Research Article

An Experimental Study on Effect of Pranayama on Anxiety and Selected Physiological Parameters in Patients Undergoing Radiation Therapy for the First Time at a Selected Hospital of a Metropolitan City

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Abstract

Aim: This study aims to assess the effect of pranayama on patients undergoing radiation therapy for the first time.

Materials and Methods: A true experimental design was used on 60 patients undergoing radiation for the first time in a selected hospital of a metropolitan city.

Results: The results show that there was a noticeable improvement in anxiety and selected physiological parameters among patients undergoing radiation therapy for the first time after pranayama. Anxiety is statistically verified with Z value which was 4.66 against table value of 1.96 for the experimental group. Means of systolic BP in the experimental group are 136.7, 124.6, and 135.4 for pre-intervention, post-intervention I, and II, respectively, which shows the minimal difference. Means of diastolic BP for pre-intervention, post-intervention I, and II are 83.7, 77, and 80.8, respectively, which shows the difference. Pre-intervention reading of heart rate highlights as 92.2 mean, which shows a noticeable reduction as 85 and 87.9 in I and II intervention. Mean of systolic BP in the control group shows 125.6, 123.9, and 126.6 for pre-intervention, post-intervention I, and II, respectively, which shows a rise in values. Mean of diastolic BP for pre-intervention is 77.1, post-intervention I, and II is 76.5 which shows no difference. Pre-intervention mean of heart rate is 84.5 that shows not much change as 83.6 and 84.1 in I and II intervention.

Conclusion: The analysis of data showed that pranayama can be used to reduce anxiety and maintain the physiological parameters in patients undergoing radiation therapy for the first time.

Keywords: Pranayama, Radiation, State-trait Anxiety Inventory

Introduction

Cancer has a major impact on society all over the world. Each person reacts differently to cancer diagnosis and will cope in different ways. The incidence of cancer in India is 70–90 per 100,000 populations. About 6% of death in India are due to cancers, which contribute to 8% of global cancer mortality.[1] Radiation therapy is one of the most common treatments for cancer. It uses high energy particles or waves such as X-rays, gamma rays, electron beams, and to destroy or damage cancer cells.

Each person reacts differently to a cancer diagnosis and will cope in different ways. Starting radiation therapies can lead to new worries and fears and may cause anxiety. Studies have shown that there can be an increase in heart rate and blood pressure in patients undergoing radiation therapy because of the fear of radiation.[2] Most people with anxiety show a combination of physical and psychological symptoms. Psychological

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symptoms may include symptoms such as feeling restless and irritable, tense or jumpy, and anticipating the worst. Physical symptoms include rapid or pounding heartbeat, shortness of breath, sweating, fatigue or weakness, etc.[3] Anxiety can be treated medically with drugs called as benzodiazepines, but their use has been declined due to addictive nature. Other therapies can be psychological counseling, relaxation methods, exercise, rest, and meditation technique.[4]

The potential for complementary and alternative medicine (CAM) to manage stress and anxiety and alleviate other health problems is an area of growing interest. The people with cancer are increasingly using CAM to treat cancer or improve physical or psychological well-being. Relaxation techniques are easy ways that can be effectively used to combat stress and anxiety.

Although the effectiveness of most CAM therapies is lacking, number of studies of CAM therapies have shown promising results, suggesting that CAM may be able to alleviate psychological and/or physical symptoms and improve quality of life in patients with cancer. There is an urgent need for positive results to be verified in larger studies using methodologies appropriate and sensitive to CAM.[5]

Pranayama is the art of breath control whereby the mental and physical state is brought to a harmonious state of health and serenity. In this study, pranayama means alternate nostril breathing. It is also called as *Nadi Shodhan pranayama* or *Anulom Vilom.* Nadis are the subtle energy channels in the body that get blocked due to various reasons. The Nadi Shodhan pranayama is the breathing technique that helps clear this blocked energy channels, thus calming the mind.[6]

In this study, the effect is appreciable difference post-intervention in the following parameters:

For anxiety, the effect is a decrease in score by a minimum three on Spielberger State-trait Anxiety Inventory (STAI).

For selected physiological parameters, the effect is a decrease in score by a minimum five on physiological parameters checklist.

Anxiety is the physical and psychological disturbances in patients undergoing radiation for the first time, as measured by STAI before and after pranayama.

Physiological parameters include heart rate and systolic, diastolic, and mean blood pressure as measured by non-invasive calibrated digital B.P apparatus.

