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IMPACT OF NUTRITIONAL AND LIFESTYLE INTERVENTIONS ON QUALITY OF LIFE IN WOMEN WITH BREAST CANCER UNDERGOING CHEMOTHERAPY: A NARRATIVE REVIEW

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Abstract:

Breast cancer remains the most prevalent malignancy among women worldwide, with lifestyle factors such as diet, physical activity, and body weight playing pivotal roles in its prevention, progression, and survivorship. This systematic review synthesizes evidence from epidemiological studies, clinical trials, and meta-analyses published between 2005 and 2025 to evaluate the impact of nutritional interventions and healthy behaviors on breast cancer risk, recurrence, and mortality.

A comprehensive literature search across major databases identified over 50 high-quality studies, including randomized controlled trials and cohort analyses. Key findings indicate that adherence to healthy dietary patterns—characterized by high intake of vegetables, fruits, whole grains, and omega-3 fatty acids, while limiting red/processed meats, saturated fats, and alcohol—reduces breast cancer incidence by 20-30% and improves survival rates by mitigating oxidative stress and inflammation. Obesity, particularly postmenopausal, emerges as a strong prognostic factor, increasing recurrence risk by up to 40%, whereas weight management through combined diet and exercise interventions enhances chemotherapy tolerance and quality of life. Physical activity, even at moderate levels, is associated with a 25-35% reduction in mortality, potentially via improved insulin sensitivity and immune function. Specific nutrients like vitamin D and antioxidants show promise in adjuvant therapy, alleviating treatment side effects and supporting estrogen receptor-positive subtypes.

Despite these benefits, inconsistencies arise from study heterogeneity, including variations in menopausal status and tumor molecular profiles. Future research should prioritize personalized nutrition strategies and long-term trials to optimize outcomes. Overall, integrating evidence-based dietary and lifestyle modifications into clinical guidelines could significantly lower breast cancer burden and empower survivors.

Keywords :- *Breast cancer, Chemotherapy, Nutritional interventions, Lifestyle interventions ,Dietary supplements , Oral nutritional supplements.*

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INTRODUCTION:

Breast cancer remains one of the most prevalent malignancies worldwide and a leading cause of cancer mortality among women, with over 2.3 million new cases reported annually and a rising incidence in low- and middle-income regions (Wilkinson & Gathani, 2021). Despite significant advances in multimodal treatment—including surgery, chemotherapy, radiotherapy, endocrine, and targeted therapies—treatment-related toxicities continue to impair quality of life, treatment adherence, and overall prognosis (Scafuri et al., 2025). These challenges have catalyzed an expanding interest in adjunct nutritional and lifestyle interventions aimed at mitigating chemotherapy side effects, improving physiological resilience, and optimizing treatment outcomes (Sanft et al., 2023; Jia et al., 2022).

