

# Mediterranean vs. western dietary patterns: preventing and treating obesity and other diseases.

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**ABSTRACT:** Mediterranean diet seems to be the most highly recommended dietary pattern due to both preventive and therapeutic properties, as well as its positive impact on wellness and quality of life. It has been abandoned in western and westernized societies lately. However, the health benefits derived from it are widely recognized. This is an effort to demonstrate the impact of Mediterranean diet to human health, in relation to obesity and other diseases. There is sound evidence that this dietary pattern favors the control of the epidemic of obesity, as well as its management. High quality of this diet seems to be able to help in avoiding/minimizing the possibility of developing cancer and cardiovascular diseases. The new fields of nutrigenomics and nutrigenetics seem to be really promising for individualized management in the near future. The Mediterranean diet pattern seems to consist of nutrients of high quality, which can favor pathophysiological processes and prevent, as well as treat, obesity, cancer and/or cardiovascular diseases. Therefore, health care professionals could recommend this dietary pattern to wide populations, in order to promote public health and quality of life, and to minimize health care system expenses.

**Key words:** *Mediterranean diet, obesity, olive oil, cardiovascular diseases, cancer*

## INTRODUCTION

During the last few decades, lifestyle and food choices of Mediterranean countries inhabitants have been influenced by Western way of living<sup>1</sup>. Cardioprotective properties have been attributed to the dietary pattern consumed in these countries in the past, known as the “Mediterranean diet”. Nowadays, this dietary pattern is less, or no more, followed in the Mediterranean region. The study of Laurenzi in Italy, a typical Mediterranean region, concluded that the different lifestyle followed by the Italians nowadays, with increased salt intake and alcohol consumption, was related to decreased heart protection and consequent increase in the rates of obesity<sup>2</sup>.

The dietary pattern followed in European countries around the Mediterranean Sea during the decades of 50’s and 60’s, after the end of World War II, is called “Mediterranean diet”. In those areas olive trees prospered and, therefore, the main fat constituent of this dietary pattern was olive oil<sup>3</sup>. Abundant consumption of fruits and vegetables was the characteristic of this dietary pattern, as well as high consumption of carbohydrate foods, whole grains and unrefined cereals, legumes, moderate consumption of alcohol (mainly wine) and low consumption of red meat and animal derived food, with preference to fish and poultry<sup>4</sup>. On the whole, Mediterranean dietary patterns include food choices that can be adopted by all socioeconomic classes<sup>5</sup>.

Low consumption of red meat and animal derived foods results in low consumption of saturated fats and that explains the cardioprotective action that has been attributed to this dietary pattern, as long as it does not increase total cholesterol and low density lipoproteins (LDL) serum levels, or decrease high density lipoprotein (HDL)/LDL ratio. Low red meat quantities consumption diminishes the possibility of cancer derived from meat during the cooking process. Moreover, Mediterranean diet favors the prevention of osteoporosis, as long as urinary calcium loss

is limited and bone density does not undergo mechanical changes due to poor nutritional quality<sup>3</sup>.

There are many patterns, of Mediterranean diet, each one derived from a different region of the Mediterranean area. In each pattern, the local cuisine and the ingredients dominate the differences. Nevertheless, olive oil is the main common characteristic of them all<sup>6</sup>.

## OLIVE OIL CONSUMPTION AND HEALTH BENEFITS

Olive oil is considered cardioprotective due to its content of monounsaturated fatty acids. It has no direct effect on high density lipoproteins (HDL), which act in a cardioprotective way, mediating reverse cholesterol transport, and inhibiting foam cell and arterial atherosclerotic plaque formation<sup>7</sup>. However, olive oil seems to promote reduction of low density lipoproteins (LDL) serum levels<sup>6</sup>.

