Association Between Physical Activity, Weight Loss, Anxiety, and Lumbopelvic Pain in Postpartum Women

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ABSTRACT

Objective: Lumbopelvic pain (LBPP) affects 45% to 81% of pregnant women, and 25% to 43% of these women report persistent LBPP beyond 3 months after giving birth. The objective of this study was to investigate the association of physical activity, weight status, anxiety, and evolution of LBPP symptoms in postpartum women.

Methods: This was a prospective observational cohort study with 3 time-point assessments: baseline (T0), 3 months (T3), and 6 months (T6). Women with persistent LBPP 3 to 12 months after delivery were recruited. At each time point, pain disability was assessed with the Pelvic Girdle Questionnaire and the Oswestry Disability Index (ODI), physical activity with Fitbit Flex monitors, and anxiety with the French-Canadian version of the State-Trait Anxiety Inventory. Weight was recorded using a standardized method. Pain intensity (numerical rating scale, 0-100) and frequency were assessed using a standardized text message on a weekly basis throughout the study.

Results: Thirty-two women were included (time postpartum: 6.6 ± 2.0 months; maternal age: 28.3 ± 3.8 years; body weight: 72.9 ± 19.1 kg), and 27 completed the T6 follow-up. Disability, pain intensity, and pain frequency improved at T6 ($P < .001$). Participants lost a mean of 1.9 ± 4.5 kg at T6, and this weight loss was correlated with reduction in LBPP intensity ($r = 0.479$, $P = .011$) and LBPP frequency ($r = 0.386$, $P = .047$), Pelvic Girdle Questionnaire score ($r = 0.554$, $P = .003$), and ODI score ($r = 0.494$, $P = .009$). Improvement in ODI score at T6 was correlated with the number of inactive minutes at T3 ($r = -0.453$, $P = .026$) and T6 ($r = -0.457$, $P = .019$), and with daily steps at T6 ($r = 0.512$, $P = .006$).

Conclusion: Weight loss is associated with positive LBPP symptom evolution beyond 3 months postpartum, and physical activity is associated with reduction in pain disability. (J Manipulative Physiol Ther 2020;43;655-666)

Key Indexing Terms: *Low Back Pain; Pelvic Girdle Pain; Exercise; Weight Loss*

INTRODUCTION

Although definitions vary across studies, lumbopelvic pain (LBPP) can be described as either low back pain (LBP) or pelvic girdle pain (PGP), or a combination of both types of pain occurring at the same time. In fact, the authors of the European Guidelines for the Diagnosis and Treatment of Pelvic Girdle Pain concluded that PGP is a specific form of LBP that can occur separately or concurrently with LBP.[1] PGP is localized between the posterior iliac crest and the gluteal fold, particularly in the vicinity of the sacroiliac joints (SIJ), and can also occur in conjunction with or separately at the symphysis,[1] whereas LBP is usually defined as any ache or muscle tension located below the costal margin and above the inferior gluteal folds.[2]

LBPP is a frequent condition during pregnancy, affecting 44% to 72% of pregnant women,[3-8] whereas its prevalence before pregnancy is estimated at 18%.[7] Women who report PGP or LBP often have disabling pain and functional limitations during pregnancy.[8-10]

LBPP usually spontaneously resolves within a few months postpartum for the majority of women.[8] However, women can also experience LBPP during the postpartum period and even years after pregnancy. It is estimated that 25% to 68% of women report persistent LBPP (including PGP, LBP, or both) beyond 3 months postpartum,[8,11-14] 43% of women still experience LBPP 6 months after

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delivery, and 20% 3 years postpartum.[6,15] A recent study even reported that 1 in 10 women with LBPP still experience pain up to 11 years postpartum.[16]

Several risk factors for persisting LBPP (including PGP, LBP, or both) have been identified, including age,[8,17,18] high body mass index (BMI),[6] strenuous work, and low sick leave.[19,20] Long-term LBPP has been associated with previous caesarean delivery,[21] higher fetal weight,[12] history of LBP, and pain severity[6,22] and emotional distress.[23]

The persistence of LBPP, particularly in the form of PGP during the postpartum period, has important consequences on a woman's quality of life. For instance, women with LBPP (including PGP, LBP, or both)—especially continuous pain—can experience lower sexual satisfaction,[24] reduced quality of life, and lower self-rated health.[25] Women experiencing continuous postpartum LBPP also report a higher extent of sick leave and are more prone to seek health care services.[26]

Only a few studies have explored the persistence of LBPP beyond 3 months postpartum. Potential risk factors remain unclear, and knowledge about such risk factors is limited based on studies with methodological issues or small study samples. The postpartum period, however, is a critical period during which LBPP may become chronic[27] and negatively affect the daily life of women. Therefore, a better understanding of risk factors for LBPP persisting beyond 3 months postpartum is essential to develop effective preventive strategies.

Because women with persistent LBPP beyond 3 to 6 months postpartum have a higher pre-pregnancy, delivery, and postpartum BMI,[6] and given that emotional distress (symptoms of anxiety and depression) has been identified as an independent predictor of persistent LBPP,[23] the contribution of these factors to postpartum-related LBPP should be further investigated. Moreover, although a recent meta-analysis showed that maternal physical activity is associated with decreased symptoms of LBPP during pregnancy,[28] the literature on the association between postnatal physical activity and evolution of LBPP symptoms in postpartum women is limited and needs to be clarified.[29] Thus, the objective of this study was to investigate the association of physical activity, weight status, anxiety, and evolution of LBPP symptoms beyond 3 months postpartum, using a 6-month follow-up period. It was hypothesized that higher physical activity and lower anxiety levels, in addition to weight loss, would be associated with positive evolution of LBPP symptoms.

