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Mini review

The Role of Diet and Lifestyle in Women with Breast Cancer: A Review of the Literature

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Abstract

One in eight women worldwide will develop breast cancer in their lifetime. Obesity, physical activity, and dietary composition are known to influence the prognosis of breast cancer. There have been significant concerns regarding the toxicity of existing pharmaco- and chemotherapies, and additional complementary dietary and lifestyle interventions are suggested for breast cancer prevention.

This review aims to highlight current information regarding the association between dietary patterns and lifestyle with BC, including risk and prognosis. In addition, this article discusses dietary intake, physical activity, and other habits as lifestyle modification strategy targets.

The incidence of breast cancer is increasing at an alarming rate worldwide, making it the most prevalent malignancy in women. A significant relationship exists between obesity, physical inactivity, a sedentary lifestyle, dietary patterns, and breast cancer risk. Unhealthy lifestyle habits, such as smoking, alcohol consumption, and tobacco use, also contribute to this increased risk. Obese women who have a high risk of breast cancer had better metabolic and inflammatory profiles when they engaged in lifestyle activities and diet interventions that were tailored to their needs. Physical activity was linked with a reduction in cancer incidence and mortality risk. A decrease in an individual's consumption of red meat, animal fat, and sugary foods, as well as their increased consumption of fiber, fruits, and vegetables, were associated with a reduced risk of breast cancer. Other modifiable risk factors, such as smoking cessation and the avoidance of alcohol and tobacco, contributed to breast cancer survival.

A healthy lifestyle that includes exercise and dietary modifications may serve as adjuvants to expedite breast cancer prevention interventions and optimize the health of cancer survivors.

Keywords: ***Breast cancer, obesity, diet, lifestyle, physical activity.***

Introduction

Breast cancer (BC) is caused by the proliferation of malignant breast cells. The malignant cells originate in the ductal epithelium that lines the milk glands or ducts of the breast. Cancer cells are characterized by their abnormal and uncontrolled cell division and growth, which leads to their invasion of normal tissue locally or their spreading to other organs in the body via metastasis [1].

Epidemiological studies provide conclusive evidence of a link between human breast cancer incidence and dietary and lifestyle factors [2]. BC is the most prevalent form of cancer in females. Nearly 1.38 million new cases were diagnosed worldwide in 2008, accounting for approximately one-fourth of all female cancers [3]. It is the most prevalent cancer in both developed and developing nations, with the highest reported incidence in Western Europe (almost 90 cases per 100,000 women) [4].

Numerous studies indicate a link between dietary patterns and lifestyle and an individual's risk of developing breast cancer [5]. In the pathogenesis of breast tumours, several modifiable risk factors have been identified including diet, eating patterns, physical activity, smoking, alcohol consumption, and body fat [6]. This review focuses on the association between a healthy lifestyle and diet (including a high intake of fruits and vegetables, high levels of physical activity, and other habits) and a decline in the incidence and mortality of breast cancer in women.

Objectives

This review aims to highlight current data regarding the relationship between dietary patterns and lifestyle and BC, including risk and prognosis. In the face of mounting BC incidence, survivors, and the need for evidence-based interventions, this review circumscribes dietary intake, physical activity, and other habits as targets for lifestyle modification strategies. Negative associations between adverse lifestyle habits and unhealthy diet with BC are summarized. Recommended guidelines or preventive eHealth program measures for BC survivors targeting these factors are discussed.

Review

Epidemiology of BC

Cancer is characterized by dysregulated cell growth resulting in the spread of abnormal cells to other parts of the body by local invasion and/or metastasis. Approximately one in eight women in the United States will develop invasive BC in their lifetime [4,7]. In 2016, in US an estimated 246,660 new cases of invasive BC were diagnosed, resulting in approximately 40,450 deaths [4]. Breast cancer is the most common malignancy among women worldwide and is the leading cause of cancer-related mortality among women [8]. There are variations in BC incidence and mortality worldwide, with increasing incidence but waning mortality rates in most high-income countries, whilst other countries experience an increase in both

incidence and mortality rates [9]. Metastasis accounts for most of the deaths from BC [1]. The geographic variation of BC rates may be attributed to differences in reproductive patterns, lifestyle factors, early detection of BC, and healthcare access [10]. BC was the second-most diagnosed cancer in 2008, [3] but its global burden exceeds all other cancers. BC's incidence is on the rise and is expected to double by 2030.

