

# Assessing Plantar Pressure and Feet Pain in Females during the Third Trimester of Pregnancy

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## ABSTRACT

**Background:** The centre of gravity is altered in pregnant females resulting in hyperextended knees and resulting pain in the lower back and feet due to postural changes to adapt and recreate balance. The frequency and prevalence of back pain in the second and third trimesters are around 43.6% and 34.8% respectively, whereas the frequency of foot swelling is found to be around 32.6% of pregnant females in the third trimester. Similar trends are observed in overweight non-pregnant females with prevalence trends as the frequency of ankle and feet pain, and knees pain found to be in 68.7% and 53.3% respectively.

**Aims:** This study will aim to assess plantar pressure and feet pain in pregnant females in the third trimester. The study will further assess and compare the severity of symptoms between pregnant females and females who are overweight or obese using a visual analogue scale.

**Materials and methods:** A cross-sectional study was conducted during the period of November 2020 to October 2021. The study was conducted at the Orthopaedic department of Mardan Medical Complex/BKMC, Mardan and Obs and Gynae department of Swabi Medical Complex /GKMC, Swabi. It consisted of 90 females which comprised the study group and control group. The study group consisted of 45 females who were in the third trimester of pregnancy. All the recruited control participants had BMI in the overweight category. The control group consisted of 45 females and the recruitment criteria for the control group as females with Body Mass Index (BMI) ranging between overweight and obese. Both study and control groups were assessed for plantar pressure and foot pain by employing a visual analogue scale for pain severity.

**Result:** The readings showed that the study group 37.7% (17 participants out of 45) complained of an 8/10 severity of pain during the third trimester whereas control participants 24.4% (11 out of 45) showed a 6/10 severity of pain. 91.1% of study group females showed the severity of pain to be 6/10 or more. Results showed that a maximum number of pregnant females had plantar pressure and feet pain similar to or more than that of the control group. Moreover, the control group showed 57.7% of females having symptom severity similar to or greater than 6/10 on the visual analogue scale.

**Conclusion:** The results suggest the prevalence of severe feet pain and plantar pressure is significantly greater in pregnant females in the third trimester with 91.1% as compared to 57.7% of non-pregnant obese females. The severity of pain was also recorded to be higher in pregnant females than in control counterparts.

**Keywords:** Plantar pressure, Feet pain, Pregnancy, Obesity, Visual analogue scale.

## INTRODUCTION

It is not uncommon to think that increased weight gain due to developing fetuses in pregnant females alters the weight-bearing capacity in females. Evidence suggests that during the development of the fetus and resultant weight changes in the mother, accompanied change is observed in the centre of gravity. Pregnant females have a change in centre of gravity which lies in the abdominal area which is followed by musculoskeletal adaptation such as hyperextension of knees and more commonly notice pronounced feet [1]. With the progression of pregnancy, females usually start complaining of feet and lower back pain around the second trimester [2]. To accommodate the unusual weight and pressure increased pronation of the feet is seen during the second and third trimester of pregnancy in comparison to normal counterparts [3]. Therefore, many pregnant females complain of lower back pain and an increase in foot pain during the second and third trimesters of pregnancy [4]. The frequency and prevalence of back pain in the second and third trimesters are around 43.6% and 34.8% respectively, whereas the frequency of foot swelling is found to be around 32.6% of pregnant females in the third trimester [5]. Weight gain during pregnancy is not the only cause of feet pain. Overweight and obese females are found to have varying ranges of foot pain along with flatter feet [6]. Prevalence of musculoskeletal pain is also significantly high in overweight individuals with the frequency of ankle and feet pain, and knees pain found to be at 68.7% and 53.3% respectively [7].

This study will aim to assess plantar pressure and feet pain in pregnant females in the third trimester. The study will further assess and compare the severity of symptoms between pregnant females and females who are overweight or obese using a visual analogue scale. A visual analogue scale is a psychometric instrument used to assess the severity of symptoms based on

subjective answers in response to the severity scale provided; subject can mark the severity of their symptoms on a 10 cm line with starting end labelled as no pain and endpoint labelled as not more pain possible [8].

