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Effects of Yogic Practices on Stress and Sleep Quality among Middle-Aged Women with Knee Osteoarthritis: A Randomized Controlled Study

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ABSTRACT: Knee osteoarthritis (KOA) is a common degenerative condition of the musculoskeletal system that is associated with psychological stress, poor sleep quality, as well as pain and loss of mobility. The aim was to explore the stress and sleep quality responses of middle-aged women with KOA to a 12-week yoga intervention. The middle-aged women with KOA (35–55 years old) were split into two groups: the Control group (n = 45) and the Experimental group (n = 45). The women in the control group kept on doing their normal work during the active rest while the women in the experimental group did yoga for 12 weeks. The Pittsburgh Sleep Quality Index (PSQI) and the Perceived Stress Scale (PSS) were used to measure stress and quality of sleep before and after the treatment. This study examined if there were any effects of regular yoga practice on middle-aged women with osteoarthritis in their knees with regard to stress and sleep quality.

1. INTRODUCTION

Knee osteoarthritis is a disease of joint degeneration in the knees. In other words, it refers to the changes in the structure and function of the knee joint. (KOA) is generally connected with such symptoms as pain, stiffness, lack of mobility, reduced physical abilities, and inability to do various activities. Such impairments might have an effect on the patient's psychological state and increase his/her stress levels and sleep disorders.

Middle age Women have musculoskeletal disorders, exercise, occupational stress and physiological changes caused by aging. Chronic symptoms of (KOA) might interfere with their daily activities, result in affecting the sleep pattern, and change their stress perception. Consequently, to treat (KOA), not only physical but also psychosocial and behavioural aspects should be included in the treatment process.

Yoga is a traditional holistic mind-body approach which includes postures, breathing exercises, relaxation and concentration, and meditation. This approach might be used by those who suffer from chronic musculoskeletal disorders since yoga will improve physical flexibility as well as help relax and control mental processes.

Chronic musculoskeletal disorders are especially associated with stress and sleep. The Perceived Stress Scale (PSS) is a tool commonly employed in measuring perceived stress for an individual, whereas the Pittsburgh Sleep Quality Index (PSQI) is an assessment tool intended to evaluate subjective sleep quality and sleep problems. The original PSQI measures sleep over the past month based on seven subscales and yields an overall score for sleep quality. Cohen, Kamarck, and Mermelstein created the PSS as a tool for measuring subjective stress. Though yoga has been studied concerning musculoskeletal conditions, further study is required with respect to the influence of yoga on psychological stress and sleep quality for middle-aged women suffering from (KOA).

2. AIM OF THE STUDY

This study's primary goal is to find out how middle-aged women with osteoarthritis in their knees respond to an organized 12-week yoga intervention in terms of stress and sleep quality.

Research Hypothesis

It was hypothesized that participants who received the structured yogic intervention would demonstrate significant changes in stress and sleep-quality scores compared with participants in the control group.

3. Methodology

3.1 Research Design and Study Framework

A 12-week, structured Yoga intervention was tested in a randomized controlled research design to determine stress reduction and sleep quality improvement in middle-aged women suffering from KOA.

The total number of participants was 90, who were divided randomly into 2 groups:

Experimental Group (n=45) – These were subjected to structured yogic intervention.

Control Group (n=45) – These participants conducted their routine day-to-day activities in the form of active rest without undergoing any structured yogic intervention.

Baseline data collection took place before performing the experiment. Outcome measures data collection was done after 12 weeks of intervention.

The randomized trial should include five major elements – participant flow, allocation, intervention, outcome, and analysis.

3.2 Selection of Participants

The study included 90 women aged 35–55 years with KOA who fulfilled the predetermined eligibility criteria.

Inclusion Criteria

Criteria for selecting participants were: Women between the ages of 35 and 55 years. Participants must have diagnosed KOA. Ability and willingness to engage in the 12-week intervention period. Consent of the participant prior to the intervention. Participants not engaged in yoga or other forms of exercise regimen.

Exclusion Criteria

Participants who fulfilled any of the following exclusion criteria were excluded from the study:

Previous knee surgery or presence of medical conditions that may limit the mobility of their knees. Presence of severe musculoskeletal/neurological conditions that may hinder their participation. Presence of medical conditions that make it impossible for them to participate in the proposed yoga practices. Presence of previous practice in yoga or exercise program. Inability to participate on a regular basis during the intervention period. Participants who failed to maintain proper attendance or who could not participate in the post-intervention procedures were excluded from the analysis of the per-protocol study.