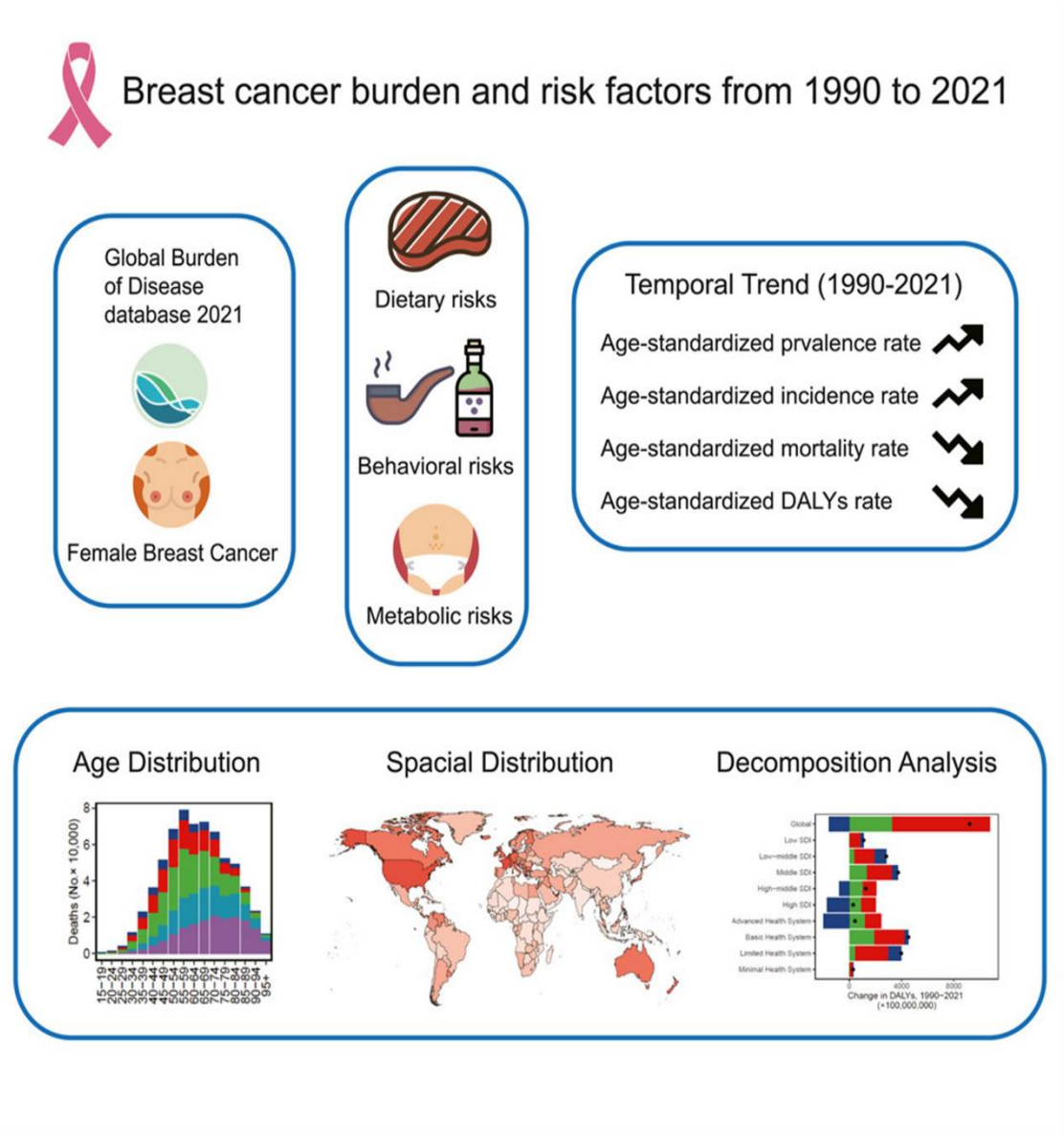

Figure 1: Breast cancer burden & risk factors.

Emerging evidence over the past 15 years highlights that modifiable lifestyle factors—including diet quality, physical activity, and weight management—play a pivotal role in both prevention and adjuvant cancer care (Armenta-Guirado et al., 2023; Deeb et al., 2024). Meta-analytical findings demonstrate that adherence to healthy lifestyle indices encompassing balanced diets, regular exercise, and limited alcohol and red-meat intake can reduce breast cancer risk by approximately 20–25%, irrespective of menopausal status or molecular subtype (Armenta-Guirado et al., 2023). Likewise, randomized clinical trials have revealed that exercise-nutrition programs during chemotherapy may enhance pathological complete response rates and preserve physical function without compromising dose intensity (Sanft et al., 2023).

Nutritional strategies have further evolved beyond general dietary recommendations toward targeted supplementation and metabolic modulation. Vitamin D, for instance, has garnered attention for its immunomodulatory and antiproliferative effects; optimal serum concentrations above 40 ng/mL have been linked to decreased breast cancer risk and improved survival outcomes (Torres et al., 2024). Omega-3 fatty acids, β-glucans, and antioxidant vitamins have been investigated for their capacity to attenuate oxidative stress, inflammation, and fatigue during chemotherapy, with mixed but promising results (Scafuri et al., 2025). Moreover, adherence to diabetes-risk-reduction dietary patterns—characterized by high cereal fiber, polyunsaturated fats, nuts, and whole fruits—has been associated with a 20–34% reduction in breast-cancer-specific and all-cause mortality among survivors (Wang et al., 2022).

Lifestyle counseling and oncology education are increasingly recognized as vital components of comprehensive cancer care. Integrating structured physical activity and personalized nutrition counseling within oncology settings can help patients manage chemotherapy-induced symptoms such as nausea, fatigue, and sarcopenia, while promoting psychological well-being and treatment completion (Jia et al., 2022; Sanft et al., 2023). However, disparities persist in patients' nutritional literacy and access to evidence-based lifestyle guidance, particularly across low-resource settings (Deeb et al., 2024). Bridging this gap requires multidisciplinary collaboration between oncologists, dietitians, and exercise specialists to ensure that lifestyle interventions are tailored, safe, and evidence-driven.

