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Dietary Modifications on Chemotherapy Toxicity Management Among Breast Cancer Survivors: A Qualitative Study

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Research Article

Keywords: diet, dietary modification, dietary guidance, breast cancer survivors, chemotherapy, social determinants of health

Posted Date: November 4th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11079692/v1

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Additional Declarations: No competing interests reported.

Abstract

Background

As breast cancer survival rates improve, increased chemotherapy use has heightened the risk of experiencing toxicities. While there is growing interest in implementing dietary strategies to alleviate these toxicities, no established dietary guidelines currently exist. Limited research has explored how breast cancer survivors perceive and use dietary modifications and guidance during chemotherapy.

Methods

We conducted a qualitative study to explore breast cancer survivors' perceptions of dietary modification during chemotherapy. Interviews were conducted via Zoom, transcribed verbatim, and analyzed using qualitative descriptive methodology with conventional content analysis.

Results

Twenty-one breast cancer survivors participated in the study. Participants were women with invasive breast cancer, predominantly White, well-educated (> high school), and privately insured. Most had triple-negative breast cancer and were receiving neoadjuvant chemotherapy. Four main themes were derived from the data: 1) navigating chemotherapy, 2) dietary support, 3) social and environmental determinants of diet, and 4) perceptions of specific dietary patterns.

Conclusions

Findings highlight how survivors navigate dietary modification during chemotherapy and the challenges they encounter doing so. The data revealed key gaps in dietary support for survivors. These insights have the potential to inform practical, specific dietary recommendations tailored to the unique needs and lived experiences of patients undergoing chemotherapy.

Background

Breast cancer remains the most diagnosed malignancy among women in the United States [1]. As the number of survivors continues to rise annually, preserving quality of life (QOL) becomes incredibly important [1]. This focus is particularly critical in the context of treatment-related toxicities. This paper uses the term "toxicity" to refer to the harmful effects that chemotherapy drugs have on normal, healthy cells due to their toxic composition, resulting in unpleasant effects such as nausea, fatigue, and organ damage [2, 3]. As the use of neoadjuvant chemotherapy in breast cancer treatment has increased 14.7% since 2006, a growing number of patients are experiencing treatment toxicities [4]. While advancements in chemotherapy have led to more effective and less toxic regimens, treatment still damages healthy

cells and results in significant toxicities such as nausea, diarrhea, and fatigue [5, 6]. Studies indicate that between 86% and 97.4% of survivors face at least one toxicity, often beginning as early as the first treatment cycle, and many breast cancer survivors report these toxicities as debilitating or persistent [5, 7]. Additionally, the average duration of chemotherapy has increased to six months, with an increased average of 12.5 cycles per treatment [4]. The extension of treatment duration and higher cumulative dosage further elevate the risk and severity of toxicities [8].

Although pharmacological treatments are available to manage chemotherapy toxicities, such as nausea and vomiting, their effectiveness varies, and many symptoms often persist despite their use [5]. For example, anti-nausea medications may help reduce post-chemotherapy vomiting but often do little to improve nausea [9, 10]. This distinction is critical, as up to 80% of chemotherapy patients report that nausea significantly impacts their QOL [9, 10]. Furthermore, pharmacological interventions can contribute to the overall financial burden of cancer care [9]. One retrospective cohort study of 19,139 patients found the estimated mean costs of chemotherapy induced nausea and vomiting (CINV) visits, including inpatient, outpatient, and emergency room visits to be $5299 for the first chemotherapy cycle (a period up to 30 days) and mean per-patient CINV-associated costs to be $731 [11].

In recent years, nonpharmacological therapies, such as dietary interventions, have been increasingly explored as strategies to manage chemotherapy toxicities and are generally well tolerated [9]. However, studies have shown mixed results regarding the effectiveness of dietary modification during chemotherapy, and there is currently insufficient evidence to support or oppose any particular dietary intervention for alleviating toxicities [12, 13]. Despite this, the National Cancer Institute (NCI) reports that patients who maintain good nutrition during chemotherapy tend to better tolerate treatment toxicities [8]. Nonetheless, nutritional interventions remain insufficiently integrated into oncology care, often due to systemic issues such as understaffing of dietitians and lack of standardized guidelines [13, 14].

To develop realistic and standardized dietary guidelines for breast cancer survivors, it is essential to first understand how they perceive diet as a strategy for managing treatment-related toxicities. Although research has shown that breast cancer survivors frequently adopt self-initiated dietary changes, such as reducing fat, red meat, and sugar intake, there remains a lack of comprehensive understanding of the underpinnings, challenges, and contextual factors that shape these decisions [15–17]. Such dietary changes often occur without structured guidance and are influenced by barriers such as individuals' physical environment, community influences, financial resources, and personal perceptions about dietary change [18–20].

There is limited research on how breast cancer survivors perceive and utilize dietary modification and guidance during chemotherapy, particularly for managing the related toxicities. Among the current literature, various forms of fasting have shown preliminary efficacy in reducing chemotherapy toxicities [21, 22]. Two RCTs demonstrated fasting reduced mouth sores, diarrhea, vomiting and nausea, long-term weight gain, insomnia, and fatigue. However, more robust evidence is needed to determine whether fasting is a realistic option for cancer survivors [23, 24]. To assess its realistic integration into oncology

care, we asked participants about their perceptions of fasting during treatment. We also asked about their perceptions of maintaining a generally healthy diet given the widespread use of self-initiated dietary strategies among breast cancer survivors and the NCI's general recommendation to maintain good nutrition [8, 15–17]. We used a qualitative approach to explore these gaps [25].

This study aimed to 1) explore diet modifications used among breast cancer survivors; 2) explore breast cancer survivors' perceptions of dietary modification during chemotherapy; and 3) understand the barriers breast cancer survivors' experience with diet and dietary modification.

Methods

Participants and recruitment

This was a qualitative study with adult breast cancer survivors (age ≥ 18 years) receiving chemotherapy treatment from the University of Pennsylvania Health System (Penn Medicine). The study was approved by the IRB at the University of Pennsylvania. We utilized the Standards for Reporting Qualitative Research (SRQR) checklist to guide the study procedures [26].

We used purposive sampling to recruit participants [27]. The study was first introduced to clinicians, who then recommended potential participants to the study team. The first author (J.A.) contacted potential participants and conducted chart reviews to assess initial eligibility. Those who met preliminary criteria based on EMR data were then contacted by phone and email for further screening and invited to participate. The inclusion criteria were: 1) breast cancer survivors who been on chemotherapy for at least four weeks or completed chemotherapy within the past three months; 2) no other active cancer diagnosis; 3) no history of disordered eating, an eating disorder, or chemotherapy-related malnutrition; and 4) willing to participate in a 30-minute recorded interview. The exclusion criteria were: 1) received radiation in combination with chemotherapy; 2) difficulty maintaining a healthy weight in the past three months; and 3) non-English speaking.

