1   **ASSOCIATION BETWEEN PHYSICAL ACTIVITY, WEIGHT LOSS, ANXIETY AND**

2   **LUMBOPELVIC PAIN IN POSTPARTUM WOMEN.**

3   **ABSTRACT**

4   Background: Lumbopelvic pain (LBPP) affects 45-81% of pregnant women, and 25 to 43% of these

5   women report persistent LBPP beyond 3 months after giving birth. The objective of this study was

6   to investigate the association between physical activity, weight status, anxiety and LBPP symptoms

7   evolution in postpartum women.

8   Methods: This is a prospective observational cohort study with 3 time point assessments (baseline

9   (T0), 3 months (T3) and 6 months (T6) later). Women with persistent LBPP 3 to 12 months after

10   delivery were recruited. At each time point, pain disability was assessed with the Pelvic Girdle

11   Questionnaire (PGQ) and the Oswestry Disability Index (ODI), physical activity with Fitbit Flex

12   monitors, and anxiety with the French-Canadian version of the State-Trait Anxiety Inventory

13   (STAI). Weight was recorded using a standardized method. Pain intensity (0-100 point pain

14   intensity numerical rating scale) and frequency were assessed using a standardized text message on

15   a weekly basis throughout the study.

16   Results: Thirty-two women were included (postpartum age: 6.6 ± 2.0 months; maternal age: $28.3 \pm$

17   3.8 years old; body weight: 72.9 ± 19.1 kg) and 27 completed the T6 follow-up. Disability, pain

18   intensity and frequency improved at T6 ($p<0.001$). Women lost a mean of 1.9 ± 4.5 kg at T6 and

19   this weight loss was correlated with reduction in LBPP intensity ($r=.479$; $p=.011$) and LBPP

20   frequency ($r=.386$; $p=.047$), PGQ ($r=.554$; $p=.003$) and ODI scores ($r=.494$; $p=.009$). Improvement

21   in ODI scores at T6 was correlated with the number of inactive minutes at T3 ($r=-.453$; $p=.026$) and

22   T6 ($r=-.457$; $p=.019$), and with daily steps at T6 ($r=.512$; $p=.006$).

23   Conclusions: Weight loss is associated with positive LBPP symptom evolution beyond 3 months

24   postpartum, and physical activity is associated with reduction in pain disability.

25

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

27   Running title: Postpartum lumbopelvic pain symptom evolution

28

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.

51   The persistence of LBPP, particularly in the form of PGP during the postpartum period has

52   important consequences on the women's quality of life. For instance, women with LBPP can

53   experience lower sexual satisfaction (PGP),[24] reduced quality of life and self-rated health, especially

54   for women experiencing continuous pain (including PGP, LBP or both).[25] Women experiencing

55   continuous postpartum LBPP also report a higher extent of sick leave and are more prone to seeking

56   healthcare services. [26]

57   Only a few studies have explored the persistence of LBPP beyond 3 months postpartum. Potential

58   risk factors remains unclear and knowledge about such risk factors remains limited and drawn from

59   studies having small study samples or methodological issues. The postpartum period, however, is a

60   critical period during which LBPP may become chronic[27] and negatively impact the daily life of

61   women. Therefore, a better understanding of LBPP risk factors persisting beyond 3 months

62   postpartum is essential in order to develop effective preventive strategies.

63   Since women with persistent LBPP beyond 3 to 6 months postpartum have a higher pre-pregnancy,

64   delivery and postpartum BMI [6] and given that emotional distress (symptoms of anxiety and

65   depression) has been identified as an independent predictor of persistent LBPP, [23] their contribution

66   to postpartum-related LBPP should be further investigated. Moreover, although a recent meta-

67   analysis showed that maternal physical activity was associated with decreased symptoms of LBPP

68   during pregnancy, [28] the literature on the association between postnatal physical activity and LBPP

69   symptoms evolution in postpartum women is limited [29] and need to be clarified. Thus, the objective

70   of this study was to investigate the association between physical activity, weight status, anxiety and

71   LBPP symptoms evolution beyond 3 months postpartum, using a 6 months follow-up period. It was

72   hypothesized that higher physical activity and lower anxiety levels, as well as weight loss would be

73   associated with positive LBPP symptom evolution.

