ASSOCIATION BETWEEN PHYSICAL ACTIVITY, WEIGHT LOSS, ANXIETY AND LUMBOPELVIC PAIN IN POSTPARTUM WOMEN.

ABSTRACT

Background: Lumbopelvic pain (LBPP) affects 45-81% 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 between physical activity, weight status, anxiety and LBPP symptoms evolution in postpartum women.

Methods: This is a prospective observational cohort study with 3 time point assessments (baseline (T0), 3 months (T3) and 6 months (T6) later). 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 (PGQ) 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 (STAI). Weight was recorded using a standardized method. Pain intensity (0-100 point pain intensity numerical rating scale) and frequency were assessed using a standardized text message on a weekly basis throughout the study.

Results: Thirty-two women were included (postpartum age: 6.6 ± 2.0 months; maternal age: 28.3 ± 3.8 years old; body weight: 72.9 ± 19.1 kg) and 27 completed the T6 follow-up. Disability, pain intensity and frequency improved at T6 (p<0.001). Women lost a mean of 1.9 ± 4.5 kg at T6 and this weight loss was correlated with reduction in LBPP intensity (r=.479; p=.011) and LBPP frequency (r=.386; p=.047), PGQ (r=.554; p=.003) and ODI scores (r=.494; p=.009). Improvement in ODI scores at T6 was correlated with the number of inactive minutes at T3 (r=-.453; p=.026) and T6 (r=-.457; p=.019), and with daily steps at T6 (r=.512; p=.006).

Conclusions: Weight loss is associated with positive LBPP symptom evolution beyond 3 months postpartum, and physical activity is associated with reduction in pain disability.

Key words: Low Back Pain; Pelvic Girdle Pain; Exercise; Weight Loss; Postpartum; Disability.

Running title: Postpartum lumbopelvic pain symptom evolution

INTRODUCTION

Although definitions may vary across study, 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, 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 44-72% of pregnant women,[3-8] while 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 following 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] whereas 43% of women still experience LBPP 6 months after 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 sick leave. [19, 20] Previous caesarean section, [21] higher fetal weight, [12] history of LBP and pain severity [6, 22] and emotional distress [23] have also been associated to long term LBPP.

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

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

Since 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] their contribution to postpartum-related LBPP should be further investigated. Moreover, although a recent meta-analysis showed that maternal physical activity was associated with decreased symptoms of LBPP during pregnancy, [28] the literature on the association between postnatal physical activity and LBPP symptoms evolution in postpartum women is limited [29] and need to be clarified. Thus, the objective of this study was to investigate the association between physical activity, weight status, anxiety and LBPP symptoms evolution beyond 3 months postpartum, using a 6 months follow-up period. It was hypothesized that higher physical activity and lower anxiety levels, as well as weight loss would be associated with positive LBPP symptom evolution.

MATERIALS AND METHODS

Design

This study was a prospective observational cohort study with a 6-month follow-up period.

Participants

Thirty-two women were recruited through advertisements published in local newspapers and social medias. Women were eligible to participate in the study if they were 3-12 months postpartum, over 18 years old and had actual persistent LBPP that started during pregnancy or within the first three 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 non-musculoskeletal pain. The institutional research ethics committee approved this study (CDERS-16-8-06.01) and all participants provided their 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 an alpha level <0.05. An attrition rate of 10% was also considered.

Outcome assessment

Outcome assessment was scheduled at 3 time points: at baseline (T0) and 3 and 6 months later (T3 and T6, respectively). The T0 visit took place at the 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 XXX 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

99 completed a standardized evaluation for each women. The standardized evaluation that included six
100 physical tests to assess sacroiliac joints (SIJ) pain: the Faber Patrick test, the Distraction test, the
101 Thigh Trust test, the Gaenslen test, the Active strait leg raise test and the Iliac compression test.
102 Those tests are frequently used to assess SIJ pain and have acceptable sensibility, specificity and
103 reliability.[1, 30-33] Symphysiolysis was assessed using the modified Tredelenburg test and the
104 symphysis palpation, which had the highest sensitivity and specificity.[1] Lumbar pain was assessed
105 using palpation. Confirmation of LBPP was based on the clinician's clinical judgment, after recent
106 medical history and physical examination.
107 *General information*: Sociodemographic and anthropometric data were collected for each
108 participant (age, education level, body weight and height). The number of days with LBPP over the
109 last year was assessed using the Modified Nordic Classification (CNM; 0, 1-30 and >30 days).[34]
110 Obstetrical data were self-reported by the women and included parity (number of pregnancies
111 lasting more than 20 weeks), gravidity (total number of pregnancies, regardless of the pregnancy
112 outcome) and total weight gain during pregnancy.
113 *Pain-related outcomes*: The French-Canadian version[35] of the Tampa Scale of Kinesiophobia (TSK)
114 was used to assess pain-related fear, which can have an impact on the participant's physical activity
115 levels, and is recognized to be a predictor for chronic LBP.[36] Scores range from 17 to 68 and a score
116 of ≥38 identifies individuals with high kinesiophobia. The French version of the STarT Back
117 Screening Tool (SBST)[37] was used to classify women according to 3 groups for risk of poor
118 prognosis associated with LBPP: low, medium and high. The SBST include 9 items and the overall
119 scores range from zero to 9. The overall score is used to separate the low risk patients from the
120 medium-risk subgroups. Patients with a score of 0-3 are classified into the low-risk subgroup and
121 those with scores of 4-9 into the medium-risk subgroup. A distress subscale score (including 5 items

