ORIGINAL RESEARCH ARTICLE

# Effect of Pranayama on Reducing the Level of Fatigue During External Radiation Therapy Among the Patients in A Cancer Hospital of Guwahati, Assam, India

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## ABSTRACT

**Introduction:** Cancer related fatigue, a problem often less understood and under-diagnosed. It is imperative to find non-invasive and non-pharmacological solutions for managing it. The aim of the study was to assess the effect of pranayama on reducing the level of Fatigue during External Radiation Therapy (ERT) among the patients in a selected cancer hospital of Guwahati, Assam.

**Materials and methods:** The study adopted Quantitative evaluative approach; randomized pre-test post-test control group design. Simple random sampling technique without replacement was used and 84 cancer patients were equally divided in control group (42) and experimental group (42). The pre-test level of fatigue was assessed from both the groups and pranayama as intervention was given to experimental group.

**Result**: Pranayama was found to be effective in patients receiving ERT. It was found that following pranayama, majority in experimental group 41 (97.6%) had mild level of fatigue whereas in control group 27 (64.3%) experienced severe level of fatigue. There is significant mean difference in the experimental group as compared to control group after the intervention of pranayama (t=17.99, df=41, p-value=<.001).

C**onclusion:** Pranayama is found to be effective intervention in reducing fatigue among cancer patients receiving ERT.

**Keywords**: Cancer; cancer-related-fatigue; pranayama; external radiation therapy

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## INTRODUCTION

Cancer is one of the important causes of morbidity and mortality in India. According to World Health Organization, non-communicable diseases Country Profiles of 2014, in India cancer contributes to 7 percent of deaths that are caused by non-communicable diseases. The number of cancer cases are rising rapidly in the country and as well as in north-eastern states. A study revealed that in states namely Manipur, Mizoram, Tripura, Meghalaya, and Assam the number of cancer cases due to tobacco is around 60 percent of other respective states.[1]

A study conducted by B. Barooah Cancer Institute (BBCI) reported cancer statistics in Kamrup Urban District, including incidence and mortality, revealed the statistics of remarkable growth of cancer cases in Assam. The number of new cases of all cancer was increased from 155.3 to 188.5 and 102.7 to 165.3 per 100,000 men and women respectively from the year 2007 to 2011. The data from Kamrup urban district also have shown that for some specific types of cancer has the highest incidence rates in the world; particularly cancers of upper aero-digestive tract consist of anatomical sites such as oral cavity, hypo-pharynx, larynx, gallbladder, stomach, lung, prostate, and oesophageal cancer. Overall cancer incidence and mortality rates was found to be increased since 2007 in Assam.[2]

Cancer is a complex disorder involving complex alterations in the physiological conditions of the body. It is of utmost importance to search active treatment modalities for cancer despite knowing about its severe complications that occurs due to certain side-effects to the normal body cells. Fatigue is one of the most common complaints of people diagnosed with cancer. Fatigue occurs because of various treatment modalities of cancer like; chemotherapy, radiation therapy or both. Cancer treatment-related fatigue is reported in 14 percent to 96 percent of patients undergoing cancer treatment and in 19 percent to 82 percent of patients post-treatment. Fatigue is a multidimensional condition that involves subjective feelings of tiredness, weakness, and/or lack of energy.[3] The pattern of fatigue associated with cancer treatment varies according to type and schedule of treatment. Patients receiving cyclic chemotherapy regimens generally exhibit peak fatigue in the days following treatment, then report lower level of fatigue until the next treatment; however, those undergoing external-beam radiation therapy report gradually increasing fatigue over the course of therapy of the largest treatment field.[4] Since Cancer-Related fatigue is multi factorial and subjective in nature. Cancer Related Fatigue profoundly affects patients' abilities to perform activities associated with daily living and limits their personal and social roles within their family and community resulting in a significant decrement in overall Quality of Life.[5] Above all fatigue has the negative aspects over person's life. Therefore, it is imperative to find non-invasive and non-pharmacological solutions for managing it. Exercise interventions are known to alleviate fatigue. There include various forms of non-pharmacological interventions like: Aerobic resistance training, massage, healing touch, yoga, pranayama and relaxation techniques, resistance training etc.