Apart from monounsaturated fatty acids, olive oil contains phenolic compounds<sup>8,9</sup> which are antioxidants, found in green tea and in licorice root<sup>10</sup>. It is believed that these compounds might protect against LDL oxidation and could possibly minimize the incidence of cardiovascular diseases<sup>8</sup>. The action of phenolic compounds is associated with reduced susceptibility of LDL to oxidation<sup>11,12</sup> regulation of enzymatic activity, such as reduction in activity of human cytochrome P450S, 3A4, 2B6 and 2C9<sup>13</sup>, as well as retention of glutathione levels<sup>14</sup>. Extra virgin olive oil also contains phenolic compounds, such as oleuropein and protocatechuic acid<sup>15</sup>.

It has been found that transition metals promote LDL oxidation taking place in the arterial wall via muscle cells, macrophages and, possibly, endothelial cells<sup>16</sup>. The oxidation of LDL resulting from macrophages action could be prevented by the presence of phenolic compounds existing in extra virgin olive oil, as long as they possibly act as chain-breaking antioxidants, as well as radical scavengers. These properties are due to the phenol ring of

these compounds which has the ortho- and para-hydroxyl groups<sup>17</sup>. Therefore, within a Mediterranean dietary pattern, virgin olive oil moderately consumed may increase Total Antioxidant Capacity (TAC)<sup>18</sup>.

Despite its benefits, olive oil is recommended to be consumed in moderation, especially by atherosclerotic patients, due to its increased calorie content<sup>6</sup>. However, it has been mentioned that despite its high fat content, olive oil does not promote weight gain<sup>19</sup>. This statement might need further investigation, pure individualized consultation and clarification of the population group studied. All these are needed in order to accept or suggest a slight change in the daily consumption of olive oil, taking into account the reduced physical activity levels of the populations nowadays compared to people having followed this dietary pattern in the 50's and 60's.

### DIETARY FIBER

According to the World Health Organization (WHO) and the Food and Agriculture Organization (FAO)<sup>20</sup> dietary fiber is defined as: "carbohydrate polymers with ten or more monomeric units which are not hydrolyzed by endogenous enzymes in the small intestine". Dietary fiber and whole grains can contribute a number of valuable nutritional substances to an individual's health, which include antioxidants<sup>21</sup>, phytochemicals, vitamins, minerals, and slowly digested energy<sup>22</sup>.

There has been found a link among obesity and consumption of dietary fiber as well as whole grain products<sup>23</sup>. A possible mechanism is believed to be the fact that fiber induces the ingestion of reduced energy intake thus resulting in weight maintenance or loss<sup>24</sup>. In addition, an inverse association between increase of body weight and dietary fiber intake has been shown<sup>23</sup>. The possible reasons leading to such a result are: 1) Possible reduction of the Metabolized Energy (ME) of a diet (equals: gross energy – energy lost in gases – energy lost in faeces- energy lost in urine)<sup>25</sup>, 2) Possible contribution to the reduction of ingested energy, and 3) The fermentation of soluble fiber in the large intestine promotes secretion of glucagon-like peptide 1 (GLP-1) and YY peptide (PYY), which are hormones contributing to satiety regulation<sup>23</sup>. Apart from whole grain products, fruits and vegetables consist an excellent source of fiber, too.

### FRUITS AND VEGETABLES

Fruits and vegetables are abundant in the Mediterranean diet. Apart from their fiber content, they contain nutrients that seem to promote human health. Vegetables, such as broccoli, cauliflower and Brussels sprouts have been found to show anticarcinogenic action probably due to high glucosinolate content, which possibly inhibits cell cycle while it induces apoptosis<sup>26,27,28,29</sup>. According to the Massachusetts Hispanic Elders Study, apart from this action, fruits and vegetables help to reduce CRP and homocysteine levels by 21% and 17%, respectively, for every extra portion of fruits and vegetables consumed<sup>30</sup>. Therefore, they probably exert anti-inflammatory and antioxidant properties, as well.

