

ORIGINAL ARTICLE

Effect of core strengthening and dynamic hip mobility exercises on non-specific low back pain in female police officers

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ABSTRACT

Background: Non-specific lower back pain (NSLBP) is prevalent among female police officers, influenced by genetic factors, aging, and occupational risks such as heavy lifting. This study evaluates a 6-week program combining core strengthening and hip mobility exercises to alleviate NSLBP. **Objective:** To assess the effectiveness of core strengthening and dynamic hip mobility exercises in reducing NSLBP among female officers. **Methods and Material:** The study involved 40 female officers aged 25-55 with NSLBP lasting at least 6 weeks using simple random sampling technique. Participants were randomly assigned to Group A (control) or Group B (experimental). Group B underwent a 6-week core strengthening and hip mobility exercise regimen, with pain intensity (NPRS) and low back disability (ODI) measured before and after. **Results:** Group B exhibited significantly lower pain intensity (3.5 ± 1.147 vs 7.3 ± 0.9234) and reduced low back disability (13.6 ± 2.909 vs 28.65 ± 2.207) compared to Group A. **Conclusions:** The study revealed that among female officers with NSLBP, core strengthening and hip mobility exercises proved more effective than traditional exercises in alleviating pain and reducing low back instability

KEYWORDS

Biomechanical Abnormalities; Degenerative; Non-Specific; Spinal Stability

INTRODUCTION

Non-specific lower back pain (NSLBP) is highly prevalent among female police officers due to factors such as aging, genetic predisposition, and occupational demands, including prolonged standing, heavy lifting, and the use of duty belts. These factors, combined with biomechanical abnormalities and hormonal fluctuations, often lead to musculoskeletal issues. Weakness in the core and hip muscles

can result in compensatory over-activation of muscles like the hamstrings and iliopsoas, further exacerbating pain.

Aim & objective: To assess the effectiveness of core strengthening and dynamic hip mobility exercises in reducing non-specific low back pain among female police officers.

MATERIAL & METHODS

The study protocol (Protocol no. 043/2023-2024) was approved by the Krishna Institute of Medical Sciences Ethics Committee, and subjects provided written informed consent prior to commencement. This interventional experimental study focused on female police officers from Ahmednagar city police stations. Simple random sampling technique was used for selection and calculation of the sample size.

Using the formula $n = \frac{N}{1+N(e^2)}$

Where:

- n = desired sample size (41)
- N = population size (total number of female police officers was 46)
- e = margin of error (0.05)

The study initially aimed for a sample size (n) of 41 based on calculations, but due to practical considerations, 40 participants were selected to evenly allocate them between two groups. Participants were randomly assigned to either Group A (control) or Group B (experimental), with each group consisting of 20 participants. Group A received conventional exercises, while Group B underwent a 6-week intervention with sessions lasting 40-45 minutes.

The study's inclusion criteria involved officers aged 25 to 55 experiencing non-specific low back pain (NSLBP) for at least 6 weeks with pain intensity ≥ 3 on the NPRS, who gave written consent and agreed to participate, while exclusion criteria encompassed officers with low back pain attributable to specific underlying conditions (such as pregnancy-related issues, spinal fractures, inflammatory or degenerative spinal conditions, carcinoma, or nerve root involvement), as well as participants unwilling to participate or complete the study.

Over a 6-week period, the study took place across various police stations in Ahmednagar District, where participants were comprehensively briefed on its objectives. The research employed established outcome measures such as the Numerical Pain Rating Scale (NPRS) and Oswestry Disability Index (ODI) to assess baseline conditions through pre-test evaluations. Group A (control) underwent a regimen of conventional exercises, while Group B (experimental)

followed a tailored exercise protocol designed specifically for the study. Each daily session lasted between 40 to 45 minutes, incorporating a 5-minute warm-up session at the beginning and a cool-down session at the end. After the conclusion of the 6-week intervention period, post-test assessments were administered to evaluate any changes in the participants' pain levels and functional disability. The collected data underwent rigorous statistical analysis, focusing on measures such as mean values and standard deviations. Paired sample t-tests were utilized within each group to compare pre- and post-test scores of the NPRS and ODI. Statistical analysis was conducted using InStat software to determine the effectiveness of the exercise interventions in managing non-specific low back pain among female police officers in Ahmednagar District.

RESULTS

(Table 1) outlines the essential characteristics of the 40 participants engaged in the intervention. In (Table 2), the mean pain scores at baseline and post-intervention for Group A and Group B are displayed. Group A's baseline score was 7.85 ± 0.9881 , decreasing to 7.3 ± 0.9234 after 6 weeks, while Group B's baseline score was 7.45 ± 1.932 , decreasing to 3.5 ± 1.147 post-intervention. Notably, both groups underwent a notable decrease in pain intensity ($p < 0.05$). (Table 3) shows the mean low back instability scores at baseline and post-intervention for both groups. Group A's baseline score of 30.25 ± 2.552 decreased to 28.65 ± 2.207 after 6 weeks, while Group B's baseline score of 24 ± 5.448 decreased to 13.6 ± 2.909 post-intervention. Both groups demonstrated a reduction in the disability index following treatment ($p < 0.05$), with Group B showing a greater decrease compared to Group A. (Table 4) presents the comparison of post-intervention NPRS test scores in each group, revealing a highly significant outcome (t-value = 11.541, $p < 0.001$). Group A exhibited a post-test score of 7.3 ± 0.9234 , while Group B showed a score of 3.5 ± 1.147 , indicating the intervention's effectiveness in reducing pain levels, with Group B showed a notable reduction compared to Group A. (Table 5)

illustrates the post-intervention ODI scores comparison within each group, demonstrating a highly significant result (t-value = 18.432, $p < 0.0001$). Group A displayed a post-test score of 28.65 ± 2.207 , whereas Group B exhibited a

score of 13.6 ± 2.909 , emphasizing the intervention's effectiveness in alleviating pain levels, with Group B showing notably lower ODI scores compared to Group A.