Studies revealed as relaxation as the best ranked intervention to reduce CRF followed by yoga.[6] Another study findings revealed that Yoga therapy was appeared to be feasible and beneficial supportive care strategy for cancer patients.[7]

Cancer Related Fatigue is a very deliberating experience. Patients find ways to get rid of it but feel helpless both physiologically and financially. There are various cost effective and relaxing interventions patients can go for rather than vigorous exercises. Studies revealed very slow breathing techniques which includes pranayama provide valuable insights into mechanisms of autonomous nervous system regulation. A study result revealed that eight sessions of nadishodhana pranayama when practiced at a rate of one breath per minute; was found to be effective.[8] Researcher observed that a good number of cancer patients receiving radiation therapy complained of fatigue. Cancer-related fatigue is considered as an expected problem among these patients and is currently not actively diagnosed and treated. Timely assessment and appropriate intervention are required to reduce fatigue and ease patients suffering. The meagreness of related researched literature in Indian setting, the hardship of cancer patients related to fatigue experienced by the investigator during clinical posting. Moreover, yoga and pranayama are seen as the effective measure which is used to treat various communicable and non-communicable diseases including cancer and can be easily adopted as supportive therapies. The researcher was encouraged by the positive result of the above-mentioned studies but could not locate the same type of study in Assam.

Hence the investigator felt the need of conducting a study titled: A study to assess the effect of Pranayama on reducing the level of Fatigue during External Radiation Therapy among the patients in a selected Cancer Hospital of Guwahati, Assam.

### OBJECTIVE

The present study was conducted to assess the pre-test and post-test level of fatigue in cancer patients during external radiation therapy in the experimental group and control group. The study also aimed to evaluate the effect of pranayama in reducing the level of fatigue in cancer patients during external radiation therapy; and to determine the association between level of fatigue with selective variables such as age, gender, marital status, religion, diagnosis, stage of cancer, mode of treatment, duration of radiation therapy, educational qualification, dietary pattern, food consistency, undergoing yoga activity/training and occupation.

**Hypotheses**

**$H_1$**- There is significant mean difference between post-test fatigue score among patients receiving external radiation therapy of experimental group and control group following pranayama.

**$H_2$**- There is a significant association between level of fatigue among patients receiving external radiation therapy and selected variables such as age, gender, marital status, religion, diagnosis, stage of cancer, mode of treatment, duration of radiation therapy, educational qualification, dietary pattern, food consistency, undergoing yoga activity/training and occupation.

**Delimitation:** The study was delimited to all patients aged of 40 years and above, and the patients who came to the hospitals for receiving external radiation therapy and received external radiation therapy for at least 10 days.

**Conceptual Framework:** The present study was to assess the effect of pranayama on reducing the level of fatigue during external radiation therapy among the cancer patients in a selected cancer hospital. The framework of the study is based on Sister Calista Roy's Adaptation Model (RAM).[9]

## METHODOLOGY

An experimental research study was conducted in a selected cancer hospital of Guwahati, Assam. The selected research approach for this study was Quantitative evaluative approach. The study was conducted from 2nd March to 20th March 2020. A randomized pre-test post-test control group design was selected for this study. The study was conducted in State Cancer Institute (SCI), annexure of GMCH is a 200 bedded hospital located in Bhangagarh, at a distance of 550 meters from the Guwahati Medical College and Hospital, Bhangagarh. The population comprised of all the patients receiving external radiation therapy in the mentioned hospital.

**Sample and Sample Size-** In the present study, a sample of 84 cancer patients receiving external radiation therapy in the mentioned hospitals and who fulfilled the desired set of criteria were chosen. (42 samples in experimental group and 42 samples in control group). The author included all the eligible patients visiting to the hospital during the study period and thus the above-mentioned sample size was achieved.

**Sampling Technique**- In the view of the nature of problem statement and to accomplish the objectives of the study, the sampling technique used was simple random sampling technique without replacement.

In this study, the patients receiving external radiation therapy in Day care basis and the admitted patients in the State Cancer Institute who met the inclusion criteria (age above 40 years, who received radiation therapy for 10 days and are planned for next 12 days or more, patients who can understand verbal command) and were available was the accessible population. As per the records collected from the registers and files which are maintained in the radiation outdoor department. The average number of patients receiving external radiation therapy in SCI were 140-150 per day. Data collection was done in the month of March 2020. The names of the patients from register, files of ward (third floor) and outdoor radiation therapy room (room no 21 and 22); who fulfilled the inclusion criteria were listed out on February 27th, 2020. The list included a number of 93 patients, out of which 88 were outdoor patients and 5 were indoor patients. On the first day of data collection i.e., on 2nd March 2020, out of 88 outdoor patients 79 were the accessible population. Therefore, the sampling frame was prepared for 79 outdoor and 5 indoor which aggregates to be 84 patients who were accessible on the day of data collection. The sampling frame included the names of 84 patients and against each name a number was designated.

