



The Journal of Nutritional Epidemiology

journal homepage: <https://epismart.org/journal/index.php/jcn/index>

Review

Sustainable Diets and The Risk of Breast Cancer: A Literature Review

Ala Najafi¹, Saeid Doaei², Maryam Karkhane^{2*}

¹Student of Nutrition Sciences (B.Sc.), Faculty of Nutrition and Food Technology, National Nutrition and Food Technology Research Institute, Shahid Beheshti University of Medical Sciences, Tehran, Iran. ²Department of Community Nutrition, Faculty of Nutrition and Food Technology, National Nutrition and Food Technology Research Institute, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

ABSTRACT

Background: Sustainable diets, such as plant-based and Mediterranean diets, have gained attention for their potential role in reducing breast cancer risk. This review aims to explore the relationship between sustainable dietary patterns and breast cancer risk, prognosis, and outcomes, summarizing current evidence from relevant studies.

Methods: A systematic search was conducted using PubMed, Web of Science, and Scopus with a focus on studies published between 2020-2024. Observational and interventional studies that investigated sustainable diets and breast cancer risk in human populations were included.

Results: This review identified evidence suggesting that sustainable diets rich in fruits, vegetables, whole grains, and plant-based proteins are associated with a lower risk of breast cancer. However, evidence for the impact of these diets on prognosis and survivorship is less conclusive and requires further research.

Conclusion: Sustainable diets show promise for breast cancer prevention, although more randomized trials are needed to establish stronger clinical guidelines.

Keywords: Sustainable diets, breast cancer, Mediterranean diet, plant-based diet, cancer prevention

Introduction

Breast cancer is one of the most prevalent malignancies worldwide, ranking as the leading cause of cancer-related mortality among women. According to the World Health Organization (WHO), approximately 2.3 million women were diagnosed with breast cancer in 2020 alone, resulting in over 680,000 deaths attributed to the disease [1]. The risk of developing breast cancer is influenced by a range of factors including genetics (BRCA1 and BRCA2 mutations), hormonal factors, reproductive history, lifestyle choices, and environmental exposure. Dietary patterns have drawn increasing attention due to their role in shaping cancer risk and progression, offering opportunities for targeted prevention strategies [2].

Sustainable diets refer to dietary patterns that aim to

achieve optimal nutrition while minimizing environmental impacts, ensuring food security, and promoting health equity [3]. The Food and Agriculture Organization (FAO) defines sustainable diets as those that protect biodiversity, are culturally acceptable, accessible, economically fair, and nutritionally adequate [3]. Typically, these diets emphasize plant-based foods, reduced consumption of animal-based products, and lower intake of ultra-processed foods [3]. As they address both ecological sustainability and human health, sustainable diets have emerged as potential tools not only for mitigating environmental degradation, but also for reducing the risk of chronic diseases, including cancer [3].

Emerging evidence suggests a potential protective role for sustainable dietary patterns against breast cancer. Epidemiological studies have consistently

* Corresponding Author: Maryam Karkhane

E-mail address: karkhane9@gmail.com

DOI: 10.31557/JNE.49.2024122

Received 5 August 2024; Received in revised form 3 September 2024; Accepted 5 October 2024; Available online 29 December 2024



linked plant-based diets, particularly those rich in fiber, antioxidants, and phytochemicals, to lower breast cancer incidence [4]. The Mediterranean diet a prime example of a sustainable diet has been associated with reduced breast cancer risk, attributed to its anti-inflammatory and antioxidant properties, as well as its impact on estrogen metabolism [4]. Conversely, diets high in red and processed meats, refined carbohydrates, and saturated fats have been associated with an increased risk of breast cancer [5]. Mechanistically, sustainable diets may exert their protective effects by modulating inflammation, oxidative stress, hormonal pathways, and gut microbiota composition [5].

The current study aims to conduct a comprehensive literature review examining the relationship between sustainable diets and the risk of breast cancer. This review critically evaluates the existing evidence, highlights gaps in current knowledge, and offers insights into the potential role of sustainable diets in breast cancer prevention. By synthesizing the available data, this work intends to contribute to both the nutritional and oncology fields, helping to inform future research and public health initiatives.

Methods

Literature Search Strategy

A comprehensive literature search was conducted using the PubMed, Web of Science, and Scopus databases to identify relevant studies on sustainable diets and breast cancer risk. The search was limited to articles published up to 2025 in peer-reviewed journals. Key search terms included “sustainable diets,” “plant-based diets,” “Mediterranean diet,” “breast cancer,” “breast cancer risk,” and “dietary patterns.” Boolean operators, such as “AND” and “OR” were used to combine the terms. The search also included manual reviews of the reference lists of selected articles to identify additional relevant studies not captured in the initial database search. The search strategy was designed to capture both observational studies (case-control, cohort, and cross-sectional) and interventional studies exploring the link between sustainable diets and breast cancer incidence or risk factors.

