REVIEW ARTICLE

IMPORTANCE OF DIET IN REDUCING CANCER INCIDENCE IN POLAND: A REVIEW

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ABSTRACT

Cancer is one of the leading causes of death in most countries in the world. In Poland, after cardiovascular disease, cancer is the leading cause of death, and the number of malignant tumors has more than doubled in the last three decades. Increased cancer mortality in the immediate future is expected to be mainly associated with lung cancer caused by smoking (both sexes), colorectal cancer (both sexes), breast cancer in women, and prostate cancer in men. It is estimated that 20 to 30% of all malignant tumors are diet-dependent, in which cases the cancer-inducing factors are the nutritional components of the food and the 'hygiene' of eating. Research by the Institute of Food and Nutrition in Warsaw indicates that an important factor in the prevention of cancer is also the individual's state of awareness concerning diet. It is emphasized that running nutritional education programs, especially for children and adolescents, may help to limit the occurrence of diet-dependent cancers in Poland over the next few decades. The aim of this review is to assist the promulgation of knowledge about the importance of a high-quality diet in the prevention of cancer. The need for such knowledge is indicated by the upward trend in the incidence of these types of disease in Poland.

Key words: *nutrition, diet, cancer, prevention*

STRESZCZENIE

Choroby nowotworowe stanowią jedną z głównych przyczyn zgonów w różnych krajach świata. W Polsce nowotwory obok chorób układu krążenia są jedną z przyczyn największej ilości zgonów, a liczba zachorowań na złośliwe rodzaje tych schorzeń wzrosła ponad dwukrotnie w ciągu ostatnich trzech dekad. Umieralność z powodu prognozowania dotyczące dalszego wzrostu ilości tych zachorowań, związane są głównie z paleniem tytoniu i dotyczą nowotworów jelita grubego u obu płci oraz nowotworów płuca oraz piersi u kobiet, jak również prostaty w populacji mężczyzn. Uznaje się, że około 20 – 30% wszystkich nowotworów złośliwych stanowią nowotwory dietozależne, w których czynnikiem indukującym raka są składniki żywieniowe oraz higiena odżywiania. Badania Instytutu Żywności i Żywienia w Warszawie wskazują, że ważnym czynnikiem profilaktyki zachorowalność na nowotwory złośliwe jest również stan świadomości związanej ze stosowaną dietą. Podkreśla się również, że prowadzenie edukacji żywieniowej już u dzieci i młodzieży może ograniczać występowanie nowotworów dietozależnych w Polsce. Celem niniejszego artykułu jest popularyzacja wiedzy na temat jakości diety stosowanej w profilaktyce chorób nowotworowych, z uwagi na niekorzystną tendencję wzrostową zachorowalności na te rodzaje schorzeń w Polsce.

Słowa kluczowe: *pożywienie, dieta, choroby nowotworowe, zapobieganie*

INTRODUCTION

Cancer is one of the leading causes of death in developed and developing countries around the world. The term cancer is understood to mean an abnormal, excessive growth of tissue originating from normal cells of the body that have undergone cancerous transformation. Over time, cancer cells in the case of malignant tumors are transferred by the lymphatic or blood circulatory systems to other organs of the body, creating secondary foci (metastases). The primary causes of cancerous transformation are mutations in proto-oncogenes, anti-oncogenes and mutator genes regulating the cell cycle, and DNA repair systems. Both genetic factors (affecting about 10% of the population) and environmental factors (affecting about 80% of the population) are involved in the development of tumors. The environmental factors include ionizing

radiation, excessive exposure to the sun, factory fumes, some metals (asbestos, lead, nickel, chromium), dioxins (from grilled food, cigarette smoke, garbage incineration smoke, car fumes), smoking tobacco, medicines, viruses and bacteria, alcohol and certain types of diet (*DeVita* et al. 2011).

According to reports from the GLOBOCAN project, in 2012 there were about 14.1 million new cases of cancer and 8.2 million deaths related to cancer in the whole world. It is presumed that in the near future cancerous diseases will be the main cause of deaths for both men and women before the age of 65 (*Torre* et al. 2015). In Poland, cancer is the second highest cause of death, and the number of malignant tumors has more than doubled in the last three decades. Mortality from malignant tumors in Poland is higher than the average for other European Union countries. The most common cases of malignant tumors in men are found in the lungs (about 20% of cases), the prostate (13%), the colon and rectum (12%), the bladder (7%), and then the stomach, kidneys, larynx, and circulatory systems (leukemia and lymphoma). Among women the incidence is breast cancer (over 20% of cases), large intestine (10%), lungs (9%), uterine body (7%), ovary (5%), and then cervix, kidneys, stomach and thyroid. The number of deaths from malignant tumors in Poland in the last five decades has increased by almost 2.4 times (*Didkowska* et al., 2017, Europejski Raport Zdrowia, 2013).