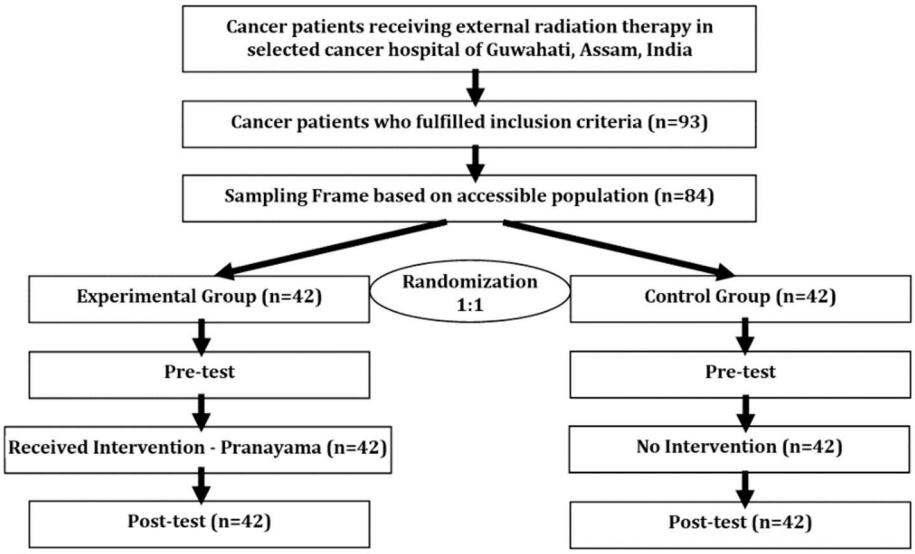


**Figure 1: CONSORT Flow Chart**

Consequently, the subjects were randomized into experimental group and control group using lottery method without replacement. The assigned number against each designated name were written on a chit of paper and put in a bowl and mixed thoroughly. The investigator picked up chits blindfolded and they were the subjects for the study, the first pick was taken for experimental group and the second one was considered for control group. Each time before drawing a chit, chits were mixed thoroughly in the bowl.

**Eligibility Criteria**

The inclusion criteria were the patients aged 40 years and above; who had been receiving external radiation therapy for at least 10 days were scheduled for another 12 days or more; whoever can follow verbal command and who were willing to participate were included in the study. On the other hand, patients who were critically ill. (Tracheostomy patient, patients having NG tube) were excluded from the study.

**Variables under study**

Demographic Variables included in the study were age, gender, marital status, religion, diagnosis, stage of cancer, mode of treatment, duration of radiation therapy, educational qualification, dietary pattern, food consistency, undergoing yoga activity/training and occupation.

Independent variable was Pranayama as intervention (Nadishodhana, Sheethali, Brahmari, Ujjayi, Chandrabhidi and Suryabhidi, Bhastrika and relaxation techniques) which was given to cancer patients who were receiving external radiation therapy, in a State Cancer Institute of Guwahati, Assam.

Level of Fatigue was a dependent Variable which was assessed by Cancer Fatigue Scale.

**Study tools:**

The tools of the study consist of 3 sections: Section I: Demographic data on selected variables.

Section II: Standardised Cancer Fatigue Scale to assess Fatigue[10] : A set of questionnaires was used to assess radiation induced fatigue by Cancer Fatigue Scale. This scale is developed by Toru Okuyama. It is a brief, three-dimensional, self-rating scale for assessment of fatigue in cancer patients. It covers 3 dimensions (Physical, cognitive and affective) and has 15 items to measure the level of fatigue. The CFS has good stability (Average test- retest reliability r=0.69 P<0.001) and good internal consistency (Cronbach's alpha coefficient for all items=0.88). The advantages of this scale over other fatigue scales are it follows simplicity; so, it can be easily completed in 2 minutes even by advanced cancer patients.

