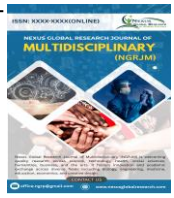
Nexus Global Research Journal of Multidisciplinary; Vol-1. Issue- 6 (Dec 2025):327-337 ISSN: XXX-XXXX (Online)

Nexus Global Research Journal of Multidisciplinary

Journal homepage: https://nexusglobalresearch.com/journal/ngrjm/



Review Article

The Role of Plant-Based Diets in Improving Physical, Emotional, and Social Functioning in Breast Cancer Survivors

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ABSTRACT

Breast cancer survivorship has unique challenges in the physical, emotional, and social domains of health. There is emerging evidence that plant-based dietary patterns may bring significant benefits to breast cancer survivors through a variety of biological mechanisms and lifestyle factors. This review outlines the current state of research into the relationship between plant-based diets and quality of life outcomes among survivors of breast cancer, covering physical functioning, psychosocial wellbeing, and social health. The review draws together epidemiological studies, clinical trials, and mechanistic research to provide a comprehensive understanding of how plant-based nutrition could support survivorship care. Evidence exists to show that plant-based diets high in fruits, vegetables, whole grains, and legumes are related to weight management, less fatigue, improved physical function, improved emotional health, and increased social interaction among survivors. These seem to be mediated by anti-inflammatory and hormonal effects, improvement in gut microbiota composition, and psychosocial factors associated with self-efficacy in lifestyle changes. Although there are methodological limitations, the balance of evidence supports the incorporation of plant-based dietary counselling into comprehensive survivorship care programs.

Keywords: *Breast Cancer Survivors, Plant-Based Diet, Quality Of Life, Physical Functioning, Emotional Health, Social Well-Being.*

1. INTRODUCTION

1.1 Breast Cancer Survivorship: A Growing Population

Breast cancer remains the most diagnosed malignancy among women worldwide, with approximately 2.3 million new cases annually. Advances in early detection and treatment have substantially improved survival rates, with five-year relative survival rates surpassing 90% in developed countries. As a result, the population of breast cancer survivors is becoming increasingly large, thereby placing greater demands on evidence-based interventions that optimize long-term health outcomes and quality of life.

Among these, the challenges faced by breast cancer survivors go beyond the physical recovery from the disease and its treatment: persistent fatigue, weight gain, reduced physical functioning, lymphedema, cognitive impairment, anxiety, depression, fear of recurrence, body image concerns, and social isolation. The multidimensionality of the survivorship challenges calls for a host of holistic interventions that address the physical, emotional, and social health domains all at once.

1.2 The Promise of Dietary Interventions

Dietary modification is a lifestyle factor that can be modified by the survivors themselves and can provide potential physiological and psychological benefits. In contrast to pharmaceutical interventions, changes in diet are generally accessible, inexpensive, and

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DOI: 10.5281/zenodo.17918461

Received 30 Nov 2025; **Accepted** 09 Dec 2025; **Available online** 14 Dec 2025.

associated with limited adverse effects if implemented appropriately. Furthermore, engaging in health-enhancing dietary behaviors may promote survivors' feelings of mastery and self-efficacy, leading to greater emotional well-being.

1.3 Defining Plant-Based Diets

The definition of a plant-based diet varies widely in the scientific literature and encompasses many different dietary patterns that broadly emphasize foods of plant origin while minimizing or excluding animal products. These patterns include vegan diets that exclude all animal products, vegetarian diets that include dairy products and/or eggs, and predominantly plant-based diets that may include a small amount of animal foods. The common features are high intakes of fruits, vegetables, whole grains, legumes, nuts, and seeds, with corresponding high intakes of dietary fiber, phyto-nutrients, antioxidants, and micronutrients.

1.4 Objectives

This paper critically reviews and synthesizes available evidence regarding the role of plant-based diets in improving physical, emotional, and social functioning among survivors of breast cancer, explores potential biological and psychosocial mechanisms underlying the observed associations, identifies gaps in current knowledge, and gives recommendations for clinical practice and future research.