## METHODOLOGY

The study design of this clinical research is cross-sectional and was conducted during the period of January 2020 to December 2020. This study was conducted at the Orthopaedic department of Mardan Medical Complex/BKMC, Mardan and Obs and Gynae department of Swabi Medical Complex /GKMC, Swabi. The study consisted of 90 females which comprised the study group and control group. The study group consisted of 45 females who were in the third trimester of pregnancy. All the recruited control participants had BMI in the overweight category. The control group consisted of 45 females and the recruitment criteria for the control group as females with Body Mass Index (BMI) ranging between overweight and obese. Control and study subjects were compared at the 32<sup>nd</sup> week of gestation. The exclusion criteria for the study included control females in any other trimester than third, females who have normal BMI, females that have a systemic disease which can alter the credibility of pain assessment such as arthritis, leg or foot replacement or reparative surgeries or any other musculoskeletal disease that may sabotage the pain perception.

Both study and control groups were assessed for plantar pressure and feet pain by employing a visual analogue scale for pain severity. A visual analogue scale is a type of psychometric scale which allows the characterization of pain associated with diseases based on subjective response to a set of questions and enable health worker to classify the severity of patients' symptoms [9]. It was made sure that the demographical data of the study and control groups were coincident and variables that were included in

demographic data were age, BMI, height and weight. The demographic data of the study and control group are as follows:

Table 1: Demographic data of control and study group

Demographic data	Study group	Control group
age	30.2 years $\pm$ 4.5	29.3 years $\pm$ 3.9
BMI	28.3 $\pm$ 0.4	28.9 $\pm$ 0.4
height	157 cm $\pm$ 4	161 $\pm$ 5
weight	72 kg $\pm$ 8	71 kg $\pm$ 6

## RESULTS

A visual analogue scale was used for the assessment of plantar pressure and feet pain for females in the third trimester and the control group. The visual analogous scale consisted of a 100mm scale with one extreme labelled as no pain and the other labelled as agonizing pain. Both control and study groups were subjectively allowed to label the scale in accordance with the severity of pain. Assessment of scale was made for both groups. the findings were observed by measuring the mark placed by a participant from the start point and documented over 10. The results of the study showed the following trend:

Table 2: readings of visual analogue scale

Visual analogue scale reading	Number of study participants	Number of control participants
10/10	2	0
9/10	6	4
8/10	17	4
7/10	10	7
6/10	5	11
5/10	2	8
4/10	3	6
3/10	0	2
2/10	0	2
1/10	0	1

The readings showed that the study group showed the highest number of study group 37.7% (17 participants out of 45) complained of an 8/10 severity of pain during the third trimester whereas the highest number of control participants was 24.4% (11 out of 45) showed a 6/10 severity of pain. 91.1% of study group females showed the severity of pain to be 6/10 and more showed a maximum number of pregnant females had plantar pressure and feet pain similar to or more than that of the control group. Moreover, the control group showed 57.7% of females having symptom severity similar to or greater than 6/10 on the visual analogue scale.

## DISCUSSION

This research assessed the plantar pressure and foot pain in pregnant females in the third trimester and non-pregnant obese counterparts. The study found that pregnant females reported higher frequency and severity when foot pain and plantar pressure were measured on a visual analogue scale than their non-pregnant obese counterparts. This section of this literary piece will compare and contrast the findings of this experimental research against pre-existing literature.

feet pain and plantar pressure have been major complaints of pregnant and obese females. The prevalence of pain in both groups is significant however some studies report a higher prevalence in one group over another. A study conducted by Ramachandra et al. assessed the frequency of foot pain in the third trimester of pregnancy within the Indian population. The sample size of the study consisted of 261 pregnant females. The participants were subjected to a questionnaire-based assessment of musculoskeletal pain. The results of the study showed that 37.1% of the participants reported foot pain and increased plantar pressure [10]. A similar study was conducted by Harrison et al. in 2016 where they assessed musculoskeletal pain in pregnant females in comparison to control counterparts. The study population consisted of 15 pregnant females and 14 non-pregnant

females. The results of the study showed that arch rigidity, lower back pain and foot pain were common findings among pregnant females [11]. These studies show that foot pain has been a long-documented problem in females during gestation and the frequency of findings is high in these studies, however frequency of reported foot pain is not as great as found in this research article. The variability of such results must be due to variation of the gestational period in each research as this clinical experiment only recruited participants from the third trimester whereas the other two studies recruited participants irrespective of their gestational age.

