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Study on chronic neck pain, respiratory rate, and flexibility: A yogic practice intervention

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Abstract
The purpose of this study was to investigate the impact of yogic practices on respiratory rate and flexibility levels among women with chronic neck pain. To achieve this aim, thirty middle-aged women professionals from the Pondicherry Region, aged between 35 to 40 years, were selected by the investigator. The participants were divided into two groups: An Experimental group and a Control Group. The Experimental group underwent yogic practices, consisting of one-hour sessions of Yogic Practices five days per week for a duration of eight weeks, whereas the Control group did not engage in any specific practices. Pre-tests and post-tests were conducted for both groups.
Following the pre-test, the experimental group underwent training with yogasanas and Pranayama for one hour, five days per week, for a duration of eight weeks. Post-tests were conducted after the completion of the eight-week training program. Data collected were analyzed using Repeated Measures ANCOVA, and the F ratio was found to be significant. The results indicated a significant difference between the pre-test and post-test outcomes. After the experimental group, all the subjects were tested in abdominal muscle strength and flexibility levels. A 0.05 level of significance was fixed to test the hypothesis.
Further analysis using analysis of variance (ANCOVA) revealed significant differences among the adjusted post-test means. The findings suggest that post-test results indicate an increase in respiratory rate and flexibility levels among the participants.

Keywords: Yoga, low back pain, muscular endurance and flexibility

Introduction
Yoga is an ancient practice originating from Hindu traditions, which the Western world has recently begun to document for its potential therapeutic effects. It is believed that yoga enhances the connection between the mind and body and is utilized as a therapeutic intervention for various diseases. The potential therapeutic effects of yoga are thought to be facilitated by mechanisms such as the modulation of the autonomic nervous system, particularly a reduction in sympathetic tone, as well as the activation of antagonistic neuromuscular systems and stimulation of the limbic system. Chronic nonspecific neck pain (CNNP) is a prevalent public health issue in the modern world, largely due to sedentary lifestyles, with a reported lifetime prevalence of around 50% and increasing frequency among adolescents. It is a major risk factor across preventable diseases that lower the quality of life. Sedentary living can lead to various problems such as decreased muscle strength, decreased joint range of motion (ROM), and hindered performance of daily activities.
Normal respiratory mechanics play a crucial role in the musculoskeletal system, contributing significantly to posture and spinal stabilization. Intact respiratory mechanics are essential for maintaining normal posture and spinal stability. There exists a dynamic interaction among the key muscles involved in respiration, where dysfunction in one can affect the function of others (co-dependency). During respiration, a stabilized cervical and thoracic spine is necessary for other muscles to act, facilitating the movement of ribs upward or downward. In cases of instability, the rib cage may undergo mechanical alterations, potentially leading to insufficient respiratory function, impacting all involved muscles such as the diaphragm, intercostals, or abdominals due to adapted contraction patterns based on muscles' force-length curve. Therefore, it can be suggested that patients with neck pain might experience diminished strength during inspiration and expiration.

Materials and Methods

To achieve this aim, thirty middle-aged women professionals from the Pondicherry Region, aged between 35 to 40 years, were selected by the investigator. The participants were divided into two groups: An Experimental group and a Control Group. The Experimental group underwent Yogic practices such as modified Urdva tadasana, Tadasana paschima namaskarasana, Tadasana Gomukasana, Adavasana Bharatwajasana, and brahmari pranayama, whereas the Control group did not engage in any specific practices. Pre-tests and post-tests were conducted for both groups. The Experimental group underwent one-hour sessions of Yogic Practices five days per week for eight weeks. Post-tests were conducted upon completion of the eight-week training program.

Based on considerations such as tool accessibility, subject suitability, and testing time constraints, the variables for the inquiry were chosen. Two physical variables, Neck flexibility, and Respiratory Rate, were selected as the study's criteria bearing these factors in mind. Both before and immediately after the training session, all subjects were tested to measure the pain level using a visual analog scale, and Respiratory rate measured by counting the number of breaths a person takes per minute when at rest by observing how many times the chest rises. Flexibility was measured using the Goniometer on these chosen dependent variables.

To analyze the data, Analysis of Covariance (ANCOVA) was used to statistically analyze the obtained data to find any significant differences in the specified dependent variables between the groups before and after the training session. In all situations, a significance threshold of 0.05 was chosen for testing.