Materials and Methods

The research objectives have been met through the analysis of relevant data obtained through a study conducted in a selected hospital of a metropolitan city. A sample size of 60 patients undergoing radiation therapy for the first time (30 in experimental and control groups, respectively) who fulfilled the inclusion criteria was selected and the data obtained were analyzed using a *t*-test. Further, the scoring is done using STAI which was graded as mild, moderate, and severe to assess the anxiety levels. The observation checklist for physiological parameters was used.

Research Approach

The research approach collected for this study is true experimental.

Research Design

In this study, pre- and post-test control group design is used.

Variable

• Independent variable: Pranayama.

• Dependent variable: Anxiety and physiological parameters, that is, blood pressure and heart rate.

Setting

The investigator conducted the study in the radiation department of a selected hospital in a metropolitan city.

Hypotheses

Null hypotheses

Ho1: There is no significant change in Anxiety levels after pranayama.

Ho2: There is no significant change in selected physiological parameters after pranayama.

Research hypotheses

H1: There is a significant change in anxiety levels after pranayama.

H2: There is a significant change in selected physiological parameters after pranayama.

Sample

The samples who are participating in the study consist of patients undergoing radiation therapy for the first time.

Criteria for sample selection

The subjects included in the study had to fulfill the following criteria.

Inclusion Criteria

The following criteria were included in the study:

- Patient undergoing radiation therapy for the first time.
- Patient above 20 years of age and willing to participate.
- Patients who know Hindi/Marathi/ English.
- Patients having a score of more than 30 on STAI.

Exclusion Criteria

The following criteria were excluded from the study:

- Patients with psychiatric illness or disorder.
- Patients with lung condition, abdominal inflammation, and hernia.
- Patients with nasopharyngeal cancer.

Sample Size

In this study, the sample size is 60, with 30 of them assigned each to experimental and the control group.

Sampling Technique

Simple random sampling was the method adopted. In this method of sampling, each element in the population has an equal, independent chance of being selected. Samples were selected by lottery method. Chits with a unique number in it were made and were placed in a bowl. Each day, after proper mixing, randomly chits were picked up, and alternate chits were included in each group.

Data Collection Tool

For the sample selection, the investigator approached the concerned authority of the selected hospital in a metropolitan city and discussed the objective of the study. Formal permission was taken from authority consent, which was obtained from the participation.

- Section A – Demographic variables.
- Section B – STAI Y-6.
- Section C – Observational checklist for physiological parameters
- Section D – Opinionnaire related to intervention

Results

Section – I

This section deals with the demographic data of samples in both the experimental and control group. The data are presented in the form of frequency and percentage.

Table 1 depicts the distribution of the subjects in relation to their age, gender, and education. Maximum subjects in the experimental and control groups 50% (15) and 53.3% (16), respectively, were in the age group of 41-60 years. Males were 46.7% (14) and 50% (15), while the females were 53.3% (16) and 50% (15) in the experimental and control group, respectively. Most of the subjects under the study were graduated and above with 60% (18) in the experimental group and 63.3% (19) in the control group.

Table 2 depicts the distribution of the sample in relation to their type of cancer. In the experimental group, among 30 samples, maximum sample 12 (40%) of them belonged to other categories of cancer followed by 7 (23.3%) samples suffering from breast cancer. A few 6 (20%) belonged to the head and neck cancer category. Three (10%) samples had Hodgkin's and non-Hodgkin's type of cancer and minimum 2 (6.7%) samples were suffering from brain cancer.

Control group among 30 samples, maximum sample 8 (26.7%) of them belonged to other and breast cancer categories. Moderate 6 (20%) sample suffering from head and neck cancer category. A few 5 (16.7%) belonged to brain cancer and minimum 3 (10%) sample were suffering from Hodgkin's and non-Hodgkin's type of cancer

Table 3 elicits the distribution of the sample in relation to their comorbidities. Maximum samples in both the control and experimental group had no comorbidities.