The comparison between pain severity among pregnant females and their non-pregnant counterparts, although intriguing, is very less studied. Elsayed et al. studied the changes in plantar pressure in pregnant females in the year 2017. Their study sample included 22 pregnant females in a study group and 22 non-pregnant females in the control group. The severity of pain was assessed by using a visual analogue scale whereas plantar pressure was evaluated by a global postural analysis device. The results of the study showed that the study group had asymmetry in bearing weight as well as increased severity of pain in comparison to the control group. Furthermore, the authors also suggested that excessive contact points at levels of calcaneus bone, 1<sup>st</sup> and 5<sup>th</sup> metatarsal were identical in both groups however, the study group showed a directly proportional relationship between gestational period and load on 5<sup>th</sup> metatarsal [12]. Another study by Ondrej et al. conducted in 2017 assessed the variation of plantar pressure in pregnant females during gestation periods of 27<sup>th</sup> week to 36<sup>th</sup> week. The number of study participants was 72 who were divided into study and control groups. Results of the study showed that during pregnancy an increase in peak plantar pressure was visualized in the midfoot area on the left foot and on the right foot peak plantar pressure was seen in the hindfoot in the study group [13]. The studies previously mentioned also suggest that an increase in pain severity is more common in pregnant females in comparison to obese counterparts. The change in plantar pressure peaks and postural changes may indicate increased susceptibility to pain and symptoms.

## CONCLUSION

The results suggest the prevalence of severe feet pain and plantar pressure is significantly greater in pregnant females in the third trimester with 91.1% as compared to 57.7% of non-pregnant obese females. The severity of pain was also recorded to be higher in pregnant females than in control counterparts. As advocated by pre-existing studies and other evidence it can be concluded that pregnant females are more susceptible to foot pain during gestation and peak pain complaints are seen towards the end of pregnancy in the third trimester. Furthermore, studies suggest a shift in plantar pressure to be more in the middle of the foot in the left foot and towards the hindfoot in the right foot.

**Recommendations:** the author recommends further research on larger models to assess kinematic changes in pregnancy which may be responsible for plantar pressure change and increased foot pain in pregnant females.

## REFERENCES

1. K. A. P. A. L. N. Vlasova<sup>1</sup> EV, "Change of anatomical parameters of the foot in the second and third trimesters of pregnancy," 2020.
2. D. A. A. R. M. G.-N. G. Y. C. Pardo FJ, "Changes in foot posture during pregnancy and their relation with musculoskeletal pain: A longitudinal cohort study," *Women and Birth*, vol. 31, no. 2, pp. 84-8, 2018.
3. O.-H. O. M.-G. M. T.-R. F. M.-O. A. C. M. B. J. P. A. Martínez-Martí F, " Plantar pressure changes and their relationships with low back pain during pregnancy using instrumented insoles," *Journal of Sensors*, 2019.
4. Z. D. Bakilan F, "Musculoskeletal problems during pregnancy," *Journal of Clinical Medicine of Kazakhstan*, vol. 6, no. 60, pp. 53-5, 2020.

5. W. K. K. M. M. E. Jankowicz-Szymańska A, "Foot longitudinal arches in obese, overweight and normal weight females who differ in age," *Homo*, vol. 69, no. 1-2, pp. 37-42, 2018.
6. N. M. d. S. R. A. S. E. Mendonça CR, "High prevalence of musculoskeletal pain in individuals with severe obesity: sites, intensity, and associated factors," *Korean Journal of Pain*, vol. 33, no. 3, pp. 245-47, 2020.
7. H. M. Begum MR, "Validity and reliability of visual analogue scale (VAS) for pain measurement," *Journal of Medical Case Reports and Reviews*, vol. 2, no. 11, 2019.
8. S. AJ, "Visual analogue scale. A simple tool for daily treatment monitoring in allergic rhinitis," *Pediatrics I Medycyna Rodzinna-Paediatrics Family Med*, vol. 14, no. 3, pp. 277-81, 2018.
9. M. A. K. P. K. A. Ramachandra P, "Prevalence of musculoskeletal dysfunctions among Indian pregnant women," *Journal of pregnancy*, 2015.
10. M. C. T. K. M. P. M. J. Harrison KD, "The Relationship Between Lower Extremity Alignment and Low Back, Hip, and Foot Pain During Pregnancy: A Longitudinal Study of Primigravid Women Versus Nulliparous Controls," *Journal of Women's Health Physical Therapy*, vol. 40, no. 3, pp. 139-146, 2016.
11. D. I. E. H. A. A. A. M. Elsayed E, "Changes in foot plantar pressure in pregnant women.," *Journal of back and musculoskeletal rehabilitation*, vol. 30, no. 4, pp. 836-7, 2017.
12. G. M. Z. M. Mikeska O, "Assessment of distribution of plantar pressures and foot characteristics during walking in pregnant women," *Acta of Bioengineering and Biomechanics*, vol. 21, no. 3, 2019.