Research conducted at the Institute of Food and Nutrition in Poland indicates that the state of health of Poles, including the incidence of malignant tumors, could have been affected by changes in the quality of nutrition. After the political transformation of 1989, dietary habits in the country changed for better and for worse. Among the favorable trends occurring in the period since then were, firstly, an increased consumption of vegetables and fruits, resulting in a higher content of vitamin C in the diet, and, secondly, a reduced consumption of red meat, resulting in an associated reduction in the consumption of animal fats. In addition, there was a reduction in salt intake and an increase in the content of vitamin D. These dietary changes were accompanied by a reduction in the number of cigarettes smoked. However, despite there having been some favorable changes in nutrition, certain negative trends have also become apparent, such as an increase in alcohol consumption, a decrease in dairy product consumption, resulting in a reduced supply of calcium in the diet, a decrease in the consumption of cereal products, resulting in a reduction in foliate and fiber consumption, and an increase in the fat content of the diet (*Jarosz*, 2017). The special relationship between diet and cancer is shown by the incidence of colon and rectal tumors. In the last few decades, there has been an increase in both morbidity and deaths among Poles from these cancers to the extent of a four-fold increase in the incidence of the cancers among men and a three-fold increase among women. The research of *Didkowska* et al. (2009), regarding the prognosis of morbidity and mortality of Poles due to cancer, indicates that a significant increase is likely to occur in the coming years, especially due to cancer associated with smoking. These studies suggest a future increase in the incidence of lung and colorectal cancer in both sexes, breast cancer in the female, and prostate cancer in the male population.

The aim of this article is to assist the promulgation of knowledge about the role of diet in the prevention of cancer. This is considered essential because of the unfavorable upward trend in the incidence of cancer in Poland.

DISCUSSION

DIETARY MISTAKES STIMULATING THE DEVELOPMENT OF CANCER IN POLAND

Some of the main reasons for the increased incidence of cancer are dietary errors. These include excessive consumption of industrially processed food products. Such products contain significant amounts of preservatives that, in stimulating the production of free radicals, damage the genetic material of cells and thus lead to cancer transformation (*Valko* et al. 2006). Mutations in the genome are very often also caused by toxic factors in the products themselves; such products would include those with an excessive content of nitrogen compounds (N-nitro compounds, nitrates and nitrites) from chemical fertilizers. This particularly dangerous phenomenon concerns the reduction of intestinal nitrates to nitrites and oxides under the influence of intestinal bacteria, which may result in carcinogenic nitrosamines (*Hamra* et al, 2015). Improper processing of food products, as in processes of smoking, grilling or frying of relatively long duration, can be a source of carcinogenic heterocyclic amines and polycyclic aromatic hydrocarbons that easily penetrate into food (*Moorthy* et al., 2015). One of the great dietary errors is the consumption of stale foods. Such foods may contain shreds of mushrooms from the Aspergillus family that are the source of carcinogenic aflatoxins. Consumption of some products in excess may cause the development of many diseases, including cancers. One example of such products is alcohol, which in excess can destroy mucous membranes of the respiratory and digestive tracts, thus enabling the toxic effects of carcinogens to manifest themselves in the associated tissues (*Varela-Rey* et al, 2013). Excessive fat intake affects the proliferation of cells that have undergone cellular transformation, which speeds up the development of cancer (*Park* et al, 2018). The increased amount of

animal protein consumed, e.g. in red meat, which is subjected to thermal treatment, also contributes to the formation of carcinogenic changes and excessive amounts of free radicals (*Yen* et al, 2018). Consumption of excess table salt affects the mucous membrane of the stomach and intestines, which increases its permeability also for harmful substances (*D'Elia* et al, 2014). The study also suggests that total amount of fiber in the diet is a strong protecting factor against colorectal cancer. Moreover, soluble and insoluble fiber consumption is in inverse relationship to the incidence of colorectal and colon cancer (*Song* et al, 2015).

