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Original Research

Relationship between Physical Activity and Lumbopelvic Pain during Pregnancy: A Cross-Sectional Study

Rika Kawabe[1], Chiaki Yamashiro[1], Saori Morino[2], Mika Ishihara[3,†], Chang Yu Chen[1,†], Masumi Koshi[4,†], Naoko Kato[4,†], Hiroko Hatanaka[4,†], Fumiko Umezaki[4,†], Mamoru Yamashita[4], Tomoki Aoyama[1], Momoko Nagai-Tanima[1,*]

[1]Department of Physical Therapy, Human Health Sciences, Graduate School of Medicine, Kyoto University, 606-8507 Kyoto, Japan
[2]Department of Rehabilitation Science, School of Medicine, Osaka Metropolitan University, 583-8555 Osaka, Japan
[3]Women's Pilates Association, 465-0069 Aichi, Japan
[4]Kishokai Medical Corporation, 460-0003 Aichi, Japan
*Correspondence: tanima.momoko.8s@kyoto-u.ac.jp (Momoko Nagai-Tanima)
[†]These authors contributed equally.
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Abstract

Background: More than half of the pregnant women are affected by lumbopelvic pain (LPP) in their daily lives. Physical activity (PA) contributes to LPP relief. There are several reports on exercise habits, including the recommended activity intensity (moderate) and time spent (at least three times a week); however, only a few detailed reports on household/child-rearing and occupational activity are available. Therefore, this study explored the relationships between housework/child-rearing, occupational hours, and LPP. **Methods**: This study included 95 pregnant females who attended an obstetrics and gynecology hospital. The participants were divided into two groups based on the results of an interview on the presence of LPP and classified by intensity or category using the Pregnancy Physical Activity Questionnaire (PPAQ-J). The Wilcoxon signed-rank test was used to compare PA between the two groups. When a significant difference was observed, we performed logistic regression analysis using body mass index (BMI) as an adjustment variable. **Results**: There were 16 females with LPP and 17 women without LPP in the third trimester. There were significant associations between the PPAQ scores of housework/child-rearing activities and LPP in the third trimester. No significant differences in any category of PPAQ scores were observed between the groups with and without LPP in the first and second trimester of pregnancy. **Conclusions**: Our study showed the association between PA and LPP in the third pregnancy. Pregnant females with LPP tended to spend more time on housework and child-rearing necessary for their lives. The duration of housework and child rearing should be reduced because of prolonged standing and the burden on the lumbar area.

Keywords: physical activity; lumbopelvic pain; pregnancy

1. Introduction

More than half of the pregnant women are affected by lumbopelvic pain (LPP) in their daily lives, with subsequent chronic low back pain [1,2]. However, the causes of LPP during pregnancy have not yet been elucidated, and they have negative effects on various activities [3]. Physical activity (PA) contributes to the LPP relief. Suitable PA has been reported to have many positive outcomes, including a reduction in the risk of depression, postpartum recovery time, and pain relief [4]. Females who engage in PA before pregnancy tend to maintain their activities even after pregnancy; therefore, appropriate activity should be maintained before and during early pregnancy [5,6].

Several studies have reported on leisure time exercise habits, with one systematic review reporting that exercise recommendations such as moderate intensity, low impact, and aerobic exercise at least three times per week [7]. More recently, updated recommendations for muscle strengthening have also been suggested [8]. Although there are several reports on such leisure-time physical activity, detailed reports on daily physical activity related to household chores, child-rearing, and labor activities that are essential to daily life are lacking. Housework in late pregnancy with the increased abdominal size and fatigue is challenging. In particular, the burden increases because the multipara manages housework in parallel with childcare. Japanese women are more responsible for the majority of housework and childcare, regardless of their working conditions than women in other countries [9,10].

Thus, it is necessary to assess the risks associated with daily physical activities during pregnancy. Clarifying the relationship between housework, child-rearing behavior, working hours, and LPP will help alleviate LPP.

2. Materials and Methods

2.1 Study Design

This was a cross-sectional study was conducted following the Declaration of Helsinki guidelines. This study

Table 1. Characteristics of participants.

