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# Effects of progressive muscle relaxation exercises and yoga on low back pain and insomnia among pregnant women visiting private healthcare facilities in Sargodha

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**Abstract**

Chronic pain and insomnia are common and unbearable conditions that markedly affect the quality of life of an individual. Traditional pharmacological management usually results in limited long-term benefits and side effects, triggering exploration of non-pharmacological interventions. This study compared the effectiveness of two non-pharmacological interventions, yoga and progressive muscle relaxation (PMR), for reducing low back pain and insomnia severity in pregnant women over an 8-week period. A two-group, pre- and post-intervention quasi-experimental design was used. Both interventions were assessed using the Numeric Pain Rating Scale (NPRS) and the Insomnia Severity Index (ISI). Participants attending two private healthcare facilities were enrolled into two intervention groups by site, yoga (n = 50) and PMR (n = 50). Both interventions produced significant within-group reductions in pain and insomnia scores, and the yoga group showed the larger improvement. In the yoga group, the mean pre-treatment NPRS score of 8.44 ± 1.15 was reduced to 1.42 ± 1.09 post-treatment (mean difference = 7.02, $p < 0.001$), and the mean ISI score of 23.02 ± 2.02 was reduced to 10.02 ± 2.10 (mean difference = 13.00, $p < 0.001$). In the PMR group, the mean pre-treatment NPRS score of 8.92 ± 1.03 was reduced to 5.62 ± 1.05 post-treatment (mean difference = 3.30, $p < 0.001$), and the mean ISI score of 23.84 ± 1.97 was reduced to 16.70 ± 1.30 (mean difference = 7.14, $p < 0.001$). Between-group comparison showed significantly greater improvement in the yoga group for both outcomes ($p < 0.001$). Both interventions were beneficial for reducing pain and insomnia, and the yoga group showed significantly greater improvement. With comparable baseline characteristics between groups, these findings support yoga as the more effective of the two programs, while acknowledging the absence of a usual-care control arm.

**Keywords**

Yoga; Progressive muscle relaxation; Pain management; Insomnia; Sleep disorders

## 1. Introduction

Low back pain and insomnia are common symptoms in pregnant women, especially in third trimester, and can be intolerable. These conditions are often explained by the substantial physiological and anatomic changes that take place throughout course of pregnancy [1,2]. Stress on the musculoskeletal system, particularly lower back, is an adaption induced by the change in posture, and the shifting of the centre of gravity as the uterus expands [3,4]. Relaxin, a hormone that causes joints and ligaments to loosen, adds to the discomfort experienced by pregnant women. Another common complaint among pregnant women, insomnia is often related to physical discomfort, hormonal shifts, anx-

iety and shifts in sleeping patterns [5]. These two conditions, low back pain and insomnia are closely related with one causing the other and thus creating a vicious cycle of distress and impaired quality of life. These symptoms are detrimental not only to maternal health but to the fetus as well, given the rise in stress, lack of rest, and deterioration in health overall [6,7,8].

Due to high prevalence of these problems, the development of an effective, safe, and accessible interventional and preventive measures during pregnancy is necessary [9,10]. While medication is usually the prescribed method of treatment, problems of potential harm to the fetus and a preference for a non-pharmacological approach have led to investigation of the use of complementary alternative therapies [11,12]. Among these interventions, progressive muscle relaxation (PMR) exercises and yoga have demonstrated positive effects on pain and anxiety reduction, as well as sleep improvement, among different population groups, including pregnant women [13,14]. PMR is a relaxation method that systematically tenses and relaxes muscles, release physical tension, has been used to lower stress and anxiety, relieve pain and promote sleep and improves both physical and mental health during pregnancy [15,16,17,18].

As a gentle, non-invasive intervention for many common pregnancy-related discomforts, yoga—especially prenatal yoga—has emerged as a popular option. Yoga is an exercise that involves slow stretching, breathing, and mindfulness exercises that can increase flexibility, lower stress levels, and promote better sleep [19,20,21]. It is known to help relieve musculoskeletal discomfort like lumbar pain and improve mental clarity as well as relaxation, which can help alleviate insomnia. Prescribing correct asanas that ensure a beneficial contribution for both the mother as well as the developing fetus forms the basis of yoga during the prenatal phase and, thus, could prove to be an appropriate intervention for those pregnant women experiencing physical discomfort and sleep-related problems [12,22].