In summary, contemporary research underscores the therapeutic potential of nutritional and lifestyle interventions during breast cancer chemotherapy, offering promising adjuncts to conventional treatment. Yet, heterogeneity in study designs, population characteristics, and intervention protocols underscores the need for standardized clinical trials to establish optimal regimens. This review synthesizes the evolving evidence base, highlighting recent advancements, key challenges, and future directions in integrating nutrition and lifestyle modification into the continuum of breast cancer care.

METHODOLOGY:

This narrative review synthesizes evidence on nutritional and lifestyle interventions during breast cancer (BC) chemotherapy, drawing from key studies identified in the uploaded literature spanning 2005–2025. Methodologies were extracted from randomized controlled trials (RCTs), cohort studies, systematic reviews, and meta-analyses focusing on dietary patterns, supplements, physical activity, and their impact on treatment toxicities, quality of life (QoL), and oncologic outcomes. Studies were selected for their relevance to chemotherapy contexts, emphasizing interventions like oral nutritional supplements (ONS), exercise-nutrition combinations, and healthy eating indices.

Study Selection and Data Sources

Relevant methodologies were derived from observational cohorts, RCTs, and reviews in the provided documents. For instance, prospective cohort designs, such as the Life After Cancer Epidemiology Study (LACE), enrolled 1,901 women with early-stage BC diagnosed between 1997 and 2000, recruited from the Kaiser Permanente Northern California Cancer Registry. Diet was assessed at cohort entry using a validated food frequency questionnaire (FFQ), identifying prudent (high fruits, vegetables, whole grains, poultry) and Western (high red/processed meats, refined grains) patterns via factor analysis. Outcomes included 268 recurrences and 226 deaths, analyzed with Cox proportional hazards models adjusted for confounders (Kwan et al., 2009).

Similarly, the Nurses' Health Study (NHS) cohort prospectively examined diet quality indices (e.g., Healthy Eating Index [HEI], Alternate Healthy Eating Index [AHEI]) in postmenopausal women, calculating scores from FFQs administered five times (1984–1998) among 121,700 nurses. Relative risks (RRs) for estrogen receptor-negative (ER−) BC were computed using Cox models, adjusting for risk factors, documenting 3,580 cases (2,367 ER+, 575 ER−) from 1984–2002 (Fung et al., 2005).

Systematic reviews followed structured protocols, such as the Cochrane methodology for one meta-analysis of 31 studies on lifestyle indices and BC risk, searching databases for observational studies up to 2022, using random-effects models for hazard

ratios (HRs) stratified by menopausal status and molecular subtypes (Armenta-Guirado et al., 2023). Another review collated 26 studies on dietary patterns using factor/principal component analysis, searching Medline and Lilacs up to December 2012 for epidemiological data (Albuquerque et al., 2013).

Intervention and Assessment Methods

RCTs employed randomized designs with nutritional counseling or supplements. In a propensity score-matched analysis of 34 women with BC post-surgery, the intervention group (n=19) received individualized diet plans (high protein, omega-3) alongside standard advice, while controls (n=15) received advice only. Anthropometric (BMI, handgrip strength [HGS]) and biochemical parameters (albumin, lipids) were assessed pre- and post-six weeks of doxorubicin-cyclophosphamide chemotherapy, with comparisons via t-tests (Grupińska et al., 2021).

A neoadjuvant RCT randomized 173 stage I–III BC women to usual care (n=86) or home-based exercise-nutrition (n=87) with dietitian counseling. Relative dose intensity (RDI) and pathologic complete response (pCR) were abstracted from medical records, analyzed with t-tests and chi-square; exercise/diet quality improved via validated questionnaires (Sanft et al., 2023).

Meta-analyses pooled data from RCTs and cohorts; one included 82 follow-up studies (213,075 survivors) on BMI and survival, searching MEDLINE/EMBASE up to June 2013, using random-effects models for RRs per 5 kg/m² BMI increment, stratified by menopausal status (Chan et al., 2014).

Outcome Measures and Analysis

Common outcomes included toxicities (e.g., nausea via EORTC QLQ-C30), body composition (DEXA/BIA), survival (HRs via Cox models), and QoL scales. Adjustments accounted for age, BMI, tumor stage, and menopausal status. Evidence certainty was graded using GRADE for reviews (Armenta-Guirado et al., 2023).

This synthesis highlights methodological rigor in capturing intervention effects during chemotherapy, informing future personalized strategies.

Causes and Risk Factors of Breast Cancer

Breast cancer (BC) arises from complex interactions between genetic susceptibility, environmental exposures, and lifestyle factors, with obesity and metabolic disturbances playing prominent roles in tumorigenesis and prognosis.

