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Original Research Article

Efficacy of Yoga and Naturopathy as an Adjuvant in the Management of Non-Hodgkin's Lymphoma

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ABSTRACT

To evaluate the effects of Yoga and Naturopathy interventions on hematological, biochemical parameters, psychological morbidity, conventional treatment related side effects and quality of life in patients with Non-Hodgkin's Lymphoma (NHL) undergoing conventional cancer chemotherapy. Adult patients with confirmed NHL were randomized to chemotherapy and Psychological counseling alone (control group) and chemotherapy along with Yoga and Naturopathy intervention (experimental group) and followed up. Subjects were assessed at baseline (before any intervention starts) and after 6 weeks, 15 weeks, 6 months and 9 months. Out of 136 patients enrolled on to the study, 36 patients dropped out even before they were randomized. The remaining 100 patients were randomized into two groups: 50 in control group and 50 in experimental group. Both the groups had similar baseline scores. All the results were analyzed by repeated measures of ANOVA. Statistically significant reductions in anxiety ($p < 0.0001$), depression ($p < 0.0001$), distress bothering ($p < 0.0001$), conventional treatment related side effects ($p < 0.0001$), and improving quality of life along with the improvement in the haemoglobin content ($p < 0.05$) were observed in experimental group patients compared to control group. However, there was no significant change in Total leukocyte counts, platelet counts, serum creatinine, blood urea, serum total bilirubin, serum uric acid and serum lactate dehydrogenase levels. Our results demonstrate that regular practice of both the interventions i.e. Yoga and Naturopathy are beneficial for patients with early stage NHL. Thereby it indicates the possible use of Yoga and Naturopathy as an adjuvant therapy in NHL patients who are undergoing chemotherapy.

Keywords: Non-Hodgkin's Lymphoma; Yoga; Naturopathy; Chemotherapy.

Highlights

- Yoga and Naturopathy interventions include scheduled Yoga practices, vegetarian diet and naturopathy sessions for patients with NHL undergoing chemotherapy.
- There was a significant decrease in psychological parameters such as anxiety, depression, and distress bothering along with improved haemoglobin content.
- The present study also demonstrates the reduced conventional treatment related side effects and improvement in quality of life in experimental group as compared to the control.
- Yoga and Naturopathy can be regarded as potential adjunct therapeutic approach along with the chemotherapy in NHL patients.

INTRODUCTION

Lymphoma is a heterogeneous malignancy of the lymphatic system characterized by proliferation of lymphoid cells or their precursors. Any of various malignant lymphomas characterized by the

absence of Reed-Sternberg cells and producing symptoms similar to those of Hodgkin's disease may be attributed as Non-Hodgkin's lymphoma (NHL). [1] There are two major subtypes of NHL: Indolent and Aggressive based on the speed at which the disease progresses. NHL is treated by combinations of chemotherapy, immunotherapy, radiation, and hematopoietic stem cell transplantation and targeted therapeutic approaches such as monoclonal antibodies. However, these lines of management have several adverse effects on long term treatment. Recent studies, including the European Bone Marrow Transplantation Registry (EBMTR) -sponsored 'CUP Trial' (Conventional Chemotherapy, Unpurged autograft, Purged autograft), demonstrate that for patients under age 60 years with recurrent chemotherapy-sensitive disease, autologous and allogeneic stem cell transplantation (ASCT) provides a survival benefit over conventional therapy. [2,3] In spite of all the technological advances in the management of NHL, the incidence is increasing globally. Around 385,741 new cases of incidence and 199,630 death cases have been reported (GLOBOCON, 2012). A person's risk of developing NHL during their lifetime is about 1 in 50. [4] This hike in the incidence can be attributed to several risk factors includes occupations and industries. Increased risks have been reported among farmers, printers, medical professionals, electronic workers and leather workers. [5]

In order to understand the efficacy of existing conventional treatment modalities, Ardeshna et al. assessed 57 patients [Hodgkin's Lymphoma 17, histological-aggressive NHL 26, histological-indolent NHL 14] who received more than one modality of conventional-dose salvage therapy. The analysis indicated that patients with malignant lymphomas, who have progressive disease on 1 degree salvage therapy, are not rescued by subsequent salvage regimens. [6] The follicular NHL usually diagnosed at advanced stage and remains incurable using conventional approaches. Hence the palliative or novel approaches along with the treatment should be explored.

