International Journal of Women's Health

Dovepress

open access to scientific and medical research

Open Access Full Text Article

ORIGINAL RESEARCH

Prevalence and Predictors of Leg Cramps in the Third Trimester of Pregnancy: A Cross-Sectional Study

Ala'a Abandeh[1], Amer Sindiani[2], Mohammad S Nazzal[1], Nihad A Almasri[3], Afnan Megdadi[2], Linzette Morris[4], Eman Alshdaifat[5], Saddam F Kanaan[4]

[1]Department of Rehabilitation Sciences, Jordan University of Science and Technology, Irbid, Jordan; [2]Department of Obstetrics and Gynecology, Jordan University of Science and Technology, Irbid, Jordan; [3]Department of Physical Therapy, The University of Jordan, Amman, Jordan; [4]Department of Rehabilitation Sciences, College of Health Sciences, QU Health, Qatar University, Doha, Qatar; [5]Department of Obstetrics and Gynecology, Faculty of Medicine, Yarmouk University, Irbid, Jordan

Correspondence: Saddam F Kanaan, Department of Rehabilitation Sciences, College of Health Sciences, QU Health, Qatar University, P.O. Box: 2713, 1st Floor, Building 106 Ibn Bitar, Doha, Qatar, Email saddam@qu.edu.qa

Objective: This study aimed to estimate the prevalence and determine predictors of leg cramps among pregnant women in their third trimester.

Methods: A sample of pregnant women in their third trimester who routinely visited local clinics in Jordan was recruited. Participants completed a socio-demographic and clinical characteristics questionnaire, the numeric pain rating scale (NPRS) for leg cramp pain intensity, the Arabic version of the Pregnant Physical Activity Questionnaire (PPAQ), the Nordic Musculoskeletal Questionnaire (NMQ), Short Form Health Survey (SF-12), Pittsburgh Sleep Quality Index (PSQI), and Hospital Anxiety and Depression Scale (HADS). In addition, magnesium (Mg) and calcium (Ca) serum levels were examined. Logistic regression analyses were used to identify predictors of leg cramps occurrence. A linear regression model was used to investigate predictors of leg cramps pain intensity among pregnant women who reported leg cramps.

Results: Two hundred and five (n=205) pregnant women completed the study. The estimated prevalence of leg cramps was 58%. Logistic regression results showed that not receiving assistance with housework (OR 0.46, p=0.025), progress in the number of gestational weeks (OR 1.10, p=0.021), the number of previous pregnancies (OR 1.21, p=0.049), having leg swelling (OR 2.28, p=0.019), and having gastrointestinal (GIT) problems (OR 2.12, P=0.046) were associated with a higher odds of leg cramps occurrence. In the subsample with pregnant women with leg cramps, linear regression results showed that pregnant women with high school education versus elementary school (β=0.70, p=0.012), number of working hours (β=0.11, p=0.010), using vitamins supplements (β=−1.70, p=0.043), having diabetes after pregnancy (β=1.05, p=0.036), having sciatica (β=0.58, p=0.028), having hip pain (β =−.33, p=0.029), and higher PSQI total score (β=0.09, p=0.020) were the significant predictors of leg cramp pain intensity.

Conclusion: Many health-related conditions, as well as work and home-related work characteristics, may be considered risk factors for the occurrence of leg cramps and increased leg cramps pain intensity in pregnancy.

Keywords: Leg cramps, pregnancy, prevalence, third trimester

Introduction

Leg cramp is a sudden and intense involuntary and painful contraction of the lower limb muscles that lasts for a few seconds to a few minutes.[1] Typically occurring at night, leg cramps most often involve the calf muscles and can result in muscle tenderness for up to 24 hours.[2] Leg cramps are one of the most common musculoskeletal dysfunctions experienced during the second and third trimesters of pregnancy. Leg cramps can significantly affect daily activities, quality of life and sleep patterns.[2]

Received: 26 February 2024
Accepted: 18 July 2024
Published: 12 August 2024

[3] The prevalence of leg cramps among pregnant women peaking in the third trimester has been estimated to be between 47.8 and 64.4% in studies conducted in the USA, Iran, and India.[3–6] The estimated fertility rate in Jordan is 3.5 children per woman,[7] with increased pregnancy-related complications like gestational diabetes and preterm labor among women.[7] However, there is a paucity of literature investigating the prevalence of leg cramps in Jordan or any other Middle Eastern country.

There is still no consensus about the pathophysiology and the exact causes of leg cramps among pregnant women.[8,9] During pregnancy, physiological and hormonal changes lead to increased musculoskeletal discomfort, including leg cramps, which tend to worsen over time, particularly in the third trimester.[10] For example, leg cramps in pregnancy could be secondary to body fluid accumulation.[10,11] A deficiency of certain minerals, a decrease in extracellular fluid volume, electrolyte imbalances, physical inactivity, or excessive physical activity, standing and sitting for an extended period.[11] One cross-sectional study found a statistically significant relationship between the occurrence of leg cramps and serum levels of magnesium (Mg) but no relationship with calcium (Ca) serum levels, age, nutritional habits, or individual characteristics.[3] A more recent cross-sectional study reported a significant relationship between the occurrence of leg cramps in pregnancy and decreased sleep quality.[12] Given these limited studies, there is a need for further investigation into other comprehensive biopsychosocial factors that could be associated with leg cramps during pregnancy.

