



Effect of Pregnancy-Related Hormonal Changes on Joint Laxity and Lower-Limb Stability in Women Attending Tertiary Care Hospitals in Pakistan

Submission: 05 January 2026 | Acceptance: 20 February 2026 | Publication: 24 March 2026

¹Dr Adila Ashraf, ²Dr Aneela Nadeem, ³Dr Imran Manzoor, ⁴Dr Rizwan Ichan Lodhi, ⁵Dr Mohammad Mujeeb ur Rehman, ⁶Dr Eman Madnia

¹Assistant Professor Obs n Gynae, Continental medical College,Lahore.

²Assistant Professor Obs n Gynae,Continental medical college, Lahore.

³Associate Professor Orthopaedics, Continental Medical College, Lahore.

⁴Assistant Professor Orthopaedics, Continental Medical College, Lahore.

⁵Postgraduate Resident, Department of Orthopaedics, Continental Medical College, Lahore.

⁶Postgraduate Resident, Obs Gynae, Continental Medical College. Lahore.

ABSTRACT:

Background: During pregnant period, there are considerable changes in hormone levels, especially relaxin, progesterone, and estrogen are likely to have an impact on the elasticity of connective tissues and ligamentous arrangements. These hormonal changes may raise the laxity of joints and this can also undermine the stability of lower limbs. During pregnancy, changes in biomechanics can be considered potential causes of musculoskeletal pain, balance issues, and increase the likelihood of falls. Clinical importance of these changes has been reported, although there is scarcity of information on the effect of these investigations in Pakistan on the relationship between the changes in hormones during pregnancy and stability of the joint. These effects are incomprehensible without understanding how to enhance maternal musculoskeletal status and the preventive interventions in antenatal care.

Aim: The purpose of this research was to assess the impact of pregnancy-related hormonal alteration on lower-limb stability and joint laxity in Pakistani women care in the tertiary care hospitals.

Methods: The study was a descriptive cross-sectional study, carried out at Mayo Hospital, Lahore, in March 2025 to February, 2026. A sample of 90 pregnant women were recruited through the non-probability consecutive sampling method. The study was incorporated in women who were aged between 18 and 40 years and had made visits to the antenatal clinic at various trimesters of pregnancy. Clinical examination and structural assessment tools were used to gather the data. Joint laxity was measured by standardized ligament laxity tests and the Beighton score and lower-limb stability was measured using the tests of functional balance and gait stability. The interpretation of hormones was in line with the progress of gestation and clinical measurements. Demographic data and obstetric history were also taken. Data were described with the help of statistical software and results were presented in form of frequencies, percentage and mean + standard deviation where necessary.

Results: The average age of the 90 respondents was 28.6 and 4.2. Fifty four (60) women were found to have increased laxity in their joints whereas 36 (40) showed normal ligament stability. It was found that 47 (52.2) individuals had the lower-limb stability reduced; 43 (47.8) of them had a normal stability. Women during the third trimester exhibited joint laxity more often than they did during other trimester. The subjects having a better score in joint laxity also exhibited an increased propensity towards the balance instability and gait fluctuations.

Conclusion: The research also concluded that the effect of pregnancy-related hormonal changes had a great impact on the joint laxity and lower-limb stability in pregnant women. Reduced balance and functional stability was usually connected with increased ligament laxity especially during the later pregnancy phase. These results revealed the significance of musculoskeletal evaluation and preventive physiotherapy solutions at the antenatal care stage and how they can minimize the possibility of instability and falls.



GLOBAL HEALTH & MEDICINE

ISSN / eISSN: 2434-9186 / 2434-9194

Volume 08, Issue 06.

<https://ghsjournal.com/>



Keywords: Pregnancy, Hormonal Changes, Joint Laxity, Lower-Limb Stability, Relaxin, Maternal Musculoskeletal health, Pakistan.