Results

Table 1: Analysis of co-variance of the pre-test and test means of the yoga practices and control group in pain

Group	Yoga	Control	Source of variance	Sum of squares	DF	Mean Square	'F' Ratio
Pre-test Mean	6.81	6.11	Between	6.685	1	6.685	2.78 NS
SD	1.33	1.73	Within	124.741	52	2.399	
Post-test Mean	4.15	7.22	Between	127.574	1	127.574	10.40*
SD	1.32	0.89	Within	66.074	52	1.271	
Adjusted Post-test mean	5.69	6.46	Between	132.046	1	132.046	9.508*
			Within	68.520	52	2.036	

From the above table results reveals that the pre-test mean score on Yoga practices is 6.81 and control group is 6.11. Therefore, it is inferred that the obtained calculated 'F' value is 2.78 for Pre-Test mean score. Therefore the framed research hypothesis is rejected. It is inferred that there is no significant difference between the pre-test means of the pain. However, the Post-test mean score on yoga group is 4.15 and control group is 7.22. Therefore, it is evident that the obtained 'F' value 10.40 for Post-Test mean score. Therefore the framed research hypothesis is accepted. Further, the above table taking into consideration of the adjusted post-test mean score on yoga practice is 5.69, control group is 6.46. Therefore, it is evident that the calculated 'F' value is 9.508. Therefore the framed research hypothesis is accepted. It is inferred that there is a significant difference between the adjusted post-test means of the pain.

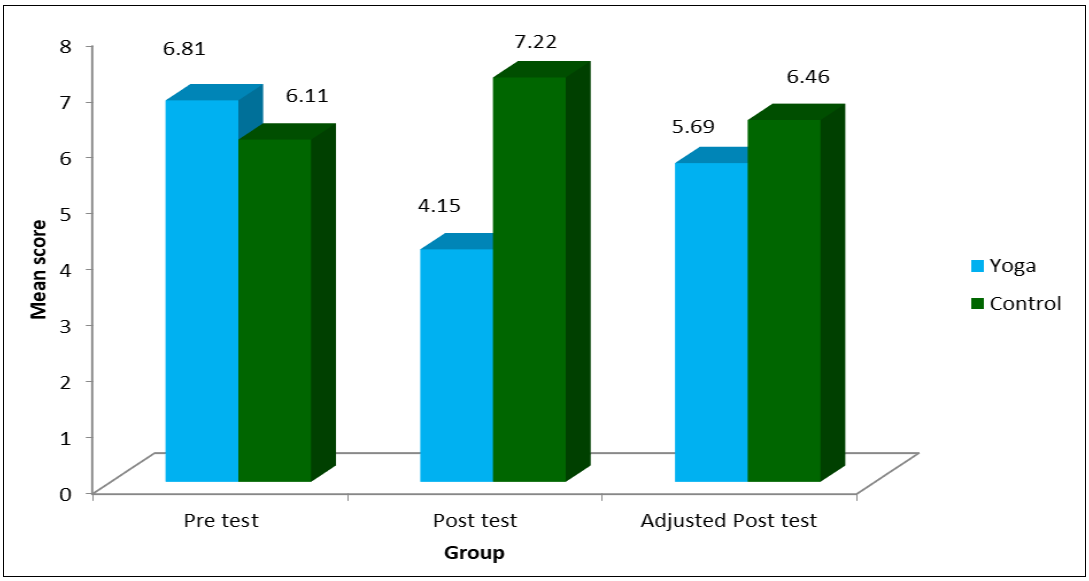

Fig 1: Show yoga practices and control group in respiratory rate test

Table 2: Analysis of co-variance of the pre-test and test means of the yoga practices and control group in respiratory rate test

Group	Yoga	Control	Source of variance	Sum of squares	DF	Mean square	'F' Ratio
Pre-test Mean	18.50	19.40	Between	8.100	1	8.100	1.23 NS
SD	2.56	2.59	Within	249.800	38	6.574	
Post-test Mean	17.65	19.35	Between	28.900	1	28.900	7.67*
SD	1.78	2.08	Within	143.100	38	3.766	
Adjusted post-test mean	18.50	18.95	Between	32.458	1	32.458	6.405*
			Within	154.780	38	5.238	

The above table result reveals that the pre-test mean score on yoga practices is 18.50, control group is 19.40. Therefore, it is observed that the obtained 'F' value 1.23 for Pre-Test mean score. Therefore the framed research hypothesis is rejected. It is inferred that there is no significant difference between the pre-test means of the respiratory rate test. Also, the Post-test mean score on yoga group is 17.65, control group is 19.35. Therefore, it is evident that the obtained 'F' value 7.67 for Post-Test mean score. Therefore the framed research hypothesis is accepted. Further, the above table taking into consideration of the adjusted post-test mean score on yoga practices is 18.50, control group is 18.95. Therefore, it is evident that the obtained 'F' value is 6.405. Therefore the framed research hypothesis is accepted. It is inferred that there is a significant difference between the adjusted post-test means of the respiratory rate test.

