

Effect of Long-term Yoga Practice on Psychological outcomes in Breast Cancer Survivors

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Abstract

Aim: Breast cancer has become a pandemic with an ever-increasing incidence. Although better diagnostics and treatment modalities have reduced mortality, a large number of survivors face cancer and treatment-related long-term symptoms. Many survivors are taking up yoga for improving the quality of life (QoL). The present study attempts to evaluate predictors of psychological states in breast cancer survivors with long-term yoga experience. **Materials and Methods:** A case-control study recruited early breast cancer survivors, 30–65 years, completing treatment > 6 months before recruitment, and grouped them based on prior yoga experience (BCY, $n = 27$) or naïve (BCN, $n = 25$). Demography, cancer history, diet, exercise habits, and yoga schedule were collected and tools to assess stress, anxiety, depression, general health, and QoL were administered. Multivariate linear regression was done to identify predictors of psychological variables. **Results:** BCY had significantly lower stress, anxiety, depression, better general health, and QoL ($P < 0.001$). Global QoL and trait anxiety were significantly predicted by Yoga practice; depression was predicted by yoga practice, annual income, and sleep quality; state anxiety was predicted by Yoga practice and income; and stress was predicted by Yoga practice and sleep quality. **Conclusion:** Results indicate that breast cancer survivors, doing yoga, have better psychological profiles and are able to deal with demanding situations better. The psycho-oncogenic model of cancer etiology suggests that a better psychological state in survival has the potential to improve prognosis and survival outcomes and Yoga may be a suitable practice for staying cancer-free for a longer time.

Keywords: Anxiety and depression, breast cancer survivors, perceived stress, quality of life, Yoga

INTRODUCTION

Cancer is one of the leading cause of death worldwide, with an incidence of 14 million in 2012 and about 1 million diagnosed each year, (Ferlay *et al.*, 2008)^[1] of which 10% is from India (Jemal *et al.*, 2008).^[2] While the prevalence of cancer has increased over the past decade and is expected to rise by 8% in the next 5 years, regular screening, early detection, and improved therapies have increased the 10-year survival from 61% to 77% in the past decade (Ferlay *et al.*, 2008).^[1]

The patients surviving primary cancer treatment are called cancer survivor^[3] and experience several physical symptoms, treatment-related side-effect,^[4] and psychological disturbance, persisting long after completion of active treatment. Cognitive impairment, depression,^[5] and development of secondary cancers are some of the late side effects seen in survivors. Anxiety about recurrence and the future are primary concerns

for survivors.^[6] This existential distress coupled with daily hassles can pose a significant problem to cancer survivors, impacting their quality of life (QoL). Studies have shown that coping with such chronic stressors, over a long-term, can lead to immune suppression and dysregulation of body's defense mechanisms.^[7]

The role of stress in cancer etiology has gained interest among many scientists and it was shown that cancer is more common in depressed individuals.^[8] Orthotopic mouse studies have demonstrated a pathway, by which chronically stressed mice

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promote malignant cell growth.^[9] Furthermore, in humans, psychological stress has shown to enhance carcinogenesis and cancer progression.^[10] This is evident through studies that have associated recurrence with depression and sedentary lifestyle among breast cancer survivors.^[11]

Cancer survivors are advised a healthy lifestyle, comprising of exercise,^[12] fiber and antioxidant rich diet, and lower psychological stress (fear, mood imbalance, anxiety, and depression) because these lifestyle factors are associated with risk of recurrence (Nechuta *et al.*, 2016)^[13] and changes in these factors go a long way in influencing disease, improving treatment outcomes, and preventing recurrence,^[14] while improving quality of life. Several lifestyle intervention is being studied to find evidence for this psycho-oncology theory,^[15] and many survivors are opting for complementary and alternative medical systems (CAM) such as Yoga to improve disease-free survival and QoL (21% in US,^[16] 56% in India^[17]).