Rationale for evidence-based intervention

While rates of BC are increasing rapidly in women, improved diagnostic and therapeutic tools, healthcare access, and check-up screenings have contributed to a dramatic increase in the number of cancer survivors [4]. Only 5-10% of BC cases are attributable to genetic defects while 90-95% are due to environmental and lifestyle factors [6,11]. Diet and obesity contribute approximately 30-35% and 10-20%, respectively, thus providing opportunities for nutritional prevention. In this context, lifestyle measures gain significance as they represent opportunities for BC patients to make self-controlled decisions alongside a switch to a healthier lifestyle even after the onset of cancer. It is therefore essential to provide evidence-based recommendations for BC patients to prevent unsuitable lifestyle practices and alleviate their suffering.

Dietary habits, physical activity and BC risk

During the last three decades, BC incidence has escalated while mortality rates have declined. This trend is likely to continue over the next decade or so, resulting in a substantial increase in BC survivors. Survivors of BC are at a higher risk of developing secondary cancers and other complications [12-14]. Prospective studies comparing pre- and post-diagnosis dietary changes, namely the Health, Eating, Activity, and Lifestyle (HEAL) study, have indicated that adopting a healthier lifestyle may improve long-term outcomes for these patients [15,16].

Dietary constituents and BC

A growing body of literature suggests that a healthy diet is associated with a decrease in BC recurrence and an improvement in overall mortality [17,18]. A diet consisting of high levels of refined grains, potatoes, sweets, high-fat food, coffee, black tea, soft drinks, dressing, sauce, mayonnaise, red meat, and processed foods constitutes an unhealthy dietary pattern and contributes to tumor pathogenesis [19]. Per the World Cancer Research Foundation, a plant-based diet high in vegetables, fibers, and fruits, and low in red and processed meat and animal fat is recommended [20,21]. A study on BC survivors reported similar post- diagnosis dietary changes [22]. In contrast to these findings, another study reported that dietary intervention did not prevent BC recurrence or death among women [20]. However, dietary intervention was effective in those who did not experience hot flashes post-treatment [23]. Adopting a healthy lifestyle has been reported to lower the risk of death from cardiovascular disease post-BC [24]. Post-diagnosis soy food intake has also been found to have a protective effect in breast cancer patients [25,26]. Micronutrients, such as carotenoids and vitamins C and E, are suggested to have antioxidant and apoptosis-inducing potential in cancer cells [27,28].

The consumption of red and processed meat is reported to coincide with the incidence of BC due to the presence of nitrates, nitrites, and pro-inflammatory fatty acids [29]. Red meat has heterocyclic aromatic amines, heme iron, and exogenous hormones that are considered potential carcinogens. Heterocyclic aromatic amines may also be generated by cooking at high temperatures and may act on DNA causing point mutations, deletions, or insertions [30]. Heme iron is pro-oxidant and damages DNA, causing lipid peroxidation [31,32]. Cattle are injected with steroid hormones to promote their growth and muscle mass. These hormones cause BC by inducing cellular proliferation, angiogenesis, and inhibiting apoptosis [32].

The intake of seafood such as fish has also been associated with BC risk [33,34]. Fish may be contaminated with water-absorbed heavy metals and pesticides, activating estrogen receptors. Further, cooking fish at high temperatures produces heterocyclic aromatic amines [34].

A positive correlation is reported to exist between the consumption of carbohydrate-rich foods such as sweets and chocolates and BC risk [33,35]. Foods with a high glycemic index (i.e., the digestibility of carbohydrates and subsequent absorption of glucose in the bloodstream), such as refined sugar, can cause both insulin resistance and increased insulin-related growth factor, a carcinogen. A higher intake of sucrose elevates glycemic load and obesity, increasing endogenous estrogen levels [35]. In addition, insulin also increases BC risk by stimulating estrogens and androgens [36].

Fruits and vegetables contain anti-carcinogenic compounds such as polyphenolic compounds, flavonoids, isoflavones, epigallocatechin-3- gallate, lycopene, isothiocyanates, resveratrol, selenium, beta carotenoids, vitamins E, D, C, A, B12, and B6 and folic acid [33]. Intake of fruits and salads has a greater impact on lowering BC risk [33,37]. This could be due to the destruction of antioxidants such as carotenoids and vitamins upon cooking, thus diminishing the anti-carcinogenic properties of vegetables. However, a positive correlation has been found between the consumption of pickled vegetables and BC risk, probably due to the presence of nitrates, nitrites, and extra salt, all of which are suggested to be potential carcinogens [33,38].