Once participants signed an informed consent form, Zoom interviews were scheduled. A $30 Visa gift card was offered to participants at the end of the interview to compensate them for their time. The number of interviews was determined by ongoing analysis and concluded once data saturation was achieved at 21 participants [27–29].

Data collection

Semi-structured interviews were conducted by one researcher (J.A.) between February and April 2025. The interviewer is a registered nurse currently in the third year of a PhD nursing program, trained by the second author (S.A.) to ensure consistency and fidelity throughout the interview process. A semi-structured interview guide was initially developed by the first author (J.A.) and reviewed and revised by the 3rd (K.L.) and the last author (J.D.). It consisted of a series of open-ended questions about breast

cancer survivors' experiences and perceptions of implementing dietary modifications during chemotherapy to reduce or avoid chemotherapy toxicities. At the end of the interview, participants had the opportunity to share any additional thoughts. Interviews lasted approximately 30 minutes and were recorded via Zoom. One researcher (J.A.) transcribed the recordings verbatim. All transcripts were cross-checked to the recordings by two researchers.

Demographic data such as age, sex, race/ethnicity, income, education level, occupation, insurance status, residency (urban or rural), housing stability, and dietary restrictions were collected through a questionnaire administered via REDCap directly prior to the interviews. Disease and treatment information was collected via chart review and recorded in a separate form.

Analysis

Data were analyzed utilizing qualitative descriptive methodology with conventional content analysis. This methodology is ideal for providing rich participant descriptions upon which future interventions can be developed [27, 30]. We used the qualitative data analysis software ATLAS.ti to organize data analysis.

Analysis began as soon as the first interview was complete and continued with ongoing interviews. Two authors independently analyzed the data to develop an initial set of codes drawn directly from participants' language [27]. All codes were amended through discussion between the two researchers, and a third reviewed any further discrepancies and finalized codes. Once finalized, the codes were clustered into broader categories, then themes were developed by analyzing the relationship between and among the categories. Three authors reviewed and refined the themes. To ensure the themes accurately reflected the experiences of breast cancer survivors, they were also member-checked with two participants.

Results

During recruitment, the first author (J.A.) contacted 50 potential participants, each up to two times. Of those, 26 completed the phone screening. Four participants did not attend their scheduled interviews. One additional participant was excluded from analysis after rescheduling their interview and no longer meeting the inclusion criteria. In total, 21 participants were included in the study.

As presented in Tables 1–3 participants were women diagnosed with invasive breast cancer, with a mean age of 49.7 years. The majority were White, had higher levels of education (> high school), and were privately insured. Most had triple-negative breast cancer and were receiving neoadjuvant chemotherapy as part of the KEYNOTE-522 regimen [31]. None reported housing instability, and most had reliable transportation to oncology appointments and did not experience food insecurity.

Table 1
Demographics.

Variable		**Total (n = 21)**
Sex	Female	21 (100.0%)
Age	N	21
	Mean	49.7
	STD	15.99
	Min	25.0
	Max	80
Race	Asian	1 (4.8%)
	Black or African American	7 (33.3%)
	White	12 (57.1%)
	More than one race	1 (4.8%)
Ethnicity	Not Hispanic	19 (90.5%)
	Do not care to respond	2 (9.5%)
Education	11	1 (4.8%)
	12 (high school)	1 (4.8%)
	16 (college)	5 (23.8%)
	18 (master)	11 (52.4%)
	19	1 (4.8%)
	20 (doctorate)	2 (9.5%)
Marital Status	Single	7 (33.3%)
	Single, living with partner	1 (4.8%)
	Married	12 (57.1%)
	Widowed	1 (4.8%)
Employment	Employed full time	15 (71.4%)
	Retired	4 (19.0%)
	Unemployed	2 (9.5%)

Variable		Total (n = 21)
Area of Residence	City	10 (47.6%)
	Country	2 (9.5%)
	Suburb	9 (42.9%)
Who do you live with?	Alone	5 (23.8%)
	With a significant other	9 (42.9%)
	With children (≤ 18)	5 (23.8%)
	With adult children (> 18)	2 (9.5%)
Distance to treatment center	10–30 minutes	8 (38.1%)
	31 minutes - an hour	8 (38.1%)
	over 1-hour	5 (23.8%)
Inadequate transportation to appointments	No - I never had to miss an appointment	19 (90.5%)
	Yes - I missed an appointment due to transportation	2 (9.5%)
Ever used or smoked tobacco?	No	14 (66.7%)
	Yes	7 (33.3%)
Ever drink alcohol?	No	6 (28.6%)
	Yes	15 (71.4%)
Insurance coverage	Medicare	5 (23.8%)
	Medicaid	1 (4.8%)
	Private Insurance	12 (57.1%)
	HMO	2 (9.5%)
	Other	1 (4.8%)
Medical problems aside from cancer (e.g. HTN DM Obesity)	No	11 (52.4%)
	Yes	10 (47.6%)
Household income	$10,000 or less	1 (4.8%)
	$10,001 to $ 20,000	1 (4.8%)

Variable		Total (n = 21)
	$20,001 to $ 30,000	1 (4.8%)
	$30,001 to $40,000	1 (4.8%)
	$50,001 to $60,000	6 (28.6%)
	Do not care to respond	11 (52.4%)

Table 2
Food Security.

Variable		Total (n = 21)
To what extent is the following true in the past 12 months…		
Food didn’t last and I didn’t have money to get more	Sometimes true	3 (14.3%)
	Never true	18 (85.7%)
Couldn’t afford balanced meals	Sometimes true	4 (19.0%)
	Never true	17 (81.0%)
Cut or skip meals because there wasn’t enough money for food	No	20 (95.2%)
	Yes	1 (4.8%)
If yes, how often did you cut meals	Some months but not every month	1 (100.0%)
Ate less because there wasn’t enough money for food	No	19 (90.5%)
	Yes	2 (9.5%)
Didn’t eat when hungry due to money	No	19 (90.5%)
	Yes	2 (9.5%)

Table 3
Clinical Information.

