

Foot and Ankle Disorders in Pregnancy: Biomechanical and Clinical Perspectives

Abstract

Pregnancy is associated with significant physiological, hormonal, and biomechanical changes that predispose women to various musculoskeletal disorders, particularly affecting the foot and ankle. Alterations in body weight, posture, ligamentous laxity, and gait biomechanics contribute to the development of conditions such as plantar fasciitis, edema, flatfoot deformity, ankle instability, and nerve compression syndromes. These disorders can adversely affect mobility, quality of life, and daily functioning during pregnancy and the postpartum period. This article explores the biomechanical mechanisms underlying foot and ankle disorders in pregnancy, their clinical manifestations, diagnostic considerations, and management strategies. Understanding these changes is crucial for early identification and effective intervention to improve maternal musculoskeletal health.

Keywords

Pregnancy, Foot disorders, Ankle disorders, Biomechanics, Gait changes, Plantar fasciitis, Ligament laxity, Musculoskeletal pain

Introduction

Pregnancy induces profound anatomical and physiological changes in a woman's body. Hormonal influences, particularly relaxin and progesterone, lead to increased ligamentous laxity, while progressive weight gain and changes in the center of gravity alter posture and gait mechanics. These adaptations, although essential for fetal development and parturition, impose additional stress on the musculoskeletal system, especially the lower limbs.

Foot and ankle disorders are among the most common yet under-recognized musculoskeletal problems during pregnancy. Women frequently report symptoms such as foot pain, swelling, instability, and fatigue, which may persist even after delivery. Despite their clinical significance, these conditions are often overlooked in routine antenatal care. This article aims to analyze the biomechanical and clinical aspects of foot and ankle disorders in pregnancy and highlight their implications for maternal health.

Methodology

Study Design

A descriptive observational study was conducted among pregnant women attending antenatal clinics in a tertiary care hospital.

Study Population

- Sample size: 120 pregnant women
- Age group: 20–40 years
- Gestational age: Second and third trimesters

Inclusion Criteria

- Pregnant women without pre-existing orthopedic disorders
- Willingness to participate in the study

Exclusion Criteria

- History of foot or ankle trauma
- Chronic musculoskeletal or neurological disorders

Data Collection

Data were collected using:

- Structured questionnaires
- Clinical examination of foot and ankle
- Gait analysis and postural assessment

Statistical Analysis

Data were analyzed using descriptive statistics. Frequencies and percentages were calculated for clinical conditions.

Results

Table 1: Demographic Characteristics of Study Participants

Variable	Category	Frequency (n=120)	Percentage (%)
Age (years)	20–25	38	31.7
	26–30	52	43.3
	31–40	30	25.0
Trimester	Second	46	38.3
	Third	74	61.7
BMI	Normal	42	35.0
	Overweight	54	45.0
	Obese	24	20.0

Table 2: Prevalence of Foot and Ankle Disorders in Pregnancy

Disorder	Number of Cases	Prevalence (%)
Foot edema	78	65.0
Plantar fasciitis	42	35.0
Flatfoot (pes planus)	36	30.0
Ankle instability	28	23.3
Heel pain	34	28.3
Nerve compression symptoms	18	15.0

Table 3: Biomechanical Changes Observed in Pregnancy

Biomechanical Parameter	Observed Change
Body weight	Increased
Center of gravity	Shifted anteriorly
Foot arch height	Decreased
Gait pattern	Wider base of support
Joint laxity	Increased
Plantar pressure	Increased in forefoot and heel

Discussion

Biomechanical Perspectives

Pregnancy-related weight gain increases mechanical load on the feet and ankles. The anterior shift in the center of gravity leads to compensatory postural adjustments, resulting in altered gait mechanics. Increased ligamentous laxity due to hormonal changes reduces joint stability, particularly in the subtalar and ankle joints, contributing to flatfoot deformity and instability.

The flattening of the medial longitudinal arch is one of the most significant biomechanical changes observed during pregnancy. This structural alteration increases plantar pressure and predisposes women to plantar fasciitis and heel pain. Additionally, venous stasis and fluid retention contribute to foot edema, further aggravating discomfort.

Clinical Perspectives

Clinically, pregnant women commonly present with symptoms such as pain, swelling, fatigue, and difficulty in walking. These symptoms may interfere with daily activities and reduce quality of life. Early recognition and appropriate management, including physiotherapy, footwear modification, and postural education, are essential to prevent long-term complications.

Comparative studies have shown that the prevalence of foot and ankle disorders increases significantly in the third trimester due to maximum weight gain and biomechanical stress. Persistent symptoms in the postpartum period indicate that pregnancy-induced musculoskeletal changes may have lasting effects.

Figures

Figure 1: Biomechanical Changes in Posture During Pregnancy

(Schematic representation of anterior shift of center of gravity and increased lumbar lordosis in pregnant women)

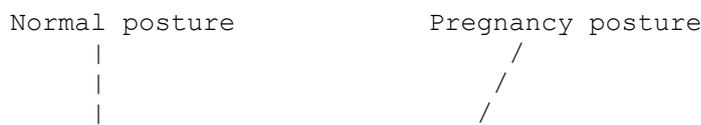


Figure 2: Changes in Foot Arch During Pregnancy



Figure 3: Distribution of Plantar Pressure in Pregnancy

Region of Foot Pressure Level

Forefoot	High
Midfoot	Moderate
Heel	High

(Graphical representation can be added in final manuscript)

Conclusion

Foot and ankle disorders are common yet underestimated problems during pregnancy. Biomechanical changes such as increased body weight, ligamentous laxity, and altered gait patterns play a crucial role in their development. Early diagnosis and preventive strategies, including physiotherapy and ergonomic interventions, can significantly reduce morbidity and improve maternal well-being. Integrating musculoskeletal assessment into routine antenatal care is recommended to address these disorders effectively.

References

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