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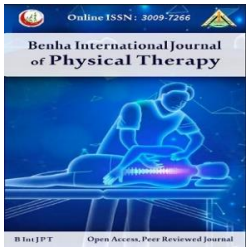

Original research

Effect of pumped Technique for Ilio-Lumber Ligament Release on Postnatal Low Back Pain

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Abstract

Background: Postpartum low back pain is a common complaint after pregnancy, occurring as a result of hormonal changes and affecting approximately 25% of women. **Purpose:** This study was done to detect the impact of the pumped technique for ilio-lumbar ligament (ILL) release on postpartum LBP. **Methods**: Fifty women complaining of postnatal low back pain (LBP) participated. They were selected randomly from the outpatient clinic of Pharos University in Alexandria. They were aged from 25 to 35 years. All women were within 3 months postnatal. Their BMI was less than 30 kg/m². They were randomized into two equivalent groups; the control group was treated by hot packs for 20 minutes, 3 sessions a week for 8 weeks, and the study group was treated by hot packs for 20 minutes in addition to the pumped technique for ILL release for 30 minutes, 3 sessions a week for 8 weeks. All women were assessed by VAS to assess the intensity of LBP; a goniometer was used to measure lumbar flexion ROM. An inclinometer was used to assess lumbar curvature at baseline and post-treatment. **Results:** The results showed that both groups' VAS and lordotic curve decreased significantly and lumbar flexion ROM increased significantly post-treatment. There was no statistically significant difference between the two groups pre-treatment. Significant differences in VAS, lordotic curve, andlumbar flexion ROM were seen between groups post-treatment, favoring the study group. **Conclusion:** It can be concluded that the pumped technique for ILL release is effective in reducing post-natal LBP through decreasing pain intensity and lumbar lordotic curve and increasing lumbar flexion ROM.

Keyword: Ilio-lumbar ligament release ,Low back pain, Postnatal,Pumped technique.

Introduction

Low back pain (LBP) is a prevalent global complain, with two-third of both adult genders complain of low back pain [1]. From 70-85% of people complain with low back pain in their life 2**.** The most age suffering from low back pain is 35-55 years[3]. LBP is described as pain located on region between last rib and buttocks [4]. Based on Makenzie approach low back pain is classified into mechanical pain or non-specific pain and chemical pain [5]. Mechanical pain is represent as 95% of low back pain [4]. Mechanical pain is referred to pain that doesn't arise from specific pathology [6]**.** There is many factors that contributed to increase low back

pain such as desk jobs, fault posture and weakness of muscles [7].

Postpartum low back pain is common complaint of pregnancy that occur after labor, in result to changes in hormones that effect on muscles and joints lead to changes in female's posture [8,9]. A round 45-50% of pregnant women suffering from low back pain and 25% have postnatal LBP [10,11]. During the pregnancy, women posture is changes in result of hormonal changes that is alert the normal biomechanical may lead to low back pain[12]. Increasing level of relaxin hormone during pregnancy lead to increasing in ligaments laxity so it causes changes in normal musculoskeletal structure [11,13,14].

During pregnancy spinal curvatures are changed where increasing in lordotic curve in lumbar spine while thoracic spine increase kyphosis curves [15]. These changes can impact on quality of life and active daily living (ADLs) [16]. Because of increasing of lordotic curve in lumbar and anterior pelvic tilt in Sacroiliac joint, it increase mechanical tension on ligaments of pelvic lead to LBP [17]. During pregnancy, the increased anterior pelvic tilt leads to greater activity of the erector spinae muscles, which restricts lumbar flexion and contributes to low back pain[18,19].

Ilio-lumbar ligament (ILL) attachment to transverse process of fourth and fifth lumbar spine proximally and attachment to iliac crest distally [20]. Ilio-lumbar ligament (ILL) provides stability of lumbosacral region where is be tightness during anterior rotation of lumbar and act as control posterior rotation of pelvic [21]. Ilio-lumbar ligament dysfunction is a common cause of low back pain. Releasing the ilio-lumbar ligament reduces anterior pelvic tilt, decreases the over-activation of the erector spinae muscles, and improves low back pain and lumbar flexion [22].

Treatment options for postpartum low back pain including lumbosacral belt, drugs, non-pharmacological treatment such as yoga [23]. and physiotherapy modalities used in postpartum low back pain including osteopathic methods, exercises, dry cupping, acupuncture, mobilization of lumber spine, massage, myofascial release, and electrotherapy such as shock wave, Transcutaneous Electrical Nerve Stimulation, Ultrasound and Low level laser [24-28]. One of new technique in treating LBP is Pumped technique for the ilio-lumbar ligaments to relive low back pain[29].