There are several studies which demonstrate the role of lifestyle and stress in the outcome of cancers. Stress alters the neuro-endocrine system, immunity, and cancer progression. Recent studies reported that chronic restraint stress impairs T-cell mediated immunity and enhances tumor growth in mice. [7] As lifestyle modification plays a major role in the management of cancer, newer methods have been evolved and considered as complimentary (in most cases) and alternative (in rare occasions) to conventional treatment in cancer management. An earlier study made an attempt to understand the role of Complementary and Alternative Therapies (CAT) in reducing psycho-social morbidity associated with the disease and the conventional treatment. [8,9] It has been reported that complimentary therapies have been found to reduce the stress and anxiety levels in cancer patients when employed in the form of massage therapies, hydrotherapy and relaxation techniques. [10] In a pilot study conducted on children to study the effect of massage on cancer, it showed no significant changes in blood pressure, cortisol, pain, nausea, or fatigue. However, children reported that massage helped them feel better, lessened their anxiety and worries, and had longer lasting effects than quiet time. [11]

The effects of meditation and relaxation techniques in outcome of early breast cancer patients, it was concluded that, with the increasing success of cancer treatment and the ability to return to previous family, social and work activities, symptom management and quality of life are an essential part of survivorship. [12,13] However, the studies on CAM therapies especially related to Naturopathy are lacking. Hence present study has been designed to evaluate the efficacy of Naturopathic and Yoga modalities as an

adjuvant to conventional therapies in the management of NHL.

MATERIALS AND METHODS

Participants

The subjects were recruited from the Department of Medical Oncology, Indo-American Cancer Institute & Research Centre, and Hyderabad. Individuals who had diagnosed NHL based on a standard diagnostic criterion (WHO categorization) were screened.

Inclusion criteria

Subjects who fulfill the international diagnostic and staging criteria for NHL will be included. Pathologically confirmed NHL disease, aged 18-60 years, both genders, those with serum lactate dehydrogenase (LDH) concentration above normal, Eastern Cooperative Oncology Group (ECOG) performance status – 0, 1 & 2, Ann Arbor stage I or II, Number of extranodal disease sites < 2, estimated life expectancy more than 6 months, patient compliance & geographic proximity that allows adequate follow-up and patients with a prescribed conventional treatment regime including chemotherapy with or without radiotherapy.

Exclusion criteria

Subjects with Ann Arbor stage III or IV, Blastic natural killer cell lymphoma (B-NKL), ECOG Performance status –3, HIV positive, associated with other malignancies and metastasis to the brain.

Ethical clearance and informed patient consent

The study protocol was approved by Institutional Ethical Committee. An informed consent has been prepared in accordance with the ICMR guidelines and the same has been translated to Telugu. Subjects were explained about the study protocol and the proposed investigations including the procedure. They are also informed about the intervention (Yoga and Naturopathy) which were tried on the experimental group along with the conventional treatment. The wait-list control group (who continue to receive the conventional treatment and psycho-social counseling was given an option to take up Yoga and Naturopathy intervention after the completion of one-year follow-up assessment.

Study design

Subjects on consenting to participate in the study were matched for age, sex and severity of disease (based on the staging) and then sequentially allotted one of the two groups i.e., experimental and wait-list control (Table. 1). The experimental group was received conventional treatment for NHL with Yoga and Naturopathy as an adjuvant, while the wait-list control group was received the conventional treatment and standard psycho-social counseling. The experimental group received Yoga and Naturopathy during the treatment. Subjects were assessed at baseline (before any intervention starts) and after 6 weeks, 15 weeks, 6 months and 9 months chemotherapy.

Blinding and masking

Participants involved in the study could not be blinded to treatment allocation arm because of the nature of the intervention. The teams involved in the assessments, statistician were not involved in administering the intervention.

Treatment planning

Participants involved in the study were advised to join as inpatients for a minimum period of 15 days initially. The first 5 days patients were undergone conventional treatment as prescribed by the consulting medical oncologist. The chemotherapy protocol with CHOP was the first line of treatment includes 4-6 cycles, each lasting for 5 days, and the cycles was repeated after 21days gap. The detailed protocol for chemotherapy is detailed in Table. 2.