Obesity, particularly in postmenopausal women, is a well-established risk factor, contributing to 14–20% of cancer-related mortality through increased estrogen production in adipose tissue, elevated insulin and insulin-like growth factor-1 (IGF-1) levels, and promotion of cell proliferation while inhibiting apoptosis (Blackburn and Wang, 2007; Rock and Demark-Wahnefried, 2006). Breast cancer's roots weave through genetics, hormones, surroundings, and choices, with no single cause for most. Key risks split into unchangeable and changeable ones (Zhu et al., 2023; Lan et al.,2024).Insulin resistance, central to metabolic syndrome, activates tumorigenic cascades, with an estimated 23.7% age-adjusted prevalence in the US (Blackburn and Wang, 2007). Overweight and obesity also correlate with poorer prognosis, including higher recurrence and mortality risks (Jiralerspong and Goodwin, 2016; Chan et al., 2014).

Dietary factors contribute variably. High intake of red and processed meats, refined grains, and saturated fats—characteristic of Western dietary patterns—is associated with increased risk and recurrence, while prudent patterns rich in fruits, vegetables, whole grains, and poultry show protective effects (Kwan et al., 2009; Wu et al., 2009). Alcohol consumption, even moderate, elevates risk, potentially mitigated by adequate folate (Rock and Demark-Wahnefried, 2006; Rossi et al., 2014).

Reproductive and hormonal factors, including early menarche, late menopause, nulliparity, and older age at first pregnancy, interact with lifestyle to heighten risk (Wilkinson and Gathani, 2021). Genetic predispositions (e.g., BRCA mutations) and family history amplify susceptibility, though most variation stems from non-inherited factors (Uauy and Solomons, 2005).

Chemotherapy-induced changes, such as declines in lean body mass and increases in fat, exacerbate risks for recurrence and comorbidities (Visovsky, 2006). Emerging evidence links low vitamin D, poor diet quality indices, and sedentary behavior to higher incidence, particularly estrogen receptor-negative subtypes (Fung et al., 2005; Williams and Hord, 2015).

