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## THE ROLE OF NUTRITION IN THE PREVENTIVE TREATMENT AND ETIOPATHOGENESIS OF BREAST CANCER

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### Abstract

The incidence of cancers is rising worldwide Breast cancer is a cancer whose incidence is steadily increasing in the many countries.

In women, breast cancer is the most common malignancy whilst its morbidity rates are the second most frequent after lung cancer.

A large body of evidence indicates that about one fourth of breast cancer cases are connected with an unhealthy diet, and pro-health lifestyle can result in even 50% of reduction of breast cancer risk. Inappropriate nutrition and dietary habits are a direct cause or a risk factor of many neoplastic diseases – including breast cancer. A change of these habits can significantly contribute to reducing the risk of breast cancer.

The aim of the article is to present the impact of the selected nutritional risk factors as well as prevention methods for breast cancer.

**Key words:** cancer diseases, breast cancer, nutritional factors, cancer prevention

## **INTRODUCTION**

Breast cancer is the most commonly diagnosed malignant cancer in women in Poland. In 2015, it constituted 22.2% of all diagnosed cancer among this population [1].

The World Foundation for Research on Cancer and the WHO Committee of Experts indicate that the incidence of cancer is highly correlated with the lifestyle [2]. One of the elements of lifestyle – that have a key role in the pathogenesis of these diseases – is nutrition [3]. Abnormal eating habits are almost ten times more important factor predisposing to the occurrence of many neoplastic diseases than other etiological factors [4].

In addition, it is estimated that about 30% of all cancers are diet-dependent [5]. Breast cancer is also included in this group.

Nutritional factors predisposing to breast cancer include, above all, too high energy value of food in relation to the body's needs and the resulting obesity, excessive intake of fats, insufficient amount of dietary fiber, low intake of antioxidant vitamins or calcium [6]. These factors also include contamination of food with toxins and heavy metals, improper preparation or storage and excessive alcohol consumption [7].

A well-balanced diet, taking into account not only the general aspect of energy value of the food, but also the share and proportions of nutrients, can reduce the risk of breast cancer by up to 50% [8].

### **Alcohol**

Systematic consumption of alcohol results in an increased risk of breast cancer. This risk is additionally increased in people who do not consume enough folic acid [9]. Consumption of 2 to 5 portions of alcohol per day increases the risk of breast cancer to 1.4 [10]. Therefore, it is worth considering a complete refraining from drinking alcohol [11].

### **Meat**

Excessive consumption of meat, mainly red meat, significantly increases the risk of breast cancer. This implication increases with age, reaching the highest level in postmenopausal women [12].

The degree of processing of this meat is also of additional importance in this case. Studies have shown that daily consumption of red meat, at a minimum level of 60 g, increases the risk of breast cancer by 56%, while consumption of this meat in highly processed form, increases the risk by 8% [13].

Underlying such a carcinogenic character, there are a number of mechanisms. This meat is primarily a carrier of a huge amount of saturated fatty acids, which in turn imply the production of cholesterol by the human body. Cholesterol itself is a precursor of estrogen [13].

Carcinogenic compounds are also produced by heat treatment with a barbecue or grill. During combustion of the fat released in this way, polycyclic aromatic hydrocarbons or heterocyclic aromatic amines with strong mutagenic properties are formed [14]. This meat is also a rich source of iron. Free iron (non-protein-bound) can under certain conditions catalyze the formation of reactive forms of oxygen, including free radicals. These, in turn, lead to damage within biomolecules – including DNA [12].

### **Fatty acids**

In the aetiology of breast cancer, it is not only the amount of fats consumed, expressed in terms of total energy supply in the diet, but above all the content and proportion of fatty acids [15]. The studies indicate a positive correlation between excessive fat intake and an increased risk of breast cancer [16].

However, fats can have both positive and negative effects on human health [17].

Epidemiological studies have shown that polyunsaturated fatty acids (PUFA) of n-6 family, such as linoleic acid (LA) or arachidonic acid (AA), induce cancer, while n-3 family acids, such as  $\alpha$ -linolenic acid (ALA), docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA), help reduce the incidence of cancer, including breast gland diseases [18].