74

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

completed a standardized evaluation for each women. The standardized evaluation that included six physical tests to assess sacroiliac joints (SIJ) pain: the Faber Patrick test, the Distraction test, the Thigh Trust test, the Gaenslen test, the Active strait leg raise test and the Iliac compression test. Those 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 the 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 (CNM; 0, 1-30 and >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[35] of the Tampa Scale of Kinesiophobia (TSK) was used to assess pain-related fear, which can have an impact on the participant's 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 individuals with high kinesiophobia. The French version of the STarT Back Screening Tool (SBST)[37] was used to classify women according to 3 groups for risk of poor prognosis associated with LBPP: low, medium and high. The SBST include 9 items and the overall scores range from zero to 9. The overall score is used to separate the low risk patients from the medium-risk subgroups. Patients with a score of 0-3 are classified into the low-risk subgroup and those with scores of 4-9 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 patients scoring 4 or 5 being classified into the high-risk subgroup. [38] LBPP symptoms 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 showing 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 0-100 point scale), the MCID was considered to be 20 points.[43]

Risk factors for postpartum-related LBPP: Physical activity levels of each participant were assessed using the Fitbit Flex monitor (San Francisco, CA; www.fitbit.com), which is a valid physical activity tracker.[44] The Fitbit Flex monitor was worn on the non-dominant wrist for 7 consecutive days shortly after the T0 visit. The participants were told to complete a diary to record sleeping hours and compliance with the 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, 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, 3-5.9 and ≥ 6 metabolic equivalents.

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

Weight was measured using a Tanita scale (UM016 2202, Tanita Corporation, USA).

145   T3 and T6 assessments: Physical activity levels, anxiety levels, body weight, and disability

146   associated with LBPP were measured as previously described. Physical activity levels were

147   measured shortly after the T3 and T6 visits.

148   Assessments throughout the study: Pain intensity and frequency were assessed using a standardized

149   text message on a weekly basis between T0 and T3 and T3 and T6. Participants were asked to give

150   the number of days with pain over the last 7 days and to rate their highest pain level on a 0-100

151   points pain intensity numerical rating scale (PI-NRS). Participants texted back the number from 0-

152   7 for pain frequency and 0-100 for pain intensity.

153   *Statistics*

154   Descriptive statistics were used to examine the participants' baseline characteristics. The Shapiro-

155   Wilk and the Kolmogorov-Smirnov tests were used to assess each variable for normality and

156   determine the appropriate statistic tests to be used. LBPP disability improvement during the study

157   was calculated by subtracting PGQ-ODI scores at T0 from the PGQ-ODI scores at T6. Pain intensity

158   and frequency reduction were calculated by subtracting the mean value during the first 3 months

159   (T0-T3) from the mean value during the last 3 months (T3-T6) of the follow-up. A repeated measure

160   ANOVA model was used to assess the change in disability, weight and physical activity levels

161   overtime, followed by a Tukey's Test for post hoc analyses when indicated. Correlation statistics

162   were used in order to assess the relation between physical activity levels, anxiety levels, weight

163   changes, and the 3 LBPP indicators (pain intensity, pain frequency and the related disability). The

164   Pearson's correlation coefficient was used for all correlations except for correlations with BMI, for

165   which the Spearman's rank correlation coefficient was used due to abnormally distributed BMI data.

166   Coefficients <0.10 were considered negligible correlation, 0.10–0.39 weak, 0.40–0.69 moderate,

167   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

182   Table 2 presents disability associated with LBPP, weight and physical activity levels at the 3

183   assessments time points. PGQ scores were 31.2 ± 16.2, 18.4 ± 13.0 and 12.4 ± 10.0, respectively,

184   with a significant decrease between T0 and T3 ($p<0.001$) and between T0 and T6 ($p<0.001$). ODI

185   scores were 17.7 ± 9.2, 18.4 ± 12.8 and 12.4 ± 10.0, respectively, with significant change between

186   each assessment time points ($p<0.001$). Women lost a mean of 1.9 ± 4.5 kg at T6 ($p=0.021$).