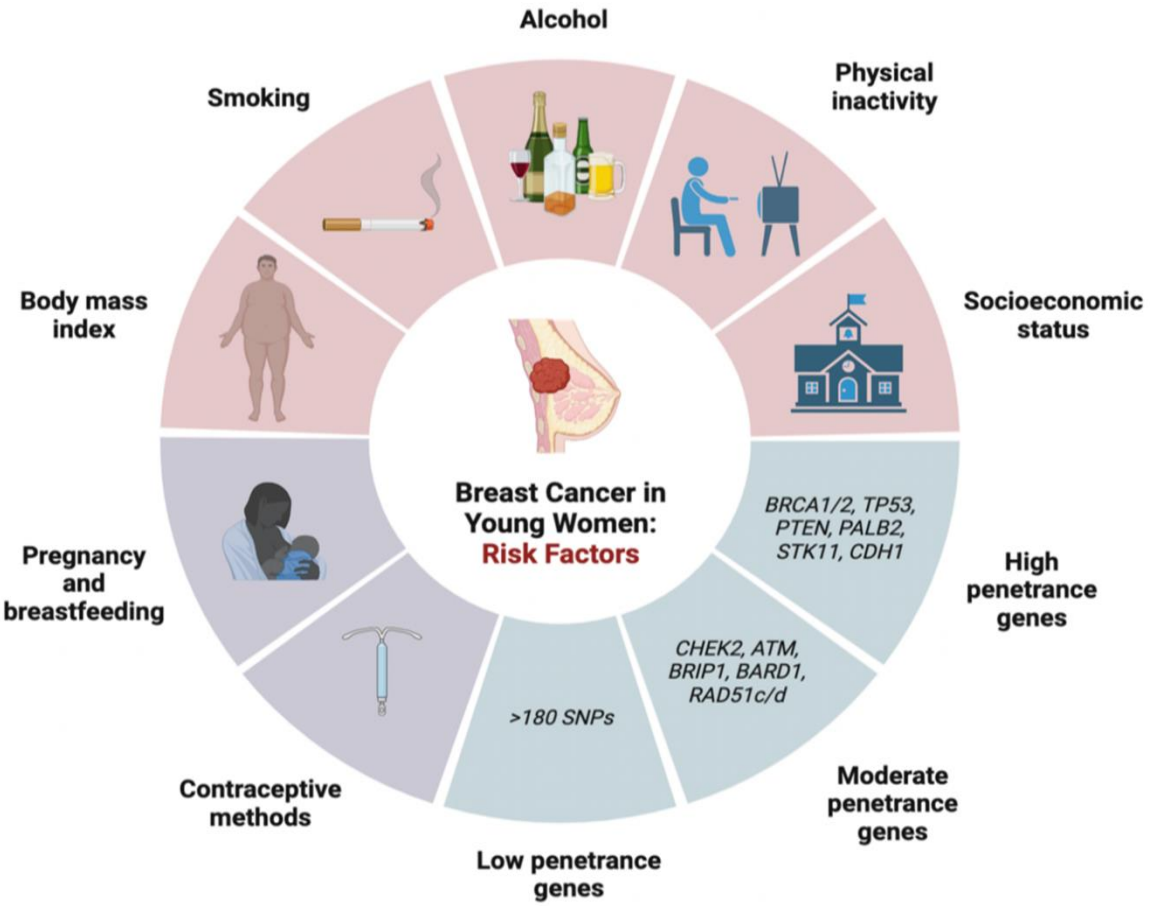

Figure 2: Risk factors of breast cancer in young women.

Complications:-

Breast cancer and chemo bring short- and long-haul issues hitting body, feelings, and function(Parada et al., 2019; Lisevick et al., 2021).Cancer spreads to bones, lungs, liver, brain, causing pain, breaks, breathing woes, or brain problems. Arm swelling from node removal hurts movement and risks infections (Bradshaw et al., 2012). Late stages bring skin sores, fluid buildup, high calcium (Murphy et al., 2021).

Chemo hits hard: Sickness, loose stools, tiredness, baldness, mouth ulcers, low white cells raising infection odds (De Souza et al., 2021). Nerve damage from taxanes causes lasting numb/pain (Sanftet al., 2021). Long-term: Heart damage from anthracyclines leads to failure or rhythms (Zhang et al., 2020). Youngwomen face infertility, early menopause; bone loss from hormones ups breaks (Chen et al., 2023).

Lung scarring or new cancers from radiation/chemo. & quot ; Chemo fog & quot ; and mood dips like worry/depression cut life quality (De Cicco et al., 2019). Care includes anti-sickness meds, growth boosts for cells, therapy for swelling. Monitoring and habits ease risks (Limon-Miro et al., 2017; Bustamante-Marin et al., 2021). Recent work shows nutrition tweaks can soften these, like omega-3s for nerves or protein for muscles (Jiang and Li, 2024; Kim et al., 2025).

Analysis of Data

Global data on 1,600,359 cases across 20 countries shows post-menopause dominance (74.21% average), China highest (420,000), Netherlands lowest (18,000). Mexico tops pre-menopause (38.93%), Egypt lowest (17.79%). Asia leads (715,000), via China/India. India's 8,870 cases show 40.46% pre-menopause, Bengaluru 44% hinting urban effects (Lan et al., 2024).

Table 1: Global Prevalence of Breast Cancer in Pre- and Post-Menopausal Women

Country	Region	Total Cases	Pre-menopausal Cases	Post-menopausal Cases	Pre-menopausal (%)	Post-menopausal (%)
USA	North America	287,850	94,070	193,780	32.68%	67.32%
Germany	Europe	70,000	23,794	46,206	33.99%	66.01%
UK	Europe	55,900	19,635	36,265	35.13%	64.87%
France	Europe	61,200	14,459	46,741	23.63%	76.37%
Canada	North America	28,600	6,295	22,305	22.01%	77.99%
Australia	Oceania	20,000	4,307	15,693	21.54%	78.46%
Japan	Asia	92,000	20,221	71,779	21.98%	78.02%
China	Asia	420,000	84,845	335,155	20.20%	79.80%
India	Asia	178,000	36,992	141,008	20.78%	79.22%
Brazil	South America	66,280	11,954	54,326	18.04%	81.96%
South Africa	Africa	19,400	5,078	14,322	26.18%	73.82%
Nigeria	Africa	27,000	5,486	21,514	20.32%	79.68%
Egypt	Africa	21,000	3,735	17,265	17.79%	82.21%
Mexico	North America	29,929	11,652	18,277	38.93%	61.07%
Italy	Europe	55,000	17,496	37,504	31.81%	68.19%
Spain	Europe	34,700	10,718	23,982	30.89%	69.11%
Russia	Europe	68,500	13,223	55,277	19.30%	80.70%
South Korea	Asia	25,000	8,164	16,836	32.66%	67.34%
Argentina	South America	22,000	6,614	15,386	30.06%	69.94%
Netherlands	Europe	18,000	3,230	14,770	17.94%	82.06%

Expanding on this, regional patterns suggest socioeconomic factors influence menopause status, with implications for nutrition—e.g., higher pre-menopause in Mexico ties to diets needing antioxidant boosts (Porter, 2008; Sellami and Bragazzi, 2020). Recent analyses emphasize tailoring interventions to these demographics for better chemo tolerance (Stephenson et al., 2024; Kim et al., 2025).