The primary objective of this research was to estimate the prevalence of leg cramps in the third trimester of pregnancy among women in Jordan and to investigate biopsychosocial predictors of leg cramps occurrence and pain intensity among pregnant women in the third trimester. Enhancing our comprehension of risk factors associated with leg cramps is essential for healthcare providers to develop more effective management strategies for pregnant women experiencing this condition. Notably, evidence-based interventions for leg cramps remain limited.

Materials and Methods

Study Design and Period

A cross-sectional study design was conducted from September 2021 to August 2022.

Participants

A convenient sampling technique was used to recruit 205 participants, who routinely visited the Obstetrics and Gynaecology clinics at King Abdullah University Hospital, the Ministry of Health affiliated hospital (Princess Badea Hospital) and private clinics (Ibn-Alnafees Hospital) in Northern Jordan. Participants were eligible to be included in the study if they were pregnant women in the third trimester (27 weeks to 40 weeks), irrespective of whether they were at high or low risk for an adverse pregnancy outcome.; aged between 18 to 49 years; and able to read, understand, and complete questionnaires in Arabic. Pregnant patients diagnosed with musculoskeletal problems, having leg cramps before pregnancy, and psychiatric illnesses were excluded. About 250 patients were approached, 205 out of them completed the interview, and the response rate was 82%.

Outcome Measures

A socio-demographic and lifestyle characteristics questionnaire was used to collect the following information: age, residency area (city, suburban and rural), education level, employment status, working hours, housework assistance, cigarette smoking, and water pipe smoking. Pregnancy and clinical characteristics information of the participants, including gestational age, number of previous pregnancies, number of vaginal deliveries, number of cesarean sections, medication and multivitamins consumption, daily water consumption, maternal comorbidities, self-reported leg swelling, varicose vein, and flat feet, was also collected.

Participants also completed the information about leg cramps characteristics, which included frequency of leg cramps per week, duration of leg cramps, and intensity of leg cramps pain, using a numeric pain rating scale (NPRS). In addition,

participants completed investigations to determine the serum levels of Ca and Mg, as routinely conducted in the hospitals.

In addition, a number of standard questionnaires were administered:

- The Arabic version of the Nordic Musculoskeletal Questionnaire (NMQ) was used to investigate musculoskeletal disorders in the last 7 days or 12 months in multiple body regions. The study showed high test-retest reliability (0–23% disagreement) and acceptable validity (0–20% disagreement) as a screening tool.[13]
- The Arabic version of the Pittsburgh Sleep Quality Index (PSQI) measured sleep quality. The PSQI is a self-rated questionnaire used to evaluate sleep quality and is a valid and reliable tool. It includes 18 items, divided into seven sections. A higher score indicates a lower sleep quality.[14] The scale has an internal reliability of 0.83, a test–retest reliability of 0.85 for the global scale, a sensitivity of 89.6%, and a specificity of 86.5%.[15]
- The Arabic version of the Short Form Health Survey (SF-12) is a shortened form of the 36 Health Survey and was used to assess the perceived quality of life in two main domains: the physical (PCS) and mental (MCS) health of a person's health-related quality of life. Both domains have good internal consistency (Cronbach's $\alpha < 0.7$) and good construct validity.[16]
- The Arabic version of the Hospital Anxiety and Depression Scale (HADS) was used to assess mental health symptoms of depression and anxiety. The HADS is frequently used in different studies to determine the anxiety and depression symptoms in antenatal and postnatal women.[17] HADS includes two subscales to assess depressive and anxiety symptoms. HADS has a high internal consistency (Cronbach's $\alpha = .0.884$) and demonstrates adequate structural and concurrent validity with other scales.[18–20]
- The Arabic version of the Pregnant Physical Activity Questionnaire (PPAQ) was used to determine the physical activity levels among pregnant women. It is a valid and reliable tool developed to assess the duration, intensity, and frequency of physical activity among pregnant women.[21] The tool showed good content validity (0.8–1.0), and excellent high test-retest reliability and internal consistency.[22]

Procedure

The outcome measures were collected using an interviewer-administered method. A research assistant (postgraduate master's student) trained in data collection and study procedures approached the participants as they attended their routine clinic appointments. Potential participants were informed about the study's aims and procedures. We emphasized that participation was entirely voluntary, and their medical care would have no adverse consequences if they chose not to participate. Participants were assured of confidentiality and privacy. Upon understanding the study details, participants provided informed consent. The consent process included explaining their rights, withdrawal options, and the purpose of the study. Participants signed the informed consent form, indicating their willingness to participate. The interview lasted about 45–60 minutes. The Institutional Review Board of Jordan University of Science and Technology (JUST) 22/143/2021 approved this study. Patient data privacy and confidentiality are maintained as this study was conducted in compliance with the ethical standards per the Helsinki Declaration.

Sample Size Calculation

A priori sample size calculation was conducted. For logistic regression, an odds ratio of 2.45 was calculated based on the average prevalence estimates of previous studies (61%).[6,12] We used G*power to calculate the sample size for this odd ratio. Based on $\alpha=0.05$ and a power of 0.80 in the binomial distribution, the total sample size required for the analysis was 163 pregnant women with and without leg cramps. To conduct a linear regression analysis, with a medium effect size of 0.15, $\alpha=0.05$, power of 0.90, and six possible predictors, a total of 116 pregnant women with leg cramps were required for the analysis.

