



Intake of selected food groups in relation to risk of breast cancer

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Abstract

Introduction and Objective. Breast cancer is the most frequently diagnosed malignant neoplasm among women in Poland and worldwide. It is believed that increasing nutritional awareness in this population can significantly reduce the risk of this disease. In addition, the role of nutritional factors is increasingly the subject of extensive epidemiological, observational and clinical studies in this field. Therefore, the aim of this article was to present the current state of knowledge on the impact of selected groups of food products on the risk of developing breast cancer.

Review Methods. In the process of systematic review sources of medical information were searched in order to identify secondary evidence. Systematic reviews and meta-analyses dated May 1st, 2008 as the cut-off date, present in PubMed, Scopus, Cochrane Library were included. The following key words were included in the recognition/research strategy: breast cancer, risk factors and food groups.

Brief description of the state of knowledge. The review of the literature shows that a diet is one of the factors influencing the risk of breast cancer incidence. Red and processed meat, sweets and pastries, as well as animal derived fats can be recalled as products having potential carcinogenic action. Fresh fruits and vegetables, legumes, nuts, (whole) grain products and foods rich in omega-3 fatty acids may have a protective effect against cancer.

Conclusions. Nutrition is one of the environmental factors that can lead to breast cancer formation. Data presented in the article can be useful in everyday clinical practice as well as in direct nutritional care of an oncological patient. Moreover, this evidence can be used to update the nutritional recommendations for breast cancer prevention.

Key words

risk factors, breast cancer, disease prevention, healthy nutrition, clinical oncology

INTRODUCTION AND OBJECTIVE

Breast cancer is the most common malignant tumour in women and is the second most frequent cause of death in this group. Overall it constitutes 25% of newly-diagnosed cancer cases in the world, and is responsible for 13% of deaths caused by this disease [1]. Also in Poland the percentage of women with breast cancer is high and constitutes 22% of all diagnosed cancers [2].

There are many factors that may influence the occurrence of malignant breast cancer [3, 4]. These include not only genetic predispositions, early menarche (before 12 years of age) and late menopause (after 55 years of age), but also mutations acquired during the lifetime, and epigenetic modifications of oncogenes and suppressor genes, which are largely influenced by the lifestyle and diet. According to the World Cancer Research Fund (WCRF), diet plays a significant role in the etiology of cancer. Importantly, dietary habits can influence development of up to 35% of cancers [5]. Therefore, various dietary recommendations are formulated which, on the one hand, focus on the elimination of harmful dietary factors, and on the other hand, emphasise dietary elements

that reduce cancer risk. Unfortunately, the recommendations regarding the prevention of breast cancer are not entirely consistent. Therefore, it seems reasonable to summarise the existing knowledge on this subject [1, 3].

The aim of this review article is to analyse the available literature on the effects of specific product groups on breast cancer risk.

REVIEW METHODS

In the process of the systematic review, sources of medical information were searched in order to identify secondary evidence. Systematic reviews and meta-analyses in PubMed (National Library of Medicine), Cochrane Library, and Excerpta Medica dataBASE (EMBASE) were included. The cut-off date was decided as 1 May 2008. The following key words were searched for: breast cancer, risk factors and food groups.

Since this was a narrative review, the objectives were broad, and defined criteria for the selection or exclusion of studies were not applied, which represents a limitation common to all narrative reviews. Hand-searching the references of the studies and reviews of the field was performed to augment the search strategy. Meta-analyses of randomised studies, cohort studies and randomised, controlled clinical studies were included in the research review.

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DESCRIPTION OF THE STATE OF KNOWLEDGE

Meat and meat products and breast cancer. Meat is an excellent source of complete protein, iron and zinc, and is therefore an important part of the daily diet. However, despite meat being a source of key nutrients, processed meat may contain carcinogenic substances. Amongst them, two groups are the most important: heterocyclic aromatic amines (HAA) and polycyclic aromatic hydrocarbons (PAH) [3].

Additional risk factors are the presence of high amounts of saturated fatty acids contained in those products which stimulate the production of cholesterol which, in turn, may lead to an excessive increase in the concentration of estrogen, thus contributing to an increased risk of breast cancer [1, 3, 6]. Kazemi et al. (2021) showed that any increase in total meat intake by 100 g per day was associated with a 7% (RR=1.07; 95% CI: 1.01–1.13) increase in breast cancer risk [7]. Converging results were also obtained in a meta-analysis by Wu et al. (2016), in which meat consumption in general could increase the risk of breast cancer by 5% (RR=1.05 95%; CI: 0.95–1.16), whereas when 120 g of this product was consumed daily, the risk increased even up to 7% (RR=1.07; 95% CI: 1.01–1.14). Different results were obtained from the multi-centre European Prospective Investigation into Cancer and Nutrition (EPIC) study, which found no association between meat and fish consumption and breast cancer risk [8].

