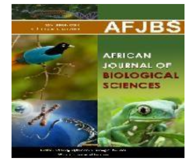
https://doi.org/10.33472/AFJBS.6.2.2024.564-572

African Journal of Biological Sciences



Research Paper Open Access

Unilateral Versus Bilateral Hamstring Muscle Tightness on Lumbar Lordotic Angle in Patients with Lumbar Disc Prolapse

Reda K. Abdelrazik[1]; Hanady Abdallah Mouhamed[2]; Kamaleldin Ahmed Kamal Ali Marie[3]; Mohammed Elsayed[4]; Ali Essawy Ali Mostafa[5]; Adel M. E. Zedan[1]

[1] Department of Physical Therapy for musculoskeletal disorders and its surgery, Faculty of Physical Therapy, Benha University, Benha, Egypt.

[2] Department of Physical Therapy for Pediatrics, Faculty of Physical Therapy, Benha University, Benha, Egypt.

[3] Department of Physical Therapy for Surgery, Faculty of Physical Therapy, Ahram Canadian University, Egypt.

[4] Fellow of Physical Therapy at Helwan University Hospital, a partial delegate as Lecturer of Physical Therapy, Basic Sciences Department, Faculty of Thysical therapy, Helwan National University, Egypt.

[5] Department of Physical therapy for neuromuscular disorders and its surgery, faculty of physical therapy, Al Salam University, Tanta, Egypt

Correspondence to

Reda k. Abdelrazik: Physical therapy department for Musculoskeletal disorders and its surgery, faculty of physical therapy, Benha university, Benha, Egypt.

reda.gad@fpt.bu.edu.eg, adel.zidan@fpt.bu.edu.eg,

Article History

Volume 6, Issue 2, April 2024

Received:19 April 2024

Accepted: 10 May 2024

Published: 16 May 2024

doi: 10.33472/AFJBS.6.2.2024.564-572

Abstract: Background: Hamstring muscle tightness is blamed for lumbar disc prolapse. There is a lack of consistency about effect of hamstring muscle tightness on lumbar angle. This may be attributed to variations in laterality of the hamstring tightness; being unilateral or bilateral.

Purpose: to examine the effect of laterality of hamstring muscle tightness on lumbar angle in adults with lumbar disc prolapse (LDP).

Methods: This cross-sectional study included forty-five patients of both genders complained from lumbar disc prolapse (LDP). They were divided into three groups; group A included 15 patients with bilateral hamstring tightness (active knee extension angle >-20 in both legs), group B included 15 patients with unilateral hamstring tightness (active knee extension angle >-20 in one leg), and group C included 15 patients with normal hamstring tightness (active knee extension angle ≤-20 in both legs). Lumbar curve angle was measured by Cobb, s angle (on lateral radiographs) and hamstring muscle tightness was measured with a standard goniometer using active knee extension test.

Results: Lumbar lordotic angle not significantly differs between the three groups of hamstring muscle tightness (unilateral, bilateral, and normal) (P-value = 0.87).

Conclusion: Hamstring muscle tightness does not seem to affect lumbar lordotic angle even after controlling for laterality in patients with LDP. Stretching of hamstring muscle may be not important for these patients, but this needs further randomized clinical trial to prove

Keywords: Hamstrings muscle tightness; cob's angle; Low back pain; Lumbar disc prolapse; radiographs; active-knee-extension

Introduction: Low back pain (LBP) is highly prevalent. It affects up to 89% of the population causing significant disability (1-4). The most common specific cause of LBP is disc prolapse (40-60%) in which nucleus part protrudes and extrudes through the annulus part of the disc (3-5).

Hamstring tightness, in which active knee extension ≤160 degrees (6), is common in LBP patients (7). This may be explained by effect of hamstring tightness in causing altering pelvic orientation, lumbar curvature, and lumbopelvic rhythm (7) increasing loads in discs and other structures, as hamstrings attach to the ischial tuberosity (8-14).

Lumbar curvature or lordosis can be measured through lumbar lordotic angle (LLA). This angle ranges normally between 20 and 45 degrees and increases with hyperlordosis (5).

Conservative treatment of this condition, besides rest and medication, includes physical therapy that commonly include hamstring stretching and other treatments to improve its flexibility (3, 15,16).

It was found an inconsistency in the literature about the relation between hamstring tightness and spinal posture (9, 17-20). This could result from variations in the age range of participants, the clinical condition under investigation, the degree of hamstring tightness, and the laterality of the tightness (unilateral or bilateral).