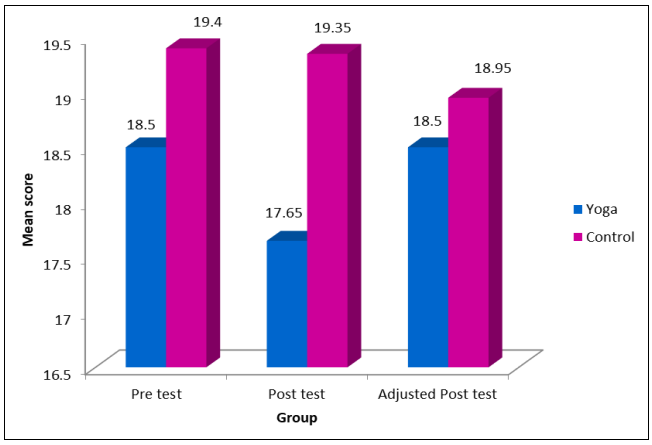

Fig 2: Show significant difference between the adjusted post-test means of the respiratory rate test

Table 3: Showing the mean, standard deviation and T-Value of the range of motion test for flexion of the neck

Group	N	Mean	Std. Deviation	T-Value	P-Value
Pre-test	16	63.12	7.50	4.22	0.001*
Post-test	16	73.43	6.25		

From the above table it is seen that in the pre-test, respondents scored of means value (63.12) than the post-test respondents are higher mean value (73.43). This mean difference is statistically proved by the obtained T-Value (4.22), which is significant at 0.001 level. Therefore the framed research hypothesis that there is a significant difference in range of motion for Flexion level among the respondents between pre and post-test is accepted.

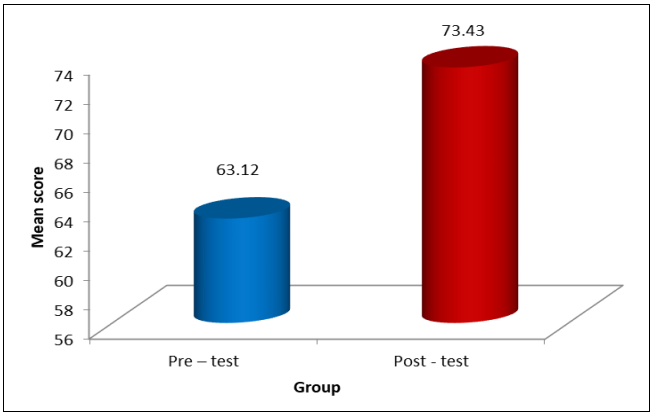

Fig 3: Show Flexion level among the respondents between pre and post-test is accepted

Table 4: Range of motion test extension of neck

Group	N	Mean	Std. Deviation	T-Value	P-Value
Pre-test	16	52.12	6.99	3.83	0.001*
Post-test	16	61.25	6.45		

It is inferred from the above table result shows that in the pre-test, respondents scored of means value (52.12) than the post-test respondents are higher mean value (61.25). This mean difference is statistically proved by the obtained T-Value (3.83), which is significant at 0.001 level. Therefore the framed research hypothesis that there is a significant difference in range of motion for Extension level among the respondents between pre and post-test is accepted.

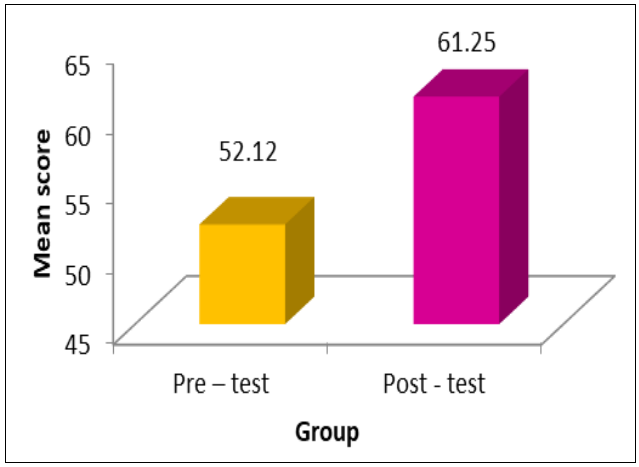

Fig 4: Show extension level among the respondents between pre and post-test is accepted

Table 5: Range of motion test of lateral flexion of neck right

Group	N	Mean	Std. Deviation	T-Value	P-Value
Pre-test	16	28.43	3.52	5.01	0.001*
Post-test	16	36.87	5.73		

From the table 6 it is evident that in the pre-test, respondents scored of means value (28.43) than the post-test respondents are higher mean value (36.87). This mean difference is statistically proved that in the obtained T-Value (5.01), which is significant at 0.001 level. Therefore the framed research hypothesis that there is a significant difference in range of motion for Lateral Flexion of Neck Right level among the respondents between pre and post-test is accepted.

