

REVIEW ARTICLE

The Impact of Yoga on Cancer Survivorship: A Scoping Review

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ABSTRACT

Background: As cancer survival rates improve, survivors face numerous physical and psychological challenges. Yoga, an ancient practice integrating physical, mental, and spiritual health, has shown potential in alleviating cancer treatment-related symptoms and enhancing overall health.

Methods: This scoping review conducted a comprehensive literature search across multiple databases, focusing on randomized trials that assessed yoga's effects on cancer survivors post-treatment. The review spanned studies published between 2018 and 2022, emphasizing physical and psychosocial benefits.

Results: Eight randomized trials were identified, demonstrating yoga's diverse benefits across physical and psychological dimensions. Significant findings include reductions in depression, improvements in shoulder mobility, pain, and anxiety, management of cancer-related fatigue, sleep quality, and modulation of inflammatory cytokine profiles, suggesting holistic benefits in managing cancer side effects.

Conclusion: Yoga presents a holistic, low-risk intervention that significantly improves quality of life, manages fatigue, and supports psychological well-being in cancer survivors. Future research should investigate yoga's therapeutic potential and develop personalized interventions for survivors' recovery and long-term well-being.

1. INTRODUCTION

Cancer is a significant contributor to the global burden of disease, and projections indicate that this burden will continue to grow for at least the next two decades.^[1,2] In 2019, there were 23.6 million new cases of cancer and 10.0 million cancer-related deaths across 204 countries and territories. Excluding non-melanoma skin cancer, there were an estimated 17.2 million new cancer cases and 9.97 million cancer-related deaths.

Globally, the number of new cancer cases increased from 18.7 million in 2010 to 23.6 million in 2019, an increase of 26.3%. Similarly, the number of total cancer deaths increased by 20.9% from 8.29 million in 2010 to 10.0 million in 2019. Cancer deaths also increased as a proportion of total deaths of all causes, rising from 15.7% in 2010 to 17.7% in 2019.

In 2019, cancer-related disability-adjusted life years (DALYs) were second only to cardiovascular diseases in their contribution to the global disease burden. In the high Sociodemographic Index quintile, cancer overtook cardiovascular disease to become the leading cause of DALYs.^[3]

The progress made in medical treatments has contributed significantly to the increased life expectancy of many cancer patients. Several studies have highlighted significant advancements in treating various types of cancer, leading to enhanced patient survival rates.^[4]

The increasing cure rates for cancer can be attributed to several factors. First, advancements in the early detection and treatment have significantly contributed to the increasing number of cancer survivors.^[5-7] For instance, the collective cure rate for childhood cancers has increased from about 20% in the 1960s to over 80% today, showcasing the impact of improved treatments.^[8]

In addition, progress made in disease-directed clinical trials has significantly increased cure rates for children and adolescents with

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cancer.^[9] Advancements in multimodal treatments have also led to higher cure rates, even in advanced stages of cancer.^[10] Furthermore, the introduction of targeted therapies and immune checkpoint inhibitors has substantially increased the overall survival of patients.^[11]

In addition to treatment advancements, concerted action involving prevention to decrease incidence, early detection, and personalized/precision cancer medicine has played a crucial role in increasing the cure rate and improving health-related quality of life (HRQOL).^[12] It is important to note that despite the high survival rates and recent progress in treatment modalities, cancer remains a critical health-care issue with a widespread socioeconomic impact.^[13]

Improvements in cancer survival rates have undoubtedly led to a growing population of long-term cancer survivors; this positive trend is accompanied by a myriad of psychological and physical challenges that affect the well-being of these survivors. According to the US National Coalition for Cancer Survivorship agency, a cancer survivor is an individual who has been diagnosed with cancer and continues to live with it or is cancer-free. The term encompasses a diverse group of individuals, including survivors who are still undergoing treatment and those who have completed their treatment. Survivorship experiences and care goals vary widely among individuals, and research in this field aims to improve survivors' and caregivers' health and well-being. This includes addressing the physical, psychological, social, and economic impacts of cancer and its treatment.

In addition, with advancements in cancer treatments, a new category of patients has emerged, living long-term with metastatic cancer. These individuals often referred to as "metavivors," experience life with cancer as an ongoing, terminal condition, challenging the traditional definition of cancer survivorship. This concept highlights the importance of providing ongoing support, advanced medical care, and quality-of-life considerations for those with metastatic disease.^[14]

The experience of cancer and the long-term physical effects of treatment can significantly impact the psychological well-being of survivors, leading to increased levels of psychological distress.^[15] which can lead to adverse changes in biobehavioral responses, inducing detrimental effects on immune health and function, and contributing to immunological ageing.^[16]

With the increase in survivorship, there has been a rise in the attention given to the long-term physical and psychological challenges faced by cancer survivors. In addition, for cancer survivors, returning to work signifies a positive step toward an improved quality of life (QOL) and social recovery after treatment.^[17] These challenges stem from both the disease and treatment's side effects. Addressing these multifaceted issues is crucial in enhancing the QOL of cancer survivors. This highlights the need for comprehensive care strategies that incorporate interventions such as yoga to manage the morbidities associated with cancer survivorship.