The current work aimed to investigate the effect of laterality of the hamstring tightness on lumbar lordotic angle (LLA) in adults with lumbar disc prolapse (LDP).

2. METHODS

2.1. Study Design:

The current study design was cross-sectional. It was approved by the research ethical committee of Faculty of Physical Therapy, MTI University (REC/2111/MTI.PT/2310291). The Declaration of Helsinki's Principles for the Conduct of Human Research was observed during the study.

2.2. Patients:

This study included 45 male and female patients with LDP. They were selected from Cairo University Hospital and participated after signing the consent form.

2.2.1. Inclusion Criteria:

Patients were allowed to participate if their age ranged from 25-55 years and had LDP confirmed by physician with magnetic reasonance imaging (MRI).

2.2.2. Exclusion Criteria:

Patients were not allowed to participate if they had structural, inflammatory, infectious, metabolic, congenital, or traumatic spinal disorders and spinal or lower limb surgery.

Patients who met the eligibility criteria were divided into three groups; group A included 15 patients with bilateral hamstring tightness, group B included 15 patients with unilateral hamstring tightness, and group C included 15 patients with normal hamstring tightness. Hamstring muscle was considered tight if the lost knee extension angle on active knee extension test was more than twenty degrees.

2.3. Assessment:

2.3.1. Measuring hamstring tightness:

Hamstring tightness was assessed using the active-knee-extension (AKE) test, in which patients were in supine position, the hip of the tested leg fixed in 90 degrees flexion (with help of vertical board), and the other leg was flat on the bed. Patients were asked to extend the knee while maintaining the thigh against the vertical board. The axis of the standard goniometer was placed over the joint axis, and the goniometer arms were positioned with the fixed arm along the femur and the movable arm along the fibula. The lost range of knee extension was recorded. Three measurements were taken and averaged. Both knees were evaluated (21).

Average values of both sides in the bilateral group were reported and used for analysis. While in the normal group, the value of the side that is matched with the affected side in the unilateral group was used for analysis to control for any effect of limb dominance.

2.3.2. Measuring lumbar lordotic angle (LLA):

Sagittal radiographs of the lumbosacral spine were taken while the patients were standing. Two lines (from L1's superior surface and L5's inferior surface) were drawn on these radiographs with help of Kinovea software (v.3.1) to measure the cobb، s angle at the meeting point of the two lines (or the equivalent angle).

The accuracy of radiographic methods of lumbar curve evaluation is high, with reliability values of 0.98 **(13)**.

3. STATISTICAL ANALYSIS

Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) version 24, with alpha=0.05. Differences between groups in all variables (except gender distribution was tested with Chi-square test) were tested using one way ANOVA.

In order to detect an effect size of f = 0.49 (Based on the work of Gajdosik et al. (22) with 80% power (alpha = .05), G*Power suggests we would need 45 participants (15 per groups) in an one-way ANOVA .

4. RESULTS

First, sixty patients were assessed for eligibility and only 45 patients were participated, as shown in the flow chart (Figure 1).