Variable		**Total (n = 21)**
Cancer type	Invasive breast cancer	21 (100%)
Menopause status	pre-menopausal	11 (52.4%)
	post-menopausal	10 (47.6%)
Breast cancer location	Left	9 (42.9%)
	Right	11 (52.4%)
	Bilateral	1 (4.8%)
Cancer stage	IA	1 (4.8%)
	IIA	6 (28.6%)
	IIB	9 (42.9%)
	IIIA	3 (14.3%)
	IIIC	1 (4.8%)
	X (unstageable)	1 (4.8%)
Hormone status	Triple negative	10 (47.6%)
	HR+ HER2 negative	6 (28.6%)
	HR+/- HER2 positive	5 (23.8%)
Chemotherapy	Docetaxel + Carboplatin + Trastuzumab +Pertuzumab	2 (9.5%)
	Audo-trastuzumab emtansine (Kadcyla)*	1 (4.8%)
	Doxorubicin + Cyclophosphamide followed by Carboplatin + Paclitaxel + Pembrolizumab (Keynote 522)	10 (47.6%)
*participant received both neoadjuvant and adjuvant chemotherapy		

Variable		Total (n = 21)
	Dose-dense Doxorubicin + Cyclophosphamide followed by Paclitaxel (ddAC-T)	3 (14.3%)
	Docetaxel + Cyclophosphamide	1 (4.8%)
	Pembrolizumab + Carboplatin + Docetaxel	1 (4.8%)
	Docetaxel + Carboplatin + Trastuzumab + Pertuzumab and Kadcyla	1 (4.8%)
	Carboplatin Paclitaxel Pembrolizumab (Keynote 522 without the Doxorubicin + Cyclophosphamide portion)	1 (4.8%)
	Docetaxel + Carboplatin + Trastuzumab	1 (4.8%)
Line of treatment	Neoadjuvant	15 (71.4%)
	Adjuvant	5 (23.8%)
	Both neoadjuvant and adjuvant	1 (4.8%)
Surgery	No	11 (52.4%)
	Yes	10 (47.6%)
Hormone therapy	No	18 (85.7%)
	Yes	3 (14.3%)
Targeted drug therapy	No	20 (95.2%)
	Yes	1 (4.8%)
Immune checkpoint inhibitors	No	10 (47.6%)
	Yes	11 (52.4%)
*participant received both neoadjuvant and adjuvant chemotherapy		

Themes

Four main themes were derived from the data set: navigating chemotherapy, dietary support, social and environmental determinants of diet, and perceptions of specific dietary patterns. Each theme is broken down into two subthemes.

Theme 1: Navigating chemotherapy

This theme consists of two subthemes that describe survivors' experience with and management of chemotherapy toxicities (subtheme 1A) and dietary modifications practiced by patients (subtheme 1B).

Subtheme 1A: Experience with and management of chemotherapy toxicities

Participants described experiencing chemotherapy toxicities with the most common being fatigue, nausea, taste alterations (foods tasting metallic, bitter, or bland), constipation, diarrhea, neuropathy, physical weakness, and fluctuations in weight (both gain and loss). Symptoms such as fatigue, gastrointestinal disturbances, and taste alterations were frequently linked to disruptions in dietary intake and food preferences.

When probed about toxicity management, most participants reported that their oncology teams prescribed medications such as Zofran (a commonly prescribed anti-nausea medication). Some patients mentioned the medications were effective, but a few survivors mentioned "the medications they gave… didn't work" (P1) and the toxicities continued to affect their daily routines and eating behaviors.

Although they were provided pharmacological support, few participants were made aware of alternative strategies to manage their chemotherapy-induced toxicities. They expressed a desire to receive alternative and complementary approaches to manage toxicities (Supplementary Table 1). Besides receiving medication from their provider, participants identified strategies from other resources such as hospital posters or informal sources to manage chemotherapy toxicities. This included exercise, massage, reiki, acupuncture, chewing mints, and aromatherapy (incense) (Supplementary Table 1). Additionally, sleep was frequently mentioned as both a coping mechanism and a way to temporarily relieve symptoms.

Subtheme 1B: Dietary modifications practiced by patients

Participants described making changes, whether intentional or not, to their diets during chemotherapy. Many decided to incorporate what they described as a healthier diet by adding "real food, fruits, vegetables…more protein, more fiber, good fats, [and] things…like that " (P22), while removing "like processed [foods]…refined sugars…stuff like that, " (P2) and "stopped eating fried food as much " (P18). They wanted to fuel their body to better cope with the physical toll of treatment (Supplementary Table 1).

Participants frequently reported increasing their liquid intake during chemotherapy, both to stay hydrated and to “help flush out my system” of the chemotherapy (P7). Others increased intake of drinks perceived to have health-promoting properties (Supplementary Table 1). Most participants, however, reported making unintentional changes due to the toxicities they experienced. Many participants noted that familiar foods no longer tasted the same and became less appealing. Taste alterations typically reduced their overall intake (Supplementary Table 1). One participant described how she even switched to “plastic silverware in instead of the traditional silverware” to reduce the metallic taste she experienced while eating (P6).

Some developed strong aversions to hot foods, describing them as more difficult to taste or more likely to induce nausea. As a result, cold foods like smoothies became more appealing and easier to tolerate. Others reported an increased reliance on processed foods, noting that these were sometimes the only foods their bodies found palatable (Supplementary Table 1).

Participants often linked their reduced desire to eat to fatigue (Supplementary Table 1). In addition to suppressing appetite, fatigue led many participants to prefer meals that were both comforting and easy to prepare (Supplementary Table 1). Some participants began ordering takeout more frequently to cope with low energy levels. In contrast, others avoided takeout due to symptom triggers (Supplementary Table 1). Several participants described turning to home cooking as a way to regain control over ingredients and reduce symptom exacerbations (Supplementary Table 1). Beyond fatigue, participants also described emotional stress as a contributing factor in their shift toward comfort foods (Supplementary Table 1).

Furthermore, gastrointestinal symptoms such as nausea or altered bowel patterns were described as “dictat[ing]…what I eat in a given day” (P22). Some described that they “won’t eat anything” (P19) while feeling nauseous. Although some participants reduced their intake, others intentionally increased consumption to avoid nausea from an empty stomach. Other participants adopted strategies such as “switch[ing] to more blander foods [and] more frequent meals” (P23) to manage nausea. One participant described that she “found that carbs actually made me more nauseous. And so… that was something I… cut [out of my diet]”. This participant “found protein was really helpful” in reducing nausea (P2).

Theme 2: Dietary support

This theme consists of two subthemes that explore survivors’ experience receiving dietary advice and guidance (subtheme 2A) and attitudes towards dietary change (subtheme 2B).

Subtheme 2A: Experience receiving dietary advice and guidance

A few participants received general guidance from their oncology providers. When they discussed the guidance received from their providers, they felt the advice lacked specificity. Providers who initiated conversations about diet addressed the topic briefly and left participants uncertain about how to

interpret or implement the advice (Supplementary Table 1). Participants felt guidance was broad, such as encouraging hydration, consuming whole foods, eating whatever they could get down, maintaining their typical diet, or avoiding foods that upset the stomach.