Intervention

Subjects who completed the first cycle of chemotherapy were recruited for the Naturopathy and Yoga intervention as and-add on therapy. Participants in the experimental group were given yoga training sessions by trained yoga instructors as mentioned in Table 3. The patients have

received the add-on interventions [yoga & naturopathy and psycho-social counseling] as an intensive for 10 days at the hospital and thereafter were followed the respective interventions at home using the audio-visual aids.

The treatment protocol includes: Hydrotherapy (application of water in different forms and temperatures either as partial application or as general application, also given as packs) for 20 minutes, Massage therapy for 45 minutes, Mud pack (application of sterile mud in room temperature in the form of a pack over closed eyes and abdomen) for 15 minutes, Enema (using 1-1.5 liters of plain water at room temperature) given for the first 3-5 days, and Yoga Therapy (simple breathing exercises, loosening exercises, physical postures, regulated breathing practices, meditation, relaxation techniques, for 1 hour every day (Table 3). Apart from these external treatments patients were given a special naturopathy based vegetarian diet (Table S1).

After completing the 10 days intensive treatment, subjects were given a basic home-based treatment schedule for Naturopathy, Yoga therapy and Diet counseling to continue at home. They were asked to maintain a treatment diary and the same was checked by the investigators during their follow-up visits. Follow-up was done 21 days after each cycle of chemotherapy till the completion of 4-6 cycles of chemotherapy. Further follow-up was done after six months, nine months and one year. At each follow-up visit, patients on experimental arm received 2 days of naturopathy and yoga intervention. The detailed intervention during the intensive and the follow-up period is provided in Table S2.

The control group received the conventional treatment i.e., chemotherapy along with the standard psycho-social counseling. After the conventional therapy control group was also asked to admit to the hospital along with the experimental group. They will spend 1 hour of psycho-social counseling along with normal diet regimen during these 15 days. Hence, the two general components of test intervention (i) counseling and (ii) rest would be given to the patients in this group.

Assessments

The percentage hemoglobin, total WBC count and platelet count were measured by automated cell counter and microscopic examination by a pathologist. Hematological parameters such as Blood Urea, Serum Creatinine, Total Serum Bilirubin and Serum tumor markers i.e. Lactate Dehydrogenase (LDH) were determined on Olympus AU 400 analyzer.

State-Trait Anxiety Inventory (STAI)

STAI consists of separate self-report scales for measuring two distinct anxiety concepts: state anxiety and trait anxiety, each having twenty statements. Subjects will be asked to rate their subjective scores on a four-point scale based on the experience of various anxiety-related symptoms.

Beck's Depression Inventory (BDI)

The inventory is composed of 21 categories of symptoms and attitudes, each with a graded series of 4-5 evaluation statements ranked to indicate the range of severity of symptoms from neutral to maximal severity. This scale has a reliability of 0.48-0.86 and validity of 0.67 with the Diagnostic and Statistical Manual of Mental Disorders (DSM) diagnostic criteria for depression.

Quality of life and stress symptoms

Quality of life of study participants was ascertained using the Functional Living Index of Cancer (FLIC). This scale is a self-administered measure of the global quality of life for cancer patients having a high correlation (0.44-0.75) with other scales.

A subjective symptom checklist was developed during the pilot phase to assess stress, treatment-related side effects, problems with image and relevant psychological and somatic symptoms related to NHL. The checklist consists of 31 such items, each evaluated on two dimensions, the severity graded from "none

to very severe (0-4)" and distress from "not at all to very much (0-4)". This scale measured the total number of symptoms experienced, total and mean severity and distress score and was evaluated previously in a similar cancer population.

Data extraction

Demographic and vital clinical data including personal information was obtained at the time of enrollment, before and after the treatment. Individual values for all the biochemical and immunological variables were tabulated as raw scores. The psychological variables were scored as per the standard procedure given in respective manuals.

Statistical analysis

The data were analyzed using Microsoft Excel, GraphPad quickcalcs, SAS 9.4 and GraphPad Prism version 5.00. The data of outcome variables were tabulated and analyzed using descriptive statistics. Based on the data type and distribution of data appropriate statistical tests were adopted to analyze the data to draw final inferences. A general scheme of analysis includes Pre-post comparisons using Fisher's exact test, the normality test for all variables by the number of cycles done using Shapiro-Wilk's test using SAS univariate procedure. The alpha level used for normality test is 0.05 (5%) and group analysis using repeated measures two way ANOVA and repeated measures RMANOVA.