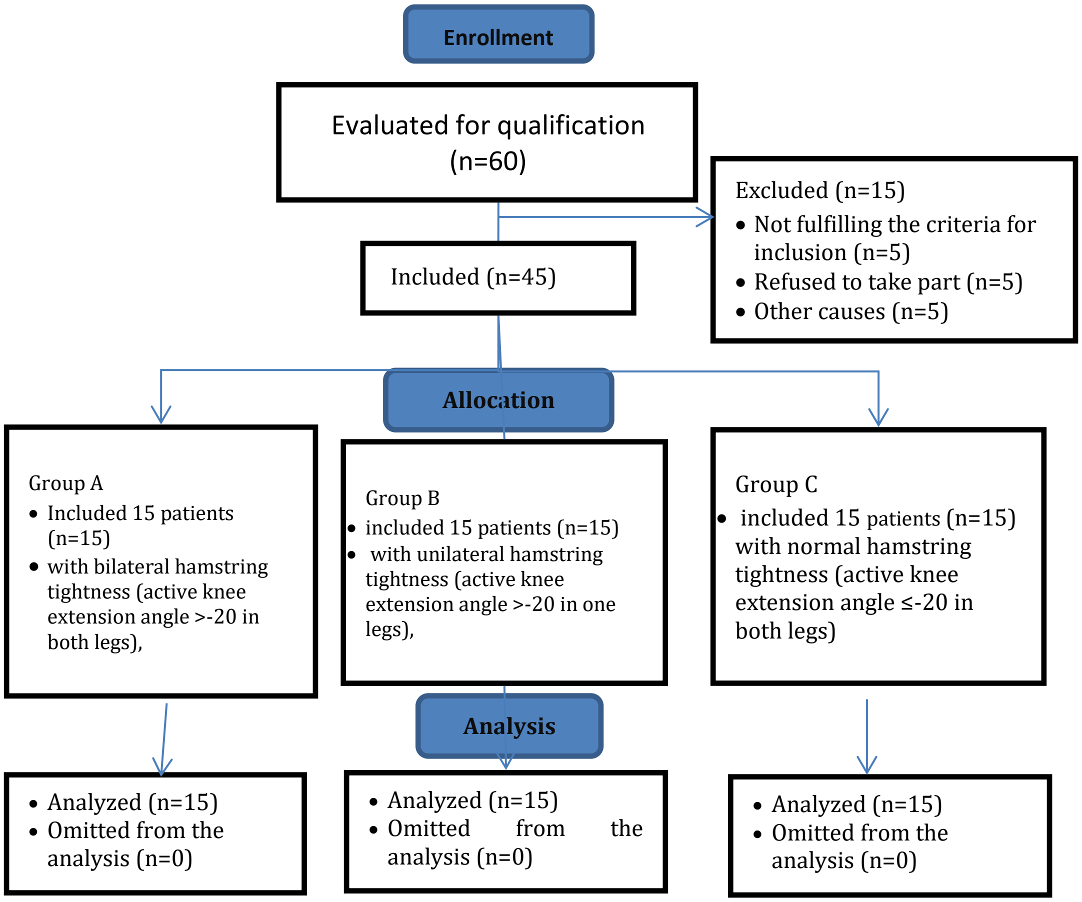


Fig. (1). Flow Chart

Baseline characteristics of all patients were presented in table (1) and figure (2). There were non-significant differences between groups in the baseline characteristics (P-value > 0.05). While, there was significant difference between groups in the hamstring tightness (P-value < 0.05). Bilateral and unilateral tightness were significantly higher compared to normal group and bilateral tightness was significantly higher compared to unilateral tightness. (Table 1).

Table (1) Baseline characteristics of the patients.

Baseline characteristics		Group A Mean (±SD)	Group B Mean (±SD)	Group C Mean (±SD)	P-value
Age (years)		37.2(±11.5)	41.4(±11)	43.5(±9.6)	0.27
BMI (kg/m²)		25.7(±2.2)	27 (±2)	26 (±1.9)	0.10
Gender (count)	**Male**	7	6	7	0.91

Female	8	9	8	
HT (degrees)	41 (±10)[a]	28 (±5)	15 (±5)[b]	0.00*

(SD): standard deviation; HT: hamstring tightness; ([a]): taken the average of both sides; ([b]): taken the value of the side matched to the unilateral group; (*): significant differences between bilateral and unilateral tightness compared to normal and between bilateral compared to unilateral tightness in favor of bilateral.

