

The Risk Assessment and Its Application of Diet and Living Habits to Breast Cancer

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Abstract. Breast cancer (BC) is the most frequent cancer among women globally and remains a major public health concern. While genetic predispositions have been long recognized, recent studies increasingly emphasize the role of modifiable factors such as diet and lifestyle in influencing BC risk. Current research has shown that plant-based diets, rich in fruits, vegetables, and whole grains, along with regular physical activity, significantly reduce the risk of developing BC. Conversely, diets high in red and processed meats, as well as sedentary lifestyles, are associated with increased cancer risk. However, there remains a gap in understanding the precise mechanisms through which these factors influence BC development, particularly in relation to hormonal regulation and inflammation. This paper analyzed key dietary components and lifestyle habits associated with BC, focusing on the protection role of plant-based diets and physical activity, as well as the risks posed by processed foods and obesity. The researches highlight the importance of maintaining a healthy weight and engaging in regular exercise to reduce BC risk and provides a reference for future studies exploring diet and lifestyle interventions for BC prevention. While it explains several protective and risk factors, the interaction of specific micronutrients and genetic factors is still disputed. Future research should focus on recommendations for personalised dietary and explore the influence by cultural and regional differences in BC prevention strategies.

Keywords: Breast cancer, risk, diet, physical activity.

1. Introduction

According to the World Health Organization (WHO), approximately 12% of all new cancer cases are BC, which is the most frequently diagnosed cancer among women [1]. In the whole world, the prevalence of BC varies fourfold by region. To explain this difference, in addition to genes being a factor in BC risk, the new study highlights the role of diet and lifestyle habits in impacting risks.

Early research focused on genetic predisposition, such as BRCA1 and BRCA2 mutations. However, recent studies focus more on environmental and lifestyle factors. A diet rich in fruits, vegetables, and whole grains, which are high in fibre, antioxidants, and phytoestrogens, can reduce the risk of BC. On the contrary, diets rich in red and processed meats, saturated fats, and alcohol result in an increased risk of developing BC [2, 3]. Some specific micronutrients, such as vitamin D and calcium, show protective effects [4].

In addition, physical activity and body weight are also associated with BC. Regular physical activity and maintaining a healthy weight can reduce the risk of BC, especially in postmenopausal women [5]. These factors can be mediated by hormonal regulation, insulin sensitivity and inflammation influence the development of BC [6].

This article aims to provide a comprehensive risk assessment of diet and lifestyle factors associated with BC. Understanding the roles of diet and lifestyle in BC prevention is important to public health. By identifying individuals based on their diet and living habits, healthcare providers can provide targeted advice to reduce BC risk.

2. Association between Diets and BC Risk

2.1. Fruits and Vegetables

Fruits and vegetables are recognized for their health benefits due to their rich supply of vitamins, minerals, dietary fiber, and bioactive compounds. These nutrients and phytonutrients, particularly antioxidants, are important in protecting cells from oxidative stress and may influence cancer-related processes such as metabolic activation and detoxification. Research shows that increasing consumption to 9-13 servings of fruits and vegetables per day could significantly benefit overall health, carotenoids, flavonoids, and phenolic acids in fruit and vegetables can detoxify carcinogens, enhance immune function, which is particularly relevant in the context of cancer prevention [7]. Another meta-analysis examining through 49 essays, more than 3 million subjects highlights individuals who stuck to plant-based diets, had a significantly lower risk of developing cancers compared to those who consumed lower amounts of plant-based foods [8]. Increasing the intake of fruits and vegetables, especially antioxidant-rich plant foods, may be effective in reducing the risk of BC and improving your overall health.

2.2. Red Meat

Red meat, on the other hand, has been defined as a risk of cancer, particularly BC. Research suggests that high consumption of red and processed meats might cause increased BC risk. The main concerns include the presence of carcinogenic compounds formed during high-temperature cooking [e.g., grilling] and the fat content in certain cuts of red meat. However, more recent research supports the classification of lean red meat as a balanced diet. Lean red meat, particularly after fat modifications in the past two decades, is considered a low-fat and nutritious source of protein when consumed in moderation [9].