RESULTS

Demographic data

Out of 136 patients who were recruited, 100 patients (50 in each group) completed all the assessments (Fig. 1). Both the groups were comparable with respect to demographic and medical characteristics. Median age in the experimental and control groups were 43 yrs and 43 years with a M: F Ratio of 2:1 (34 &16) and 2:1 (33 & 17) respectively. Stage I and II patients were only considered in this study. Subjects in both groups received 6 cycles of chemotherapy (Table 2) and they were followed up to 9 months after the treatment. A repeated measure analysis of variance was performed for all the haematological, biochemical and psychological parameters.

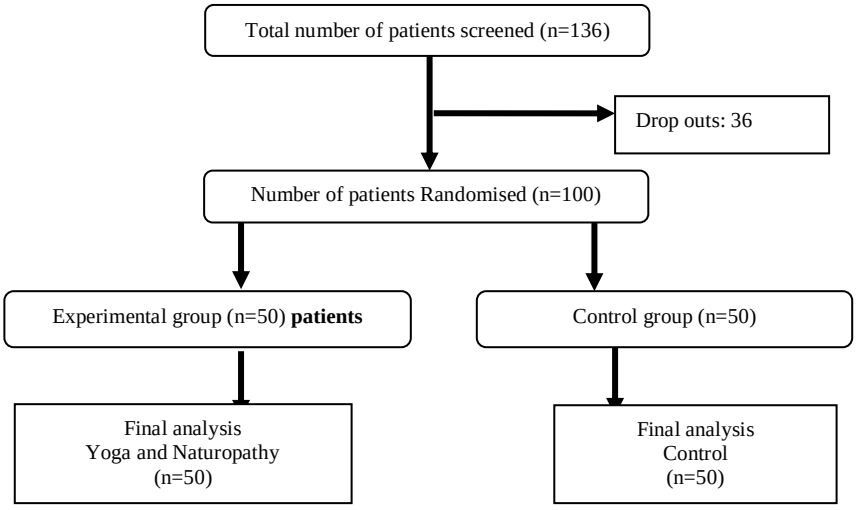

Figure 1. Trial flow diagram

Table 1. Demographic characteristics

Variable	Control group	Experimental group
Number of participants	50	50
Age (mean ± SD)	43+13	43+12
Sex		
Male	33	34
Female	17	16
NHL stage		
I	7	16
II	43	34

Table 2. Chemotherapy doses and schedules.

Day(s)	Drug	Dose	Route of administration
Day 1	Cyclophosphamide	750 mg/m^2	IV
Day 1	Doxorubicin	50 mg/ m^2	IV
Day 1	Vincristine	1.4 mg/ m^2	IV
Day 1 through 5	Prednisone	100 mg/day	O
Day 1	Rituximab (wherever necessary)	375 mg/ m^2	IV

CHOP chemotherapy consists of four agents: Cyclophosphamide (Cytoxan), Doxorubicin (Adriamycin, Hydroxydaunomycin), Vincristine (Oncovin), and Prednisone. One complete course is given every 21 days. Full treatment usually consists of four to six cycles. IV-intravenous dose, O-Oral.

Table 3. Integrated approach of Yoga therapy and Naturopathy for NHL used in this study during 10 day IP intensive treatment after 1st cycle of chemotherapy.

