

Yoga as a complementary cancer therapy for mitigating oncological repercussions: A review

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The greatest challenge in the treatment of cancer is to mitigate the side effects of oncological diagnoses such as radiation therapy, chemotherapy and surgery, amidst a surging cancer catastrophe, and their physiological and psychological implications on the patient's body. Research shows the importance of mitigating therapeutic side effects of oncological procedures and processes for preventing cancer cell regrowth and the overall stability of cancer patients. Yoga, a time-validated practice, is a complementary therapy involving physical postures, breathing exercises, and mindful meditation with an impact on physical health, and psychological well-being. The impact of yoga is in particular linked to the emotions and feelings of cancer patients in reducing oncological stress, depression, pain, anxiety, and fatigue and improving the overall quality of life. Simultaneously, diagnostic protocols as a part of comprehensive oncological strategies and therapies to integrate yoga into mainstream healthcare are needed. Yoga's role in the prevention of cancer through lifestyle orientations needs deeper and more focused clinical research. This review examines the advantages of yoga for cancer patients, emphasizing improvements in physical health, psychological well-being, and overall quality of life to deal with cancer burden.

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Cancer encompasses a wide range of diseases and abnormalities that originate in nearly all organs or body tissues when abnormal cells proliferate out of control at varying paces. These cells can invade neighbouring body parts and/or spread to other organs. Globally, cancer has evolved as the second leading cause of death, alone responsible for about 9.6 million deaths in 2018, which is roughly 1 in 6 deaths. Men are most likely to develop lung, prostate, colorectal, stomach, and liver cancers, whereas women are more likely to develop breast, colorectal, lung, cervical, and thyroid cancers¹.

The newer cancer cases in 2020, according to the GLOBOCAN 2020 report, alone stood at about 19.3 million cases globally resulting in a staggering 10 million deaths for the year. The figures were close to 20 million cases resulting in 9.7 million deaths for 2022². The number of female breast cancer cases stood the highest at 2.3 million cases - 11.7% followed by cancers of the lung - 11.4%; colorectal -

10.0%; prostate - 7.3% and stomach - 5.6%³. However, the mortality rates occurring due to cancer cases were the highest for lung - 18%; colorectal - 9.4%; liver - 8.3%; stomach - 7.7% and breast - 6.9%³. The demographic variation of cancer patients stood in the developed nations as compared to the developing ones. The report forecasts the number of cancer patients to rise to 28.4 million in the year 2040 with a whopping 47% rise from the total cases reported in 2020 which is set to reversely affect the developing countries of today more than that of the developed countries due to the demographic changes and the associated risk factors such as globalization, economization and lifestyle change³.

Due to demographic changes and the widespread use of screening methods, cancer incidences are expected to rise even further and in technologically advanced countries like Germany, approximately 50% of people get diagnosed with cancer at some point in their lives⁴. In this order of events, the global cancer cases would be 35 million by the year 2050 and hence mitigation of risk factors for cancer prevention

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including that of smoking, obesity, overweight and infection can prevent a catastrophic global cancer burden². Thus, provision of medical care for cancer patients is a critical responsibility of our healthcare system.

In modern oncology, the causes of cancer can be attributed to mutations in genes, external carcinogenic components or compounds, lifestyle related and chronic infections. In Ayurveda, concept of cancer is linked to Tridosha imbalance leading to abnormal cell proliferation that are caused by *arbuda* or tumour like growth, *granthi* which are small swellings, *raktadushti* – impurity of blood⁵. Ayurveda also emphasizes other causes of cancer such as *agnimandya* – low digestion, *pragyaparadha* – improper lifestyle, *beejadosha* – defective genetics as the causes of cancer⁵. Ayurvedic herbs like Ashwagandha, Guduchi, Triphala, Haridra play an integrated role along with yoga in oncological care through detoxification⁶. Panchakarma therapies and dietary modification also help in balancing tridoshas⁶.

Physiological and psychological side effects of cancer diagnosis

The global cancer burden continues to increase, causing significant physical, psychological, and financial pressure on individuals, families, communities, and healthcare systems¹. Numerous psychological and physiological difficulties are frequently associated with cancer and its therapies. Patients who are diagnosed with cancer undergo treatment over an extended period of time at the multimodal level and are accompanied by cumulative morbidity⁷. Though the oncological therapies like radiation therapy, chemotherapy, and surgery are considered necessary, these treatments methods have quite often resulted in devastating side effects that rigorously harm and weaken the patient's overall functional quality of life (QOL), which results even in changes related to their appearance, infertility, alterations in their sexual functioning, loss of hair, fatigue and nausea, vomiting, pain and infections resulting in low blood counts⁸.