Dietary choices that prioritize fruits and vegetables while moderating red meat intake appear to provide a protective effect against BC risk. By keeping a plant-based diet rich in bioactive compounds and fiber, individuals can reduce their consumption to potential carcinogens and promote overall health. Therefore, dietary patterns that emphasize fruits, vegetables, and lean meats in moderation can be recommended to minimize the risk of BC and other chronic diseases.

3. Role of Physical Activity and Body Weight in BC Prevention

Physical activity and body weight play a key role in BC prevention has garnered significant attention due to the modifiable nature of these factors. Research has shown that regular physical activity and maintaining a healthy body weight are crucial in reducing the risk of BC and improving outcomes for BC survivors.

Higher levels of physical activity are leading to a lower risk of BC, particularly among postmenopausal women. Studies show that engaging in moderate-to-vigorous physical activity. Interventions incorporating both aerobic and resistance exercise significantly improve physical fitness, body composition, and quality of life in BC survivors, highlighting the importance of structured exercise programs during and after treatment. A regulated exercise intervention for BC survivors improves the quality of life and physical health. Additionally, four-cohort research shows that each 5-hour physical activity will decrease by 13%, 24%, and 34% death rate [10,11]. Therefore, as shown in figure 1, overweight increases the risk of breast cancer recurrence and poor prognosis through multiple mechanisms, including endocrine, inflammatory and metabolic disorders. Physical activity plays a protective role by regulating hormone levels, reducing inflammatory responses and enhancing immune function.

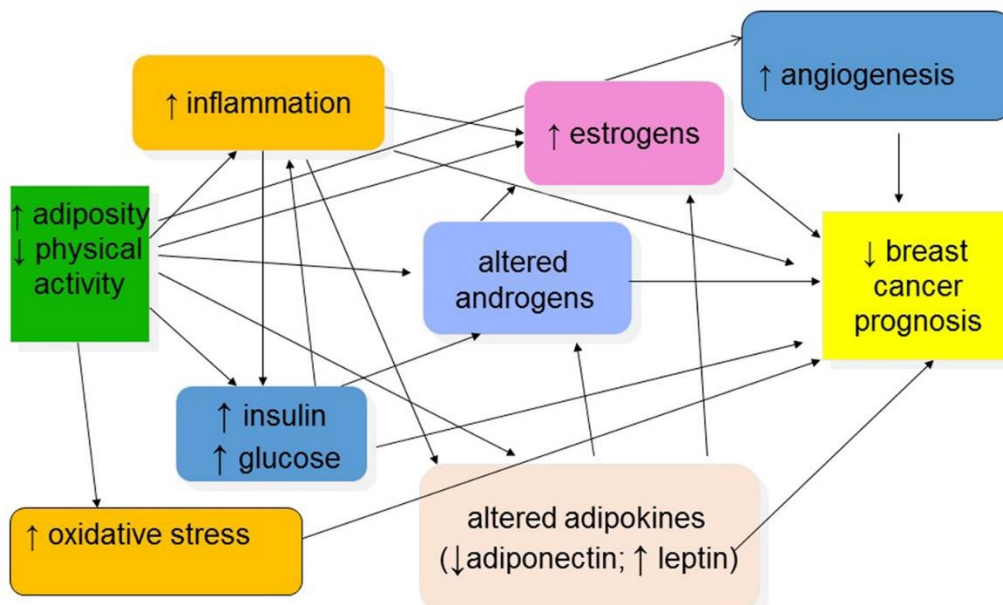


Fig. 1 The mechanism of physical activity and body weight in BC prevention [10].

Body weight is another critical factor in BC prevention. Excess body weight and obesity are well-documented risk factors for BC, particularly after menopause. Weight control through a healthy diet and regular physical activity is essential in reducing this risk. Research indicates that BC patients who maintain or achieve a healthy weight post-diagnosis have better prognoses and outcomes [12]. This connection emphasizes the dual role of physical activity in not only enhancing overall fitness but also in managing body weight, which further contributes to cancer prevention.