3.3 Ethical Considerations

This experiment was conducted with respect to all accepted ethical guidelines for conducting an experiment on humans. Participants received all necessary information regarding the goal, procedure, duration, potential advantages, and their right to refuse without negative consequences prior to the experiment. Every participant provided written agreement to take part in the study, and their privacy was maintained throughout.

3.4 Yogic Intervention Protocol and Conditions

The experimental group engaged in a twelve-week program centered around yoga which is specifically aimed at women with KOA. This involved a few light physical exercises, breathing exercises, relaxation, and meditation. The sessions were 1 hour each and were structured in a consistent order.

Components of the Yogic Intervention

- Preparatory practices
- Sukshma Vyayama

Asana practices

- Janu Sirsasana,
- Setu Bandhasana,
- Trikonasana,
- Upavistha
- Konasana,
- Supta Padangusthasana,
- Modified Virabhadrasana,
- Padahastasana,
- bhujangasana,
- Salabhasana,
- Makarasana

Pranayama practices

- Kapalabhati,
- Anuloma Viloma,
- Sheetali,
- Sitkari,
- Bhramari

Relaxation and contemplative practices

- Aum chanting
- Yoga Nidra
- Vayu Mudra

Practices were chosen and adapted as per the functional capability and tolerance of the subjects. Specific emphasis was put on not overloading the knee joint or doing any painful movements for the same.

The control group was kept under the same active rest regimen but without the yogic practices.

3.5 Instruments and Outcome Measures

Two primary outcome measures were used to assess the psychological and sleep-related outcomes of the intervention.

3.5.1 Perceived Stress Scale (PSS)

The PSS, created by Cohen, Kamarck, and Mermelstein, was used to measure stress. The scale was created to gage how stressed out people felt about their life. The PSS score was measured at the beginning and end of the intervention. All assessments were done in the same way for both experimental and control groups.

3.5.2 Pittsburgh Sleep Quality Index (PSQI)

The quality of sleep was assessed using the PSQI, a self-report tool developed by Buysse et al. Within a month, this tool assesses sleep problems and quality. The global sleep-quality scale is made up of seven component scales. The PSQI was given to the subjects before and after the intervention of 12 weeks.

3.6 Procedure for Data Collection

The procedure for gathering data was completed in a systematic way among the middle-aged female participants, aged between 35 and 55 years, suffering from KOA To begin with, the participants were screened based on the criteria for inclusion and exclusion. Prior to their participation, written informed consent was obtained from each eligible participant after they were informed about the study.

Upon recruitment of the participants, information regarding the demographics and other clinical features was obtained. After that, these individuals were split into two groups at random: the experimental group (n = 45) and the control group (n = 45). Prior to administering the intervention, both groups were tested for stress and sleep quality based on PSS and PSQI, respectively.

The experimental group further participated in a yoga intervention for 12 weeks in an appropriate setting. The intervention included selected yogic techniques such as asanas, pranayama, relaxation techniques, and Yoga Nidra that were appropriately modified based on the physical abilities of the participants. Participants were required to conduct the yogic techniques on a regular basis and report any discomfort that occurred during the process.

Participants in the control group remained engaged in their usual activities and were directed not to participate in any organized form of yoga or exercises during the intervention period. Both groups were observed throughout the intervention period.

After completing the 12-week intervention period, the post-test assessment was performed on both groups using the same standardized measures used in the pre-test assessment process. PSS was used to assess the perceived stress levels, while PSQI measured subjective sleep quality.

All filled questionnaires were checked for completeness, coded, and entered into the study database for analysis purposes. The identities of all participants were kept anonymous, and the collected data were used for research purposes only.

3.7 Statistical Methods and Analytical Techniques

Following data collection, data entry, coding, and analysis were carried out. The baseline and outcome characteristics of the subjects were analysed using descriptive statistics. The data was expressed using means and standard deviations (Mean ± SD). The differences between the groups before and after the intervention were evaluated using a paired-samples t-test. To ascertain if the experimental group and the control group differed substantially, the independent-samples t test was employed. Statistical significance was defined as $P<0.05$. A p-value was deemed statistically significant if it was less than 0.05, extremely statistically significant if it was less than 0.001, and non-statistically significant if it was greater than 0.05. The study's two outcome variables for felt stress and sleep quality were the Felt Stress Scale PSS and PSQI, respectively. The mean, standard deviation, t value, and p value are displayed as the outcomes of the data analysis.