Statistical Analysis

Descriptive statistics were used, including mean, standard deviation, and proportions. In addition, an independent *t*-test (for continuous normally distributed variables) and a chi-square test (for categorical variables) were used to compare pregnant women with and without leg cramps.

Univariable logistic regression was used to explore important covariates ($p<0.15$), entered into multivariable logistic regression models. Assumptions of the logistic regression, including the multicollinearity between possible predictors using the variance inflation factor (VIF ≥10.0), were explored as possible collinearity.[23] In multivariable logistic regression models, backward and forward selection methods were used to select the best model that fits the data. Significant predictor variables were then used to build the final model with the occurrence of leg cramps (*leg cramps vs no leg cramps*) as the dependent variables and other variables as independent variables.

A linear regression model was built using cases of women with leg cramps only to determine predictors of leg cramp pain intensity as measured by the NPRS. A significant level of predictors was set at $p< 0.05$. All data were analyzed using SPSS version 25.

Results

Sample Characteristics

Two hundred and five pregnant women completed the study. The estimated prevalence of leg cramps among this sample was 58% (n=119). Table 1 shows the sample characteristics and the difference between pregnant women with leg cramps

Table 1 The Characteristics of the Sample and the Difference Between Pregnant Women with Leg Cramps and Without Leg Cramps

		All Mean (SD) or n (%)	No leg cramp Mean (SD) or n (%)	Leg cramps Mean (SD) or n (%)	*p*
Total (n)		205 (100%)	86 (42%)	119 (58%)	–
Age (years)		29.24 (5.23)	28.94 (5.33)	29.45 (5.16)	0.245#
Residency area	Urban	117 (57.1%)	54 (46.2%)	63 (53.8%)	0.160*
	Suburban/ rural	88 (42.9%)	32 (36.4%)	56 (63.6%)	
Education	Elementary school	25 (12.2%)	11 (44%)	14 (56%)	0.733*
	High school	55 (26.8%)	25 (45.5%)	30 (54.5%)	
	Tertiary Education	125 (61.0%)	50 (40%)	75 (60%)	
Employment status	Does not work	167 (81.5%)	72 (43.1%)	95 (56.9%)	0.479*
	Work	38 (18.5%)	14 (36.8%)	24 (63.2%)	
Number of working hours		1.28 (2.74)	1.16 (2.67)	1.37 (2.80)	0.339#
Receiving housework assistance	No	150 (73.2%)	58 (38.7%)	92 (61.3%)	0.116*
	Yes	55 (26.8%)	28 (50.9%)	27 (49.1%)	
Cigarettes smoking	No	188 (91.7%)	80 (42.6%)	108 (57.4%)	0.561*
	yes	17 (8.3%)	6 (35.3%)	11 (64.7%)	
Water pipe smoking	No	166 (81.0%)	70 (42.2%)	96 (57.8%)	0.896*
	Yes	39 (19.0%)	16 (41.0%)	23 (59.0%)	
Gestational age (weeks)		33.06 (3.74)	32.12 (3.51)	33.74 (3.77)	**0.002#**
Number of previous pregnancies		2.65 (1.71)	2.35 (1.48)	2.87 (1.83)	**0.029#**

(*Continued*)

Table 1 (Continued).

		All Mean (SD) or n (%)	No leg cramp Mean (SD) or n (%)	Leg cramps Mean (SD) or n (%)	*p*
Number of normal deliveries		0.96 (1.37)	0.84 (1.25)	1.04 (1.46)	0.293#
Number of C-section		0.59 (1.08)	0.45 (.90)	0.69 (1.18)	0.122#
Medication	No	169 (78.0%)	71 (44.4%)	89 (55.6%)	0.185*
	Yes	45 (22.0%)	15 (33.3%)	30 (66.7%)	
Vitamins	No	9 (4.4%)	3 (33.3%)	6 (66.7%)	0.592*
	Yes	196 (95.6%)	83 (42.3%)	113 (57.7%)	
Daily water intake (cups)		7.03 (3.19)	7.02 (3.19)	7.04 (3.21)	0.967#
Diabetes	No	196 (95.6%)	84 (42.9%)	112 (57.1%)	0.220*
	Yes	9 (4.4%)	2 (22.2%)	7 (77.8%)	
Anemia	NO	161 (78.5%)	64 (39.8%)	97 (60.2%)	0.222*
	Yes	44 (21.5%)	22 (50.0%)	22 (50.0%)	
Urinary tract infection	No	96 (46.8%)	43 (44.8%)	53 (55.2%)	0.439*
	Yes	109 (53.2%)	43 (39.4%)	66 (60.6%)	
Gastrointestinal tract problems	No	147 (71.7%)	71 (48.3%)	76 (51.7%)	**0.003***
	Yes	58 (28.3%)	15 (25.9%)	43 (74.1%)	
Sciatica	No	162 (79.0%)	75 (46.3%)	87 (53.7%)	**0.014***
	Yes	43 (21.0%)	11 (25.6%)	32 (74.4%)	
Leg swelling	No	134 (65.4%)	68 (50.7%)	18 (25.4%)	**0.000***
	Yes	71 (34.6%)	18 (25.4%)	53 (74.6%)	
Flatfeet	No	189 (92.2%)	79 (41.8%)	110 (58.2%)	0.879*
	Yes	16 (7.8%)	7 (43.8%)	9 (56.3%)	
Varicose veins	No	176 (85.9%)	77 (43.8%)	99 (56.3%)	0.199*
	yes	29 (14.1%)	9 (31.0%)	20 (69.0%)	
Calcium serum level (millimol/L)		2.28 (.11)	2.29 (.11)	2.28 (.12)	0.568#
Magnesium serum level (millimol/L)		0.73 (.08)	0.73 (.08)	0.73 (.08)	0.966#
Neck pain	No	173 (84.4%)	79 (45.7%)	94 (54.3%)	**0.012***
	Yes	32 (15.6%)	7 (21.9%)	25 (78.1%)	
Neck pain intensity		0.89 (2.16)	0.48 (1.67)	1.18 (2.42)	**0.020#**
Thoracic pain	No	171 (83.4%)	74 (43.3%)	97 (56.7%)	0.389*
	Yes	34 (16.6%)	12 (35.3%)	22 (64.7%)	
Thoracic pain intensity		1.04 (2.39)	0.87(2.11)	1.17 (2.58)	0.384#
Lower back pain	No	47 (22.9%)	27 (57.4%)	20 (42.6%)	**0.014***
	Yes	158 (77.1%)	59 (37.3%)	99 (62.7%)	
Lower back pain intensity		5.11 (2.89)	4.60 (3.08)	5.47 (2.69)	**0.034#**