Materials and Methods

Design

This study was a prospective observational cohort study with a 6-month follow-up period. The Universite du Quebec a Trois-Rivi ethics committee approved this study with certificate CDERS-16-8-06.01. Written informed consent was obtained from each participant. No children under 18 were involved, so no parent or legal-guardian consent was needed.

Participants

Thirty-two women were recruited through advertisements published in local newspapers and on social media. Women were eligible to participate in the study if they were 3 to 12 months postpartum, were over 18 years old, and had actual persistent LBPP that started during pregnancy or within the first 3 weeks postpartum. Women were excluded if they presented with inflammatory arthritis, severe degenerative changes, collagenosis, severe osteoporosis, radiculopathy, progressive neurologic deficit, myelopathy, lumbar disc herniation, history of vertebral surgery, malignant tumor, infection, or any other nonmusculoskeletal pain. The institutional research ethics committee approved this study (CDERS-16-8-06.01), and all participants provided informed written consent.

Sample Size

Sample size calculation (N = 32) was performed assuming a linear correlation analysis, considering moderate correlations ($r = 0.5$), a statistical power of 0.8, and $\alpha < 0.05$. An attrition rate of 10% was also considered.

Outcome Assessment

Outcome assessment was scheduled at 3 time points: baseline (T0) and 3 and 6 months later (T3 and T6, respectively). The T0 visit took place at a chiropractic teaching clinic, and both T3 and T6 were home visits.

Baseline Assessment (T0). Women who volunteered to participate in the study were scheduled for an appointment at the Universite du Quebec a Trois-Rivi chiropractic teaching clinic to confirm eligibility and completed a baseline assessment aimed at confirming the presence of LBPP. During the baseline assessment, participants were screened for eligibility and examined by experienced clinicians (JO and CD), who completed a standardized evaluation for each woman. The standardized evaluation used six physical tests to assess SIJ pain: the Patrick test, the distraction test, the thigh thrust test, the Gaenslen test, the active straight-leg raise, and the iliac compression test. These tests are frequently used to assess SIJ pain and have acceptable sensibility, specificity, and reliability.[1,30-33] Symphysiolysis was assessed using the modified Tredelenburg test and symphysis palpation, which had the highest sensitivity and specificity.[1] Lumbar pain was assessed using palpation. Confirmation of LBPP was based on the clinician's clinical judgment, after recent medical history and physical examination.

General Information. Sociodemographic and anthropometric data were collected for each participant (age, education level, body weight, and height). The number of days

with LBPP over the last year was assessed using the Modified Nordic Classification (0, 1-30, or >30 days).[34] Obstetrical data were self-reported by the women and included parity (number of pregnancies lasting more than 20 weeks), gravidity (total number of pregnancies, regardless of the pregnancy outcome), and total weight gain during pregnancy.

Pain-Related Outcomes. The French-Canadian version of the Tampa Scale of Kinesiophobia (TSK)[35] was used to assess pain-related fear, which can have an impact on physical-activity levels and is recognized to be a predictor for chronic LBP.[36] Scores range from 17 to 68, and a score of ≥38 identifies an individual with high kinesiophobia. The French version of the Start Back Screening Tool[37] was used to classify women according to 3 groups for risk of poor prognosis associated with LBPP: low, medium, and high. The tool has 9 items, and overall scores range from 0 to 9. The overall score is used to separate low-risk and medium-risk subgroups. Participants with scores of 0 to 3 are classified into the low-risk subgroup, and those with scores of 4 to 9 into the medium-risk subgroup. A distress subscale score (including 5 items out of 9) is used to identify the high-risk subgroup. Subscale scores range from 0 to 5, with participants scoring 4 or 5 being classified into the high-risk subgroup.[38] LBPP symptom evolution was assessed using 3 LBPP indicators: pain intensity, pain frequency, and related disability. Disability associated with LBPP was assessed using the French-Canadian Pelvic Girdle Questionnaire (PGQ)[39] and the French-Canadian Oswestry Disability Index (ODI),[40] both of which show good internal consistency, reliability, and construct validity when used with pregnant or postpartum women.[41] PGQ and ODI scores both range from 0 to 100, where 100 represents the highest possible level of disability. In order to interpret our results, the minimal clinically important difference (MCID) was considered to be 25 points for PGQ scores[42] and 10 points for ODI scores.[43] For pain intensity (on a scale of 0 to 100), the MCID was considered to be 20 points.[43]

Risk Factors for Postpartum-Related LBPP. Physical-activity levels of each participant were assessed using a Fitbit Flex monitor (Fitbit, San Francisco, California), which is a valid physical-activity tracker.[44] The Fitbit Flex monitor was worn on the nondominant wrist for 7 consecutive days shortly after the T0 visit. The participants were told to complete a diary to record sleeping hours and wearing of the monitor. Valid data were defined as ≥4 days with no more than 4 awake hours per day without the monitor. Daily steps and inactive and active times (lightly, fairly, and very active) were recorded. According to the manufacturer, lightly, fairly, and very active times corresponded respectively to <3, 3 to 5.9, and ≥6 metabolic equivalents.