NUTRIENTS REDUCING
THE INCIDENCE OF CANCER

Natural factors that strengthen the body's immunity are physical activity, optimal sleep, and a proper diet. Such a diet should contain the right amount of high-value proteins, polyunsaturated fatty acids, vitamins with antioxidant activity, flavonoids, minerals and probiotics (*Kaledkiewicz* and *Lange*, 2013). Among the food ingredients that reduce the risk of cancer are those compounds with a strong antioxidant effect. However, it should be noted that too high a concentration of antioxidants in the diet may result in their role's being reversed, with the result that the protective substances become oxidants, thus contributing to serious disease symptoms (*Bast* and *Haenen*, 2002). Antioxidants behaving in this way include vitamins with properties that inactivate free radicals, e.g. vitamins C, E, D, B_{12} and folic acid. The strongest antioxidant activity among these vitamins is obtained from ascorbic acid (vitamin C), which increases cellular immunity and thus reduces the incidence of cancer. It can also effectively inhibit the formation of carcinogens such as nitrosamines contained in nitrite-conserved foods. It inhibits nucleic acid oxidation, thus preventing DNA damage and providing genome stability (*Kaput* and *Rodriguez*, 2004). Vitamin E, as a component of phospholipids that build cell membranes and blood plasma lipoproteins, protects against the peroxidation of polyunsaturated fatty acids and interacts with vitamin C in inhibiting the formation of nitrosamines. It is a powerful antioxidant and, like vitamin C, inhibits the oxidation of nucleobases, thereby preventing DNA damage leading to, for example, the formation of colon cancer (*Kaput* and *Rodriguez*, 2004). An important role in inhibiting cancer cell proliferation, by regulating growth and differentiation, is played by vitamin D (*Jacobs* et al, 2005). Research by *Peters* et al. (2001) confirmed a reduction in the risk of colorectal cancer by 26% when there was an increase in vitamin D concentration in serum of 10 ng/ml. Vitamin D is also a stimulator of calcium binding protein biosynthesis,

thanks to which a larger amount of this element is absorbed in the intestine. Vitamin B_{12} is involved in cell metabolic processes and protects against DNA strand damage (*Xiao* et al, 2014).

An important group of factors that reduce the incidence of cancer is the carotenoids, which include β-carotene, lycopene, lutein, canthaxanthin and zeaxanthin. It is a group of organic chemical compounds (unsaturated hydrocarbons) that occur in chloroplasts and chromatophores of plant cells, e.g. vegetables and fruits, giving them the colors yellow, red, and orange. Carotenoids are powerful antioxidants. They stimulate the immune system of the body, inhibit cell proliferation, capture free radicals, inhibit mutagenesis in bacterial cells, inhibit chemically induced neoplastic processes, protect cells from UV radiation, and protect cells against neoplastic transformation. In addition, they dissolve in fats, protecting unsaturated fatty acids against oxidation. The strongest antioxidant ability is demonstrated by lycopene. Its activity consists in preventing the oxidation of LDL lipoproteins. Lycopene also has antimutagenic and anti-cancer activity, especially with regard to lung cancer (*Nguyen* and *Schwatz*, 1999, *Pouchieu* et al, 2014). Another important group of plant compounds showing antioxidant activity is the polyphenols, which include flavonoids, isoflavones, catechin phytoestrogens, stilbene and lignin. Anti-cancer activity of these compounds in food products consists in removing heavy metals, enhancing the action of other antioxidants (vitamins A and E), inhibiting and strengthening the activity of some enzymes responsible for immunological functions, and inhibiting carcinogenesis and cell proliferation. Examples of polyphenols that effectively counteract cancer are anthocyanins that stimulate phase II antioxidants and the expression of detoxification genes such as reductase, peroxidase and glutathione S-transferase (*Singletary* et al, 2007). In addition, anthocyanins, like other polyphenols, influence regulatory proteins, thus controlling various stages of the cell cycle, which effectively inhibits the proliferation of cancer cells (*Zhang* et al, 2005). According to *Feng* et al. (2007), the extract obtained from black cranberries and grapes containing anthocyanins and anthocyanidins activates the process of programmed cell death (apoptosis). The phenolic acids constituting a group of plant chemopreventive compounds are also significant. These include coffee, chlorogenic, ferulic, elagic and gallic acids. The phenolic acids have the ability to block the carcinogens formed as a result of metabolic transformations of some carcinogenic substances such as 4 - nitroquinoline - 1 oxides. The health-promoting properties of phenolic acids are also associated with their antioxidant properties (*Andreasen* et al, 2001). Another group of glycoside