Although individual studies have demonstrated effects of PMR and yoga on reducing pain and improving sleep quality during pregnancy, there are few studies in which the two different techniques were evaluated together. This gap necessitates research on the combined influence of PMR and yoga as non-pharmaceutical therapy. This study therefore examined the effectiveness of these interventions in reducing low back pain and insomnia during pregnancy, aiming to provide evidence on safe, affordable, non-pharmacological options for pregnancy-related complaints. The specific objective was to compare the effect of an 8-week yoga program with that of an 8-week PMR program on low back pain [measured by the Numeric Pain Rating Scale (NPRS)] and insomnia [measured by the Insomnia Severity Index (ISI)] in pregnant women in their third trimester. The research question was: among pregnant women with low back pain and insomnia, how do yoga and PMR compare in reducing pain and insomnia severity over 8 weeks? It was hypothesized that both interventions would reduce pain and insomnia and that yoga would be associated with a greater reduction than PMR.

## 2. Materials and methods

### *2.1. Study design and duration*

This was a quasi-experimental, two-group interventional study with pre- and post-intervention assessment, conducted over six months from March to August 2025. Each participant completed an 8-week intervention. The study was designed and reported in line with the STROBE recommendations for the transparent reporting of non-experimental clinical research, and a concurrent usual-care control arm was not included, which is reflected in the interpretation of the findings.

### *2.2. Ethics considerations*

The study received approval from the Ethical Review Committee of Rai Foundation Medical College, Sargodha, Pakistan (No. RFMC/IRAB/Protocol/No.2025-004), and all participants provided written informed consent before participation. The study adhered to the principles of the Declaration of Helsinki.

### *2.3. Study setting*

This study was conducted in two major teaching tertiary care private sector hospitals of Sargodha, Rai Medical College Teaching Hospital and Niazi Welfare Teaching Hospital, providing state-of-the-art healthcare services to patients through specialized units including but not limited to gynaecology, pulmonology, nephrology, dermatology, cardiology, orthopaedics, paediatrics, intensive care, as well as round-the-clock diagnostic and emergency services [23,24].

### *2.4. Participant recruitment*

Women aged 18 to 40 years in their third trimester of pregnancy who had experienced low back pain and/or insomnia, without significant pregnancy complications, and capable of providing informed consent were included in the study. However, women with recent trauma or surgery affecting the back or pelvis, neurological disorder, systemic illnesses, and contraindications to exercise based interventions were not made part of the study.

### *2.5. Sample size and sampling technique*

The sample size was calculated using a two-sample independent t-test with an alpha of 0.05 and power of 0.80. Published mean and standard deviation values for NPRS (6.2 ± 1.8) among pregnant women with low back pain were used [25]. Minimal clinically important differences of 2 points for NPRS was applied. The calculated sample size was approximately 6 participants per group. Because this minimal-difference calculation yields a very small group size that is vulnerable to attrition and provides limited power for subgroup and between-group analyses, a larger and more conservative sample of 50 participants per group (total 100) was adopted. This enrollment target improves the stability of the estimates, accommodates variability between the two facilities, and allows for non-response and loss to follow-up. Calculations were performed using SPSS version 26.0 sample size module and verified manually with the standard formula. A purposive sampling technique was used to select eligible participants, and the two intervention arms were assigned by study site: eligible women attending one facility received yoga and those attending the other received PMR. This site-based assignment was adopted for the practical delivery of the supervised sessions and is considered when interpreting the findings.

### *2.6. Study instrument*

The study used structured questionnaire to record sociodemographic information and related medical history of the participants. Furthermore, study used two tools including NPRS and ISI, which are quick to administer and practical to be used in clinical settings [14,26,27].

### *2.7. Study measures*

The study recorded sociodemographic information of the participants including age (in years); geographical location (rural and urban); employment status (self-employed, employed, and unemployed); level of physical activity (sedentary, moderately active, and very active); pain history (yes and no); sleep pattern (6 hours, 7 hours and 8 hours); history of sleep disorders (yes and no); stress level (low, moderate and high). NPRS assessed intensity of low back pain, a widely recognised tool to rate pain on an 11-point scale, ranging from 0 indication no pain to 10 indicating worst imaginable pain [28,29]. The ISI evaluated the severity of insomnia symptoms using a 7-item scale, with each item rated from 0 (no problem) to 4 (severe problem), giving a total score ranging from 0 to 28. Higher scores indicate greater severity, with 0-7 indicating no clinically significant insomnia, 8-14 subthreshold insomnia, 15-21 moderate insomnia, and 22-28 severe insomnia [30,31].