Patients and Methods

Subjects

Fifty women complaining of postnatal low back pain took-part in this study. They were chosen from the outpatient clinic of Faculty of Physical Therapy, Pharos University at Alexandria according to the subsequent criteria: They were aged from 25-35 years. All women were within 3 months postnatal. Their body mass index was below 30 kg/m^2. All women were primipara or multipara. All women were normal vaginal labor delivery or caesarian section. Women with lumbar disc prolapse, lumbar spondylolysis and spondylosis, history of back trauma or fracture, lumbar canal stenosis, rheumatoid arthritis, any deformity for low limb and scoliosis are excluded from the study.

Ethical committee:

The Faculty of Physical Therapy at Cairo University's ethical review board gave approval to this research (No: P.T.REC/012/0055571).

Design of study:

The research is design as randomized controlled study pre and post experimental design. They were divided randomly into two equal groups A and B:

Group A (Control group):

It involved 25 postnatal women and were treated by hot packs for 20 minutes three sessions a week for 8 weeks [30].

Group B (Study group):

It involved 25 postnatal women and were treated by hot packs for 20 minutes in addition to pumped technique for ilio-lumbar ligament release for 30 min. three sessions a week for 8 weeks.

Outcome measures:

1- Standard weight height scale:

It measured each patient's height and weight in order to determine their BMI.

2- Visual analog scale (VAS):

It was utilized to evaluate the intensity of LBP reported by each woman in both the A and B groups prior to and after treatment [31]. (It numerical scale which divided into 10 points from 1 to 10 where 1 is no pain while 10 is great pain).

3- Goniometer:

Prior to and after treatment, it was used to measure the lumbar flexion ROM for each participant in both the A and B groups.

The patient was asked to stand on his feet in comfortable position with arm flexed 90 degrees when decided to measure flexion while in extension the patient's arm is bending behind his head, the fulcrum of goniometer fixed on iliac crest, the moveable arm is in mid line of axillary and fixed arm is parallel to mid-thigh then asked patient to flex or extend his trunk.

4- Inclinometer:

It was used to assess lumbar curvature for each woman in both groups A and B before and after treatment,

The inclinometer was affixed to the skin across the individual's sacrum utilizing self-adhesive straps surrounding the pelvis to maintain its position. The unit is placed to center the level vial, and the measurement is taken in degrees. An L-shaped slide arm is positioned within the distal section of the unit to measure the distance from T12 to S1 spinous processes [32-35].

Treatment procedures:

Pumped technique:

Pumped technique for ilio-lumbar ligament (the patient in supine position while therapist stand at level of patient's thighs, the therapist applied pressure by drawing the patient's pelvis downward for 90 seconds, ten times on each side, using one hand on the medial part of the thigh while the other placed on the posterior portion of the iliac crest, which is near to the stabilization of the ilio-lumbar ligaments [29]. Both groups received 3 sessions per week with 24 hours interval between two alternating sessions for 8 weeks [36].

Statistical analysis:

The results are shown as the mean ± the standard deviation. The Kolmogorov-Smirnova test was used to check the normality of the data collected before treatment. Since the data followed a normal distribution, an independent t-test was used to compare the two groups' parameters. The two groups' pre-treatment values were compared using the analysis of covariance (ANCOVA) test, and the post-treatment values were compared simultaneously in order to control for the impact of the pre-treatment values. A dependent t test was used to compare the same group's data prior to and post treatment. For this study, we used the Windows version of the Statistical Package for the Social Sciences (SPSS) software to analyze the data. A significant result was defined as a P value < 0.05.

Results

1-General characteristics of the two studied groups:

When comparing the age and BMI of groups A and B prior to treatment, no statistically significant difference was found (Table 1).

Table (1):Comparison between mean age and BMI values of the two studied groups.

	Group A	Group B	t value	p value
Age (yrs.)	29.08 ± 2.50	29.16 ± 2.70	-0.109	0.914 (NS)
BMI (kg/m^2)	23.93 ± 2.36	24.10 ± 2.87	-0.220	0.827 (NS)

Data are expressed as mean ± SD. NS= p> 0.05= not significant.

II-Visual Analogue Scale:

Within groups: Statistical analysis revealed that both Group A and Group B's mean VAS values decreased significantly after treatment compared to their pre-treatment values (Table 2; Fig1).

Between groups: At pre-treatment; there was no statistical significant difference between the two groups (Table 2; Fig1).

Post-treatment; there was significant difference between both group A and B in VAS, with favor of group B (more decrease) (Table 2; Fig.1).

Table (2): Inter- and intra-groups comparison between values of VAS in the two studied groups measured at pre- and post-treatment.