Cancer survivors often use complementary and alternative medicine (CAM) to alleviate symptoms, improve their QOL, and manage stress.^[18-20] These survivors usually seek advice from CAM practitioners to manage their ongoing symptoms and reduce their reliance on conventional medicines.^[21] CAM can include various techniques such as dietary interventions, art therapy, acupuncture, massage, relaxation therapy, and exercise to address different aspects of well-being.^[21,22] The high prevalence of CAM use among cancer survivors shows the need for a holistic approach to care that goes beyond conventional cancer treatment.^[23]

While CAM is widespread among cancer survivors, it is essential to acknowledge the lack of scientific evidence supporting its effectiveness.^[24] However, some CAM modalities such as ginseng and exercise have shown promising effects in managing cancer-related fatigue (CRF) and sleep outcomes and may have potential benefits for survivors.^[25,26] The economic evaluation of CAM in oncology also highlights its high level of interest among cancer patients, emphasizing its importance in survivorship care.^[27] Although the evidence supporting the efficacy of CAM is mixed, its widespread use and potential benefits for managing symptoms and improving QOL highlight its significance in caring for cancer survivors.

Yoga is a scientific practice that originated in India over 5000 years ago and has gained prominence for its potential benefits in managing treatment-related symptoms and improving health outcomes in patients with cancer.^[28] Yoga is not a religion or belief system; instead, it is a science that encompasses various practices and techniques. The exact mechanisms through which yoga supports physical and psychological improvement have yet to be entirely understood. However, scientific evidence supports the belief that it down-regulates the hypothalamic-pituitary-adrenal axis and the sympathetic nervous system.

Yoga involves many techniques, including physical postures (asanas), breathing exercises (pranayama), meditation, and ethical principles. These techniques create a harmonious balance between the body, mind, and soul. Yoga is recognized for enhancing bodily systems, improving posture, regulating sleep, and reducing stress and anxiety, among other benefits.^[29] Yoga has positively impacted various health conditions, including neurological diseases, heart and lung diseases, and chronic pain.^[30-33] Its holistic nature, addressing physical, emotional, and spiritual dimensions, makes it particularly relevant for individuals navigating the complexities of cancer treatment.^[34,35]

Yoga in cancer care involves integrating it as a supportive therapy to conventional treatments. Several studies have explored the feasibility and benefits of yoga interventions for cancer patients, showing promising results, indicating that yoga is well-tolerated and can improve various outcomes, including physical functioning, fatigue, sleep quality, and psychological well-being.^[36-38] While studies have indicated positive outcomes, the diversity in yoga interventions, varying methodologies, and the subjective nature of well-being measures necessitate a structured review. This scoping review aims to map the existing literature, identify research gaps, and guide future inquiries into yoga's role in cancer survivorship. Different styles of yoga can offer unique benefits to cancer patients depending on their needs. Gentle forms such as Hatha and Restorative yoga (RY) can help manage fatigue and anxiety, while more vigorous styles such as Vinyasa and Ashtanga can help build endurance and strength. Iyengar yoga, which focuses on detail and alignment, can benefit cancer survivors with physical limitations. Understanding these different styles and their benefits can help create customized patient yoga programs.

1.1. Objective

Our comprehensive review seeks to thoroughly evaluate the existing literature on the potential benefits of practicing yoga for cancer survivors who have completed their treatment. Our primary focus is on the physical and psychosocial advantages that yoga can offer to these individuals. We aim to conduct a deep analysis of the available studies to provide a comprehensive and detailed perspective on yoga's role in the recovery and overall well-being of cancer survivors. We hope our review will shed light on the potential of yoga as a complementary therapy for cancer survivors and help inform future research in this area.

2. METHODS

Our research methodology involved conducting a comprehensive literature search across multiple databases, including PubMed, Cochrane, Embase, and CINAHL, to identify articles exploring yoga's effects on cancer survivors. We only included randomized trials that used yoga as an intervention for patients who had completed their cancer treatment. We restricted our focus to fully published trials in the English language conducted over a 5 year period between 2018 and 2022. We excluded conference proceedings and studies only available as abstracts to ensure the highest quality of evidence. This approach allowed us to gather reliable and current findings on the impact of yoga in the post-treatment phase of cancer survivorship. We gathered relevant data on various aspects of each study, such as sample size, study design, intervention and control conditions, and outcome measures. We screened the articles based on their titles, abstracts, and full texts and extracted relevant data.