	Total (N = 95)	First (N = 19)	Second (N = 43)	Third (N = 33)
Age (y)	31.5 ± 4.4	29.9 ± 5.1	32.0 ± 4.3	31.8 ± 4.0
Height (cm)	158.0 ± 5.5	157.9 ± 5.4	157.8 ± 5.7	158.4 ± 5.3
Weight before pregnancy (kg)	52.9 ± 9.0	52.4 ± 9.1	51.7 ± 6.5	54.8 ± 11.4
Weight during pregnancy (kg)	57.4 ± 9.0	52.9 ± 9.3	55.9 ± 7.1	61.9 ± 9.4
BMI before pregnancy (kg/m^2)	21.2 ± 3.4	20.9 ± 3.2	20.7 ± 2.1	21.8 ± 4.7
BMI during pregnancy (kg/m^2)	23.0 ± 3.4	21.2 ± 3.3	22.4 ± 2.4	24.7 ± 3.8
Gestational age (wks)	24.5 ± 7.8	12.8 ± 1.3	23.0 ± 3.0	33.1 ± 2.6
Prevalence of LPP (% [n])	46.3 [44]	31.6 [6]	51.2 [22]	48.5 [16]

Data are expressed as mean ± standard deviation. BMI, Body mass index.

was approved by the Ethics Committee of Kyoto University Graduate School of Medicine (Approval number R1840).

2.2 Procedure

Pregnant women were recruited at obstetrics and gynecology clinics in Aichi Prefecture, Japan. The recruitment period was May-September 2019. Eligible pregnant women had no physical or obstetric complications that could reduce their activity level. Those who had back pain disorders such as hernias before pregnancy were excluded from the study. Obstetricians and midwives at the clinic where the study was conducted identified pregnant women who had attended gynecological examinations and met the inclusion criteria. All participants were informed in writing and verbally about the study, particularly its objectives and methods. Written informed consent was also obtained from all participants. Data were collected during regular health checkups and on midwifery health promotion days.

2.3 Participants

95 pregnant women who visited one obstetrics and gynecology clinic, who met the inclusion criteria, and agreed to participate in the study were included in the study.

2.4 Questionnaire

The amount of activity of pregnant women was examined using the Japanese version of the Pregnancy Physical Activity Questionnaire (PPAQ-J) [11]. PPAQ-J was found to have cross-cultural equivalency with the original English version of the Pregnancy Physical Activity Questionnaire (PPAQ) [12]. Respondents were asked to report the amount of time spent on 33 different activities in the following categories: household/caregiving (13 activities), occupational (5 activities), sports/exercise (8 activities), transportation (4 activities), and inactivity (3 activities) [11]. The PPAQ-J can be used to measure the average energy expenditure (metabolic equivalents [METs] $\times$ time) by calculating the time spent during each activity multiplied by its intensity, based on the physical activity compendium as for the original PPAQ [11,13]. The physical activity compendium defines the intensity of each activity as $<$1.5 METs for sedentary activity, 1.5 to $<$3.0 for light activity, 3.0 to $<$6.0 for moderate activity, and $\geq$6.0 for vigorous activity [13]. Thus, for the PPAQ, each activity was classified by its intensity defined in the physical activity compendium, and the average number of MET hours spent at each intensity level was calculated. Activities were also classified by type (household/caregiving, occupational, sports/exercise), and the average number of MET hours spent on each activity type was calculated. In this study, the self-reported time spent on each activity was multiplied by the activity intensity (in METs) to arrive at a measure of the average weekly energy expenditure (METs $\times$ hours/week) as PPAQ scores.

The current condition of the LPP were assessed using self-administered questionnaires. LPP assessment was conducted using a numerical rating scale (NRS). The NRS is an 11-point pain rating scale with the lower endpoint: 0 represents “no pain”, and the higher endpoint: 10 represents “worst pain imaginable”. Participants circled the number that best represented their pain level. We defined NRS $>$0 as the presence of LPP based on previous studies [14]. The participants were divided into the LPP and non-LPP group based on the results of an interview about the current presence or absence of LPP.

2.5 Data Analysis

Analyses were performed using the JMP Pro version 15 (SAS Institute, Cary, NC, USA). The participants were divided into two groups based on the results of an interview about the presence of LPP. The primary comparison was PA, which was classified by intensity (mild, moderate, and strength) and category (household/caregiving, occupational, and sports/exercise). The differences in PA between with or without LPP groups in each of the first trimester ($<$16 weeks’ gestation), second trimester (16–27 weeks’ gestation), and third trimester ($>$27 weeks’ gestation) were compared. The Shapiro-Wilk test was used to confirm the statistical normality of each PA, classified by intensity and category. To determine the relationship between PA and the presence or absence of LPP, the Wilcoxon signed-rank test was performed. When a significant difference was observed in the above-mentioned test, we performed a logistic regression analysis using body mass index (BMI) as an adjustment variable. The significance level was set at $p <$ 0.05.