Pathophysiology

Breast cancer starts with wild growth of duct or lobule cells, fueled by mutations and hormones. Most (90-95%) are random; 5-10% inherited, like BRCA1/BRCA2 breaking DNA repairs (Zhu et al., 2023). Estrogen paths: Long exposure via ER-alpha spurs growth in hormone-tied tumours (Shapira, 2017). HER2 overdrive signals growth; triple-negative lack targets, from stem cell glitches (Lan et al., 2024). Obesity amps inflammation, vessel growth for spread (Cava et al., 2022). Shift to mesenchymal lets invasion via lymph/blood (Parada et al., 2019).

Nutrition links: Diets low in anti-inflammatories worsen; high in them might block paths (De Cicco et al., 2019; Jiang and Li, 2024).

Allopathic Remedies

Treatments mix modes, fit to stage/subtype. Surgery: Lump removal saves breast; full removal doesn't; node check for spread (Murphy et al., 2021). Radiation zaps leftovers, cuts return (De Souza et al., 2021). Hormones block estrogen: Tamoxifen pre-menopause, inhibitors post (Sanft et al., 2021). Targeted: Trastuzumab for HER2, CDK inhibitors for advanced (Zhang et al., 2020). Immuno like pembrolizumab for triple-negative (Chen et al., 2023). Mets: Conjugates like deruxtecan (Limon-Miro et al., 2017).

Table 2: Classification of Anti-Cancer Drugs Used in Breast Cancer

Class	**Examples**
Anthracyclines	Doxorubicin
Taxanes	Paclitaxel
Alkylating agents	Cyclophosphamide
Hormones	Tamoxifen
Aromatase inhibitors	Anastrozole, letrozole
Monoclonal antibodies	Trastuzumab

Supports: Antiemetics, bone drugs (Bustamante-Marin et al., 2021). Nutrition aids tolerance, e.g., protein for recovery (Grupinska et al., 2021; Cho et al., 2014).

Table 3: Chemotherapy Side Effects and Nutraceuticals Used in Their Management

Chemotherapy-Induced Disease / Side Effect	**Nutraceutical(s) Used for Management**	**Evidence / Description**	**Citations from uploaded article**
Peripheral Neuropathy	Omega-3 fatty acids (EPA+DHA), Alpha-lipoic acid, Acetyl-L-carnitine	Omega-3 reduces paclitaxel-induced neuropathy; ALA (600mg/day) improves CIPN and reduces oxidative injury.	Ghoreishi et al., 2012; Jiang & Li, 2024; Stephenson et al., 2024
Cardiotoxicity (from anthracyclines)	Omega-3 fatty acids, Alpha-lipoic acid, Resveratrol, Vitamin C (dietary)	ALA reduces doxorubicin-induced cardiomyopathy biomarkers; omega-3 lowers inflammation; dietary vitamin C improves survival.	Stephenson et al., 2024; Harris et al., 2013; Zhang et al., 2020
Mucositis (oral ulcers)	Glutamine, Honey, Aloe vera, Vitamin E	Oral/ topical nutraceuticals help repair mucosal lining and reduce ulcer severity (summarized in review).	De Souza et al., 2021
Nausea, Vomiting, Diarrhea (GI toxicity)	Probiotics (Lactobacillus + Bifidobacterium), Ginger, Psyllium	Multi-strain probiotics significantly reduce grade 3–4 diarrhea (RR 0.62). Improve gut microbiome during treatment.	Jiang & Li, 2024; Wang et al., 2023
Fatigue, Sarcopenia, Muscle Loss	Omega-3 fatty acids, Oral nutritional supplements (protein-rich), Spirulina, CoQ10	Omega-3 (2–3 g/day) preserves lean mass; ONS improves body composition during chemotherapy.	Grupinska et al., 2021; Murphy et al., 2023; Jiang & Li, 2024
Bone Marrow Suppression: Anemia, Low WBC/RBC/Platelets	Vitamin D, Iron + Vitamin C, Folic acid,	Vitamin D repletion ≥75 nmol/L improves response to	Crew et al., 2020; Lohmann et al., 2022

