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PHYSICAL FITNESS AND THEIR ASSOCIATION WITH LOW BACK PAIN ACROSS GESTATIONAL TRIMESTERS

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ABSTRACT

Background: Pregnancy-related low back pain (LBP) is a widespread yet poorly managed condition. While physical activity is recommended, the specific relationship between objectively measured physical fitness and LBP throughout pregnancy remains unclear, hindering the development of effective exercise interventions.Objective: This study aimed to investigate the association between comprehensive physical fitness and the prevalence of LBP in pregnant women during mid- and late-gestation. Methods: In a cross-sectional study at Sir Syed College of Nursing and Allied Health Sciences, Karachi, 180 pregnant women were divided into mid-gestation (14-28 weeks, n=101) and late-gestation (28-37 weeks, n=79) groups. LBP was assessed using the Oswestry Disability Index (ODI). Physical fitness was objectively evaluated using a validated 23-component test system measuring core strength, flexibility, balance, and muscular endurance.Results: A high prevalence of LBP was observed (77.23% in mid-gestation; 72.15% in late-gestation). As pregnancy progressed, significant declines were found in key fitness components: back strength decreased from 32.09 ± 10.22 kg to 28.59 ± 9.07 kg, flexibility worsened from -1.80 ± 7.63 cm to -7.46 ± 9.63 cm, and balance (left blind balance) reduced from 7.30 ± 8.04 seconds to 4.78 ± 4.20 seconds. LBP was negatively correlated with performance in lower limb and gluteal strength exercises, such as standing heel raises and glute kickbacks.Conclusion: The decline in physical fitness, particularly in core strength, flexibility, and balance, is significantly associated with LBP during pregnancy. These findings highlight the critical need for targeted exercise programs that strengthen the core and lower limb muscles to alleviate and potentially prevent pregnancy-related low back pain.

Keywords: *Pregnancy-Related Low Back Pain, Physical Fitness, Gestational Trimesters, Core Strength, Exercise Intervention.*

INTRODUCTION

Low back pain (LBP) is a common complication of pregnancy, frequently involving sacroiliac joint dysfunction and muscular weakness [1]. Movement control exercises designed to enhance muscular strength and spinal posture have proven effective in reducing the associated pain and disability [2]. With a growing consensus on the safety of physical activity during gestation, it is now widely recommended to alleviate pregnancy-related symptoms [3-5]—a stance strongly endorsed by the World Health Organization for women without contraindications [6-8]. Although targeted exercise regimens for pregnancy-related LBP exist [9-11], a comprehensive review of 34 clinical trials found only low-quality evidence supporting the pain-relieving benefits of land-based exercise [12]. This underscores a significant evidence gap and calls for a deeper investigation into the connection between LBP and objectively measured physical fitness. While studies link self-reported fitness to reduced pain [13] and implicate daily activities in LBP onset [14], the field lacks robust tools for the objective, comprehensive assessment of physical fitness in pregnant populations [15]. This methodological shortcoming, coupled with a poor understanding of how fitness and LBP interact across gestational stages, has hindered the development of truly effective exercise programs. To address this, we developed a specialized 23-component physical fitness testing system for pregnant women. This system, crafted through expert consensus and validated in a pilot study with 60 participants, is a safe, practical, and scientific tool for objective assessment [16].

This study aimed to employ this novel system to evaluate the physical fitness of pregnant women, quantify LBP using the Oswestry Disability Index (ODI) [17], and analyze the correlation between these metrics. Our goal is to provide a methodological foundation for objective fitness measurement in pregnancy and to establish an evidence base for developing targeted exercise interventions that can effectively prevent and manage low back pain.

MATERIALS AND METHODS

Study Design and Participants

This cross-sectional study investigated i**n Sir Syed College of Nursing and Allied Health Sciences, Karachi.** to the correlation between physical fitness and pregnancy-related low back pain (LBP). A total of 180 pregnant women were recruited and divided into two gestational groups: mid-gestation (14-28 weeks, n=101) and late-gestation (28-37 weeks, n=79). All participants provided informed consent and met the inclusion criteria of being healthy, single-ton pregnancies with medical clearance for exercise. Women with pre-existing musculoskeletal conditions were excluded.

