

## COMMENTARY

# Comparison of Mediterranean, Western and Japanese Diets and Some Recommendations

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### Abstract

During the past thousands of years, food systems, and thus human diets, have been and are shaped by climate, terrain, seasons, location, culture, and technology. In this context, many types of diet patterns have emerged. Nowadays, numerous epidemiological studies are being conducted in many countries in order to find relationships between empirically identified dietary factors and the occurrence of illnesses. Today, some dietary patterns are described as healthy eating models while others are generally qualified as unhealthy.

**Key Words:** Dietary patterns - Mediterranean - Western - Japanese

*Asian Pacific J Cancer Prev*, 9, 351-356

### Eating Habits and Illness

The main target of most published research during the 1960s, the 1970s and even the 1980s was the isolated effect of each macronutrient (i.e. carbohydrates, protein or the different types of fat). During the late 1980s and early 1990s the interest shifted to micronutrients with a predominant emphasis on vitamins and antioxidants (carotenoids, tocopherols, vitamin C, selenium) (Martinez 2004).

It was noted in the 1970s that developed Western countries have diets high in animal products, fat and sugar, and high rates of cancers of the colorectum, breast and prostate. In contrast, developing countries typically have diets based on one or two starchy staple foods, low intakes of animal products, fat and sugar, low rates of these 'Western' cancers, and sometimes high rates of other types of cancer such as cancers of the oesophagus, stomach and liver. Several carefully researched Mediterranean and Asian populations, whose traditional diets consist largely of foods of vegetable origin, show the lowest recorded rates of certain chronic diseases and the highest adult life expectancies (Ortega 2006). Therefore, investigators have focused on environmental factors in attempting to explain temporal trends or international differences in cancer rates. Especially, migrants' studies strongly suggest that lifestyle-related diets can affect promotion of the aforementioned cancers (Irigaray 2007). For example, colorectal cancer (CRC) rates for Japanese migrants to the United States increased rapidly to surpass the level of the host population. CRC rates for the Japanese in Hawaii and California are now the highest in the world. Rates for this disease have also increased in Japan, presumably as the result of the westernization of the diet (Michels 2003). Some of the main hypotheses that were derived

from the ecological observations have not been supported by the results of detailed studies of the diets of individuals. However, the international variations in diet and cancer rates continue to suggest that diet is an important risk factor for many types of cancer, and therefore that cancer may be partly preventable by dietary changes (Marchand 1999; Key et al. 2003). The recent studies have further confirmed that some of the cancer types are increasing in definite geographical regions and most cancers are largely preventable by the alteration of some factors including food, nutrition, and physical activity (Martinez 2004; Visioli et al. 2005; Visioli et al. 2007).

Another impact of eating habit is on the prevalence of non-communicable disease such as cardiovascular diseases and type-2 diabetes mellitus. The prevalence of cardiovascular disorders, type-2 diabetes and certain types of cancer, is rampant in Western societies, accounting for approximately 60% of all causes of death. According to several health authorities and regulatory bodies a large proportion of non-communicable diseases can be prevented through appropriate diets and lifestyles, perhaps around 20%. (Visioli et al. 2007; Key et al 2003). Westernisation of diet has led to a health crisis, so Mediterraneanisation or easternisation of dietary practices worldwide is needed. Actually, the considerable effects of diet on cancer as well as cardiovascular disease risk are of great public health importance, but research to date has covered only few definite effects and left frustratingly large areas of uncertainty.

Many of the prominent hypotheses for effects of diet on cancer risk have been derived from examination of associations between dietary patterns and cancer rates in different populations around the world. In this article scientific evidence related to three widely accepted dietary patterns will be examined.

## Mediterranean Diet

Mediterranean dietary pattern has drawn increasing interest as a model for healthy eating and the primary prevention of cancer. During the past decades a large body of evidence has related adherence to a Mediterranean diet with reductions in all-cause mortality, the prevalence of certain chronic diseases, including cardiovascular disease, metabolic disorders and various types of cancer (such as large bowel, breast, endometrium, and prostate) (Trichopoulou et al 2000; Martinez 2004; Leonhäuser et al. 2004; Ortega 2006; Dalvi 2007).