	Group A	Group B	F value	P value
Pre-treatment	8.01 ± 0.75	8.09 ± 0.76	0.140	0.710 (NS)
Post-treatment	6.06 ± 0.66	1.89 ± 0.69	996.705	0.001 (S)
Mean difference	1.95	6.20		
% change	24.34 ↓↓	76.64 ↓↓		
t# value	27.594	45.717		
p value	0.001 (S)	0.001 (S)		

Data are expressed as mean ± SD. F value= ANCOVA test. t value= unpaired t test; t# value= paired t test. NS= p> 0.05= not significant; S= p≤ 0.05= significant.

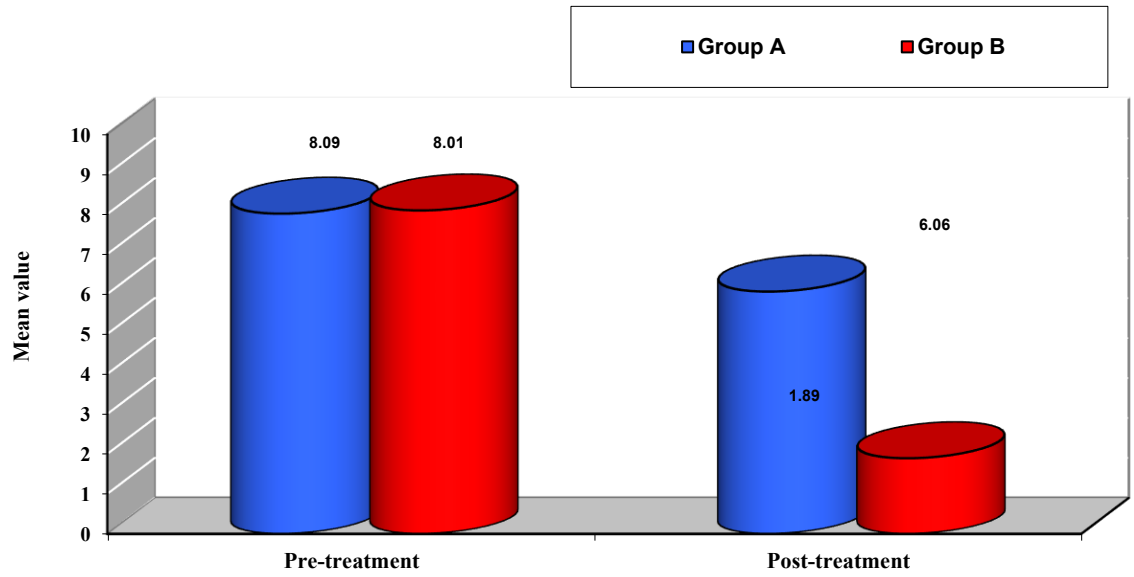

Fig.1: Mean values of VAS in the two studied groups measured pre- and post-treatment.

III-Lumbar Flexion ROM:

In both groups A and B, a statistically significant improvement in the mean value of lumbar flexion ROM was found after treatment compared with pre-treatment (Table 3; Fig 2).

Between groups: At pre-treatment, no statistically significant difference was observed among the two groups (Table 3; Fig 2).

Post-treatment, a significant difference was observed between groups A and B in lumbar flexion ROM, with group B demonstrating greater improvements (Table 3; Fig.2).

Table (3): Inter- and intra-groups comparison between values of lumbar flexion ROM in the two studied groups measured at pre- and post-treatment.

	Group A	Group B	F value	P value
Pre-treatment	69.16 ± 6.84	69.32 ± 7.09	0.007	0.936 (NS)
Post-treatment	76.00 ± 7.21	93.20 ± 6.40	426.878	0.001 (S)
Mean difference	-6.84	-23.88		
% change	9.89 ↑↑	34.45 ↑↑		
t# value	-15.599	-32.976		
p value	0.001 (S)	0.001 (S)		

Data are expressed as mean ± SD. F value= ANCOVA test. t value= unpaired t test; t# value= paired t test. NS= p> 0.05= not significant; S= p≤ 0.05= significant.