The risk of breast cancer can be influenced not only by the volume, but also by the type of meat consumed. Products in this group can be divided into red meat and white meat, with poultry and fish included in the former. The latter, which includes, among others, pork, mutton, beef or veal, as well as processed meat, i.e. meat that has undergone technological treatment (e.g. curing, salting, fermentation or marinating) or thermal treatment (e.g. traditional grilling, smoking or prolonged frying) raises the greatest concerns. In 2015, the International Agency for Research on Cancer (IARC) classified red and processed meat as probable carcinogens, for which there is clear evidence of carcinogenicity to humans [9]. The World Cancer Research Fund together with the American Institute for Cancer Research (WCRF / AICR) recommend consumption of up to a maximum of 500 g of red meat per week and no more than 50 g of processed meat per day. Although the conclusions of this report focused mainly on colorectal cancer, the authors also stressed that carcinogens contained in red or processed meat may also contribute to an increased risk of breast cancer [6, 9]. The relationship between red and processed meat consumption was considered in the large prospective NutriNet-Santé study (2018) [6], which demonstrated that higher consumption of processed red meat could increase the risk of breast cancer by up to 83% (HR=1.83; 95% CI: 1.33–2.51). This risk was significantly higher in premenopausal women – by 21 percent points (HR=2.04; 95% CI: 1.03–4.06) compared to post-menopausal women, where it dropping by 4 percent points (HR=1.79; 95% CI: 1.26–2.55) [6]. The relationship between red meat consumption and breast cancer risk was also demonstrated in two meta-analyses of prospective studies by Wu et al. (2016) and Farvid et al. (2018) [4, 10]. Similar results were obtained by Kazemi et al. (2021), who demonstrated that an increase in red meat consumption of 100 g/day increased the risk of developing breast cancer by 10% (RR=1.10; 95% CI: 1.03–1.18) [7]. This coincides with the results obtained by

Guo et al. (2015), where an additional 120 g of red meat per day resulted in an 11% (RR=1.11; 95% CI: 1.05–1.16) increase in breast cancer risk [11].

In contrast to red meat, poultry consumption is thought to be indifferent as far as breast cancer risk is concerned [4, 7]. In contrast, Farvid et al. (2014) demonstrated that in post-menopausal women, poultry consumption may be protective and reduce the risk of breast cancer by up to 27% (RR=0.73; 95% CI: 0.58–0.91) [12]. This study also showed that replacing one portion of red meat daily with a portion of poultry resulted in a 17% (RR=0.83; 95% CI: 0.72–0.96) reduction in breast cancer risk.

Processed meat is another group of products that may be of key importance to breast cancer formation. Wu et al. (2016) demonstrated that its consumption can increase breast cancer risk by 7% (RR=1.07; 95% CI: 1.01–1.14), while including 50 g of this product in the diet increases this risk up to 9% (RR=1.09; 95% CI: 1.02–1.17) [4]. These results are consistent with the meta-analysis of Farvid et al. (2018), which also showed a 9% (RR=1.09; 95% CI: 1.02–1.17) increase in breast cancer risk with the consumption of processed meat [10]. Kazemi et al. (2021) further demonstrated that a 50 g per day increase in consumption of this product resulted in an 18% (RR=1.18; 95% CI: 1.04–1.33) increase in breast cancer risk [7].

Although species-wise fish should be considered as meat, it is commonly treated as a separate group of foods. Fish, on the one hand, may have a protective effect on the risk of breast cancer due to its content of polyunsaturated fatty acids, but on the other hand, they may contain heavy metals, such as lead, mercury and dioxins, which may increase the risk of breast cancer. A meta-analysis of 21 prospective cohort studies demonstrated that a higher intake of fish rich in omega-3 polyunsaturated fatty acids was associated with a reduced risk of breast cancer.