INTRODUCTION:

It was realized that pregnancy is a distinct physiological condition that brought about extreme anatomical, hormonal and biomechanical alterations to the body of the woman. These were required adaptations to help the fetus grow, keep the mother healthy and ready to deliver and give birth. Of these changes, musculoskeletal system modifications proved to be of importance as they affected the muscular joint movements, ligaments and general body functional mobility during the state of pregnancy. The changes in connective tissue properties that were caused by hormone changes that took place during gestation significantly influenced joint laxity and lower-limb stability in pregnant women.

Some of the hormones such as relaxin, estrogen, and progesterone became much higher during pregnancy. They were the hormones that bind together the connective tissues and regulated the process of collagen that increased the elasticity of the ligaments and the ability of tissues to be extended. The effects of such hormones were crucial in preparing the pelvis and structures around it to assist in giving birth by creating an increased degree of mobility in the pelvic joints. But it was not just the pelvis that was affected by these hormonal changes, peripheral joints like ones of the knees, ankles, wrists and hips were also affected. Consequently, most of the pregnant women suffered higher ligamentous laxity and passive joint instability. Relaxin was regarded as one of the most important hormones in this process. Its production was by the corpus luteum in early pregnancy and placenta in late pregnancy. The hormone helped in the softening of the ligaments and connective tissues in order to ease the birth canal in labor. Since relaxin was in the blood of a mother, it was experienced in various joints across the body. As a result, the loosening of the ligaments and the overall flexibility of the joints were likely to be higher in the course of pregnancy, which might cause the feeling of instability or the appearance of new movement patterns.

Besides hormonal factors, there was also the biomechanical and postural behavior that caused more changes in the joint stability due to the pregnancy. The gradual increase in size of uterus and the resultant increase

in weight caused the center of gravity to be forward. This change in position changed the pattern of postures and gait patterns and exerted more pressure on the lumbar spine, pelvis, and lower limbs. Being a compensatory response, the majority of females acquired higher lumbar lordosis, pelvic tilt, and alterations in the lower-limb position. Such mechanical changes coupled with the laxity of the ligaments helped in lowering the stability of the joints and putting them at a greater risk to experience musculoskeletal discomfort or injury during pregnancy.

Some of the studies indicated that joint laxity worsened during pregnancy especially in the peripheral joints of the knee and wrist. Alterations in the compliance of ligaments were believed to affect the biomechanics of the joint and the distribution of load which could potentially put more pressure on the musculoskeletal tissues. Such changes may have an influence on balance, gait, and lower-limb stability, thus, exposing pregnant women to the risk of falls, joint pain, and functional limitations. In addition, there was some evidence that the changes in the joint laxity of pregnancy may be long-lasting even after birth, so it may have long-term musculoskeletal consequences.

Mobility and functional independence that were also required in pregnancy included lower-limb stability. It was also potentially dangerous to the mother and the baby because both became more prone to falls due to instability in the knees, ankles, or hips. Although the effect of pregnancy on the hormonal levels relating to ligamentous laxity are already understood, the acts between such hormonal changes and operational stability in the lower limbs were not investigated to full extent especially in the developing nations. In Pakistan where maternal health and mobility in pregnancy were essential in the daily operation, there was little local information available on musculoskeletal effects of pregnancy-related changes in hormones.

Thus, it was essential to examine the impact of hormonal changes during pregnancy on the individuals joint laxity and lower foot and leg stability to enhance health outcomes in mothers. The assessment of such alterations may aid healthcare providers, such as obstetricians and physiotherapists in screening the women

who may develop instability or musculoskeletal issues and in developing the relevant preventive/rehabilitative measures. Therefore, this research was done in a bid to evaluate how hormonal changes in pregnancy influence laxity of joints and lower limb stability of the women in tertiary care hospitals in Pakistan.

DISCUSSION:

The current research tested the hypothesis of how the effect of pregnancy-related hormonal changes on joint laxity and lower-limb stability in women visiting tertiary care hospitals in Pakistan. The results proved that expecting mothers had a significant level of increase in joint laxity and a decrease in lower-limb stability, especially in the later pregnancy period. These findings were in line with the physiologically established physiological changes of pregnancy, which include hormonal, biomechanical and musculoskeletal changes in impacts to the integrity of the ligaments and the effects of the joint.