Since the first published research articles evaluating the benefits of a support group therapy,^[18] several researchers have used mind-body techniques, such as yoga, in combination with conventional treatment and seen a plethora of benefits in cancer care. Yoga-based lifestyle changes have been studied for their beneficial effects on cancer-related symptoms, morbidities,^[19] immune functioning,^[20,21] treatment adherence,^[22] psychological profiles (anxiety, depressions, and stress), and QoL.^[23,24] Among survivors practicing yoga, enhanced QoL,^[25] fatigue,^[26] sleep,^[27] depression, other psychological measures,^[28] and restoration of menopausal health has also been observed.^[19,29]

Yoga, a more popular of the CAM modalities, opted for by cancer survivors, is defined as the willful mastery over the modifications of the mind.^[30] Yoga defines the human system as comprising five personalities,^[31] that is, the physical, the vital energy, the mind, the intellect, and the existential happiness. When these five aspects are in a state of balance, they bring about a state of being aware and in control of oneself. This, according to yoga, is the definition of health (swa-stha [self-established]). Prolonged imbalance in any of these layers may show up as disorder at the physical level.^[32] Techniques in yoga offer a way to regain control over these five personalities and restore normal health. Chronic psychological stress is now being implicated in many noncommunicable, lifestyle disorders,^[33] and a yoga-based lifestyle intervention is suggested as a novel add-on to conventional cancer care.

Although there are studies that validate short-term benefits of yoga practice, there are limited studies that show long-term benefits of yoga in survivors. The present case-control study aimed to assess the differences between breast cancer survivors who do and do not practice Yoga with respect to their psychological states.

MATERIALS AND METHODS

A case-control explorative study was planned, with breast cancer survivors doing regular Yoga (BCY, $n = 27$) and

age-matched yoga naïve survivors (BCN, $n = 25$). Participants were screened and recruited during their 6-month follow-up with the oncologist, at three comprehensive cancer care centers in Bengaluru, India, and divided into two groups based on their history of yoga practice. The approval of the Institutional Ethical Review and written consent from the participating hospitals were obtained, before commencement of the study. Informed consent was elicited from the study participants, before screening. All data collection were done at HCG Hospital, to maintain uniformity, and participants received refreshments and transportation allowance for the commute.

Female breast cancer survivors, of both groups (BCY, BCN), between the ages of 30 and 65 years, diagnosed with stage II or III, invasive lobular or ductal carcinoma of the breast, with no neutropenia or stage III and IV thrombocytopenia were included in this study. All participants had completed conventional cancer treatment more than 6 months before recruitment and received adjuvant chemotherapy as part of their treatment. Participants reporting chronic illnesses such as diabetes, arthritis, high blood pressure, thyroid imbalance, obesity (body mass index >40), those who had an acute infection in the past 2 months (erythrocyte sedimentation rate >55), and those who used other CAM modalities in the past 6 months were excluded from this study. Participants reporting more than 6 months of regular yoga practice during the past 1 year were allocated into yoga group (BCY) and those who had attended less than three yoga sessions in the past 1 year were allocated into the yoga naïve groups (BCN).

A study by Gielissen *et al.*,^[34] looking at psychological well-being with cognitive behavioral therapy among fatigued cancer survivors, yielded an effect size of 0.78 and thereby an optimum sample size of $n = 15$ in each arm, with α was 0.05 and power 0.8, was calculated. Final data analyses exceeded the derived optimum sample sizes as seen in the trial profile [Figure 1]. Furthermore, to correlate and predict psychosocial and lifestyle practices with psychological measures, the minimum sample size was estimated to be $n = 30$.

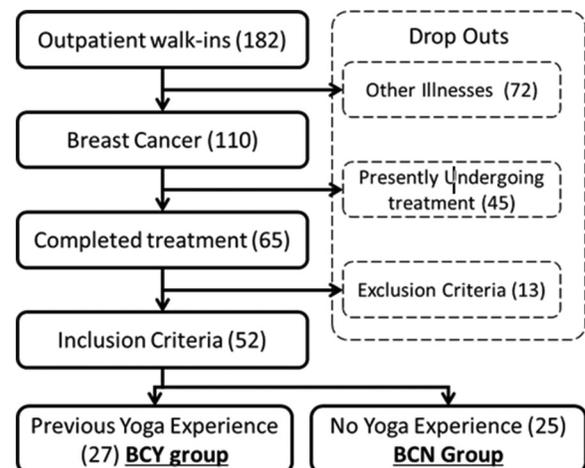


Figure 1: Trial profile

Participants complying with the selection criteria were requested to complete a patient information checklist, eliciting information about demography, cancer history, diet, exercise habits, and yoga schedule. Researchers ensured accuracy by scrutinizing participants' medical records. A battery of reliable psychometric instruments, evaluating stress (perceived stress scale), anxiety (Spielberg's state and trait anxiety questionnaire), depression (Beck's depression inventory), general health (General Health Questionnaire), and QoL (WHO QoL Questionnaire-BREF) were administered.