Only a few participants referred to meeting with a dietitian, but described the dietary advice given as similarly vague or generalized. Recommendations often centered on broad concepts such as balance and protein intake, however, this was not specific enough to be implemented by participants (Supplementary Table 1). Others did not “remember a dietitian being recommended” (P25), were unsure of how to access one, or did not perceive the need to do so. Participants reported obtaining dietary information from a variety of other sources. Many took dietary advice from internet searches, online forums such as Reddit, YouTube, and social media platforms, as opposed to their care team (Supplementary Table 1). Participants shared that cancer support groups, both in person and online, served as valuable sources of dietary guidance. Many survivors reported trying dietary practices that helped those who experienced similar chemotherapy toxicities. They often felt more comfortable seeking advice from other patients, describing it as more relatable and practical.

Subtheme 2B: Attitudes towards dietary change

When asked about whether dietary changes could alleviate chemotherapy-induced toxicities, a majority of participants believed diet plays a significant role in how they feel during chemotherapy. Participants emphasized that diet consistently affects how you feel, and that it becomes especially important during chemotherapy. They described how eating well could help strengthen the body at a time when chemotherapy often left them feeling physically depleted. Several noted wanting to consume as many nutrients as possible to help counteract the harsh effects of chemotherapy (Supplementary Table 1).

The majority of participants expressed openness to making dietary changes during chemotherapy. Most participants indicated they would have welcomed more specific dietary advice and wished there had been more structured support around diet during chemotherapy. One participant stated that “if I had had guidelines, I almost feel like I would have been more likely to like start a better healthy lifestyle right away than to kind of slowly meander into one” (P25).

Several conveyed being “willing to try anything” (P7) that might improve their ability to tolerate chemotherapy or toxicities (Supplementary Table 1). Participants also emphasized that any recommended dietary changes would need to be practical and sustainable, noting “I think I would [follow recommendations]… as long as it's reasonable… and something that I can tolerate within my body ” (P2). This also reflected concerns about affordability, as one participant explained the need for “the money…to buy whatever” the diet required (P1). Others expressed concerns of recommendations being too restrictive because “chemo is hard enough” (P24).

Participants who implemented dietary modification based on information from external sources during chemotherapy reported diet made a “difference in helping me with… side effects” (P24). They noticed improvements in diarrhea, nausea, indigestion, and energy. These positive outcomes reinforced their

belief in the connection between diet and symptom management (Supplementary Table 1). Some participants also described how dietary changes reduced their reliance on medications to treat side effects. While some saw their use of pharmacologic therapies decrease with dietary modification, others mentioned that they implemented dietary modifications to reduce the number of additional medications they were on in the first place (Supplementary Table 1).

Despite the generally positive attitudes toward diet, not all participants reported noticeable benefits from dietary change. Several participants did not observe any improvements in their toxicity profiles (Supplementary Table 1). They questioned whether diet could truly impact the severity of side effects. Others were unsure, expressing uncertainty or lack of knowledge about the potential influence of diet on chemotherapy toxicities (Supplementary Table 1).

Theme 3: Social and environmental determinants of diet

This theme consists of two subthemes that illustrate social influences on diet during chemotherapy (subtheme 3A) and food resource accessibility (subtheme 3B).

Subtheme 3A: Social influences on diet during chemotherapy

Participants described how their social environments significantly shaped their dietary behaviors during chemotherapy. Friends and family often played a supportive role by helping with meal preparation, grocery shopping, or encouraging healthy eating. Some participants noted that coworkers also offered support by providing meals or reminding them to maintain good nutrition while at work.

Although family members were generally supportive, their eating patterns sometimes posed a challenge to the participant in making dietary modifications. Several participants expressed difficulty modifying their diets when family meals did not align with their own nutritional needs. For those with children at home, caregiving responsibilities often take precedence over dietary goals, with one participant acknowledging “I’m oftentimes more concerned for them than I am for what I need to be doing” (P15).

Cultural beliefs played a significant role in shaping dietary behaviors during chemotherapy. Many participants shared that their family traditions and cultural practices influenced the types of foods they consumed while undergoing chemotherapy. For example, certain cultural foods with believed healing properties or the ability to combat cancer prompted participants to incorporate them into their diets (Supplementary Table 1). In contrast, some cultural beliefs discouraged the consumption of specific foods such as sugar which was seen by some as feeding cancer. Participants also spoke about the emotional and symbolic role of food in their culture. Changes in taste or appetite were causing deeper disruptions in identity and social engagement (Supplementary Table 1).

When asked whether their occupation influenced their dietary habits, most participants said their work had little to no impact. However, a few noted that the demands of work sometimes led them to prioritize convenience over nutrition (Supplementary Table 1). Limited time and strict work schedules could

interfere with their ability to prepare or consume healthy meals or switch to practices such as more frequent meals to manage chemotherapy toxicities.

Subtheme 3B: Food Resource Accessibility

All participants reported primarily purchasing their food from supermarkets, with most living close to grocery stores and having access to transportation. Although some participants experienced fatigue or physical weakness that made in-person shopping difficult, they were able to maintain food access with support from family, friends, or grocery delivery services.

The majority of participants stated they did not face significant financial barriers in obtaining food during chemotherapy. They expressed, however, awareness that rising food costs could be a serious issue for others undergoing chemotherapy. Several participants expressed that the affordability of food during chemotherapy was an obstacle and forced them to make difficult decisions (Supplementary Table 1).

Even among participants who had the financial means to buy groceries, some encountered challenges related to food storage. Those living with roommates struggled with limited space that made it difficult to store all the foods they wanted. They often wished they could buy a wider variety of foods to see what they might be able to tolerate, but space constraints made that difficult (Supplementary Table 1).

Theme 4: Perceptions of specific dietary patterns

This theme consists of two subthemes that describe survivors' perceptions of fasting (subtheme 4A) and perceptions of a healthy diet (subtheme 4B).

Subtheme 4A: Perceptions of Fasting

When asked to define fasting, participants generally described it as intentionally abstaining from food for a set period of time, ranging from several hours to up to two days (Supplementary Table 1). Most participants were unfamiliar with the concept of fasting during chemotherapy. Among those who had heard of it, their knowledge was typically obtained through online articles, research studies, or informal conversations with family members, friends, or alternative health providers such as acupuncturists.

Approximately half of the participants expressed hesitation or opposition to fasting during chemotherapy. Their concerns centered around the belief that the body requires increased nutrition and energy during chemotherapy, the risk of exacerbating nausea, the emotional and cultural role of food, and the general discomfort or weakness they associated with not eating. Some felt fasting would be an unnecessary burden during an already stressful time (Supplementary Table 1). At the same time, participants acknowledged significant challenges to fasting during chemotherapy. Barriers to fasting included feelings of deprivation, emotional and psychological difficulty in avoiding food, not consuming enough calories or protein to support healing, and the unpredictability of their appetite (Supplementary Table 1).

