

Gait variables comparison between pregnant women with and without lumbopelvic pain

Comparação entre variáveis da marcha entre grávidas com e sem dor lombopélvica

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ABSTRACT

BACKGROUND AND OBJECTIVES: The various gestational adaptations may lead to changes in the gait pattern. Also, the lumbopelvic pain in this period can impact the gait dynamics. The objective of this study was to compare gait variables between pregnant women with and without lumbopelvic pain, according to the gestational trimesters, and to compare the outcome variables between the second and third gestational trimesters.

METHODS: Analytical and cross-sectional study with 277 pregnant women. They were divided into two groups, considering the gestational trimester as a grouping factor. Subsequently, the two groups were subdivided considering the absence or presence of lumbopelvic pain. All participants were submitted to the evaluation protocol: identification form, visual analog scale, and gait assessment using the Balance Master System®.

RESULTS: The chronological age averages of the second and third-trimester groups were, respectively, 29.9±4.6 and 29.7±3.7 years. When comparing gait variables between pregnant women with and without lumbopelvic pain, a statistically significant difference was observed only for the gait velocity ($p=0.04$) in the third-trimester group.

CONCLUSION: It is suggested that women in the third trimester with complaints of lumbopelvic pain have reduced gait velocity when compared to those without pain.

Keywords: Gait, Low back pain, Pregnancy.

RESUMO

JUSTIFICATIVA E OBJETIVOS: As diversas adaptações decorrentes da gestação podem levar a modificações no padrão da marcha. A queixa de dor lombopélvica nesse período pode repercutir na dinâmica da marcha. Assim, o objetivo deste estudo foi comparar as variáveis da marcha entre gestantes com e sem dor lombopélvica, respeitando os trimestres gestacionais, e comparar as variáveis-desfecho entre o segundo e o terceiro trimestre gestacionais.

MÉTODOS: Estudo do tipo analítico e transversal com 277 gestantes alocadas em dois grupos, considerando o trimestre gestacional como fator de agrupamento. Posteriormente, os dois grupos foram subdivididos considerando a ausência ou presença de dor lombopélvica. Todas as participantes foram submetidas ao protocolo de avaliação: preenchimento de ficha de identificação, escala analógica visual e avaliação da marcha por meio do Balance Master System®.

RESULTADOS: As médias da idade cronológica para o grupo do segundo e terceiro trimestres foram, respectivamente, entre 29,9±4,6 e 29,7±3,7 anos. Ao comparar as variáveis da marcha entre gestantes com e sem dor lombopélvica foi observada diferença estatisticamente significativa, apenas para a velocidade da marcha ($p=0,04$), no grupo do terceiro trimestre.

CONCLUSÃO: Sugere-se que mulheres no terceiro trimestre com queixas de dor lombopélvica apresentam redução da velocidade da marcha, quando comparadas àquelas sem dor.

Descritores: Dor lombopélvica, Gravidez, Marcha.

INTRODUCTION

Pregnancy is a physiological process in which several changes occur in the woman's body that can lead to changes in the gait pattern. These changes include: ligament laxity, changes in the center of gravity (CG), decreased neuromuscular control, anthropometric alterations in the size of the support base and the width of the feet, deviations of ground reaction forces (GRF) and propulsion force^{1,2}.

During pregnancy, women often complain about lumbopelvic pain (LPP)^{3,4}. LPP usually increases throughout pregnancy, reaching a peak of greater severity in the third trimester⁴. Increased abdominal volume observed during this period may cause a decrease in the range of motion of the torso, and it may affect their gait dynamics³.

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Gait is an activity of daily life, being one of the main abilities of the human being. Even though it is a natural gesture, it is believed that different patterns in this ability occur throughout the gestation process⁵. Previous studies analyzing gait changes during pregnancy report that there is a decrease in gait length, increased step width, changes in torso movement and reduced self-selected walking speed⁴ during this period. There is also an increase in the duration of the stance phase, while the duration of the swing phase remains virtually unchanged⁶.

