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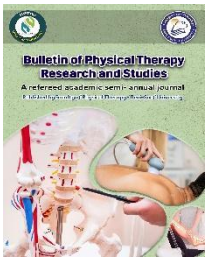

Age-Related Decline in Lumbar Flexibility Among Non-Specific Low Back Pain Patients

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Running Title: Lumbar Flexibility Decline with Age in Non-Specific Low Back Pain Patients.

Abstract

Non-specific low back pain (NSLBP) is a prevalent musculoskeletal condition with multifactorial etiology. Age-related reductions in lumbar flexibility may adversely affect functional outcomes in this population. The Modified Modified Schober (MMS) test is a valid and reliable clinical tool for assessing lumbar flexibility, yet, its relationship with age in NSLBP remains unexplored. **[Purpose]** To investigate the association between age and lumbar flexibility measured by MMS test in NSLBP patients and to assess differences by gender. **[Methods]** A cross-sectional correlational study included 42 NSLBP patients (21 males, 21 females). The mean age of the female group was 34.9 ± 12.5 years, while the male group had a mean age of 30.76 ± 10.24 years. Lumbar flexibility was assessed using MMS test. Pearson's correlation analyzed associations between age and MMS test scores, both overall and within each group ($p<0.05$). [**Results]** A significant strong negative correlation was found between age and MMS scores ($r= -0.654$, $p=0.001$). Subgroup analysis showed a significant stronger correlation in males ($r=-0.772$) than females ($r=-0.443$). Yet, it showed no significant difference ($p= 0.349$). [**Conclusion]** Advancing age correlates with reduced lumbar flexibility in NSLBP, with gender differences observed, highlighting the importance of age-specific assessment and intervention strategies in physical therapy.

Keywords: Non-Specific Low Back Pain, Modified Modified Schober, Lumbar Flexibility, Aging.

Introduction

Low back pain (LBP) remains one of the most prevalent musculoskeletal disorders globally, with non-specific low back pain (NSLBP) accounting for approximately 90% of all LBP cases. [1] Non-specific low back pain refers to lumbar pain without a specific underlying pathology, such as disc herniation or spinal stenosis, and is influenced by a complex interplay of biomechanical, psychological, and lifestyle factors in addition to physiological age- related spinal degeneration. [2]

Age is widely recognized as a determinant of musculoskeletal function, with evidence suggesting that spinal flexibility diminishes progressively with advancing age in asymptomatic subjects. [3] Evaluating lumbar flexibility is therefore a critical aspect of clinical assessment and therapeutic planning for NSLBP patients.As the global population ages, the prevalence of degenerative spinal conditions contributing to NSLBP continues to rise, making age-related flexibility assessment vital issue. Structural changes such as intervertebral disc height reduction, facet joint arthropathy, and ligamentous calcification are hallmark features of spinal aging, all of which can impair lumbar flexibility [4,5], which in turn may influence pain perception and functional outcomes.

While many studies have investigated age-related changes as spinal flexibility and its sex-specific differences among healthy individuals, [3,6] these changes have not been extensively examined in patients with NSLBP. Therefore, this study was carried out to investigate the relation between age and lumber flexibility measured by Modified Modified Schober (MMS) test in NSLBP patients and to determine whether this relationship is gender dependent or not. [7]

Methods

This study employed a cross-sectional correlational design to study the relationship between age and lumbar flexibility in patients with NSLBP. The study design and sampling were carried out after obtaining ethical approval from the institutional review board at Faculty of Physical Therapy, Cairo University before study commencement (No: P.T.REC/ 012/004982) and an informed consent form was signed by each patient before participating in the study.Patients of both sexes were included. Eligible patients were those suffering from NSLBP for more than three months, aged 20 to 50 years old and with a body mass index (BMI) between 18.5 and 30 kg/m². Additionally, patients needed to possess sufficient cognitive abilities to understand and follow study instructions, that was assessed through informal clinical observation during the initial history taking process.

A total of 42 patients diagnosed with NSLBP were allocated into two groups based on gender; Group A consisted of 21 males, and Group B consisted of 21 females. Patients were recruited from various professional backgrounds.