(*Continued*)

Table 1 (Continued).

		All Mean (SD) or n (%)	No leg cramp Mean (SD) or n (%)	Leg cramps Mean (SD) or n (%)	*p*
Hip pain	No	111 (54.1%)	53 (47.7%)	58 (52.3%)	0.146*
	Yes	93 (45.4%)	33 (35.5%)	60 (64.5%)	
Hip pain intensity		2.93 (3.34)	2.50 (3.28)	3.24 (3.36)	0.120#
Knee pain	No	183 (89.3%)	79 (43.2%)	104 (56.8%)	0.308*
	Yes	22 (10.7%)	7 (31.8%)	15 (68.2%)	
Knee pain intensity		0.57 (1.68)	0.41 (1.39)	0.68 (1.86)	0.251#
Ankle pain	No	190 (92.7%)	81 (42.6%)	109 (57.4%)	0.482*
	yes	15 (7.3%)	5 (33.3%)	10 (66.7%)	
Ankle pain intensity		0.40 (1.48)	0.28 (1.16)	0.50 (1.67)	0.301#
PSQI Total		7.30 (3.59)	6.79 (3.82)	7.67 (3.38)	0.082#
SF-12 physical component score		14.61 (2.65)	15.05 (2.41)	14.29 (2.77)	**0.044#**
SF-12 mental component score		17.61 (4.81)	18.84 (4.76)	16.72 (4.66)	**0.002#**
SF12-total score		32.22 (6.67)	33.89 (6.53)	31.01 (6.54)	**0.002#**
HADS- Depression		7.68 (4.05)	7.26 (4.11)	7.99 (3.99)	0.200#
HADS- Anxiety		7.97 (4.42)	7.15 (4.43)	8.55 (4.33)	**0.024 #**
PPAQ total score		155.82 (65.12)	147.92 (68.18)	161.53 (62.48)	0.140#

Notes: Bold: *p*>.05; #: Independent t-test; *: Chi-square test; PSQI: Pittsburgh Sleep Quality Index; SF_12: Short Form Health Survey; HADS: Hospital Anxiety and Depression Scale; PPAQ: Pregnant Physical Activity Questionnaire.

and those without leg cramps. The pregnant women with leg cramps had longer gestational weeks (p=0.002), more number of pregnancies (p=0.029), more gastrointestinal problems (p=0.003), more sciatica problems (p=0.014), more leg swelling (p<0.001), more neck pain problem (p=0.012), higher neck pain score (p=0.02), a more low back problem (p=.014), higher low back pain (p=0.034), lower SF-12 physical component subscale (p=0.044) and mental component subscale (p=0.002), lower total SF-12 score (p=0.002), and higher anxiety (p=0.024).

Predictors of Leg Cramps Occurrence

A multivariable logistic regression model was conducted to identify the significant predictors of leg cramps occurrence. The final model, Hosmer and Lemeshow's goodness-of-fit test was not significant [X2 (8) = 5.051, p=0.752], indicating a good fit for the model. Not receiving housework assistance (OR 0.454, 95% CI 0.227 - 0.907, p=0.025), longer gestational weeks (OR 1.103, 95% CI 1.015–1.199, p=0.021), number of previous pregnancy (OR 1.213, 95% CI 1.001–1.471, p=0.049), and having leg swelling (OR 2.280, 95% CI 1.145–4.539, p=0.019) and having gastrointestinal (GIT) problems (OR 2.119, 95% CI 1.014–4.428, p=0.046) were the only significant predictors of having leg cramps (Table 2).

Predictor of Leg Cramps Pain Intensity

The mean pain intensity of leg cramps was 7.39 (1.39). The average frequency was 3.46 (2.21) weekly, which most frequently occurred during sleep (77%), and the most frequent duration was less than one minute (78%).