Previous studies have suggested that pregnant women with lumbopelvic pain have impairments in performing gait due to changes in coordinating pelvis and torso rotation⁵. In addition, musculoskeletal discomfort in this period may be associated with overloads occurring as a consequence of secondary gait deviations, which try to correct weight gains and weight distribution throughout the body⁵. These factors make it difficult to analyze the characteristics of gait during pregnancy, and it is necessary that its evaluation respects the gestational trimester.

However, there are still few studies that analyze the influence of LPP on gait variables during gestation. Thus, this article has the main objective to compare the gait variables between pregnant women with and without LPP, respecting the gestational trimesters which the volunteers are in. Secondly, we aimed to compare the outcome variables between the second and third gestational trimesters.

METHODS

This study is characterized as analytical and cross-sectional research.

The research was developed in the Physiotherapy Department of the Federal University of Rio Grande do Norte, in the Laboratory of Analysis of Neuromuscular Performance (LAPERNE), from December 2014 to December 2015.

The sample of 277 pregnant women was recruited from a population of 338 pregnant women attending the Multiprofessional Course for Pregnant Women, sampled by convenience. For the initial analyzes, the sample was divided into two groups, considering the pregnant women who were in the second and third trimesters as a grouping factor. These two groups were subsequently subdivided, regarding the absence or presence of lumbopelvic pain, as shown in the flowchart (Figure 1).

The inclusion criteria for the sample selection were: (1) women in the second or third gestational trimesters; (2) enrolled and participating in the Multiprofessional Course for Pregnant Women; and (3) with low-risk pregnancies. Those who: (1) did not complete the evaluation protocol; or (2) wished to drop out of the study were excluded from the research.

Clinical, obstetric and gestational-related information was collected through an evaluation form designed and structured by