Anxiety levels were self-reported by each participant using the French-Canadian version of the State-Trait Anxiety Inventory.[45] Scores range from 20 to 80, where 80 is the highest anxiety level. Anxiety levels were considered minimal (≤35), low (36-45), moderate (46-55), high (56-65), or very high (≥66).

Weight was measured using a Tanita scale (2202/UM-016; Tanita, Arlington Heights, Illinois).

T3 and T6 Assessments. Physical-activity levels, anxiety levels, body weight, and disability associated with LBPP were measured as previously described. Physical-activity levels were measured shortly after the T3 and T6 visits.

Assessments Throughout the Study. Pain intensity and frequency were assessed using a standardized text message on a weekly basis between T0 and T3 and between T3 and T6. Participants were asked to give the number of days with pain over the last 7 days and to rate their highest pain level on a pain intensity numerical rating scale from 0 to 100. Participants texted back the number from 0 to 7 for pain frequency and 0 to 100 for pain intensity.

Statistics

Descriptive statistics were used to examine the participants' baseline characteristics. The Shapiro-Wilk and Kolmogorov-Smirnov tests were used to assess each variable for normality and determine the appropriate statistical tests to be used. LBPP disability improvement during the study was calculated by subtracting PGQ and ODI scores at T0 from PGQ and ODI scores at T6. Reduction of pain intensity and frequency were calculated by subtracting the mean value during the first 3 months (T0-T3) of the follow-up from the mean value during the last 3 months (T3-T6). A repeated-measures analysis of variance was used to assess the change in disability, weight, and physical-activity levels over time, followed by a Tukey test for post hoc analyses when indicated. Correlation statistics were used to assess the relation between physical-activity levels, anxiety levels, weight changes, and the 3 LBPP indicators (pain intensity, pain frequency, and related disability). The Pearson correlation coefficient was used for all correlations except for correlations with BMI, for which the Spearman rank correlation coefficient was used because of abnormally distributed BMI data. Coefficients of <0.10 were considered negligible correlation, 0.10 to 0.39 weak, 0.40 to 0.69 moderate, 0.70 to 0.89 strong, and >0.90 very strong. Finally, exploratory multiple regression analyses were conducted to test whether physical-activity levels, anxiety levels, and weight loss predicted LBPP evolution. IBM SPSS Statistics 25.0 (IBM Corp, Armonk, New York) was used for all analyses.

Results

Recruitment took place over a 1-year period (August 2017-August 2018). Thirty-five women were interested in participating in the study. Three did not meet inclusion criteria, 3 were lost to follow-up, and 2 were excluded from the analyses because they became pregnant during the follow-up

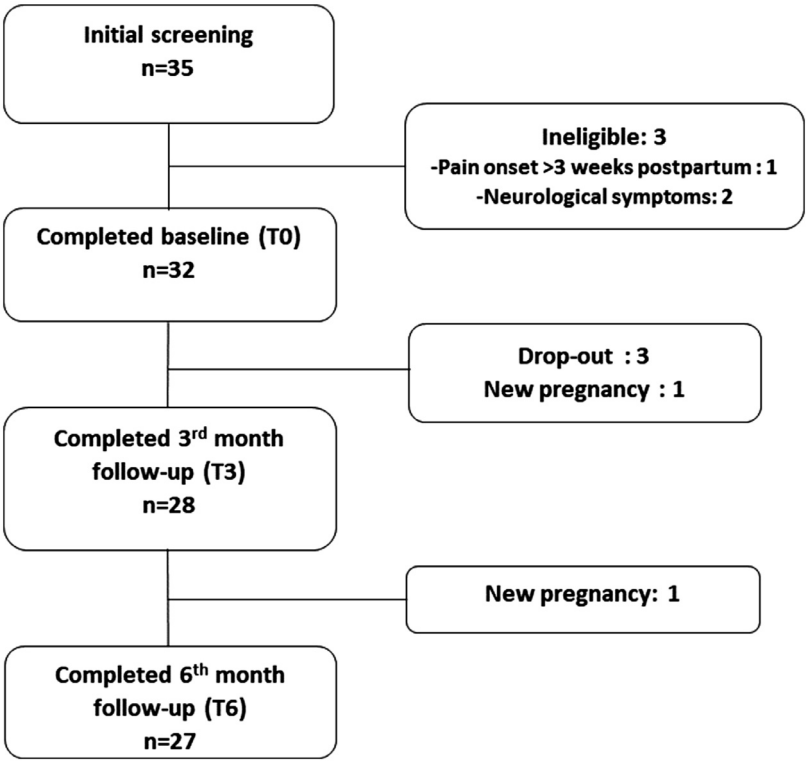

Fig 1. *Flowchart.*

period. Thus, 27 women completed the 3 assessments (T0, T3, and T6). Figure 1 presents the study flowchart. Table 1 presents baseline characteristics of the sample and basic demographic information.

Table 2 presents disability associated with LBPP, weight, and physical-activity levels at the 3 assessment time points. PGQ scores were 31.2 ± 16.2, 18.4 ± 13.0, and 12.4 ± 10.0, respectively, with a significant decrease between T0 and T3 ($P < .001$) and between T0 and T6 ($P < .001$). ODI scores were 17.7 ± 9.2, 18.4 ± 12.8, and 12.4 ± 10.0, respectively, with significant change between each pair of assessment time points ($P < .001$). Women lost a mean of 1.9 ± 4.5 kg at T6 ($P = .021$). However, some active and inactive minutes were incomplete owing to malfunctioning of the Fitbit Flex monitor and were therefore excluded from the analyses (2 participants at T0 and 3 participants at T3 and T6). Our results show that physical-activity levels did not change significantly between the 3 assessment time points.