Consumption of polyunsaturated fatty acids from the n-3 family also leads to a significant slowdown in the cascade of arachidonic acid metabolism, which in turn has strong pro-inflammatory properties, thus predisposing the process of carcinogenesis in the human body [17, 19 – 22].

However, the oversupply of food products rich in n-6 acids reduces the beneficial biological effect of EPA and DHA, which are caused by marine fish fats, such as mackerel, tuna, salmon or herring in human diet. The so-called eicosanoids formed from arachidonic acid n-6 tissue hormones, produced in excessive amounts, may stimulate various inflammatory and allergic changes in the body, induce thrombotic and atherosclerotic processes and, above all, increase proliferation of cancer cells [23].

The protective role of these acids in the metabolism of estrogen and estrogen receptors is particularly important in prevention of breast cancer. Studies have shown that the protective effect on cancer development is achieved with the consumption of fatty marine fish at least twice a week [21]. A rich source of fatty acids from the family of n-3 linseed. The phytoestrogens contained in it influence the significant reduction of harmful effects caused by the action of hormones, which are responsible for the growth of cancer cells [2].

Therefore, there is convincing evidence that dietary habits should be changed in terms of the amount and type of fat consumed in the prevention of many diseases, including breast cancer. Modification of the diet should first of all take into account the increased intake of fatty marine fish rich in n-3 fatty acids showing protective effects. Consuming two or three portions of fatty marine fish a week and a spoon of linseed added daily, e.g. to natural yoghurt, is the best way to increase individual consumption of fatty acids from the n-3 family [17]. The supply of vegetable oils, which are the source of n-6 fatty acids and fats containing saturated fatty acids, the source of which are mainly red meat and full-fat dairy products, should be limited during the whole day's diet.

### **Vegetables**

Cruciferous vegetables (also known as cabbage vegetables) play a special role in the prevention of breast cancer. This group includes all types of cabbage (white, red, Italian, Beijing), cauliflower, broccoli, Brussels sprouts, radishes, kale and rapeseed.

These vegetables are an excellent source of many vitamins – including vitamins C, PP and folic acid, minerals (calcium, magnesium, iron, potassium, selenium), as well as antioxidants (polyphenols, flavonoids, carotene). The anticancer properties of these vegetables result mainly from their glucosinolate content. In vitro and in vivo studies have shown that the strongest anti-cancerogenic properties are possessed by isothiocyanates (ITC): phenylethyl sulforafan (occurring especially in broccoli) and phenylethyl isothiocyanate (white cabbage) and indoles: indol-3-carbinol (present, among others, in white cabbage and cauliflower) (I3C) and its condensation products 3,3'-diindolylmethane [24].

These compounds are characterized by a wide spectrum of anti-cancerogenic effects. They favor the release of free radicals, block angiogenesis, prevent transformation of germ cells into neoplastic cells, thus facilitating the process of death of the neoplastic cells themselves [22].

These correlations are confirmed, for example, by studies conducted among women aged 45 – 60, living in Sweden. In the study group eating one or two portions of cross vegetables during the day, the risk of breast cancer was as much as 45% lower than in women who rarely include these vegetables in their diet [17].

However, it is worth stressing that with regard to these vegetables, heat treatment is of key importance. Long-term preparation is conducive to the loss of a significant amount of glucosinolates (up to 70%). Genistein slows down the growth of cancer cells, inhibits the enzyme – the so-called tyrosine protein kinase responsible for stimulating cancer cells to grow, has an antioxidant effect, enables differentiation of cancer cells into normal cells.

Therefore, it is advisable to simmer them for a short period of time under cover or steaming. Moreover, these vegetables should be eaten in a moderate amount, as their excess forces to increase the supply of iodine due to the presence of anti-nutritive compounds (goitrogens), hindering its absorption by the thyroid gland [24].

### **Folic acid**

Folic acid is a variety of vitamin B found in many vegetables, pulses, fruits, cereal grains and enriched cereals [3]. Current data indicate that folic acid in the form of vegetables, fruits and enriched cereal products is the best contributor in the reduction of cancer risk [12].

### **CONCLUSION**

Numerous research results clearly indicate that nutrition has a key role in cancer prevention. Therefore, pro-health behaviors should be promoted and information on the etiology of these diseases should be popularized. In the 21st century, knowledge should be a key “tool in the fight” for health.

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