In contrast, several participants expressed openness to the idea of fasting if it was safe and may support their recovery (Supplementary Table 1). Participants who were open to fasting identified a variety of potential benefits, including improved “mental clarity” (P4) or “cognitive fog” (P11), “spiritual perceptive” (P6), “alleviates…major…side effects” (P4), “clean out your system” (P18), “fights the cancer cells” (P8), “prevents recurrence” (P20), “sleep better” (P23), and “develop…hunger again” (P17).

Subtheme 4B: Perceptions of a Healthy Diet

When asked to define a healthy diet, participants commonly described it as rich in vegetables, fruits, lean proteins, and whole foods, while being low in sugar, processed items, and carbohydrates (Supplementary Table 1). All participants saw benefit to eating a healthy diet during chemotherapy. They associated healthy eating with a variety of physical and mental health benefits such as increased energy, reduced fatigue, improved clarity of mind, and enhanced physical strength. Some noted its importance in fueling the body and counteracting toxicities experienced during chemotherapy. While participants generally recognized the value of healthy eating, some emphasized the importance of finding enjoyment in food alongside its functional purpose (Supplementary Table 1).

Although most participants expressed openness to adopting healthier eating habits during chemotherapy, one participant described it as being “one more thing to think about when I am already dealing with all these… treatments and things to navigate” (P24). Participants described how following a healthy diet is “easier said than done” (P20) and “[may] be extremely difficult to achieve” (P12). Several participants described practical challenges to maintaining a balanced diet during chemotherapy. While many expressed a desire to eat nutritiously, they often struggled due to chemotherapy toxicities. Some could not tolerate foods such as fruits and vegetables due to heightened sensitivity to bitter or acidic tastes. Others lacked an appetite, especially for healthy foods. Moreover, participants voiced that their irregular eating patterns made it difficult to keep fresh food at home, as they frequently spoiled (Supplementary Table 1).

Fatigue and competing responsibilities further disrupted their ability to shop, cook, and find recipes their bodies could tolerate. Many emphasized that following a healthy diet required “time and energy” (P9) they simply did not have during chemotherapy. Beyond physical limitations, participants also pointed to structural and social barriers. These included “hard to change [habits] (P12), “the cost” (P4), “family needs” (P15), and the influence of “American culture” (P2). Processed food options were described as cheaper, more convenient, and longer lasting than healthier alternatives.

Discussion

This study aimed to explore breast cancer survivors’ perceptions of dietary guidance and modification during chemotherapy, modifications they are using, and what barriers affect their experience with and management of chemotherapy toxicities. To our knowledge, this is the first study to explore breast cancer survivors’ perceptions of dietary modifications, including specific interventions such as fasting, in

addition to what barriers impact their dietary practices. Overall, participants expressed an openness to dietary change but highlighted a lack of tailored guidance.

Consistent with previous research, participants described struggling with chemotherapy toxicities despite pharmacologic interventions [11, 32]. Toxicities such as taste alterations, fatigue, and nausea often impacted their dietary behaviors. They expressed turning to alternative strategies they found outside of their provider's guidance to manage their experienced toxicities. Participants often used distraction techniques such as sleep, massage, and aromatherapy. Many expressed a desire for their oncology teams to more clearly communicate available alternative therapy options. This finding aligns with existing research, which highlights a common gap in provider communication and education around complementary therapies for cancer patients [33, 34].

Our study supports previous research indicating that breast cancer survivors make dietary changes during chemotherapy [15–17, 35–37]. Many participants described efforts to adopt eating patterns they perceived as healthy by reducing sugar and processed foods and increasing whole foods. Several believed that fueling their body well would help them respond better to chemotherapy. This belief reinforces prior research showing that a cancer diagnosis often leads patients to prioritize a balanced, nourishing diet [35, 38]. On the other hand, others described changing their typical diet in response to toxicities. Many eliminated foods due to taste alterations, nausea triggers, and having limited energy to prepare foods. This reinforces that chemotherapy toxicities impact dietary behavior [38].

Our findings reflect a previously documented lack of specific dietary guidance from oncology providers and dietitians [38]. Participants recalled receiving general advice, if any, from their oncology providers. This may reflect the limited clinical practice guidelines surrounding diet during chemotherapy [16]. While ASCO provides general nutrition tips for patients undergoing cancer treatment, they lack specificity on food choice: "there is currently insufficient evidence to recommend for or against dietary interventions such as ketogenic or low-carbohydrate diets, low-fat diets, functional foods, or fasting to improve outcomes related to QOL, treatment toxicity, or cancer control"[13]. As a result, dietary decisions are largely left to the discretion of the patient and clinician [39]. Likewise to prior research, several participants described turning to dietary advice from other cancer survivors online, finding it more practical and better tailored to the specific toxicities they experienced [35].

Current literature indicates that survivors often seek evidence-based nutrition information [35, 38, 40]. The breast cancer survivors in this study expressed a desire for focused and individualized dietary guidance during chemotherapy. Participants were generally motivated to make dietary changes they believed would optimize their health and chemotherapy tolerance, reinforcing that cancer survivors often view diet as an important factor in how they feel during treatment [41–43]. Several even acknowledged the improvement they noticed with toxicities such as nausea, diarrhea, and fatigue while eating better.

Furthermore, our findings reinforce that dietary behaviors are often shaped by an individual's environment, family, and culture [18–20, 44]. Family and friends frequently helped participants obtain and prepare foods, but those with caregiving responsibilities found dietary changes difficult as they had

to balance family needs with their own. Cultural beliefs also influenced food choices. Some participants added culturally significant foods believed to promote healing and others avoided foods perceived as harmful.

While most breast cancer survivors in this study did not report personal food insecurity, many acknowledged that others in similar circumstances might face financial barriers to accessing food. For those who did face barriers, they described having to choose between eating enough and eating healthy. Even among those with adequate resources, challenges surrounding preparing and tolerating nutritious meals during chemotherapy were common. These findings align with existing research suggesting that socioeconomic status and living conditions can influence dietary patterns and in turn shape patients' overall experiences with chemotherapy and its related toxicities [37, 45–56].

Previous literature suggests that the main motivation to fast during chemotherapy is to alleviate toxicities, however barriers to fasting, such the psychological challenge of not eating, have been reported [28]. In our study, fasting was met with mixed attitudes. Some patients were aware of its potential benefits, but many held skepticism about its practicality and safety during chemotherapy. In contrast, participants viewed a healthy diet more positively and emphasized dietary modification reported in previous studies such as balanced nutrients, whole foods, and minimal processing [35, 38]. While all participants recognized the physical benefits of healthy eating during chemotherapy, many reinforced substantial barriers to its adoption such as difficulty tolerating certain foods, limited energy for meal preparation, and the higher cost of healthier options [57]. For both dietary patterns, participants highlighted the psychological burden of maintaining a new diet during an already stressful time.