Though there has been an observable advancement in the detection of cancer and its systematic diagnosis resulting in an increase in the number of survivors, it has also been witnessed among the patients as to how they endure and live with anxiety about the disease's re-occurrence, its diagnostic progression, and death as a possibility⁹. Hence the patients face emotional fury, low levels of motivation and acute psychological

distress as they become worried, helpless and hopeless as an adverse repercussion of the oncological diagnosis¹⁰. The resulting distress has the potential to create a vicious cycle of anxiety, stress, vasomotor, and pain symptoms, reducing patients' ability to recover from the incurring intolerable pain and oncological symptoms¹¹. This results in an even larger dosage of drugs and increased reliance on it causing negative side effects. Some cancer patients may experience anxiety or depressive disorders as a result of treatment-related distress. This can cause the patient to be helpless and hopeless combined with low willingness to survive, a loss of control over one's life, a change in attitude toward cancer and very survival^{9,12}, a decrease in the threshold for pain and discomfort¹³, lowered self-esteem¹⁴, and an increase in cancer-related symptoms. Empirical studies indicate at an alarming state of mind of cancer patient's mental state adversely resulting in sleep disruptions, abnormal cortisol rhythms, reduced immune responsiveness, and decreased survival rates with early deterioration¹⁵.

Cancer patients are frequently forced to undertake lifestyle adjustments to cope with and adjust to side effects related to treatment and associated distress, which can be powerful short- and long-term stressors. As a result, patients may seek supportive care. Compared to healthy individuals, cancer patients have significantly greater rates of anxiety disorders and depression^{16,17}. This is particularly seen among breast cancer patients who have undergone radial mastectomy¹⁸. One of the most common complaints among cancer patients, aside from depression and anxiety, is fatigue caused by cancer¹⁹. Over half of the patient's experience fatigue either during or after their course of treatment²⁰. These symptoms that are related to cancer may result in lower survival rates of those patients who are not afflicted, and cause a decline in quality of life²¹. As a consequence of this, cancer-related psychological and physical impairments also need to be considered in treatment plans which can be abundantly addressed though yoga and meditational techniques.

Yoga and Meditation: preventive and alternative therapeutical approach for cancer diagnosis

In order to address these issues, 35% to 50% of cancer patients and healthcare providers are adopting complementary and alternative medicine systems²². Yoga, which is an ancient Indian practice, is a prime example of complementary and alternative medicine

system which is globally recognized for its physiological benefits in cancer care²³. Different forms and traditions of yoga such as Iyengar Yoga, Integrated Approach of Yoga Therapy, Sudarshan Kriya Yoga, Vinyasa Yoga, Tibetan Yoga, Integrated Yoga, and Hatha Yoga emphasize one or more specific practices and are beneficial in stress reduction, mood improvement, and symptom distress alleviation thereby contributing towards better quality of living in cancer patients²⁴. In the West, meditation practices like Mindfulness-Based Stress Reduction (MBSR) and transcendental meditation are also popular in cancer care²⁵. Below are the physical, and psychological benefits, and symptom-reduction effects observed in various interventions through yoga and meditation.

Psychological Benefits

Stress reduction and mental health

Yoga plays an important role in cancer symptom management by reducing anxiety, depression, distress, stress and overall quality of life²⁶. The psychological burden of cancer diagnosis and treatment can lead to increased levels of stress, anxiety, and depression. Yoga has been demonstrated as an effective tool in the reduction of self-reported depression, anxious nature in cancer patients undergoing oncological treatment²⁷. The practice of yoga promotes mindful relaxation in patients thereby reducing stress hormone levels and improve mood. Studies show cancer patients who engage in yoga, experience lower levels of anxiety and depression compared to those who do not. A study conducted by Weimin Liu *et. al.*²⁸ validates the effectiveness of mindfulness yoga on anxiety and depression in breast cancer patients diagnosed at an early stage. The identified 136 participants were assigned a 1:1 ration on a random basis to the experimental group comprising 'mindfulness yoga and conventional care' while the control group comprised the 'conventional care' ones²⁸. To primarily assess anxiety and depression symptoms the hospital anxiety and depression scale was used and the assessments were performed at baseline time, the 8th week, and the 20th week. The experimental group had a better prognosis in comparison with those in the control group, especially for anxiety [inter-group effect, $T1: 1.18$ (95% CI 0.20-2.17; $p = 0.018$)], depression [$T1: 1.49$ (95% CI 0.48 - 2.50; $p = 0.004$)] and health-related life quality [$T1: - 6.34$ (95% CI - 11.81 to - 0.87; $p =$