The concept of the 'Mediterranean diet' was first studied by Keys and Grande (1957) as the traditional dietary pattern detected in the olive-growing areas of the Mediterranean (mainly Greece, Italy and France) in the late 1950s and early 1960s. With some variations, it is also found in many regions of Albania, Spain, France, Lebanon, Morocco, Portugal, Syria, Tunisia and Turkey (Martinez 2004; Leonhäuser et al. 2004; Ortega 2006). It is characterized as a diet higher in consumption of fruits and vegetables, whole grains, breads, nuts, lowers to moderate in consumption of meats, dairy products and eggs, and lowers to moderate in consumption of alcohol, mainly wine (Trichopoulou et al 2000; Martinez 2004; Garcia-Closas 2005). In the Mediterranean diet, meals are usually accompanied by large quantities of whole grain bread. Meat, being expensive, used to be rarely consumed, whereas fish consumption was a function of proximity to the sea. Wine is consumed in moderation and usually with meals. All these items are important sources of antioxidants. Apart from the most widely known antioxidants contained in fruits and vegetables, other compounds such as oleuropein, hydroxytyrosol and resveratrol from red wine, possess a marked antioxidant activity and other advantageous biological properties (Trichopoulou et al 2000; Martinez 2004). Different countries and regions in the Mediterranean basin may have their own dietary traditions, but in all of them olive oil (Trichopoulou et al 2000; Visiloi 2005; Ortega 2006) the main source of fat with mono-unsaturated fatty acids is the principal component used to dress salads and to cook. And also, wild edible greens frequently eaten in rural Mediterranean areas, mainly in the form of salads, are very rich in flavonoids (Trichopoulou and Vasilopoulou, 2000). In carcinogenesis free radical production role together with many epidemiologic studies linking antioxidant intake with a reduced incidence of cancer indicates that dietary antioxidants probably play a protective role. Therefore, the highly palatable traditional Mediterranean diet has many options to be the first choice in the dietary prevention of cancer (Martinez 2004, Ortega 2006; Vecchia & Bosetti 2006).

The Seven Countries Study was the first published examination to draw attention the possible health benefits of the Mediterranean diet on lipid metabolism, blood pressure, body mass index, inflammation and coagulation. And then, increasing number of studies has shown that the traditional Mediterranean diet is associated with low rates of chronic diseases and certain types of cancer (Visiloi 2005; Garcia-Closas 2005; Ortega 2006).

Many of the characteristic components of the Mediterranean Diet (MD) have positive effects on health;  $\beta$  Vegetables are the most important sources of phenolic compounds and phytosterols in the MD. Wild edible greens are among the vegetables commonly consumed in MD. These greens have a high flavonoid content, which in several cases substantially exceeds the respective values in foods and beverages, such as onions, black tea and red wine. Flavonoids in particular are thought to be essential bioactive compounds that provide health benefits; and phytosterols the intake of which is associated with a reduction in serum cholesterol levels and of cardiovascular risk

Fruits also provide fibre, as well as vitamins, minerals, flavonoids and terpenes, many of which provide protection against oxidative processes. Due to the phytoestrogenic substances they contain, an increased consumption of fruits, vegetables, whole grains and pulses (common in the MD) may offer an alternative to hormone replacement therapy in menopausal women. In the intestine, these compounds turn into oestrogen and help counteract the hormonal deprivation suffered at menopause. Fruit and vegetables are also one of the main sources of folate in the diet.

Although the mechanisms are not fully understood, carotenoids and folic acid all of which are abundant in the MD, appear to play important roles in the prevention of coronary artery disease and certain cancers.

$\beta$  Among the minor components of tomato, carotenoids such as beta-carotene, lycopene, lutein, and zeaxanthin have been extensively investigated because of their relative abundance in human plasma and their antioxidant properties. Accordingly, both basic research and epidemiological studies concur to suggest the cardioprotective and chemopreventive activities of carotenoids, in particular of beta-carotene and lycopene (Visiloi 2005). The addition of olive oil to tomatoes during cooking greatly increases the absorption of lycopene (a carotenoid that reduces the risk of certain cancers and heart disease).

Nuts in particular are rich in phenols, flavonoids, isoflavonoids, phytosterols and phytic acid, and have been linked to reductions in plasma lipids and protection against cardiovascular disease.

$\beta$  Accumulating evidence suggests that olive oil (monounsaturated fatty acid content, namely in the form of oleic acid) an integral component of the MD, may have health benefits, including the reduction of coronary heart disease risk, the prevention of several types of cancers and the modification of the immune and inflammatory responses. Olive oils and wine or apple vinegars were the salad dressings that afforded the greatest increase in antioxidant capacity.