This study has many strengths. First, it is the first study to explore breast cancer survivors' perceptions of dietary modifications during chemotherapy and provide an in-depth understanding of dietary guidance they received. Additionally, it explores their perceptions of specific dietary patterns and attitudes towards dietary change. These insights can inform the development of future dietary guidelines tailored to the needs of breast cancer survivors undergoing chemotherapy. This study is not without limitations. The sample was predominantly composed of White, female participants from higher socioeconomic backgrounds. Despite this limitation, some participants did indicate that rising food costs could be a serious issue for others undergoing chemotherapy. Additionally, the study may be affected by recall bias, as participants often struggle to provide accurate and complete dietary recall information [58].

Conclusion

This study highlights the complexity of diet and dietary modification among breast cancer survivors undergoing chemotherapy. Despite facing significant chemotherapy toxicities and limited guidance from healthcare providers, participants demonstrated a clear motivation to manage their symptoms through dietary changes. Their experiences provide insight into the challenges related to making dietary modifications such as physical symptoms, emotional coping, social context, cultural beliefs, and access to resources. Importantly, the findings point to a critical gap in dietary support during chemotherapy.

Survivors expressed a desire for stronger dietary guidance from their oncology teams as they navigate managing toxicities. Findings from this study have the potential to inform the development of practical, specific dietary recommendations tailored to the unique needs and lived experiences of patients undergoing chemotherapy, addressing the critical gap in cancer care.

Declarations

Ethics Statement

The University of Pennsylvania institutional review board approved the study (protocol #857418)

Consent for Publication:

Written informed consent for participation and publication of anonymized quotations was obtained from all participants included in this study.

Competing Interests:

The authors declare no competing interests.

Funding:

This work was supported by the Rita and Alex Hillman Foundation

Author Contribution

All authors contributed to the study conception and design. Material preparation, data collection, and analysis were performed by J.A., J.D., R.Q., and G.V.. The first draft of the manuscript was written by J.A. and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Acknowledgement

The first author (J.A.) is a Hillman Scholar in Nursing Innovation.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

References

1. American Cancer Society. Cancer Treatment & Survivorship 2022–2024 2024 [Available from: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/cancer-treatment-and-survivorship-facts-and-figures/2022-cancer-treatment-and-survivorship-fandf-acs.pdf
2. Licaj I, Coquan E, Dabakuyo-Yonli TS, Dauchy S, Vaz Luis I, Charles C, et al. Baseline quality of life and chemotherapy toxicities in patients with early breast cancer. Cancer. 2023;129(7):1085–95. https://doi.org/10.1002/cncr.34643.
3. Katta B, Vijayakumar C, Dutta S, Dubashi B, Nelamangala Ramakrishnaiah VP. The Incidence and Severity of Patient-Reported Side Effects of Chemotherapy in Routine Clinical Care: A Prospective Observational Study. Cureus. 2023;15(4):e38301. https://doi.org/10.7759/cureus.38301.
4. Bhimani J, O'Connell K, Ergas IJ, Foley M, Gallagher GB, Griggs JJ, et al. Trends in chemotherapy use for early-stage breast cancer from 2006 to 2019. Breast Cancer Res. 2024;26(1):101. https://doi.org/10.1186/s13058-024-01822-9.
5. Di Mattei VE, Perego G, Milano F, Gatti F. The Effectiveness of Nonpharmacological Interventions in the Management of Chemotherapy Physical Side Effects: A Systematic Review. Healthcare. 2024;12(18):1880.
6. Vardy JL, Liew A, Warby A, Elder A, Keshet I, Devine R, et al. On the receiving end: have patient perceptions of the side-effects of cancer chemotherapy changed since the twentieth century? Support Care Cancer. 2022;30(4):3503–12. https://doi.org/10.1007/s00520-022-06804-1.
7. Di Nardo P, Lisanti C, Garutti M, Buriolla S, Alberti M, Mazzeo R, et al. Chemotherapy in patients with early breast cancer: clinical overview and management of long-term side effects. Expert Opin Drug Saf. 2022;21(11):1341–55. https://doi.org/10.1080/14740338.2022.2151584.
8. National Cancer Institute. Nutrition in Cancer Care (PDQ®)–Health Professional Version 2024 [Available from: https://www.cancer.gov/about-cancer/treatment/side-effects/appetite-loss/nutrition-hp-pdq
9. National Cancer Institute (US). PDQ Supportive and Palliative Care Editorial Board. Nausea and Vomiting Related to Cancer Treatment (PDQ®): Health Professional Version. Bethesda (MD)2025 [Available from: https://www.ncbi.nlm.nih.gov/books/NBK66056/
10. Diez de los Rios de, la Serna C, Boers-Doets CB, Wiseman T, Radia B, Hammond R. Early Recognition and Management of Side Effects Related to Systemic Anticancer Therapy for Advanced Breast Cancer. Semin Oncol Nurs. 2024;40(1):151553. https://doi.org/https://doi.org/10.1016/j.soncn.2023.151553.
11. Gupta K, Walton R, Kataria SP. Chemotherapy-Induced Nausea and Vomiting: Pathogenesis, Recommendations, and New Trends. Cancer Treat Res Commun. 2021;26:100278. https://doi.org/10.1016/j.ctarc.2020.100278.