The statistician analyzing data and phlebotomists were blinded to the groups. The demographic datasheet and questionnaires were removed of personal identifiers, coded, and numbered, the codes for which was revealed at the end of the study. The questionnaires were manually scored, entered into data processing software and checked for accuracy and completeness.

Statistical procedures were conducted using Statistical procedures were conducted using SPSS version 10 (Sun Micro solutions, Gujarat, India). The probability values <0.05 were considered as statistically significant. Correlations were done between anthropometric, occupational and sociodemographic variables, and psychological measures. Within the yoga group, correlation between yoga practice and psychological variables was conducted. Significant correlations were used as predictors of psychological states through a multivariate linear regression.

RESULTS

Two cohorts of breast cancer survivors (BCY and BCN) were recruited to compare psychological and immune differences between those who practiced (BCY) and did not practice (BCN) yoga. Characteristics of the two groups are presented in Table 1. Anthropometric, occupational, and sociodemographic values were similar between the two groups. Yoga groups reported significantly more number of meals per day ($P = 0.050$). Furthermore, significantly more number of participants in the yoga group reported good quality of sleep as compared to the non-Yoga group ($P = 0.015$). Independent group comparisons between the two cohorts indicated significantly lower ($P < 0.001$) values in all the psychological and QoL variables, as shown in Table 2.

Bivariate correlation was done between all psychological variables and independent predictor variables. Of the predictor variables, group (BCY or BCN) and sleep quality were related to all psychological outcomes. Annual income correlated with general health ($P = 0.046$), physical QoL ($P = 0.011$), functional QoL ($P = 0.01$), depression ($P = 0.014$) and state ($P = 0.01$), and trait anxiety ($P = 0.025$). Work hours was correlated with physical ($P = 0.037$) and functional QoL ($P = 0.023$).

Variables with significant correlations to psychological variables were used as predictors in multiple hierarchical regression. Group, annual income, work hours, and sleep quality were used as predictors on subdomains of OoL, general

health, stress, depression and state, and trait anxiety outcomes. The variance (r^2) and B coefficients were determined for independent predictors in the model.

There were no significant correlations observed between differences in yoga practices and psychological states and hence multivariate regression, using these variables were not attempted.

Group was a significant predictor for general health issues [F (3, 48) = 42.902, $P < 0.001$, $R^2 = 0.711$] adjusted for sleep quality ($P = 0.087$) and annual income ($P = 0.087$); physical QoL [F (4, 47) = 8.691, $P = 0.001$, $R^2 = 0.425$] adjusted for income ($P = 0.089$), sleep quality ($P = 0.107$), and work hours ($P = 0.621$); psychological QoL [F (2, 49) = 27.896, $P < 0.001$, $R^2 = 0.532$] adjusted for sleep quality ($P = 0.652$); psychosocial QoL [F (2, 49) = 21.086, $P < 0.001$, $R^2 = 0.463$] adjusted for sleep quality ($P = 0.449$); functional QoL [F (4, 47) = 19.848, $P < 0.001$, $R^2 = 0.628$] adjusted for work hours ($P = 0.948$), income ($P = 0.164$), and sleep quality ($P = 0.383$); and trait anxiety [F (3, 48) = 43.520, $P < 0.001$, $R^2 = 0.731$] adjusted for income ($P = 0.119$) and sleep quality ($P = 0.638$).

Depression was predicted by group ($B = 18.607$, $P < 0.001$), income ($B = -7.1 \times 10^6$, $P = 0.042$) significantly, and sleep quality ($B = -2.436$, $P = 0.058$) [F (3, 48) = 40.123, $P < 0.001$, $R^2 = 0.715$]; state anxiety predicted by group ($B = 27.608$, $P < 0.001$) and income ($B = -1 \times 10^5$, $P = 0.032$) [F (3, 48) = 45.729, $P < 0.001$, $R^2 = 0.741$], adjusted for sleep quality ($P = 0.720$); and perceived stress predicted by group ($B = 13.213$, $P < 0.001$) and sleep quality ($B = -2.066$, $P = 0.029$) [F (2, 49) = 51.925, $P < 0.001$, $R^2 = 0.679$].