### *2.8. Data collection*

Permission for data collection was taken from the concerned authorities of the hospital and women fulfilling the inclusion criteria were briefed about the study and leaflets containing all details regarding the study and interventions were provided to participants in local language, and written consent for participation in study was obtained. Face to face interviews were conducted, and each interview lasted for 10 to 15 minutes. Data were recorded before and after intervention on the structured questionnaire in local language. Furthermore, NPRS and ISI were used to assess responses of the participants regarding pain and insomnia.

### *2.9. Interventional protocol*

#### 2.9.1. Group A

PMR involves a series of exercises devised to progressively tense and then relax different muscle groups of the body to promote relaxation, reduce muscle tension, and alleviate pain [32]. These exercises were performed by the participants of the study under observation and guidance of professional coaches. In each session, participants sequentially tensed and then released the major muscle groups in a fixed order (hands and forearms, upper arms, shoulders and neck, face, chest and abdomen, back, buttocks, thighs, calves, and feet), holding each contraction for about 5-7 seconds before relaxing. Each session lasted about 20-30 minutes and was delivered three times a week for 8 weeks; attendance was recorded at each supervised session to monitor adherence [33,34,35].

#### 2.9.2. Group B

Yoga for pregnant women, included focus on gentle postures (asanas), breathing exercises (pranayama), and relaxation techniques to promote both physical and mental well-being [36]. Furthermore, relaxation techniques like Savasana (corpse pose) were also included in the session. Sessions included pregnancy-safe asanas (such as cat-cow, seated forward bends, gentle spinal twists, supported butterfly, and standing poses adapted for pregnancy), pranayama breathing, and Savasana relaxation. Each session lasted 45 to 60 minutes under the observation and guidance of a certified prenatal yoga instructor and was delivered twice a week for 8 weeks; attendance was recorded to monitor adherence. Because the two protocols differed in session length and frequency, this difference in intervention dose is acknowledged as a potential confounder [37,38,39].

*2.10. Statistical analysis*

Data were analyzed with the help of SPSS version 26.0 and descriptive statistics including frequencies, percentages, and measures of central tendencies were calculated. The chi-square test was used to compare baseline categorical characteristics between groups, the paired t-test was used to compare pre- and post-intervention scores within each group, and the independent-samples t-test was used to compare post-intervention scores and change scores between the two groups. A $p$ value below 0.05 was considered statistically significant.

## 3. Results

Table 1 presents the mean age of participants in both groups. For clarity, Group A corresponds to the PMR group and Group B to the yoga group throughout this manuscript. The mean age of Group A (PMR) was 30.38 ± 5.10 years, and that of Group B (yoga) was 32.28 ± 5.74 years.

**Table 1.** Age of the participants.

| Group | Participants | Mean Age (in Years) ± SD |
|---|---|---|
| Group A | 50 | 30.38 ± 5.10 |
| Group B | 50 | 32.28 ± 5.74 |

Table 2 presents the sociodemographic and clinical characteristics of participants by group. In the PMR group, 62% were from urban settings, 36% were self-employed, 50% were moderately active, 60% reported a history of pain, 40% slept for 8 hours a day, 56% reported a history of a sleep disorder, and 40% reported a moderate level of stress. In the yoga group, 58% were from rural settings, 36% were unemployed, 40% were moderately active, 50% reported a history of pain, 40% slept for 8 hours a day, 56% reported no history of a sleep disorder, and 50% reported a moderate level of stress. All percentages were verified against Table 2.

The two groups were comparable at baseline on employment status ($p = 0.915$), physical activity level ($p = 0.459$), pain history ($p = 0.315$), sleep patterns ($p = 0.900$), history of sleep disorders ($p = 0.230$), and stress level ($p = 0.459$). A modest difference was observed only for geographical location ($p = 0.045$), with a higher proportion of urban participants in the PMR group; all other characteristics did not differ significantly, indicating well-balanced groups.