	Yoga therapy		**Naturopathy**	
Day	Morning	Evening	Morning	Evening
1	Pranayama (10 min). Nadishuddi and Bhramari; (10 min) of DRT	Cyclic meditation	Mudpack - (10 min), enema, partial massage to limbs for (10 min) followed by warm r bath.	Mudpack - (10 min)
2	Pranayama (10 min). Nadishuddi and Bhramari; (10 min) of DRT	Cyclic meditation and Yoga based imagery and auto-suggestion- relaxation for (30 min)	Mudpack - (10 min) followed by local hot fomentation, 7 minutes, neutral water bath	Neutral /hot foot bath (10 min) at bed time
3	Pavanmukta series of asanas for (10 min); Pranayama (10 min). Nadishuddi and Bhramari; (10 min) of DRT	Cyclic meditation and Yoga based imagery and auto-suggestion- relaxation for (30 min)	Mudpack for (10 min). hot & cold hepato- gastric pack and neutral water	Neutral /hot foot bath (10 min) at bed time
4	Pavanmukta series of asanas for (10 min); Pranayama (10 min). Nadishuddi and Bhramari; (10 min) of DRT	Cyclic meditation and Yoga based imagery and auto-suggestion- relaxation for (30 min)	Mudpack for (10 min), partial massage for 15 minutes	Neutral Immersion bath with temperature 92-98 degree F for (10 min)
5	Pavanmukta series of asanas for (10 min); Pranayama (10 min). Nadishuddi and Bhramari; (10 min) of DRT	Cyclic meditation and Yoga based imagery and auto-suggestion- relaxation for (30 min)	Mudpack for (10 min), hot chest pack.	Neutral /hot foot bath (10 min) at bed time
6	Pavanmukta series of asanas (10 min); Pranayama (10 min). Nadishuddi and Bhramari; (10 min) of DRT	Cyclic meditation and Yoga based imagery and auto-suggestion- relaxation for (30 min)	Mudpack for (10 min), enema, body massage for 20 min).	Neutral hip bath with temperature of 80-92 degree F for 15 – 20 min)
7	Pavanmukta series of asanas for (10 min); Pranayama (10 min). Nadishuddi and Bhramari; (10 min) of DRT	Cyclic meditation and Yoga based imagery and auto-suggestion- relaxation for (30 min)	Mudpack for (10 min), hot wrappings to legs.	Steam bath for 5-7 minutes followed by jet bath for 1 minute
8	Pavanmukta series of asanas for (10 min); Pranayama (10 min). Nadishuddi and Bhramari; (10 min) of DRT	Cyclic meditation and Yoga based imagery and auto-suggestion- relaxation for (30 min)	Mudpack for (10 min), hot & cold hepato- gastric pack and neutral water bath.	Neutral /hot foot bath (10 min) at bed time
9	Pavanmukta series of asanas for (10 min); Pranayama (10 min). Nadishuddi and Bhramari; (10 min) of DRT	Cyclic meditation and Yoga based imagery and auto-suggestion- relaxation for (30 min)	Mudpack for (10 min), massage for 20 min)	Neutral hip bath with temperature of 80-92 degree F for 15 – 20 min).
10	Pavanmukta series of asanas for (10 min); Pranayama (10 min). Nadishuddi and Bhramari; (10 min) of DRT	Cyclic meditation and Yoga based imagery and auto-suggestion- relaxation for (30 min)	Mudpack for (10 min), Neutral spinal jet bath with Temperature of 92-98 degree F for 15 – 20 min).	Neutral /hot foot bath (10 min) at bed time

Table 4: Comparison of hematological parameters between experimental and control group at base line and following intervention duration.

Hematological parameters	Visit	LS Mean difference (standard error)	95% CI of difference	p-value
Hemoglobin	Base line	0.23 (0.334)	(-0.427, 0.887)	0.4914
	After 6 weeks	0.73 (0.334)	(0.075, 1.389)	0.0290
	After 15 weeks	1.29 (0.334)	(0.631, 1.945)	0.0001
	After 6 Months	0.94 (0.334)	(0.285, 1.599)	0.0050
	After 9 Months	1.28 (0.334)	(0.619, 1.933)	0.0002
Total Leukocyte counts	Base line	2614.0 (1146)	(360.91, 4867.1)	0.0231
	After 6 weeks	2446.0 (1146)	(192.91, 4699.1)	0.0334
	After 15 weeks	2888.0 (1146)	(634.91, 5141.1)	0.0121
	After 6 Months	1582.0 (1146)	(-671.1, 3835.1)	0.1682
	After 9 Months	1686.0 (1146)	(-567.1, 3939.1)	0.1420
Platelet count	Base line	0.28 (671.5)	(-1320, 1320.5)	0.9997
	After 6 weeks	1500.5 (671.5)	(180.30, 2820.7)	0.0260
	After 15 weeks	0.56 (671.5)	(-1320, 1320.7)	0.9993
	After 6 Months	0.62 (671.5)	(-1320, 1320.8)	0.9993
	After 9 Months	0.72 (674.9)	(-1326, 1327.6)	0.9991

Table 5: Comparison of psychological parameters between experimental and control group at base line and following intervention duration.