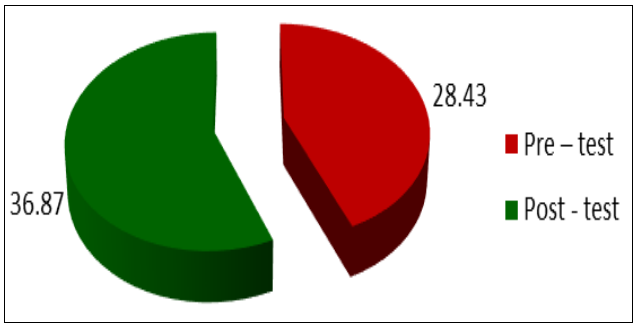

Fig 5: Show neck right level among the respondents between pre and post-test is accepted

Table 6: Range of motion test lateral flexion of neck left

Group	N	Mean	Std. Deviation	T-Value	P-Value
Pre-test	16	28.75	3.41	5.42	0.001*
Post-test	16	37.50	5.47		

From the above table it is seen that in the pre-test, respondents scored of means value (28.75) than the post-test respondents are higher mean value (37.50). This mean difference is statistically proved by the obtained T-Value (5.42), which is significant at 0.001 level. Therefore the framed research hypothesis that there is a significant difference in range of motion for Lateral Flexion of Neck Left level among the respondents between pre and post-test is accepted.

It is inferred from the above table result reveals that in the pre-test, respondents scored of means value (63.43) than the post-test respondents are higher mean value (72.81). This mean difference is statistically proved by the obtained t-value (3.26), which is significant at 0.003 level. Therefore the framed research hypothesis that there is a significant difference in range of motion for rotation of neck right level among the respondents between pre and post-test is accepted.

Table 7: Range of motion test rotation of neck right

Group	N	Mean	Std. Deviation	T-Value	P-Value
Pre-test	16	63.43	9.61	3.26	0.003*
Post-test	16	72.81	6.31		

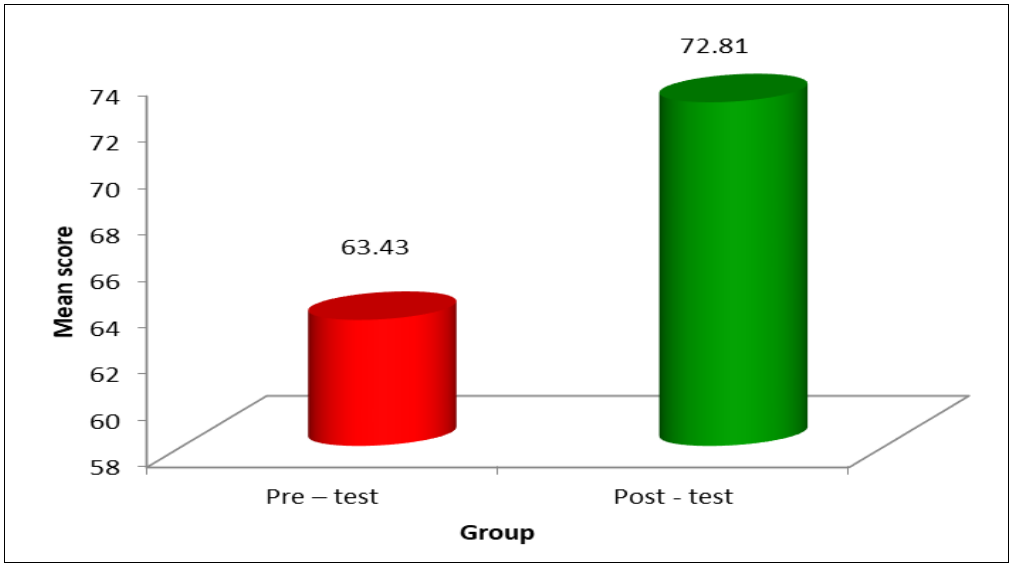

Fig 6: Show motion for rotation of neck right level among the respondents between pre and post-test is accepted

Table 8: Range of motion test rotation of neck Left

Group	N	Mean	Std. Deviation	T-Value	P-Value
Pre-test	16	55.31	7.84	2.60	0.01*
Post-test	16	62.18	7.06		

From the table 9 it is evident that in the pre-test, respondents scored of means value (55.31) than the post-test respondents are higher mean value (62.18). This mean difference is statistically proved that in the obtained T-Value (2.60), which is significant at 0.01 level. Therefore the framed research hypothesis that there is a significant difference in range of motion for rotation of neck left level among the respondents between pre and post-test is accepted.