Table 1 Demographic variables of the study subjects

| Variables | Group A | Group B |
|-------------|----------------|-----------------|
| Age | 37.6 ± 9.6 | 41.3 ± 9.45 |
| Height (m) | 1.6 ± 0.04 | 1.62 ± 0.06 |
| Weight (kg) | 60.5 ± 5.5 | 61.1 ± 6.57 |
| BMI | 23.3 ± 2.2 | 23.1 ± 2.82 |

Table 2 Comparison of average NPRS scores within and among both groups.

| NPRS | BASELINE | POST | T value | P value | Inference |
|------------------------|-------------------|------------------|---------|---------|----------------------------------|
| Group A (control) | 7.85 ± 0.9881 | 7.3 ± 0.9234 | 4.067 | 0.0007 | Considered extremely significant |
| Group B (experimental) | 7.45 ± 1.932 | 3.5 ± 1.147 | 16.823 | <0.0001 | Considered extremely significant |

Values are expressed as mean \pm standard deviation, NPRS – Numeric pain rating scale

Table 3 Comparison of average ODI scores within and among both groups.

| ODI | BASELINE | POST | T value | P value | Inference |
|------------------------|-------------------|-------------------|---------|---------|----------------------------------|
| Group A (control) | 30.25 ± 2.552 | 28.65 ± 2.207 | 5.007 | <0.0001 | Considered extremely significant |
| Group B (experimental) | 24 ± 5.448 | 13.6 ± 2.909 | 12.751 | <0.0001 | Considered extremely significant |

Values are expressed as mean \pm standard deviation, ODI – Oswestry disability index

Table 4 Comparison of NPRS post-intervention scores between Group A and Group B.

| NPRS | POST | T value | P value | Inference |
|------------------------|------------------|---------|---------|----------------------------------|
| Group A (control) | 7.3 ± 0.9234 | 11.541 | <0.0001 | Considered extremely significant |
| Group B (experimental) | 3.5 ± 1.147 | | | |

Values are expressed as mean \pm standard deviation, NPRS – Numeric pain rating scale

Table 5 Comparison of ODI post-intervention scores between Group A and Group B.

| ODI | POST | T value | P value | Inference |
|------------------------|-------------------|---------|---------|----------------------------------|
| Group A (control) | 28.65 ± 2.207 | 18.432 | <0.0001 | Considered extremely significant |
| Group B (experimental) | 13.6 ± 2.909 | | | |

Values are expressed as mean \pm standard deviation, ODI – Oswestry disability index

DISCUSSION

This experimental study discusses the rehabilitation of NSLBP with the application of core muscle strengthening and hip mobility in a curated exercise program to reduce low back instability and pain. The principal objective of this study was to determine if Group B, which received a combination of hip mobility exercises and core strengthening exercises, would exhibit more substantial improvements compared to Group A, which underwent conventional exercises. We observed a

reduction in pain intensity and low back instability in Group A. Conversely, Group B exhibited greater improvements in reducing both lower back instability and pain intensity compared to Group A. Female police officers commonly encounter a multitude of challenges within their profession. These challenges encompass a variety of factors, including biomechanical variations unique to the female anatomy, hormonal fluctuations inherent to the menstrual cycle, and other physiological processes. The combination of

these factors can play a major role in development of musculoskeletal issues, particularly presenting as low back pain. These difficulties highlight the necessity for customized strategies and supportive systems to cater to the unique requirements of female officers and reduce the likelihood of encountering such health issues while on duty. In a study done by Beomryong(1) it was found that combining hip muscle stretching with core stability exercises improves physical function and activity in patients with nonspecific lower back pain. (2) also illustrated that in older adults with low back pain, a combined exercise approach demonstrates higher effectiveness in improving physical function compared to lumbar stabilization exercises alone.(3) reported that core stability exercises benefit those with chronic non-specific low back pain by reducing pain, improving function and quality of life, activating core muscles, and increasing core muscle thickness.(4,5,6,7) concluded that the combination of core muscle strengthening, lumbar flexibility, and gluteus maximus exercises was found to be highly effective in rehabilitating chronic low back pain patients, regardless of pain duration (<1 year or >1 year). Similarly, Lee & Kim⁸ emphasized the importance of assessing and treating the hip joint in chronic LBP patients with lumbar instability. They found that hip exercises yielded greater effectiveness than traditional therapy was effective in reducing low-back pain and disability levels among these patients. Therefore, our study results emphasize the importance of designing a tailored exercise program focusing on hip mobility and core strengthening for individuals with NSLBP.

CONCLUSION

This study shows that core strengthening and hip mobility exercises significantly reduce pain and improve low back stability in female officers with non-specific lower back pain (NSLBP) more effectively than conventional exercises. A 6-week intervention led to marked improvements in pain and instability scores.

RECOMMENDATION

Effective interventions like these can benefit occupations involving prolonged standing,

such as teaching, laboring, nursing, and security, by reducing back pain incidents.

LIMITATION OF THE STUDY

The study was limited to police stations in Ahmednagar city. Larger, more diverse studies are needed. Other occupations like teaching and nursing also need targeted interventions.

RELEVANCE OF THE STUDY

Research on back pain in female officers is limited. Given their prolonged standing hours, including musculoskeletal assessments in their health checkups is crucial.

AUTHORS CONTRIBUTION

All authors have contributed equally.

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Nil

CONFLICT OF INTEREST

No conflict of interest.

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DECLARATION OF GENERATIVE AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

Instate software was used for statistical analysis.

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