Each 0.1 g/day increase in dietary marine n-3 PUFA consumption was associated with a 5% (RR=0.95 95%CI: 0.90, 1.00) reduction in breast cancer incidence [13]. Moreover, Dydjow, Bendek and Zagozdzi (2020) demonstrated that among Polish women, the consumption of polyunsaturated fatty acids at the level of more than 10% of total energy was associated with a reduction in the chance of breast cancer by up to 60% (OR=0.4; 95% CI: 0.19–0.85) [14]. However, according to the EPIC study, low consumption of oily fish may be associated with a higher risk of breast cancer (HR=1.8; 95% CI: 1.17–2.78) [8]. Less optimistic results were obtained by Kazemi et al. (2021), who observed no relationship between the consumption of additional 100 g of fish and breast cancer risk (RR=1.0; 95% CI: 0.93–1.08) [7].

Relationship between intake of dairy products and breast cancer incidence. Milk and milk products are another food group that is an important part of the daily diet and are included in most dietary guidelines. Dairy products contain a number of substances that can affect the risk of breast cancer in various ways. These mainly include high content of saturated fatty acids. In addition, milk and its products contain growth factors such as insulin-like growth factor I (IGF-I), which can promote the proliferation of cancer cells. In addition, these products may contain contaminants such as pesticides with potential carcinogenic effects. On the other hand, these products contain nutrients, such as calcium, vitamin D and conjugated linoleic acid (CLA), which might have a protective effect against breast cancer [15, 16, 17].

Many studies on the effect of general consumption of milk and milk products do not show any effect of these products on breast cancer risk [4, 7]. However, different results were obtained by Shin et al. (2019), who demonstrated that consumption of one or more servings of milk per day was associated with a reduction in breast cancer risk by up to 42% (HR=0.58; 95% CI: 0.35–0.97) [15]. These results, however, applied only to women under the age of 50. In the analysis of the effect of milk on cancer formation, the fat content of individual products should also be taken into account. Results concerning the consumption of milk high in fat showed that there was no significant relationship between the consumption of this product and breast cancer risk [16]. Similar results were obtained in a meta-analysis by Wu et al. (2016), in which also no relationship was observed between consumption of full-fat milk and cancer risk (RR=0.99; 95% CI: 0.87–1.12) [4]. Nevertheless, they demonstrated that there was a relationship between skimmed milk consumption and a reduction in breast cancer risk by 4% (RR=0.96; 95% CI: 0.92–1.00) [4]. Interesting results were also obtained by Han et al. (2019), who studied the effect of milk consumption on mammographic density, a key diagnostic factor in breast cancer [18]. They demonstrated that as the intake of low-fat milk increased, the percentage of mammographic density decreased.

Fermented milk and milk products are included in most national recommendations, therefore it is worth paying attention to this group of products [18, 19]. Many years of scientific research demonstrate that yoghurt, along with other fermented milk products, provides beneficial health effects [19, 20]. It has been shown that there is a correlation between the consumption of fermented milk and reduced risk of breast cancer [21]. Kaluza et al. (2021), in their study analysed the relationship between the consumption of unfermented and fermented milk products and breast cancer risk, depending on receptor status (estrogen receptor (ER) and progesterone receptor (PR)) [22]. The study demonstrated that long-term consumption of unfermented milk products in a group of people with positive estrogen receptor status (ER+) and progesterone receptor status (PR+) was associated with an increase in this risk by up to 30% (HR=1.30, 95% CI: 1.02–1.65), while no relationship with breast cancer was observed in the group with negative status of these receptors. Consumption of fermented dairy products in the ER-/PR- group reduced this risk by up to 61 percent points (HR=0.28; 95% CI: 0.10–0.78) compared to the ER+/PR+ group (HR=0.89; 95% CI: 0.69–1.14). However, in a meta-analysis including yoghurt consumption, Wu et al. (2016) observed a 10% (RR=0.90; 95% CI 0.82–1.00) reduction in breast cancer risk, while the results of Shin et al. (2019) suggest no relationship between breast cancer risk and cheese or yoghurt consumption [4, 15].

Cereal products and breast cancer. Cereal products form the basis of our daily diet. They are characterised by high carbohydrate and protein content. On the one hand, these products may contain various types of contaminants, e.g. arsenic in the case of rice [23], but on the other hand, they are a valuable source of bioactive components that may have a protective effect in the prevention of breast cancer [24, 25, 26]. Whole grain products are also a rich source of dietary fibre, which has potential anticancer properties based on the reduction of N-nitroso compounds and the support of

immunity through the production of anti-inflammatory cytokines. Dietary fibre also reduces the risk of cancer by clearing the digestive tract of damaged cells or by binding estrogens in the colon and removing them with the faeces. In addition, dietary fibre binds to or dilutes bile acids to reduce cell proliferation and the likelihood of mutation [25, 27].