The response rate for pain frequency and intensity that were assessed on a weekly basis was 95.2%. Table 3 presents LBPP intensity and frequency over the course of the study. Mean frequency was 3.7 ± 1.6 days of pain per week during the first 3 months of follow-up (T0-T3) and 2.9 ± 2.0 days of pain per week during the last 3 months of follow-up (T3-T6), which represent a significant reduction in pain frequency ($P < .001$). Maximal pain intensity was 40.0 ± 15.5 on the 100-point pain intensity numerical rating scale during the first 3 months of follow-up (T0-T3); it significantly decreased to 30.4 ± 16.8 during the last 3 months of follow-up (T3-T6, $P < .001$).

Statistically significant correlations were found between weight loss at T6 and the evolution of LBPP over the course of the study (Figures 2-5). Indeed, a reduction in LBPP intensity ($r = 0.479$, $P = .011$), frequency ($r = 0.386$, $P = .047$), PGQ score ($r = 0.554$, $P = .003$), and ODI score ($r = 0.494$, $P = .009$) were all positively correlated with weight loss. Baseline BMI ($r = 0.420$, $P = .029$) and TSK ($r = 0.465$, $P = .014$) scores were positively correlated with PGQ score improvement at T6 (Table 4), indicating that women with higher BMI and higher kinesiophobia at T0 showed a larger reduction in their PGQ score at T6. Regarding physical-activity levels, inactive minutes at T3 and T6 and steps at T6 were correlated with improvement in ODI score at T6 (Table 4). These correlations were not found with the PGQ nor with pain intensity or frequency.

Results from the regression analyses are presented in Table 5. Overall, results from regression analyses showed that weight loss at T6 significantly predicts positive LBPP evolution in postpartum, whether in PGQ score ($\beta = 0.554$, $P = .003$), ODI score ($\beta = 0.369$, $P = .037$), pain intensity ($\beta = 0.479$, $P = .011$), or pain frequency ($\beta = 0.386$, $P = .047$). Mean steps at T6 also predict reduction in ODI score ($\beta = 0.404$, $P = .024$).

Table 1. *Participants' Baseline Characteristics*

Characteristic	N	Mean ± SD
Age (y)	32	28.3 ± 3.8
Time since delivery (mo)	32	6.6 ± 2.0
BMI (kg/m^2)	32	26.9 ± 6.5
Total gestational weight gain (kg)	28	16.6 ± 7.0
Characteristic	**N**	**N (%)**
BMI category	32	
Underweight (<18.5)		1 (3.1)
Normal (18.5-24.9)		14 (43.8)
Overweight (25-29.9)		7 (21.9)
Obese (≥30)		10 (31.3)
Educational level (degree obtained)	32	
None		3 (9.4)
High school		2 (6.3)
Professional		3 (9.4)
Collegiate[a]		5 (15.6)
University		19 (59.4)
Gravidity	32	
1		15 (46.9)
2		4 (12.5)
3 or more		13 (40.7)
Parity	32	
1		19 (59.4)
2		5 (15.6)
3 or more		8 (25)
CNM	32	
>30 d		32 (100)
TSK (17-68)	32	Mean ± SD: 34.7 ± 6.8
High kinesiophobia (≥38)		8 (25)
SBST	32	
Low		20 (62.5)
Medium		10 (31.3)
High		2 (6.3)
STAI (20-80)	32	Mean ± SD: 44 ± 10.5
Minimal (≤35)		7 (21.9)
Low (36-45)		11 (34.4)
Moderate (46-55)		10 (31.3)
High (56-65)		3 (9.4)
Very high (≥66)		1 (3.1)

BMI, body mass index; *CNM*, Modified Nordic Classification; *SBST*, STarT Back Screening Tool; *STAI*, State-Trait Anxiety Inventory; *TSK*, Tampa Scale of Kinesiophobia.

[a] In Québec, Collegiate studies follow high school studies and precede university studies.

Discussion

The objective of this study was to investigate the association between physical activity, weight status, anxiety, and LBPP symptoms evolution in postpartum women. This prospective observational cohort study followed postpartum women with persistent LBPP over a 6-month period after their inclusion in the study (between 3 and 12 months after delivery). Results showed that during this time frame, LBPP and the related disability indicators improved. However, although these improvements were statistically significant, they did not reach clinically significant thresholds. Indeed, PGP scores (0-100) were reduced by 19 points, whereas the MCID is considered to be 25 points.[42] Similarly, ODI scores (0-100) decreased by 6 points, whereas the MCID is 10 points,[43] and pain intensity (0-100) decreased by only 10 points, whereas the MCID is considered to be 20 points.[43]

Our hypothesis concerning the association between physical-activity levels and LBPP evolution in postpartum was partly validated. Improvements in ODI disability scores showed a moderate correlation with inactive minutes at T3 and T6 and with steps at T6, indicating that improvement in ODI scores was greater in women who were more physically active. Also, exploratory regression analysis showed that mean steps at T6 predicted reduction in ODI scores. For each 1000 steps walked, ODI scores were reduced by 2 points, suggesting that it would take 3000 steps to clinically improve ODI scores.