DISCUSSION

The psychological profile of breast cancer survivors are influenced by whether or not they have practiced yoga before. It was observed that the yoga group had significantly lower stress, anxiety, depression, perceived stress, health impairment and better physical, psychological, social, and functional QoL, compared to yoga naïve group. In breast cancer survivors, annual income also predicted depression and state anxiety significantly. This would indicate the role of financial difficulties affecting psychological stress and coping in survivorship scenario.

The participants in the yoga group had lower psychological disturbances, similar to earlier studies showing benefit finding with various forms of yoga interventions in cancer patients.^[29] The magnitude of difference in distress and mood states between yoga versus yoga naïve survivors could be attributed to milder levels of distress, compared to those seen during treatment. Consequently, these milder levels could have created a floor effect. Yoga naïve survivors have habituated higher levels of trait anxiety and depression scores nearing moderate depression (≥ 30 on Beck depression inventory [BDI]). The mean values of anxiety and depression

Table 1: Comparison of characteristics between two groups

	BCY (n=27), n (%)	BCN (n=25), n (%)	Significant
Anthropometry			
Age (years)	51.22±11.0	53.08±10.4	0.535 [‡]
Height (cm)	157.85±5.7	156.92±9.3	0.761*
Weight (kg)	63.41±9.15	61.76±6.66	0.465 [‡]
BMI (kg/m ²)	25.43±3.38	25.17±2.70	0.763 [‡]
Cancer history			
Age at diagnosis (years)	49.33±11.1	47.76±10.4	0.600 [‡]
Years of survival (years)	4.07±0.87	3.84±1.38	0.789 [‡]
Stage			
I	9 (33.33)	8 (32)	0.999 [†]
II	13 (48.15)	12 (48)	
III	4 (14.81)	4 (16)	
IV	1 (3.7)	1 (4)	
Present hormone therapy	4	3	0.766 [†]
Occupational			
Occupation			
Homemaker	10 (37.04)	15 (60.00)	0.251 [†]
Employed	14 (51.85)	8 (32.00)	
Retired	3 (11.10)	2 (8.00)	
Working hours (among employed)	7.36±3.18	6.19±3.87	0.451 [‡]
Annual income (×100,000 Rs.)	47.21±39.20	31.75±90.36	0.430*
Sociodemographic			
Marital status			
Married	25 (92.59)	23 (92.00)	0.511 [†]
Unmarried	2 (7.41)	2 (8.00)	
Parity	1.67±0.83	1.88±1.13	0.700 [‡]
Lifestyle			
Appetite			
Poor	2 (7.41)	2 (8.00)	0.349 [†]
Normal	16 (59.26)	19 (76.00)	
Good	9 (33.33)	4 (16.00)	
Meals per day	3.15±0.456	2.96±0.200	0.050*
Nonvegetarian	10 (37.04)	10 (4.00)	0.826 [†]
Frequency of nonvegetarian/month (among nonvegetarian)	7.50±8.46	7.00±9.02	0.590*
Sleep (h)	6.78±0.93	6.84±1.18	1.000*
Quality of sleep			
Poor	7 (25.93)	15 (6.00)	0.015 [†]
Normal	6 (22.22)	6 (24.00)	
Good	14 (51.85)	4 (16.00)	
Yoga			
Yoga (months)	74.06±96.1	-	NA
Regularity			
Irregular	2 (7.41)	-	NA
1-2/weeks	1 (3.70)	-	
3-4/weeks	9 (33.33)	-	
5-6/weeks	10 (37.04)	-	
7/weeks	2 (7.41)	-	

[‡]P-value of independent samples *t*-test; *P-value of Mann–Whitney test for 2 independent samples; [†]P-value of Chi-square test; P<0.05 are considered significant. BMI: Body mass index, NA: Not available

in the yoga group were significantly lower indicating that they were not clinically depressed (≤ 10 on BDI). This observation adds to the benefit findings reported earlier.^[35]

Yoga group showed significantly lower impairment in general health functioning, with 3.704% of patients in BCY

group, compared to 88% in BCN group, having values, higher than the cut-off value of 24 for general health impairment.