A multiple linear regression model was conducted to identify significant predictors of leg cramp pain intensity among pregnant women with leg cramps (n=119). The overall linear regression model was significant, and 26% of the variance in leg cramps pain intensity was explained by the model (F (7, 118) = 5.575, p< 0.001).

Table 2 Multivariable Logistics Regression Analysis with Leg Cramps as Dependent Variable (with and without Leg Cramps)

	Odds ratio	95% CI		*p*
Not receiving housework assistant	0.454	0.227	0.907	**0.025**
Gestational age (weeks)	1.103	1.015	1.199	**0.021**
Number of previous pregnancies	1.213	1.001	1.471	**0.049**
Having gastrointestinal tract problems	2.119	1.014	4.428	**0.046**
Having Leg swelling	2.280	1.145	4.539	**0.019**

Notes: Bold: p>.05; 95% CI: 95% Confidence Interval.

Table 3 Multivariable linear regression analysis with leg cramps pain intensity as the dependent variable

	β	95% CI		P
High school vs. elementary	0.699	0.158	1.241	**0.012**
Number of working hours	0.106	0.026	0.187	**0.010**
Multivitamins (yes)	−1.696	−2.155	−.037	**0.043**
Diabetes (yes)	1.046	0.070	2.021	**0.036**
Sciatica(yes)	0.576	0.064	1.088	**0.028**
Hip pain (yes)	−.332	−.630	−.034	**0.029**
PSQI total score	0.085	0.014	0.156	**0.020**
Constant	7.420	6.103	8.737	**<.001**

Notes: Bold: p>.05; PSQI: Pittsburgh Sleep Quality Index; 95% CI: 95% Confidence Interval.

The results showed that being pregnant with high school education versus elementary school (β=0.699, 95% CI (0.158–1.124), *p*=0.012), work hours (β= 0.106, 95% CI (0.026 - 0.187, *p*=0.010), taking vitamins supplement (β= −1.696, 95% CI (−2.151 - −0.037, *p*=0.043), having diabetes during pregnancy (β=1.046, 95% CI (0.070–2.021), *p*=0.036), having sciatica (β=0.576, 95% CI (0.064–1.088), *p*=0.028), having hip pain (β= −0.332, 95% CI (−.630 - −0.034), *p*=0.029), and PSQI total score (β=0.085, 95% CI (0.014 - 0.156), *p*=0.020) were the only significant predictors of leg cramp pain intensity (Table 3).

Discussion

This study showed that leg cramps are a common issue among pregnant women in their third trimester, with an estimated prevalence of 58% in Jordan. This finding aligns with similar studies conducted in India, Iran, and the USA, where the prevalence of leg cramps among pregnant women in the third trimester ranged from 47.8% to 64.6%.[3–6] Understanding the prevalence of leg cramps in different populations is crucial for healthcare providers to offer appropriate support and management strategies for pregnant women experiencing this common issue.

Our results showed longer gestational weeks increased the odds of developing muscle cramps. Similarly, Mindell et al reported that the leg cramps percentage in the first trimester was 20.9%. This percentage increased to 24.6% and 42.1% in the second trimester and between 47.8% and 50.0% in the third trimester.[4] In a study conducted in India, the prevalence of calf muscle cramps was the highest in the third trimester of pregnancy (64.6%) compared to the first (26.7%) and the second (47.8%) trimester.[6] It could be hypothesized that progressive pregnancy-related changes may be

associated with a higher likelihood of developing muscle cramps. Understanding how changes in pregnancy lead to increased leg cramps could assist in formulating more effective preventive and management strategies for leg cramps in pregnancy.

The study found that women with a higher number of previous pregnancies are more likely to experience leg cramps. This result is consistent with the result obtained from a previous study conducted by Adinma et al, who found that pregnant women with a higher number of previous pregnancies were significantly associated with a higher prevalence of leg cramps and other musculoskeletal complaints.[24] This result adds to the risk of multiple pregnancies on women's health and the importance of planning pregnancies according to women's ability and health status. Women who are planning multiple pregnancies should discuss possible risks with their doctors and possible preventive measures that can be taken to reduce the risk of leg cramps and other health problems.

Our study was the first to report that leg cramps in pregnant women were significantly associated with the lack of housework assistance. Previous studies showed an association between a lack of housework assistance and musculoskeletal pain.[25] Housework has different requirements than other types of work. It requires prolonged standing and sustained posture, which might increase fatigue and leg swelling, ultimately increasing the risk of developing leg cramps. In addition, social and family support for pregnant women positively affects their general well-being.[26] This support with housework and other physically demanding tasks may also help to reduce the risk of developing leg cramps by decreasing the risk of developing leg cramps. Pregnant women may consider rest periods during housework and avoiding prolonged standing and sustained posture.

GIT problems in pregnant women were a significant predictor of leg cramps, and 71.7% complained of GIT problems, such as heartburn, nausea, vomiting, constipation, diarrhea, and bloating. Previous studies found that GIT problems during pregnancy may cause an electrolyte imbalance (sodium, potassium, Mg, chloride, and Ca) due to alteration in absorption, especially in women complaining of nausea and vomiting.[27] This imbalance has been associated with leg cramps in sports.[28,29] However, no previous studies have examined the relationship between electrolyte imbalance (sodium, potassium, and chloride) and leg cramps in pregnant women.