122 out of 9) is used to identify the high-risk subgroup. Subscale scores range from 0 to 5 with patients
123 scoring 4 or 5 being classified into the high-risk subgroup. [38] LBPP symptoms evolution was
124 assessed using 3 LBPP indicators: pain intensity, pain frequency and related disability. Disability
125 associated with LBPP was assessed using the French-Canadian Pelvic Girdle Questionnaire (PGQ)[39]
126 and the French-Canadian Oswestry Disability Index (ODI),[40] both showing good internal
127 consistency, reliability and construct validity when used with pregnant or postpartum women.[41]
128 PGQ and ODI scores both range from 0 to 100, where 100 represents the highest possible level of
129 disability. In order to interpret our results, the minimal clinically important difference (MCID) was
130 considered to be 25 points for PGQ scores [42] and 10 points for ODI scores. [43] For pain intensity (on
131 a 0-100 point scale), the MCID was considered to be 20 points.[43]
132 *Risk factors for postpartum-related LBPP*: Physical activity levels of each participant were assessed
133 using the Fitbit Flex monitor (San Francisco, CA; www.fitbit.com), which is a valid physical activity
134 tracker.[44] The Fitbit Flex monitor was worn on the non-dominant wrist for 7 consecutive days
135 shortly after the T0 visit. The participants were told to complete a diary to record sleeping hours and
136 compliance with the wearing of the monitor. Valid data were defined as ≥ 4 days with no more than
137 4 awake hours per day without the monitor. Daily steps, inactive and active times (lightly, fairly and
138 very active) were recorded. According to the manufacturer, lightly, fairly and very active times
139 corresponded respectively to <3, 3-5.9 and ≥6 metabolic equivalents.
140 Anxiety levels were self-reported by each participant using the French-Canadian version of the
141 State-Trait Anxiety Inventory (STAI).[45] Scores range from 20 to 80, where 80 is the highest anxiety
142 level. Anxiety levels were considered minimal (score ≤35), low (score 36-45), moderate (score 46-
143 55), high (score 56-65) and very high (score ≥66).
144 Weight was measured using a Tanita scale (UM016 2202, Tanita Corporation, USA).

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 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 0-100 points pain intensity numerical rating scale (PI-NRS). Participants texted back the number from 0-7 for pain frequency and 0-100 for pain intensity.

Statistics

Descriptive statistics were used to examine the participants' baseline characteristics. The Shapiro-Wilk and the Kolmogorov-Smirnov tests were used to assess each variable for normality and determine the appropriate statistic tests to be used. LBPP disability improvement during the study was calculated by subtracting PGQ-ODI scores at T0 from the PGQ-ODI scores at T6. Pain intensity and frequency reduction were calculated by subtracting the mean value during the first 3 months (T0-T3) from the mean value during the last 3 months (T3-T6) of the follow-up. A repeated measure ANOVA model was used to assess the change in disability, weight and physical activity levels overtime, followed by a Tukey's Test for post hoc analyses when indicated. Correlation statistics were used in order to assess the relation between physical activity levels, anxiety levels, weight changes, and the 3 LBPP indicators (pain intensity, pain frequency and the related disability). The Pearson's correlation coefficient was used for all correlations except for correlations with BMI, for which the Spearman's rank correlation coefficient was used due to abnormally distributed BMI data. Coefficients <0.10 were considered negligible correlation, 0.10–0.39 weak, 0.40–0.69 moderate, 0.70–0.89 strong and >0.90 very strong correlation. Finally, exploratory multiple regression

