

What to Expect When They're Expecting: A Look at Biomechanical Changes in Walking/Running During Pregnancy

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Background

The importance of physical activity throughout an individual's life is indisputable. As healthcare professionals, it is important to provide everyone with the opportunity to be active no matter their age, background or ability. Before we can provide this opportunity we must first understand the potential risks of exercise from a biomechanical lense. Walking and running are affordable and accessible forms of exercise during pregnancy, however, there is conflicting information regarding the safety. As movement experts, it is our responsibility to teach women how their body may change during pregnancy and how that can impact their walking and running mechanics. The American College of Obstetricians and Gynecologists acknowledges that exercise should be continued through pregnancy and recommends 30 minutes of moderate intensity exercise most days of the week.³ Our research can help to pinpoint the biomechanical changes in a woman's walking and running kinematics during each trimester and postpartum to keep women active and healthy throughout pregnancy.

Methods

Current research focuses on the impacts of the foot mechanics of a pregnant runner with less evidence on impacts of knee and hip mechanics. Based on the current literature, it was hypothesized that women who are pregnant will have different kinematics and kinetics of the lower extremity during walking and running as compared to women who are not pregnant. To analyze our clinical question, we used one subject under two conditions; pregnant (wearing a 9 months pregnant empathy belly) and not pregnant with 2 levels; walking and running. The participant completed 3 walking trials and 3 running trials under each condition. Joint angular

displacements were calculated using Vicon 3D-motion capture system. Ground reaction forces and joint moments of the lower extremity were calculated using Kistler© force plates. The data was analyzed in the frontal and sagittal planes to assess for gait deviations during walking and running.

Results

Current evidence supports that musculoskeletal changes occur throughout pregnancy including an increase in body mass and an anterior displacement of the individual's center of mass, that become more pronounced in later trimesters.¹ These changes can elicit biomechanical changes that alter running mechanics such as stride length/width and time spent in double limb support.¹ Postural and mechanical changes cause increased demand on the body as the woman adapts her gait to maximize stability, which can lead to increased risk of running related injuries.² Despite these changes, there are better outcomes throughout pregnancy for women who exercise before and during pregnancy.¹

Our results confirm that there are gait deviations during walking and running while pregnant. The trends observed included increased stance time as well as increased hip extension and knee abduction and adduction angular displacements while pregnant. The collected data also showed decreased hip flexion and adduction, decreased ground reaction forces and decreased knee abduction/adduction moments while pregnant, but no other significant differences of lower extremity moments were observed. See Tables 1-3.

Conclusion

The data show alignment with previous literature that gait deviations are present in walking and running during pregnancy. The question then becomes, are these biomechanical changes increasing women's risk for running-related injuries (RRI) while pregnant? Increased loading rates and prolonged rearfoot eversion during the gait cycle are two findings that could suggest

higher risk for RRI. This study is being continued further with a comparison to a real-world case. The findings from this empathy belly study will be compared to a woman who was 26 weeks pregnant. Data on her running mechanics were collected pre-pregnancy and during her second trimester, representing a comparable data set. The real-world study provides subjective data on walking and running while pregnant and enhances the validity of the data collected without the limitations of the empathy belly. The implications of this combined study will strive to discover what biomechanical changes may occur while a woman is walking and running while pregnant. These findings will contribute to a scarce and growing body of research on how to optimally educate women who are pregnant and exercising to prevent or treat RRI. Determining common biomechanical gait changes while pregnant that may increase a woman's risk for RRI is a key component to preventing injury and allowing women to continue to exercise safely throughout pregnancy.

References

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2. Branco M, et al. Kinematic analysis of gait in the second and third trimesters of pregnancy. *J Pregnancy.* 2013; doi 10.1155/2013/718095
3. Physical activity and exercise during pregnancy and the postpartum period. Committee Opinion No. 650. American College of Obstetricians and Gynecologists. *Obstet Gynecol.* 2015;126:135-142.

Supporting Materials

Table 1

MOMENTS (Nm/kg)	Non-pregnant Walk	Pregnant Walk	Non-pregnant Run	Pregnant Run
Hip Flexion	15.64 ± 1.47	12.51 ± 1.12	16.79 ± 1.22	12.54 ± 1.78
Hip Extension	21.07 ± 0.82	21.68 ± 1.03	8.40 ± 4.29	15.44 ± 0.79
Hip Adduction	10.26 ± 1.18	11.25 ± 0.64	18.99 ± 2.19	19.66 ± 1.28
Hip Abduction	5.05 ± 0.81	4.55 ± 1.84	6.70 ± 0.57	3.03 ± 0.47
Knee Flexion	6.28 ± 0.45	6.68 ± 0.46	21.3 ± 1.16	21.76 ± 2.09
Knee Extension	8.36 ± 1.27	7.18 ± 0.91	8.79 ± 0.35	5.72 ± 1.59
Knee Adduction (Varus)	6.61 ± 0.94	4.97 ± 0.69	14.92 ± 1.84	11.34 ± 0.23
Knee Abduction (Valgus)	3.12 ± 0.55	2.16 ± 0.47	2.10 ± 0.21	0.53 ± 0.36
Ankle Dorsiflexion	27.81 ± 0.43	23.01 ± 0.45	42.75 ± 1.15	30.65 ± 3.51
Ankle Plantarflexion	1.5 ± 0.07	1.63 ± 0.05	0.56 ± 0.05	0.55 ± 0.33
Ankle Inversion	0.75 ± 0.58	0.30 ± 0.20	0.39 ± 0.08	0.17 ± 0.08
Ankle Eversion	1.14 ± 0.41	0.89 ± 0.13	0.96 ± 0.31	1.02 ± 0.07

Table 1: Joint moments in the frontal and sagittal planes during pregnant/not pregnant running and walking tasks.