Inclusion and Exclusion Criteria

Studies were included in the review if they met the following criteria: (1) primary research articles or meta-analyses published in peer-reviewed journals; (2) studies that explicitly investigated the relationship between dietary patterns consistent with sustainable diets (e.g., plant-based diets, Mediterranean diet) and breast cancer risk; (3) studies conducted in human populations with a focus on adults (age ≥ 18 years); and (4) studies with clear definitions of diet types and breast cancer outcomes. The exclusion criteria were as follows: (1) studies that focused solely on animal models or cell lines; (2) studies without a specific focus on dietary sustainability; (3) review articles without original data; and (4) articles not available in English. Additionally, studies with a high risk of bias or poor methodological quality, as assessed

using standard risk of bias tools, were excluded from the final analysis.

Data Extraction

Data from selected articles were extracted using a standard form that included the first author’s name, study location, number of participants in both the intervention and control groups, intervention duration, participants’ age and sex, study type and design, type of cancer, and dietary pattern.

Results

The current literature review investigates sustainable diets and the risk of breast cancer. Table 1 provides detailed information about the studies included in this review. Each row represents a different study, while the columns describe various characteristics, such as the author and year, study design, method, and outcome.

The systematic review conducted by Bu et al. which included 47 studies on breast cancer risk, 10 on treatment outcomes and prognosis, and 2 on quality of life, highlighted the potential role of balanced dietary patterns, such as those rich in fruits, vegetables, nuts, and whole grains, in reducing breast cancer risk and improving patient outcomes [6]. While most studies have found that healthier diets tend to lower breast cancer incidence, few studies have examined their impact on prognosis and quality of life [6]. This review emphasizes the need for more randomized controlled trials and mechanistic studies to clarify how dietary habits influence breast cancer biology and long-term survival outcomes [6].

Similarly, Dilnaz et al. found synergistic benefits of a Mediterranean diet and physical activity in reducing breast cancer risk [7]. The review analyzed existing literature on the Mediterranean diet and physical activity, focusing on their potential roles in breast cancer prevention. It evaluated epidemiological data and studies that connect dietary and lifestyle habits with breast cancer risk. The diet’s high intake of antioxidants and healthy fats, coupled with exercise, contributes to lower levels of inflammation and oxidative stress, both of which have been implicated in cancer development [7]. The authors suggested that adopting these lifestyle modifications may play a critical role in primary prevention strategies. However, the review also highlights the need for more long-term randomized controlled trials to confirm these findings and establish stronger clinical recommendations [7].

Furthermore, Kazemi Jahromi et al. investigated the relationship between high-protein diets and breast cancer risk among Iranian women [8]. These findings which are obtained from a sample of 401 participants, which included 134 women with histologically confirmed breast cancer and 267 controls, suggest that replacing fats and refined carbohydrates with proteins, particularly plant proteins, significantly reduces the odds of breast cancer [8]. Specifically, a high-protein diet with low carbohydrate and fat contents was associated with a reduced risk of breast cancer, while diets rich in animal fats and low in carbohydrates did not show a protective effect [8]. This highlights the potential benefits of dietary adjustments,

TABLE 1
Study Characteristics of the Included Studies.