0.023)]²⁸. The current research had shown the dominance of the experimental group over the control group in the effective management of anxiety and depressive symptoms at T1, and the group comprising mindful yoga emerged as a statistically and clinically significant group for improving anxiety and depressive symptoms²⁸.

A study by Anna Lundt *et al.*¹⁰ conducted a trial comprising 58 patients to observe the long-term improvement of anxiety and depression after a yoga intervention in cancer patients with mixed diagnosis. In total a Yoga therapy schedule of 60 min each - once a week - for 8 weeks was provided through yoga classes in such a way that the yoga sessions contained both body and breathing activities as well as meditation²⁹. Anxiety and depressive symptoms were with the Generalized Anxiety Disorder scale (GAD-7) and Patient Health Questionnaire-2 (PHQ-2), respectively and the results of the study suggest that six months after the end of yoga therapy, symptoms of anxiety, depression were significantly reduced compared with baseline. However, symptoms of anxiety slightly increased during the follow-up period, whereas symptoms of depression remained stable²⁹. As cancer and stress are interconnected³⁰, below are given specific instances of yoga and meditation-based complementary oncological intervention for breast, colorectal and lung cancer patients.

Specific instances of yoga and meditation in oncological diagnosis

Breast Cancer

A 4 - 8 week intervention through yogic exercises reduced overall fatigue and its otherwise negative influence of chemotherapy on the daily lives of breast cancer patients thereby enhancing the psychological and physiological health of women patients through reduced anxiety, depression and fatigue resulting in improved QOL^{31,32}. Mindfulness-based cognitive therapy³³ and yoga³⁴ have proved effective for breast cancer patients in stress reduction and improved sleep quality for a specific duration of time post-intervention³⁵. The effects seen on a 12-week intervention through Hatha yoga and practice of meditation on the breast cancer survivors experiencing menopausal symptoms was effective for at least 3 months³⁵ thereby prompting the long-term use of yoga for improved QOL from the emotional, physical, behavioural and spiritual perspectives³⁶. For reducing menopausal symptoms laughter yoga,

acupressure and mindful meditation are effective in terms of improving quality of life³⁷. The integration of spiritual aspects and religious perspectives into oncological treatment can enhance patient well-being for positive outcomes³⁸. Mindfulness-based stress reduction therapies have a positive influence by reducing anxiety and depression of women breast cancer patients³⁹ and are worthy of recommendation as a complementary treatment⁴⁰. The use of integrative therapies such as meditation, yoga, relaxation and music therapy during and after breast cancer treatment for the management of anxiety, stress, fatigue, chemotherapy-induced nausea, vomiting, pain, panic⁴¹ and sleep disturbances is accepted as a clinical practice and hence are valid tools and strategies for improving the quality of life⁴². The results of a randomised, controlled pilot study conducted by Banasik *et al.* suggest that participating in a 90-min - twice weekly for 8 weeks in Iyengar yoga class may decrease the secretion of salivary cortisol in survivors of breast cancer^{43,10}. In addition, an overall improved emotional well-being was observed in both groups, with a statistically significant improvement in the yoga group⁴³. Personalised yoga therapy and mindfulness-based interventions can hence enhance the quality of living and maintain weight among women undergoing chemotherapy for breast cancer⁴⁴. Hence, yogic intervention can be an alternative to relieve patients from oncological pain as it is psychologically induced therapy targeting oncologically induced trauma⁴⁵. Moreover, yoga is a corrective course of action for mitigating chronic stress-induced tumour development in tumour cells in cancer patients as well as metabolic changes in surrounding non-cancerous cells⁴⁶. Yoga practice also brings about a reduction in tissue thickening and hardening, particularly the skin, in the limb area and brings greater spinal mobility and strength in shoulder abduction⁴⁷. In cancer patients who have undergone radial mastectomy¹⁸, which involves a surgical procedure to remove the whole breast and the lymph nodes, yoga and mindful meditation has demonstrated to reduce stress, enhancing self-esteem, improving the perception of their body, thus advocating yogic intervention from the preoperative stage onwards⁴⁸.

