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8**An impact on Mediterranean diet on Cancer – an update****JA Reenu^{1*}, MJ Jesna¹, R Shanmugasundaram²**¹Department of Pharmacy Practice, J.K.K. Nattraja College of Pharmacy, Komarapalayam - 638138, Tamilnadu, India.²Department of Pharmacology, J.K.K. Nattraja College of Pharmacy, Komarapalayam - 638138, Tamilnadu, India.

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ABSTRACT: Cancer is one of the major public health problem worldwide, and the number of incidence cases of cancer increases every year and it was expected to reach 17.1 million a year by 2020. Mediterranean diet is a type of traditional in mediterranean countries, which was characterized by adding more amounts of fruits and vegetables, fish, cereals, and poly-saturated fats with a reduced consumption of meat and dairy products and moderate intake of alcohol and red wine. The incidence of cancer in mediterranean counties is lower than in other countries. Cancers in largebowel, breast, endometrium, and prostate has been less in Mediterranean countries because these forms of cancer have been linked to dietary factors, particularly low consumption of vegetables and fruits, and high consumption of meat. The aim of this review is to find out the protective effect of the mediterrenean diet on cancer.

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INTRODUCTIONS:

Cancer is one of the most common causes of mortality and morbidity in U.K ^[1]. Cancer is one of the leading causes of death in both developed and developing countries, and is an increasing medical burden worldwide, due to population growth and aging. Cancer is a major public health problem worldwide, and the number of incident cases increases every year ^[2]. Cancer is mainly treated using surgical resection, fractionated radiotherapy, and chemotherapy ^[3]. The term cancer describes a group of diseases that are characterized by the uncontrolled cellular growth, cellular invasion into adjacent tissues, and the potential to metastasize if not

Keywords: Mediterranean diet, breast cancer. prostate cancer. endometrium.

treated at a sufficiently early stage. These cellular aberrations arise from accumulated genetic modifications, either via changes in the underlying genetic sequence or from the epigenetic alterations (e.g., modifications to gene activation- or DNA-related proteins that do not affect the genetic sequence itself) [4,5]. It is estimated that by the year of 2030 the incidence of cancer will be 18 % [6].

The causes of tumors that are formed in cancer are regarded to be an age-dependent phenomenon. Despite this factor, cancer and other chronic diseases increasingly manifest themselves at a very younger age [7]. This emphasizes the fact that the growing incidence of these malignant diseases is not exclusively attributable to an increase in life expectancy, but it can be rather due to a number of basic environmental and lifestyle risk factors. Approximately 5 to 10 % of all tumor diseases that are mainly caused by genetic predisposition, while the pathogenesis of the remaining tumors 90 to 95 % which may be caused due to the unfavorable environmental conditions or an unhealthy lifestyle [8]. The latter can mainly be characterized by an unbalanced diet, lack of exercise, and consumption of alcohol and tobacco [9]. The World Cancer Research Fund (WCRF) assumes that 3 to 4 million cases of cancer worldwide might be avoided by adopting a healthier lifestyle [10]. It has been estimated that approximately 30 % of cancers that can be prevented by following a healthy diet [11], however, foods that may contain both ingredients that are protective to our health as well as in others way that may cause harm to our health. Some specific bioactive compounds from foods with tumor-preventive potential have been characterized in the past, e.g. polyphenols, n-3 fatty acids, or monounsaturated fatty acids [12].

The Growing evidence indicates that the Mediterranean diet has a beneficial influence on health. In some studies [13-15], it have been reported a reduction of risk for coronary heart diseases [16,17] and an improvement in the survival [18-22] and it has been suggested that such a diet could have some favorable effect on cancer risk as well [23-26].