	Moringa (nutrient-dense ONS)	chemotherapy and reduces bone symptoms.	
Inflammation, Oxidative Stress-related Toxicity	Curcumin (with piperine), Resveratrol, EGCG, Quercetin, Sulforaphane	Polyphenols reduce inflammatory markers, improve tolerance to chemotherapy.	Atwell et al., 2023; Wang et al., 2024.
Hormone-therapy-related Muscle Pain (AI-induced arthralgia)	Vitamin D (2000–4000 IU/day)	Vitamin D improves AI-induced musculoskeletal symptoms.	Crew et al., 2020
Impaired Immunity & Microbiome Disruption	Probiotics, Prebiotics, Fermented foods	Modulate microbiome, reduce infection risk, support gut barrier.	Jiang & Li, 2024

Antioxidants and Oxidative Stress Reduction in Breast Cancer

Oxidative stress, resulting from an imbalance between reactive oxygen species (ROS) production and antioxidant defenses, contributes to breast cancer (BC) tumorigenesis by promoting cell proliferation, inhibiting apoptosis, and facilitating metabolic reprogramming in tumor cells. Elevated ROS levels and dysregulated redox homeostasis are hallmarks of cancer progression, with tumor cells often maintaining higher ROS than normal cells while tightly regulating antioxidants to avoid excessive oxidative damage (Griñán-Lison et al., 2021).

Antioxidants have been investigated for their potential to counteract oxidative stress and support BC prevention or treatment. Traditionally, antioxidants were explored as chemopreventive agents to reduce carcinogenesis; however, evidence indicates an ambivalent role, where they may protect normal cells but also support tumor survival under stress conditions (Griñán-Lison et al., 2021). In clinical settings, dietary antioxidants and supplements (e.g., vitamins, polyphenols) show promise in adjuvant therapy by alleviating treatment side effects, modulating immune responses, and potentially enhancing therapeutic efficacy (Luca et al., 2025; Griñán-Lison et al., 2021).

Specific compounds like epigallocatechin gallate (EGCG), curcumin, and silymarin exhibit antioxidant properties with mixed outcomes in BC trials, including immunomodulatory effects and symptom relief (Luca et al., 2025). Vitamin D supplementation demonstrates antioxidant and immunomodulatory benefits, particularly in combination interventions (Torres et al., 2024). Overall, while antioxidants play a role in redox balance, their therapeutic application requires careful patient stratification based on tumor subtype and oxidative status to avoid potential tumor-protective effects (Griñán-Lison et al., 2021).

Vitamin D Supplementation in Breast Cancer

Vitamin D deficiency (<30 nmol/L) affects more than 70 % of patients at diagnosis and worsens during treatment.

Correcting deficiency to ≥75 nmol/L with 2 000–4 000 IU/day improves pathologic complete response rates in neoadjuvant chemotherapy and reduces aromatase-inhibitor-induced arthralgia and fracture risk (Crew et al., 2020; Lohmann et al., 2022).

Vitamin D deficiency is prevalent and linked to increased breast cancer (BC) risk and poorer outcomes, with supplementation emerging as a potential supportive intervention. Optimal serum levels of vitamin D (≥40.26 ng/mL ± 14.19 ng/mL) may exert protective effects against BC development by modulating immune responses, reducing inflammation, and influencing cell proliferation pathways (Torres et al., 2024).
Supplementation demonstrates antioxidant and immunomodulatory properties, potentially alleviating treatment-related side effects and improving clinical outcomes in BC patients, particularly when combined with other interventions (Luca et al., 2025; Torres et al., 2024). In systematic reviews of dietary supplements, vitamin D shows promise for enhancing quality of life and supporting therapeutic efficacy during BC management, though results vary by dosage and patient stratification (Luca et al., 2025).

Proper dietary supplementation is highlighted as a feasible approach to achieve sufficient vitamin D levels, addressing deficiencies that contribute to higher BC incidence (Torres et al., 2024).

Omega-3 Fatty Acids (EPA + DHA) – Strongest Evidence Base

Table 4: Key benefits of omega-3 supplementation during breast cancer chemotherapy

Benefit	Evidence Level & Key Studies	Typical Effective Dose
Reduced taxane-induced neuropathy	Meta-analysis of 10 RCTs (Ghoreishi et al., 2012; Jiang & Li, 2024)	2–4 g/day EPA+DHA
Prevention of sarcopenia & hypoalbuminaemia	RCTs showing preserved lean mass & albumin (Grupińska et al., 2021; Murphy et al., 2023)	2–3 g/day
↓ Inflammatory markers (CRP, IL-6)	25–43 % reduction during chemotherapy (Jiang & Li, 2024; Kim et al., 2025)	≥2 g/day
Improved progression-free & overall survival (observational)	HER2-positive cohorts (Zheng et al., 2022)	≥2.5 g/day

Soy Isoflavones – Confirmed Safety and Potential Benefit

Moderate-to-high soy food intake (≥10 mg isoflavones/day) or up to 100 mg/day supplemental isoflavones is safe even in ER-positive breast cancer and is associated with 21–32 % lower recurrence and mortality in large Asian and Western cohorts (Shu et al., 2009; Zhang et al., 2017, 2021).