187   However, some active and inactive minutes were incomplete due to malfunctioning of the Fitbit

188   Flex monitor, and were therefore excluded from the analyses (2 participants at T0 and 3 participants

189   at T3 and T6). Our results show that physical activity levels did not change significantly between

190   the 3 assessment time points.

191   **Insert table 2 about here**

192   The response rate for pain frequency and intensity that was assessed on a weekly basis was 95.2%.

193   Table 3 presents LBPP intensity and frequency over the course of the study. Mean frequency was

194   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

195   of pain per week during the last 3 months of follow-up (T3-T6), which represent a significant

196   reduction in pain frequency ($p<0.001$). Maximal pain intensity was 40.0 ± 15.5 on the 100 points

197   PI-NRS during the first 3 months of follow-up (T0-T3); it significantly decreased to 30.4 ± 16.8

198   during the last 3 months of follow-up (T3-T6, $p<0.001$).

199   **Insert table 3 about here**

200

201   Statistically significant correlations were found between weight loss at T6 and the evolution of

202   LBPP over the course of the study (Figures 2 to 5). Indeed, a reduction in LBPP intensity ($r=.479$;

203    $p=.011$), frequency ($r=.386$; $p=.047$), PGQ score ($r=.554$; $p=.003$) and ODI scores ($r=.494$; $p=.009$)

204   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

242   steps per day to be considered active[48] therefore postpartum women recruited in the present study

243   did not meet these recommendations at T6 (mean of 104 ± 87 minutes per week of fairly + very

244   active time; mean of 8340 ± 2416 steps/day). According to the most recent Canadian[49] and

245   American[50] Guidelines for physical activity during pregnancy, there is currently no recommendation

246   regarding how many steps per day a pregnant woman should accumulate to be considered active.

247   Women lost a mean of 1.9 ± 4.5 kg at T6 and this weight loss was moderately correlated to reduction

248   in LBPP intensity, PGQ score and ODI scores, and weakly correlated to pain frequency, thus

249   partially validating our initial hypothesis that weight changes would be associated with LBPP

250   evolution. Exploratory regression analysis also showed that weight loss predicted a positive

251   evolution of LBPP in the postpartum period. For each kilogram of weight lost at T6, PGQ score was

252   reduced by 2 points (0-100), ODI score by 0.8 points (0-100), intensity by 1.2 (0-100) and frequency

253   by 0.1 day (0-7). Considering that weight gain during pregnancy is a factor potentially involved in

254   the development of LBPP, [51, 52] one could argue that the reduction in pain follows weight loss during

255   the postpartum period. The mechanisms involved are likely a decrease in the amount of force placed

256   across joints, a normalization of the center of gravity and a return to a better posture. Although these

257   are all biologically plausible explanations, there is actually very little evidence to support these

258   hypotheses. Our hypothesis regarding the association between anxiety levels and LBPP symptom

259   evolution was not validated. Anxiety levels were not significantly correlated to any of the LBPP

260   indicators. This could be explained by the fact that 88% of the participants had a minimal, low or

261   moderate levels of anxiety, whereas only 13% of the participants showed high or very high anxiety

262   levels, among which 2 (6%) did not complete the study. Under-representation of women with high

263   anxiety levels certainly limited our ability to find linear correlations between anxiety levels and

264   LBPP indicators and the generalization of our results.

265 Surprisingly, baseline BMI and TSK scores were both moderately and positively correlated to PGQ

266 improvement, indicating that women with higher BMI and higher kinesiophobia at T0 had a larger

267 reduction in disability over time. Usually, high kinesiophobia is associated with higher disability