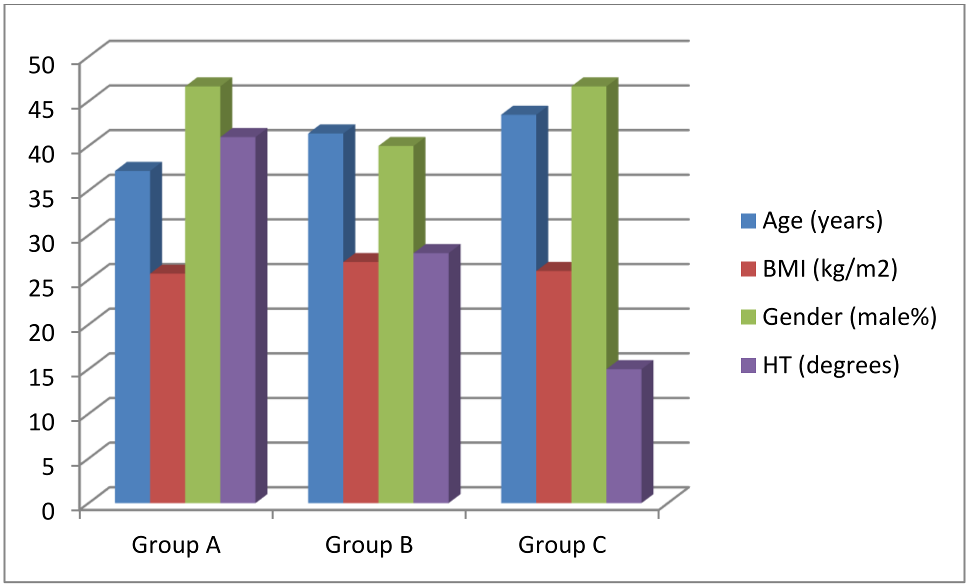


Fig. (2): Sex distribution (male %) and mean values of age, body mass index (BMI), and hamstring tightness (HT) among the three groups.

Means (standard deviations) of lumbar lordotic angle for the three groups were presented in table (2) and figure (3). There was no significant difference between groups in LLA mean values (P-value =0.59) (Table 2).

Table (2): Descriptive and analytical statistics for lumbar lordotic angle for the three groups:

Outcome	Group A Mean (±SD)	Group B Mean (±SD)	Group C Mean (±SD)	P-value
LLA	38.6(±8)	40.2(±6.9)	37.3(±7.96)	0.59

SD: standard deviation; LLA: lumbar lordotic angle.

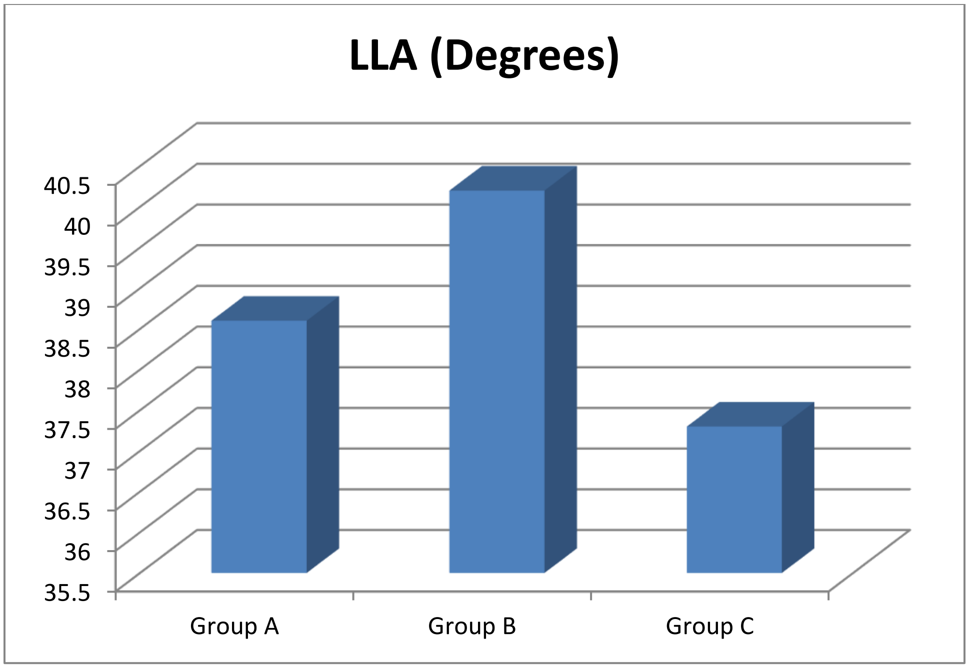


Fig. (3): Mean values of lumbar lordotic angle (LLA) among the three groups.

5.DISCUSSION

The present study was conducted to investigate the effect of laterality of hamstring tightness (measured by active knee extension test) on lumbar lordotic angle (measured as Cobb، s angle from lateral radiographs) in patients with prolapsed lumbar disc.

The current study found non-significant difference in LLA between unilateral and bilateral hamstring tightness. In other words, laterality could not explain the inconsistency in literature about relation of hamstring tightness and LLA. However, small sample size might affect the result of this study.

The current study also did not find a significant difference in LLA between patients with and without hamstring tightness.

The finding of the present study can be explained as unilateral shortening of the hamstring may induce unilateral posterior ilium and shortening of the lower limb ipsilateraly that is compensated by frontal plane motion of the spine more than sagittal plane motion, so authors of the current study recommend more studies which measure effect of hamstring tightness on sagittal plane motions of the spine.

The current study agrees with Arab and Nourbakhsh (7) who reported that lumbar lordosis was similar between LBP patients with and without hamstring tightness. In addition to that, Sarhan et al. (20) found that hamstring tightness not relates to lumbar lordotic angle.