Despite an association between physical-activity levels and ODI disability scores, PGQ disability scores were not correlated with any of the physical-activity outcomes. A possible explanation is that physical-activity levels at T6 were not high enough to affect the various constructs assessed with the PGQ. Although there are no specific physical-activity recommendations for postpartum women, it is recommend for pregnant women[46] (and adults in general) to accumulate at least 150 min/wk of moderate-intensity physical activity.[47] Adults should also accumulate at least 10 000 steps per day to be considered active,[48] and therefore postpartum women recruited in the present study did not meet these recommendations at T6 (mean of 104 ± 87 min/wk of fairly + very active time; mean of 8340 ± 2416 steps/day). According to the most recent Canadian[49] and American[50] guidelines for physical activity during pregnancy, there is currently no recommendation regarding how many steps per day a pregnant woman should accumulate to be considered active.

Women lost a mean of 1.9 ± 4.5 kg at T6, and this weight loss was moderately correlated with reduction in LBPP intensity and PGQ and ODI scores, and weakly correlated with pain frequency, thus partially validating our initial hypothesis that weight changes would be associated with LBPP evolution. Exploratory regression analysis also showed that weight loss predicted a positive evolution of

Table 2. *Disability Associated With Lumbopelvic Pain, Weight, and Physical Activity (Mean ± SD) at Follow-ups*

Outcomes	N	Baseline (T0)	N	3-mo assessment (T3)	N	6-mo assessment (T6)	*P*
PGQ (0-100)	32	31.2 ± 16.2	28	18.4 ± 13.0	27	12.4 ± 10.0	<.001[a,c]
ODI (0-100)	32	17.7 ± 9.2	28	18.4 ± 12.8	27	12.4 ± 10.0	<.001[a-c]
Weight (kg)	32	72.9 ± 19.1	28	70.7 ± 20.1	27	70.1 ± 19.2	.021[c]
Weight change (kg)	32	—	28	−0.8 ± 2.5	27	−1.9 ± 4.5	—
PA data							
Valid days (0-7)	32	6.4 ± 0.8	28	6.5 ± 0.7	27	6.4 ± 0.7	.833
Steps (per d)	32	7970 ± 1977	28	8318 ± 2233	27	8340 ± 2416	.785
Inactive min (per d)	30	1117 ± 60	25	1104 ± 62	27	1096 ± 73	.390
Active min (per d)	30		25		27		
Lightly		307 ± 56		318 ± 56		329 ± 67	.443
Fairly		9 ± 9		10 ± 8		10 ± 8	.738
Very		7 ± 7		8 ± 9		5 ± 6	.237
Fairly + very active (per wk)		107 ± 88		113 ± 107		104 ± 87	.92

ODI, Oswestry Disability Index; *PA*, physical activity; *PGQ*, Pelvic Girdle Questionnaire.
[a] Post hoc analysis showed a statistical difference between T0 and T3.
[b] Post hoc analysis showed a statistical difference between T3 and T6.
[c] Post hoc analysis showed a statistical difference between T0 and T6.

LBPP in the postpartum period. For each kilogram of weight lost at T6, PGQ score (0-100) was reduced by 2 points, ODI score (0-100) by 0.8 points, intensity (0-100) by 1.2 points, and frequency (0-7) by 0.1 day. Considering that weight gain during pregnancy is a factor potentially involved in the development of LBPP,[51,52] one could argue that the reduction in pain follows weight loss during the postpartum period. The mechanisms involved are likely a decrease in the amount of force placed across joints, a normalization of the center of gravity, and a return to better posture. Although these are all biologically plausible explanations, there is actually very little evidence to support these hypotheses. Our hypothesis regarding the association between anxiety levels and LBPP symptom evolution was not validated. Anxiety levels were not significantly correlated to any of the LBPP indicators. This could be explained by the fact that 88% of the participants had minimal, low, or moderate levels of anxiety, whereas only 13% of the participants showed high or very high anxiety levels, 2 of whom (6%) did not complete the study. Underrepresentation of women with high anxiety levels certainly limited our ability to find linear correlations between anxiety levels and LBPP indicators, in addition to the generalization of our results.

Table 3. *Pain Intensity and Frequency (Mean ± SD)*

Pain outcomes	T0-T3 (n = 28)	T3-T6 (n = 27)	*t* test (*P*)
Pain frequency (0-7 d)	3.7 ± 1.6	2.9 ± 2.0	<.001
PI-NRS (0-100)	40.0 ± 15.5	30.4 ± 16.8	<.001

PI-NRS, pain intensity numerical rating scale.