2. BIOLOGICAL MECHANISMS LINKING PLANT-BASED DIETS TO IMPROVED OUTCOMES

2.1 Anti-Inflammatory Effects

Chronic inflammation is a central player in tumor development and recurrence, and it also contributes to many treatment-related side effects. Plant-based diets are typically high in anti-inflammatory nutrients, such as polyphenols, carotenoids, and plant-based omega-3 fatty acids. These bioactive phytochemicals dampen inflammatory pathways by inhibiting the production of pro-inflammatory cytokines like interleukin-6, tumor necrosis factor-alpha, and C-reactive protein.

Several studies have shown that a higher intake of fruits and vegetables is associated with lower systemic inflammation markers among survivors of breast cancer. Plant-based diets are also anti-inflammatory because their fiber content stimulates the production of short-chain fatty acids from gut microbiota, exerting a systemic immunomodulatory effect.

2.2 Hormonal Modulation

Many breast cancers are hormone-receptor positive, making estrogen metabolism of particular importance for survivors. Plant-based diets affect estrogen levels through several mechanisms. Dietary fiber increases the fecal excretion of estrogen, decreasing enterohepatic recirculation and lowering circulating estrogen levels. Phytoestrogens present in soy products, flaxseeds, and other plant foods have weak estrogenic activity and may competitively inhibit more potent endogenous estrogens.

Moreover, plant-based diets typically support healthier body weight and composition, which influences aromatase activity in adipose tissue and subsequent estrogen production. The resulting hormonal impact may account in part for the reduced risk of recurrence and improved symptoms, particularly hot flashes and other menopausal symptoms common among survivors.

2.3 Antioxidant Protection

Plant foods are rich sources of antioxidants, including vitamins C and E, selenium, and many phytochemicals, such as flavonoids and carotenoids. These compounds neutralize reactive oxygen species and reduce oxidative stress, which contributes to fatigue, cognitive

dysfunction, and cellular damage. Enhanced antioxidant status may protect against treatment-related toxicities and support recovery of normal tissue function.

2.4 Gut Microbiome Modulation

The diversity of gut microbiota, as highlighted by emerging research, plays a key role in cancer outcomes and overall health. Plant-based diets enhance microbial diversity and abundance of bacterial species through the provision of dietary fiber and polyphenols. A healthy gut microbiome impacts systemic inflammation, immune function, neurotransmitter production, and metabolic health-all aspects that impact physical functioning, mood, and energy levels.

Indeed, studies among breast cancer survivors have shown that plant-based dietary interventions can change the composition of gut microbiomes toward profiles associated with improved metabolic health and lower inflammation, which may contribute to improved quality of life outcomes.

3. PHYSICAL FUNCTIONING OUTCOMES

3.1 Weight Management and Body Composition

Weight gain is common following the treatment of breast cancer, occurring in roughly 50-96% of survivors and associated with an increased risk of recurrence, comorbidities, and reduced quality of life. Plant-based diets have consistently demonstrated efficacy for weight management due to their lower energy density, higher fiber content promoting satiety, and favorable effects on metabolic rate.

Clinical trials of plant-based dietary interventions among breast cancer survivors have reported significant weight loss ranging from 3-6 kg over 12-24 week periods compared to control groups. Beyond weight reduction, these interventions improve body composition by preferentially reducing fat mass while preserving or increasing lean muscle mass, important for physical functioning.

Although not exclusively plant-based, the WINS and WHEL study showed that dietary interventions that emphasized increased fruit and vegetable consumption with reduced fat intake resulted in modest weight loss and improved metabolic parameters among breast cancer survivors.

3.2 Fatigue Reduction

Cancer-related fatigue is among the most prevalent and distressing symptoms for survivors, with 30-60% of individuals affected even years after the completion of treatment. The multifactorial etiology of fatigue encompasses inflammation, anemia, hypothyroidism, depression, and deconditioning.

Research evidence indicates that plant-based diets may improve fatigue through numerous pathways. In a study of 3,000 breast cancer survivors, higher dietary quality scores that emphasized plant foods were associated with significantly reduced fatigue severity. Of particular relevance are the anti-inflammatory properties of plant-based diets, given that systemic inflammation is a strong predictor of fatigue intensity.