3. Results

The participants were 95 pregnant females (mean ± standard deviation, age: 31.5 ± 4.4 years; height: 158.0 ± 5.5 cm; weight: 57.4 ± 9.0 kg; BMI: 23.0 ± 3.4 kg/m^2); 40 were primipara, and 55 were multipara, of which of 35 had one child and 20 had two or more children. Six (31.6%), 22 (51.2%), and 16 (48.5%) pregnant women in the first, second trimester, and third trimesters, respectively, had LPP. Table 1 presents the characteristics of the study participants.

Table 2 presents the results for each trimester of pregnancy. It was found that pregnant women with LPP had long durations of housework and child-rearing engagements among women in the third trimester.

Statistically significant differences were not observed in other weeks of pregnancy or all trimester, and it was seen only in the third trimester. No significant associations were found between occupational, sports activities stratified by category and LPP. Furthermore, a multivariate logistic regression analysis was conducted on the PPAQ scores of households and caregiving. Table 3 shows the results of multivariate logistic regression analysis with BMI as the adjustment variable in the third trimester. There were significant associations between the PPAQ score for housework/child-rearing activities and LPP in the third trimester.

4. Discussion

In the third trimester of pregnancy, the women with LPP had longer durations of housework and child-rearing than those without LPP. It was not related when grouping in the early middle of pregnancy or analyzed as a whole, and it was only observed in the third trimester. There was also no association between labor and sports activities. Although previous reports have revealed that optimal exercises are effective for back pain, this is the first study to focus on indispensable daily life behavior.

The physical and PA changes during pregnancy can be considered to depend on the trimester of pregnancy based on previous studies and the results of this study. First, as physical changes due to pregnancy, the women had an increased load on the lumbar region in late pregnancy that was caused by shifting of the center of gravity forward, which was consistent with the increase in the uterine size [15,16]. Prolonged standing leads to long-term swayback posture, which is a characteristic of pregnant women, with the lumbar dorsal muscles being persistently tense and making them prone to low back pain [17]. Walking during pregnancy is reported to be unstable, with a larger shift in the center of gravity during standing [18]. Activities that can be performed without problems before pregnancy become challenging and fear of falls increases the overall operating time [19]. Therefore, the duration of housework and child-care gets extended. Second, as there is a change in PA due to pregnancy, indoor activities increase over the course of pregnancy [20,21]. In this study, child-rearing behavior and medium-intensity outdoor sports activities, such as playing with children, were reduced, which is consistent with the findings of previous studies. In addition, many pregnant women take maternity leave and get a break from office work in their third trimester. Even if work continues, there may be fewer intensive activities such as prolonged standing and carrying heavy objects, and light or moderate activities, such as working in the sitting position, become the primary activities. A few pregnant women place a burden on the body through their work, such as prolonged standing, and the difference was not due to the presence or absence of work.

It is suggested that some degree of aerobic exercise during pregnancy not only prevents and alleviates back pain as well as results in favorable changes in the physical and mental health, along with fetal growth [22,23]. Sports activities before pregnancy lead to the maintenance of PA during pregnancy; therefore, exercise habits should be acquired before pregnancy [4,24]. In this study, there was no significant association between back pain and sports activities; however, the group without back pain tended to have longer durations of sports activities. PA includes housework and child-rearing that takes the burden of lumbar region and light sports activities that are considered appropriate for pregnant women and fetuses. On the other hand, this study showed that 80% of pregnant women only walked as a sports activity or exercise, and 56.7% only walked at a slow speed. Prolonged walking with poor posture may increase pain because walking is most likely not performed under professional guidance but their selves [17,18]. In addition, previous studies have reported that people with back pain walk slower than those without, which may lead to longer walking times in people with LPP [25]. Moreover, because this was a cross-sectional study, the timing of LPP onset and sports activity initiation was not specified. Thus, if the onset of LPP triggered the initiation of sports activities, the participants may have increased the amount of exercise to relieve pain. Hence, it would be considered that no significant differences were observed in this study.

In this study, the duration of housework and child-rearing were related to LPP. Continuous activities such as housework and child rearing in an uncomfortable posture, can lead to prolonged duration and increased back pain [17,19]. Therefore, the improvement of household equipment and teaching the appropriate posture that can reduce the burden on the lumbar spine are warranted. Housework and child-rearing were originally carried out by both husbands and wives. It is common for males to take paternity leave overseas; however, the rate of Japanese males taking paternity leave was <3% [26]. Thus, males should actively participate in child rearing to reduce the burden on females. Moreover, family support, along with the services of housework agencies and daycare centers may be utilized to enhance efficiency. LPP may be prevented or relieved by reducing the burden on females and performing appropriate exercises.