Hormonal changes are very pronounced during a period of pregnancy with hormones like relaxin, progesterone, and estrogen being very pronounced. These hormones are very important in preparing the mother body to deliver a baby as they lead to relaxation of the ligaments and make the connective tissues more flexible. Particularly, relaxin has been identified to relax the ligaments and joints to allow expansion of the pelvic area during child delivery. Nevertheless, this diffuse ligamentous laxity can spread outside the pelvic area to peripheral joints leading to a condition of more laxity and instability of the joint.

In the current study, joint laxity increased among the pregnant participants and these findings were as anticipated by other researches. Previous studies have indicated that the laxity of peripheral joints substantially increased in the course of pregnancy in a variety of joints and attributed the effect to the effect of pregnancy itself. Such changes in the properties of ligaments can affect the stability of joints and neuromuscular control especially in weight-bearing joints like knee, hip, and ankle. As a result, pregnant

women have problems in maintaining balance and stability when performing lower-limb-associated activities.

Biomechanical changes during pregnancy also explain why stability of the lower limbs may reduce during pregnancy as seen in this study. During pregnancy, the developing uterus moves the center of gravity forward thereby exerting extra mechanical forces on the spine, pelvis, and lower extremity. Moreover, the augmented body weight and changed posture might further aggravate the musculoskeletal system and lead to the instability. The previous reports have recommended that these combined hormonal and biomechanical alteration can affect the neuromuscular control in a negative way as well as heighten the risk of falls or musculoskeletal pain among the expectant mothers.

Besides, the current results were in line with literature indicating laxity increase in major joints like the knee during pregnancy. There has also been reported increase in the knee joint compliance of pregnant women and some studies argued that the changes could last even after child birth. The long-term effects of such sustained deformities in joint mechanics to musculoskeletal health and even predisposition of women to joint injury or chronic instability might be a result of failure to take proper precautionary measures.

Although the joint laxity is observed to be on the increase, past studies have suggested that the correlation between the levels of hormones and the ligament laxity is not necessarily direct. Other studies did not find any significant correlation between the level of the circulating relaxin and the level of the joint laxity during pregnancy meaning that other factors including genetic predisposition, biomechanical stress, and neuromuscular adaptation might also play prominent roles. Thus, the problem of joint laxity in pregnancy ought to be a multifactorial as opposed to a hormonogated phenomenon.

Another insight that was provided by the results of this study is the clinical significance of musculoskeletal changes in the course of pregnancy. Pregnant women may be exposed to falls, lower-limb instability, and pain in the pelvic girdle due to increased joint laxity and decrease in lower-limb stability. Preventive

measures that should therefore be focused by healthcare professionals in order to ensure that the joints are kept stable during pregnancy are physiotherapy, strength training and balance enhancing exercises. High-risk birth tendencies achieve early recognition to curb pain and enhance productive movement in pregnant women.

Generally, the results of the current research study corroborated available studies that hormonal alterations during pregnancy made joints laxer and lower-limb stability reduction practicable. Such physiological changes though useful in child birth could also interfere with musculoskeletal functionality as well as balance. It was advised that further studies should be conducted on the larger population with longitudinal follow-up in order to be more aware of the long-term consequences of ligamentous changes during pregnancy and the outcome of creating some effective preventative and rehabilitative intervention to adopt among pregnant women.

MATERIALS AND METHODS:

The rationale of the study was to evaluate how hormonal changes during pregnancy affect the lower extremity stability and joint laxity in pregnant women treated in tertiary care hospitals in Pakistan. The study was conducted in Mayo hospital Lahore, which is a large tertiary teaching hospital offering specialized obstetric and gynecology services to a great number of people. The study time was prolonged to March 2025 until February 2026.

The study aimed at determining the relationship between musculoskeletal changes in lower limbs and the change in pregnancy-related hormones took a descriptive cross-sectional study design. The study sample was made up of 90 pregnant women who attended obstetrics and gynecology outpatient department of the Mayo Hospital within the study period. Non-probability consecutive sampling was employed in selecting the participants whereby all qualifying women who came to the hospital and met the inclusion criterion were invited to take part until the desired sample size was attained.