4. RESULTS

4.1 Overview of Findings

The current study aimed to discover how middle-aged women with osteoarthritis in their knees perceived stress and how well they slept after participating in a 12-week structured yoga exercise program. The study used a total of 90 volunteers, ages 35 to 55, including 45 individuals in each of the experimental and control groups.

The experimental group went through a structured yoga program for 12 weeks, performing 5 sessions a week for one hour. The control group continued living their regular lifestyle without being involved in the yoga program.

The PSQI and the PSS were used to measure the variables. The paired-samples and independent-samples t-tests were used to assess the data.

4.2 Baseline Characteristics

The experimental and control groups' baseline levels of subjective stress and sleep quality were comparable. Before the experiment, there were no notable differences among the groups.

The experiment's average perceived stress score was 26.80 ± 4.24. The control group demonstrated a mean score of 27.10 ± 4.55. No significant difference was revealed in the comparison of both groups ($t = 0.316$, $p = 0.753$).

As far as sleep quality is concerned, the experimental group showed a mean PSQI score of 13.20 ± 3.13. Consequently, the mean score for the control group was 13.60 ± 3.43. There were no differences between the groups ($t = 0.574$, $p = 0.568$). Thus, baseline characteristics were similar between the groups.

Table 4.2.1 Baseline Characteristics of Participants

Variable	Experimental Group (n=45) Mean+SD	Control Group (n+45) Mean+SD	p.value
Quality of sleep	13.2+3.13	13.60+3.43	0.568
Perceived stress	26.80+4.24	27.10+4.55	0.753

As seen in the above table, both groups were comparable before the intervention, and there was no significant difference between them at baseline.

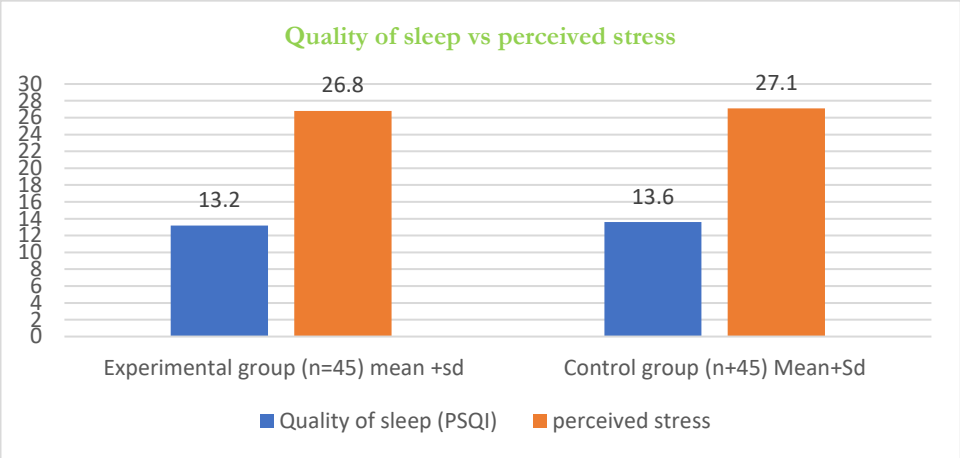

Figure 4.2.1.a Baseline comparison of variables between groups

The baseline levels of stress PSS and sleep quality PSQI in this figure compare the experimental and control groups. This figure suggests the two groups were comparable since there was no significant difference between their mean ratings for felt anxiety and sleep quality prior to the intervention.

4.3. Stress Scores(PSS)

The levels of stress experienced by the experimental group were greatly reduced after undergoing 12 weeks of yogic training sessions. Stress levels were measured using the PSS prior to intervention. The mean stress levels for the experimental group (n=45) was 26.80 ± 4.24 whereas for the control group (n=45) was 27.10 ±4.55. Prior to the action, however, there was not a significant distinction between the two categories (independent samples t-test, t = 0.316, p = 0.753).

Table 4.3.1. Stress scores (pre-test and post-test)

Group	Pre-Test Mean = SD	Post-Test Mean= SD	t-value	p-value
Experimental	26.8+4.24=	17.39+3.94	0.316	0.753
Control	27.1+4.55=	26.5+4.76	9.897	P=0.000

Only the experimental group demonstrated a statistically significant decrease in felt stress during the intervention period, as shown in Table 2, whereas the control group showed minimal change.