At first, full standardized history was taken from potentially eligible patients to be included in this research study, then patients were excluded if they have at least one of the following exclusion criteria; spinal trauma, fractures, osteoporosis, use of analgesic medications within the past two weeks, pregnancy, lactation, neurological or musculoskeletal diseases affecting the lower back (such as spondylolisthesis) or a history of spinal surgery, postural deformities, cauda equina symptoms, signs of serious pathology (such as malignancy or inflammatory disorders), and the presence of severe psychiatric disorders. After the provision of signed informed consent, patient characteristics were recorded, including gender, age, height, body weight and occupation, as all of these may potentially influence NSLBP. The MMS test which is a valid and reliable clinical test in both LBP patients [7] and healthy subjects [8] was used to assess lumbar spine flexibility. To start the test, patients were asked to stand upright with full spine exposed, feet apart and hands beside the body. A line connecting the two posterior superior iliac spines was drawn. Then two points were marked, one in the middle of the line and another one 15 cm above it. Then patients were asked to lean forward while maintaining knees fully extended as shown in figure 1. After full lumbar flexion, the distance between the two points was measured and subtracted from the 15 cm initial distance. [7, 8]

Figure (1): Modified Schober Test.

Statistical Analysis

Descriptive statistics were employed to show the demographic information and data collected from the patients. The Shapiro-Wilk test was conducted to determine whether the data follows a normal distribution. To assess the relationship between hamstring flexibility and dynamic trunk muscle endurance, the Pearson Correlation Coefficient was utilized. A significant level of $p \leq 0.05$ was established for all statistical tests. The analysis was carried out using version 27 of the Statistical Package for Social Sciences (SPSS) for Windows.

Results

The Modified Modified Schober Test (MMST) measurements were normally distributed, as indicated by the Shapiro-Wilk test ($p \geq 0.05$). Regarding participants' demographic data, results showed no significant differences between males and females in age ($p = 0.247$), weight ($p = 0.390$), height ($p = 0.069$), BMI ($p = 0.319$), occupation ($p = 0.103$) or limb dominance ($p = 0.454$). Moreover, a statistically significant strong negative correlation was found between age and MMS scores across the entire sample. Subgroup analysis revealed a stronger correlation in Group A (Males), as shown in figure 2 and table 1, compared to a moderate correlation in Group B (Females), as shown in figure 3 and table 1. Between group comparison showed no statistical difference, as shown in table 1.

Table 1: *Correlation coefficients and statistical significance values.*

	Correlation Coefficient (r)	Statistical Significance (p-value)	Between Group Comparisons
Group A (Male)	-0.772	0.001	(p= 0.349)
Group B (Female)	-0.443	0.045	
The Entire Sample	-0.654	0.001	