Measures and Procedures

Low Back Pain. LBP and its related disability were assessed using the validated Oswestry Disability Index (ODI).

Physical Fitness. A comprehensive, 23-component Maternal Physical Fitness Test was used. This system, developed and piloted for safety and practicality, assesses key domains including core strength (e.g., Kneeling Plank, Back Strength), flexibility (Sit-and-Reach), balance (Blind Balance Test), and muscular endurance (e.g., Heel Raises, Glute Kickbacks). To ensure reliability, all tests were demonstrated via a standardized video, and a trained professional supervised and recorded all results in a controlled environment.

Data Analysis

Data were analyzed using SPSS software (version X). Descriptive statistics summarized participant characteristics. Independent samples t-tests compared physical fitness levels between the two gestational groups. Pearson's correlation coefficients were computed to examine the relationships between ODI scores and physical

fitness test performances. A p-value of < 0.05 was considered statistically significant.

RESULTS

The study assessed the physical fitness of 180 pregnant women, divided into mid-gestation (14–28 weeks) and late-gestation (28–37 weeks) groups. Key results showed a decline in physical fitness as pregnancy progressed, with significant differences between the two groups. Vital capacity was slightly lower in late-gestation (2594.75 ± 595.84 ml) compared to mid-gestation (2631.97 ± 609.88 ml). Back strength significantly decreased from 32.09 ± 10.22 kg in mid-gestation to 28.59 ± 9.07 kg in late-gestation. Flexibility, measured by the sit-and-reach test, worsened in late-gestation (-7.46 ± 9.63 cm) compared to mid-gestation (-1.80 ± 7.63 cm). Balance also deteriorated, with the left blind balance test dropping from 7.30 ± 8.04 seconds in mid-gestation to 4.78 ± 4.20 seconds in late-gestation. The study also found that women in late-gestation performed fewer resistance band pullbacks (21.22 ± 4.59 reps) compared to mid-gestation (22.87 ± 4.87 reps). These results indicate that core strength, flexibility, and balance worsen as pregnancy progresses, highlighting the need for targeted exercise interventions to improve physical fitness and alleviate pregnancy-related low back pain.

Test Name	Mid-Gestation (N=101)	Late-Gestation (N=79)	Total (N=180)
Vital Capacity (ml)	2631.97 ± 609.88	2594.75 ± 595.84	2615.63 ± 602.36
2 min March-in-place (steps)	191.12 ± 20.64	190.05 ± 21.64	190.65 ± 21.03
Kneeling Plank (s)	29.35 ± 2.52	26.32 ± 8.70	28.02 ± 6.23
Back Strength (kg)	32.09 ± 10.22	28.59 ± 9.07*	30.56 ± 9.86
30s Sit-stands (repetitions)	12.49 ± 2.51	11.78 ± 2.84	12.18 ± 2.67
Schulte Table Test (s)	4.33 ± 0.87	4.50 ± 0.92	4.40 ± 0.89
Finger Grip and Release (20s)	29.74 ± 7.83	30.82 ± 8.52	30.22 ± 8.13
Standing Heel Raises (20s)	15.53 ± 4.09	15.38 ± 4.35	15.47 ± 4.20
Overhead Arm Claps (30s)	23.50 ± 4.16	23.01 ± 3.96	23.28 ± 4.07
Arm Claps Forward (30s)	24.11 ± 3.65	23.25 ± 3.70	23.73 ± 3.69
Resistance Band Pullbacks (30s)	22.87 ± 4.87	21.22 ± 4.59*	22.14 ± 4.81
Left Front Knee Lifts (30s)	24.51 ± 5.62	23.76 ± 4.69	24.18 ± 5.23
Right Front Knee Lifts (30s)	23.59 ± 5.48	22.99 ± 4.33	23.33 ± 5.01
Left Lateral Leg Swings (30s)	25.77 ± 6.80	23.95 ± 5.93	24.97 ± 6.48
Right Lateral Leg Swings (30s)	24.83 ± 6.20	23.76 ± 5.19	24.36 ± 5.79
Left Glute Kickbacks (30s)	24.63 ± 6.51	24.49 ± 6.06	24.57 ± 6.30
Right Glute Kickbacks (30s)	23.89 ± 5.49	23.27 ± 5.51	23.62 ± 5.49
Left Shoulder Mobility (cm)	12.51 ± 6.33	12.73 ± 6.63	12.60 ± 6.45
Right Shoulder Mobility (cm)	9.47 ± 5.29	9.99 ± 5.91	9.70 ± 5.56
Sit and Reach Test (cm)	-1.80 ± 7.63	-7.46 ± 9.63**	-4.28 ± 8.99
Left Side-lying Hip Abduction (°)	79.93 ± 15.96	78.35 ± 16.74	79.23 ± 16.28
Right Side-lying Hip Abduction (°)	82.78 ± 17.09	81.77 ± 15.54	82.34 ± 16.39
Hexagon Step Test (s)	25.86 ± 4.50	26.39 ± 3.72	26.09 ± 4.17
Left Blind Balance Test (s)	7.30 ± 8.04	4.78 ± 4.20*	6.20 ± 6.73
Right Blind Balance Test (s)	5.56 ± 4.87	4.85 ± 5.03	5.25 ± 4.94
Left Bird-dog Balance (s)	25.17 ± 8.46	24.45 ± 8.93	24.85 ± 8.65