No.	Author, Date	Study design	Method	Main outcome
1	Bu et al. 2022 [19]	Systematic Review	This study systematically reviewed existing research on the impact of various dietary patterns, such as Mediterranean, plant-based, and Western diets, on breast cancer risk, prognosis, and quality of life. It included 47 studies on breast cancer risk, 10 on treatment outcomes and prognosis, and 2 on quality of life.	The findings suggest that certain balanced dietary patterns, rich in fruits, vegetables, whole grains, and white meat, may lower breast cancer risk and improve prognosis. In contrast, Western dietary patterns are associated with an increased risk. However, evidence on the specific dietary patterns and their impact on breast cancer outcomes has remained inconsistent.
2	Dilnaz et al. 2021 [20]	Narrative Review	The review analyzed existing literature on the Mediterranean diet and physical activity, focusing on their potential roles in breast cancer prevention. It evaluated epidemiological data and studies that connect dietary and lifestyle habits with breast cancer risk.	The findings suggest that adherence to the Mediterranean diet, characterized by high consumption of fruits, vegetables, whole grains, and olive oil, along with regular physical activity, may reduce breast cancer risk. The protective effects are linked to anti-inflammatory properties and improved metabolic function.
3	Kazemi Jahromi et al. 2024 [21]	Hospital-based case-control study	The study assessed dietary intake using a validated food frequency questionnaire in a sample of 401 participants, which included 134 women with histologically confirmed breast cancer and 267 controls. Logistic regression models were applied to determine the association between high-protein diet scores and breast cancer risk, adjusting for confounders.	The study found that higher adherence to a high-protein, low-carbohydrate, and low-fat diet, characterized by plant proteins and reduced refined carbohydrates, was inversely associated with breast cancer risk. Substituting refined carbohydrates with plant proteins, and fats with proteins, also showed a protective effect against breast cancer.
4	Karavasiloglou et al. 2022 [22]	Systematic Review	The review analyzed over 500 records, ultimately including 9 studies (mostly prospective cohort studies from Europe and the USA).	The review found modest inverse associations between sustainable diets and cancer risk or mortality. However, results varied across studies due to differences in sustainability indicators and types of cancer.
5	Khalifa et al. 2020 [23]	Systematic Review	The study conducted a systematic review of existing literature, focusing on the role of diet and physical activity in the prevention, treatment, and prognosis of breast cancer. Data were drawn from multiple observational studies and randomized controlled trials.	The findings suggest that adherence to healthy dietary patterns, particularly the Mediterranean and low-fat diets, along with regular physical activity, is associated with a lower risk of breast cancer incidence and improved outcomes in survivors, such as reduced recurrence and mortality rates.
6	Tsai et al. 2023 [24]	Narrative Review	The review involved a systematic search of peer-reviewed articles that explored the dietary patterns most associated with breast cancer risk. The focus was on studies comparing the Mediterranean diet and the Western diet. The review also examined existing literature on the bioactive compounds in these diets and their roles in cancer prevention.	The review highlights that adherence to the Mediterranean diet, which is rich in fiber, phytochemicals, and healthy fats, is associated with a lower risk of breast cancer. Conversely, the Western diet, characterized by high consumption of processed meats, saturated fats, and refined sugars, is linked to an increased risk of breast cancer.
7	Virani et al. 2023 [25]	Systematic Review	This review analyzed existing literature on the effects of dietary unsaturated fats and the Mediterranean diet on breast cancer prognosis and outcomes. Data from studies focusing on breast cancer survivors were compiled.	The findings suggest that following the Mediterranean diet, rich in unsaturated fats, may help improve survival and quality of life in women diagnosed with breast cancer. However, more clinical trials are needed to establish stronger evidence.



particularly increasing plant-based proteins, in reducing breast cancer risk [8].

On the other hand, Karavasiloglou et al. in the review analyzed over 500 records, ultimately including 9 studies (mostly prospective cohort studies from Europe and the USA), underscored the potential cancer prevention benefits of sustainable diets [9]. These findings suggest that diets with lower greenhouse gas emissions and higher biodiversity, along with organic food consumption, may be linked to reduced cancer risk and mortality [9]. However, the heterogeneity of sustainability measures and cancer outcomes across the included studies limits definitive conclusions. This review calls for more standardized, long-term studies to establish stronger links between sustainable diets and cancer prevention [9].

Khalifa et al. highlighted the importance of lifestyle factors, particularly diet and exercise, in breast cancer prevention and treatment [10]. The Mediterranean diet, rich in plant-based foods and healthy fats, along with sustained physical activity, has shown significant benefits in reducing breast cancer risk and improving patient prognosis [10]. Exercise also contributes to enhanced survival and quality of life among breast cancer survivors. While the findings are promising, the authors emphasize the need for further large-scale trials to confirm these benefits and establish comprehensive guidelines for breast cancer prevention and management [10].

Likewise, Tsai et al. emphasized the role of dietary patterns in influencing breast cancer risk [11]. The Mediterranean diet, rich in polyunsaturated fatty acids, antioxidants, and fiber, has the potential to reduce the risk of breast cancer due to its anti-inflammatory and antioxidant effects [11]. In contrast, the Western diet, associated with obesity and metabolic disorders, tends to promote a higher risk of breast cancer. This study calls for further research on the underlying mechanisms through which these dietary patterns exert their influence on cancer risk and progression [11].

Lastly, Virani et al. highlighted the potential benefits of a Mediterranean diet, particularly unsaturated fats, in improving the prognosis of breast cancer patients [12]. This suggests that anti-inflammatory properties and an overall healthy diet profile contribute to improved outcomes. However, despite promising observational data, the authors called for more rigorous clinical trials to confirm these benefits in breast cancer survivors [12].