In agreement with our findings, Johnson and Thomas (18) found that hamstring did not affect lumbar range during tasks in patients with LBP. As well, Allam et al. (23) found There was no relation between the degree of hamstring tightness and LBP in female students at Jouf University.

Kachanathu et al. (24) reported that hamstring tightness (less than 130 degrees) is not important as it did not affect lumbar lordosis. So, they suggested not stretching hamstring in these patients. Allam et al. (25) documented that there was a non-significant correlation between lumbar lordosis and hamstring tightness measures supporting the finding of the preent study.

In contrary to finding of the present study, hamstring tightness was previously reported to be related to altered lumbar angle (13), altered trunk muscle activity (9), and presence of lumbar pathology or back injury (17,26). This contradiction can be explaind by differences between the present study and the previous studies in the method and the position of the patients during the measurements and the studied population.

González-Gálvez et al. (19) did not agree with the finding of the present study as they found that improved hamstring tightness is associated with improved lumbar curvature.

Wilke et al. (27) found in their systematic review a direct link between muscles including hamstrings and erector spinae. The current study does not support this link between hamstring and the spine.

Results of our study partially agree with the work of Toppenberg and Bullock (28) who found that hamstring tightness did not relate to pelvic tilt, rather than it was related to lumbar hyperlordosis. The differences may be due to differences between the studies in the participants and the method of assessment.

5. CONCLUSION

Hamstring tightness either unilateral or bilateral does not affect LLA in patients with prolapsed lumbar disc. However, hamstring tightness may affect frontal plane angle, so further studies are required to investigate this.

References:

1. Aldera, M. A., Alexander, C. M., & McGregor, A. H. (2020). Prevalence and incidence of low back pain in the Kingdom of Saudi Arabia: a systematic review. *Journal of Epidemiology and Global Health*, *10*(4), 269..

2. Wu, A., March, L., Zheng, X., Huang, J., Wang, X., Zhao, J., ... & Hoy, D. (2020). Global low back pain prevalence and years lived with disability from 1990 to 2017: estimates from the Global Burden of Disease Study 2017. *Annals of translational medicine*, *8*(6).

3. Kaur S. Lumbar prolapsed intervertebral disc & its management. International Journal of Healthcare Sciences 2020; 8 (1): 30-37.

4. Chauhan A, Sharma Y, Upadhyay P. Prevalence of prolapsed intervertebral disc (PIVD) in cab drivers: a cross sectional study. Int J Res Analyt Rev 2022: 9(3):930-978.

5. Lin RM, Jou IM, Yu CY. Lumbar lordosis: normal adults. Journal of Formosan Medical Association (1992); 91(3):329-333.

6. Labovitz JM, Yu J, Kim C. The role of hamstring tightness in plantar fasciitis. Foot and Ankle Specialist (2011); 4(3): 141-144.

7. Cejudo, A., Centenera-Centenera, J. M., & Santonja-Medina, F. (2021). The Potential Role of Hamstring Extensibility on Sagittal Pelvic Tilt, Sagittal Spinal Curves and Recurrent Low Back Pain in