Table 4 represents the assessment pre- and post-test mean of physiological parameters among patients undergoing radiation therapy in the experimental group. Data of systolic BP in the experimental group show 136.7 pre-intervention mean. Post-intervention I indicates as 124.6 mean and post-

Table 1: Distribution of subjects according to their demographic data, *n*=60

Demographic variable	Experimental	*n*=30	Control	*n*=30
	F	%	F	%
Age				
21–40	5	16	5	16.7
41–60	15	50	16	53.3
Above 60	10	33.3	9	30
Gender				
Male	14	46.7	15	50
Female	16	53.3	15	50
Education				
Illiterate	1	3.3	1	3.3
Primary	3	10	6	20
Secondary	8	26.7	4	13.3
Graduation and above	18	60	19	63.3

Table 2: Distribution of sample in relation to their clinical demographic data – Type of cancer, *n*=60

S. No.	Clinical demographic data	Experimental (*n* = 30)		Control (*n* =30)	
		F	%	F	%
	Type of cancer				
1	Brain	2	6.7	5	16.7
2	Head and neck cancer	6	20.0	6	20.0
3	Breast cancer	7	23.3	8	26.7
4	Hodgkin's and non-Hodgkin's	3	10.0	3	10.0
5	Other	12	40.0	8	26.7
	Total	30	100	30	100

Table 3: Distribution of sample in relation to their clinical demographic data – comorbidities, *n*=60

S. No.	Clinical demographic data	Experimental (*n*=30)		Control (*n*=30)	
		F	%	F	%
	Comorbidities				
1	None	19	63.3	20	66.7
2	Hypertension	9	30.0	8	26.7
3	Diabetes	5	16.7	7	23.4
4	Thyroid disorder	0	0	0	0
5	Other	0	0	0	0

Table 4: Distribution of sample according to the pre- and post-test mean of physiological parameters among patients undergoing radiation therapy in the experimental group, *n*=30

S. No.	Physiological parameters	Experimental group		
		Pre-intervention	Post-intervention I	Post-intervention II
1	Systolic BP	136.7	124.6	135.4
2	Diastolic BP	83.7	77.0	80.8
3	Mean BP	101.0	92.5	98.7
4	Heart rate	92.2	85.0	87.9

intervention II as 135.4 mean, which shows the minimal difference. Data of diastolic BP depict pre-intervention mean as 83.7. Post-intervention I shows 77 mean and II as 80.8 mean which shows the difference. Mean BP is 101.0 in pre-intervention which is reduced to 92.5 and 98.7 in I and II intervention. Pre-intervention reading of heart rate highlights as 92.2 mean which shows a noticeable reduction as 85 and 87.9 in I and II intervention. Gradual reduction in the values of the mean of post-experiment result when compared to that of pre-mean results supports the effectiveness of pranayama.

Table 5 represents the assessment pre- and post-test mean of physiological parameters among patients undergoing radiation therapy in the control group. Data of systolic BP in the control group show 125.6 pre-intervention mean. There is rise in reading from 123.9 in Post-intervention I to 126.6 in post-intervention II. Data of diastolic BP depict pre-intervention mean as 77.1. Post-intervention I and II reading focuses as 76.5, which shows no difference. Mean BP is 92.9 in pre-intervention, which shows not much change as 91.9 and 92.9 and I and II intervention. Pre-intervention reading of heart rate shows 84.5 mean, which also shows not much change as 83.6 and 84.1 in I and II intervention. There is not much improvement in post-experiment results mean when compared to that of pre-mean results in the control group.

Table 6 highlights the distribution of the sample according to the pre- and post-test observations of anxiety level among patients undergoing radiation therapy in the experimental group. In pre-intervention, very few 4 (13.3%) samples had mild and severe anxiety followed by 22 (73.3%) with moderate anxiety post-intervention I score reveals 12 (40%) sample had mild anxiety and then 18 (60%) with moderate anxiety. Nil samples were there in severe anxiety category post-intervention II score points at 19 (63.3%) sample had mild anxiety and 11 (36.7%) with moderate anxiety. Nil samples were there in severe anxiety category; we find that most of the samples have shifted from a severe and moderate level in pre-intervention to mild and moderate in post-intervention observations. This trend proves that pranayama is an effective tool in reducing anxiety of patients undergoing radiation therapy.

Table 7 reveals the distribution of sample according to the pre- and post-test observations of anxiety level among patients undergoing radiation therapy in the control group. In pre-intervention, very few 1 (3.3%) sample had mild anxiety. A few 2 (6.7%) had severe anxiety, maximum 27 (90%) with moderate anxiety. Post-intervention I score reveals a minimum 2 (6.7%) sample had severe anxiety at the next level 3 (10%) with mild anxiety. Maximum had moderate anxiety i.e., 25 (83.3%). Post-intervention II score shows that 7 (23.3%) samples had mild anxiety and 22 (73.3%) with moderate anxiety. Only 1 (3.3%) sample was there in the severe anxiety category. In the control group, we find a minimal shift of sample to mild anxiety level and few samples had severe anxiety even in second observation.