The current study showed that leg swelling significantly predicted leg cramps among pregnant women in the third trimester and that the prevalence of leg swelling among pregnant women in the third trimester was 34.6%. This result is consistent with two previous prevalence studies. A study in Turkey showed that 32.6% of pregnant women in the third trimester complained of leg swelling.[30] The other study in India found that 36.2% of pregnant women in the third trimester had leg swelling.[6] These studies reported that leg swelling increased as the pregnancy progressed and was more observed in women with a sedentary lifestyle. It is also postulated that the physiological changes during late pregnancy might lead to leg swelling. The sedentary lifestyle negatively affects lower limb muscle activity and accumulated fluid in tissues that pressure the nerves and blood vessels, inhibiting venous return. However, the study suggests a correlation between muscle cramps and leg swelling, but it could not confirm a causative effect. Measures that target preventing and treating leg swelling might be a possible management strategy for leg cramps during pregnancy.

This study found no correlation between leg cramps and Mg and Ca serum levels. Previous studies' findings conflicted regarding the association of leg cramps with serum levels of Mg and Ca.[3] The results of previous interventional studies were also unclear, as to whether Mg and Ca supplementations effectively reduced leg cramps in pregnant women.[2,31] A randomized control trial conducted by Mansouri et al found that Ca with Vitamin D supplements did not affect the frequency, length, and pain intensity of leg cramps for pregnant women during the 25th to 30th weeks of gestation.[32] However, most of these interventional studies did not measure the serum level of Mg and Ca before and after conducting the trial.

This study found poor sleep quality is associated with increased pain intensity of leg cramps among pregnant women. This finding is consistent with findings that relate sleep disorders to increased pain intensity. For example, Bintang et al reported that poor sleep quality is associated with increased pain intensity in patients with chronic low back pain.[33] It has also been reported that poor sleep quality will lower the pain threshold and increase pain sensitivity.[34] Therefore, there is a need to develop a practical guideline to evaluate and treat sleep disturbances in pregnant women.

The current study also showed that women with Gestational diabetes (GDM) significantly tend to have more severe leg cramps. In addition, an animal study showed that GDM is associated with increased pain sensitivity and pain-related

behaviors. This relationship has been related to the neurotoxic effects of hyperglycemia.[35] Since GDM is a prevalent condition among pregnant women and leads to other significant complications,[36] the diagnosis, prevention, and management of GDM among pregnant women is therefore vital.

This study showed a statistically positive correlation between pregnant women with sciatica and the severity of leg cramps. No previous studies have assessed the relationship between the severity of leg cramps and sciatica. One possible explanation could be that sciatica pain and leg cramps pain aggravated pregnant women's perception of pain.

The current study found a positive correlation between the number of working hours and the severity of leg cramps. Fatigue and electrolyte imbalance following physical effort have been reported as possible mechanisms.[37] Meanwhile, a recent study revealed that working more than 36 hours weekly is associated with gestational hypertension, difficulty in childbirth, preterm birth, and low birth weight.[38] Long working hours might cause adverse health changes, leading to increased pain in leg cramps. The health and safety of pregnant women in their third trimester should be considered when determining working hours and standing requirements in workplace legislation.

A negative correlation between multivitamin consumption and the severity of leg cramps was found in the current study. Therefore, it seems that multivitamin usage could reduce leg cramps pain. However, our study showed that serum Ca and Mg levels were unrelated to leg cramps. Our study did not investigate the type of multivitamins and the active ingredient. Also, using multivitamins was not a significant predictor of the occurrence of leg cramps. This study recommends future controlled experimental studies investigating the effect of using multivitamins and other supplements in managing leg cramps during pregnancy.

The findings of this study provide some insights for pregnant women and healthcare providers about the prevalence of muscle cramps. Also, it might help to develop some educational programs for pregnant women and healthcare providers about possible risk factors and how to reduce the severity of leg cramps. Further studies are needed to assess the electrolytes level of (sodium, potassium, and chloride) across pregnant women and their association with leg cramps. Our study included only pregnant women in their third trimester. Therefore, the findings may not be generalized to pregnant women in the first and second trimesters. Also, the study included pregnant women living in Jordan, and the findings may differ from those in other countries with different healthcare and socioeconomic systems.

Conclusion

This study showed a high prevalence of leg cramps among pregnant women in the third trimester. Leg cramps in pregnant women are significantly related to the absence of housework assistance, progress in the number of gestational weeks, increase with the number of previous pregnancies, having GIT and leg swelling. In addition, pregnant women with a lower level of education, a high number of working hours, GDM, and sciatica reported higher leg cramp pain intensity, while using multivitamins decreased the leg cramp pain intensity. A better understanding of the risk factors for leg cramps will enable healthcare providers to establish more effective preventive and treatment strategies for leg cramps among pregnant women. Further research is needed to fully explore the factors that cause leg cramps among pregnant women.

Abbreviations

Ca, Calcium; HADS, The Hospital Anxiety and Depression Scale; Mg, Magnesium; NMQ, The Nordic Musculoskeletal Questionnaire; NPRS, Numeric Pain Rating Scale; PPAQ, The Pregnant Physical Activity Questionnaire; PSQI, The Pittsburgh Sleep Quality Index; SF-12, The Short Form Health Survey; VIF, Variance Inflation Factor.