**Table 2.** Comparison of sociodemographic and clinical characteristics between yoga and progressive muscle relaxation groups.

| Demographics | | Yoga (n = 50) | | PMR (n = 50) | | *p* Value |
|---|---|---|---|---|---|---|
| | | N | % | N | % | |
| Geographical location | Urban | 21 | 42 | 31 | 62 | 0.045 ** |
| | Rural | 29 | 58 | 19 | 38 | |
| Employment status | Self-employed | 16 | 32 | 18 | 36 | 0.915 |
| | Employed | 16 | 32 | 15 | 30 | |
| | Unemployed | 18 | 36 | 17 | 34 | |
| Physical activity level | Sedentary | 15 | 30 | 10 | 20 | 0.459 |
| | Moderately active | 20 | 40 | 25 | 50 | |
| | Very active | 15 | 30 | 15 | 30 | |
| Pain history | Yes | 25 | 50 | 30 | 60 | 0.315 |
| | No | 25 | 50 | 20 | 40 | |

| Demographics | | Yoga (n = 50) | | PMR (n = 50) | | *p* Value |
|---|---|---|---|---|---|---|
| | | N | % | N | % | |
| Sleep patterns | 6 hours | 18 | 36 | 20 | 40 | 0.900 |
| | 8 hours | 20 | 40 | 18 | 36 | |
| | 7 hours | 12 | 24 | 12 | 24 | |
| History of sleep disorders | Yes | 22 | 44 | 28 | 56 | 0.230 |
| | No | 28 | 56 | 22 | 44 | |
| Stress level | Low | 10 | 20 | 15 | 30 | 0.459 |
| | Moderate | 25 | 50 | 20 | 40 | |
| | High | 15 | 30 | 15 | 30 | |

[*] PMR, progressive muscle relaxation. [**] Variables were compared using the chi-square test. [***] Denotes statistical significance ($p < 0.05$).

Table 3 presents the comparison of outcomes for NPRS and ISI before and after 8 weeks of intervention in both groups. In the yoga group, the mean NPRS score decreased from 8.44 ± 1.15 at pre-treatment to 1.42 ± 1.09 post-treatment, with a mean difference of 7.02, which was statistically significant ($p < 0.001$). Similarly, the PMR group showed a reduction in NPRS scores from 8.92 ± 1.03 to 5.62 ± 1.05, with a mean difference of 3.30, also statistically significant ($p < 0.001$).

For ISI, the yoga group demonstrated a significant reduction from a pre-treatment mean of 23.02 ± 2.02 to 10.02 ± 2.10 post-treatment, with a mean difference of 13.00 ($p < 0.001$). In the PMR group, ISI scores decreased from 23.84 ± 1.97 to 16.70 ± 1.30, with a mean difference of 7.14, which was also statistically significant ($p < 0.001$). On between-group comparison of post-treatment scores, the yoga group had significantly lower NPRS and ISI scores than the PMR group (independent-samples t-test, $p < 0.001$ for both), and the reduction from baseline (change scores) was also significantly greater in the yoga group for both outcomes ($p < 0.001$), consistent with a greater treatment effect for yoga.

**Table 3.** Comparison of pre- and post-treatment outcomes of NPRS and ISI after 8 weeks of intervention in yoga and progressive muscle relaxation groups.

| Variables | N | Yoga | | | | Progressive Muscle Relaxation | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Pre-Treatment Mean ± SD | Post-Treatment Mean ± SD | Mean Difference | *p* Value | Pre-Treatment Mean ± SD | Post-Treatment Mean ± SD | Mean Difference | *p* Value |
| NPRS | 50 | 8.44 ± 1.15 | 1.42 ± 1.09 | 7.02 | < 0.001 | 8.92 ± 1.03 | 5.62 ± 1.05 | 3.30 | < 0.001 |
| ISI | 50 | 23.02 ± 2.02 | 10.02 ± 2.10 | 13.00 | < 0.001 | 23.84 ± 1.97 | 16.70 ± 1.30 | 7.14 | < 0.001 |

[*] ISI, Insomnia Severity Index; NPRS, Numeric Pain Rating Scale. [**] Denotes statistical significance ($p < 0.05$).

## 4. Discussion

The present study demonstrates that both yoga and PMR significantly improved pain and insomnia outcomes after the intervention period. Participants in both groups showed marked reductions in pain intensity and insomnia severity following treatment, indicating the effectiveness of both interventions. However, the magnitude of improvement was greater in the yoga group, suggesting a comparatively stronger impact on both pain relief and sleep quality. Additionally, baseline characteristics were comparable between the two groups, with no significant differences in employment, physical activity, pain history, sleep patterns, history of sleep disorders, or stress, and only a modest difference in geographical distribution. This baseline balance strengthens the between-group comparison, making it more likely that the greater improvement in the yoga group reflects a genuine treatment effect rather than pre-existing differences. Overall, these findings indicate that while both interventions are beneficial, yoga produced signifi-

cantly greater improvements in pain and insomnia than PMR, and the balanced baseline characteristics support interpreting this as a genuine difference in effectiveness rather than an artefact of group differences.