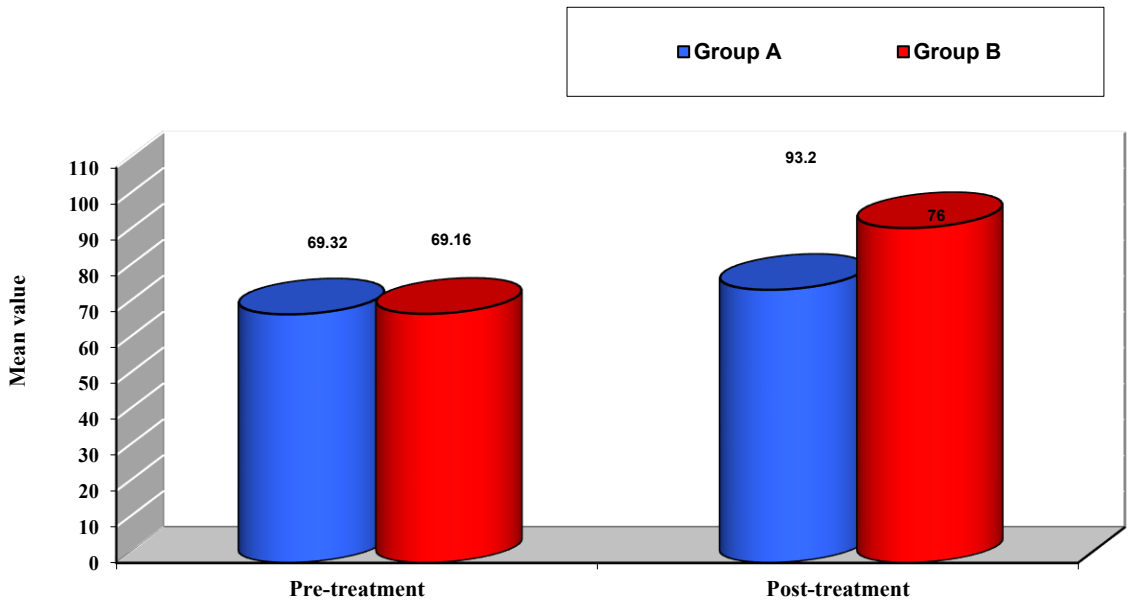

Fig.2: Mean values of lumbar flexion ROM in the two studied groups measured pre- and post-treatment.

IV-Lumbar lordotic curve:

In both groups A and B, a statistically significant reduction in the mean value of the lumbar lordotic curve was observed post-treatment when compared to pre-treatment (Table 4; Fig 3).

Between groups: At pre-treatment, no statistically significant difference was observed among the two groups (Table 4; Fig 3).

Post-treatment, a significant difference was observed between groups A and B regarding the lumbar lordotic curve, with group B exhibiting a greater decline (Table 4; Fig 3).

Table (4): Inter- and intra-groups comparison between values of lumbar lordotic curve in the two studied groups measured at pre- and post-treatment.

	Group A	Group B	F value	P value
Pre-treatment	31.12 ± 2.35	31.32 ± 2.53	0.084	0.773 (NS)
Post-treatment	30.20 ± 2.10	25.88 ± 2.51	603.768	0.001 (S)
Mean difference	0.92	5.44		
% change	2.96 ↓↓	17.37 ↓↓		
t# value	8.048	35.411		
p value	0.001 (S)	0.001 (S)		

Data are expressed as mean ± SD. F value= ANCOVA test. t value= unpaired t test; t# value= paired t test. NS= p> 0.05= not significant; S= p≤ 0.05= significant.

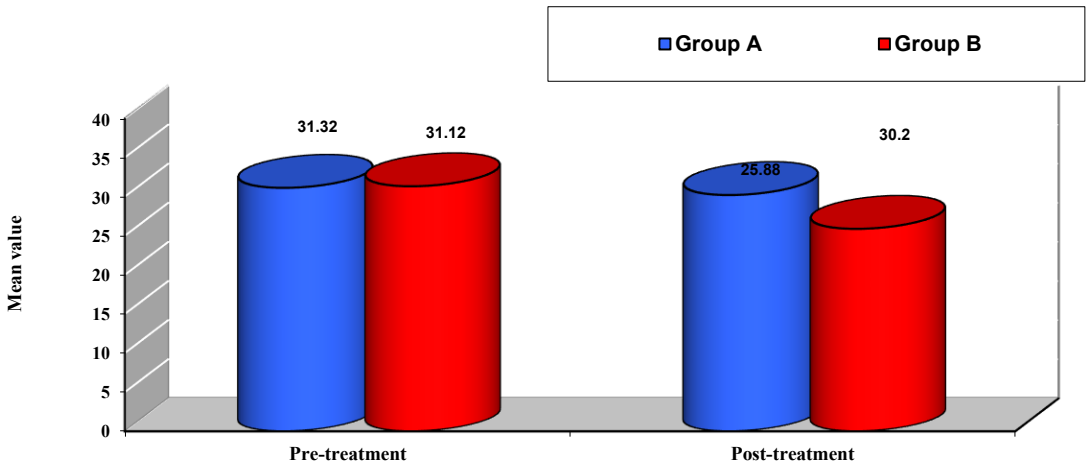

Fig.3: Mean values of lumbar lordotic curve in the two studied groups measured pre- and post-treatment

Discussion:

Most of women compliant with LBP during last trimester in pregnancy. Although majority of pregnant women recover spontaneously from low back pain within 3 months following labor, 30% of them having from chronic LBP. The LBP isn't just pain in your lower back, but also affect your quality of life, ADLs, standing, weight lift and walking [37]. Osteopathy is a non-invasive alternative treatment that helps reduce and relieve lower back pain [38].