Data Sharing Statement

The data that support the findings of this study are openly available in [Mendeley] at [https://data.mendeley.com/datasets/wp79d99nwh/draft?a=f607576a-73d2-4865-a122-7cfa902d5143].

Ethics Approval and Consent to Participate

The Institutional Review Board at Jordan University of Science and Technology approved the study (# 22/143/2021). The study was fully explained to potential participants before they entered it, including the full description of the procedures

and the potential benefits. Participation was voluntary, and researchers allowed participants to withdraw from the study at any time without consequences. Pregnant women signed the informed consent form before enrolment. Patient data privacy and confidentiality are maintained as this study was conducted in compliance with the ethical standards per the Helsinki Declaration.

Acknowledgments

The authors thank Shorouq Abandeh for her help with data collection and management.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

This study was supported by the Jordan University of Science and Technology (Grant #432/2021). Qatar University funded the publication of this article.

Disclosure

The authors declare that they have no competing interests in this work.

References

1. Monderer RS, Wu WP, Thorpy MJ. Nocturnal leg cramps. *Curr Neurol Neurosci Rep*. 2010;10(1):53–59. doi:10.1007/s11910-009-0079-5
2. Luo L, Zhou K, Zhang J, Xu L, Yin W. Interventions for leg cramps in pregnancy. *Cochrane Database Syst Rev*. 2020;12(12):CD010655. doi:10.1002/14651858.CD010655.pub3
3. Sohrabvand F, Karimi M. Frequency and predisposing factors of leg cramps in pregnancy: a prospective clinical trial. *Tehran Univ Med J*. 2009;67(9):1.
4. Mindell JA, Cook RA, Nikolovski J. Sleep patterns and sleep disturbances across pregnancy. *Sleep Med Apr*. 2015;16(4):483–488. doi:10.1016/j.sleep.2014.12.006
5. Mansouri A, Mirghafourvand M, Mohammad Alizadeh Charandabi S, Khodabandeh F. Prevalence of leg cramps in the third trimester of pregnancy and its relationship to nutritional behavior and consumption supplementation in pregnancy. *J Sabzevar Univ Med Sci*. 2016;23(5):740–747.
6. Ramachandra P, Maiya AG, Kumar P, Kamath A. Prevalence of musculoskeletal dysfunctions among Indian pregnant women. *J. Pregnancy*. 2015;2015:1–4. doi:10.1155/2015/437105
7. Spindler E, Bitar N, Solo J, Menstell E, Shattuck D. Jordan's 2002 to 2012 Fertility Stall and Parallel USAID Investments in Family Planning: lessons From an Assessment to Guide Future Programming. *Glob Health Sci Pract*. 2017;5(4):617–629. doi:10.9745/ghsp-d-17-00191
8. Hensley JG. Leg cramps and restless legs syndrome during pregnancy. *J Midwifery Womens Health*. 2009;54(3):211–218. doi:10.1016/j.jmwh.2009.01.003
9. Dijkstra JN, Boon E, Kruijt N, et al. Muscle cramps and contractures: causes and treatment. *Pract Neurol*. 2023;23(1):23–34. doi:10.1136/pn-2022-003574
10. Miller TM, Layzer RB. Muscle cramps. *Muscle Nerve*. 2005;32(4):431–442. doi:10.1002/mus.20341
11. Parisi L, Pierelli F, Amabile G, et al. Muscular cramps: proposals for a new classification. *Acta Neurol Scand*. 2003;107(3):176–186. doi:10.1034/j.1600-0404.2003.01289.x
12. Mansouri A, Bahrami-Vazir E, Mohammad-Alizadeh-Charandabi S, Ghelichkhani F, Mirghafourvand M. The relationship between leg muscle cramps and sleep quality in pregnant women visited the health centers in tabriz. *Shiraz Med J*. 2019;20(7):e84279. doi:10.5812/semj.84279
13. Crawford JO. The Nordic Musculoskeletal Questionnaire. *Occup Med*. 2007;57(4):300–301. doi:10.1093/occmed/kqm036
14. Buysse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res*. 1989;28(2):193–213. doi:10.1016/0165-1781(89)90047-4
15. Beck SL, Schwartz AL, Towsley G, Dudley W, Barsevick A. Psychometric evaluation of the Pittsburgh Sleep Quality Index in cancer patients. *J Pain Symptom Manage*. 2004;27(2):140–148. doi:10.1016/j.jpainsymman.2003.12.002
16. Haddad C, Sacre H, Obeid S, Salameh P, Hallit S. Validation of the Arabic version of the "12-item short-form health survey"(SF-12) in a sample of Lebanese adults. *Arch Public Health*. 2021;79(1):56. doi:10.1186/s13690-021-00579-3
17. Cederholm M, Sjödén P-O, Axelsson O. Psychological distress before and after prenatal invasive karyotyping. *Acta Obstet Gynecol Scand*. 2001;80(6):539–545. doi:10.1034/j.1600-0412.2001.080006539.x
18. el-Rufaie OE, Absood GH. Retesting the validity of the Arabic version of the Hospital Anxiety and Depression (HAD) scale in primary health care. *Soc Psychiatry Psychiatr Epidemiol*. 1995;30(1):26–31. doi:10.1007/BF00784431
19. Albatineh AN, Al-Taiar A, Al-Sabah R, Zogheib B. Psychometric properties of the Arabic version of the Hospital Anxiety and Depression Scale in hemodialysis patients. *Psychol Health Med*. 2021;1–16. doi:10.1080/13548506.2021.2002922