Colorectal cancer

In an experiment involving 116 adult patients with stage-II and stage-III Adenocarcinoma colon cancer, it has been evidenced that yoga and naturopathy

interventions along with chemotherapy positively improve the overall quality of life along with enhanced haemoglobin and carcinoembryonic antigen production apart from reduction in anxiety and depression⁴⁹. A unique patient-derived 'integrative oncology model of care' with lifestyle-modifying intervention tools such as yoga, mindfulness, Buddhist meditation techniques, psychotherapeutic and nutritional support was reported to be supportive for stage-IV colorectal cancer patients⁵⁰. Yoga, among other therapies, is further recommended as an adjuvant therapy after the initial cancer treatment to reduce the effects of chemotherapy on colorectal cancer patients⁵¹.

Lung cancer

Lung cancer poses serious threat as it has the highest mortality rate among all cancers³. In various cases, yoga breathing exercises have been used for pulmonary rehabilitation post-lung cancer surgery⁵². With chronic side effects coming in through chemotherapy, laughter yoga as a non-invasive complementary aerobic exercise and psychological stimulator can reduce stress, improve moods and improve exercise capacity in lung cancer patients thereby improving their emotional and physical functioning⁵³. A randomized clinical trial at Reza Radiotherapy and Oncology Centre conducted on 69 cancer patients undergoing chemotherapy showed significant difference in fatigue, pain, sleep quality; and emotional, physical and role functioning among those subjected to a structured laughter yoga intervention⁵⁴. The clinical trial also showed a significant decrease in chemotherapy-induced nausea and vomiting thus reducing the stress effect⁵⁵. Yogic mind-body exercises has also reduced psychological distress and anxiety among lung cancer patients^{56,57}. Low-intensity yoga and mindfulness intervention is a promising complementary tool for 'dyadic intervention' aimed at physical, psychological, social and spiritual challenges faced by lung cancer patients and care partners or caregivers in negating the psychosocial impact⁵⁸. The Vivekananda Yoga Program focussed on joint loosening with breath synchronisation, *asanas* - postures, deep relaxation technique, *pranayama* - breath energization with sound resonance and meditation for inducing interconnectedness of the dyad-- advanced lung cancer patients and their family caregivers^{59,60}. The caretakers showed reduced depression, stress and anxiety levels post Iyengar yoga and 'Breathe Easier'

intervention and their cardiometabolic biomarkers measured by NMR spectroscopy showed the possibility of reducing cardiometabolic disease risks in caregivers⁶¹.

Physical benefits

Reduction of therapeutic side effects

Cancer related treatments and therapies such as chemotherapy and radiation, often lead to devastating side effects, including fatigue, pain, and nausea. Several studies have indicated that yoga can help alleviate these symptoms.

Yoga has been used in the management of a variety of symptoms such as fatigue, sleep disturbances, loss of appetite, chemotherapy-induced nausea and vomiting (CINV), and pain in cancer patients^{62,63}. The effects of yoga intervention have been moderate to large in these studies. Cooling Pranayama such as Sheetal, Sheetakari, and Sadanta have been useful in managing CINV along with Pavanamuktasana (supine knee-chest) and Uttanapadasana (straight leg raise)⁴¹. Loosening exercises, gentle stretches, Yogasanas (stretching postures), Sudarshankriya, and relaxation techniques are effective in managing fatigue, pain, and sleep problems⁶⁴. Even physicians practicing Sudarshan Kriya Yoga regularly have experienced improved wellness apart from decreased stress and strain-induced burnout thereby preventing a fallout on their families, patients and wider healthcare system⁶⁵. Practitioners of Sudarshan Yoga kriya exhibited significantly higher resting heart rate, quality sleep, and social connectedness that positively impacted their physiology⁶⁶. Techniques that use postures interspaced with relaxation techniques (cyclic meditation/movement meditation) are useful in reducing stress and improving sleep⁶⁷. Mind sound resonance technique that involves chanting and meditating on sounds “a,” “u,” and “m,” and mantras have been shown to reduce fear, and anxiety, and instil a restful state of mind⁶⁸. Other schools of yoga that have used props to facilitate stretching followed by relaxation have also been found to reduce fatigue and pain in cancer patients⁶⁰. According to the Pancha Prana theory, the asanas that are chosen for the management of symptoms depend on the direction of the flow of prana⁶⁹. For example, for managing Chemotherapy Induced Nausea and Vomiting (CINV), the problem lies in correcting of Samanavayu whose seat is in the stomach and gut, sluggishness of this vayu causes abdominal