Section III: Pranayama as an Intervention: The researcher included pranayama techniques like NadiSodhana (Alternate nostril breathing), Sheethali, Brahmari, Ujjayi, Chandrabhedi and Suryabhedi, relaxation (Sahaj Pranayama)

**Intervention**

It consisted of techniques of pranayama practiced to the experimental group that was administered for 40 minutes for 12 days done by cancer patients receiving external radiation therapy under the guidance of investigator. While doing pranayama, the patients were taught to sit on the floor in padmasana. Those who had difficulty sitting in padmasana were sitting in "ardha padmasana or sitting on a chair with the spine straight". The pranayama techniques include- Sahaj Pranayama, NadiSodhana, Sheethali and Brahmari, Ujjayi, Chandrabhedi and Suryabhedi, and Bhastrika. These are basically the breathing techniques.[8,11,12]

Nadi Shodhana, also known as Alternate Nostril Breathing or Anilom Vilom Pranayama, is a powerful breathing practice with wide reaching benefits.

Sheethali pranayama (cooling breath technique) is an effective way to cool the body and calm the mind while simultaneously expelling toxins from the body. In Sheethali pranayama, patients were taught to draw in air slowly and deeply through a curled tongue, which is stretched out of the mouth. After the inspiration, the tongue is withdrawn and the mouth is closed, and they were asked to exhale passively through the nose. Those who had difficulty in making a curled tongue were taught to draw in air slowly and deeply through clenched teeth and exhale passively through the nose.

Brahmari Pranayama breathing technique derives its name from the black Indian bee called Bhramari.

Ujjai Pranayama - Ujjayi means victorious breath; it is also referred to as ocean breath due to the sound it creates. Ujjayi encourages full expansion of the lungs.

Chandrabhedi and Suryabhedi Pranayama: Chandrabhedi also known as Left Nostril Breathing and Suryabhedi known as Right Nostril Breathing.

Bhastrika Pranayama is one of the breathing techniques which is known as bellows breath, is a form of pranayama and is considered one of the most important and beneficial yogic breathing techniques

**Data Collection:** Ethical permission was obtained from the Institutional Ethics Committee of Regional College of Nursing, Guwahati (Ref No: RNC/271/2011/244-268). Administrative permission was obtained from the superintendent of State cancer Institute, Guwahati, Assam (No. GMC/CH/39/2017/Pt-II/85). Informed written consent was taken from participants and they were assured confidentiality of their responses. They were also assured that they may leave the study process if they wish. The data collection was started from 2nd March to 20th March 2020. Minimum of 8 hours were spent every-day for collection of data.

## RESULTS

Table 2 findings revealed that there was very less mean difference between both control group and experimental group before administering the therapy, which suggest both the group were comparable. It portrays that majority in experimental group 41 (97.6%) had mild level of fatigue after giving pranayama as intervention; whereas in control group 27 (64.3%) experienced severe level of fatigue followed by 7 (16.7%) in control group and 1 (2.4%) in experimental group had moderate level of fatigue.