12. Ilerhunmwuwa NP, Abdul Khader AHS, Smith C, Cliff ERS, Booth CM, Hottel E, et al. Dietary interventions in cancer: a systematic review of all randomized controlled trials. JNCI: J Natl Cancer Inst. 2024;116(7):1026–34. https://doi.org/10.1093/jnci/djae051.
13. Ligibel JA, Bohlke K, May AM, Clinton SK, Demark-Wahnefried W, Gilchrist SC, et al. Exercise, Diet, and Weight Management During Cancer Treatment: ASCO Guideline. J Clin Oncol. 2022;40(22):2491–507. https://doi.org/10.1200/jco.22.00687.
14. Erickson N, Sulosaari V, Sullivan ES, Laviano A, van Ginkel-Res A, Remijnse W, et al. Nutrition Care in Cancer: An Overlooked Part of Patient-Centered Care. Semin Oncol Nurs. 2025;41(1):151799. https://doi.org/https://doi.org/10.1016/j.soncn.2024.151799.
15. Pedersini R, di Mauro P, Bosio S, Zanini B, Zanini A, Amoroso V, et al. Changes in eating habits and food preferences in breast cancer patients undergoing adjuvant chemotherapy. Sci Rep. 2021;11(1):12975. https://doi.org/10.1038/s41598-021-92138-7.
16. Conigliaro T, Boyce LM, Lopez CA, Tonorezos ES. Food Intake During Cancer Therapy: A Systematic Review. Am J Clin Oncol. 2020;43(11):813–9. https://doi.org/10.1097/coc.0000000000000749.
17. Limon-Miro AT, Lopez-Teros V, Astiazaran-Garcia H. Dietary Guidelines for Breast Cancer Patients: A Critical Review. Adv Nutr. 2017;8(4):613–23. https://doi.org/10.3945/an.116.014423.
18. Sherman AM, Bowen DJ, Vitolins M, Perri MG, Rosal MC, Sevick MA et al. Dietary Adherence: Characteristics and Interventions. Controlled Clinical Trials. 2000;21(5, Supplement 1):S206-S11 https://doi.org/https://doi.org/10.1016/S0197-2456(00)00080-5
19. de Mestral C, Khalatbari-Soltani S, Stringhini S, Marques-Vidal P. Perceived barriers to healthy eating and adherence to dietary guidelines: Nationwide study. Clin Nutr. 2020;39(8):2580–5. https://doi.org/https://doi.org/10.1016/j.clnu.2019.11.025.
20. Deslippe AL, Soanes A, Bouchaud CC, Beckenstein H, Slim M, Plourde H, et al. Barriers and facilitators to diet, physical activity and lifestyle behavior intervention adherence: a qualitative systematic review of the literature. Int J Behav Nutr Phys Activity. 2023;20(1):14. https://doi.org/10.1186/s12966-023-01424-2.
21. Abene J, Deng J. Evaluating the role of dietary interventions in reducing chemotherapy toxicities in cancer patients: a systematic review. J Cancer Surviv. 2025. https://doi.org/10.1007/s11764-025-01777-6.
22. Abene J, Tyburski S, Kral TVE, Quinn R, Deng J. Diet as an Adjunct Therapy in Reducing Chemotherapy Toxicities and Improving Patients Quality of Life: A Systematic Review and Meta-Analysis. Nutr Cancer. 2025;77(3):341–59. https://doi.org/10.1080/01635581.2024.2437833.
23. Omar EM, Omran GA, Mustafa MF, El-Khodary NM. Intermittent fasting during adjuvant chemotherapy may promote differential stress resistance in breast cancer patients. J Egypt Natl Canc Inst. 2022;34(1):38. https://doi.org/10.1186/s43046-022-00141-4.
24. Lugtenberg RT, de Groot S, Kaptein AA, Fischer MJ, Kranenbarg EM, Carpentier MD, et al. Quality of life and illness perceptions in patients with breast cancer using a fasting mimicking diet as an

adjunct to neoadjuvant chemotherapy in the phase 2 DIRECT (BOOG 2013-14) trial. Breast Cancer Res Treat. 2021;185(3):741–58. https://doi.org/10.1007/s10549-020-05991-x.

25. Haskins CP, Champ CE, Miller R, Vyfhuis MAL. Nutrition in Cancer: Evidence and Equality. Adv Radiation Oncol. 2020;5(5):817–23. 10.1016/j.adro.2020.05.008. https://doi.org/https://doi.org/.
26. O'Brien BC, Harris IB, Beckman TJ, Reed DA, Cook DA. Standards for reporting qualitative research: a synthesis of recommendations. Acad Med. 2014;89(9):1245–51. https://doi.org/10.1097/acm.0000000000000388.
27. Kim H, Sefcik JS, Bradway C. Characteristics of Qualitative Descriptive Studies: A Systematic Review. Res Nurs Health. 2017;40(1):23–42. https://doi.org/10.1002/nur.21768.
28. Mas S, Le Bonniec A, Cousson-Gélie F. Why do women fast during breast cancer chemotherapy? A qualitative study of the patient experience. Br J Health Psychol. 2019;24(2):381–95. https://doi.org/10.1111/bjhp.12358.
29. Redding A, Santarossa S, Murphy D, Udumula MP, Munkarah A, Hijaz M, et al. A patient perspective on applying intermittent fasting in gynecologic cancer. BMC Res Notes. 2023;16(1):190. https://doi.org/10.1186/s13104-023-06453-5.
30. Green J, Thorogood N. Qualitative methods for health research. 3rd ed. Los Angeles, CA: Sage; 2014.
31. Dent R, Cortés J, Pusztai L, McArthur H, Kümmel S, Bergh J, et al. Neoadjuvant pembrolizumab plus chemotherapy/adjuvant pembrolizumab for early-stage triple-negative breast cancer: quality-of-life results from the randomized KEYNOTE-522 study. J Natl Cancer Inst. 2024;116(10):1654–63. https://doi.org/10.1093/jnci/djae129.
32. Artale S, Grillo N, Lepori S, Butti C, Bovio A, Barzaghi S, et al. A Nutritional Approach for the Management of Chemotherapy-Induced Diarrhea in Patients with Colorectal Cancer. Nutrients. 2022;14(9). https://doi.org/10.3390/nu14091801.
33. Wode K, Sharp L, Fransson P, Nordberg JH. Communication About Complementary and Alternative Medicine When Patients Decline Conventional Cancer Treatment: Patients' and Physicians' Experiences. Oncologist. 2023;28(9):e774–83. https://doi.org/10.1093/oncolo/oyad084.
34. Citrin DL, Bloom DL, Grutsch JF, Mortensen SJ, Lis CG. Beliefs and Perceptions of Women with Newly Diagnosed Breast Cancer Who Refused Conventional Treatment in Favor of Alternative Therapies. Oncologist. 2012;17(5):607–12. https://doi.org/10.1634/theoncologist.2011-0468.
35. Beeken RJ, Williams K, Wardle J, Croker H. What about diet? A qualitative study of cancer survivors' views on diet and cancer and their sources of information. Eur J Cancer Care (Engl). 2016;25(5):774–83. https://doi.org/10.1111/ecc.12529.
36. Sun Y, Bao W, Liu B, Caan BJ, Lane DS, Millen AE, et al. Changes in Overall Diet Quality in Relation to Survival in Postmenopausal Women with Breast Cancer: Results from the Women's Health Initiative. J Acad Nutr Diet. 2018;118(10):1855–63. e6 https://doi.org/10.1016/j.jand.2018.03.017.
37. Lee E, Kady V, Han E, Montan K, Normuminova M, Rovito MJ. Healthy Eating and Mortality among Breast Cancer Survivors: A Systematic Review and Meta-Analysis of Cohort Studies. Int J Environ

Res Public Health. 2022;19(13). https://doi.org/10.3390/ijerph19137579.