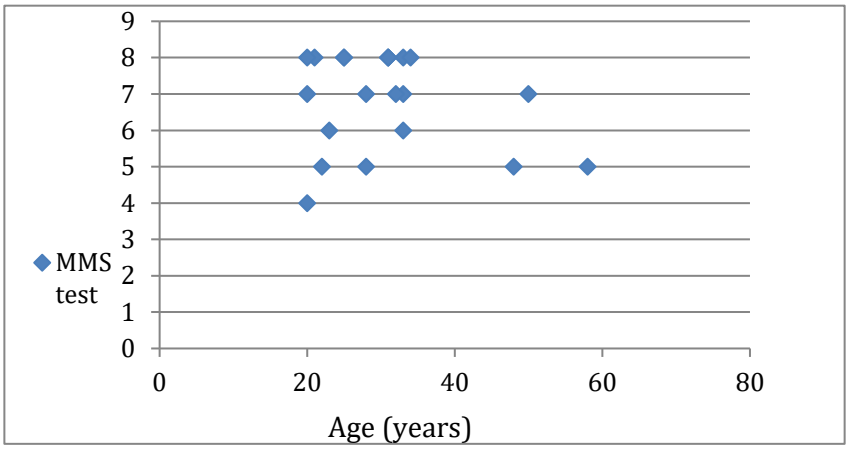

Figure (2): *Correlation Between Age and MMS Test in Group A.*

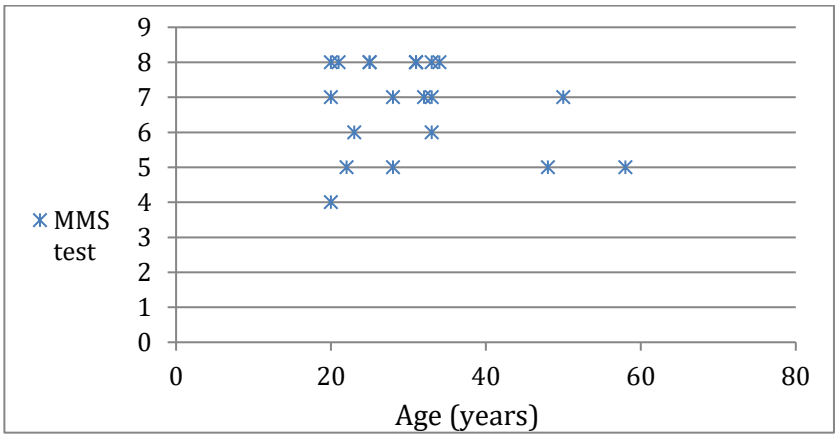

Figure (3): *Correlation Between Age and MMS Test in Group B.*

Discussion

The current study was conducted to investigate the relation between age and lumbar flexibility in NSLBP patients and assess gender differences. The findings revealed a significant inverse relationship between age and lumbar spine flexibility, as measured by the MMS test, indicating that lumbar flexion decreases with advancing age in this population. This is consistent with previous literature reporting age-related degenerative changes in normal elderly such as disc dehydration, loss of disc height, facet joint arthritis, and ligamentous stiffening as primary contributors to reduced spinal flexibility. [4,9] The strong negative correlation observed in this study across the entire sample ($r = -0.654$, $p = 0.001$) aligns with these aging changes and their clinical manifestations. Age-related decline in lumbar spine flexibility has been well documented in healthy individuals and is often attributed to gradual structural and biomechanical changes. Studies have consistently shown that spinal flexibility, particularly in flexion, diminishes progressively with age, even in asymptomatic populations. [6,10,11] In the present study, similar trend was observed in patients with NSLBP suggesting that age-related structural degeneration may have a compounded effect in symptomatic individuals, where pre-existing flexibility limitations are further exacerbated by pain, muscle guarding, and functional avoidance. Therefore, the interplay between physiological aging and pathological processes in NSLBP may accelerate the decline in lumbar flexibility beyond that seen in healthy elderly. The findings of our study align with literature indicating that lumbar flexibility decreases with age in individuals experiencing LBP, even when various assessment methods are employed as fingertip-to-floor distance, inclinometer, and radiographic techniques. For example, a systematic review by Arshad et al. (2019), based on data from multiple studies utilizing different measurement techniques, demonstrated that lumbar range of motion diminishes significantly with aging. [3] These studies, while employing different metrics than the MMS test, support the broader conclusion that advancing age is associated with decreased lumbar motion and

functional limitation in symptomatic individuals. The present findings extend this evidence by confirming that such decline is also detectable using the MMS test. This consistency across assessment methods reinforces the relationship between aging and impaired lumbar flexibility in the NSLBP population and reinforce the validity of our results obtained via the MMS test. Subgroup analysis revealed a stronger correlation in males ($r = -0.772$) compared to females ($r = -0.443$), Yet, between group analysis showed no significant difference ($p = 0.349$). Gender-based differences regarding lumbar spine flexibility in healthy subjects is controversial in literature. While some studies have reported that females generally exhibit greater lumbar flexibility [6] that may be attributed to gender-based anatomical differences as increased pelvic tilt [12] and sacral slope angle in females [12] or lower muscle stiffness. [13] Additionally, it may be explained through hormonal effect, for example, the influence of estrogen on connective tissue and laxity of ligaments. [14] Other researchers have failed to find statistically significant differences between sexes. [11,15,16] For example, Abid et al. (2022) found no significant difference between the two genders in LBP patients using inclinometer as an assessment tool. [15] On contrary, other studies found that male showed statistically significant higher lumbar flexibility using MMS than female patients in healthy subjects and attributed this inconsistency with literature to regional and racial variations. [11] This controversy may stem from differences in study populations, measurement techniques, or physical activity levels. In the current study, although both male and female groups showed a negative correlation between age and lumbar flexibility, the strength of this correlation differed, with males exhibiting a stronger association. This highlights the need for further research to clarify the role of gender in spinal flexibility, particularly in symptomatic populations like those with NSLBP. Eventually clinicians should integrate age- and sex-specific considerations into their assessment protocols. Tailoring interventions to address patients' dysfunction to mitigate functional decline and reduce the risk of chronicity. Although the findings provide valuable insights, certain limitations must be acknowledged. The cross-sectional design limits causal reasoning, and the relatively small sample size may restrict generalizability. Additionally, excluding patients with comorbidities or structural spinal disorders narrows the applicability to the broader population. Other factors such as pain severity, activity level, and psychological influences were not assessed but may contribute to lumbar flexibility in NSLBP populations. Future studies should consider longitudinal design, larger sample size, addressing other confounding variables and examining how interventions targeting spinal flexibility affect lumbar flexibility in both males and females.

Conclusion

The present study demonstrated a significant inverse relationship between age and lumbar spine flexibility in patients with NSLBP, with evidence suggesting that this association may vary by gender. While gender-based differences were observed, their clinical significance remains inconclusive due to mixed findings in the literature. Clinicians should consider both age and gender when evaluating spinal flexibility and designing individualized treatment plans for NSLBP patients.

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