Surprisingly, baseline BMI and TSK scores were both moderately and positively correlated with PGQ improvement, indicating that women with higher BMI and higher kinesiophobia at T0 had a larger reduction in disability over time. Usually, high kinesiophobia is associated with higher disability levels when assessed in populations with chronic musculoskeletal pain.[53] Notably, only 25% of our participants had high kinesiophobia levels, which may have limited the identification of any association between kinesiophobia and disability. Women with higher BMI did not have greater weight loss nor higher physical-activity levels at T6, which could have been suitable explanations for the correlation between BMI and PGQ scores. Some confounding factors not measured in our study, such as breastfeeding and diet, could mediate these correlations.[54,55]

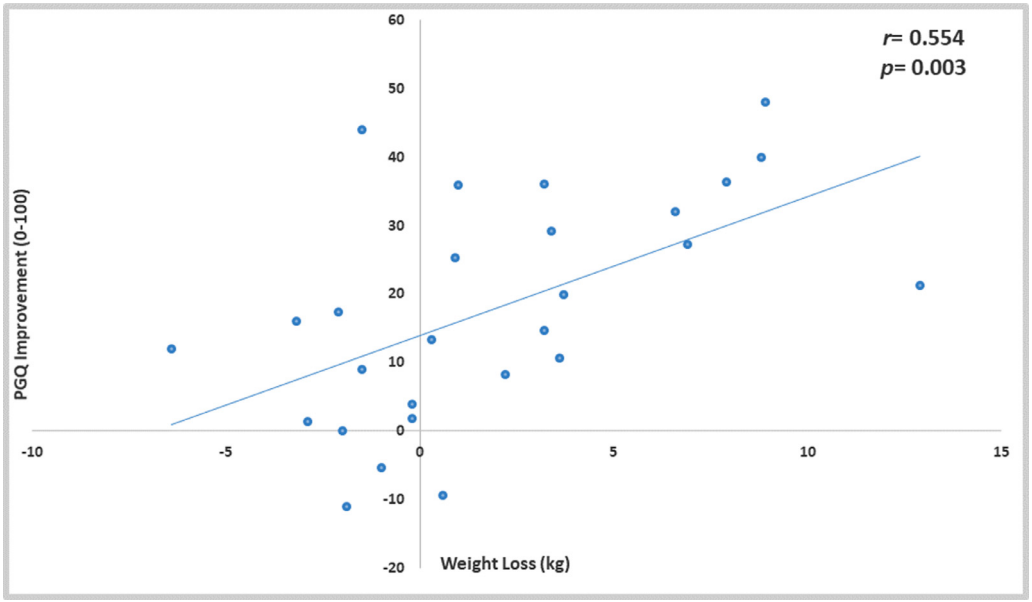

Fig 2. *Correlation between Pelvic Girdle Questionnaire improvement and weight loss at T6.*

Strengths and Limitations

The use of a physical-activity monitor, combined with weekly assessments of pain intensity and frequency and the longitudinal nature of this study, played a significant role in reducing recall bias. Participants adhered to the use of the Fitbit monitors, and no data had to be excluded owing to noncompliance. Furthermore, the response rate to the weekly text messages was high (95%), as was the proportion of participants who completed the T6 follow-up (84%). Finally, although the sample size of this study was small, which may have limited the ability to identify significant correlations between various investigated outcomes, participants who were excluded from the analyses had similar clinical profiles, although they were younger (24 vs 29 years).

The use of a physical-activity monitor was paradoxically also a limitation of this study owing to the short stocking period

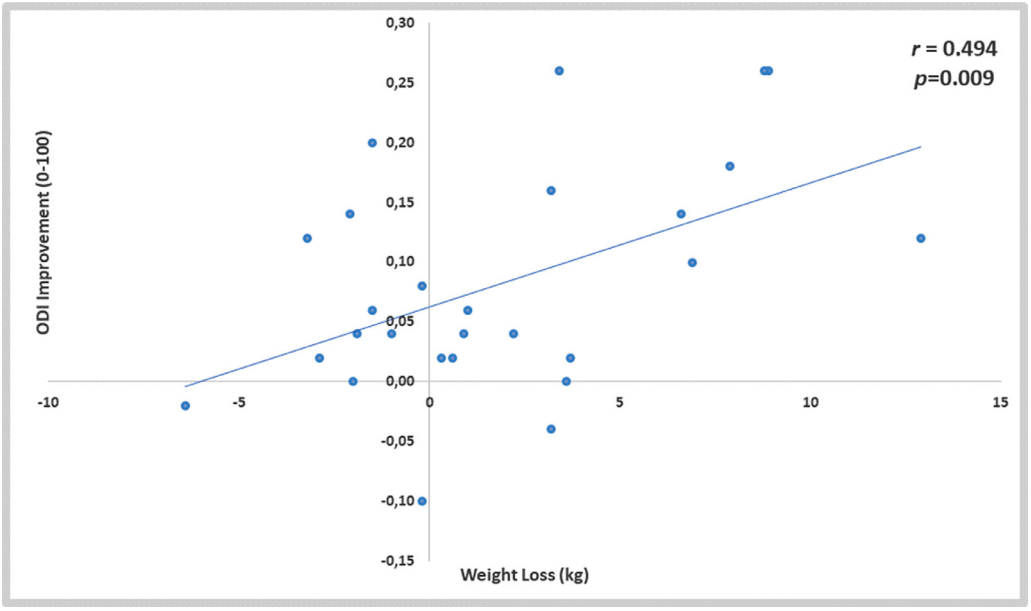

Fig 3. *Correlation between Oswestry Disability Index improvement and weight loss at T6.*