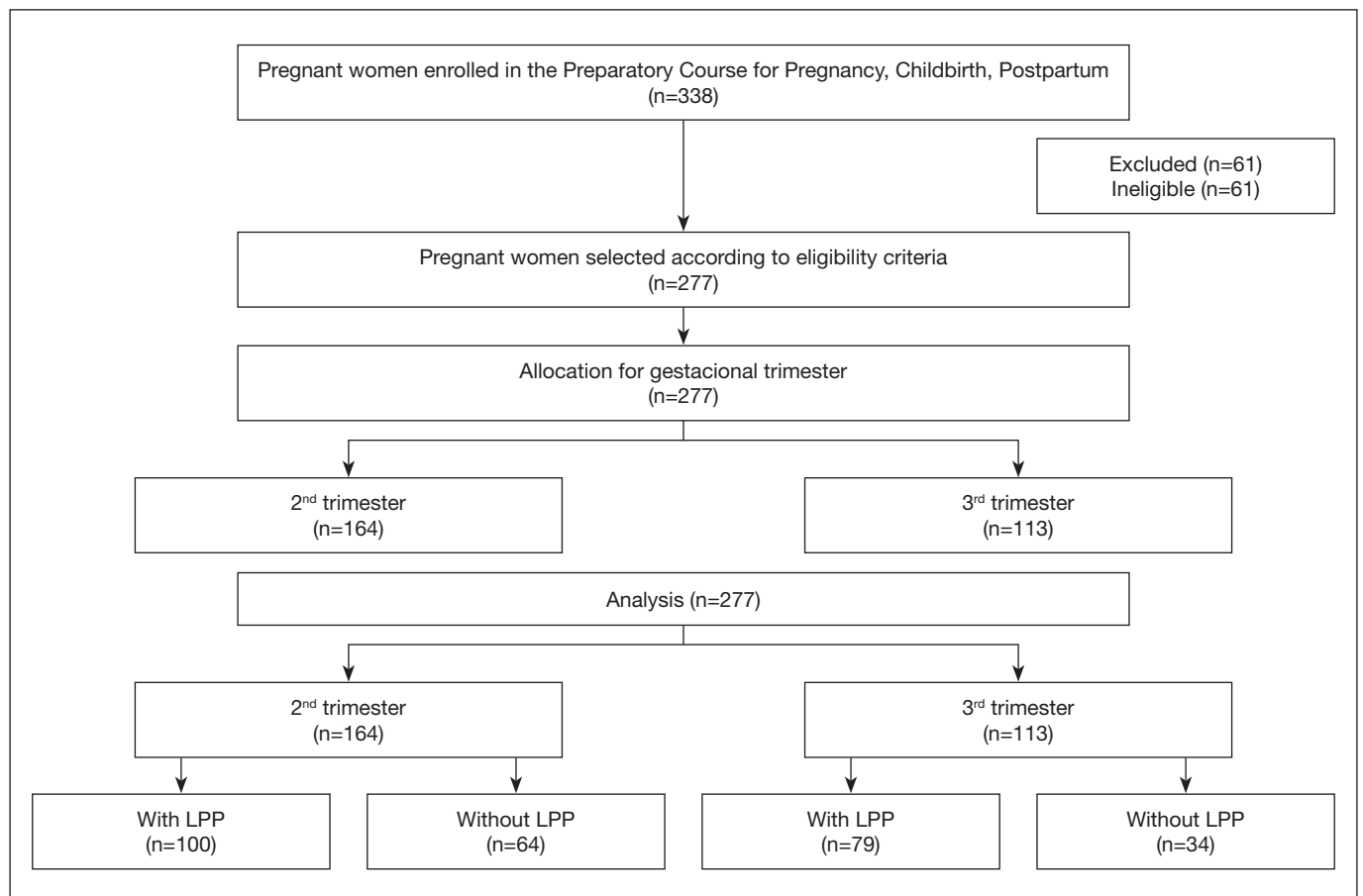


Figure 1. Study distribution flowchart
LPP = lumbopelvic pain.

the responsible researchers. After this procedure, volunteers were questioned about the presence or absence of LPP. If affirmative, the pregnant woman informed the researcher about the intensity of pain according to the visual analog scale (VAS). The VAS is an instrument graduated from zero to 10, in which zero represents the absence of pain, and 10 the maximum amount of tolerable pain. The pain intensity is divided into categories, in which: 1 to 2, the intensity is considered mild; 3 to 7 is moderate; 8 to 9 is intense, and 10 is unbearable. This instrument has been used for the evaluation of pain intensity in populations of pregnant women^{7,8}. The Balance Master System[®] (NeuroCom, Clackamas, USA) was used for evaluating gait. This equipment consists of a system that uses a force platform with four transducers which measure the vertical reaction forces exerted by the individual's feet, the CG position and quantitative measures of static and dynamic balance performance⁹. The analysis of the gait variables was performed using the Walk Across (WA) test.

During execution of the WA test, the participants had their gait evaluated into four different variables, obtaining measurements for each of: (1) step width (SW) in centimeters; (2) step length (SL) in centimeters; (3) speed of progression (SPEED), in centimeters per second; and (4) symmetry of step length (SSL) in percentage (9). Each participant performed the test 3 times, and an average of the obtained values was implemented for data analysis. In all the situations, the volunteer was instructed to walk at free speed. The study was approved by the Human Research Ethics Committee of the Federal University of Rio Grande do Norte under protocol number 719.939 and registered in the Brazilian Registry of Clinical Trials under the Registry number RBR-4j35g5.

All the volunteers signed the Free and Informed Consent Form (FICF) in accordance with Resolution 466/12 of the National Health Council.

Statistical analysis

The Shapiro Wilk test was used to verify the normality of the quantitative variables. For the sample characterization, a descriptive analysis was performed regarding sociodemographic, obstetric and anthropometric data, lifestyle and lumbopelvic pain. This analysis presented the average and the standard deviation, as well as the absolute and relative frequencies, depending on the type of variable (categorical and quantitative).

The Mann-Whitney test was used to compare the gait variables between the formed groups considering the gestational trimester and the presence or absence of lumbopelvic pain. The statistical significance considered was $p < 0.05$. The calculation of the sample size was done through openepi.com site. A power of 80%, 95% confidence interval and the following means for the oscillation velocity were considered: group with pain, $14^{\circ}/\text{sec} \pm 4$ and group without pain, $10^{\circ}/\text{sec} \pm 5$. The sample per group was 21. Therefore, the sample expected for the study was 88 pregnant women.