Team Sports Players: A Gender Perspective Analysis. *International journal of environmental research and public health*, *18*(16), 8654..
8. Sadler S. G., Spink M. J., Ho A., De Jonge X. J., Chuter V. H. Restriction in lateral bending range of motion, lumbar lordosis, and hamstring flexibility predicts the development of low back pain: a systematic review of prospective cohort studies. *BMC Musculoskeletal Disorders .* 2017;18(1):p. 179. doi: 10.1186/s12891-017-1534-0.
9. Nikzad S, Pirouzi S, Taghizadeh S, Hemmati L. Relationship Between Hamstring Flexibility and Extensor Muscle Activity During a Trunk Flexion Task. Journal of Chiropractic Medicine 2020; 19 (1): 21-27.
10. Ara´ujo F, Lucas R, Alegrete N, Azevedo A, and Barros H 2014 Sagittal standing posture, back pain, and quality of life among adults from the general population: a sex-specific association. Spine 39 (13): E782–E794.
11. Sorensen CJ, Norton BJ, Callaghan JP, Hwang CT, and Van Dillen LR 2015 Is lumbar lordosis related to low back pain development during prolonged standing?. Manual Therapy 20 (4): 553–557.
12. Nourollahi, Maryam, Afshari, Davood, and Dianat, Iman. 'Awkward Trunk Postures and Their Relationship with Low Back Pain in Hospital Nurses'. 1 Jan. 2018 : 317 – 323
13. Vrtovec T, F. Pernuˇs, and B. Likar. (2009) A review of methods for quantitative evaluation of spinal curvature. European Spine Journal 18 (5): 593–607.
14. Kendall FP. McCreary EK 1983 Muscle function in relation to posture. In: Muscle testing and Function. 3rd ed. Baltimore, Md: Williams & Wilkin: 3269-320.
15. Shamsi, M., Mirzaei, M., Shahsavari, S. *et al.* Modeling the effect of static stretching and strengthening exercise in lengthened position on balance in low back pain subject with shortened hamstring: a randomized controlled clinical trial. *BMC Musculoskelet Disord* **21**, 809 (2020).
16. Bazzaz-Yamchi M, Naghdi S, Nakhostin-Ansari A, Hadizadeh M, Ansari NN, Moghimi E, Hasson S. Acute and Short-Term Effects of Dry Needling in Patients with Chronic Nonspecific Low Back Pain and Hamstring Tightness: A Pilot Study. ScientificWorldJournal. 2021 Nov 20;2021:7259956. doi: 10.1155/2021/7259956. PMID: 34845408; PMCID: PMC8627360.
17. Orchard JW, Farhart P, Leopold C. Lumbar spine region pathology and hamstring and calf injuries in athletes: is there a connection? *British Journal of Sports Medicine* 2004;**38:**502-504.
18. Johnson EN, Thomas JS. Effect of Hamstring Flexibility on Hip and Lumbar Spine Joint Excursions During Forward-Reaching Tasks in Participants With and Without Low Back Pain. Archives of Physical Medicine and Rehabilitation 2010; 91 (7): 1140-1142.
19. González-Gálvez, N., Marcos-Pardo, P.J., Trejo-Alfaro, H. *et al.* Effect of 9-month Pilates program on sagittal spinal curvatures and hamstring extensibility in adolescents: randomised controlled trial. *Sci Rep* **10**, 9977 (2020). https://doi.org/10.1038/s41598-020-66641-2.
20. Sarhan MAM, Adel MEZ, ELshazly M. Relationship between lumbar lordotic angle and hamstring muscles tightness. Egy. J. Phys. Ther. 2022; 9:35-39
21. Gajdosik R and Lusin G 1983 Hamstring muscle tightness: reliability of an active-knee-extension-test. Physical Therapy 63:1085-1090.
22. Gajdosik RI, Albert CR, Mitrnan JJ. (1994). Influence of Hamstring Length on the Standing Position and Flexion Range of Motion of the Pelvic Angle, Lumbar Angle, and Thoracic Angle. JOSPT; 20 (4): 213-219.
23. Allam, N. M., Eladl, H. M., Elruwaili, L. T., Elruwaili, L. F., Elbenya, T. J., Elanzi, E. M., ... & Abdelbasset, W. K. (2022). Correlation between hamstring muscle tightness and incidence of low back pain in female students at Jouf University, Saudi Arabia. *European Review for Medical & Pharmacological Sciences*, *26*(21).
24. Kachanathu, S. J., AlAbdulwahab, S. S., Hafez, A. R., Aldaihan, M. M., Nuhmani, S., & Rizvi, M. R. (2022). A randomised controlled trial between hamstring muscle tightness and lumbar lordotic angle. *Comparative Exercise Physiology*, *18*(3), 179-183.

25. Allam, N. M., Ebrahim, H. A., Ibrahim, A. M., Elneblawi, N. H., El-Sherbiny, M., & Fouda, K. Z. (2023). The association of hamstring tightness with lumbar lordosis and trunk flexibility in healthy individuals: gender analysis. *Frontiers in Bioengineering and Biotechnology*, *11*..
26. Kouledakis Y, Fristhknecht R, and Murthy M 1997 Knee flexion to extension peak torque ratios and low back injuries in highly active individuals. International Journal of Sports Medicine 18(4): 290-295.
27. Wilke J, Krause F, MA, Vogt L, Banzer W. What Is Evidence-Based About Myofascial Chains: A Systematic Review. Archives of Physical Medicine and Rehabilitation 2016;97:454-61.
28. Toppenberg K and Bullock M. (1986). The interrelation of spinal curves, pelvic tilt and muscle length in the adolescent female. Australian Journal of Physiotherapy 32:6-12.