38. O'Callaghan N, Douglas P, Keaver L. A qualitative study into cancer survivors' relationship with nutrition post-cancer treatment. J Hum Nutr Diet. 2023;36(2):406–14. https://doi.org/10.1111/jhn.13094.
39. American Cancer Society. Eating Well During Treatment 2022 [Available from: https://www.cancer.org/cancer/survivorship/coping/nutrition/once-treatment-starts.html
40. Caprara G, Pagan E, Titta L, Tieri M, Magionesi G, Gallosti S, et al. Results of the Italian cross-sectional web-based survey Nutrition and breast cancer, what would you like to know? An attempt to collect and respond to patients' information needs, through social media. Front Oncol. 2024;14:1436610. https://doi.org/10.3389/fonc.2024.1436610.
41. Kristoffersen AE, Stub T, Nilsen JV, Nordberg JH, Broderstad AR, Wider B, et al. Exploring dietary changes and supplement use among cancer patients in Norway: prevalence, motivations, disclosure, information, and perceived risks and benefits: a cross sectional study. BMC Nutr. 2024;10(1):65. https://doi.org/10.1186/s40795-024-00872-8.
42. Caprara G, Tieri M, Fabi A, Guarneri V, Falci C, Dieci MV, et al. Results of the ECHO (Eating habits CHanges in Oncologic patients) Survey: An Italian Cross-Sectional Multicentric Study to Explore Dietary Changes and Dietary Supplement Use, in Breast Cancer Survivors. Front Oncol. 2021;11:705927. https://doi.org/10.3389/fonc.2021.705927.
43. Caprara G, Tieri M, Fabi A, Guarneri V, Falci C, Dieci MV, et al. Corrigendum: Results of the ECHO (Eating habits CHanges in Oncologic patients) Survey: An Italian Cross-Sectional Multicentric Study to Explore Dietary Changes and Dietary Supplement Use, in Breast Cancer Survivors. Front Oncol. 2022;12:851999. https://doi.org/10.3389/fonc.2022.851999.
44. Thomas TW, Cankurt M. Influence of Food Environments on Dietary Habits: Insights from a Quasi-Experimental Research. Foods. 2024;13(13). https://doi.org/10.3390/foods13132013.
45. Zettler ME, Feinberg BA, Jeune-Smith Y, Gajra A. Impact of social determinants of health on cancer care: a survey of community oncologists. BMJ Open. 2021;11(10):e049259. https://doi.org/10.1136/bmjopen-2021-049259.
46. Majercak KR, Gorman EF, Robert NJ, Palmer B, Antwi HA, Mullins CD. Which social determinants of health have the highest impact in community oncology to advance patient care equity and improve health outcomes? A scoping review. Cancer Med. 2024;13(17):e70160. https://doi.org/10.1002/cam4.70160.
47. Mittelman SD. The Role of Diet in Cancer Prevention and Chemotherapy Efficacy. Annu Rev Nutr. 2020;40:273–97. https://doi.org/10.1146/annurev-nutr-013120-041149.
48. Mello AV, Pereira JL, Leme ACB, Goldbaum M, Cesar CLG, Fisberg RM. Social determinants, lifestyle and diet quality: a population-based study from the 2015 Health Survey of São Paulo, Brazil. Public Health Nutr. 2020;23(10):1766–77. https://doi.org/10.1017/s1368980019003483.
49. Amegbletor DY, Goldberg D, Pope DA, Heckman BW. Food and Nutrition Security as Social Determinants of Health: Fostering Collective Impact to Build Equity. Prim Care. 2023;50(4):633–44.

https://doi.org/10.1016/j.pop.2023.05.006.

50. de Groot S, Lugtenberg RT, Cohen D, Welters MJP, Ehsan I, Vreeswijk MPG, et al. Fasting mimicking diet as an adjunct to neoadjuvant chemotherapy for breast cancer in the multicentre randomized phase 2 DIRECT trial. Nat Commun. 2020;11(1):3083. https://doi.org/10.1038/s41467-020-16138-3.
51. Khodabakhshi A, Seyfried TN, Kalamian M, Beheshti M, Davoodi SH. Does a ketogenic diet have beneficial effects on quality of life, physical activity or biomarkers in patients with breast cancer: A randomized controlled clinical trial. Nutr J. 2020;19(1). https://doi.org/10.1186/s12937-020-00596-y.
52. Sathiaraj E, Afshan K, Jadoni RS, Murugan A, Patil K. Effects of a Plant-Based High-Protein Diet on Fatigue in Breast Cancer Patients Undergoing Adjuvant Chemotherapy - a Randomized Controlled Trial. Nutr Cancer. 2023;75(3):846–56. https://doi.org/10.1080/01635581.2022.2159044.
53. Zhang Y, Cui G, Xiu Y, Zhao M. The Effect of Nutritional Support Based on the Dietary Anti-Inflammatory Index on Cancer-Related Fatigue in Lung Cancer Patients Undergoing Chemotherapy. Cancer Nurs. 2023;46(5):394–404. https://doi.org/10.1097/ncc.0000000000001124.
54. Bauersfeld SP, Kessler CS, Wischnewsky M, Jaensch A, Steckhan N, Stange R, et al. The effects of short-term fasting on quality of life and tolerance to chemotherapy in patients with breast and ovarian cancer: a randomized cross-over pilot study. BMC Cancer. 2018;18(1):476. https://doi.org/10.1186/s12885-018-4353-2.
55. Jabbal IS, Bilani N, Yaghi M, Elson L, Liang H, Nahleh ZA. Geographical Disparities and Factors Associated With the Decision to Decline Chemotherapy in Breast Cancer. JCO Oncol Pract. 2022;18(9):e1417–26. https://doi.org/10.1200/op.21.00719.
56. Lee E, Zhu J, Velazquez J, Bernardo R, Garcia J, Rovito M, et al. Evaluation of Diet Quality Among American Adult Cancer Survivors: Results From 2005–2016 National Health and Nutrition Examination Survey. J Acad Nutr Diet. 2021;121(2):217–32. https://doi.org/10.1016/j.jand.2020.08.086.
57. Harvey BI, Youngblood SM, Kleckner AS. Barriers and Facilitators to Adherence to a Mediterranean Diet Intervention during Chemotherapy Treatment: A Qualitative Analysis. Nutr Cancer. 2023;75(5):1349–60. https://doi.org/10.1080/01635581.2023.2192891.
58. Ravelli MN, Schoeller DA. Traditional Self-Reported Dietary Instruments Are Prone to Inaccuracies and New Approaches Are Needed. Front Nutr. 2020;7:90. https://doi.org/10.3389/fnut.2020.00090.

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