During pregnancy the woman passes through package of changes in her body due to hormonal change that lead to changes in her gait, biomechanical and

causing pain, one of most common dysfunction that occur in LBP due to change of biomechanics of body which increase stress on lumbar spine that cause pain [39]. Pumping for the ilio-lumbar ligament release is one of the osteopathic techniques that have shown a significant effect in reducing lower back pain [29].

The aim of study was to detect the impact of pumped technique for ilio-lumbar ligament release on postpartum low back pain. Fifty women complaining of postnatal low back pain took-part in this study. They were chosen from the outpatient clinic of Faculty of Physical Therapy, Pharos University at Alexandria according to the subsequent criteria: They were aged from 25-35 years. All women were within 3 months postnatal. Their body mass index was below 30 kg/m^2. All women were primipara or multipara. All women were normal vaginal labor delivery or caesarian section.

The research is design as randomized controlled study. They were divided randomly into two equal groups A and B: Group A (Control group): It involved 25 postnatal women and were treated by hot packs for 20 minutes 3 sessions a week for eight weeks. Group B (Study group): It involved 25 postnatal women and were treated by hot packs for 20 minutes in addition to pumped technique for ilio-lumbar ligament release for 30 min. 3 sessions a week for eight weeks.

VAS was used to assess severity of low back pain, Goniometer was utilized to assess lumbar flexion ROM. Each woman in both the A and B groups had her lumbar curve measured prior to and post treatment using an inclinometer. After treatment, both groups showed a significant improvement in lumbar flexion ROM and a significant decline in VAS and lumbar lordotic curve (CL). In terms of VAS, lumbar lordotic curve, as well as lumbar flexion ROM before treatment, there was no statistically significant difference among groups A and B; however, group B showed more improvement (greater reductions in VAS and ROM) after treatment.

By comparing the result between baseline and post treatment in group (B), found significant difference between them in ROM of lumbar flexion, significant improvement in decreasing of lumbar lordotic curve and significant decreasing of pain which agreed with (Sakabe et al., 2020)[29].

Sakabe et al., (2020)[29] divided 40 patients in two equal groups, and built his treatment on manual technique such as the pumped technique used to release the ilio-lumbar ligament then measured the pain before and after by using VAS and to assess the ROM he used fingertip-to-floor testes, he found significant effect of manual therapy in decreasing pain, increasing ROM, and improving function in patients with low back pain.

The results of the study are confirmed by Licciardone et al., (2005)[40] who gathered the results from different researches about the effect of osteopathy technique in decreasing pain in patients having LBP and found strong improvement in pain.

Additionally, these results strongly agreed with Franke et al., (2014)[41] who built his systematic literature search on unrestricted by language in October 2013 and selected 31 studies and excluded 16 studies about effect of manual therapy and osteopathic treatment for LBP then he found there is significant effect of osteopathic techniques in decreasing pain and improving function in postnatal women suffering from low back pain.

The findings of study agree with Ożóg et al., (2023)[42] who indicated that pumped technique in release of ilio-lumbar ligament and other manual therapy only without exercises or devices can improve range of motion, functional disability, posture stability and reduce pain.

The findings of this study came in agreement with Martí et al., (2018)[43] who utilized the Oswestry Disability Questionnaire to evaluate functional level and quality of life when using osteopathic manual therapy to normalize the ilio-lumbar ligament in order to treat low back pain patients. Martí et al., (2018)[43] stated that osteopathic manual therapy to normalize the ilio-lumbar ligament is an effective way to improve functional levels of low back pain patients.

The findings of this study align with those of Dal Farra et al., (2021)[44] who stated in their meta-analysis on the use of manual therapy and osteopathic techniques in the treatment of low back pain that these approaches significantly improve patients' functional levels, decrease pain level, and increase the range of motion.

The findings of this study align with those of Thomas et al., (2019)[45] who stated case report about the effect of osteopathic manual therapy in pelvic and lumbar pain after labor and found a significant effect not only in decreasing pain and increasing range of motion but also in improving the functional level of mothers during the postnatal period, particularly during the baby care phase.