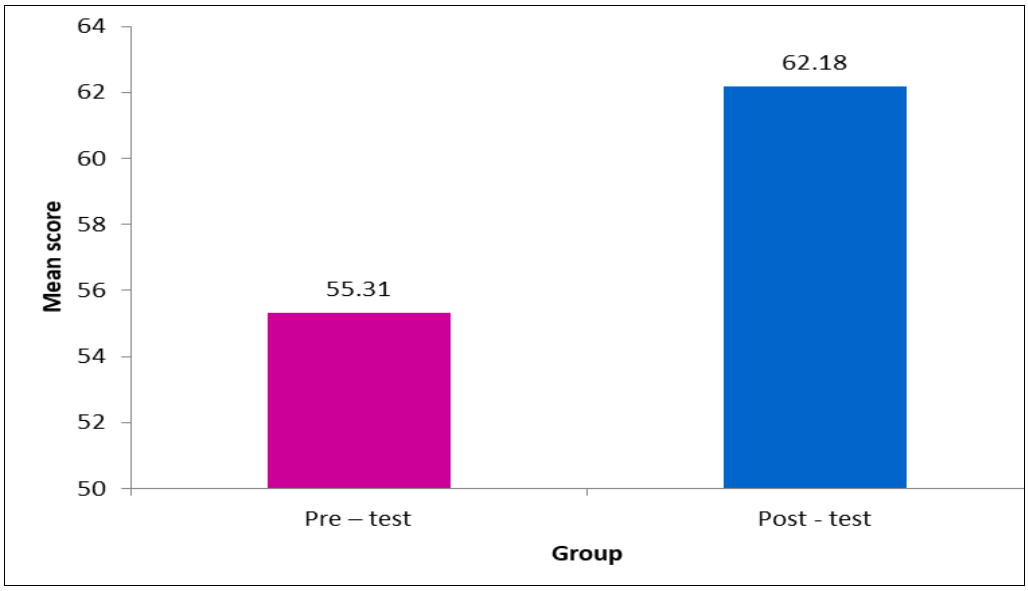

Fig 7: Show rotation of neck left level among the respondents between pre and post-test is accepted

Conclusion

The study findings indicate that Yogic practices, including asana (physical postures) and pranayama breathing exercises, yielded substantial benefits for middle-aged women professionals grappling with chronic neck pain. Specifically, the research demonstrated notable reductions in pain levels experienced by participants, along with improvements in respiratory rate and enhanced range of motion in various neck movements, including flexion, extension, and rotation.

The incorporation of Yogic practices into the participants' routines appeared to have a multifaceted positive impact on their overall well-being. By engaging in specific physical postures and focused breathing techniques, individuals were able to address the underlying factors contributing to their chronic neck pain. These practices likely promoted relaxation, reduced muscle tension, and improved circulation in the affected areas, thereby alleviating discomfort and enhancing mobility.

Moreover, the observed decrease in respiratory rate suggests that Yogic breathing exercises fostered a state of calmness and reduced stress levels among the participants. This aspect is particularly significant, as stress and tension can exacerbate neck pain and contribute to its persistence over time. By learning to regulate their breathing patterns and cultivate mindfulness through pranayama, individuals may have gained valuable tools for managing both physical and emotional aspects of their pain.

Furthermore, the documented improvements in range of motion indicate that Yogic practices have the potential to enhance flexibility and functional mobility in individuals with chronic neck pain. By systematically engaging in targeted movements and stretches, participants likely experienced a gradual expansion of their range of motion, allowing for greater ease and comfort in performing everyday activities.

Overall, the study's findings underscore the therapeutic benefits of incorporating Yogic practices into the management of chronic neck pain among middle-aged women professionals. By embracing a holistic approach that integrates physical postures, breathing techniques, and mindfulness principles, individuals can empower themselves to address the root causes of their pain and cultivate a greater sense of well-being and resilience in their daily lives.

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