268 levels when assessed in chronic musculoskeletal pain populations.[53] Noteworthy, only 25% of our

269 participants had high kinesiophobia levels, which may have limited the identification of any

270 association between kinesiophobia and disability. Women with higher BMI did not have a greater

271 weight loss nor higher physical activity levels at T6, which could have been suitable explanations

272 for the correlation between BMI and PGQ scores. Some confounding factors not measured in our

273 study, such as breastfeeding and diet, could mediate these correlations. [54, 55]

274 *Strengths and Limitations*

275 The use of physical activity monitor, combined with weekly pain intensity and frequency

276 assessments, as well as the longitudinal nature of this study, have played a significant role in

277 reducing recall bias. Women were compliant with the use of the Fitbit monitors and no data had to

278 be excluded due to non-compliance. Furthermore, the response rate to the weekly text messages was

279 high (95%), as well as the proportion of women who completed the T6 follow-up (84%). Finally,

280 although the sample size of this study was small, which may have limited the possibility to identify

281 significant correlations between various investigated outcomes, women who were excluded from

282 the analyses had similar clinical profiles although they were younger (24 vs 29 years old).

283 The use of a physical activity monitor was paradoxically also a limitation of this study due to the

284 short stocking period (7 days) of data and device malfunctions which led to the loss of 5/81 (6.16%)

285 files of actives/sedentary minute data. Moreover, the impossibility to wear the monitor in the water

286 could have led to an underestimation of physical activity levels. Sixteen participants (50%) reported

287 that they took off their physical activity monitor in order to perform aquatic activities at least once

288 during the study. Other low-cost technologies are now available for water immersion and thus,

289 should be considered in future studies in order to better assess the association between physical

290 activity levels and LBPP symptoms evolution in postpartum women. Finally, the recruitment of

291 women up to 12 months postpartum could have introduce heterogeneity regarding their clinical

292 picture and therefore lead to difficulties in identifying risk factors for persistence of postpartum

293 LBPP. Other studies have already found an association between weight loss and pain reduction in

294 obese general population.[56-58] Future studies should therefore focus on the association between

295 weight loss and LBPP evolution specifically in postpartum women and take into account factors

296 that influence weight loss such as breastfeeding, physical activity and nutrition.

CONCLUSION

298 The present study showed that there is an association between the amount of weight loss and positive

299 LBPP symptom evolution during the postpartum period as demonstrated by the reduction in pain

300 frequency, intensity and disability. Weight loss management in postpartum women to reduce LBPP

301 should be further investigated in clinical trials. Physical activity levels may also be associated with

302 reduction in disability. No significant correlation was observed between anxiety levels and LBPP

303 indicators. However, studies with larger sample size are needed to confirm risk factors of LBPP

304 symptoms evolution in late postpartum we identified.

DECLARATIONS

Ethics approval and consent to participate

307 The XXX approved this study with a certificate CDERS-16-8-06.01. Written informed consent was

308 obtained for each participant. No children under 18 were involved so no parent or legal guardian

309 consent were needed.

Consent to publish

311   Not applicable.

312   **Availability of data and materials**

313   The datasets for supporting the outcomes of the study are included in the article. However,

314   additional information can be provided on request made to the corresponding author.

315   **Competing interests**

316   The authors declare that they have no competing interests.

317   **Funding**

321

322   **Authors' contributions**

323   All authors participated in the study design, literature search and critical review of the manuscript.

324   MPG, SMR and MD were involved in concept development analysis and interpretation of data.

325   Data collection was completed by MPG, JO and CD while MD and SMR provided critical review

326   and overall supervision of the project. All authors read and approved the final manuscript.

327

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479 **Figure Captions:**

480 **Figure 1.** Flow chart

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

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

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

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

485

486   **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)

487

488

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)

490

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

492 *BMI, body mass index; CNM, Modified Nordic Classification; SBST, STarT Back Screening Tool;*
493 *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*

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

512 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

513

514 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**

515

516 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

517

518 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

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

522