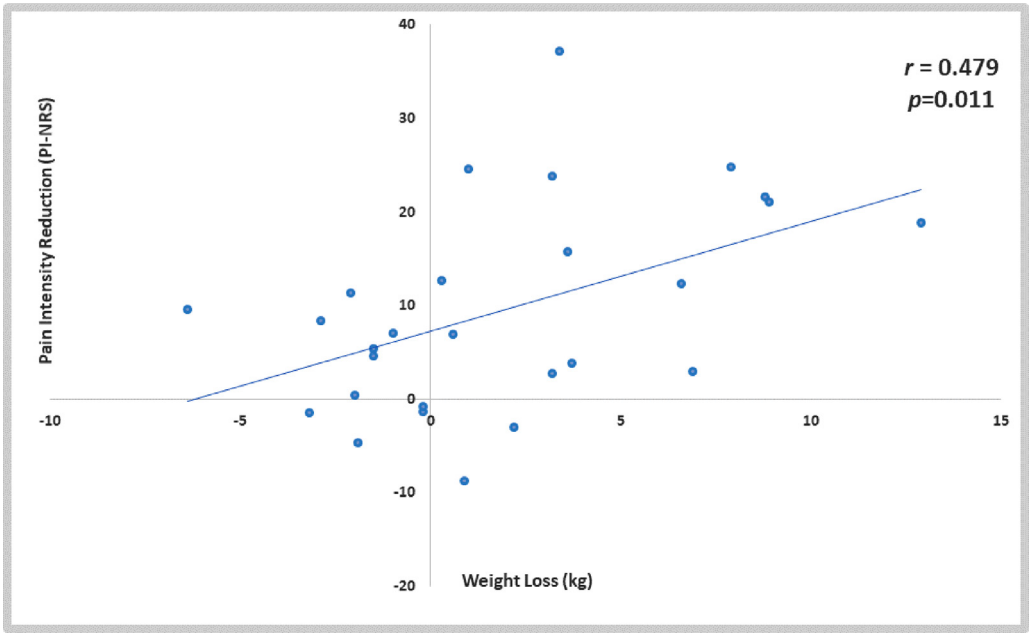

Fig 4. *Correlation between pain intensity reduction and weight loss at T6.*

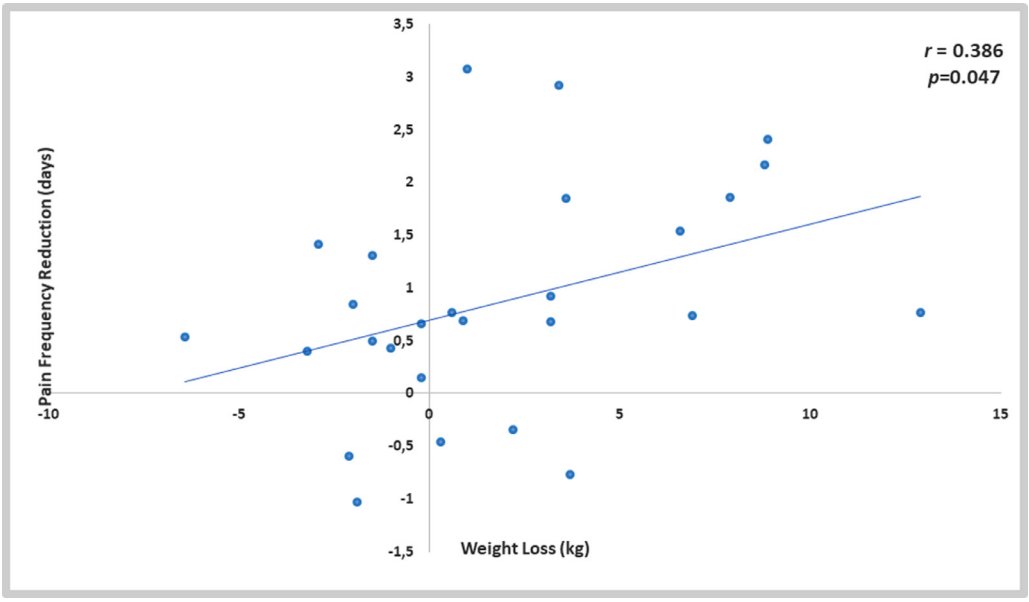

Fig 5. *Correlation between pain frequency reduction and weight loss at T6.*

(7 days) of data and to device malfunctions which led to the loss of 5 of 81 files (6.16%) of data on active and inactive minutes. Moreover, the inability to wear the monitor in water could have led to an underestimation of physical-activity levels. Sixteen participants (50%) reported that they took off their physical-activity monitor in order to perform aquatic activities at least once during the study. Other low-cost technologies are now available for water immersion and thus should be considered in future studies in order to better assess the association between physical-activity levels and evolution of LBPP symptoms in postpartum women. Finally, the recruitment of women up to 12 months postpartum could have introduced heterogeneity regarding their clinical picture and therefore led to difficulties in identifying risk factors for persistence of postpartum LBPP. Other studies have already found an association between weight loss and pain reduction in people in the general population who are obese.[56-58] Future studies should therefore focus on the association between

Table 4. *Correlations of Lumbopelvic Pain, Frequency, Intensity, Disability, and Their Potentially Associated Factors*