3. RESULTS

Initially, we conducted a search in the databases which resulted in finding 354 records. However, on closer examination, 308 of these records did not meet the inclusion criteria and were excluded from further consideration. This left us with 46 reports that required retrieval. We successfully appraised all 46 reports and further reviewed them, leading to the exclusion of 31 reports. The eligibility of the remaining 15 reports was assessed, and as a result, eight studies were included in the final evaluation.^[39-46] These studies focused on the effects of yoga on cancer survivors, revealing a variety of benefits across both physical and psychological dimensions. One study highlighted yoga's potential in reducing depression among African-American breast cancer survivors (AA BCS), while another observed improvements in shoulder mobility, pain, and anxiety in head and neck cancer (HNC) survivors. A significant study found yoga to enhance CRF management, and sleep quality and reduce daytime dysfunction. Another trial compared yoga with massage therapy for breast cancer survivors on aromatase inhibitors, indicating yoga's superiority in alleviating joint pain, correlating with cytokine levels and meridian energy changes. Further research showcased yoga's positive impact on chemotherapy-induced peripheral neuropathy (CIPN), enhancing QOL, and reducing anxiety. In addition, yoga combined with Vitamin D supplementation was shown to improve leukocyte gene expression related to cell survival and significantly modulate inflammatory cytokine profiles, suggesting a holistic benefit in managing cancer side effects. We discuss the studies in detail below.

Taylor *et al.* evaluated the practicality of an 8-week RY program for AA BCS.^[39] The study had three objectives: (1) to measure changes in study outcomes in a RY group compared to a wait-list control group, (2) to assess adherence to the RY program, and (3) to assess program satisfaction among study participants. The study randomly divided 33 AA BCS into the RY intervention ($n = 18$) or wait-list control group ($n = 15$). RY classes were conducted once a week for 8 weeks, and pre- and post-testing assessments were measured at 0 and 8 weeks (immediately post-intervention). Results showed that depression scores at follow-up were significantly lower in the yoga group ($M = 4.78$, $SD = 3.56$) compared to the control group ($M = 6.91$, $SD = 5.86$). No significant group differences were observed for sleep quality, fatigue, or perceived stress. The yoga program participants who completed baseline assessments demonstrated 61% adherence to the yoga classes, and the average rating of the yoga program was beneficial.

Adair *et al.* conducted a randomized wait-list control study of HNC survivors who had not practiced yoga before and were more than 3 months post-cancer treatment.^[40] The study collected baseline data and randomized participants into an 8-week hatha yoga intervention or wait-list control group. Feasibility and efficacy data were collected, and patients underwent a repeat health assessment at four and 8 weeks. After the data collection, the wait-list control group participants were offered the yoga program. The study evaluated feasibility using descriptive statistics, and efficacy outcomes were estimated using mixed-effects general linear models. The results showed that 73 individuals were screened, and 40 were eligible. All eligible individuals consented and enrolled, and five individuals from the intervention group discontinued early, but none in the wait-list control group. The study affirmed feasibility since participants were recruited and retained, there were no adverse events, fidelity to the protocol was demonstrated, and satisfaction rates were high. The efficacy measures indicated potential benefits for shoulder range of motion ($d = 0.57-0.86$, $P < 0.05$), pain ($d = 0.67-0.90$, $P \leq 0.005$), and anxiety ($d = 0.59$, $P = 0.015$).

Lin *et al.* conducted a large randomized controlled study to compare the effectiveness of YOCAS® (a type of yoga) with standard survivorship care on CRF among 410 cancer survivors.^[41] The study also aimed to examine the role of improved sleep, resulting from yoga, on changes in CRF. The Multidimensional Fatigue Symptom Inventory assessed CRF, while the Pittsburgh Sleep Quality Index measured sleep quality. Between- and within-group intervention effects were analyzed using analysis of covariance and a two-tailed *t*-test, respectively. The study found that YOCAS® participants experienced a significant improvement in CRF compared to those receiving standard survivorship care. The improvement in overall sleep quality and the reduction of daytime dysfunction (e.g., excessive napping) resulting from yoga significantly contributed to the effect of yoga on CRF (22% and 37%, respectively, both $P < 0.01$).