The findings of this study align with those of Hastings et al., (2016)[46] who used McGill Pain Questionnaire and VAS to evaluated the effect of osteopathic manual therapy and found a significant effect in decreasing pain in postnatal women who suffering from postnatal low back pain.

The findings of this study came in accordance with Zhang et al., (2024)[39] who stated that manual therapy and osteopathic manual therapy have significant effect on decreasing the pain and improving functional level of postnatal women who suffering with mechanical low back pain.

The findings of this study came in accordance with Majchrzycki et al., (2007)[37] who stated that different osteopathic techniques, such as ligament and joint visceral release, are safe and non-invasive techniques for treating LBP. Depending on the assessment and examination of chronic and acute LBP, choosing the suitable osteopathic technique, these techniques are effective in decreasing pain and improving functional levels in a safe manner.

On the contrary, findings of this study disagreed with Kasimis et al., (2023)[49] who compared between two equal groups with chronic low back pain, first group treated by manual therapy and other treated by manual therapy and TECAR, he evaluated pain by numeric pain rating scale and flexibility by fingertip –to-floor test while functional ability by Roland-Morris disability Questionnaire, finally he found that manual therapy when combine with TECAR has greater effect than manual therapy alone.

Based on researches and systemic reviews osteopathic technique especially pumped technique for releasing ilio-lumbar ligament for treated low back pain patients have significant effect in decreasing pain and increasing ROM. However, none of this research looked on effect of pumped technique for releasing ilio-lumbar ligament on postpartum women with chronic LBP. In this study, the effect of pumped technique for releasing ilio-lumbar ligament on postpartum LBP was examined

and found to significantly reduce pain and increasing ROM.

Conclusion:

It can be concluded that pumped technique for ilio-lumbar ligament release is effective in reducing post natal low back pain through decreasing pain intensity and lumbar lordotic curve increasing lumbar flexion ROM.

Reference

1. Lateef H and Patel ÆD. 2009: What is the role of imaging in acute low back pain?, 69-73.
2. Hong J, Song K, Cho JH, Lee JH and Kim NH. 2023. An Updated Overview of Low Back Pain Management. 968-982.
3. Burton AK, Balagué F, Cardon G, Eriksen HR, Hänninen O, Harvey E, Henrotin Y, Indahl A, Lahad A, Leclerc A, Müller G and van der Beek A. 2005: How to prevent low back pain. Best Practice and Research: Clinical Rheumatology, 19(4): 541-555.
4. Borenstein D. 2013: Mechanical low back pain - A rheumatologist's view. Nature Reviews Rheumatology, 9(11): 643-653.
5. Avaghade RR, Shinde SB, Dhane SSB. 2023 Effectiveness of McKenzie approach and segmental spinal stabilization exercises on neck pain in individuals with cervical postural syndrome: An experimental study. Journal of Education and Health Promotion 12(1):225.
6. Care P. 2023: Family Practice & Palliative Care R eview Article Diagnostic approach to low back pain. 8(2): 49-52.
7. Bajaj MN, Bhore PR and Shinde SB. 2022: Effect of spinal extension exercises on mechanical low back pain in work from home IT professionals in India. International Journal of Occupational Safety and Health, 12(2): 75-80.
8. Angelo R, di C, de O, Da Silva DC, Zambaldi CF, Cantilino A and Sougey EB. 2014: Influência do tipo postural na associação entre depressão pós-parto e dor. Trends in Psychiatry and Psychotherapy, 36(1): 32-39.
9. Kamel DM, Abdel Raoof NA and Tantawy SA. 2016: Efficacy of Lumbar Mobilization on Postpartum Low Back Pain in Egyptian Females: A Randomized Control Trial. 1: 55- 63.
10. Ehsani F, Sahebi N, Shanbehzadeh S, Arab AM and ShahAli S. 2020: Stabilization exercise affects function of transverse abdominis and pelvic floor muscles in women with postpartum lumbo-pelvic pain: a double-blinded randomized clinical trial study. International Urogynecology Journal, 31(1): 197-204.
11. Borg-Stein J and Dugan SA. 2007: Musculoskeletal Disorders of Pregnancy, Delivery and Postpartum. Physical Medicine and Rehabilitation Clinics of North America, 18(3): 459-476.
12. Okanishi N, Kito N, Akiyama M and Yamamoto M. 2012: Spinal curvature and characteristics of postural change in pregnant women. Acta Obstetricia et Gynecologica Scandinavica, 91(7): 856-861.
13. Borg-Stein J, Dugan SA and Gruber J. 2005: Musculoskeletal aspects of pregnancy. American Journal of Physical Medicine and Rehabilitation, 84(3): 180-192.
14. Dehghan F, Haerian BS, Muniandy S, Yusof A, Dragoo JL and Salleh N. 2014: The effect of relaxin on the musculoskeletal system. Scandinavian journal of medicine & science in sports, 24(4): 220-229.
15. Yoo H, Shin D and Song C. 2015: Changes in the spinal curvature, degree of pain, balance ability, and gait ability according to pregnancy period in pregnant and non-pregnant women. Journal of Physical Therapy Science, 27(1): 279-284.
16. Conder R, Zamani R and Akrami M. 2019: The biomechanics of pregnancy: A