Table 5: Distribution of sample according to the pre- and post-test mean of physiological parameters among patients undergoing radiation therapy in the control group, $n=30$

S. No.	Physiological parameters	Experimental group		
		Pre-intervention	Post-intervention I	Post-intervention II
1	Systolic BP	125.6	123.9	126.6
2	Diastolic BP	77.1	76.5	76.5
3	Mean BP	92.9	91.9	92.9
4	Heart rate	84.5	83.6	84.1

Table 6: Distribution of sample according to the pre- and post-test observations of anxiety level among patients undergoing radiation therapy in the experimental group, $n=30$

S. No.	Anxiety level	STAI score range	Pre-intervention		Post-intervention I		Post-intervention II	
			F	%	F	%	F	%
1	Mild anxiety	20–39	4	13.3	12	40.0	19	63.3
2	Moderate anxiety	40–59	22	73.3	18	60.0	11	36.7
3	Severe anxiety	60–80	4	13.3	0	0	0	0

Section – II

Comparison of post-observation of physiological parameters and anxiety levels between the groups using independent sample "*t*" test and Mann–Whitney test among patients undergoing radiation therapy.

A comparison of post-test physiological parameters is done by unpaired T-test as the data are in parametric format.

The data displayed in Table 8 displays the significant difference in the mean of post-test II scores of physiological parameters among patients undergoing radiation therapy between the experimental and control group.

Before calculating the "*t*" value null hypothesis (H_{02}) and alternate hypothesis (H_2) was stated. The two-tailed "*t*" value for 0.05 level of significance is 2.00 for pooled degree of freedom df = 58. The calculated "*t*" value was found to be 2.53, 1.99, 2.57, and 1.12 for systolic BP, diastolic BP, mean BP, and heart rate, respectively. As the calculated value is statistically more than the table "*t*" value of 2.00 at 0.05 level of significance for systolic BP and mean BP and less than for

Table 7: Distribution of sample according to the pre- and post-test observations of anxiety level among patients undergoing radiation therapy in the control group, $n=30$

S. No.	Anxiety level	STAI score range	Pre-intervention		Post-intervention I		Post-intervention II	
			F	%	F	%	F	%
1	Mild anxiety	20–39	1	3.3	3	10.0	7	23.3
2	Moderate anxiety	40–59	27	90.0	25	83.3	22	73.3
3	Severe anxiety	60–80	2	6.7	2	6.7	1	3.3
	Total	20–80	30	100	30	100	30	100

diastolic BP and heart rate physiological parameters; hence, null hypothesis (H_{02}) is accepted for systolic BP and mean BP and alternate hypothesis(H_2) is rejected, whereas null hypothesis (H_{02}) is rejected for diastolic BP and heart rate and alternate hypothesis(H_2) is accepted in case of comparison of post-test II experimental and control group.

The data displayed in Table 9 shows that there is a significant difference in comparing post-intervention I and post-intervention II anxiety levels between the experimental and control group. Hypothesis was tested using the Mann–Whitney test as the data were in the ordinal format. The z table value for 0.05 level of significance is 1.96. The Mann–Whitney "U" calculated value for post-intervention I was found to be 223. After conversion into Z stat, the calculated "z" value of 3.38 and post-intervention II was found to be 260. After conversion into Z stat, the calculated "z" value of 2.84 was found to be more than the Z tab score of 1.96 for anxiety level; therefore, the null hypothesis (H_{01}) is rejected and alternate hypothesis (H_1) is accepted for comparison between the group for both post-intervention I and post-intervention II anxiety levels.

Table 10 represents the distribution of the sample in relation to their response toward opinionnaire related to intervention in the experimental group among patients undergoing radiation therapy. It is observed that all the samples have responded positively for all the above questions. From this, we can interpret that the perception of experimental samples is that the pranayama is beneficial in reducing anxiety levels and normalizing physiological parameters.

Table 11 displays the association of anxiety with educational qualification in both experimental and control groups. The Kruskal–Wallis test for independent samples was conducted to find the significant difference between groups of education with respect to anxiety. The calculated X^2 value of anxiety for educational qualification is 2.35 in the experimental group and 7.11 in the control group. Both the calculated X^2 values are less than their respective X^2 table value at 0.05 levels. From the above, we can state that there is no statistically significant difference between the groups of demographic variable education with respect to their anxiety.

Discussion

A cancer diagnosis can have a huge impact on most patients, families, and caregivers. Radiation is a therapy which most of the cancer patients have to undergo as a part of treatment.