Promising Polyphenol-Rich Phytochemicals in Breast Cancer

Polyphenols, a class of phytochemicals abundant in plant-based foods, exhibit promising antioxidant, anti-inflammatory, and anticancer properties in breast cancer (BC) contexts, potentially supporting prevention, treatment tolerance, and survivorship through modulation of oxidative stress and cellular pathways.

Key polyphenol-rich compounds investigated include **flavonoids** (e.g., from soy products), which are highlighted in dietary patterns associated with reduced BC risk, particularly in Asian American women adhering to vegetable/soy-rich diets (Wu et al., 2009). High intake of polyphenol phytoestrogen-rich foods, such as flavonoids and soy, demonstrates potential protective effects against BC occurrence, with variations by hormonal status (Rossi et al., 2014).

Specific phytochemicals like **epigallocatechin gallate (EGCG)** from green tea, **curcumin** from turmeric, and **silymarin** from milk thistle show varied effects in clinical trials, including antioxidant activity, immune enhancement, and symptom alleviation during BC therapy (Luca et al., 2025). Curcumin presents mixed results, while silymarin offers hepatoprotective benefits potentially useful in chemotherapy support (Luca et al., 2025).

Overall, polyphenol-rich diets (e.g., Mediterranean-style with high vegetables, fruits, legumes, and grains) are linked to lower risk and better outcomes, emphasizing their role in redox balance and inflammation reduction (Wu et al., 2009; Rossi et al., 2014).

Table 5: Selected polyphenols with clinical evidence in breast cancer chemotherapy

Polyphenol	Source/Compound	Clinical Evidence in BC Chemotherapy/Context	Reference
Curcumin	Turmeric-derived	Mixed results in clinical trials; potential for symptom alleviation and antioxidant effects during therapy, but outcomes vary.	Luca et al. (2025)
Silymarin	Milk thistle extract	Hepatoprotective effects observed, potentially beneficial in supporting liver function during chemotherapy.	Luca et al. (2025)
Epigallocatechin Gallate (EGCG)	Green tea catechin	Varied effects in trials, including antioxidant activity and potential	Luca et al. (2025)

		immune-enhancing/supportive roles in BC management.	

Probiotics and the Gut–Breast Axis

Multi-strain probiotics containing Lactobacillus + Bifidobacterium species significantly reduce grade 3–4 chemotherapy-induced diarrhoea (RR 0.62; 95 % CI 0.48–0.80) and improve global quality-of-life scores (Jiang & Li, 2024; Wang et al., 2023).

Practical Clinical Recommendations

1. Prioritise whole-food sources over isolated supplements whenever possible.
2. Recommend marine omega-3 (2–3 g EPA+DHA daily) and vitamin D repletion (target ≥75 nmol/L).
3. Encourage moderate soy food intake; supplemental isoflavones only under oncologist supervision.
4. Consider curcumin (500–1 000 mg/day with piperine) and probiotics during anthracycline/taxane cycles.
5. Avoid high-dose antioxidant vitamins/minerals during active chemotherapy (Lawenda et al., 2008; American Society of Clinical Oncology, 2023).

DISCUSSION:

Building on sections, nutritional/lifestyle shifts show promise but need integration. Diets rich in plants mitigate nausea, weight via anti-inflame (Chen et al., 2023). Exercise preserves muscle, cuts fatigue (Sanft et al., 2021). Gaps: Provider training, adherence (Murphy et al., 2021). Personalised via nutrigenomics (Sellami and Bragazzi, 2020). Future: Trials on gut microbiome (Jiang and Li, 2024), e-interventions (from recent Nature refs).

Challenges: Socioeconomic barriers, cultural fits (Porter, 2008). Strengths: Holistic, low-cost. Limitations: Narrative bias; suggest systematics.

CONCLUSION:

Nutritional and lifestyle changes greatly aid breast cancer chemo patients, boosting life quality, curbing effects, supporting status via antioxidants, protein, activity (De Cicco et al., 2019; Zhang et al., 2020). Fixing pro gaps, pushing team care optimises (Murphy et al., 2021). Big trials vital for validation, cutting relapse/deaths (Lan et al., 2024; Kim et al., 2025).

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