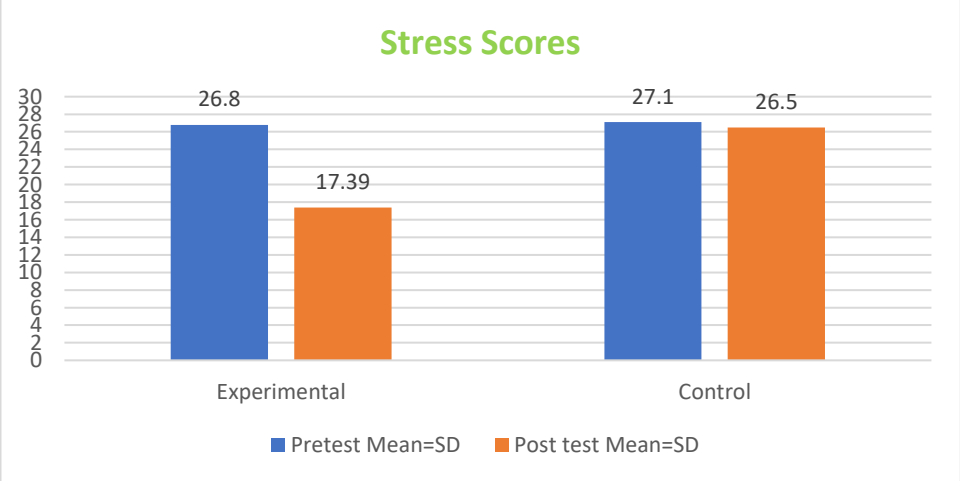

Figure.4.3.1. a Stress Scores

This decrease in stress levels is seen graphically in Figure 2, where the experimental group's sharp decline contrasts with the control group's nearly flat trend.

4.4 Quality of Sleep (PSQI)

The experimental group's sleep quality improved as a result of this intervention. The PSQI score decreased from 13.2 to 7.1, indicating better sleep quality, including deeper, more restful sleep and fewer disruptions at night. The control group did not show any improvements. The sleep quality scores prior to and following the tests are displayed in Table no 4.4.1

Table 4.4.1: Pre-Test and Post-Test Sleep Quality Scores

Group	Pre-Test Mean=SD	Post-Test Mean ±SD	t-value	p-value
Experimental	13.2+3.1	7.1+2.9	12.76	<0.001*
Control	13.6+3.4	13.1+3.3	1.12	0.27

The experimental group's notable increase in sleep quality, as indicated in table 4.4.1, further supports yoga's all-encompassing for women with osteoarthritis in their knees.

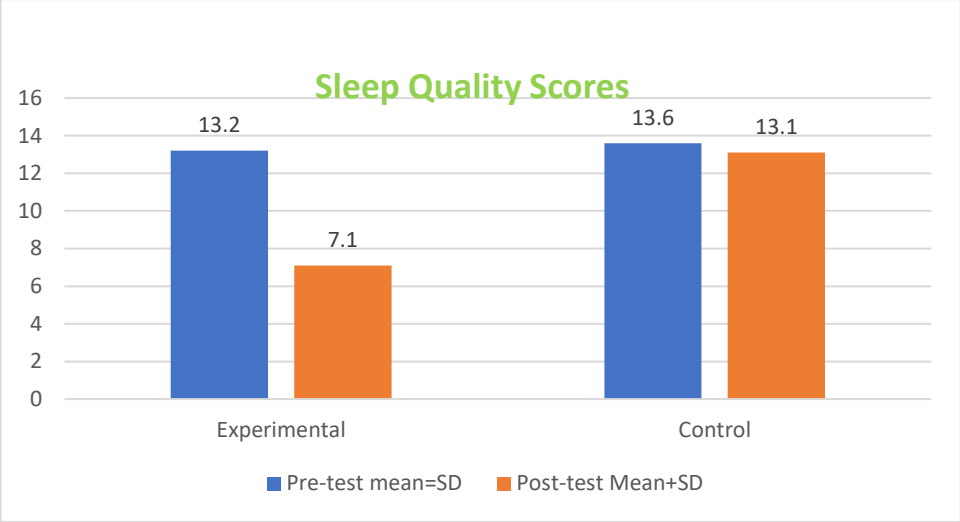

Figure 4.4.1.a: sleep quality before and after yoga training

A visual comparison of sleep quality scores is presented in Figure 3. which amply illustrates the experimental group's significant improvement as opposed to the control group's negligible change.

Overall, the results show that middle-aged women with KOA who participated in a 12-week yoga program saw statistically significant improvements in both pain relief and sleep quality. In the control group, neither of the variables changed significantly. These findings provide strong empirical support for the effectiveness stress and sleep disorders using yoga, in this population, as an alternative to drug treatment.