Table 2

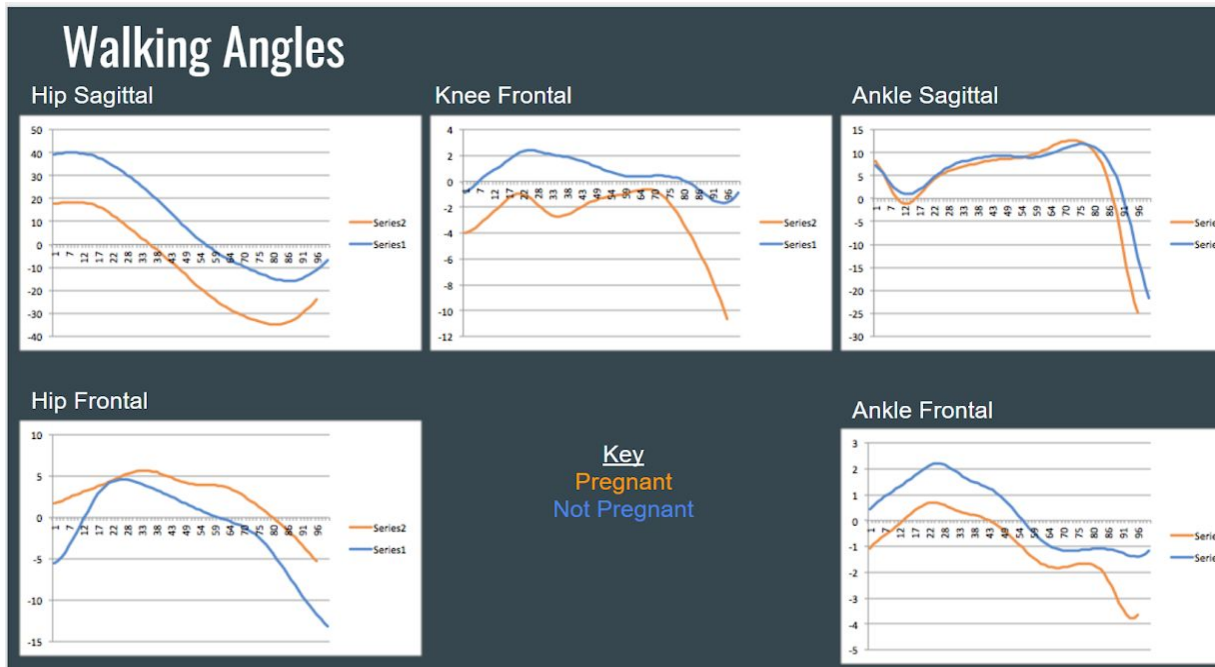


Table 2: Joint angles in the frontal and sagittal plane during walking tasks. Pregnant is represented by orange and not pregnant is represented by blue.

Table 3

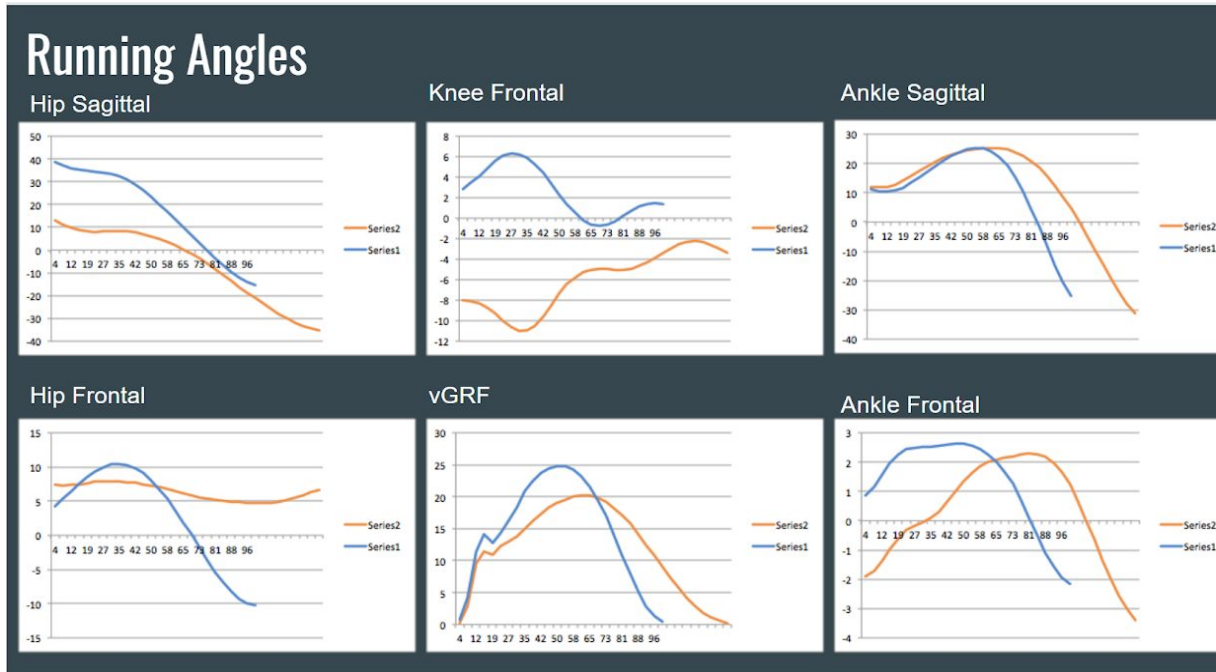


Table 3: Joint angles in the frontal and sagittal plane and ground reaction forces during running tasks. Pregnant is represented by orange and not pregnant is represented by blue.