Better energy metabolism, the result of improved glycemic control, increased mitochondrial function due to antioxidant protection, and optimized micronutrient status through nutrient-dense plant foods, may also increase energy levels. Survivors who adopt plant-based patterns of eating often describe subjective improvements in vitality and a reduced need for daytime rest.

3.3 Physical Activity and Functional Capacity

Physical functioning includes the ability to perform activities of daily living, exercise capacity, and overall mobility. Plant-based diets support physical functioning by managing weight, reducing inflammation, improving cardiovascular health, and facilitating recovery processes.

Studies have demonstrated that breast cancer survivors with eating patterns characterized by a high consumption of plants showed better performance on objective measures of physical function such as the six-minute walk test, grip strength assessments, and self-reported physical activity. The DIANA-5 trial of a diet rich in plant foods using a Mediterranean approach among breast cancer survivors revealed improvements in physical activity levels and metabolic health markers.

The relationship between diet and exercise seems to be bidirectional, with improvements in diet frequently catalyzing increases in exercise, which further enhances physical functioning and fosters a positive cycle in health behavior.

3.4 Cardiovascular Health

The risk of cardiovascular disease is increased in survivors of breast cancer due to cardiotoxic treatments, as well as shared and hormonal risk factors. Plant-based diets have considerable cardiovascular benefits, including blood pressure reduction, lipid profile improvement, enhancement of endothelial function, and decrease in arterial stiffness.

These benefits to cardiovascular status directly improve exercise capacity, reduce dyspnea, and support overall physical functioning. Plant-based dietary patterns have been shown in cancer survivors to be associated with significant reductions in total cholesterol, LDL cholesterol, and blood pressure, comparable to those observed in general populations.

4. EMOTIONAL AND PSYCHOLOGICAL OUTCOMES

4.1 Depression and Anxiety

About 25% of breast cancer survivors are thought to have major depression, while up to 18% have anxiety disorders. Emotional distress has arisen from the time of diagnosis, the experience associated with treatment, concern about recurrence, and challenges of survivorship.

There is emerging evidence that plant-based diets may improve mental health through multiple mechanisms. The gut-brain axis is influenced by microbiota composition and its metabolites, thereby modulating neurotransmitter production, the stress response, and mood regulation. Plant-based diets foster gut microbial profiles associated with increased production of serotonin precursors and anti-inflammatory metabolites.

It has been noted in observational studies that greater adherence to plant-based diets is inversely associated with the risk of depression in cancer survivors. In the longitudinal study of 6,500 breast cancer survivors, greater intake of fruits, vegetables, and whole grains predicted lower depressive symptom scores over the five years of follow-up.

Nutritional psychiatry research has emphasized that a number of key nutrients, particularly abundant in plant foods, play a critical role in optimal brain functioning and mood regulation: folate, magnesium, zinc, and omega-3 fatty acids. Deficiencies in these key nutrients, common in Western dietary patterns, may contribute to mood disorders.

4.2 Cognitive Function

Cognitive dysfunction associated with cancer, or "chemobrain," affects 20-30% of survivors and presents as symptoms of disturbance in memory, attention, processing speed, and executive function. While mechanisms are incompletely understood, contributing factors to cognitive dysfunction include oxidative stress, inflammation, and vascular factors.

Plant-based diets containing neuroprotective compounds may protect cognitive function by offering antioxidant protection, enhancing cerebral blood flow, reducing neuroinflammation, and promoting neuroplasticity. The MIND diet, emphasizing plant foods, with special focus on berries and leafy greens, has also shown cognitive benefits in aging populations.

Limited research specific to survivors of breast cancer suggests that a higher dietary quality emphasizing plant foods associates with better cognitive performance in standardized assessments. The anti-inflammatory and vascular benefits of plant-based eating can be particularly relevant in the prevention of cognitive decline in this population.