THE MEDITERRANEAN DIET:

The mediterranean diet (MD), typical of southern European countries, and it has different variants, characterized by some common features, which including abundant plant foods, fresh and varied fruit as the main and usual dessert, high consumption of cereals, olive oil as the main source of fat, moderate consumption of wine

mainly during meals, and relatively low intake of meat and dairy products [27,28]. The MD was introduced to the scientific community as a health protecting diet by the classic studies which were done by Ancel Keys and Colleagues [29].

A simple score to assess the adherence to the MD was introduced in 1995 [30], and this score, has been used to evaluate the relation of the MD to the overall mortality, as well as to identify the specific health outcomes, which included Alzheimer's disease, diabetes mellitus, and cancer overall [31-33].

The number of cancer survivors in the United States and Europe is growing rapidly [34,35]. A few prospective cohort studies have investigated the association between composition of MD and cancer survival [36]. There is evidence that the people who adhere to the MD have lower incidence of cancer [37,38].

MD which includes plant foods such as fruits, vegetables, cereals, legumes, nuts, seeds, and olive oil. The diet also contains dairy products with recommended low consumption of milk and high consumption of cheese and yoghurt, moderate consumption of fish, eggs, low amounts of red meat consumption, and low to moderate consumption of wine, mainly with meals.³⁹MD, which is the most recognized of a balanced ecosystem which was supported by the benevolent climate of the Mediterranean region [40,41].

The mediterranean basin has their own dietary traditions, but in all of them olive oil occupies a main central position in their diet. Olive oil is important, not only because it has in itself beneficial properties [42,43], but also because it facilitates the consumption of large quantities of vegetables and legumes in the form of raw salads and cooked foods [44].

The fundamentals of the MD have been formulated on the basis of eating habits of people living in the **Mediterranean countries.**

The following common features have been found in their diet that are high consumption of fruits, vegetables, potatoes, legumes, nuts, whole grains; high consumption of olive oil as the main source of fat; high consumption of spices such as oregano, garlic, basil, thyme, rosemary, sage; Moderate consumption of fish and seafood; Moderate consumption of milk and dairy products (mainly cheese and yoghurt); Moderate consumption of wine, mainly for meals and Low consumption of meat and meat products; Consumption of local, seasonal fresh produce [45].

EATING PATTERNS OF MD:

The MD eating patterns have been established through the blending of many foods, religious, economic and the cultural practices by civilizations that have occupied the Mediterranean basin for millennia [46]. The MD eating pattern also recommends the inclusion of water, tea, and herbal infusions as non-alcoholic beverages in the diet [47-49]. The Mediterranean dieting pattern can be described as the one that it is abundant in plant-based foods such as the whole grains, legumes, nuts, seeds, fruits, and vegetables; it comprises the use of olive oil as the main source of their dietary fat; it limits the intakes of red and processed meat, saturated fat, and refined sugars; the MD favors low- to-moderate intake of low-fat dairy and moderate consumption of fish sources and it emphasizes regular, but moderate, alcohol (mostly red wine) consumption with meals [50].

Mechanisms of Olive Oil and its Components against Cancer Risk:

Olive oil is a liquid fat which was obtained from a tree crop of the Mediterranean regions. The two main major components of the olive oil are 18:1 oleic acid (~70 %) and phenolic compounds i.e., tyrosol, hydroxytyrosol, catechin, epicatechin, epigallocatechingallate (EGCG), oleuropein, quercetin, and rutin [51,52]. The mechanism of Olive oil-associated with the contribution to good health primarily the anti-inflammatory and antioxidant properties [53,54]. The phenolic compounds that present in olive oil may interact with the inflammatory cascade via their antioxidant action. So this interaction can be primarily related to their ability to scavenge free radicals, thus it will prevent the cellular injury [55]. Thus these chemoprotective properties may translate into a number of protective mechanisms which was beneficial to health, which may include protection against viral infections and cancer development, as well as cardiovascular protection [56].