Psychological parameters	Visit	LS Mean difference (standard error)	95% CI of difference	p-value
STAI Anxiety	Base line	21.02 (2.278)	(16.542, 25.498)	<.0001
	After 6 weeks	7.26 (2.278)	(2.782, 11.738)	0.0016
	After 15 weeks	-12.00 (2.278)	(-16.48, -7.522)	<.0001
	After 6 Months	-21.30 (2.280)	(-25.78, -16.82)	<.0001
	After 9 Months	-31.51 (2.281)	(-36.00, -27.03)	<.0001
BDI Depression	Base line	-0.98 (2.000)	(-4.913, 2.953)	0.6245
	After 6 weeks	-11.10 (2.000)	(-15.03, -7.167)	<.0001
	After 15 weeks	-23.74 (2.000)	(-27.67, -19.81)	<.0001
	After 6 Months	-29.28 (2.002)	(-33.22, -25.35)	<.0001
	After 9 Months	-33.38 (2.004)	(-37.32, -29.44)	<.0001
Distress Bothering	Base line	0.16 (0.153)	(-0.140, 0.460)	0.2953
	After 6 weeks	-0.84 (0.153)	(-1.140, -0.540)	<.0001
	After 15 weeks	-1.78 (0.153)	(-2.080, -1.480)	<.0001
	After 6 Months	-2.04 (0.153)	(-2.343, -1.741)	<.0001
	After 9 Months	-2.40 (0.153)	(-2.699, -2.096)	<.0001
Symptoms severity	Base line	0.18 (0.132)	(-0.080, 0.440)	0.174
	After 6 weeks	-0.68 (0.132)	(-0.940, -0.420)	<.0001
	After 15 weeks	-1.68 (0.132)	(-1.940, -1.420)	<.0001
	After 6 Months	-2.05 (0.133)	(-2.314, -1.792)	<.0001
	After 9 Months	-2.36 (0.133)	(-2.616, -2.095)	<.0001
FLI	Base line	-0.22 (0.776)	(-1.745, 1.305)	0.7769
	After 6 weeks	5.66 (0.776)	(4.135, 7.185)	<.0001
	After 15 weeks	10.40 (0.776)	(8.875, 11.925)	<.0001
	After 6 Months	10.09 (0.778)	(8.558, 11.617)	<.0001
	After 9 Months	11.31 (0.779)	(9.776, 12.837)	<.0001

Haematological and Biochemical parameters

Changes in haematological parameters such as haemoglobin content, total leukocyte count and platelet count were measured before and after 6 weeks, 15 weeks, 6 months and 9 months of yoga and naturopathy are summarized in Table 4. The results of control and experimental group comparison revealed significant change in haemoglobin content. The total leukocyte count was significant only after 6 and 15 weeks. However, after 6 and 9 months there was no significant change. In case of platelet count, only 6 weeks comparison was significant among all four different time point comparison.

Further, comparison between experimental and control revealed statistically not significant ($p > 0.05$) changes in all the biochemical parameters such as serum creatinine, blood urea, serum total bilirubin, serum uric acid and serum LDH (Table S3).

Psychological parameters

Stress was assessed using standard self-report questionnaires such as the State Trait Anxiety Inventory (STAI) or anxiety whereas Beck's Depression Inventory (BDI) was assessed for depression. BDI is a self-report measure used to assess behavioral

manifestations of depression. Our results from experimental group also show that there was a significant decrease ($p < 0.0001$) in all the psychological parameters including STAI anxiety, BDI depression, distress bothering, and symptom severity (Table 5). Quality of life, as measured by functional Living Index in cancer patients, was similar in both the groups at baseline. Upon subsequent assessments, the index was significantly ($p < 0.0001$) superior in patients in the experimental group throughout the study period. This benefit persisted even after 9 months of follow-up.

DISCUSSION

Complementary and alternative medicine (CAM) use among cancer patients varies with geographical area, gender, and disease diagnosis. The prevalence of such techniques is reported between 7-50% among cancer patients. [14] Yoga is an emerging and evolving complementary and integrative health practice. Randomized controlled studies from India showed the significant positive effects of Yoga therapy in controlling psychological factors, quality of life and immunity system among cancer patients undergoing chemotherapy. [15] However, the effects of combination of Yoga and Naturopathy as adjunct therapy to patients on cancer chemotherapy have not been described so far to the best of our knowledge.

