

## Mediterranean diet and diabetes prevention: Myth or fact?

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### Abstract

Type 2 diabetes is a major, non-communicable disease with increasing prevalence at a global level. Therefore, in order to prevent this condition action should be taken regarding the modifiable factors that influence its development - lifestyle and dietary habits. As the Mediterranean dietary pattern has beneficial effects on both human health and regarding the development and treatment of type 2 diabetes, promoting adherence to this pattern is of considerable public health importance.

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**Key words:** Mediterranean diet; Type 2 diabetes; Nutrition

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### INTRODUCTION

Diabetes mellitus, one of the major non-communicable diseases at a global level, is a condition difficult to treat and expensive to manage<sup>[1]</sup>. Individuals with type 2 diabetes are at a high risk of developing a range of debilitating complications that can lead to disability and premature death: cardiovascular disease, peripheral vascular disease, nephropathy, changes to the retina and blindness; imposing important medical and economic burdens. Genetic susceptibility and environmental influences seem to be the most important factors responsible for the development of this condition. However, a drastic increase of physical inactivity, obesity and type 2 diabetes has been recently observed; a fact which indicates that obesity and physical inactivity may constitute the main reasons for the increasing burden of diabetes in the developed world<sup>[2]</sup>. Fortunately, because environmental factors are modifiable, disease manifestation from these factors is largely preventable<sup>[3]</sup>.

### MEDITERRANEAN DIET AND DIABETES

The Mediterranean diet was first described in the 1960s by Ancel Keys based on his observation of food habits of some populations in the Mediterranean region. The Mediterranean dietary pattern emphasizes a consumption of fat primarily from foods high in monounsaturated fatty acids and mainly olive oil and encourages daily consumption of fruits, vegetables, low fat dairy products and whole grains, weekly consumption of fish, poultry, tree nuts, legumes, monthly consumption of red meat, as well as a moderate consumption of alcohol, normally with meals but the proportions of macronutrients may vary. There is no single Mediterranean diet although the dietary patterns that prevail in the Mediterranean region have many common characteristics. Total lipid intake may be high as in Greece (around 40% of total energy intake), or moderate as in Italy (around 30% of total energy intake)<sup>[4,5]</sup>.

The Mediterranean diet is one of the best known dietary patterns for its beneficial effects on human

health and seems to have pleiotropic effects that may act beneficially against the development of type 2 diabetes, including reduced oxidative stress and insulin resistance. High consumption of vegetables, fruits, legumes, nuts, fish, cereals and olive oil together with moderate consumption of alcohol, predominantly wine, leads to a high ratio of monounsaturated fatty acids to saturated fatty acids, a low intake of trans fatty acids and high ingestion of dietary fiber, antioxidants, polyphenols and magnesium<sup>[3]</sup>. Therefore, the Mediterranean diet could serve as an anti-inflammatory dietary pattern which could protect from or even treat diseases that are related to chronic inflammation including type 2 diabetes<sup>[6]</sup>. At this point it should be mentioned that several large epidemiological studies have shown that diets characterized by a low degree of energy density overall such as the Mediterranean diet, prevent weight gain and exert a protective effect on the development of type 2 diabetes, a condition that is partially mediated through weight maintenance<sup>[3]</sup>.

Results from epidemiological studies show the beneficial effect of the Mediterranean dietary pattern on diabetes mellitus and glucose metabolism in general. According to a large prospective study of 13380 Spanish university graduates, a traditional Mediterranean food pattern was associated with a significant reduction of 83% in the risk of developing type 2 diabetes<sup>[7]</sup>. An inverse association has been also found between adherence to Mediterranean diet and indices of glucose homeostasis in a Greek adult population<sup>[6,8]</sup>, among elderly people<sup>[9]</sup> and high-risk patients<sup>[10]</sup>. Greater adherence to the Mediterranean diet in combination with light physical activity was associated with lower odds of having diabetes after adjustment for various factors according to the ATTICA Study<sup>[11]</sup>. Finally, according to a recent study in Italy in 901 outpatients with type 2 diabetes, greater adherence to the traditional Mediterranean diet was associated with lower HbA<sub>1c</sub> levels and 2 h post-meal glucose levels independently of other confounding factors<sup>[12]</sup>. On the other hand, a Paleolithic diet (i.e. a diet consisting of lean meat, fish, shellfish, fruits and vegetables, roots, eggs and nuts, but not grains, dairy products, salt or refined fats and sugar) was associated with marked improvement of glucose tolerance while control subjects who were advised to follow a Mediterranean-like diet did not significantly improve their glucose tolerance despite decreases in weight and waist circumference<sup>[13]</sup>.

Results from clinical trials also support the protective role of the Mediterranean diet on type 2 diabetes. According to a multicenter randomized primary prevention trial, subjects without diabetes allocated to a Mediterranean diet either focused on olive oil or nuts had lower fasting glucose levels, lower fasting insulin levels and insulin resistance compared to those assigned to a low fat diet. However, in this study, nutritional education was more intense for the participants assigned to the Mediterranean diet groups<sup>[14]</sup>. According to Shai *et al.*,

participants with diabetes assigned to the Mediterranean diet had lower levels of fasting plasma glucose and insulin than those assigned to the low fat diet. Insignificant changes in plasma glucose were observed for subjects without diabetes while insulin levels decreased significantly in all groups<sup>[15]</sup>. Finally, according to another intervention dietary study in a young healthy normolipidemic population, *in vivo* insulin sensitivity was improved when saturated fatty acids were replaced by carbohydrates or monounsaturated fatty acids in an enriched Mediterranean diet<sup>[16]</sup>.

Furthermore, it is worth mentioning that certain individual components of the Mediterranean dietary pattern may also protect against the development of diabetes. High consumption of olive oil, fruits and vegetables, whole grain cereals, fish and moderate consumption of alcohol leads to a low glycaemic index diet and to a higher intake of monounsaturated fatty acids, n-3 fatty acids, dietary fiber and antioxidant and anti-inflammatory factors<sup>[5,17]</sup>. Finally, due to the high fiber content of the Mediterranean diet, favourable changes may occur in the composition of the gut microbiota which may be another link for the protective effect of this pattern<sup>[18]</sup>.

Nevertheless, dietary habits in the developed world and in developing countries at “nutrition transition”, in particular India and China, are changing towards the opposite direction despite the nutritional recommendations for a healthy diet and lifestyle<sup>[19-21]</sup>. Even in Mediterranean countries, more fat, meat, egg, dairy products and sugar and less cereals, legumes, vegetables and seafood are being consumed<sup>[22]</sup>. Therefore, lifestyle measures for the prevention of obesity and diabetes are of significant public health importance.

## CONCLUSION

In conclusion, effective lifestyle modifications including counseling on weight loss, adoption of a healthy dietary pattern like the Mediterranean diet, together with physical activity are the cornerstone in the prevention of type 2 diabetes. Therefore emphasis must be given to promoting a healthier lifestyle<sup>[1]</sup> and finding solutions in order to increase adherence and compliance to the lifestyle modifications, especially for high-risk individuals. Results from epidemiological studies and clinical trials evaluating the role of the Mediterranean dietary pattern regarding the development and treatment of type 2 diabetes indicate the protective role of this pattern. As a result, promoting adherence to the Mediterranean diet is of considerable public health importance as this dietary pattern, apart from its various health benefits, is tasty and easy to follow in the long term.

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