Intake of high-fat dairy products has been associated with a higher risk of BC [39]. This could be explained by dairy fat's estrogenic properties and the presence of carcinogenic contaminants (e.g., pesticides) and insulin-like growth factor I (IGF-I) often found in dairy products [40].

Physical activity and BC

Physical inactivity increases the risk for BC while vigorous physical activity has been found to lower the risk among women [33,41,42]. Physical activity has been reported to significantly improve various factors with respect to an individual's health-related quality of life (HRQoL) such as chemotherapy-related fatigue, cardiorespiratory fitness, and physical functioning [43]. The American Cancer Society reports that physically active women have a 20% to 30% lower risk of developing breast cancer than sedentary women. This could be attributed to the increase in basal metabolism, improved tissue oxygenation, and decreased weight associated with physical activity. The weight control properties of exercise further reduce body fat and insulin resistance. The insulin levels associated with physical inactivity cause chronic inflammation and upregulate the growth-promoting hormones associated with cancer [44]. Obesity-related inflammation has been strongly linked to BC risk and progression in both pre-and post-menopausal women [2]. The epidemic of obesity is particularly alarming among women in the Middle Eastern Region where BC incidence is increasing [8]. Their dietary pattern, which correlates with obesity, may play a significant role in the etiology of BC.

BC and lifestyle

A direct correlation between an individual's age at marriage and their risk of breast cancer has been reported [45,46]. In a recent study, oral contraceptive pill use and marriage at a younger age (less than 18 years) were associated with a 65% reduction in breast cancer risk [33]. Menopausal hormone therapy has also been found to positively correlate with BC [47]. Employed women had a higher risk of BC when compared with homemakers, possibly due to work-related stress and/or exposure to carcinogens [48]. Higher socio-economic status, higher education level, and higher family income have been reported contributory factors to breast cancer risk [46]. Hair coloring has also been linked to BC predisposition [45].

A causal association has been reported between BC and smoking habits based on the active or passive nature of the habits, the duration of smoking, and the type of cigarettes [48]. Alcohol consumption, including the frequency and timing of drinking, also modulates the association with BC [9]. BC risk may be influenced by the interaction of ethanol metabolism post-alcoholic beverage consumption with gene polymorphisms, hormonal status, and nutritional factors. Night shifts in the modern workforce have also been associated with BC risk. This is thought to be attributed to an individual's exposure to light during night hours [49]. This exposure negatively regulates the nocturnal hormone melatonin, inducing onco-static properties and disrupting the circadian rhythm.

Interventions promoting lifestyle changes in BC survivors

It is recommended that BC survivors adopt a healthy lifestyle to improve their quality of life, but adherence to these recommendations is low. Promoting lifestyle changes among survivors of breast cancer remains a difficult task for healthcare providers. Using the Promoting Physical Activity during Chemotherapy (PROACTIVE) trial, researchers designed interactive eHealth intervention programs for BC survivors in accordance with the American Cancer Society (ACS) guidelines, which recommend a higher intake of fruits and vegetables and increased physical activity [50]. The short intervention had some positive effects, and feedback from participants suggested that the web-based program could be used in a mobile format with more frequent contact and more in-depth information to improve the treatment's effects.

Conclusions

A healthy lifestyle may aid in the prevention of breast cancer. In contrast, the risk factors for BC include an unhealthy diet pattern and a lack of physical activity. Women should limit their caloric intake and eat more fruits and vegetables, particularly in raw form, to prevent the destruction of anticancer nutrients from cooking. Additionally, low-fat dairy products should be included in a healthy diet. Alcohol abstinence and weight management reduce the risk of breast cancer and the incidence of comorbidities, thereby improving the survival of affected women. In addition, people should be informed that living a healthy life and eating well are proven to be practical and effective ways to prevent cancer. The most significant limitation of the review is recall bias, a common pitfall for case-control studies. In this case, participants were required to recall their dietary habits before BC, possibly leading to recall bias. In addition, the sources and types of fish consumed by participants may have varying effects on the risk of developing BC. More research must be conducted to investigate the associations between diet and lifestyle and the risk of developing breast cancer to stop the rapid growth in incidence occurring worldwide.

Conflicts of Interest

The authors declares that there is no conflict of interest regarding the publication of this paper.

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Authors' contributions

All authors read and approved the final manuscript.

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