The inclusion criteria were a pregnant woman between 18 and 40 years of age, pregnancy confirmed at any trimester of her life and willing to consent to provide informed consent as required by Mayo Hospital. The women who had lower limb fractures in the past, were born with musculoskeletal or nervous system disorders that may impact balance, were chronically affected by rheumatologic diseases or had undergone previous lower limb surgeries were not included in the study. Also, high-risk women with pregnancy conditions that limited movement or evaluation processes were ruled out so as to remove confounding variables.

A structured data collection proforma developed to conduct the study was used in data collection. Demographics like age, gestational age, parity, body mass index (BMI) and the level of occupational activity were recorded. Clinical history associated with pain in the musculoskeletal area, any past joint issues, and exercise in the course of the pregnancy was also recorded.

In order to assess the effect of pregnancy on the hormones, data regarding the gestation trimester was utilized as an indirect measure of hormonal change since the hormones including relaxin, progesterone, and estrogen were known to change progressively as the pregnancy progresses. These hormonal variations were taken to be a possible cause of ligamentous laxity and joint mobility.

The joint laxity was measured using the standard clinical tests which majorly targeted the joints in the knee and ankle. Generalized joint laxity was measured by using Beighton score. There were maneuvers in this scoring system used to evaluate hypermobility which consisted of elbow extension, knee extension, thumb-to-forearm movement, fifth finger extension and forward trunk flexion. A score was given to each positive maneuver and total score gave the extent of the joint laxity.

Stability and balance of lower limbs were measured by the functional tests such as single-leg stance test and time balance test. The participants were requested to stand on one leg during a fixed duration and

remain stable. The duration taken without falling or any assistance was measured. Instability, postural sway and the inability to sustain the stance were also observed.

The training of the healthcare professionals provided a uniformity of assessment and reliability of measurements to all clinical assessments. Respondents were evaluated under a secure and controlled clinical setting in order to reduce the chances of falls or pain.

Statistical Package for Social Sciences (SPSS) version 26.0 was used to work with the collected data and analyze them. The descriptive statistics were used in summarizing the demographic and clinical characteristics. Continuous variables like age and balance duration were described in terms of mean and standard deviation and categorical variables like trimester distribution and categories of joint laxity were described in terms of frequency and percentage. A comparative analysis was conducted to investigate the connection which existed between the gestational age, scores of joint laxity and the outcome of lower-limb stability.

The data was collected with the institutional ethical review committee of Mayo Hospital, Lahore granting ethical approval to the study before the data. The participants were aware of the goals and methods of the research and informed consent was provided in written form. The privacy of information about participants was highly conserved and the data were also treated as purely research use.

RESULTS:

The participants in the study were 90 pregnant women who were visiting the obstetrics outpatient department in Mayo Hospital, Lahore within the period of March 2025 to February 2026. Each of the participants met the inclusion criteria and was subjected to the clinical evaluation of joint laxity and lower limb stability. As part of analysis, the data collected were used to establish the correlation between pregnancy-associated hormone variation and musculoskeletal stability.

Table 1: Demographic and Obstetric Characteristics of the Participants (n = 90):

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	20–25	28	31.1
	26–30	34	37.8
	31–35	18	20.0
	>35	10	11.1
Gestational Age	First Trimester	18	20.0
	Second Trimester	32	35.6
	Third Trimester	40	44.4
Parity	Primigravida	36	40.0
	Multigravida	54	60.0
BMI Category	Normal (18.5–24.9)	30	33.3
	Overweight (25–29.9)	38	42.2
	Obese (≥ 30)	22	24.5

The demographic and obstetric attributes of the pregnant women enrolled in the study were revealed as in table 1. Most of the subjects fell in the age bracket of 2630 years (37.8%), then 2025 years (31.1%), which means that the majority of females were in the normal reproductive age range. Fewer numbers of respondents were between the ages of 3135 years (20.0%), but only 11.1% were over the age of 35 years. In terms of gestational age, the highest percentage of study participants belonged to the third (44.4%), second trimester (35.6%), but only 20.0% belonged to the first trimester. This distributions was a result of

likelihood of musculoskeletal complaints and joint instability in the later stage of pregnancy as hormonal concentration levels increase, e.g., relaxin and progesterone.