QoL was lower in BCN group across all domains indicating a better global QoL in the cohort that did yoga. These

Table 2: Comparison of psychological variables and quality of life

Variable	BCY	BCN	Significant
General health	13.85±5.50	38.72±10.39	<0.001*
Stress	19.22±5.24	33.88±5.82	<0.001*
State anxiety	32.59±8.53	61.96±10.38	<0.001*
Trait anxiety	34.26±7.81	64.32±11.29	<0.001*
Depression	8.04±6.33	29.36±8.84	<0.001‡
QoL physical	12.66±1.46	10.31±1.83	<0.001*
QoL psychological	13.75±1.49	10.35±1.79	<0.001‡
QoL social	16.00±2.16	11.84±2.47	<0.001*
QoL functional	14.96±2.06	10.06±2.11	<0.001‡

‡*P*-value of independent samples *t*-test; **P*-value of Mann–Whitney test.
QoL: Quality of life

data are similar to previous studies^[36,37] that used the FACT QoL measure and indicated increasing trend in QoL after yoga.

Moreover, improvement in various QoL domains seen in the yoga groups can be a result of decrease in perceived stress and better coping strategies that have been shown by earlier studies, to affect survivorship issues in cancer survivors.^[38,39] Majority of the participants in the yoga group had previously been enrolled in an intensive yoga-based lifestyle intervention program, motivating them to adopting lifestyle changes, and positive health behaviors resulting in a positive impact on QoL. This study also offers support to long-term effects of a yoga-based intervention program wherein cancer patients can use these learned resources to cope with their survivorship issues. This could have also resulted in better appraisal of stressful situations resulting in decreased disturbances.

The psychological variables in this study specifically evaluated stress, which is the perception of a situation as demanding, based on the adequacy of coping resources,^[40] its' expressions as anxiety or depression and thereby the effects on general health and QoL. When cancer survival is appraised as stressful, it manifests as anxiety and/or depression, which further leads to downstream responses, and affects not only other psychosocial domains but also the physiological functioning and other determinants of disease-free survival.

This cross-sectional study has shed light on the possibilities that healthy lifestyle habits such as regular yoga practice can have long-term benefits for cancer patients and helps them to maintain better psychological and functional health. The study is a novel exploration of the connection between a range of psychological constructs in cancer survivors and long-term yoga practice. The outcomes assessed in the present study are aligned to the theory of “psycho-oncology” that postulates that psychological imbalance can impact coping and cancer progression.

The results need to be critically interpreted under different strata of an individual's personality (physical, psychological, psychosocial, and functional). The integrative approach of yoga targets all these levels and thereby differences in level

specific variables were observed, supporting the theory of psycho-oncology and emphasizing the need for mind-body modalities in the management of cancer.

As per the panchakosa model in ancient yoga texts, there are many more levels to a personality than the physical body and all individuals are a complex interplay of body and mind. Disease etiology, as understood in this context, postulates that uncontrolled mental activity has detrimental effects on body physiology, resulting in physical manifestation of disorders, or modulation of the course of several psychosomatic diseases. Studies are now suggesting that persistent psychological dysregulation is detrimental and can lead to several disorders.^[41] The present study suggests that corrective processes, very much like the disease process, should percolate from the mind into the body in restoring homeostasis thereby resulting in a more permanent restoration of health.

This, being a cross-sectional study, has several limitations in attributing psychological constructs to yoga alone. Although the study aimed to match groups on several factors such as disease stage, duration of disease, treatment, and histopathology, there could be other factors that could have confounded the results. In the present study, heterogeneity in specific yoga practices, intensity and duration of practice, feeling of well-being after practice, level of yoga practice, and spiritual well-being and connectedness could have influenced the results. Seasonal variation and dietary factors could have had an influence on psychological outcomes; nevertheless, since both groups were assessed over different seasons, a floor effect could have nullified any major seasonal variation. However, the decrements in mood disturbances, stress, and improvement in QoL offer support for using lifestyle interventions such as yoga in these populations.

Randomized controlled studies in survivorship population are needed to validate these findings and controlled interventional longitudinal studies with larger sample sizes might provide more statistical power to the conclusions. Measurement of biomarkers of cancer recurrence might provide direct information of the disease-free survival.

CONCLUSION

The results from this study support long term psychologic benefits and wellbeing with yoga practice.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Ferlay J, Shin H, Bray F, Forman D, Mathers C, Parkin D. GLOBOCAN 2008 V1.2, Cancer Incidence and Mortality Worldwide: IARC CancerBase No. 10. Medford: International Agency for Research on Cancer; 2010. Available from: <http://www.globocan.iarc.fr>. [Last accessed on 2011 Dec 06].