**Table 1: Distribution of subjects according to selected variables in control and experimental group**

| Demographic variable | Control Group (n=42) (%) | Experimental Group (n=42) (%) | Total (n=84) (%) |
|---|---|---|---|
| **Age in Years** | | | |
| 40- 49 Yrs | 5 (11.9) | 8 (19) | 13 (15.5) |
| 50- 59 Yrs | 15 (35.7) | 13 (31) | 28 (33.3) |
| 60-69 Yrs | 14 (33.3) | 16 (38.1) | 30 (35.7) |
| 70-79 Yrs | 7 (16.7) | 3 (7.1) | 10 (11.9) |
| > 80 Yrs | 1 (2.4) | 2 (4.8) | 3 (3.6) |
| **Gender** | | | |
| Male | 29 (69) | 29 (69) | 58 (69) |
| Female | 13 (31) | 13 (31) | 26 (31) |
| **Marital status** | | | |
| Married | 38 (90.5) | 42 (100) | 80 (95.2) |
| Widow | 4 (9.5) | 0 (0) | 4 (4.8) |
| **Religion** | | | |
| Hindu | 33 (78.6) | 33 (78.6) | 66 (78.6) |
| Muslim | 9 (21.4) | 9 (21.4) | 18 (21.4) |
| **Educational qualification** | | | |
| Illiterate | 2 (4.8) | 0 (0) | 2 (2.4) |
| Primary | 9 (21.4) | 8 (19) | 17 (20.2) |
| High school | 11 (26.2) | 14 (33.3) | 25 (29.8) |
| Higher secondary | 15 (35.7) | 11 (26.2) | 26 (31) |
| Graduate or above | 5 (11.9) | 9 (21.4) | 14 (16.7) |
| **Occupation** | | | |
| Govt. employee | 1 (2.4) | 3 (7.1) | 4 (4.8) |
| Private employee | 2 (4.8) | 1 (2.4) | 3 (3.6) |
| Ex-servicemen | 3 (7.1) | 2 (4.8) | 5 (6) |
| Business/Self employee | 24 (57.1) | 23 (54.8) | 47 (56) |
| Unemployed/Student/Homemaker | 12 (28.6) | 13 (31) | 25 (29.8) |
| **Diagnosis** | | | |
| Head and Neck Cancer | 26 (61.9) | 21 (50) | 47 (56) |
| Oesophageal Cancer | 10 (23.8) | 12 (28.6) | 22 (26.2) |
| Cervical Cancer | 3 (7.1) | 2 (4.8) | 5 (6) |
| Others | 3 (7.1) | 7 (16.7) | 10 (11.9) |
| **Stage of cancer.** | | | |
| Stage I | 1 (2.4) | 2 (4.8) | 3 (3.6) |
| Stage II | 21 (50) | 27 (64.3) | 48 (57.1) |
| Stage III | 18 (42.9) | 13 (31) | 31 (36.9) |
| Stage IV | 2 (4.8) | 0 (0) | 2 (2.4) |
| **Mode of treatment** | | | |
| Only Radiation therapy | 18 (42.9) | 18 (42.9) | 36 (42.9) |
| Radiation and chemotherapy | 24 (57.1) | 23 (54.8) | 47 (56) |
| Radiation after surgery | 0 (0 .0) | 1 (2.4) | 1 (1.2) |
| **Duration of radiation therapy** | | | |
| 10-14 days | 11 (26.2) | 6 (14.3) | 17 (20.2) |
| 15-20 days | 9 (21.4) | 17 (40.5) | 26 (31) |
| 21-26 days | 18 (42.9) | 17 (40.5) | 35 (41.7) |
| > 27 days | 4 (9.5) | 2 (4.8) | 6 (7.1) |
| **Dietary pattern** | | | |
| Vegetarian | 3 (7.1) | 6 (14.3) | 9 (10.7) |
| Non-Vegetarian | 39 (92.9) | 36 (85.7) | 75 (89.3) |
| **Food consistency** | | | |
| Liquid | 21 (50) | 11 (26.2) | 32 (38.1) |
| Semi-solid | 17 (40.5) | 27 (64.3) | 44 (52.4) |
| Solid | 4 (9.5) | 4 (9.5) | 8 (9.5) |
| **Undergoing yoga activity/training** | | | |
| Never | 33 (78.6) | 33 (78.6) | 66 (78.6) |
| Sometime as an exercise | 9 (21.4) | 7 (16.7) | 16 (19) |
| Regularly Practiced | 0 (0 .0) | 2 (4.8) | 2 (2.4) |

**Table 2: Assessment of pre-test and post-test fatigue score level among cancer patients receiving external radiation therapy in control and experimental group**

| Level of Fatigue | Pre-test fatigue score | | Post-test fatigue score | |
|---|---|---|---|---|
| | Control Group (n=42) (%) | Experimental Group (n=42) (%) | Control Group (n=42) (%) | Experimental Group (n=42) (%) |
| **Mild (22-32)** | 6 (14.3) | 10 (23.8) | 8 (19) | 41 (97.6) |
| **Moderate (33-49)** | 34 (81) | 19 (45.2) | 7 (16.7) | 1 (2.4) |
| **Severe (50-57)** | 2 (4.8) | 13 (31) | 27 (64.3) | 0 (0) |