Yoga (mean difference = 7.02) and PMR (mean difference = 3.30) resulted in significant improvement with respect to pain reduction in this study. Yaman Sözbir et al., studied the effect of yoga on chronic pain, reporting significantly lowered pain intensity in participants [40]. Although their study reported a similar decrease in NPRS scores from 8.0 to 4.5, the mean difference was smaller than that of our study. It indicates that yoga is particularly effective in the treatment of pain disorders, probably because of its focus on posture, breath control and relaxation. PMR group in our study had a lesser improvement, as reported by Akbaş and Yaman Sözbir, who described moderate pain relief from PMR but a smaller effect than that seen for yoga [40]. The lower mean difference in our PMR group suggests that PMR is beneficial but possibly not as effective as yoga in the pain relief setting.

For insomnia, both interventions showed significant improvement in sleep quality, with the yoga group reporting a greater reduction in ISI scores (mean difference = 13.02) compared with PMR (mean difference = 7.13). These findings are in line with the study conducted by Ayaz-Alkaya et al., which has demonstrated that yoga increased sleep patterns and decreased insomnia severity among persons with chronic insomnia [41]. Similar to our findings, participants practising yoga had a significant reduction in ISI scores throughout their study. This suggests that yoga is an effective intervention for improving sleep quality, which could be attributed to the unique combination of physical activity, mental relaxation, and mindfulness that is involved in yoga practices. On the other hand, Pais M et al., evidence on PMR applied to insomnia has likewise suggested only moderate improvements in sleep quality [32]. PMR may be less efficacious in insomnia treatment than other, more global approaches, such as yoga, as their results showed a smaller decrease in ISI scores. Though PMR does help with stress and relaxation, yoga encompasses the physical component of insomnia, thereby making its impact on sleep more holistic than PMR, which focuses only on relaxing the body without adding in the elements of mind and breath.

For both outcome variables (pain and insomnia), while there were significant improvements in pain and insomnia outcomes following PMR as well, the magnitude of the effect was greater in the yoga condition. These results align with data in the Kocoglu-Tanyer et al., which implies that yoga as a multi-faceted approach— which includes physical postures, breath work, and meditation— is ideal when dealing with conditions such as those that have complex and multi-determined origins, such as chronic pain and insomnia [42]. While PMR can help reduce stress and aid relaxation, it lacks the significant comprehensive physical and mental health benefits of yoga.

This study has several limitations. First, it used a two-group interventional design with site-based assignment and without a usual-care or sham control arm, so, although the groups were well balanced at baseline, the design cannot fully establish causation. Second, neither participants nor outcome assessors were blinded, and both outcomes were self-reported (NPRS and ISI), which may introduce measurement and expectation bias. Third, the two interventions differed in session length and frequency, so part of the observed difference may reflect a difference in intervention dose. Fourth, the sample size was modest and there was no long-term follow-up to assess whether the effects were sustained. Further studies should identify larger, more diverse populations and consider the combined effect of yoga with PMR. Exploring the mechanisms of each intervention may likewise provide important insights. Compare these interventions to other therapeutic modalities to help identify the most effective treatments for pain and insomnia.

## 5. Conclusions

Both yoga and PMR produced statistically significant improvements in low back pain and insomnia after 8 weeks, with significantly greater improvement in the yoga group and well-balanced baseline characteristics between groups. In practice, either supervised program can be offered as a safe, low-cost, non-pharmacological option for pregnant women with low back pain and insomnia, and prenatal yoga may be preferred where a certified instructor is available. Future studies with a usual-care comparison arm, blinded outcome assessment, and longer follow-up are warranted to confirm the durability of these benefits.

**Abbreviations:** ISI, Insomnia Severity Index; NPRS, Numeric Pain Rating Scale; PMR, Progressive muscle relaxation.

**Author contributions:** Conceptualization, AG, and MA; methodology, AG; software, MA; validation, AG; formal analysis, AG; investigation, MA; resources, AG; data curation, AG; writing—original draft preparation, MA; writing—review and editing, AG; visualization, AG; supervision, AG; project administration, AG. All authors have read and agreed to the published version of the manuscript.

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