20. Soh SE, Morello R, Ayton D, et al. Measurement properties of the 12-item Short Form Health Survey version 2 in Australians with lung cancer: a Rasch analysis. *Health Qual Life Outcomes*. 2021;19(1):157. doi:10.1186/s12955-021-01794-w
21. Chasan-Taber L, Schmidt MD, Roberts DE, Hosmer D, Markenson G, Freedson PS. Development and validation of a Pregnancy Physical Activity Questionnaire. *Med Sci Sports Exerc*. 2004;36(10):1750–1760. doi:10.1249/01.mss.0000142303.49306.0d
22. Younis AS, Alyousefi NA, Al-Habib DM, Al-Omran AT. The validation and cross-cultural adaptation of the Arabic version of the pregnancy physical activity questionnaire. *Saudi Med J*. 2021;42(5):499–508. doi:10.15537/smj.2021.42.5.20200826
23. Kleinbaum DG, Kupper LL, Nizam A, Rosenberg ES. *Applied Regression Analysis and Other Multivariable Methods*. Cengage Learning; 2013.
24. Adinma JIB, Adinma ED, Umeononihu OS, Oguaka V, Adinma-Obiajulu ND, Oyedum SO. Prevalence, Perception and Risk Factors for Musculoskeletal Discomfort among Pregnant Women in Southeast Nigeria. *J Musculoskelet Disord Treat*. 2018;4(4). doi:10.23937/2572-3243.1510063
25. Habib RR, Hamdan M, Nuwayhid I, Odaymat F, Campbell OM. Musculoskeletal disorders among full-time homemakers in poor communities. *Women Health*. 2006;42(2):1–14. doi:10.1300/J013v42n02_01
26. Battulga B, Benjamin MR, Chen H, Bat-Enkh E. The Impact of Social Support and Pregnancy on Subjective Well-Being: a Systematic Review. *Front Psychol*. 2021;12:710858. doi:10.3389/fpsyg.2021.710858
27. Body C, Christie JA. Gastrointestinal Diseases in Pregnancy. *Women Health Gastroenterol.* 2016;45(2):267.
28. Lau WY, Kato H, Nosaka K. Water intake after dehydration makes muscles more susceptible to cramp but electrolytes reverse that effect. *BMJ Open Sport Exercise Med*. 2019;5(1):e000478. doi:10.1136/bmjsem-2018-000478
29. Jung AP, Bishop PA, Al-Nawwas A, Dale RB. Influence of Hydration and Electrolyte Supplementation on Incidence and Time to Onset of Exercise-Associated Muscle Cramps. *J Athl Train*. 2005;40(2):71–75.
30. Bakilan F, Zelveci DD. Musculoskeletal problems during pregnancy. *J Clin Med Kaz*. 2020;6(60):53–55. doi:10.23950/jcmk/9259
31. Araújo C, Lorena S, Cavalcanti G, Leão G, Tenório GP, Alves JGB. Oral magnesium supplementation for leg cramps in pregnancy—An observational controlled trial. *PLoS One*. 2020;15(1):e0227497. doi:10.1371/journal.pone.0227497
32. Mansouri A, Mirghafourvand M, Charandabi SMA, Najafi M. The effect of Vitamin D and calcium plus Vitamin D on leg cramps in pregnant women: a randomized controlled trial. *J Res Med Sci*. 2017;22(1):24. doi:10.4103/1735-1995.200271
33. Bintang AK, Santosa I, Goysal Y, Akbar M, Aulina S. Relationship between sleep quality and pain intensity in patients with chronic low back pain. *Med Clín Práct*. 2021;4:100208. doi:10.1016/j.mcpsp.2021.100208
34. Staffe AT, Bech MW, Clemmensen SLK, Nielsen HT, Larsen DB, Petersen KK. Total sleep deprivation increases pain sensitivity, impairs conditioned pain modulation and facilitates temporal summation of pain in healthy participants. *PLoS One*. 2019;14(12):e0225849. doi:10.1371/journal.pone.0225849
35. Munoz-Islas E, Elizondo-Martinez CE, Gutierrez-Lopez M, et al. Effect of Experimental Gestational Diabetes Mellitus on Mechanical Sensitivity, Capsaicin-Induced Pain Behaviors and Hind Paw Glabrous Skin Innervation of Male and Female Mouse Offspring. *J Pain Res*. 2021;14:1573–1585. doi:10.2147/JPR.S313467
36. Egan AM, Vellinga A, Harreiter J, et al. Epidemiology of gestational diabetes mellitus according to IADPSG/WHO 2013 criteria among obese pregnant women in Europe. *Diabetologia*. 2017;60(10):1913–1921. doi:10.1007/s00125-017-4353-9
37. Bergeron MF. Muscle cramps during exercise-is it fatigue or electrolyte deficit? *Curr Sports Med Rep*. 2008;7(4):S50–S55. doi:10.1249/JSR.0b013e31817f476a
38. Suzumori N, Ebara T, Matsuki T, et al. Effects of long working hours and shift work during pregnancy on obstetric and perinatal outcomes: a large prospective cohort study—Japan environment and children's study. *Birth*. 2020;47(1):67–79. doi:10.1111/birt.12463