systematic review. Journal of Functional Morphology and Kinesiology, 4(4).

17. Sipko T, Grygier D, Barczyk K and Eliasz G. 2010: The Occurrence of Strain Symptoms in the Lumbosacral Region and Pelvis during Pregnancy and After Childbirth. Journal of Manipulative and Physiological Therapeutics, 33(5): 370-377.
18. Biviá-Roig G, Lisón JF and Sánchez-Zuriaga D. 2019: Effects of pregnancy on lumbar motion patterns and muscle responses. Spine Journal, 19(2): 364-371.
19. Provenzano SG, Hafer JF, Peacock J, Kempner S, Zendler JD and Agresta C E. 2019: Restriction in Pelvis and Trunk Motion in Postpartum Runners Compared With Pre-pregnancy. Journal of Women's Health Physical Therapy, 43(3): 119-126.
20. Kiapour A, Joukar A, Elgafy H, Erbulut DU, Agarwal AK and Goel VK. 2020: Biomechanics of the sacroiliac joint: Anatomy, function, biomechanics, sexual dimorphism, and causes of pain. International Journal of Spine Surgery, 14: S3 - S13.
21. Wang JM, Kirkpatrick C and Loukas M. 2018: The Ilio-lumbar Ligament Does Not Have a Direct Nerve Supply. The Spine Scholar, 2(1): 1-5.
22. Ettehad H, Salari A, Soleymanha M, Ezzati K and Khososi D. 2021: Evaluation of Conservative therapy in two groups of patients with low back pain associated with Ilio-lumbar ligament enthesopathy and injury of muscles around hip in comparison with patients with other causes of low back pain. Human, Health and Halal Metrics, 2(1): 27-32.
23. Schwerla F, Rother K, Rother D, Ruetz M and Resch KL. 2015: Osteopathic manipulative therapy in women with postpartum low back pain and disability: A pragmatic randomized controlled trial. Journal of the American Osteopathic Association, 115(7): 416-425.
24. Awad MA and Atta Allah AA. 2019: Effect of myofascial release technique versus mulligan mobilization technique on postnatal low back pain. The 20th International Scientific Conference Faculty of Physical Therapy Cairo, 6-7.
25. Davenport MH, Marchand AA, Mottola MF, Poitras VJ, Gray CE, Jaramillo Garcia A, Barrowman N, Sobierajski F, James M, Meah VL, Skow RJ, Riske L, Nuspl M, Nagpal TS, Courbalay A, Slater LG, Adamo KB, Davies GA, Barakat R and Ruchat SM. 2019: Exercise for the prevention and treatment of low back, pelvic girdle and lumbopelvic pain during pregnancy: A systematic review and meta-analysis. British Journal of Sports Medicine, 53(2): 90-98.
26. Akbarzadeh M, Ghaemmaghami M, Yazdanpanahi Z, Zare N, Azizi A and Mohagheghzadeh A. 2014: The Effect Dry Cupping Therapy at Acupoint BL23 on the Intensity of Postpartum Low Back Pain in Primiparous Women Based on Two Types of Questionnaires, 2012; A Randomized Clinical Trial. International Journal of Community Based Nursing and Midwifery, 2(2): 112-120.
27. Nahas EM and Morsy MS. 2018: Effect of Shock Wave Therapy on Postpartum Low Back Pain. The Medical Journal of Cairo University, 86(3): 893-901.
28. Franke H, Franke JD, Belz S and Fryer G. 2017: Osteopathic manipulative treatment for low back and pelvic girdle pain during and after pregnancy: A systematic review and meta-analysis. Journal of Bodywork and Movement Therapies, 21(4): 752-762.
29. Sakabe FF, Mazer DA, Cia JA, Sakabe DI and Bortolazzo, GL. 2020: Effects of myofascial techniques on pain, mobility and function in patients with low back pain: a double-blind, controlled and randomized

trial. Manual Therapy, Posturology & Rehabilitation Journal, 18: 1-6.