5.DISCUSSION

The current research assessed effects of 12 weeks yogic exercise program on the levels of perceived stress and sleep quality in middle-aged women suffering from osteoarthritis in knees. The results have suggested that routine yogic exercise programs might have a positive effect on the psychological well-being and sleep quality in such patients.

In terms of subjective stress and sleep quality, At first, there were no differences between the experimental and control groups. The experimental group's mean perceived stress level was 26.80 ± 4.24, whereas the control group's was 27.10 ± 4.55. As a result, the two groups did not differ significantly (p=0.753). Additionally, there was no statistically significant difference in the groups' baseline sleep quality (p=0.568).

As a result of the 12-week intervention based on yogic practices, the experimental group has shown a considerable reduction in the level of perceived stress. These results imply that the use of such techniques as asana, pranayama, mudra, and meditation

can be associated with positive stress regulation. In this regard, the yogic practices include physical activity, controlled breath, relaxation, and attentional practices that can decrease psychological stress and lead to a calmer state of mind. At the same time, the structure and progressiveness of the intervention may also motivate participants for active involvement in the program and increased self-awareness.

Furthermore, the change in the level of perceived stress is connected with the interplay between the physical pain and psychological state of a person suffering from KOA. Chronic joint pain can hinder physical activity and relaxation as well as sleep, thus increasing the level of stress. Therefore, the intervention may combine physical activity with relaxation and controlled breathing.

In addition, the PSQI was employed to evaluate the sleep quality of the subjects. Based on the baseline analysis results, the experimental group's mean PSQI score was 13.20 ± 3.13, whereas the control group's was 13.60 ± 3.43, indicating poor sleep quality among the participants. The groups did not differ statistically significantly ($p = 0.568$). According to the observed results regarding sleep, it can be concluded that the practice of yoga can help in improving the sleep quality since decreased levels of stress, relaxation, controlled breathing and awareness of bodily sensations might have an impact on sleep.

It is consistent with the general rationale that mind-body exercises might affect sleep and stress through relaxation and autonomic regulation. Pranayama and meditation can be useful in relaxing one's body, and asanas can allow performing some gentle physical exercises.

The progressive approach that was adopted in the current study could also be another key contributor. In the first four weeks, participants practiced preparatory exercises; in the next four weeks, they were subjected to intermediate-level exercises, while in the last four weeks, the exercise programme consisted of a combination of asana, pranayama, mudra, and meditation.

In conclusion, the current study's findings demonstrate that a carefully planned 12-week program involving practice of yoga can be a helpful complementary strategy in coping with stress and sleep problems among middle-aged women suffering from KOA. Yoga should not replace conventional treatment but be used as an auxiliary measure along with other health care strategies.

The study has to be understood with consideration of its limitations. For one, the study involved middle-aged women with KOA selected from a particular environment, which limits the applicability of the results to other groups of patients. Another limitation of the study was the limited period during which the interventions were performed, with no follow-up done after the end of the interventions. Longer follow-up periods and larger sample numbers in future studies may provide more information about the long-term impact of yoga practices.

Overall, the current study results reveal that regular and structured yogic practices, including asanas, pranayama, mudras, and meditation, may prove useful in the management of stress and sleep quality of middle-aged women with KOA.

6. CONCLUSION

This study sought to determine the impact of a 12-week yoga practice regimen on middle-aged women with osteoarthritis in their knees' perceptions of stress and sleep quality. A total sample of 90 women was used with 45 participants each in the experimental and control groups. The practice was done daily for 1 hour, 5 days per week, and included asana, pranayama, mudra, and meditation.

At the pre-intervention stage, the features of the experimental and control groups were identical. The levels of perceived stress were 26.80 ± 4.24 and 27.10 ± 4.55 ($p=0.753$), and PSQI was 13.20 ± 3.13 and 13.60 ± 3.43 ($p=0.568$). It was shown that no significant differences existed in the initial states of the participants.

At the post-intervention stage, it was revealed that participants in the experimental group showed significantly lower stress perception and enhanced sleep quality. The use of physical exercises, breathing techniques, relaxation, and meditation might be considered as factors leading to such results. These results indicate that structured yoga can be an effective complementary technique in treating stress and sleep problems linked to KOA. However, yoga must not replace mainstream medicine.

There are some limitations in this study, which include the target population, duration of the intervention, and self-assessed measures. Future studies must involve a bigger and more diversified population, objective assessment measures, and a longer follow-up time.

To conclude, a structured yogic program for 12 weeks, which will include asanas, pranayamas, mudras, and meditation, can be effective in decreasing stress levels and improving sleep quality in middle-aged females with KOA.

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