Fish intake (a major source of n-3 polyunsaturated fatty acids) has been shown to be a favourable indicator for several common cancers (digestive tract, gallbladder, laryngeal, breast and female genital tract cancers) and effectively regulate haemostatic factors, and provide protection against cardiac arrhythmias, and hypertension.  $\beta$  The dairy products characteristic of the MD, such as cheese and yoghurt, are better tolerated by

lactose intolerant individuals. In addition, lactic acid bacteria confer probiotic benefits, including improvements in gastrointestinal health and of the immune response. The consumption of yoghurt might induce favourable changes in the faecal bacterial flora and have a positive effect on colon cancer risk indices.

β Garlic, onions, herbs and spices are used as condiments in the MD, and may increase the nutritional value of food. Raw garlic and onion contain large quantities of allicin and it may have cardiovascular benefits and help improve cognitive function. The antioxidant activity of polyphenols may also be responsible for the cytoprotective action of red wine reported in some papers. Wine exerts its protective effect via the induction of changes in the lipoprotein profile, coagulation and fibrinolytic cascades, platelet aggregation, oxidative mechanisms and endothelial function. Because cardiovascular disease is the leading cause of death among women, moderate drinking is associated overall with a modest reduction in total mortality. However, avoiding alcohol appears to be one of relatively few methods for reducing breast cancer risk, whereas many methods exist to reduce risk for cardiovascular disease. For women choosing to consume alcohol regularly, use of a multivitamin to ensure adequate folic acid intake may decrease breast cancer risk (Trichopoulou 2001; Holmes et al 2004; Ortega 2006; Vecchia & Bosetti 2006).

Although estimates can only be crude, ~25% of the incidence of colorectal cancer, ~15% of the incidence of breast cancer, and ~10% of the incidence of prostate, pancreas, and endometrial cancer could be reduced by shifting to the traditional healthy Mediterranean diet of the people of major developed Western countries. The question recur to the mind that diet could explain the low incidence of certain forms of cancer in the traditional Mediterranean people? Available data do not allow answering this question directly and quantitatively, so only estimates are possible (Trichopoulou et al 2000; Vecchia & Bosetti 2006).

In the light of the most recent nutritional and epidemiological studies, it can be said that the ideal diet closely resembles the MD. Since food items and nutrients could have a synergistic and antagonistic effect on health outcomes, the study of overall dietary patterns rather than single nutrients would appear appropriate (Trichopoulou et al 2000; Rumm-Kreuter 2001; Jacques & Tucker 2001; Ortega 2006; Vecchia & Bosetti 2006). Furthermore, Mediterranean people's relatively good health documented in several publications is not only based on the diet but also on their culture, history and lifestyle. As Trichopoulou remarked some scientists "have argued that the relaxing psychosocial environment, mild climatic conditions, preservation of the extended-family structure, and even the afternoon siesta habit in the Mediterranean region may play contributory roles" (Leonhäuser et al. 2004).

However, although its healthy advantages are well known, the Mediterranean dietary pattern has been changed between 1960-2001 years in some Mediterranean countries due to globalisation and social change. In all European Mediterranean countries, especially Italy, Greece and Spain, shows a clear trend towards a Western

diet (Garcia-Closas 2005; Trichopoulou et al 2000; Leonhäuser et al. 2004). In this context, meat consumption increased in all Mediterranean countries within the last forty years (Leonhäuser et al. 2004; Rumm-Kreuter 2001). After the invasion of the fast food culture in the area, high incidence of stomach cancer has been attributed to the high salt intake of the Mediterranean peoples and the generally early infection by *Helicobacter pylori* (Trichopoulou et al 2000). One must keep in mind, however, that increasing incidence of a variety of cancers in Western countries may not be related to the dietary factor alone, but may probably be due to various environmental factors such as tobacco smoking and alcohol consumption. Consequently, epidemiological studies on environmental interactions including lifestyle influences such as smoking, alcohol consumption and diet have been picked up in order to reduce the risk of cancer in these regions.

## **Western Diet**

After the Second World War the increasing incidence of a variety of cancers in Western countries, has taught scientists that environmental factors play a more important role in cancer genesis. Over the last 2-3 decades, alcohol consumption and tobacco smoking in men have significantly decreased, whereas they have progressively increased in women in Western Europe and North America and also obesity is increasing in many countries. Consequently, epidemiological studies on environmental interactions including lifestyle influences such as smoking, alcohol consumption and diet have been picked up in order to reduce the risk of cancer in these regions.