RESULTS

The total sample for this study was 277 pregnant women. The average for the chronological age for the second and third-trimester groups was 29.9 ± 4.6 and 29.7 ± 3.7 years, respectively. The other data represent sociodemographic, obstetric and anthropometric data, life habits and data regarding subjective pain (Table 1).

Table 1. Sociodemographic, obstetrical and anthropometric characteristics of pregnant women participating in the study (n=277)

Variables	2T (n=164)	3T (n=113)	p-value
Sociodemographic data			
Age (years) (Mean±SD)	29.90±4.67	29.77±3.72	0.80
Education level (years) (Mean±SD)	16.34±3.25	16.62 ± 3.49	0.54
Marital status (% and n)			
Have a partner	93.9 (154)	92.9 (105)	
Does not have a partner	6.1 (10)	7.1 (8)	
Obstetrical data (Mean±SD)			
GA (weeks)	20.79±3.51	30.05 ± 2.31	0.001*
Parity (% and n)			
Nulliparous	90.2 (148)	95.6 (108)	
Multiparous	9.8 (16)	4.4 (5)	
Anthropometric data and life habits (Mean±SD)			
Weight (kg)	66.21±10.41	71.30±10.25	0.001*
Height (m)	1.62±0.06	1.62±0.06	0.81
Body mass index	24.93±4.0	27.01±3.66	0.001*
Weight gain (kg)	5.97±4.20	5.86±3.63	0.82
Physical activity (% and n)			
Active	36 (59)	46% (55)	
Sedentary	64 (105)	54% (61)	
Subjective data from LPP (Mean±SD)			
VAS	3.37±2.9	3.72±2.8	

Categorical variables are expressed as relative and absolute frequencies. The quantitative variables are expressed as mean±SD. 2T = 2nd trimester; 3T = 3rd trimester; GA = gestational age; LPP = lumbopelvic pain; VAS = visual analog scale. *statistically significant differences.

Table 2. Comparison of the variables of gait among pregnant women with and without lumbopelvic pain, considering the gestational trimesters

Variables	2 nd Trimester			3 rd Trimester		
	No. (n=64)	Yes (n=100)	p-value	No. (n=34)	Yes (n=79)	p-value
SW	14.20 (12.52-15.92)	14.70 (12.07-16.17)	0.74	15 (12.40-16.72)	14.90 (12,60-17,20)	0.80
ASL	56.70 (50.65-61.30)	54.80 (48.72-59.97)	0.10	55.05 (48.12-64.82)	55.20 (48.80-59.60)	0.64
SSL	70.50 (61.37-81.02)	68.85 (60.15-77.02)	0.23	72.35 (62.60-80.32)	67.40 (60.50-74.50)	0.04*
SCP	10.50 (5.00-22.75)	12 (6.00-21.50)	0.49	8 (3.00-18.25)	12 (5.00-22.00)	0.14

The variables are expressed as median and interquartile ranges. SW = step width (in cm); ASL = average step length (in cm); SSL = speed step length (in cm/s); SCP = step length symmetry (in %); *statistically significant differences (<0.05).

Table 3. Comparative analysis of gait variables between women in the second and third gestational trimesters

Variables	2T (n=164)	3T (n=113)	p-value
SW	14.50 (12.32 - 16.10)	15.00 (12.55 - 17.00)	0.05
ASL	55.30 (49.60 - 60.17)	55.20 (48.75 - 60.40)	0.76
SSL	69.35 (61.12 - 78.07)	69.10 (60.85 - 76.15)	0.56
SCP	11.50 (5.00 - 22.00)	11.00 (4.00 - 21.00)	0.46

The variables are expressed as median and interquartile ranges. SW = step width (in cm); ASL = average step length (in cm); SSL = speed step length (in cm/s); SCP = step length symmetry (in %); 2T = 2nd trimester; 3T = 3rd trimester.

Gait and lumbopelvic pain

A statistically significant difference was only observed for gait velocity ($p=0.04$) in the third-trimester group when comparing gait variables between pregnant women with and without lumbopelvic pain according to the subjective pain assessment (Table 2).

Gait and gestational trimester

No significant differences ($p<0.05$) were found between the gait variables comparing pregnant women in the second and third trimesters. The results of this analysis are shown in table 3.