Breast cancer survivors on aromatase inhibitors were randomly assigned by Tsai *et al.* to either a 6-week yoga intervention followed by a 2-week rest and a 6-week massage exposure (Yoga first, $n = 30$) or a 6-week massage intervention followed by a 2-week rest and a 6-week yoga exposure (Massage first, $n = 30$).^[42] The researchers evaluated the effectiveness of the treatments before and after the interventions and exposures using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scale, plasma cytokine levels, and changes in meridian energy. The results indicated that yoga was significantly more effective than massage in reducing AI-associated knee joint pain, as demonstrated by the WOMAC pain score. The improvements in the yoga intervention group were also associated with changes in plasma cytokine levels and meridian energy. Therefore, this study concludes that yoga may be a better alternative than massage for reducing AI-associated knee joint pain. Furthermore, meridian energy changes could be another non-invasive, scientific way to monitor the therapeutic effects of yoga and investigate other complementary medicine options.

In their pilot randomized wait-list controlled trial, Zhi *et al.* studied the effects of 8 weeks of yoga on 41 breast and gynecological cancer survivors with moderate-to-severe CIPN.^[43] The study compared the yoga group ($n = 21$) to the wait-list control group ($n = 20$). The participants' HRQOL was measured using the Hospital Anxiety and Depression Scale (HADS), Brief Fatigue Inventory (BFI), and Insomnia Severity Index (ISI). The Treatment Expectancy Scale (TES) was also administered at baseline. The study found that at week 8, the HADS

anxiety scores decreased by -1.61 (95% confidence interval [CI]: $-2.75, -0.46$) in the yoga group, while it decreased by only -0.32 (95% CI: $-1.38, 0.75$) in the wait-list control group ($P = 0.099$). However, at week 12, the yoga group showed a more significant reduction in HADS anxiety scores (-1.42 ; 95% CI: $-2.57, -0.28$) compared to a slight increase in the wait-list control group (0.46 ; 95% CI: $-0.60, 1.53$; $P = 0.017$). There were no significant differences in HADS depression, BFI, or ISI scores between the two groups. The study also found that the baseline TES was higher in the yoga group than in the wait-list control group (14.9 vs. 12.7 , $P = 0.019$). However, the TES was not associated with HADS anxiety reduction, and HADS anxiety reduction was not associated with CIPN pain reduction.

Khedmati Zare *et al.* sought to investigate the impact of yoga training and Vitamin D supplementation on leukocyte gene expression and psychophysical status in breast cancer survivors.^[44] A randomized controlled trial was conducted with a sample of 30 breast cancer survivor women (mean age = 48 ± 8 years) who were randomly allocated to one of three groups: High-dose (4000 IU) Vitamin D supplementation (HD) ($n = 10$) yoga training with a high dose of Vitamin D (Y + HD) ($n = 10$) yoga training with a low dose (2000 IU) of Vitamin D (Y + LD) ($n = 10$). All participants performed the Hatha yoga style twice a week. Blood samples and a battery of psychological and physical tests were collected before and after the interventions, and the expression of p53, NF- κ B, Bcl2, and Bax genes was measured in leukocytes.

The results of the study revealed that both the Y + HD and Y + LD groups demonstrated significant improvement in body fat percentage ($\eta^2 = 0.36$), shoulder flexibility ($\eta^2 = 0.38$), Rockport walk tests ($\eta^2 = 0.49$), and anxiety ($\eta^2 = 0.52$) compared to the HD group ($P < 0.05$). Furthermore, the Y + HD group displayed significant overexpression of p53, while the Y + HD and Y + LD groups showed upregulation of Bcl2. NF- κ B and Bax expression downregulation was observed in all groups, although it was not statistically significant. The findings suggest combining yoga training with low and high Vitamin D doses can improve physical fitness and psychological measures. However, only the group that received a high dose of Vitamin D demonstrated positive modifications in the cell survival-related gene expression of leukocytes.

The same group also looked at another outcome measure interleukin and TNF-alpha levels in the serum and identified that interleukin-10 (IL-10) levels were substantially increased in the Y-HVD group compared to the Y-LVD and HVD groups.^[45] Furthermore, there were significant decreases in the levels of tumor necrosis factor- α (TNF- α) and interleukin-6 in the Y-HVD group after the intervention. The anti-inflammatory index (IL-10/TNF- α) was significantly increased in both the yoga groups ($P < 0.05$). The authors concluded that yoga in combination with a high dose of Vitamin D improves the cytokine profile, which can effectively manage the side effects associated with cancer.