168 analyses were conducted to test if physical activity levels, anxiety levels and weight loss predicted
169 LBPP evolution. IBM SPSS Statistics 25.0 (IBM Corp, Armonk, NY) was used for all analyses.
170
171 **RESULTS**
172 Recruitment took place over a one-year period (August 2017 to August 2018). Thirty-five women
173 were interested to participate in the study. Three did not meet inclusion criteria, 3 were lost at follow-
174 up and 2 were excluded from the analyses because they became pregnant during the follow-up
175 period. Thus, 27 women completed the 3 assessments (T0, T3 and T6). Figure 1 presents the study
176 flow-chart. Table 1 presents baseline characteristics of the sample and basic demographic
177 information.
178
179 **Insert Figure 1 and table 1 about here**
180
181

Table 2 presents disability associated with LBPP, weight and physical activity levels at the 3 assessments 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<0.001) and between T0 and T6 (p<0.001). ODI scores were 17.7 ± 9.2, 18.4 ± 12.8 and 12.4 ± 10.0, respectively, with significant change between each assessment time points (p<0.001). Women lost a mean of 1.9 ± 4.5 kg at T6 (p=0.021). However, some active and inactive minutes were incomplete due 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.

Insert table 2 about here

The response rate for pain frequency and intensity that was 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<0.001). Maximal pain intensity was 40.0 ± 15.5 on the 100 points PI-NRS 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<0.001).

Insert table 3 about here

Statistically significant correlations were found between weight loss at T6 and the evolution of LBPP over the course of the study (Figures 2 to 5). Indeed, a reduction in LBPP intensity (r=.479; p=.011), frequency (r=.386; p=.047), PGQ score (r=.554; p=.003) and ODI scores (r=.494; p=.009) were all positively correlated with weight loss. Baseline BMI (r=.420; p=.029) and TSK (r=.465;

205 p=.014) scores were positively correlated with PGQ score improvement at T6 (Table 4), indicating
206 that women with higher BMI and higher kinesiophobia at T0 showed a larger reduction in their PGQ
207 score at T6. Regarding physical activity levels, inactive minutes at T3 and T6 and steps at T6 were
208 correlated with improvement in ODI score at T6 (Table 4). These correlations were not found with
209 the PGQ nor with pain intensity and frequency.
210 Results from the regression analyses are presented in table 5. Overall, results from regression
211 analyses showed that weight loss at T6 significantly predicts positive LBPP evolution in postpartum,
212 either when predicting reduction in PGQ scores (β =0.554, p=0.003), ODI scores (β =0.369,
213 p=0.037), pain intensity (β =0.479, p=0.011) and pain frequency (β =0.386, p=0.047). Mean steps
214 at T6 also predict reduction in ODI scores (β =0.404, p=0.024).
215 **Insert figure 2 to 5 about here**
216 **Insert table 4 and 5 about here**
217
218

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 months period after their inclusion in the study (between 3 to 12 months after delivery). Results showed that during this timeframe, LBPP and the related disability indicators improved. However, although these improvements were statistically significant, they did not reach clinically significant thresholds. Indeed, PGP scores were reduced by 19 points (0-100) while the MCID is considered to be 25 points.[42] Similarly, ODI scores decreased by 6 points (0-100), whereas the MCID is 10 points,[43] and pain intensity only decreased by 10 points (0-100), while 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 (0-100), suggesting that it would take 3000 steps to clinically improve ODI scores.

Despite an association between physical activity levels and the 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 impact the various constructs assessed with the PGQ. Although there is no specific physical activity recommendations for postpartum women, It is recommend for pregnant women [46], and adults in general, to accumulate at least 150 minutes per week of moderate-intensity physical activity.[47] Adults should also accumulate at least 10 000

steps per day to be considered active[48] therefore postpartum women recruited in the present study did not meet these recommendations at T6 (mean of 104 ± 87 minutes per week 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 to reduction in LBPP intensity, PGQ score and ODI scores, and weakly correlated to 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 LBPP in the postpartum period. For each kilogram of weight lost at T6, PGQ score was reduced by 2 points (0-100), ODI score by 0.8 points (0-100), intensity by 1.2 (0-100) and frequency by 0.1 day (0-7). 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 a 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 a minimal, low or moderate levels of anxiety, whereas only 13% of the participants showed high or very high anxiety levels, among which 2 (6%) did not complete the study. Under-representation of women with high anxiety levels certainly limited our ability to find linear correlations between anxiety levels and LBPP indicators and the generalization of our results.