In conclusion, physical activity and body weight are key components in the prevention of BC and the improvement of survival outcomes. Maintaining an active lifestyle, combined with healthy weight, can reduce the risk of BC and enhance the quality of life of survivors, underscoring the importance of promoting exercise and weight management in cancer prevention strategies.

4. Potential Mechanisms through which Diet and Lifestyle Factors influence BC Development

Diet and lifestyle factors affect BC risk through various biological mechanisms. One of the most important mechanisms is hormonal regulation. Obesity, particularly post-menopause, will increase levels of circulating estrogen, which is known to promote the growth of hormone-sensitive tumours. High levels of body fat also result in insulin resistance and elevated insulin levels, which will help cancer development. Decreasing body fat and maintaining a healthy weight through regular physical activity can reduce these hormone levels and lower BC risk [13].

Another important factor is dietary composition. Diets high in fats and low in fruits and vegetables have been shown to increase the risk of BC. High-fat diets, especially rich in saturated fats, are associated with the development of BC by promoting chronic inflammation and oxidative stress, which can lead to DNA damage and mutations in cells. Oppositely, a diet rich in fruits, vegetables, and omega-3 fatty acids has been associated with reduced cancer risk, as these foods contain antioxidants and anti-inflammatory properties that protect against cancer initiation and progression [14].

5. Providing Recommendations for Dietary and Lifestyle Modifications based on the Findings

BC is influenced by many different factors. Diet and lifestyle choices are important in the prevention and management of BC.

One of the lifestyle factors associated with BC risk is the lack of physical activity. Sedentary behaviour has been linked to higher risks of developing BC, while regular exercise has demonstrated a protective effect. Engaging in moderate-to-vigorous physical activity has been shown to lower circulating estrogen levels, reduce inflammation, and improve immune function, all of which play a role in BC prevention. Studies have shown that women should consistently engage in at least 3-5 hours of daily exercise, especially aerobic exercise, such as walking or swimming, to reduce the risk of BC. Exercise not only helps to control weight but also promotes hormonal balance, thus preventing hormone receptor-positive BC [15].

Dietary choices also play a key role in reducing BC risk. Diets rich in fruits, vegetables and whole grains reduce cancer risk because they are rich in essential nutrients, antioxidants and phytochemicals that protect cells from damage. These foods contain many compounds, such as carotenoids, that may reduce the risk of BC by neutralising oxidative stress and supporting immune function. Therefore, it is recommended to increase the daily intake of fresh fruits and vegetables and decrease the intake of processed foods to maximise their protective effects.

6. Conclusion

In this essay, we have explored the influence of diet and lifestyle factors on BC risk, emphasizing the importance of fruits, vegetables, and plant-based diets in reducing BC risk while highlighting the harmful effects of red and processed meats. Physical activity and maintaining a healthy weight can reduce BC risk and improve physical condition of patients. The mechanisms through which these factors operate, such as hormonal regulation and reducing inflammation, further emphasise their relevance in both prevention and recovery. While genetic factors remain immutable, diet and lifestyle provide practical areas for intervention.

However, several limitations were not addressed in this analysis. Due to limited space, research did not involve the complex interactions between different dietary components and genetic predispositions. Additionally, while this paper discussed general dietary patterns, further exploration of specific micronutrients like vitamin D, calcium, and other dietary supplements is needed. Also, the role of cultural factors in diet and lifestyle, which vary considerably across different populations, was not thoroughly explored.

Future research should focus on specific mechanisms through which various nutrients interact with genetic and hormonal factors in BC development. Longitudinal studies that examine the combined effects of dietary patterns, physical activity, and emerging interventions like personalized nutrition could provide a more nuanced understanding. Additionally, there is a need for more region-specific research, particularly in low- and middle-income countries, where both the incidence of BC and dietary habits can vary greatly from those in high-income nations. These efforts will deepen our understanding and help develop more targeted prevention strategies for diverse populations.

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