The Westernization of dietary habits is acquired a different characteristics as increasing consumption of milk and high-fat dairy products, French fries and desserts, red and processed meat besides alcoholic beverages other than wine (Leonhäuser et al. 2004; Garcia-Closas 2005). In Western society, the time for basic needs especially for meals became less important from the 1960s to the 1990s. This European trend can be explained by the fact of an increasing employment of men and women, which leads to increased eating out, especially at fast-food restaurants, whereas in traditional Mediterranean countries, the common meal is of prime importance for family communication and regeneration (Leonhäuser et al. 2004). Several studies have shown that in highly developed Western countries, rich in red and processed meat and poor in fruits and vegetable, is a factor that fosters the occurrence of certain cancers (colon, prostate, endometrium and breast) (Giovannucci 2002; Michels 2003; Irigaray 2007). Furthermore, overweight, obesity and sedentariness have been seen especially in Western countries and USA have been incriminated as risk factors for cancer (Irigaray 2007). Some features of Western diet which may have negative effects on health are as follows; β A diet characterized by high fat consumption increases the risk of certain disease, regardless of fruit and vegetable consumption. Although results have not been entirely consistent, studies examining diet and endometrial cancer have found that higher dietary fat or energy intake from

animal sources is associated with higher risk, fruit and vegetable intake and nutrients, such as fiber and antioxidant vitamins are associated with reduced risk (Dalvi 2007, Visioli et al. 2007).

Meat consumption could be interpreted as a welfare indicator. Socio-economic theories implement that with higher welfare the rate of starchy food decreases and animal products become more relevant until they make up 33–40% of the diet in western industrialised countries (Leonhäuser et al. 2004). And red meat has a specific relevance among various aspects of diet which appear to influence cancer risk (Vecchia & Bosetti 2006). Meat, especially when cooked well-done, may be a source of exposure to chemical carcinogens, such as heterocyclic aromatic amines (HAAs), polycyclic aromatic hydrocarbons (PAHs) and other pyrolysis products which seems to increase risk somewhat for rectal cancer (Marchand et al. 2002). High consumption of meat, the major dietary source of vitamin B12 and a major component of the Western diet, has been linked to increased risk of prostate cancer in some studies (Nelson 2003). Plasma levels of vitamin B12 might therefore be a marker of meat intake or some component of meat.

Dairy products constitute an important part of the diet in many Western countries. Milk and dairy products have been suspected to increase the risk of breast cancer. International comparative studies have shown a positive association between milk and breast cancer mortality (Shin et al. 2002).

Folate is a micronutrient of special interest in relation to reduce cancer risk, and maintaining an adequate folate status has generally been shown to be protective against cancer development, with evidence strongest for colorectal cancer (Giovannucci 2002).

Alcohol consumption is most common in western countries. Chronic alcohol consumption is a strong risk factor for cancers in the upper aerodigestive tract (oral cavity, pharynx, hypopharynx, larynx, oesophagus) and also is a major aetiological factor in hepatocarcinogenesis. In addition, alcohol consumption may interfere with folate absorption and furthermore increase folate excretion by the kidney, therefore causing relative folate deficiency (Vecchia & Bosetti 2006), probably thereby increasing the risk for cancer of the colorectum and also the breast (Pöschl 2004).

Coffee is one of the most widely consumed beverages in the Western dietary pattern. Case control studies related to coffee consumption, especially conducted in Europe, have tended to support an inverse association with risk of colorectal cancer, expected through its content of potentially antimutagenic substances and phenolic compounds with antioxidant properties. In a meta-analysis of coffee consumption and colorectal cancer risk, the combined results of 12 case control studies revealed a significant 28% reduction in colorectal cancer risk for high coffee consumption versus low consumption. However, prospective cohort studies have not supported these findings (Larsson et al. 2006). On the other hand, in Michels et al. study (2005), regular consumption of decaffeinated coffee was found to be associated with a reduced incidence of rectal cancer.