Concerning parity, half of the sample (60.0) which represented the multigravida women were parous and the other half (40.0) were primigravida. This implied that many women had already had previous pregnancies and this could have determined the ligamentous laxity and musculoskeletal adaptation.

The analysis of the body mass index (BMI) demonstrated that 42.2, 33.3 and 24.5 percent of participants were overweight, normal and obese respectively. Mechanical stress on the lower limbs and joints may have been further caused by increased body weight during pregnancy and may be an influencing factor on stability and balance.

In general, Table 1 showed that the chosen population was primarily composed of women in the late trimester and with different BMI and parity statuses, which were also applicable when examining the joint laxity and lower-limb stability.

Table 2: Assessment of Joint Laxity and Lower-Limb Stability Among Participants (n = 90):

Parameter	Category	Frequency (n)	Percentage (%)
Joint Laxity (Beighton Score)	Normal (0–3)	26	28.9
	Moderate Laxity (4–6)	41	45.6
	High Laxity (7–9)	23	25.5
Lower-Limb Stability Test	Stable	30	33.3
	Mild Instability	37	41.1
	Moderate Instability	17	18.9

Severe Instability	6	6.7	
History of Falls or Balance Issues	Yes	29	32.2
	No	61	67.8

Table 2 demonstrated the results pertaining to joint laxity and lower-limb stability of the population participants under the study. Joint laxity was tested with the help of Beighton scoring system which is normally applied to determine the flexibility of the ligaments. The outcome revealed that 45.6 percent of the women had a moderate level of joint laxity with 25.5 percent of them having high level of joint laxity. Only 289 percent of respondents had normal joint flexibility. These results were an indication that a significant percentage of pregnant women were exposed to a high degree of ligament laxity, which was potentially due to the effects of hormone changes, which in turn raised the levels of relaxin, estrogen and progesterone during pregnancy.

The stability of lower limbs showed that a relatively low percentage of 33.3 percent of the participants had a steady lower-limb function. On the contrary, 41.1% of them were mildly unstable, 18.9% were moderately unstable, and 6.7% were severely unstable. These results demonstrated that instability was fairly prevalent among pregnant women especially during the late pregnancy.

Also, 32.2% of respondents indicated the experience of falls or balance issues during pregnancy, and 67.8% did not. This might have been related to greater joint looseness, altered center of gravity and impaired neuromuscular control leading to the occurrence of falls.

In general, the findings revealed an apparent pattern of more laxity in joints and less stability of lower limbs of pregnant women, especially in later pregnancy. It was indicated that pregnancy-related hormonal changes were possible causes of ligamentous relaxation and reduced musculoskeletal stability which might lead to the risk of imbalance and falls. These observations have highlighted the need to watch the musculoskeletal

health and preventive measures including physiotherapy, balance training and supportive exercise in pregnancy.

CONCLUSION:

The current study has established that hormonal shifts during pregnancy were highly linked to an increment in the joint laxity and decrease in the lower-limb stability among those women who were visiting tertiary care hospitals in Pakistan. Hormones like relaxin, progesterone, estrogen were found in large amounts, and were observed to serve as the contributing factors towards relaxation of the ligaments and changes in neuromuscular control, which were all related to creating instability in the joint during pregnancy. The results showed a significant percentage of pregnant women underwent significant alterations in the mobility of knee and ankle joints followed by lower levels of balance and functional stability. Such changes were a potential risk to musculoskeletal discomfort, gait disorders, and falls in the course of pregnancy. The article has emphasized the need to evaluate and observe joint laxity at an early stage and in the context of antenatal care. It was recommended to include specific physiotherapy, body strengthening, and balance training as part of the prenatal care programs that would alleviate instability and enhance the functional mobility. In general, the research underlined the necessity of creating more clinical awareness concerning musculoskeletal impacts of pregnancy-associated hormonal variations.