**Table 3: Assessment of effectiveness of Pranayama on cancer fatigue score on reducing the level of fatigue among patients receiving external radiation therapy**

| Level of Fatigue | Mean ± SD | Mean Difference | Effect Size | t value | df | *p* value | Remark |
|---|---|---|---|---|---|---|---|
| **Pre-test** | | | | | | | |
| Control Group (n=42) | 40.14±6.87 | -1.65 | -0.19 | -0.88 | 82 | .382$^{NS}$ | NS |
| Experimental Group (n=42) | 41.79±9.96 | | | | | | |
| **Post-test** | | | | | | | |
| Control Group (n=42) | 45.93±15.0 | 27.28 | 1.51 | 10.63 | 82 | <.001$^{**}$ | S |
| Experimental Group (n=42) | 18.64±7.19 | | | | | | |
| **Experimental group** | | | | | | | |
| Pre-test (n=42) | 41.79±9.96 | 23.15 | 2.78 | 17.99 | 41 | <.001$^{**}$ | S |
| Post-test (n=42) | 18.64±7.19 | | | | | | |
| **Control group** | | | | | | | |
| Pre-test (n=42) | 40.14±6.87 | -5.79 | -0.32 | -2.09 | 41 | 0.043$^{*}$ | S |
| Post-test (n=42) | 45.93±15.00 | | | | | | |

$^{*}$Significant at p<0.05, $^{**}$Significance at p<0.01, NS- Non-Significance

Hence it is found that at beginning the patients in both the groups experienced similar amount of fatigue but as duration passed the fatigue became severe in control group as they received the usual radiation therapy, whereas in experimental group fatigue decreased to a large extent.

Table 3 shows the calculated unpaired t value was found to be -0.88 at df 82 which was insignificant ($p$ = .382$^{NS}$). It suggested that before the administration of pranayama there was no relationship between the control group and experimental group; thus, both the group can be considered as homogenous, hence both the groups were comparable. After administration of pranayama, the post-test mean difference 27.28 with t value 10.63 at df 82 which was significant at (p=<.001). Statistically it reveals that there was a significant reduction of fatigue in the experimental group as compared to control group after the intervention of pranayama. Moreover, after administration of pranayama in the experimental group the effect size was found to be 1.51 which shows there is a significant difference between both the groups, indicating the effectiveness of pranayama.

It also shows the level of fatigue among the group itself. In both the group paired t test was computed to assess the effectiveness. In experimental group, calculated t value was found 17.99 at df 42 which was significant (<.001). In control group, calculated t value was found -2.09 at df 42 which was significant (p=0.043). However, the effect size in experimental group was found to be 2.78. Hence, there was a significant mean difference in the pre-test and post-test score of experimental groups among patients receiving external radiation therapy following pranayama whereas in control group the fatigue level worsened with increased in number of radiation therapy they received.

On analysing the level of fatigue with selected demographic variables, it was observed there was a significant association between level of fatigue and age of the patient (The calculated value of chi-square was 16.4 with df=8, p=0.036.) and undergoing yoga activity/training (The calculated value of chi-square was 16.8 with df=4, $p$= .002).

## DISCUSSION

The analysis of the data revealed that in the pre-test score of level of fatigue as assessed by Cancer Fatigue Scale, majority of patients in both control group 34 (81.0%) and experimental group 19 (45.2%) had moderate fatigue followed by 6(14.3%) in control group and 10(23.8%) in experimental group had mild fatigue. 2(4.8%) in control group and 13 (31.0%) in experimental group had severe fatigue. The findings of the study were supported by Lavdaniti M et.al (2006)[13] who also observed that among breast cancer patients before radiation therapy, approximately 13% of women experienced moderate to higher levels of fatigue at baseline. Another study conducted by Chakrabarty J, Vidyasagar MS (2015)[14] also revealed similar result that majority of breast cancer patients in the experimental (76.25%) and control group (87.5%) had only mild to moderate level of fatigue. Very few patients in the experimental group (11.25) and control group (8.75) had severe fatigue at the beginning of radiation therapy. It is possibly due to because as the number of radiations

increases the fatigue keeps increasing too. It was seen that patients on their first few days of radiation cycle were physically strengthen but with due course of time (mostly after 10th day of radiation) they use to feel weak and fatigued.