### NON-MEDITERRANEAN DIET FOODS

Some of the non-Mediterranean diet components are soft drinks. They are well known to all population groups; however their consumption in the Mediterranean region is still low. A positive association was found between increased soft-drinks consumption and higher Body Mass Index (BMI). People with higher BMI were also found to follow a life with less physical activity levels. Therefore, consumption of soft drinks deviates from the Mediterranean lifestyle pattern and could lead to long term weight gain<sup>31</sup>. Apart from soft drinks, another factor predisposing for obesity is snacking between meals. Snacking is usually food of low nutritional value and of dense energy. According to the SUN project, frequent snack consumption could lead to higher BMI rates being a potent obesity contributor<sup>32</sup>. Not only quantity of snacks and energy density, but also quality plays an important role. Confectionery and ready-made meals are usually of high glycaemic content, which results in high glucose serum levels, as well as high insulin levels quickly after consumption. Absorption of these snacks is followed by quick reduction of both glucose and insulin levels resulting in a vicious cycle; hunger mechanism is activated and the person consumes again snacks of the same quality, leading to high energy consumption<sup>33</sup>.

### OBESITY

According to the World Health Organization (WHO) obesity is a clinical condition in which the adult's BMI equals 30 kg/m<sup>2</sup> and above. There are also different levels of severity concerning obesity. For the evaluation of BMI under the age of 18 years old, and for population classification special cut-offs have been described that are age- and gender-specific<sup>34</sup>. Main characteristic for all the population subgroups is excessive fat storage in the body. Overweight individuals are characterized by BMI above normal (>25kg/m<sup>2</sup>) as well, but below 30kg/m<sup>2</sup>. No matter which category people are classified in, excess weight might have future health implications, such as type 2 diabetes mellitus, cancer, cardiovascular diseases<sup>35</sup> and shorter life span<sup>36</sup>. Therefore, obesity is a clinical condition that increasingly worsens morbidity and mortality. Central obesity is a serious health implication related to the increment of lipoprotein levels and serum lipids level<sup>37</sup>. It has been shown that visceral fat accumulation is a risk factor for cardiovascular diseases, diabetes mellitus, as well as metabolic syndrome<sup>38</sup>.

### MEDITERRANEAN DIET AND OBESITY

In Mediterranean regions, where there is abandonment of the Mediterranean diet there, a high percentage of obesity is observed<sup>39</sup>. That might be related to the fact that carbohydrates have been substituted by proteins and fatty foods of high energy density, which promote weight gain when consumed. According to Blundell et al, although high fat foods are energy dense nutrients, they do not promote satiety. This relation between fats and satiety has been called the "lipid paradox" and macronutrients have been categorized from the most satiating to the least one, i.e. protein > carbohydrates > lipids<sup>40</sup>.

Obesity is a world-wide epidemic increasing enormously. Its complications are clear and each one has as basic treatment the change of lifestyle which includes increase of physical activity and the change of dietary habits. Diet control targets to the quality of food consumed, as well as its quantity. According to fat distribution, two types of obesity have been described, peripheral and abdominal. Peripheral is the obesity in which fat predisposes in hip area and is usually observed in women. Abdominal obesity appears in the abdomen and is usually developed in men. Part of the fat stored in abdominal obesity is called visceral fat.

Adherence to Mediterranean dietary pattern seems to result in lower abdominal obesity in both men and women, citizens of European countries. This was the conclusion of the study of Romaguera D. et al, who conducted a study in 10 European countries (The Netherlands, United Kingdom, Italy, Greece, France, Sweden, France, Norway, Spain, Denmark, and Germany). Abdominal obesity was related to BMI and waist circumference, as well as to adherence to the Mediterranean diet. Adherence to this dietary pattern was scored as low, medium and high (MDS score). It appeared that the highest the score, the lower the energy density of food consumed by both genders. Moreover, in the high score group, lower consumption of proteins and dietary fat and higher fiber and carbohydrate content of the diet was observed. BMI and waist circumference were significantly lower in people whose dietary habits were rated in the highest (MDS) Mediterranean diet score than the group with the lowest MDS<sup>4</sup>.