Discussion

The current literature review supports the role of sustainable diets, particularly plant-based diets rich in fruits, vegetables, and whole grains, in reducing breast cancer risk. Studies like that of Bu et al. emphasized the protective effects of these dietary patterns, while also noting a gap in research regarding their impact on long-term prognosis and quality of life [6]. Dilnaz et al. further explore how the Mediterranean diet, combined with physical activity, reduces inflammation and oxidative stress, suggesting a strong potential for primary prevention [7]. Kazemi Jahromi's case-control study highlights the benefits of plant-based proteins in breast cancer risk

reduction, reinforcing the importance of macronutrient quality [8]. Moreover, Karavasiloglou et al. and Khalifa et al. underscored the broader cancer prevention potential of sustainable diets, although both reviews call for more long-term, standardized studies [9, 10]. The heterogeneity in sustainability measures complicates the ability to make definitive conclusions, but all findings consistently suggest that dietary patterns aligned with sustainability principles, such as those minimizing environmental impact, contribute to cancer prevention and may play a crucial role in improving outcomes in breast cancer patients.

Sustainable diets, including the Mediterranean diet, are characterized by a high intake of plant-based foods, moderate consumption of fish and poultry, and minimal intake of red and processed meats, offering both nutritional and environmental benefits. These diets are rich in antioxidants, polyphenols, monounsaturated fats, and omega-3 fatty acids, which collectively reduce oxidative stress and systemic inflammation, key contributors to breast cancer development [13-15]. Specifically, polyphenols and other bioactive compounds inhibit DNA damage and cancer cell proliferation, while monounsaturated fats and omega-3 fatty acids modulate inflammatory pathways and improve estrogen metabolism [16, 17]. The fiber content in these diets enhances gut microbiome diversity, promoting the metabolism of estrogens into less harmful forms, thereby reducing estrogen receptor-positive breast cancer risk [13, 17]. Furthermore, adherence to sustainable diets supports reduced greenhouse gas emissions, indirectly fostering public health by mitigating environmental factors linked to cancer risk [18]. These mechanisms highlight the dual role of sustainable diets in promoting health and ecological balance while emphasizing the need for further clinical trials to standardize their long-term impact on breast cancer prevention.

The hypothesis that sustainable diets, particularly plant-based and Mediterranean patterns, can influence breast cancer risk and outcomes is grounded in biological plausibility and supported by mechanisms of action. These diets are rich in bioactive compounds like antioxidants, polyphenols, and omega-3 fatty acids, which mitigate oxidative stress and inflammation, key processes in carcinogenesis. Moreover, high fiber content aids in regulating estrogen levels, which is a significant factor in hormone-sensitive breast cancers. These mechanisms suggest that dietary patterns consistent with sustainability principles can positively influence breast cancer biology. The included studies collectively highlight the value of adopting sustainable and healthy diets not only for personal well-being, but also for broader cancer prevention strategies. Despite the encouraging results, these reviews call for more rigorous trials to better establish the effects of these diets on breast cancer risk, prognosis, and overall survivorship outcomes.

The strengths of this study include a comprehensive literature search strategy across multiple databases, ensuring broad coverage of relevant studies on sustainable diets and breast cancer. The inclusion of both observational and interventional studies enhances the review's ability

to provide a well-rounded understanding of this topic. Additionally, clear inclusion and exclusion criteria helped ensure methodological rigor. However, limitations arise from reliance on observational studies, which are prone to confounding factors. Moreover, heterogeneity in study designs and definitions of sustainable diets limits the ability to draw definitive conclusions. Furthermore, the exclusion of non-English studies may have restricted the diversity of the findings.

Future research should prioritize well-designed, long-term randomized controlled trials (RCTs) to establish stronger causal relationships between sustainable diets and breast cancer outcomes. Additionally, future studies should address the current gaps by including diverse populations, accounting for lifestyle factors such as physical activity, and adopting standardized definitions of sustainability. These steps will provide more conclusive evidence and guide tailored dietary recommendations for breast cancer prevention and survivorship.

In conclusion, this review highlights the potential role of sustainable diets, particularly plant-based and Mediterranean dietary patterns, in reducing breast cancer risk and improving outcomes. While current evidence supports the protective effects of these diets, there is a need for more robust randomized controlled trials and mechanistic studies to better understand the relationship between dietary habits and breast cancer biology. Incorporating sustainability into dietary recommendations for breast cancer prevention and management may offer dual health and environmental benefits, although further research is necessary to establish comprehensive guidelines.

Author Contribution Statement

All authors contributed equally in this study.