Table 2. Comparisons at the different trimesters between the groups with and without LPP.

	First			Second			Third		
	LPP group (N = 6)	non-LPP group (N = 13)	*p* value	LPP group (N = 22)	non-LPP group (N = 21)	*p* value	LPP group (N = 16)	non-LPP group (N = 17)	*p* value
Total score of PPAQ (METs.h/wk)	219.70 ± 121.79	157.94 ± 75.26	0.25	177.74 ± 89.18	177.29 ± 129.13	0.73	172.33 ± 68.66	136.175 ± 41.09	0.13
By intensity (METs.h/wk)									
Sedentary	14.58 ± 4.65	13.73 ± 8.63	0.86	10.90 ± 7.22	10.33 ± 7.34	0.80	14.55 ± 7.50	14.51 ± 5.83	0.71
Light	153.59 ± 74.17	114.46 ± 54.59	0.22	123.66 ± 56.37	115.65 ± 63.28	0.79	115.68 ± 35.94	98.13 ± 32.72	0.17
Moderate	44.24 ± 28.91	37.49 ± 31.33	0.48	49.78 ± 37.13	55.55 ± 72.72	0.43	46.29 ± 33.96	29.91 ± 17.85	0.21
Vigorous	0.00 ± 0.00	2.83 ± 10.19	0.50	2.15 ± 6.20	1.13 ± 3.58	0.68	2.21 ± 5.52	7.51 ± 16.21	0.56
By type (METs.h/wk)									
Household/Caregiving	195.59 ± 138.49	134.98 ± 61.45	0.38	133.17 ± 88.50	131.93 ± 95.19	0.77	154.26 ± 63.50	107.53 ± 40.86	<0.05*
Occupational	28.49 ± 27.12	28.31 ± 23.79	0.93	44.01 ± 33.37	38.29 ± 54.11	0.17	20.53 ± 21.89	22.85 ± 24.58	0.79
Sports/exercise	10.21 ± 9.22	8.39 ± 15.60	0.41	11.45 ± 12.42	17.41 ± 37.46	0.53	12.09 ± 13.01	20.31 ± 24.27	0.31

Data are expressed as mean ± standard deviation.

Statistical analysis by non-parametric test (Wilcoxon signed-rank test) with a *p*-value less than 0.05 was considered significant.

* means *p*-value less than 0.05 was considered significant.

LPP, lumbopelvic pain; MET, Metabolic equivalent turnover.

Table 3. The logic regression analysis of explanatory factors associated with the Household/Caregiving PPAQ score.

	OR (95% CI)	*p* value
Household/Caregiving	1.02 (1.00 to 1.03)	0.01
BMI	1.10 (0.90 to 1.35)	0.33

Data are expressed as mean ± standard deviation.

Statistical analysis by the non-parametric test with a *p*-value less than 0.05 was considered significant.

MET, Metabolic equivalent turnover.

As a limitation of this study since it is a cross-sectional study, the increase or decrease in PA by the onset time of LPP and the number of weeks of pregnancy is uncertain. As such, it could be possible that the level of PA during the first or second trimester, and not only the third trimester, may have led to the development of pain in the third trimester. In addition, it is also unknown whether housework and child-care durations are extended due to back pain or vice-versa. Therefore, future longitudinal research should be conducted to trace the same participants over time from pre-pregnancy and early pregnancy to follow changes in PA and the timing of LPP onset. Further investigations of the causal relationship between PA and LPP during pregnancy may help to better understand the risk factors for LPP related to PA, which would lead to improvement in activities of daily living during pregnancy.

5. Conclusions

In this study, it was suggested that PA of household/caregiving and LPP were related during the third trimester. Pregnant women with LPP tend to spend more time on housework and child-rearing. Hence, the duration of housework and child-rearing should be shortened because of prolonged standing and the burden on the lumbar area.

Author Contributions

RK designed the study, collected data, analyzed and interpreted the data, and wrote the manuscript. CY collected data, analyzed and interpreted the data. SM interpreted the data and reviewed the manuscript. MI, CYC, MK, NK, HH, FU contributed to collect data and MY made all arrangements for data acquisition. TA, MN-T reviewed the manuscript and supervised the entire research process. All authors read and approved the final manuscript.

Ethics Approval and Consent to Participate

This was a cross-sectional study conducted in accordance with the guidelines of the Declaration of Helsinki. The Ethics Committee of Kyoto University Graduate School of Medicine approved the study (Approval number R1840).

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Conflict of Interest

The authors declare no conflict of interest.

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