A randomized study was conducted by Knoerl *et al.* to evaluate the feasibility and effectiveness of an 8-week yoga program for cancer survivors experiencing chronic CIPN pain.^[46] Initially, 21 out of 50 participants were enrolled in the program. However, due to the COVID-19 pandemic, the program had to be delivered virtually through Zoom. The participants self-reported CIPN and co-occurring symptom severity before and after the intervention. The study included 28 participants in the yoga group and 16 in the control group. The majority of the participants were women (96%) and had been diagnosed with stage III/IV disease (66%). Out of the 28 participants

in the yoga group, 19 (67.8%) adhered to the yoga protocol. The yoga group participants experienced significant improvements in all patient-reported outcomes, including worst CIPN pain (median change = -1.7 , $P < 0.0001$) and sensory CIPN (median change = -14.8 , $P < 0.0001$). However, only improvements in fatigue ($P = 0.05$) and depression ($P = 0.04$) were significant compared to the control group. There were no significant differences ($P > 0.05$) in changes in patient-reported outcomes between in-person ($n = 6$) or virtual ($n = 15$) yoga group participants.

4. DISCUSSION

Our scoping review on the impact of yoga on cancer survivorship integrates our research findings with those from the comprehensive review by Danhauer *et al.*^[38] Our study confirms the positive effects of yoga on QOL, fatigue, psychological outcomes, and specific biomarkers among cancer survivors, aligning with the evidence base that highlights yoga's popularity and effectiveness in oncology care.

Consistent with the broader literature, our results highlight the multifaceted benefits of yoga, encompassing physical, emotional, and psychological domains. These benefits are particularly notable in enhancing QOL and managing fatigue, two critical concerns for cancer survivors. The improvements in sleep quality and psychological well-being reported in our study echo the findings of Danhauer *et al.*, emphasizing yoga's role in addressing both the physical and emotional challenges cancer survivors face.

Our analysis extends the understanding of yoga's impact by offering insights into its potential mechanisms, such as stress reduction, enhanced immune function, and improved physical fitness. These mechanisms contribute to the holistic well-being of cancer survivors, underscoring yoga's capacity to serve as a complementary approach to conventional cancer therapies. However, our review also highlights the variability in yoga interventions and the heterogeneity of study populations, which may influence the generalizability of findings. This variability underscores the need for standardized yoga protocols in future research to better assess its efficacy across different cancer survivor groups. As reflected in our findings and supported by Danhauer *et al.*, the safety profile of yoga reaffirms its suitability for cancer survivors with minimal adverse events reported. This safety aspect, coupled with the physical and psychological benefits, supports the integration of yoga into survivorship care plans.

The integration of yoga as a supportive care modality in oncology presents a set of challenges that require careful consideration. Among these obstacles is accessibility, which disproportionately impacts specific segments of the patient population. Despite the rising popularity of yoga, not all patients have equal access to these services due to geographic, socioeconomic, and physical limitations. Moreover, the variability in the quality of yoga instruction and the absence of standardized protocols for cancer-specific yoga interventions can influence the consistency of outcomes. As a result, health-care systems must integrate yoga systematically into patient care plans and establish standardized training and certification programs for yoga instructors working with cancer patients. These limitations highlight the need for more rigorous, standardized research methodologies to elucidate the specific components of yoga that contribute to its beneficial effects. Future research should also explore the long-term impact of yoga on cancer survivorship, including its potential to sustain improvements in QOL and reduce recurrence rates. Investigating the optimal frequency, duration, and types of yoga practices for different cancer survivor populations will further refine yoga's role in survivorship care.

In addition to quantitative research, qualitative studies could provide deeper insights into patient experiences and preferences regarding yoga, enabling more effective interventions and improved adherence. Exploration of tele-yoga and digital health interventions, particularly in light of the COVID-19 pandemic, could offer innovative solutions to address access issues and provide tailored yoga instructions at scale.

5. CONCLUSION

Our review confirms the positive impact of yoga on cancer survivorship. The evidence suggests that yoga provides a low-risk, holistic intervention that significantly improves the QOL, manages fatigue, and supports cancer survivors' psychological well-being. These benefits, combined with the favorable safety profile of yoga, emphasize its significance in comprehensive cancer survivorship programs. Further, research should continue to investigate the therapeutic potential of yoga and develop personalized, evidence-based interventions to support the recovery, and long-term well-being of cancer survivors.

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Nil.

7. AUTHORS' CONTRIBUTIONS

All the authors contributed equally to the design and execution of the article.

8. FUNDING

Nil.

9. ETHICAL APPROVALS

The study not required ethical permission as it is a review article.

10. CONFLICTS OF INTEREST

Nil.

11. DATA AVAILABILITY

This is an original manuscript, and all data are available for only review purposes from the principal investigators.

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