Table 8: Effectiveness of pranayama by comparing post-intervention II results of physiological parameters among patients undergoing radiation therapy between the experimental and control group

Physiological parameters		Mean	S. D.	M.D.	SEMD	T value	*P* value
Systolic BP	Experimental	135.4	11.56	8.77	3.72	2.53	0.014
	Control	126.6	14.98				
Diastolic BP	Experimental	80.8	7.75	4.30	2.21	1.99	0.051
	Control	76.5	8.94				
Mean BP	Experimental	98.7	6.97	5.87	2.35	2.57	0.013
	Control	92.9	10.40				
Heart rate	Experimental	87.9	13.73	3.80	3.44	1.12	0.265
	Control	84.1	12.41				

Table 9: Effectiveness of pranayama by comparing post-intervention I and post-intervention II anxiety levels between the experimental and control group

S. No	Anxiety comparison		Mean	Sum of ranks	U value	Z value	*P* value
1	Post-intervention I	Experimental	39.9	688	223	3.38	0.001
		Control	47.6	1141			
2	Post-intervention II	Experimental	38.6	725	260	2.84	0.005
		Control	44.0	1105			

Table 10: Distribution of sample in relation to their response toward opinionnaire related to intervention in the experimental group among patients undergoing radiation therapy, $n=30$

S. No.	Questionnaire responses	Strongly agree		Agree		Neutral		Disagree		Strongly disagree	
		F	%	F	%	F	%	F	%	F	%
1	I have learnt to perform pranayama.	22	73.3	8	26.7	0	0	0	0	0	0
2	I felt a sense of comfort	19	63.3	11	36.7	0	0	0	0	0	0
3	I felt relaxed	25	83.3	5	16.7	0	0	0	0	0	0
4	I would perform pranayama before each radiotherapy session	25	83.3	5	16.7	0	0	0	0	0	0
5	I would practice pranayama daily	19	63.3	11	36.7	0	0	0	0	0	0
	I would recommend pranayama to others	30	100	0	0	0	0	0	0	0	0

Table 11: Association of demographic variables educational qualification with anxiety, $n=60$

Association of demographic variable Education with anxiety		*n*	Mean rank	Df	Calc. X^2 value	Table X^2 value	*P* value
Experimental group	Illiterate	1	28.50	3	2.35	7.82	0.503
	Primary	3	15.67				
	Secondary	8	15.44				
	Graduation and above	18	14.78				
Control group	Illiterate	1	29.50	3	7.11	7.82	0.068
	Primary	6	19.33				
	Secondary	4	20.13				
	Graduation and above	19	12.58				

Feelings of depression, anxiety, and fear are very common and are normal responses to the treatment of cancer such as radiation.

Sundaresan *et al*. (2012) conducted a cross-sectional survey on 1191 cancer patients undergoing radiation therapy to know the barriers to radiotherapy utilization. It was found that major concerns about (78%) were about anxiety related to radiation and lack of radiation therapy information.[7] Similar results were found in the present study, where 73% of the patients undergoing radiation therapy had moderate anxiety.

Marayam Bigdoli (2016) conducted a study to assess the effect of pranayama on anxiety levels in patients undergoing angiography. Tools used were demographic questionnaire and STAI which was used before intervention, half hour, and 1 h after the intervention. The mean score of anxiety was decreased from 53.37 to 40.75 after pranayama.[8] In the present study, the anxiety levels were checked pre-intervention, 5 min after intervention, and 15 min after radiation therapy. The mean scores of anxiety were decreased from 48.2 to 39.9. Thus, in both the studies, three observations were taken and similar results were found. Furthermore, the study helped in selecting the tool for the assessment of anxiety.

Sharma *et al*. conducted a study on 90 health-care students, who were divided into two groups, to compare the effects of slow and fast pranayama on stress and cardiovascular parameters. One group was made to perform Nadi Shodhan pranayama, pranava pranayama, which are of slow types, and the other was made to perform kapalbhatti, bhastrika, which are of fast type for 30 min thrice a week. They concluded that slow pranayama is more effective in cardiovascular parameters.[9] In the present study, there was a significant decrease in the cardiovascular parameters, that is, systolic, diastolic, and mean BP and HR after practicing Nadi Shodhan pranayama for 30 mins. Thus, Nadi Shodhan pranayama helps in maintaining the cardiovascular parameters.

Conclusion

The findings of this study showed that practicing pranayama was effective in reducing anxiety and physiological parameters in patients undergoing radiation for the first time. The control group, who was given only standard care, was indicative of a high level of anxiety. Hence, it proves that there is a need to decrease the anxiety of the patient undergoing radiation for the first time, which can be done by pranayama.

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