DISCUSSION

The objectives of this study were comparing gait variables between pregnant women with and without LPP and between the second and third trimesters. The main results show that there were no differences when comparing both groups by trimester. However, in relation to gait, pregnant women in the third trimester with LPP presented lower gait velocity when compared to pregnant women in the third-trimester without pain.

LPP is considered one of the main syndromes of the gestational period, affecting more than a third of pregnant women, especially in the third trimester of the gestational period^{10,11}.

Previous studies have suggested that the gait pattern is modulated by the presence and intensity of pain, especially when it is lo-

cated in the lumbar region, pelvic girdle and lower limbs¹². Pelvic pain may lead to gait damage due to coordination problems in pelvic and torso rotation^{10,13,14}.

No differences were found in gait variables for the group of pregnant women in the second trimester in the present study. However, pregnant women in the third trimester with LPP presented reduced gait velocity when compared to those without pain. This result was similar to that described by Wu et al.¹⁴ and Wu et al.¹³, who observed that pregnant women with low back pain had an average gait velocity lower than those who did not report pain^{13,14}. The authors attributed this finding to the greater synchronization of the pelvic and thoracic rotations, reflecting in a smaller dissociation between these body regions¹⁴.

A study carried out by Yoo, Shin and Song⁴ suggests that gait velocity is reduced in pregnant women in the third trimester as a result of pain and the increased lumbar spine curvature. Moreover, this reduction is associated with the fact that pregnant women walk more carefully in order to minimize the risk of falls. The reduced gait velocity in women with pain complaints may be related to the overload in the muscular groups involved in the gait phases¹⁵. Pain is the result of a complex interaction between the signaling and modulation systems of higher centers, associated with individual perception^{16,17}. Thus, it is suggested that the perception of pain in the group of pregnant women in the third trimester is more accentuated by the presence of factors such as fatigue, tiredness and edema (most common at the end of pregnancy), which may be mainly reflected in the gait velocity¹⁸.

No statistically significant difference was observed between groups comparing gait variables among women in the second and third gestational trimesters. Different results were found by Bertuit, Feipel and Rooze¹⁹, who compared space-time gait variables among pregnant, postpartum and non-pregnant women. By analyzing the group of pregnant women, the authors observed a decrease in gait velocity, step length, and cadence, in addition to increased step width among women in the third trimester compared to those in the second gestational trimester¹⁹.

In analyzing the characteristics of lumbopelvic pain, gait and postural balance among pregnant women in the second and third trimester, Yoo, Shin and Song⁴ found that women in the third trimester had lower gait velocity and cadence compared

to those in the second trimester. On the other hand, Branco, Santos-Rocha and Vieira²⁰ suggest that there is a decrease in the length and increase in step width throughout pregnancy.

Gottschall, Sheedan and Downs²¹ compared spatiotemporal variables and muscle activation pattern among women in the second and third gestational trimesters and found that those in the third trimester presented lower gait velocity, more time in the support phase and increased step width when compared to those in the second trimester.

According to literature data, changes in gait spatiotemporal and angular variables may be related to weight gain during pregnancy^{22,23}, which mainly occurs in the third trimester. During this period, women gain between 11 and 16 kg^{24,25}, which influences the maternal shape, size, and inertia²⁶. Therefore, we suggest that the characteristic weight gain in pregnancy would affect the hip, knee and ankle joints through gravitational and acceleration factors. This fact would require an adaptation in the inter-segmental moments to fit the shape and inertia of the lower trunk and generate adjustments, both in posture and in gait during gestation⁵.

However, no differences in weight gain were observed in this study when comparing the second and third trimesters. For the sample studied, the mean weight gain was approximately 6kg. Thus, we suggest that the absence of statistical difference for gait variables when comparing both groups can be justified by a smaller value in weight gain. We also suggest that pregnant women adapt their gait pattern to maximize stability and control mid-lateral movements⁵.

CONCLUSION

The results of this study suggest that women in the third trimester with complaints of lumbopelvic pain present reduced gait velocity when compared to those without LPP. Additionally, we found that the gait pattern is similar among pregnant women in the second and third trimesters.

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