REFERENCES:

1. Williams LR. Stepping into Motherhood: Pregnancy-Induced Changes to Foot Structure and Biomechanics.
2. da Costa Souza H, Castro RQ, de Oliveira Gonçalves ME, Caneco GV, dos Santos Oliveira AL, Nogueira LT, Freire ND, Carnaúba FR, Fonseca DS. Pregnant and postpartum women gait kinematics parameters: A systematic review and meta-analysis. *Gait & Posture*. 2025 Sep 1;121:25-36.

3. Topalidou A, Haworth L, Jassat R, Hawcroft-Hurst M. What do we actually know about the biomechanics of pregnancy and labour? A systematic scoping review. *Plos one*. 2025 Dec 1;20(12):e0337595.
4. Black AT, Yancovitz S, Rouse A, Logan D. Lower extremity considerations in the pregnant patient. *Foot & ankle specialist*. 2025 Oct;18(5):474-85.
5. Lin Z, Hou Y, Chen X, Liu Y, Wang X. Altered lumbo-pelvic-hip complex muscle morphometry and contraction change in postpartum pelvic girdle pain and asymptomatic subjects: a cross-sectional study. *Frontiers in Physiology*. 2025 Jan 6;15:1506553.
6. Shen Y, Wang Y, Huang P. Effects of exercise during pregnancy on maternal and newborn outcomes. *BMC Pregnancy and Childbirth*. 2025 Nov 3;25(1):1158.
7. Salvi RM, Kale S. Lower back pain in women across life stages: insights from adolescence to menopause. *Adesh University Journal of Medical Sciences & Research*. 2025 Jun 14;7(1):7-15.
8. Maliha AR, Billah MM, Arafin MM, Khalil I, Tabassum T. Successful management of Pott's disease in a young woman with 32 weeks of pregnancy: a rare case report. *Radiology Case Reports*. 2026 May 1;21(5):2059-65.
9. Woodroffe L, Slayman T, Paulson A, Kruse N, Mancuso A, Hall M. Return to Running for Postpartum Elite and Subelite Athletes. *Sports health*. 2025 May;17(3):614-20.
10. Yang K, Hu J, Wang J, Wang X, Yu X, Li Y. Functional training versus conventional physiotherapy for postpartum pelvic girdle pain: a randomized controlled trial. *Scientific Reports*. 2026 Mar 3.
11. Nawaz A, Arif Q, Khalid A, e Habiba U, Azfar H, Mahmood U. Comparative Effectiveness of Kinesio Taping and Pelvic Support Belts for Pelvic Girdle Pain in Pregnant Women: A Randomized Controlled Trial. *Journal of Health, Wellness and Community Research*. 2025 Sep 2:e721-.

12. Mhajne M, Weisman A, Yona T, Masharawi Y. Is pregnancy a major risk factor for musculoskeletal pain? A cross-sectional study. *Musculoskeletal Science and Practice*. 2025 Dec 27:103482.
13. Chmielowiec JM, Czyżewicz Z, Dworak K, Trędota N, Posid D, Lewczuk M, Dańda K, Chluddek A, Chobot B, Wachowska M. Effects of Pilates-Based Exercise on Diastasis Recti Abdominis, Pelvic Floor Function, and Musculoskeletal Pain Across the Perinatal Period: A Narrative Review. *Quality in Sport*. 2026 Feb 19;51:68441-.
14. Fetanat S, ShahAli S, Dadgoo M, Dehkordi SN, Fesharaki MN. Effect of motor control training and breathing exercises on pain, disability and core muscle activity in women with postpartum lumbopelvic pain: a study protocol for randomised controlled trial study. *BMJ open*. 2025 Mar 1;15(3):e093691.
15. Hassan A, Brockwell E, Dufour S, Dohi M, Davenport MH. Kicking Off Motherhood: Considering Return to Play Postpartum in the Footballer: A. Hassan et al. *Sports Medicine*. 2025 Aug 25:1-7.