Based on an observational study by Farvid et al. (2016), it was shown that consumption of whole grain cereal products was associated with a reduction in breast cancer risk in adults by up to 18% (RR=0.82; 95% CI: 0.70–0.97) [28]. Similar results were found in two meta-analyses of observational studies, Xiao et al. (2018) and Gaesser (2020), where higher intake of whole grain products was characterised by a 16% (RR=0.84; 95% CI: 0.74–0.96) reduction in the risk of this disease [25, 26]. Furthermore, Gaesser (2020) showed that a 50 g/day increase in intake of whole grain cereal products was associated with a 17% reduction in breast cancer risk [26]. Opposite results were obtained by Kazemi et al. (2021), who showed no statistically significant relationship between an increase in cereal product intake of 20 g/day and breast cancer risk (RR=1.0; 95% CI: 0.99–1.01) [7]. The type and degree of processing of cereal products are also important in assessing their impact on breast cancer risk. Farvid et al. (2016) observed that consumption of brown rice may reduce breast cancer risk by up to 6% (RR=0.94; 95% CI: 0.89–0.99), while consumption of two servings of wheat bread per week was associated with a 2% (RR=1.02; 95% CI: 1.01–1.04) increase in this risk [28]. The effect of rice on breast cancer risk was also studied by Shin et al. (2020) [29], who showed that high consumption of white rice was associated with up to a 35% (HR=1.35; 95% CI: 1.00–1.84) increase in breast cancer risk, while more frequent consumption of whole grain rice was associated with a 33% (HR=0.67; 95% CI: 0.45–0.99) reduction in this risk [29].

Effect of fruit and vegetables on breast cancer risk. Fresh fruit and vegetables may have a potential protective effect against breast cancer. A diet based on fruit and vegetables is low in fat (especially saturated fatty acids), high in dietary fibre and rich in many vitamins and minerals with bioactive compounds (i.e. polyphenols, carotenoids) with potential anticancer effects. Farvid et al. (2019) observed in their study that consumption of more than 5.5 servings of fruit and vegetables per day was associated with an 11% (HR=0.89; 95% CI: 0.83–0.96) reduction in the risk of this disease compared to the group with less than 2.5 servings of these foods [30]. This study also analysed separate consumption of vegetables and fruit. According to the researchers, high consumption of both groups of these foods could reduce the risk of breast cancer by 9% (HR=0.91; 95% CI: 0.84–0.99) [30]. Farvid et al. (2016) in their study showed that consuming about three portions of fruit per day during adolescence can reduce the risk of developing breast cancer by up to 25% (HR=0.75; CI 95%: 0.62–0.90) [31]. Similar results were also obtained in a meta-analysis by Aune et al. (2012), in which a reduction in breast cancer risk of up to 11% (RR=0.89; 95% CI: 0.80–0.99) was observed when vegetables and fruit were consumed together [32]. However, considering the intake of individual food groups, an 8% (RR=0.92; 95% CI: 0.86–0.98) reduction in the risk of breast cancer was observed in the case of high fruit consumption, but no significant differences were seen in the case of vegetable consumption [32]. A slightly smaller relationship was observed in a meta-analysis by Kazemi et al.