The post-test assessment of level of fatigue was analysed again from both the groups following administration of pranayama as an intervention to the experimental group for 12 days. On post-test assessment results revealed that majority in experimental group 41(97.6%) had mild level of fatigue after giving pranayama as intervention; whereas in control group 27 (64.3%) experienced severe level of fatigue followed by 7(16.7%) in control group and 1 (2.4%) in experimental group had moderate level of fatigue. The findings of the study were supported by Hofman M and Hockock T (2005)[15] reported that fatigue was reported by 84% of patients receiving radiation therapy and fatigue heightened during treatment. Another study conducted by Feng LR, Espina A, Saligan LN.(2018)[16] reported Fatigue increased significantly 2 weeks after EBRT initiation and over time ($F(5, 294) = 3.69$, $p = 0.03$), reaching a peak at the midpoint of EBRT Increased fatigue during EBRT was associated with perceived cognitive difficulties in executive function and recognition memory, but not with attention or verbal memory. Hence it is found that at beginning the patients in both the groups experienced similar amount of fatigue but as duration passed the fatigue became severe in control group as they received the usual radiation therapy, whereas in experimental group fatigue decreased to a large extent. As pranayama or any other breathing exercise that can be easily performed helps in activating the sympathetic nervous system, expansion of the lung capacity ultimately increasing the oxygen content in the blood hence reducing fatigue to some extent.

Again, the findings of the present study revealed that pranayama reduced the level of fatigue significantly in cancer patients receiving external radiation therapy. pre-test mean score and standard deviation of level of fatigue in control group was found to be 40.14±6.87 whereas in experimental group it was 41.79±9.96 with a mean difference of -1.65. The calculated unpaired t value was found to be -0.88 at df 82 which was insignificant ($p = .382^{NS}$). It suggested that before the administration of pranayama there was no relationship between the control group and experimental group; thus, both the group can be considered as **homogenous,** hence both the groups were comparable. After administration of pranayama, the post-test means, and standard deviation was found to be 45.93±15.0 in the control group whereas 18.64±7.19 in the experimental group revealing the mean difference 27.28 with t value 10.63 at df 82 which was significant at (p=<.001). Statistically it reveals that there was a significant reduction in the experimental group as compared to control group after the intervention of pranayama. Moreover, after administration of pranayama the effect size was found to be 1.51 which again indicates there is a significant difference between both the groups. Similar findings were reported Chakrabarty J, Vidyasagar MS, Fernandes D, Joisa G, Mayya S (2015).[14] The study was conducted among 160 eligible participants. The result reveals presence of significant difference between the two groups regarding the scores of cancers related fatigue ($p$=<0.001). The experimental group of patients who performed pranayama along with radiation therapy experienced less fatigue.

The present study revealed a significant association between level of fatigue and age of the patient ($p$= .035) and undergoing yoga activity/training ($p$= .002). No significant association was found between gender, religion, marital status, diagnosis, stage of cancer, mode of treatment, duration of radiation therapy, educational qualification, dietary pattern, food consistency. The study findings were supported by similar studies conducted by Chao HH, Doucette A, Raizen DM, Vapiwala N. (2018)[17] conducted a study on factors associated with fatigue in prostate cancer (PC) patients undergoing external beam radiation therapy (EBRT). **Findings suggests** significant increases in reported fatigue severity were seen in patients with age <60 years ($p$ = .006) before radiation start ($p$ = .04). Another study conducted by Vadiraja HS, Rao RM, Nagarathna R, Nagendra HR, Patil S, Diwakar RB, et.al. (2017)[18] conducted a study on Effects of yoga in managing fatigue in breast cancer patients: A randomized controlled trial. The results suggest that yoga reduces perceived stress ($p$ = 0.001), fatigue frequency ($p$ < 0.001), fatigue severity ($p$< 0.001).

### LIMITATIONS

Pranayama as intervention was administered to the patients for only 12 days due to time constraint.

## CONCLUSION

The present study showed the effectiveness of pranayama in reducing the level of fatigue among cancer patients receiving external radiation therapy in a selected cancer hospital. Cancer-related fatigue is a deliberating symptom which is seen to affect the patient physiologically, mentally and financially. Pranayama and other relaxation techniques are found to be very useful and effective as well. It is found that pranayama is effective in reducing the radiation induced fatigue and nurses need to employ pre radiation therapy preparation in the management of fatigue in cancer patient.

## RECOMMENDATIONS

Based on these findings, following recommendations were made for further research.

A similar study could be conducted among the cancer patients considering a specific type of cancer. Patients with Head and neck cancer receiving external radiation therapy are found to suffer more from cancer related fatigue.

A similar study could be conducted including more associated variables such as Eating habits (alcohol, tobacco, smoking), Socio-economic status, co-morbid condition, Haemoglobin percentage.

Another study can be carried out by using different tools to assess the level of fatigue among cancer patients receiving external radiation therapy. As there are various types of cancer scales available.

## Acknowledgement

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