4.3 Body Image and Self-Esteem

Treatment for breast cancer often makes a serious impact on body image due to surgery, hair loss, weight changes, and menopausal symptoms. Body image concerns significantly predict quality of life and emotional wellbeing among survivors.

Health-promoting dietary behaviors, including the adoption of plant-based eating patterns, may promote positive body image and self-esteem through several mechanisms. Successful implementation of dietary change promotes self-efficacy and sense of control, which are protective psychological factors. Weight loss and body composition changes with plant-based diets could directly enhance body satisfaction.

Qualitative research suggests that survivors view dietary modification as an empowering action they can take to enhance health outcomes, reduce recurrence risk, and recapture their bodies after treatment. This sense of agency seems therapeutically valuable regardless of objective health outcomes.

4.4 Quality of Life

Quality of life is a multidimensional construct that represents physical, emotional, social, and functional well-being. Plant-based dietary patterns have been consistently associated with positive overall quality of life in breast cancer survivors.

The Women's Healthy Eating and Living Study, which advocated for a very high level of vegetables, fruits, and fiber with limited fat, showed improvements in quality-of-life domains such as vitality, emotional wellbeing, and general health perceptions. Mediterranean diet interventions that emphasize plant foods have also demonstrated quality of life benefits in survivor populations.

These benefits likely reflect not only the gains that were made in physical functioning but also improvements in emotional health, disease management, and social engagement related to healthful eating behaviors.

5. SOCIAL FUNCTIONING AND WELLBEING

5.1 Social Support and Connection

Social isolation is an important concern for survivors of breast cancer, as many report diminished social networks and increased loneliness after diagnosis and treatment. Dietary behaviors are inherently social, since eating usually takes place within social settings, and food preparation may involve family and community.

Plant-based dietary interventions, particularly those delivered in group formats, facilitate social connection through shared experiences, mutual support, and collective learning. Such initiatives have involved cooking classes, group nutrition education sessions, and even online support communities centered on plant-based eating that create contexts for meaningful social interaction.

Indeed, studies have shown that survivors engaging in group-based dietary interventions reported enhanced social support, decreased feelings of isolation, and a greater sense of community. Such benefits from social interactions might independently add to improved health outcomes beyond the direct physiological effects of dietary change.

5.2 Family and Relationship Dynamics

These changes in diet often spill over from the individual survivor to affect household eating patterns; partners and family members often also develop healthier eating, so shared health

goals help bond relationships and improve health across the household.

However, dietary changes also bring challenges, such as when family members resist changes or survivors experience social pressure to eat certain foods. Support from healthcare providers in navigating those social dynamics seems important for sustained dietary adherence.

Couples-based dietary intervention studies in cancer survivors indicate that involving partners is associated with improved dietary adherence, better relationship quality, and the establishment of mutual accountability systems that support long-term behavior change.

5.3 Cultural and Community Engagement

Food plays a central role in cultural identity and community participation. Plant-based diets can be adapted to diverse cultural contexts, preserving cultural food traditions while emphasizing plant-forward preparations.

Community-supported agriculture programs, farmers' markets, and plant-based cooking classes allow survivors to connect with their communities on shared interests in healthy eating and sustainability. Such activities promote social integration and purpose beyond the cancer experience.

Finally, for many survivors, taking up plant-based diets is compatible with their values related to environmental sustainability and animal welfare, and therefore contributes to meaningfulness and purpose that improve psychological well-being and social identity.

6. CHALLENGES AND CONSIDERATIONS

6.1 Nutritional Adequacy

Although well-planned plant-based diets can meet all nutrient needs, survivors need to pay particular attention to certain nutrients that require extra attention. These nutrients include, but are not limited to, vitamin B12, vitamin D, calcium, iron, zinc, and omega-3 fatty acids. Consultation with registered dietitians specializing in oncology nutrition is prudent.

Particular attention is given to protein intake, since oncologic treatment can increase protein needs, and survivors might receive education on adequate protein intake from plant sources. Plant proteins are often low in leucine, which is considered the amino acid most key to muscle protein synthesis; these may necessitate higher overall protein intake.