(2021), where consumption of an additional daily 100 g of fruit and vegetables was associated with a 2% (RR=0.98; 95% CI: 0.97–0.996) reduction in breast cancer risk [7]. A 3% (respectively, RR=0.97; 95% CI: 0.95–0.99 and RR=0.97; 95% CI: 0.953–0.995) reduction in this risk was shown in the case of a 100 g increase in daily vegetable or fruit intake. Interestingly, no study has observed a significant effect of fruit juice consumption on breast cancer risk [7, 30, 31]. Similar results were obtained in the EPIC study, where low fruit and vegetable consumption contributed to a greater risk of breast cancer. Interestingly, taking into account the consumption of vegetables only, it has been shown that the difference in the risk of developing breast cancer in people with the lowest and the highest consumption of vegetables may be as much as 22 percentage points (respectively HR=0.87; 95% CI: 0.80–0.94 and HR=0.65 95% CI: 0.53–0.81) [8]. Analysing individual subgroups of vegetables, it was demonstrated that daily consumption of two or more servings of dark green leafy vegetables was associated with a 7% (HR=0.93; 95% CI: 0.87–0.99) reduction in breast cancer risk, while consumption of five or more servings of yellow and orange or brassica vegetables reduced this risk by 9% (HR=0.91; 95% CI: 0.84–0.99) and 10% (HR=0.90; 95% CI: 0.84–0.96), respectively [30]. Importantly, when yellow and orange and brassica vegetables were combined, the risk was reduced by up to 17% (HR=0.83; 95% CI: 0.76–0.91). Considering individual products, it was demonstrated that consumption of at least two servings per week of pumpkin, broccoli, cabbage or cauliflower was associated with a reduction in breast cancer risk by 10% (HR=0.90; 95% CI: 0.83–0.98), 4% (HR=0.96; 95% CI: 0.92–0.99), 7% (HR=0.93; 95% CI: 0.89–0.99) and 8% (HR=0.92; 95% CI: 0.87–0.98), respectively [30]. In addition, Fung et al. (2013) observed that consumption of a minimum of two servings per week of blueberries and peaches was associated with a reduction in post-menopausal breast cancer risk by 18% (RR=0.82; 95% CI: 0.71–0.96) and 41% (RR=0.59; 95% CI: 0.37–0.93), respectively [33]. The EPIC study also considered individual fruits, and it was noted that as apple / pear consumption increased, the risk of breast cancer was reduced (HR=0.96; 95% CI: 0.94–0.99 [34].

Importance of pulses and nuts consumption in breast cancer prevention. Legumes and nuts are significant sources of dietary fibre, B vitamins, magnesium and zinc. They also contain phytosterols and phenolic compounds, which may be important in the etiology of breast cancer. In addition, these foods have a low glycaemic index, which may also affect breast cancer risk. An observational study by Sharif et al. (2021) showed a significant relationship between both legumes and nuts consumption in reducing breast cancer risk [35]. The results of this study show that in the group of patients with the highest consumption of legumes, the risk of risk cancer may be decreased by 46%. The results of this study also suggest that consumption of legumes has the potential to reduce the occurrence of breast cancer by up to 59% (OR=0.41; 95% CI: 0.30–0.57). These relationships were confirmed both in premenopausal women, where the risk was reduced by 49% (OR=0.51; 95% CI: 0.31–0.85), and in women with normal body weight (OR=0.49; 95% CI: 0.29–0.82) [35]. Furthermore, when analysing the effect of nuts consumption, a significant reduction in breast cancer risk of up to 85% (OR=0.15; 95% CI: 0.09–0.26) was observed. This relationship was confirmed both in pre-menopausal and

post-menopausal women, where the risk of breast cancer was decreased by 79% (OR=0.21; 95% CI: 0.14–0.31) and 77% (OR=0.23; 95% CI: 0.13–0.42) respectively [35]. In addition, one study has shown that replacing one portion of red meat daily with a serving of pulse may be associated with a reduction in breast cancer risk of up to 15% (RR=0.85; 95% CI: 0.73–0.98) in all groups of women, and 19% (RR=0.81; 95% CI: 0.66–0.99) in post-menopausal patients [12]. Brandt and Nieuwenhuis (2018) [36] showed that consumption of at least 10 g of peanuts per day was associated with a 23 percent points (HR=0.55; 95% CI: 0.33–0.93), compared to the group that did not consume nuts daily (HR=0.78; 95% CI: 0.56–1.08) [36]. Quite the opposite results were obtained by Kazemi et al. (2021), who found no significant association between an increase in the intake of an additional serving of nuts (28 g) (RR=0.92; 95% CI: 0.83–1.01), and breast cancer risk [7]. Similar results were also found for the consumption of an additional serving (50 g) (RR=0.95; 95% CI: 0.87–1.05) of pulses [7]. Studies on the consumption of pulses or nuts are not only based on the group in question, but also look at individual products. Sangaramoorthy et al. (2018) showed in an observational study that bean consumption was associated with a 19% (OR=0.81, 95% CI: 0.66–1.01) reduction in breast cancer risk [37].