compounds of vegetable origin in consumed foods that act as cytotoxic to cancer cells is the saponins. These compounds stimulate the body's immunity and inhibit the proliferation of cancer cells (*Sisto* et al, 2012). In plant foods, phytosterols have an important role to play in reducing the incidence of some cancers. These compounds inhibit cell proliferation, inhibit metastasis, induce apoptosis and remove free radicals (*Jarosz* and *Sajor* 2010, *Pieszka* and *Pietras* 2010). Regularly taken as part of a diet they are effective in lowering cholesterol levels, and thus reducing the risk of atherosclerosis and heart attack, by acting against teratogen and being anti-inflammatory.

Among the phytochemicals that protect against cancer are sulforaphane, isothiocyanates, and glucosinolates, which also help to prevent heart disease. They affect all stages of the neoplastic process, the strongest effect being observed at the initiation stage. This was confirmed by *Chung* et al. (2000), who showed that dietary supplementation with sulforaphane and phenethyl isothiocyanate (PEITC) results in reduction of neoplastic changes during the initiation phase and promotion of carcinogenesis. The protective properties of sulforaphane have been observed in all stages of carcinogenesis. This compound has been shown to block the binding site of carcinogens to the DNA molecule and prevent the expansion of neoplastic cells by interfering with their cellular processes involving proliferation, differentiation and apoptosis (*Hakama*, 1998).

Two essential elements in the diet that reduce the incidence of cancer are calcium and selenium. An appropriate calcium content in the body effectively inhibits the proliferation of cancer cells (*Platz* and *Giovannucci*, 1999). According to *Fenech* et al. (2005), high levels of calcium protect the genome from damage, due to calcium's ability to inhibit chromosomal cracking [2]. Selenium is a component of many enzymes with antioxidant activity. The anticancer activity of this element consists in blocking the synthesis of DNA in neoplastic cells. In addition, it inhibits the oxidation of lipids and removes free radicals. According to *Fenech* et al. (2005), a deficiency of it may cause hypomethylation of DNA, which may lead to inappropriate gene expression and to genetic instability.

An important nutrient that indirectly protects against cancer is fiber, which contains such substances as hemicelluloses, pectin, cellulose and lignin. The protective mechanism of fiber activity manifests itself in a number of ways. First of all, fiber increases bulk stool and dilutes fecal carcinogens, as well as shortening fecal transit time in the colon. In these ways the amount of contact carcinogens have with the colon epithelium is reduced (*Bingham*, 1990, *Schatzkin* 2000). Moreover, fiber binds to the bile

acid by which it optimizes the pH inside the colon. Excess, non-binding bile acid, can be a carcinogenic factor (*Wakai* et al. 2007, *Bermudez-Soto* et al. 2007). It is well known that the fiber is fermented inside the gut to the short-chain fatty acids. Some of them inhibit carcinogenesis (*Goncalves* and *Marteal*, 2013). It was also observed that a bigger dose of fiber can reduce hyperinsulinemia (*Hawk* et al., 2002). In other studies *Trepel* (2004), *Willett* (2000) and *Augenlicht* (1999) demonstrated the contribution of fiber to maintaining the balance between proliferation, differentiation and apoptosis of colon epithelial cells. The presence in the gastrointestinal tract of bacteria of the genus *Lactobacillus, Escherichia* and *Bifidibacterium* inhibits the growth and development of carcinogenic pathogens. The sources of beneficial bacterial strains are probiotics. Lactic bacteria have the ability to bind and degrade potential carcinogens, as well as to induce the activity of enzymes involved in their metabolizing (*Fotiadis* et al., 2008).

The presence of polyunsaturated fatty acids in the diet reduces the risk of cancer. These acids are part of phospholipid cell membranes, and their anti-cancer character results from their participation in the growth and differentiation of cells and their influence on the course of inflammatory processes and the body's immune response.

