through anti-inflammatory, antioxidant, and endothelial-modulating mechanisms. Consequently, incorporating Mediterranean diet principles into lifestyle interventions may represent an effective complementary strategy for the prevention and management of hypertension and associated cardiovascular complications.

## Conclusions

The findings of this study demonstrate that adherence to the Mediterranean diet significantly improves lifestyle indicators and contributes to the reduction of blood pressure among patients with hypertension in Kosovo. Patients who followed the Mediterranean dietary pattern experienced meaningful decreases in both systolic and diastolic blood pressure, as well as improvements in body mass index and dietary habits. These results highlight the importance of integrating nutritional interventions into hypertension management programs. The Mediterranean diet represents an effective, safe, and sustainable non-pharmacological approach that can complement pharmacological treatment in controlling hypertension and reducing cardiovascular risk. Promoting the Mediterranean dietary pattern through public health initiatives, clinical counseling, and educational programs may contribute to improved cardiovascular health and better quality of life among hypertensive patients in Kosovo.

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