Demographics and outcomes	N	PGQ improvement	N	ODI improvement	N	Pain intensity reduction	N	Pain frequency reduction
Age	27	0.185 ($P = .356$)	27	0.110 ($P = .583$)	27	0.322 ($P = .101$)	27	0.053 ($P = .794$)
BMI	27	0.420 ($P = .029$)[a]	27	0.232 ($P = .245$)	27	0.272 ($P = .170$)	27	0.109 ($P = .590$)
Total gestational weight gain	27	0.290 ($P = .151$)	27	0.276 ($P = .172$)	27	0.043 ($P = .834$)	27	0.156 ($P = .448$)
Weight loss between T0 and T6	27	0.554 ($P = .003$)[a]	27	0.494 ($P = .009$)[a]	27	0.479 ($P = .011$)[a]	27	0.386 ($P = .047$)[a]
TSK score at T0	27	0.465 ($P = .014$)[a]	27	0.379 ($P = .051$)	27	0.244 ($P = .220$)	27	0.164 ($P = .415$)
STAI score at T0	27	0.125 ($P = .534$)	27	0.022 ($P = .913$)	27	−0.015 ($P = .942$)	27	−0.042 ($P = .837$)
Mean steps at T0	27	0.069 ($P = .732$)	27	0.236 ($P = .236$)	27	0.177 ($P = .377$)	27	0.200 ($P = .318$)
Mean inactive min at T0	25	−0.082 ($P = .697$)	25	−0.296 ($P = .151$)	25	−0.151 ($P = .470$)	25	−0.158 ($P = .450$)
Mean steps at T3	27	0.151 ($P = .453$)	27	0.317 ($P = .107$)	27	0.176 ($P = .380$)	27	0.269 ($P = .175$)
Mean inactive min at T3	24	−0.239 ($P = .261$)	24	−0.453 ($P = .026$)[a]	24	−0.198 ($P = .355$)	24	−0.247 ($P = .245$)
Mean steps at T6	27	0.187 ($P = .349$)	27	0.512 ($P = .006$)[a]	27	0.152 ($P = .448$)	27	0.216 ($P = .280$)
Mean inactive min at T6	27	−0.159 ($P = .439$)	27	−0.457 ($P = .019$)[a]	27	−0.093 ($P = .650$)	27	−0.145 ($P = .479$)

Data are presented as Pearson correlation coefficients, except for correlations with BMI, which were conducted using the Spearman rank correlation.
BMI, body mass index; *ODI*, Oswestry Disability Index; *PGQ*, Pelvic Girdle Questionnaire; *STAI*, State-Trait Anxiety Inventory; *TSK*, Tampa Scale of Kinesiophobia.
[a] Significant correlations.

Table 5. *Multiple Regression Analyses Predicting Positive Lumbopelvic Pain Evolution at T6*

Model Predicting Reduction in PGQ Scores at T6					
Outcomes	B (95% CI)	SE of B	β	t	P
Weight loss at T6	2.029 (0.772-3.285)[a]	0.610[a]	0.554[a]	3.325[a]	.003[a]
TSK score at T0			0.283	1.591	.125
Mean steps at T6			0.052	0.297	.769
Model Predicting Reduction in ODI Scores at T6					
	B (95% CI)	SE of B	β	t	P
Weight loss at T6	0.763 (0.051-1.475)[a]	0.345[a]	0.369[a]	2.212[a]	.037[a]
TSK score at T0			0.196	1.103	.281
Mean steps at T6	0.002 (0.000-0.003)[a]	0.001[a]	0.404[a]	2.418[a]	.024[a]
Model Predicting Reduction in Lumbopelvic Pain Intensity at T6					
	B (95% CI)	SE of B	β	t	P
Weight loss at T6	1.177 (0.289-2.065)[a]	0.431[a]	0.479[a]	2.729[a]	.011[a]
TSK score at T0			0.053	0.268	.791
Mean steps at T6			0.035	0.187	.854
Model Predicting Reduction in Lumbopelvic Pain Frequency at T6					
	B (95% CI)	SE of B	β	t	P
Weight loss at T6	0.091 (0.001-0.181)[a]	0.044[a]	0.386[a]	2.089[a]	.047[a]
TSK score at T0			0.003	0.013	.990
Mean steps at T6			0.127	0.659	.516

β, standardized beta; *B*, unstandardized beta; *ODI*, Oswestry Disability Index; *PGQ*, Pelvic Girdle Questionnaire; *SE of B*, Standard error of the unstandardized beta; *TSK*, Tampa Scale of Kinesiophobia.
[a] Significant correlations.

weight loss and LBPP evolution specifically in postpartum women and take into account factors that influence weight loss such as breastfeeding, physical activity, and nutrition.

Conclusion

The present study showed that there is an association between the amount of weight loss and positive evolution of LBPP symptoms during the postpartum period, as demonstrated by reduction in pain frequency, intensity, and disability. Weight-loss management in postpartum women to reduce LBPP should be further investigated in clinical trials. Physical-activity levels may also be associated with a reduction in disability. No significant correlation was observed between anxiety levels and LBPP indicators. However, studies with larger sample sizes are needed to confirm the risk factors of evolution of LBPP symptoms in late postpartum that we identified.

Practical Applications

- The study investigated associations between lumbopelvic pain and physical activity, weight loss, and anxiety.
- Weight loss and decreases in lumbopelvic pain and disability are associated during the postpartum period.
- Inactivity seems to be associated with low back disability.

Supplementary Data

The data sets supporting the outcomes of the study are included in the article. However, additional information can be provided on request made to the corresponding author.

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Contributorship Information

Concept development (provided idea for the research): M-P.G., S.M.R., M.D.
Design (planned the methods to generate the results): M-P.G., J.O., C.D., S.M.R., M.D.
Supervision (provided oversight, responsible for organization and implementation, writing of the manuscript): S.M.R., M.D.
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Analysis/interpretation (responsible for statistical analysis, evaluation, and presentation of the results): M-P.G., S.M.R., M.D.
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