THE IMPACT OF DIET ON REDUCING THE RISK OF CANCER INCIDENCE IN POLAND

One of the most important components of lifestyle is diet, which is an important factor in the formation of malignant tumors. It is estimated that 20 to 30% of all malignant tumors are diet-dependent cancers, in which nutritional factors have played an important role. Among these are cancer of the breast, the large intestine, the esophagus, the stomach, and the pancreas (*Pudlo* et al., 2015). An ideal nutritional model that may be used in the prevention of cancer has been sought. According to *Tantamango-Bartley* et al. (2013), the sort of vegetarian diet that reduces the risk of colon, breast and prostate cancer deserves special attention. This diet contains a variety of nutrients with anti-carcinogenic properties, eliminates the eating of red meat, and is conducive to the maintenance of a proper body weight. The advantages and limitations of using a vegetarian diet in health prophylaxis are also described extensively in the Polish literature (*Mitek* et al. 2013, *Pilis* et al. 2014). Among the diets recommended in the prevention of cancer is the so-called Mediterranean diet, containing a large amount of polyunsaturated fatty acids, oleic acid and polyphenols (*Turati* et al. 2018, *Robles-Almazan* et al. 2018).

The risk of malignant tumors associated with the digestive system, e.g. oral cancer, and cancers of the larynx, esophagus, stomach, pancreas, colon, etc., can be reduced by certain nutrients. Among them are such compounds as vitamin C, lycopene, β-carotene, caffeic acid, acid chlorogenic, carotenoids, flavonoids, terpenes, limonoids, coumarin, antioxidants - glutathione, phytosterols, folates, which are present in plant products. In the case of colorectal cancer, important are both calcium as a compound and lactic acid bacteria, both of which are found in dairy products (*Ciborowska* and *Rudnicka* 2012, *Jarosz* and *Sajor* 2013).

The World Cancer Research Fund and the American Institute for Cancer Research (Report, 2007) presented recommendations in the report designed to prevent the development of cancer. These recommendations are concerned with lifestyle, including care for physical condition, avoiding stimulants, and using the right diet. Of the ten most important recommendations more than half are concerned with proper nutrition. These recommendations include avoiding the consumption of sweetened beverages and high-energy food, especially highly processed food with a high content of fat and sugar. An important aspect of a healthy lifestyle is the consumption of the right amount of food tailored to the needs of each body in five portions each day, with appropriate proportions of vegetarian foods such as fruits, vegetables, whole grain cereals and seeds of legumes. It is important that normal body weight should be maintained, avoiding being overweight as well as being obese. It is particularly important to limit the consumption of red meat in the diet, especially when it has been subjected to smoking or salting, or when it contains preservatives. Recommendations to prevent the development of cancer also include reducing the consumption of alcohol and table salt, and the avoidance of spoiled food and dietary supplements.

NUTRITIONAL PATTERN IN THE MOST COMMON CANCER DISEASES IN POLAND

The highest incidence of malignant tumors in Poland is found in the categories of lung, colorectal, breast and prostate cancer.

Lung cancer is the cause of the highest number of deaths among oncological patients in highly developed countries. According to the latest data published by the International Agency for Research on Cancer (IARC), in 2012 there were 1.8 million cases of lung cancer in the world, which constitutes 13% of all cancers (Report 2015). In Poland, lung cancer is the most common malignancy both in terms of the number of cases and in terms of the number of deaths. In men, it accounts for about 21% of cases and in women 9%. Lung cancer

is generated by such factors as occupational exposure to asbestos, certain metals (lead, cadmium, arsenic, nickel), silica, and ionizing radiation. However, the most common cause of this disease is active smoking. In EU countries every fifth case of lung cancer is a so-called tobacco-dependent cancer. Gender also affects the risk of lung cancer, with the incidence of cases among men being three times higher than among women. The vast majority of cases of malignant lung cancer occur after the age of 50 (*Szlitkus*, 2018). The lung is one of the organs in which a tumor can develop for a very long time without there being any obvious symptoms. It is because of the lack of early symptoms that detection tends to be delayed. Furthermore, although lung cancer is one of the most common cancers, no screening for it is undertaken. Up to this point, only retrospective analysis of the causes and consequences of the disease by means of epidemiological studies has been possible.

Meta-analysis conducted by *Koutsokera* et al. (2013) confirmed the positive effect of eating fruit and vegetables in the fight against lung cancer. A beneficial effect was also noted with regard to the presence of black tea, fish, and cheese in the diet. Among food products that contribute to the development of lung cancer, the authors cite red meat. Similar conclusions were presented by *Hosseini* et al. (2014), who conducted a study on a group of 242 patients with lung cancer and a 484-person control group. The results indicated that vegetables, fruits, and sunflower oil may be protective factors against the occurrence of lung cancer, while food products that increase the risk of this cancer are non-wholegrain bread, white rice, beef, liver, and dairy products. Similar results were found in Poland by *Hawrysz* et al. (2015). They showed that people with lung cancer, compared to those without that disease, consumed significantly less often (p=0.008) products such as vegetables, wholegrain bread, milk, sour milk drinks (yoghurt, kefir, etc.) and fish dishes. People with cancer more often (p=0.02) consumed canned foods, such as meat, fish, vegetables and fruit, as well as powdered soups and pre-cooked soups.