When discussing legumes, one must not forget the role of previously-mentioned phytoestrogens, especially isoflavones, which are similarly built to female sex hormones – oestrogens. Such feature allows them to block the activity of many enzymes which take part in non-controlled growth of cancer cells, and therefore prevent the development of hormone-dependent cancers, including breast cancer [3, 7]. Because of this specific role of isoflavones in breast cancer development, many studies focus on soy and its derivatives, which are a good source of isoflavones. Kazemi et al. (2021) meta-analysis shows that each increase in soy (and derivatives) consumption by 30 g/day reduced the risk of breast cancer incidence by about 3% (RR=0.965; 95% CI=0.94–0.99) [7]. Similar results can be found in the meta-analysis by Wei et al. (2019) where it also was observed that each additional increase of soy (and derivatives) consumption by 10mg a day lowers/minimises the risk of breast cancer incidence by 3% (HR=0.97; 95% CI=0.95–0.99) [38].

A summary of the impact of different food groups on breast cancer incidence is presented in Table 1.

CONCLUSIONS

Nutrition is one of the modifiable environmental factors that can lead to breast cancer formation, and therefore is a key factor in the prevention of these diseases. At the same time, nutrition is a vital element of lifestyle as well as a factor in everyone's health. Long-standing observations/studies have shown that a menu consisting of properly chosen products (when it comes to both quantity and quality) may significantly decrease the risk of developing breast cancer. Also, nutrition and oncology specialists are consensual that diet in cancer prevention (anti-cancer diet) should be based on healthy eating rules/guidelines. Additionally, it is advised that a healthy diet should be rich in products that show protective effects. These products include, among others: fresh low-starch vegetables, fruits, seeds, nuts, whole-grain products, high-quality lean meat, legumes and omega-3 fatty acids. On

Table 1. Impact of different food groups on breast cancer incidence – summary

Food group		Breast cancer incidence risk OR – Odds Ratio RR – Relative Risk HR – Hazard Ratio	Confidence interval (95% CI)	Literature
Meat and derivatives	All meat consumption increase by 100g/day	RR = 1.07	(1.01–1.13)	(7)
	All meat consumption increase by 120g/day	RR = 1.07	(1.01–1.14)	(4)
	Red meat consumption increase by 100g/day	RR = 1.10	(1.03–1.18)	(7)
	Red meat consumption increase by 120g/day	RR = 1.11	(1.05–1.16)	(10)
	Processed meat consumption increase by 50g/day	RR = 1.09	(1.02–1.17)	(4)
	Processed meat consumption increase by 50g/day	RR = 1.18	(1.04–1.33)	(7)
	Fish consumption increase by 0.1g/day	OR = 0.4	(0.19–0.85)	(13)
	Fish consumption increase 100g/day	RR = 1.0	(0.93–1.08)	(7)
Milk and dairy	Consumption of one or more portions (200ml of milk/120ml of yoghurt/20g of cheese)	HR = 0.58	(0.35–0.97)	(14)
Cereal products	Whole grain cereal products consumption increase by 20g/day	RR = 1.0	(0.99–1.01)	(7)
	Consumption of more than 5.5 portions of fruits and vegetables	HR = 0.89	(0.83–0.96)	(29)
Fruits and vegetables	Consumption of 3 portions of fruits	HR = 0.75	(0.62–0.90)	(30)
	Vegetables consumption increase by 100g/day	RR = 0.97	(0.95–0.99)	(7)
	Fruits consumption increase by 100g/day	RR = 0.97	(0.953–0.995)	(7)
Nuts and legumes	Nuts consumption increase by 28g/day	RR = 0.92	(0.83–1.01)	(7)
	Legumes consumption increase by 50g/day	RR = 0.95	(0.87–1.05)	(7)

the other hand, food that is considered cancerogenic/rich in substances that are considered carcinogenic should be limited. This is why processed foods, fast foods and processed meat should be limited or eliminated from the diet. That being said, the proper analysis and assessment of food groups regarding breast cancer are challenging, and there is also a need to perform more studies on this topic. One of the factors that makes it harder and more challenging is lack of possibility of food groups separation, which may lead to inconsistency and incoherence in the results.

In conclusion, the authors believe that this review is a source of reliable research results consistent with evidence-based medicine. These data can be useful in everyday clinical practice as well as in direct nutritional care of an oncological patient. In addition, the reliable information collected in the review can be used by doctors, qualified dietitians and therapeutic teams to develop dietary recommendations, and to construct an optimal, individual nutritional plan for breast cancer patients at every stage of their treatment and after recovery. Current scientific data can also be used to update nutritional recommendations in the field of primary breast cancer prevention.

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