Acknowledgements

None

References

- Bray, F., et al., Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA: a cancer journal for clinicians*, 2018. 68(6): p. 394-424.
- Harvie, M., A. Howell, and D.G. Evans, Can diet and lifestyle prevent breast cancer: what is the evidence? *American Society of Clinical Oncology Educational Book*, 2015. 35(1): p. e66-e73.
- Willett, W., et al., Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. *The lancet*, 2019. 393(10170): p. 447-492.
- Schwingshackl, L., et al., Adherence to Mediterranean diet and risk of cancer: an updated systematic review and meta-analysis. *Nutrients*, 2017. 9(10): p. 1063.
- Farvid, M.S., et al., Dietary fiber intake in young adults and breast cancer risk. *Pediatrics*, 2016. 137(3).
- Bu, Y., et al., Dietary patterns and breast cancer risk, prognosis, and quality of life: A systematic review. *Frontiers in Nutrition*, 2023. 9: p. 1057057.
- Dilnaz, F., et al., Mediterranean diet and physical activity: Two imperative components in breast cancer prevention. *Cureus*, 2021. 13(8).
- Jahromi, M.K., et al., High-protein diet scores, macronutrient substitution, and breast cancer risk: insights from substitution analysis. *BMC Women's Health*, 2024. 24(1): p. 121.
- Karavasiloglou, N., et al., Sustainable diets and cancer: a systematic review. *Current Nutrition Reports*, 2022. 11(4): p. 742-752.
- Khalifa, A., A. Guijarro, and A. Nencioni, Advances in Diet and Physical Activity in Breast Cancer Prevention and Treatment. *Nutrients*, 2024. 16(14): p. 2262.
- Tsai, H.-H., et al., The risk of breast cancer between western and mediterranean dietary patterns. *Nutrients*, 2023. 15(9): p. 2057.
- Virani, S., et al., The Impact of Dietary Unsaturated Fat or the Mediterranean Diet on Women Diagnosed With Breast Cancer: A Systematic Review. *Cureus*, 2024. 16(7).
- Castelló, A., et al., Adherence to the Western, Prudent and Mediterranean dietary patterns and breast cancer risk: MCC-Spain study. *Maturitas*, 2017. 103: p. 8-15.
- Stasiewicz, B., et al., Dietary Fat Intake: Associations with Dietary Patterns and Postmenopausal Breast Cancer—A Case-Control Study. *Cancers*, 2022. 14(7): p. 1724.
- Delarue, J., Mediterranean Diet and cardiovascular health: an historical perspective. *British Journal of Nutrition*, 2022. 128(7): p. 1335-1348.
- Estruch, R., et al., Primary prevention of cardiovascular disease with a Mediterranean diet. *New England journal of medicine*, 2013. 368(14): p. 1279-1290.
- Aune, D., et al., Dietary fiber and breast cancer risk: a systematic review and meta-analysis of prospective studies. *Annals of oncology*, 2012. 23(6): p. 1394-1402.
- Tilman, D. and M. Clark, Global diets link environmental sustainability and human health. *Nature*, 2014. 515(7528): p. 518-522.
- Bu Y, Qu J, Ji S, Zhou J, Xue M, Qu J, et al. Dietary patterns and breast cancer risk, prognosis, and quality of life: A systematic review. *Frontiers in Nutrition*. 2023;9:1057057.
- Dilnaz F, Zafar F, Afroze T, Zakia UB, Chowdhury T, Swarna SS, et al. Mediterranean diet and physical activity: Two imperative components in breast cancer prevention. *Cureus*. 2021;13(8).
- Jahromi MK, Ahmadi H, Farhadnejad H, Norouzzadeh M, Mokhtari E, Teymoori F, et al. High-protein diet scores, macronutrient substitution, and breast cancer risk: insights from substitution analysis. *BMC Women's Health*. 2024;24(1):121.
- Karavasiloglou N, Pannen ST, Jochem C, Kuhn T, Rohrmann S. Sustainable diets and cancer: a systematic review. *Current Nutrition Reports*. 2022;11(4):742-52.
- Khalifa A, Guijarro A, Nencioni A. Advances in Diet and Physical Activity in Breast Cancer Prevention and Treatment. *Nutrients*. 2024;16(14):2262.
- Tsai H-H, Yu J-C, Hsu H-M, Chu C-H, Chang T-M, Hong Z-J, et al. The risk of breast cancer between western and mediterranean dietary patterns. *Nutrients*. 2023;15(9):2057.
- Virani S, Afreen S, Perthiani A, Sangster E, Lanka N, Acharya P, et al. The Impact of Dietary Unsaturated Fat or the Mediterranean Diet on Women Diagnosed With Breast Cancer: A Systematic Review. *Cureus*. 2024;16(7).