Mediterranean diet has also been related to lower percentages of obesity in the elderly. This comes to be reinforced by the MEDIS study, which showed that each unit of greater adherence to the Mediterranean diet resulted in 88% reduction of being at obesity risk and 81% reduction as a result of physical activity<sup>41</sup>.

Apart from the elderly this dietary pattern could be adopted by children to avoid or to minimize obesity levels. A contributor index to the weight loss could be the increase of physical activity levels<sup>42</sup>. Another population group is the university students. The pilot study conducted by Spanos and Hackney, having as participants university students from Greece and Scotland, concluded that some of the dietary habits of the two groups were similar, as in both countries skipping breakfast was a typical food behavior. Nevertheless, vending machines were widely used by students in Scotland (74%), while 76% of Greek students did not consume snacks bought from them<sup>43</sup>. University students' lifestyle undergoes massive changes due to intense rhythm of life which drives them to make unhealthy food choices. Deviation from the healthy, Mediterranean dietary pattern was mainly observed in Greek students who moved away from home for their studies. The new eating habits consisted of foods high in fat and sugar, alcoholic beverages and fast food meals, while a decrease in consumption of oily fish, pulses, fresh fruits and vegetables was observed<sup>44</sup>. Therefore, this westernized way of eating possibly contributed to weight gain in Greek students.

## OBESITY TREATMENT WITH DIFFERENT DIETARY MODELS

There are many dietary models for weight loss as treatment for obesity. There are three predisposing models: the low fat diet, the low carbohydrate diet and, finally, the Mediterranean diet. Any of these alternatives is effective for weight loss. However, the possible most effective one which minimizes the weight regaining is the Mediterranean diet pattern. This dietary pattern presents low glycemic index of prepared dishes and, as already mentioned, minimizes possible relapse to the initial weight<sup>45</sup>.

Unfortunately, although this dietary pattern has benefits not only to weight loss but to general health, the Mediterranean region confronts the epidemic of obesity by losing its adherence to it and by the westernization of food pattern<sup>39</sup>.

## WESTERN VERSUS MEDITERRANEAN DIET

The Western type diet is high in saturated fats and refined carbohydrates. It is a dietary pattern poor in quality and high in calorie intake. There is evidence showing that substituting saturated fatty acids with monounsaturated fatty acids or following a Mediterranean type diet there is improvement in lipid profile. In specific, Mediterranean diet results in reduction of LDL cholesterol, total cholesterol levels and an increase in HDL cholesterol levels, as well as total to HDL cholesterol ratio<sup>46</sup>. Both dietary patterns seem to have no effect on insulin sensitivity.

There is also evidence from the PREDIMED trial, that following a Mediterranean diet rich in olive oil and losing weight, in a period of 3 years, plasma antioxidant capacity becomes higher for the participants having been at high risk of cardiovascular disease<sup>18</sup>. Body weight reduction and increased antioxidant capacity could be related to longer life expectancy and avoidance of the cardiovascular event. Therefore, by adopting the Mediterranean diet model the term "prevention" could be used for these two parameters. Improvement of the endothelial function is also recorded after adoption of this diet pattern in subjects with abdominal obesity<sup>47</sup>.

It could also be suggested to health care professionals to underline health benefits of this dietary pattern and promote the adherence to it by children and adults. It is hoped that either export of foods of the Mediterranean regions to the rest of the world, or new recipes of the Mediterranean diet pattern introduced to the world-wide cuisine could help to control the obesity epidemic.

## DIET AND WOMEN

In women with visceral fat accumulation, poor quality diet has been related to increased risk of breast cancer occurrence and ovaries polycystosis, in contrast to the Mediterranean diet. In addition, women with polycystic ovary syndrome and visceral fat accumulation seem to be predisposed for breast cancer<sup>48</sup>.