2. Jemal A, Siegel R, Ward E, Hao Y, Xu J, Murray T, *et al.* Cancer statistics, 2008. *CA Cancer J Clin* 2008;58:71-96.
3. Twombly R. What's in a name: Who is a cancer survivor? *J Natl Cancer Inst* 2004;96:1414-5.
4. World Health Organization. Cancer Factsheet; 2013. Available from: <http://www.who.int/mediacentre/factsheets/fs297/en/>. [Last accessed on 2013 Apr 01].
5. Bonadonna G, Hortobagyi GN, Valagussa P. *Textbook of Breast Cancer: A Clinical Guide to Therapy*. 3rd ed. Danvers, USA: CRC Press; 2006.
6. Siegel R, DeSantis C, Virgo K, Stein K, Mariotto A, Smith T, *et al.* Cancer treatment and survivorship statistics, 2012. *CA Cancer J Clin* 2012;62:220-41.
7. Reiche EM, Morimoto HK, Nunes SM. Stress and depression-induced immune dysfunction: Implications for the development and progression of cancer. *Int Rev Psychiatry* 2005;17:515-27.
8. Dunn AJ. Psychoneuroimmunology: Introduction and general perspectives. In: *Stress, the Immune System, and Psychiatry*. New York: John Wiley and Sons Ltd.; 1996.
9. Thaker PH, Han LY, Kamat AA, Arevalo JM, Takahashi R, Lu C, *et al.* Chronic stress promotes tumor growth and angiogenesis in a mouse model of ovarian carcinoma. *Nat Med* 2006;12:939-44.
10. Sood AK, Lutgendorf SK. Stress influences on anoikis. *Cancer Prev Res (Phila)* 2011;4:481-5.
11. Lazure KE, Lydiatt WM, Denman D, Burke WJ. Association between depression and survival or disease recurrence in patients with head and neck cancer enrolled in a depression prevention trial. *Head Neck* 2009;31:888-92.
12. Phillips SM, McAuley E. Associations between self-reported post-diagnosis physical activity changes, body weight changes, and psychosocial well-being in breast cancer survivors. *Support Care Cancer* 2015;23:159-67.
13. Nechuta S, Chen WY, Cai H, Poole EM, Kwan ML, Flatt SW, *et al.* A pooled analysis of post-diagnosis lifestyle factors in association with late estrogen-receptor-positive breast cancer prognosis. *Int J Cancer* 2016;138:2088-97.
14. Burris JL, Jacobsen PB, Loftus LS, Andrykowski MA. Breast cancer recurrence risk reduction beliefs in breast cancer survivors: Prevalence and relation to behavior. *Psychooncology* 2012;21:427-35.
15. Smith N, Fuhrmann T, Tausk F. Psychoneuro-oncology: Its time has arrived. *Arch Dermatol* 2009;145:1439-42.
16. Laiyemo M, Nunlee-Bland G, Lombardo F, Adams RG, Laiyemo A. Complementary and alternative medicine use among cancer survivors in the United States. *Cancer Res* 2013;73:2522. [Abstract 2522].
17. Moran MS, Ma S, Jagsi R, Yang TJ, Higgins SA, Weidhaas JB, *et al.* A prospective, multicenter study of complementary/alternative medicine (CAM) utilization during definitive radiation for breast cancer. *Int J Radiat Oncol Biol Phys* 2013;85:40-6.
18. Spiegel D, Bloom JR, Yalom I. Group support for patients with metastatic cancer. A randomized outcome study. *Arch Gen Psychiatry* 1981;38:527-33.
19. Culos-Reed SN, Carlson LE, Daroux LM, Hatley-Aldous S. A pilot study of yoga for breast cancer survivors: Physical and psychological benefits. *Psychooncology* 2006;15:891-7.
20. Carlson LE, Speca M, Faris P, Patel KD. One year pre-post intervention follow-up of psychological, immune, endocrine and blood pressure outcomes of mindfulness-based stress reduction (MBSR) in breast and prostate cancer outpatients. *Brain Behav Immun* 2007;21:1038-49.
21. Rao RM, Nagendra HR, Raghuram N, Vinay C, Chandrashekar S, Gopinath KS, *et al.* Influence of yoga on mood states, distress, quality of life and immune outcomes in early stage breast cancer patients undergoing surgery. *Int J Yoga* 2008;1:11-20.
22. Mustian KM, Morrow GR, Carroll JK, Figueroa-Moseley CD, Jean-Pierre P, Williams GC. Integrative nonpharmacologic behavioral interventions for the management of cancer-related fatigue. *Oncologist* 2007;12 Suppl 1:52-67.