30. Garra G, Singer AJ, Leno R, Taira BR, Gupta N, Mathaikutty B and Thode HJ. 2010: Heat or cold packs for neck and back strain: A randomized controlled trial of efficacy. Academic Emergency Medicine, 17(5): 484-489.
31. Waltz CF, Strickland OL and Lenz ER. 2018: Visual Analog Scales. Measurement in Nursing and Health Research, 1990, 2001.
32. Saur PMM, Ensink FM, Frese K, Seeger D and Hildebrandt J. 1996: Lumbar Range of Motion: Reliability and Validity of the Inclinometer Technique in the Clinical Measurement of Trunk Flexibility. Spine 21(11): 1332-1338.
33. Van Blommestein AS, Lewis JS, Morrissey MC and MaCrae S. 2012: Reliability of measuring thoracic kyphosis angle, lumbar lordosis angle and straight leg raise with an inclinometer. Open Spine Journal, 4(1): 10-15.
34. Atya AM. 2013: The validity of spinal mobility for prediction of functional disability in male patients with low back pain. Journal of Advanced Research, 4(1): 43-49.
35. Kachingwe AF and Phillips BJ. 2005: Inter- and Intrarater Reliability of a Back Range of Motion Instrument. Archives of Physical Medicine and Rehabilitation, 86(12): 2347-2353.
36. Mabrouk MI. 2023: Effectiveness of myofascial release technique in treatment of sacroiliac joint hypo-mobility in postnatal women.
37. Wiezer M, Hage-Fransen MAH, Otto A, Wieffer-Platvoet MS, Slotman M H, Nijhuis-van der Sanden MWG and Pool-Goudzwaard AL. 2020: Risk factors for pelvic girdle pain postpartum and pregnancy related low back pain postpartum; a systematic review and meta-analysis. Musculoskeletal Science and Practice, 48: 102154.
38. Licciardone JC, Kearns CM and Minotti DE. 2013: Outcomes of osteopathic manual treatment for chronic low back pain according to baseline pain severity: Results from the OSTEOPATHIC Trial. Manual Therapy, 18(6): 533–540.
39. Zhang J, Pang T, Yao J, Li A, Dong L, Wang Y and Wang Y. 2024. Clinical application of myofascial therapy in the treatment of postpartum pain-related functional disorders: A review. Medicine (United States), 103(40): 39869.
40. Licciardone JC, Brimhall AK and King LN. 2005: Osteopathic manipulative treatment for low back pain: A systematic review and meta-analysis of randomized controlled trials. BMC Musculoskeletal Disorders, 6(1)–12.
41. Franke H, Franke JD and Fryer G. 2014: Osteopathic manipulative treatment for nonspecific low back pain: A systematic review and meta-analysis. BMC Musculoskeletal Disorders, 15(1).
42. Ożóg P, Weber RM and Radzimińska A. 2023: Effects of Isolated Myofascial Release Therapy in Patients with Chronic Low Back Pain—A Systematic Review. Journal of Clinical Medicine, 12(19).
43. Martí SM, Hidalgo ML, Doménech FJ, Lisón JF and Arguisuelas MD. 2018: Osteopathic Manipulative Treatment Including Specific Diaphragm Techniques Improves Pain and Disability in Chronic Nonspecific Low Back Pain: A Randomized Trial. Archives of Physical Medicine and Rehabilitation, 99(9): 1720–1729.
44. Dal Farra F, Risio RG, Vismara L and Bergna A. 2021: Effectiveness of osteopathic interventions in chronic non-specific low back pain: A systematic review and meta-analysis. Complementary Therapies in Medicine, 56:102616.

45. Thomas RM and Drew DL. 2019: An osteopathic approach to uterine-induced low back pain: A case report. AAO Journal, 29(3): 23–26.

46. Hastings V, McCallister A, Curtis S, Valant R and Yao S. 2016. Efficacy of Osteopathic Manipulative Treatment for Management of Postpartum Pain. Journal of Osteopathic Medicine, 116(8): 502-509.

47. Majchrzycki M and Hoffmann M. 2007: Selected Osteopathic Techniques. Dysfunctions of the Locomotor System, 7–17.

48. Kasimis K, Iakovidis P, Lytras D, Koutras G, Chatziprodromidou IP, Fetlis A, Ntinou SR, Keklikoglou NM, Samiotaki A, Chasapis G, Tarfali G and Apostolou, T. 2023: Short-Term Effects of Manual Therapy plus Capacitive and Resistive Electric Transfer Therapy in Individuals with Chronic Non-Specific Low Back Pain: A Randomized Clinical Trial Study. Medicina (Lithuania), 59(7).