Right Bird-dog Balance (s)	26.25 ± 7.22	23.43 ± 9.15*	25.02 ± 8.22

DISCUSSION

This study assessed physical fitness and low back pain (LBP) in 180 pregnant women, examining correlations across cardiorespiratory fitness, muscular strength, endurance, speed, flexibility, and balance. Results demonstrated a progressive decline in physical fitness as pregnancy advanced, with women in late gestation showing significantly weaker core strength, reduced flexibility, and impaired balance compared to those in mid-gestation [18]. LBP was highly prevalent, affecting 77.23% of women in mid-gestation and 72.15% in late-gestation. As pregnancy progresses, the shifting center of gravity due to the growing abdomen leads to anterior pelvic tilt and increased lumbar stress, while hormonal changes further weaken abdominal muscles, collectively exacerbating LBP [19, 20]. Although LBP intensity was slightly higher in late-gestation (0.95±0.71) than in mid-gestation (0.91±0.62), this difference was not statistically significant [21, 22]. LBP was found to interfere significantly with daily activities such as walking, standing, and bending [22, 23].

While cardiorespiratory function, speed, and agility showed no significant differences between groups, late-gestation women exhibited notable declines in back strength and resistance band pullback performance, indicating diminished core strength and muscular endurance [24]. They also demonstrated poorer flexibility and balance, with significantly reduced scores in sit-and-reach, blind balance, and bird-dog tests [25, 26]. A negative correlation was observed between LBP and performance in standing heel raises and glute kickbacks, highlighting the role of lower limb and gluteal strength in LBP management [27-30]. Interestingly, LBP was only correlated with glute kickback performance in the mid-gestation group, possibly due to biomechanical constraints in late pregnancy.

These findings underscore the association between declining physical fitness—particularly in core strength, flexibility, and balance—and LBP during pregnancy. Targeted exercise programs focusing on these areas may help alleviate LBP. Study limitations include a moderate sample size and the exclusion of preconception and postpartum periods. Future research should explore tailored exercise interventions for different gestational stages to better prevent and manage pregnancy-related LBP.

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CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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AUTHORS' CONTRIBUTIONS

The authors confirm their contribution to the paper as follows: **Samreen Sultana**: Study conception, data collection, analysis, and manuscript writing; **Dr. Jalal Uddin, Dr. Habib Ahmad Khan, Dr. Wasi Ullah, Dr. Masood**: Data interpretation, critical revision of the manuscript; **Dr. Mohammad Imran Younus**: Statistical analysis, manuscript review and editing. All authors reviewed and approved the final version of the manuscript.

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