Mediterranean diet and Cancer Risk:

A case-control study which was done in the San Francisco bay area had taken 1,703 breast cancer patients and 2,045 controls showed that cooking with olive oil, which is rich in oleic acid, reduced the risk of breast cancer while compared with hydrogenated fats (OR 1.58; 95% CI 1.20 to 2.10) or with vegetable/corn oil, which is rich in linoleic acid (OR 1.30; 95% CI 1.06 to 1.58) [57]. Another study which was done by Norat *et al.*, reported that the incidence of colorectal cancer in relation to fish

intake [58]. This study prospectively followed 478,040 cancer-free men and women from 10 European countries between 1992 and 1998 with a mean follow-up of 4.8 years. During this questionnaire-based study a number of 1,329 participants were diagnosed with the colorectal cancer. This study showed that the disease and the consumption of red and processed meat are positively related ($p = 0.001$), whereas the association with fish intake appeared to be inverse ($p = 0.003$). Another large 7-year case-control study which was done by Theodoratou *et al.*, on oleic acid and other fat consumption included 1,455 cases and 1,455 matched controls [59]. The results showed no clear association between oleic acid intake and colorectal cancer risk as opposed to the inverse relationship found for omega-3 fatty acid intake. A recent meta-analysis which was done by Sofi *et al.*, had demonstrated that the Mediterranean diet is associated with a significant improvement in the health status which was marked by a remarkable reduction in mortality due to CVD (9 %), incidence of mortality from cancer (6 %), overall mortality (9 %), and incidence of Parkinson's and Alzheimer's diseases (13 %). The components which relating to the dairy products such as, cereals, surprisingly, fish and seafood were largely inconsequential and had contributed little for predicting the mortality rate. A study which was conducted by, Simopoulos had previously emphasized that the Cretan diet with its 'high intake of fruits and fruit juice, vegetables, herbs and spices, nuts (notably walnuts), garlic, onions, cereals (whole-wheat and sourdough rather than pasta), olive oil and olives, less milk, more goat cheese, less meat, more fish, yogurt, water and moderate amounts of red wine with meals' differs considerably from the diet that has been positively associated with cancer in Europe [61,62].

Cancer is considered as the second largest cause of death in the world after cardiovascular diseases [63]. Cancer cell shows a clear and altered metabolism, with the distinct usage of the energy and biosynthetic pathways [64-66]. The diet and the use of natural antioxidants can play an important role on the metabolic pathways which effect the progression of cancer [67,68]. In keeping, several dietary supplements like MD can support in the treatment of cancer [70-73]. While comparing with the in the regions of North Europe or US, the Population living in the area of Mediterranean Sea had showed decrease incidence of cancer, so this has been attributed to healthier dietary habits [81,82]. A meta-analysis study

which was conducted by Sofi and Colleagues reported that MD is responsible of 6 % reduction of cancer death/incidence are also linked to colon cancer prevention [74,75].

The MD is able to reduce the gastric cancer's incidence and mortality in the South areas of selected Mediterranean country, such as France, Greece and Italy when compared with other countries like North areas of the same countries. The Higher adherence to mediterranean lowers up of 20 % the incidence of all the gastric cancers [76,77]. A study which was conducted by Jacobs *et al.*, have suggested that consumption of the whole grain (bran, germ, endosperm) 4 times / week reduces the risk of cancer by 40 % compared to the controls, while the continuous update of Project has determined that the intake of non-starchy vegetables and fruits lowers the risk of mouth, pharynx, larynx, esophagus and stomach cancers [78,80]. The MD has a preventive action on cancer, because of the anti-proliferative and anti-apoptotic effects on cancer cell [81].

CONCLUSION:

It is concluded that the MD is associated with reduction in overall incidence of cancer and its effects may be accentuated in the Mediterranean countries themselves. These observed beneficial effects are mainly by higher intakes of fruits, vegetables, and whole grains. Recognition of its benefits may well lead to the Mediterranean diet becoming an indispensable part of a healthy lifestyle.

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