Colorectal cancer is the third most common cancer in the world in men (660,000 cases, 10%) and the second in women (570,000 cases, 9%). Almost 60% of cases occur in economically developed countries. In Poland, the incidence of colorectal cancer in 2013 was approximately 17,000, and since 1980 there has been more than a four-fold increase in the number of these cases. Most cases occur after the age of 50 (94%), while in men they are about one and a half to two times more frequent than in women (*Zyski* et al., 2014). In most cases, colon or rectal cancer is formed on the basis of benign adenomas (polyps). As a result of genetic mutations occurring in individual cells, the adenoma is transformed into cancer. In the case of colorectal cancer, a relationship between morbidity and diet is

indicated. According to many researchers, the risk of developing cancer of the large intestine increases with the excessive consumption of red meat, carbohydrates and animal fats combined with too low a supply of dietary fiber. The above thesis is confirmed by the meta-study of *Gonzalez and Riboli* (2010), which was based on a total of 519,978 participants. These authors showed the positive effect of dietary fiber on reducing the risk of developing colorectal cancer, and also the anticancer effects of consuming fish, calcium, vegetables and fruit. Among the nutrients mentioned as effectively reducing the risk of developing colorectal cancer were probiotics and prebiotics, folic acid, methionine, vitamin D, selenium, vitamin E, anthocyanins, procyanidins, phytoestrogens, isothiocyanates, curcumin and resveratrol (*Trepel* 2004, *Kunnumakkara* et al. 2009, *Barone* et al. 2008, *Talalay* et al. 2003).

Prostate cancer is one of the most commonly diagnosed malignant tumors among men. The incidence of prostate cancer is increasing and becoming an increasingly serious medical problem in the world. The main risk factors for developing prostate cancer are old age, genetic determinants, a diet high in saturated fats, and heavy metal poisoning. The disease usually develops asymptomatically, and the emerging symptoms indicate its advanced stage (*Twardak* et al. 2015). In Poland, prostate cancer is ranked second in terms of cancer incidence in men. The number of new cases is constantly increasing. In a recent year, about 10,900 new cases were diagnosed (*Torre* et al., 2012). The increased risk of prostate cancer is positively correlated with a high intake of proteins contained in dairy products (35 g/day) and calcium from dairy products (*Gonzalez* and *Riboli* 2010, *Allen* et al. 2008). A food product that reduces the risk of prostate cancer is fish. It is recommended to consume it more often than three times a week (*Khan* et al., 2010). Likely food products containing lycopene, belonging to the carotenoids, show a protective effect against prostate cancer. Food sources of lycopene are tomatoes, papaya, watermelons, pink grapefruits, peaches, wild rose and their preparations (pastes, purees, concentrates, juices) (*Wawrzyniak* et al, 2005).

Breast cancer is the most common malignant cancer in women in Poland. It is also the second highest, after lung cancer, as the cause of deaths attributed to malignant tumors among women. As reported by the National Cancer Registry, the number of cases exceeds 16,500 cases per year (*Jassem* and *Krzakowski*, 2014). The immediate cause of breast cancer is not known; however, a group of independent risk factors has been identified. These include age (80% of breast cancers occur after 50 years of age), geographical location (high-risk groups inhabit highly developed countries), increased exposure to endogenous and exogenous estrogens (early menses before 11 years of age, menopause after age 54, childlessness), first birth after the age of 40), and genetic factors (*Dumitrescu* and *Cotarla* 2005, *Hulka* and *Moorman* 2001). Research shows that the consumption of excessive amounts of red meat (pork, beef and mutton) as well as of processed meat is associated with an increased risk of breast cancer, especially in postmenopausal women (*Taylor* et al. 2007, *Eunyoung* et al. 2006, *Ferrucci* et al. 2009). According to *Gonzalez* and *Riboli* (2010), there is a positive correlation between the incidence of breast cancer and a high content of saturated fat in the diet. Reducing the fat content by following a low-energetic diet serves to reduce the level of estrogens in the blood serum, the too high concentration of which may contribute to the development of breast cancer (*Yager* and *Davidson*, 2006). In addition, *Gonzalez* and *Riboli* (2010) are of the opinion that there are no reports that fruits and vegetables would reduce the risk of breast cancer. The observation carried out by *Kruk* (2006) contradicts this thesis. According to the author, the frequent eating of fruits and vegetables can reduce the risk of breast cancer. Of particular importance in cancer chemoprevention are cruciferous vegetables (white cabbage, red cabbage, Chinese broccoli, Italian cauliflower, broccoli, Brussels sprouts, radishes, rapeseed) (*Beliveau* and *Gingras*, 2011).