Surprisingly, baseline BMI and TSK scores were both moderately and positively correlated to 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 chronic musculoskeletal pain populations.[53] Noteworthy, 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 a 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]

Strengths and Limitations

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

The use of a physical activity monitor was paradoxically also a limitation of this study due to the short stocking period (7 days) of data and device malfunctions which led to the loss of 5/81 (6.16%) files of actives/sedentary minute data. Moreover, the impossibility to wear the monitor in the 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 LBPP symptoms evolution in postpartum women. Finally, the recruitment of women up to 12 months postpartum could have introduce heterogeneity regarding their clinical picture and therefore lead 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 obese general population.[56-58] Future studies should therefore focus on the association between 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 LBPP symptom evolution during the postpartum period as demonstrated by the 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 reduction in disability. No significant correlation was observed between anxiety levels and LBPP indicators. However, studies with larger sample size are needed to confirm risk factors of LBPP symptoms evolution in late postpartum we identified.

DECLARATIONS

Ethics approval and consent to participate

The XXX approved this study with a certificate CDERS-16-8-06.01. Written informed consent was obtained for each participant. No children under 18 were involved so no parent or legal guardian consent were needed.

Consent to publish

Not applicable.

Availability of data and materials

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

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

All authors participated in the study design, literature search and critical review of the manuscript. MPG, SMR and MD were involved in concept development analysis and interpretation of data. Data collection was completed by MPG, JO and CD while MD and SMR provided critical review and overall supervision of the project. All authors read and approved the final manuscript.

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N/A

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Figure Captions:

Figure 1. Flow chart

Figure 2. Correlation between PGQ improvement and weight loss at T6

Figure 3. Correlation between ODI improvement and weight loss at T6

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

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

Table 1. Participants' Baseline Characteristics

Characteristics	**N**	**Mean ± SD**
Age (year)	32	28.3 ± 3.8
Time since delivery (month)	32	6.6 ± 2.0
BMI (kg/m^2)	32	26.9 ± 6.5
Total gestational weight gain (kg)	28	16.6 ± 7.0
Characteristics	**N**	**N (%)**
BMI categories	32	
Underweight (<18.5)		1 (3.1)
Normal (18.5-24.9)		14 (43.8)
Overweight (25-29.9)		7 (21.9)
Obesity (≥30)		10 (31.3)
Educational levels (degree obtained)	32	
None		3 (9.4)
High school		2 (6.3)
Professional		3 (9.4)
Collegial		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)

Table 1 (continued)

Characteristics	N	N (%)
CNM	32	
>30 days		32 (100)
TSK (17-68)	32	Mean ± SD : 34.7 ± 6.8
High kinesophobia (≥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)

Data are presented as mean ± standard deviation or N (%).

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

494 **Table 2**. Mean ± SD for disability associated with LBPP, weight and physical activity at follow-ups.

	N	Baseline (T0)	N	3rd month assessment (T3)	N	6th month assessment (T6)	p-value
PGQ (0-100)	32	31.2 ± 16.2	28	18.4 ± 13.0	27	12.4 ± 10.0	<0.001[1, 3]
ODI (0-100)	32	17.7 ± 9.2	28	18.4 ± 12.8	27	12.4 ± 10.0	<0.001[1-3]
Weight (kg)	32	72.9 ± 19.1	28	70.7 ± 20.1	27	70.1 ± 19.2	0.021[3]
Weight change (kg)	32	—	28	-0.8 ± 2.5	27	-1.9 ± 4.5	—
PA data							
Number of valid days (0-7)	32	6.4 ± 0.8	28	6.5 ± 0.7	27	6.4 ± 0.7	0.833
Steps	32	7970 ± 1977	28	8318 ± 2233	27	8340 ± 2416	0.785
Inactive minutes	30	1117 ± 60	25	1104 ± 62	27	1096 ± 73	0.390
Active minutes (per day)	30		25		27		
Lightly		307 ± 56		318 ± 56		329 ± 67	0.443
Fairly		9 ± 9		10 ± 8		10 ± 8	0.738
Very		7 ± 7		8 ± 9		5 ± 6	0.237
Fairly + very active (per week)		107 ± 88		113 ± 107		104 ± 87	0.92

495 Data are presented as mean ± standard deviation

496 *ODI, Oswestry Disability Index; PA, Physical activity; PGQ, Pelvic Girdle Questionnaire*

497 [1] Post hoc analysis showed statistical difference between T0 and T3

498 [2] Post hoc analysis showed statistical difference between T3 and T6

499 [3] Post hoc analysis showed statistical difference between T0 and T6

500 **Table 3**. Mean ± SD for pain intensity and frequency.