23. Evans S, Cousins L, Tsao JC, Subramanian S, Sternlieb B, Zeltzer LK. A randomized controlled trial examining Iyengar yoga for young adults with rheumatoid arthritis: A study protocol. *Trials* 2011;12:19.
24. Vadiraja HS, Rao MR, Nagarathna R, Nagendra HR, Rekha M, Vanitha N, *et al.* Effects of yoga program on quality of life and affect in early breast cancer patients undergoing adjuvant radiotherapy: A randomized controlled trial. *Complement Ther Med* 2009;17:274-80.
25. Levine AS, Balk JL. Pilot study of yoga for breast cancer survivors with poor quality of life. *Complement Ther Clin Pract* 2012;18:241-5.
26. Bower JE, Garet D, Sternlieb B, Ganz PA, Irwin MR, Olmstead R, *et al.* Yoga for persistent fatigue in breast cancer survivors: A randomized controlled trial. *Cancer* 2012;118:3766-75.
27. Mustian KM, Palesh O, Sprod L, Peppone LJ, Heckler CE, Yates JS, *et al.* Effect of YOCAS yoga on sleep, fatigue, and quality of life: A URCC CCOP randomized, controlled clinical trial among 410 cancer survivors. *J Clin Oncol* 2010;28:9013.
28. Van Puybroeck M, Burk BN, Shnew KJ, Cronan Kuhlenschmidt M, Schmid AA. Perceived health benefits from yoga among breast cancer survivors. *Am J Health Promot* 2013;27:308-15.
29. Carson JW, Carson KM, Porter LS, Keefe FJ, Seewaldt VL. Yoga of Awareness program for menopausal symptoms in breast cancer survivors: Results from a randomized trial. *Support Care Cancer* 2009;17:1301-9.
30. Taimni IK. *The Yoga Sutras of Patanjali*. 1st ed. Wheaton Illinois: Quest Books; 1999.
31. Gambhirananda S. *Taittiriya Upanishad*. 1st ed. Kolkata: Advaitashrama; 2010.
32. Venkatesananda S, Chappel C. *The Concise Yoga Vasistha*. 1st ed. Albany: New York State University Press; 1984.
33. Gouin JP. Chronic stress, immune dysregulation, and health. *Am J Lifestyle Med* 2011;5:476-85.
34. Gielissen MF, Verhagen CA, Bleijenberg G. Cognitive behaviour therapy for fatigued cancer survivors: Long-term follow-up. *Br J Cancer* 2007;97:612-8.
35. Rao RM, Raghuram N, Nagendra HR, Usharani MR, Gopinath KS, Diwakar RB, *et al.* Effects of an integrated yoga program on self-reported depression scores in breast cancer patients undergoing conventional treatment: A randomized controlled trial. *Indian J Palliat Care* 2015;21:174-81.
36. Littman AJ, Bertram LC, Ceballos R, Ulrich CM, Ramaprasad J, McGregor B, *et al.* Randomized controlled pilot trial of yoga in overweight and obese breast cancer survivors: Effects on quality of life and anthropometric measures. *Support Care Cancer* 2012;20:267-77.
37. Moadel AB, Shah C, Wylie-Rosett J, Harris MS, Patel SR, Hall CB, *et al.* Randomized controlled trial of yoga among a multiethnic sample of breast cancer patients: Effects on quality of life. *J Clin Oncol* 2007;25:4387-95.
38. Buffart LM, van Uffelen JG, Riphagen II, Brug J, van Mechelen W, Brown WJ, *et al.* Physical and psychosocial benefits of yoga in cancer patients and survivors, a systematic review and meta-analysis of randomized controlled trials. *BMC Cancer* 2012;12:559.
39. Simard S, Thewes B, Humphris G, Dixon M, Hayden C, Mireskandari S, *et al.* Fear of cancer recurrence in adult cancer survivors: A systematic review of quantitative studies. *J Cancer Surviv* 2013;7:300-22.
40. Cohen S, Kessler R, Gordon U, editors. *Strategies for measuring stress in studies of psychiatric and physical disorder*. In: *Measuring Stress: A Guide for Health and Social Scientists*. New York: Oxford University Press; 1997. p. 2-26.
41. Aggarwal BB, Shishodia S, Sandur SK, Pandey MK, Sethi G. Inflammation and cancer: How hot is the link? *Biochem Pharmacol* 2006;72:1605-21.