CONCLUSIONS

Nowadays, neoplastic diseases are the most common diseases of civilization, affecting both women and men regardless of their age. The incidence of cancer in the world and in Poland is constantly growing. In Poland, neoplastic diseases currently account for approximately 20% of all deaths, including about 40% of deaths in women aged 45 to 65 and 30% of deaths in men in the same age range. The growth rate of the number of malignant tumors in Poland is much higher than the growth rate of the population and is among the highest in Europe (*Didkowska* et al, 2017). The increase in the number of these diseases and the deaths caused by them in Poland can be attributed to five main causes: population growth, changes in the age structure of the population consisting in an increase in the number of age groups with particularly high incidence, insufficiently fast changes in pro-health attitudes (e.g. with regard to smoking and alcohol consumption), poor quality of nutrition, and slow, and unsatisfactory improvement in the early diagnosis of cancer. Whereas the average cancer cure rate in Poland for both sexes is 30%, and in the Scandinavian and some West European countries it is 40%, in the USA it is 50% (http://www.puo.pl/program-walki-z-rakiem/narodowy-program-zwalczania-chorob-nowotworowych/epidemiologia).

Most of the tumors are the result of the effects of lifestyle and the state of the natural environment. Lifestyle means, among other things, but most importantly in this context, physical activity and a properly balanced diet. It is estimated that approximately 20 to 30% of all malignant tumors are diet-dependent cancers, in the development of which nutritional factors are significant (*Kushi* et al., 2006). Overeating is an extremely dangerous phenomenon that generates the risk of obesity, which is the main factor causing an increase in the incidence of malignant tumors. The number of obese people is increasing in Poland, especially in the 35 to 64 age group. Overweight and obesity are associated with an increased risk of developing many cancers, such as breast cancer in postmenopausal women, colon cancer, endometrial cancer, adenoma and esophageal cancer. Excessive supply of energy components and low physical activity cause an increase in body fat, which significantly affects the metabolism of estrogen in women, which may stimulate the development of breast cancer (*Pudlo* et al. 2015) Too much processed, high-calorie food, saturated with preservatives, first of all burdens the body's systems, particularly the digestive, circulatory and respiratory, and then leads to oncological disorders. It is reasonable to conclude that diet plays a major role in the development of more than a third of all cancer cases. There are several well-documented links between diet and the causes of cancer. One of the diets that reduce the risk of cancer is the Mediterranean diet. It is characterized by increased consumption of vegetables, fruits, oil, and fish and by limited consumption of red meat. The diet contains the majority of anti-inflammatory and antioxidant nutrients (phytochemicals and *omega*-3 acids), which reduce the risk of cancer. The Mediterranean diet is particularly beneficial for reducing the incidence of prostate cancer and colorectal cancer (*Pudlo* et al., 2015).

Forecasts for the coming years, which show an increased incidence of cancer in Poland, demonstrate the need for an increased awareness of the role of diet in the prevention of morbidity. Among the types of cancer most commonly afflicting Poles are lung cancer, associated mainly with smoking, and colorectal cancer. Colon cancer is one of the cancers most highly affected by genetic factors, but its incidence is increased by inappropriate lifestyle choices, in particular a poor diet, especially when it contains very little fiber. Extremely important in the context of cancer prevention is awareness of the type of food consumed, its source, its processing, and its energy value. Research shows that people with a higher level of knowledge about the prevention of cancer are taking lifestyle decisions that are more beneficial to their health.

Lack of awareness regarding dietary cancer prevention is likely to be a major factor in the steady increase that has been predicted in the incidence of these diseases. Running programs of nutritional education especially for children and adolescents may help to reduce the incidence of food-dependent cancers in Poland.

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