501

	T0-T3 (n=28)	T3-T6 (n=27)	T-test (*p*)
Pain frequency (0-7 days)	3.7 ± 1.6	2.9 ± 2.0	<0.001
PI-NRS (0-100)	40.0 ± 15.5	30.4 ± 16.8	<0.001

502 Data are presented as mean ± standard deviation

503 *PI-NRS, Pain Intensity Numerical Rating Scale*

504

505 **Table 4**. Correlation between LBPP, frequency, intensity and disability and their potentially associated factors

	N	PGQ improvement	N	ODI improvement	N	Pain intensity reduction	N	Pain frequency reduction
Age	27	.185 (*p*=.356)	27	.110 (*p*=.583)	27	.322 (*p*=.101)	27	.053 (*p*=.794)
Baseline BMI	27	**.420 (*p*=.029)**	27	.232 (*p*=.245)	27	.272 (*p*=.170)	27	.109 (*p*=.590)
Total gestational weight gain	27	.290 (*p*=.151)	27	.276 (*p*=.172)	27	.043 (*p*=.834)	27	.156 (*p*=.448)
Weight loss between T0 and T6	27	**.554 (*p*=.003)**	27	**.494 (*p*=.009)**	27	**.479 (*p*=.011)**	27	**0.386 (*p*=.047)**
TSK score at T0	27	**.465 (*p*=.014)**	27	.379 (*p*=.051)	27	.244 (*p*=.220)	27	.164 (*p*=.415)
STAI score at T0	27	.125 (*p*=.534)	27	.022 (*p*=.913)	27	-.015 (*p*=.942)	27	-.042 (*p*=.837)
Mean steps at T0	27	.069 (*p*=.732)	27	.236 (*p*=.236)	27	.177 (*p*=.377)	27	.200 (*p*=.318)
Mean inactive minutes at T0	25	-.082 (*p*=.697)	25	-.296 (*p*=.151)	25	-.151 (*p*=.470)	25	-.158 (*p*=.450)
Mean steps at T3	27	.151 (*p*=.453)	27	.317 (*p*=.107)	27	.176 (*p*=.380)	27	.269 (*p*=.175)
Mean inactive minutes at T3	24	-.239 (*p*=.261)	24	**-.453 (*p*=.026)**	24	-.198 (*p*=.355)	24	-.247 (*p*=.245)
Mean steps at T6	27	.187 (*p*=.349)	27	**.512 (*p*=.006)**	27	.152 (*p*=.448)	27	.216 (*p*=.280)
Mean inactive minutes at T6	27	-.159 (*p*=.439)	27	**-.457 (*p*=.019)**	27	-.093 (*p*=.650)	27	-.145 (*p*=.479)

506

507 Data are presented as Pearson correlation coefficient except for correlations with BMI which were conducted using the Spearman's
508 rank correlation. Bold characters indicate significant correlations.

509 *BMI, body mass index; ODI, Oswestry Disability Index; PGQ, Pelvic Girdle Questionnaire; STAI, State-Trait Anxiety Inventory; TSK,*
510 *Tampa Scale of Kinesiophobia*

Table 5. Multiple regression analyses predicting positive LBPP evolution at T6

Model predicting reduction in PGQ scores at T6

	B (95% CI)	SE of B	β	*t*	*p*
Weight loss at T6	**2.029 (0.772-3.285)**	**0.610**	**0.554**	**3.325**	**0.003**
TSK score at T0			0.283	1.591	0.125
Mean steps at T6			0.052	0.297	0.769

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)**	**0.345**	**0.369**	**2.212**	**0.037**
TSK score at T0			0.196	1.103	0.281
Mean steps at T6	**0.002 (0.000-0.003)**	**0.001**	**0.404**	**2.418**	**0.024**

Model predicting reduction in LBPP intensity at T6

	B (95% CI)	SE of B	β	*t*	*p*
Weight loss at T6	**1.177 (0.289-2.065)**	**0.431**	**0.479**	**2.729**	**0.011**
TSK score at T0			0.053	0.268	0.791
Mean steps at T6			0.035	0.187	0.854

Model predicting reduction in LBPP frequency at T6

	B (95% CI)	SE of B	β	*t*	*p*
Weight loss at T6	**0.091 (0.001-0.181)**	**0.044**	**0.386**	**2.089**	**0.047**
TSK score at T0			0.003	0.013	0.990
Mean steps at T6			0.127	0.659	0.516

β, Standardised beta; B, unstandardised beta; ODI, Oswestry Disability Index; PGQ, Pelvic Girdle Questionnaire; SE of B, Standard error for the unstandardised beta; t, test statistic; TSK, Tampa Scale of Kinesiophobia. Bold characters indicate significant correlations