discomfort and an increase in Udanavayu (upward force) causing vomiting⁶⁹. The use of antiemetic therapy causes gastroparesis and obstructs Udanavayu and Apanavayu (downward force) causing nausea. By doing postures that work on the abdomen, facilitation of the downward flow of the otherwise sluggish Apanavayu is made possible which reduces nausea and improves appetite⁶⁹. Similarly, fatigue is caused due to sluggish Samanavayu and obstructed flow of vyana that causes myalgia and fatigue on exertion⁶⁹.

Improvement in physical functioning

Yoga's emphasis on gentle stretching and strengthening exercises can significantly improve physical functioning. As a result of fall in physical abilities cancer patients are subjected to prolonged periods of inactivity resulting in treatment side effects. It is here where yoga helps in the strengthening of muscles, its flexibility and overall balance. These are crucial for day to day activities and overall well-being of cancer patients. Various forms of yoga in combination with mindful meditation techniques are effective in treating oncological diseases⁷⁰.

Quality of life improvements

Cancer patients practising Yoga Nidra or yogic sleep provide both relief to psychological distress and improve sleep quality thereby improving overall quality of life⁷¹. Research shows that Yoga Nidra has a positive effect on brainwaves, the onset of sleep and the nervous system thereby enhancing relaxation and reducing pain⁷². In breast cancer patients yogic exercise has had positive effects on sleep improvement in qualitative terms⁷³. Functional Magnetic Resonance Imaging (fMRI) studies have shown that the practice of Yoga Nidra results in a unique combination of a restful and relaxed state similar to deep sleep while maintaining a heightened awareness⁶⁶. Cancer patients who underwent the Iyengar Yoga Program have been reported to have improved overall well-being and managed the demands of living with treating cancer⁷⁴. Through a combination of postures, meditation and breathing techniques yoga effects in improving the body's flexibility, balance, strength and overall endurance with aftereffects being relaxation-induced stress reduction⁷⁵.

Enhanced quality of life

Quality of life (QoL) is an important indicator for the measurement of physical, psychological, and

social well-being of cancer patients. In cancer care it has been found that yoga can dynamically improve the QoL of cancer patients⁷⁶. Practice of various yogic asanas can result in improved sleep quality, reduction in pain, and importantly improved patient appetite and as a result yoga can contribute to a higher QoL. Group practice of yoga have the potential to foster a sense of community and support thereby enhancing social well-being⁷⁶. A standard protocol⁷⁷ for the integration of oncology and yoga can benefit patient in the management of symptoms^{78,79}.

Empowerment and self-care

Cancer patients who engage in yoga practice redefine an opportunity to become active in daily life. This leads to improved motivation and a sense of empowerment that can recourse their oncological treatment regimens with a more self-care based proactive approach towards cancer management. As a result of this patients feel more in control of their bodies and visibly positive health outcomes. This improvement that is self-judged is particularly empowering during a time when they may feel vulnerable due to oncological procedures and radiation treatment methods.

Conclusion

For cancer patients undergoing complementary therapy, yoga offers a range of selective physiological and psychological benefits leading improvement in overall quality of life. Though it is not a necessity that oncological process and procedures need to be replaced by yoga and meditation, their very intervention and incorporation as a complementary and supplementary treatment can improve the patient's life quality by also addressing the oncological repercussions as discussed in this paper. Focused research in the development and exploration of a standard mechanism and protocol for the integration of oncological diagnostic procedures with yoga-meditation is hence needed. Therefore, yoga is a valuable tool in cancer management thereby providing physiological and psychological benefits to patients. The effect of yoga on cancer patients and cancer survivors is a supportive intervention in symptom management. Developing a targeted research and diagnostic protocol as a part of oncological therapies with curative intent is needed for integrating yoga into 'mainstream healthcare' for its complementary usage during cancer diagnostics as a part of integrative oncology strategies.

Conflict of Interest

The authors affirm that there are no competing or conflict of interest.

Author Contributions

All the authors contributed significantly to the conception, study, data collection and finalizing of manuscript. The authors have read and approved the final version of the manuscript before the submission.

Data Availability

Supporting data are available from the corresponding author upon reasonable request.

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