## Japanese Diet

The third dietary pattern is “Japanese” diet, characterized as a diet lower in consumption fatty acid, and higher in consumption rice, soy-derived proteins and fish. And also green tea is widely consumed in Asian countries. The Japanese dietary pattern is also associated to a lower mortality rate because of cardiovascular events and some types of cancer (prostate, breast, colorectal). The incidence of prostate and breast cancer in Japan and Chinese (and other Asian populations in their homelands) have the lowest rates, and it has been suggested that the traditional Japanese diet, which includes many soy products, plays a preventive role against either prostate cancer in men or breast cancer in women (Wu et al 1998; Sonoda et al. 2004; Ganry 2005). On the other hand, consumption of salty foods which is one of the Japanese diet components appeared related to an elevated risk of stomach cancer (Khan et al 2004).

Some of the characteristic components of the Japanese Diet (JD) also have positive effects on health;

Soybeans are a rich source of isoflavones, a main type of plant estrogens (phytoestrogens). It has been suggested that these plant-derived, estrogen-like substances might partly suppress or inhibit normal estrogen secretion or normal estrogen activity in estrogen-responsive tissues such as breast (possibly by competing with endogenous estrogens for receptor sites in breast tissue), while themselves being less estrogenic to breast tissue, thereby reducing breast cancer risk (Wu et al. 1998; Wu et al. 2003).

Fish intake (a major source of n-3 polyunsaturated fatty acids) has been shown to be a favourable indicator for several common cancers in JD as well as in MD (digestive tract, gallbladder, laryngeal, breast and female genital tract cancers). However, salty fish products frequently consumed in Asian societies have been suspected to increase the risk of stomach cancer.

There is substantial *in vitro* and *in vivo* evidence implicating green tea polyphenols as chemopreventive agents against various cancers. Some studies have suggested an antibacterial effect of green tea, which may apply to *Helicobacter pylori* known as causing of gastric cancer (Tsubono 2001; Wu et al. 2003).

Besides many epidemiological and biological studies depicting a relationship between eating habits and cancer risk, the role of healthy diet in prevention of carcinogenesis is still not fully understood. Food consumption has been associated more often with a reduced cancer risk in case-control studies than in prospective cohort studies. Because diet is assessed after the diagnosis of cancer in case-control studies, suggesting that the inverse associations in the case-control studies may have resulted from recall and/or selection biases. Since healthy control subjects may be more likely to overestimate their food consumption or cancer patients may underreport it.

If diet plays an important role in carcinogenesis, more attention should be devoted to the effects of diet at different periods in life, *in utero* and most importantly peripubertal periods having the potential for being windows of susceptibility. Since the relationship between cancer and

diet is thought to have a long induction period (Michels et al. 2000; Irigaray 2007). And also individuals distinct dietary habits must also be taken into account. The portion sizes of food as well as pattern of food consumption, for example during or between the main meals, are very important in determining the nutritional profile of a diet. And then guidelines aimed at improving the diet of the general population should be implemented, while a global approach is desirable (Garcia-Closas 2005; Visioli et al 2007).

One essential question should be addressed at this time: Is the Mediterranean diet or are its major components transferable to populations living far from the Mediterranean area? To discuss this question would be important for scientific and policy reasons (Leonhäuser et al. 2004).

### Recommendations for Healthy Eating

The theoretical advantages of the Mediterranean (MD) and Japanese diets (JD) are multiple. The high fruits (daily intake should reach 200 g), vegetables (daily intake should not be lower than 400 g), soy products and green tea intake, add to its high antioxidant load and other mechanistic benefits provided by the consumption of extra-virgin olive oil and red wine.

It is now believed that dietary supplements do not offer the same health benefits as a diet rich in fruit and vegetables because, taken alone, the isolated pure compound either loses its bioactivity or may not behave the same way as the compound in whole foods.

Healthy diets are also low in salt (daily intake of Na to 5–7 g), and sugar.

Nutrition education and marketing strategies should communicate the MD and JD, which enjoy all the advantages of a healthy and enjoyable lifestyle and well-being. The strong background of a long tradition with no evidence of harm also makes the MD and some components of JD very promising for public health nutrition. In addition, it is necessary that the practice of more physical activity (once common among Mediterranean populations), also the leisure time and the opportunity to rest and regenerate during day especially for employees should be borne in mind.

After all, the advantages for cancer prevention of a diet rich in fruit and vegetables are more closely related to the complex mixture of phytochemicals present in whole foods than to the provision of some antioxidants in supplements (Vainio, 2000; Jacobs and Steffen, 2003; Liu, 2003; Leonhäuser et al. 2004; Martinez, 2004; Dalvi, 2007; Visioli et al. 2007).

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