6.2 Social and Practical Barriers

The practical challenges to plant-based diets may include food availability, cost considerations, cooking skills, time constraints, and social situations. Survivors of lower socioeconomic status may have more difficulty accessing fresh produce and plant-based specialty items.

Food-centered social interactions, including those with family and dining out, may be more challenging when plant-based diets are consumed. Healthcare providers should discuss these practical issues and offer resources to help overcome barriers.

6.3 Avoid Extreme or Restrictive Approaches

While plant-based diets can be healthy, highly restrictive eating patterns may also contribute to disordered eating behaviors, nutritional deficiencies, and social isolation. Survivors with histories of eating disorders require particular sensitivity and monitoring when making dietary changes.

It should focus on the addition of healthy plant-based foods, rather than the creation of tight restrictions, which could be psychologically counterproductive. Flexible approaches that occasionally allow for the inclusion of favorite foods generally offer better long-term adherence compared to absolute prohibition.

6.4 Individual Variation

Response to dietary treatments is highly variable depending on an individual's genetic background, microbiota composition,

metabolic health, food preferences, and psychosocial factors. Personalized approaches, considering individual circumstances and preferences, may maximize benefits compared with one-size-fits-all recommendations.

7. CLINICAL IMPLICATIONS AND RECOMMENDATIONS

7.1 Integration into Survivorship Care Plans

Plant-based eating patterns should be emphasized in dietary counseling and incorporated into comprehensive survivorship care plans. Evidence-based recommendations include gradually increasing consumption of vegetables, fruits, whole grains, legumes, nuts, and seeds while reducing processed foods, refined grains, and excessive animal products.

Other recommendations specific to survivors of breast cancer could include a daily intake of a minimum of 5-9 servings of vegetables and fruits; whole grains instead of refined grains; legumes several times a week; nuts and seeds daily; limiting the consumption of red and processed meat.

7.2 Multidisciplinary Approach

For dietary interventions, the optimal practice would involve a collaborative team approach including oncologists, registered dietitians, psychologists, exercise specialists, and other disciplines. Multidisciplinary survivorship clinics can coordinate comprehensive lifestyle interventions that target multiple health behaviors simultaneously.

7.3 Behavioral Support

Successful dietary change requires more than nutritional education. Behavioral counseling that focuses on goal-setting, self-monitoring, problem-solving, and relapse prevention strengthens intervention effects. Motivational interviewing techniques can be used to help survivors explore ambivalence and shore up intrinsic motivation for change.

7.4 Long-term Sustainability

Interventions should focus on sustainable dietary patterns that survivors can maintain long term, rather than short-term, restrictive diets. Flexible approaches that accommodate personal preference, cultural tradition, and social context are better adhered to than rigid prescriptions.

8. CONCLUSION

Available evidence, although in need of further confirmation from larger, rigorous trials, indicates that plant-based dietary patterns confer significant benefits in physical, emotional, and social functioning in survivors of breast cancer. The biological plausibility of the observed associations is supported by multiple mechanisms of action through which plant-based diets affect health outcomes, including anti-inflammatory effects, hormonal modulation, antioxidant protection, and microbiome optimization.

Beyond physiological benefits, engagement in health-promoting dietary behaviors appears to confer psychological advantages through enhanced self-efficacy, sense of control, and meaning-making. Social dimensions of dietary change, such as opportunities for connection and community engagement, have been shown to add value beyond the individual benefits of plant-based dietary interventions.

Counseling of breast cancer survivors regarding the potential benefits of adopting plant-based eating patterns should be considered by healthcare providers as part of comprehensive survivorship care. Respecting individual preferences and circumstances, emphasis on increasing consumption of vegetables, fruits, whole grains, legumes, nuts, and seeds represents a safe, accessible, and potentially effective strategy for optimizing survivorship outcomes.

As the population of breast cancer survivors continues to grow, it is increasingly important to identify evidence-based lifestyle interventions that improve quality of life and decrease long-term health risks. Plant-based

nutrition represents a promising, modifiable factor worthy of continued research attention and clinical implementation to support the wellbeing of this expanding survivor population.

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