### **GENES AND DIET**

The science of nutrigenetics is a branch of nutritional genomics, which studies the effect of nutrient intake to the genome, focuses in the tailored and personalized nutritional advice to people according to their genome and aims in disease prevention. It is a promising field to pure individualized nutritional consultation<sup>49,50</sup>. There is also continuous evolvement of the field of nutrigenomics, which explores the impact of nutrients on homeostasis and metabolism<sup>51</sup>. How far are these fields of science going to be evolved in disease prevention? Is this a promise to pure individualized dietetic consultation in the near future? These are questions waiting to be answered by scientists.

### **CONCLUSIONS**

Obesity is a world's epidemic that keeps rising enormously. Mediterranean lifestyle includes adherence to the

Mediterranean diet, as well as increased physical activity. This lifestyle is suggested for preventing and treating the obesity epidemic. However, it is important to limit obesity's and other diseases' health implications, such as cardiovascular events and cancer, as well. Health professionals could have a central role in the promotion of the traditional Mediterranean diet and lifestyle, by providing adults and children with knowledge and education about the adherence to it. A worldwide expansion of the Mediterranean cuisine could be in favor of the health of many people at risk for various diseases, such as diabetes and cardiovascular incidents. Finally, the continuous evolvement of nutrigenetics and nutrigenomics may provide a very promising future for pure individualized consultations in relation to the Mediterranean diet, in order to achieve the best health benefits and to ameliorate quality of life.

# Σύγκριση Μεσογειακού και Δυτικού τρόπου διατροφής: Πρόληψη και Θεραπεία της παχυσαρκίας και άλλων νοσημάτων.

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**ΠΕΡΙΛΗΨΗ:** Η Μεσογειακή διατροφή φαίνεται να είναι ο πιο ενδεδειγμένος τρόπος σίτισης, διότι δρα προληπτικά καθώς και θεραπευτικά αναφορικά με την εμφάνιση διαφόρων ασθενειών. Επίσης, συμβάλλει θετικά στην υγεία και στην ποιότητα ζωής. Οι κάτοικοι των αναπτυσσόμενων καθώς και αναπτυσσόμενων χωρών δεν ακολουθούν πια τον συγκεκριμένο τρόπο σίτισης, παρόλο που τα οφέλη που απορρέουν από αυτή είναι αναγνωρισμένα. Το συγκεκριμένο άρθρο αποσκοπεί να επιβεβαιώσει αυτά τα οφέλη. Επιστημονικά δεδομένα επιβεβαιώνουν ότι με τη Μεσογειακή διατροφή μπορεί να περιορισθεί η παχυσαρκία σε ατομικό και κοινωνικό επίπεδο. Τα συστατικά της βοηθούν στη μείωση των πιθανοτήτων να νοσήσει κανείς από καρδιαγγειακά νοσήματα, καθώς και από καρκίνο. Το νέο επιστημονικό πεδίο της διατροφολογίας πιστεύεται πως θα βοηθήσει στην εξατομίκευση της διατροφής. Γνωρίζοντας τα μεγάλα οφέλη για την Υγεία και το μειωμένο Κοινωνικό κόστος, οι επαγγελματίες Υγείας οφείλουν να προωθούν τη Μεσογειακή διατροφή.

*Λέξεις κλειδιά: Μεσογειακή δίαιτα, παχυσαρκία, ελαιόλαδο, καρδιαγγειακά νοσήματα, καρκίνος*

## ABBREVIATIONS

HDL : High Density Lipoproteins  
LDL : Low Density Lipoproteins  
GSH : Glutathione  
TAC : Total Antioxidant Capacity  
WHO : World Health Organization  
FAO : Food and Agriculture Organization  
ME : Metabolized Energy  
GLP -1 : glucagon-like peptide 1  
PYY : YY Peptide  
BMI : Body Mass Index  
MDS : Mediterranean Diet Score  
AO : Abdominal Obesity

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