

# Mediterranean diet, overweight, cancer risk and sustainable benefits

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The dietary patterns embraced by the Mediterranean people over the centuries are the result of a number of factors: food production availability, seasonality, the use of small-scale technologies, the wide variety of local cultivars used, the freshness of the food consumed, their homemade preparation, the frugality and the conviviality of meals, and a physically active lifestyle. The so called Mediterranean diet has been favourably related not only to the risk of cardiovascular diseases, but also of several cancer sites and overweight.

Overweight and obesity, in fact, are related to a number of cancer sites, including – among others- post-menopausal breast, endometrium, colorectum, esophagus (adenocarcinoma), gallbladder, pancreas, liver and kidney.

Overweight and obesity, however, have not been rising over recent years in several Mediterranean countries, particularly in France and Italy, as contrasted to what observed in North America and several northern and central European countries. In Italy, over the last three decades the prevalence of overweight has remained around 30%, and that of obesity - including that related to psychiatric disorders - around 8% of the adult population [1]. Still, overweight at various ages has been consistently associated not only to cardiovascular diseases, but also to several common cancers, including colorectal, endometrial and post-menopausal breast cancer in Italy. Physical activity, in contrast, has been favourably related to colorectal, breast, and several other neoplasms [2].

Various aspects of the traditional Mediterranean diet, nutrition and lifestyle patterns are considered favourable non only on cardiovascular disease risk [3], but also on several common neoplasms. Several aspects of the Mediterranean diet have been favourably related to cancer risk in a network of case-control studies conducted in Italy since the early 1980's on over 22,000 cases of 20 cancer sites, and a similar number of controls. For most epithelial cancers, and particularly for digestive tract ones, the risk decreased with increasing vegetable and fruit consumption, with relative risks between 0.3 and 0.7 for the highest versus the lowest tertile of intake, and the population attributable risks for low intake of vegetables and fruit ranged between 15 and 40%. The inverse association with fruit was particularly strong for cancers of the upper digestive tract [4, 5].

A number of antioxidants and other micronutrients and food components (including carotenoids, lycopene, flavonoids, proanthocyanidins and resveratrol) showed an inverse relation with cancer risk, but the main component(s) responsible for the favourable effect of a diet rich in vegetables and fruit remain undefined [4, 6]. Likewise, an a priori defined dietary inflammatory index (DII) was inversely related to most epithelial cancers, particularly of the digestive tract [7] [8].

Fish, and consequently a diet rich in n-3 fatty acids, as well as olive oil, also tended to be favourable diet indicators of the risk of several (epithelial) cancers. In contrast, subjects reporting frequent red meat intake showed elevated risks for several common neoplasms [6] [7].

Whole grain food intake was related to a reduced risk of several types of cancer, particularly of the upper digestive tract. This may be due to a favourable role of fibers, but the issue is still open to discussion. In contrast, refined grain intake

and, consequently, glycaemic load and index were associated to increased risk of different types of cancer, particularly digestive tract and hormone-related ones [9].

Further, olive oil, which is a typical aspect and the common denominator of various types of Mediterranean diets, has been inversely related to cancers of the colorectum and breast, and mainly of the upper digestive and respiratory tract neoplasms. It is not clear whether such activity is due to oleic acid itself or to the presence of antioxidants, such as vitamin E and polyphenols and other food components in olive oil. Olive oil, in fact, is a fruit juice and a major source of monounsaturated fats in Mediterranean countries, but also an important source of several micronutrients and food components. It appears therefore to be a favourable indicator of the risk of various common cancers [10]. The observed associations, in fact, may at least in part not only be due its specific fatty acid and (micro) nutrient components, but to the fact that olive oil is a general indicator of healthier (Mediterranean) diet [11].

When a Mediterranean diet score, originally developed by Antonia Trichopoulou et al on Greek data [12], was applied to our network of studies, subjects in the highest score level for adherence to Mediterranean diet had a 30 to 50% reduced risks of most common neoplasms, particularly of the digestive tract (Table 1), but also of the liver, pancreas and endometrium [13] [14] [15] [16].

These findings are only partly in agreement with the results of several (cohort) investigations from North America and northern Europe. Possible reasons for these inconsistencies, include different dietary patterns and baseline cancer risk in various population, but remain open to further discussion and hence research.

In addition, the Mediterranean diet appears to have not only a number of health benefits, but also several sustainable benefits as highlighted in the Med Diet 4.0 model: low environmental impacts and richness in biodiversity, high socio-cultural food values, and positive economic return locally [17].

Over the last few years, the Mediterranean diet has become the object of increasing studies on its sustainability, particularly on its lower environmental impact as a mainly plant-based dietary pattern with low animal product consumption, with a lower water footprint and lower greenhouse gas emissions compared with the Western dietary pattern [18].

Improved adherence at the country level to the Mediterranean diet pattern can produce at the same time: public health savings as well as lower environmental impacts, significant economic gains locally, and more social and cultural understanding of the value of food - improving the well-being of the individual and of the community. Indeed, the benevolent climate in the region and the human spirit have molded the disparate components into a balanced ecosystem for which the Mediterranean diet is only one, but highly visible, manifestation [19].

The transdisciplinary and multidimensional approaches to the Med Diet 4.0 is likely to have an important educational and communication role in the revitalization and enhancement of the Mediterranean diet by providing a broader understanding of its health and societal benefits

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**TABLE 1. Mediterranean diet score and upper digestive tract cancers [12].**

	Mediterranean diet score (number of characteristics)		
	<3	4	≥6
<b>Oral/pharyngeal</b>			
Cases/controls	214/241	120/376	41/201
OR (95% CI)	1	0.41 (0.30-0.57)	0.40 (0.26-0.62)
<b>Oesophageal</b>			
Cases/controls	102/147	66/174	14/83
OR (95% CI)	1	0.63 (0.41-0.95)	0.26 (0.13-0.51)
<b>Laryngeal</b>			
Cases/controls	183/225	98/279	19/124
OR (95% CI)	1	0.47 (0.33-0.66)	0.23 (0.13-0.40)

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