In the present study, we investigated the effects of Yoga in combination with Naturopathy interventions in quality of life and mental health among patients with NHL undergoing standard chemotherapy. The experimental and control groups were well matched in age, stage of the disease, gender and base line serum biochemical parameters. The median age among 100 randomized patients was 43 years. Male: female ratio was 2:1. Hematologic parameters are determined by multiple factors other than diet and life style, for patients receiving chemotherapy. Hence, we chose to analyze at absolute values at different time points and compare it with normal accepted standard values.

Analysis of our results indicates that haemoglobin levels were similar in both the groups at inclusion, but after starting chemotherapy, significant number of patients on the experimental group maintained hemoglobin levels above 10 gm/dl. The difference in hemoglobin became statistically significant in subsequent assessments. Yoga interventions are known to stimulate the hematopoietic system thereby resulting in the observed outcomes. In addition, patients in the experimental arm received naturopathy diet which included fresh fruits and vegetables which are known to improve haemoglobin in normal individuals. [16] Total leukocyte counts were initially similar in both the groups but as noticed with hemoglobin levels, the leukocyte count remained above 4000/cells/cumm in significant number of patients in the experimental group even after starting cytotoxic chemotherapy, which could reflect no effect on the immune system by such interventions (Table 4). Similar effect on WBC was noticed previously with yoga interventions in patients with breast cancer on chemotherapy. [13] Platelet counts did not show statistically significant variation with the interventions in the experimental group except after 6 weeks chemotherapy, although more number of patients in the experimental group had maintained platelet count of more than 1 lakh/cumm.

In a population-based case-control study to determine the association of differences in diet with NHL risk, positive associations of NHL with dairy products and fried red meat and the inverse association with fruits and vegetables was determined proving the influence of diet in carcinogenesis. [17] Another study was conducted to rule out the role of diet in NHL where NHL risk was inversely associated with higher number of weekly servings of all vegetables, green leafy, and cruciferous vegetables and with higher daily intakes of lutein and zeaxanthin and zinc

concluding that higher intakes of vegetables, lutein and zeaxanthin, and zinc are associated with a lower NHL risk. [16]

All the biochemical parameters including blood urea, serum creatinine, serum total bilirubin, serum uric acid and serum lactate dehydrogenase levels remained similar in both the groups throughout the chemotherapy. This may indicate that the Yoga and Naturopathy interventions do not adversely influence the metabolism. However, some of the research studies showed that integrated Yoga and Naturopathy interventions help in metabolic disorders such as hypertension, obesity, diabetes and thyroidism. [18-21]

Psychological parameters assessed in this study were anxiety status, depression, distress and symptom severity of various symptoms. In the present study, reduced score in STAI, BDI, distress, symptom severity and improved quality of life scores were noted in the experimental group at most time points. The psychological benefits of the interventions in the experimental group were evident across the study period and continued to exist even after the study period. Our results are supported by other studies where yoga intervention reduced chemotherapy triggered nausea and emesis in breast cancer patients. [22] Also reduced anxiety and depression as well as improved quality of life upon Yoga intervention has been demonstrated in non-cancer population. [23-25]

It is known that Yoga therapy has beneficial effect on nervous system, endocrine system and immune functions at the cellular level through altering cell cycle, apoptosis, aging, oxidative stress, and several other pathways of stress signaling molecules. [26] This is achieved by diet, the smoothening treatments like massage therapy, alternative hot and cold spinal sprays, hip baths and mud packs, Pranayama and deep relaxation techniques and repeated counselling. [15,16,27] Thus the effect of Yoga and Naturopathy on controlling the anxiety, symptom control could be demonstrated, both within the group and between the groups at various time points. The main intention behind yoga and naturopathy practices is to modify the lifestyle by cultivating positive attitude which helps in promoting health as well as psychological well being of the patients.

CONCLUSION

In summary, our Yoga and Naturopathy based interventions were efficient in decreasing the psychological morbidity, reducing conventional treatment related side effects, improving the haemoglobin content and quality of life in patients with NHL undergoing conventional cancer chemotherapy. Hence we conclude that Yoga and Naturopathy interventions are useful as an adjuvant therapy in the management of Non-Hodgkin's Lymphoma patients. These preliminary results are promising and need to explore further studies on mechanisms underlying these interventions.

Competing interests

The authors declare that they have no competing interests. No competing financial or non-financial interests from the funders exist.

Consent for publication

All authors consented to publication.

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