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Factors associated with perineal pain on the first postnatal day after vaginal delivery: a cross-sectional study of primiparous women

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ABSTRACT

Many women report postpartum perineal pain due to perineal trauma after vaginal delivery. Perineal pain after giving birth declines over time; however, perineal trauma and pain negatively impact on the women's quality of life and their ability to care for their children. The degree of perineal trauma and instrument delivery with episiotomy are associated with perineal pain. Nevertheless, no studies have examined factors related to postpartum perineal pain, including weight changes during pregnancy as well as the course of delivery so far. We aimed to elucidate obstetric factors associated with perineal pain after vaginal delivery on the first postnatal day in Japanese primiparous women. A cross-sectional study conducted in five maternity hospitals in Japan included 142 primiparous women who vaginally delivered full-term and singleton infants. Perineal pain on the first postnatal day was evaluated using a visual analog scale. The final analysis included 92 participants with a mean age of 30.3 ± 4.6 years. The median visual analog scale score was 54.0 mm. Multiple linear regression analysis demonstrated that gestational weight gain above the recommended Japanese range was positively and significantly associated with perineal pain on the first postnatal day, independent of maternal age, episiotomy, painkiller use, and neonatal birth weight. This finding may provide additional evidence regarding gestational weight gain within the recommended range based on the pre-pregnancy body mass index to reduce perineal pain on the first postnatal day.

Keywords: gestational weight gain, perineal pain, perineal trauma, primiparous women

Abbreviations:
VAS: visual analog scale
BMI: body mass index

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INTRODUCTION

Most vaginal deliveries are accompanied by trauma to the genitalia via spontaneous laceration, episiotomy, or both.[1] Tears can either be spontaneous or induced through episiotomy. Spontaneous tears are classified from the first to the fourth degree depending on their severity. A first-degree tear involves the perineal skin, a second-degree tear involves the perineum and perineal muscles but not the anal sphincter, a third-degree tear involves the perineum and anal sphincter complex, and a fourth-degree tear involves the anal sphincter complex (external anal sphincter and internal anal sphincter) and anal epithelium.[2] Consequently, many women report postpartum perineal pain due to perineal trauma after vaginal delivery.[3]

The severity of perineal pain after giving birth declines over time[4]; however, perineal trauma and pain negatively impact women's quality of life and their ability to care for their children.[5] Acute perineal pain may become chronic,[6] and perineal trauma may lead to dyspareunia and urinary and/or anal incontinence.[2,4,7] Additionally, perineal pain is also associated with postpartum depression.[8,9]

Recently, the World Health Organization has recommended interventions to reduce or prevent perineal trauma during childbirth.[10] For instance, the perineal massage performed by pregnant women themselves or their partners reportedly protects the perineum during pregnancy.[11,12] Approaches to avert severe tears or episiotomy during midwife delivery, such as hands-on/hands-off manual perineal support,[1] warm compresses,[1] avoidance of the supine position,[13] early pushing through maneuvers such as the Valsalva,[2] and cooling of the vulva after delivery with ice packs have been considered.[14]

Although various approaches have been implemented internationally, few hospitals, apart from midwifery homes in Japan, employ these methods except early pushing through maneuvers such as the Valsalva. Since the 19th century, a midwifery technique to protect the perineum during the second stage of labor has been established with supine positioning during delivery; more than 50% of women give birth in the supine position despite the introduction of concepts on active birth during labor and delivery. Shinozaki[15] explored factors that make it difficult to adopt alternative labor and delivery positions using structural modeling. The model revealed "dislike for innovation with alternative labor and delivery position" and "confusion around other types of labor and delivery position midwifery skills" as the primary reasons underlying the reluctancy. A literature review concerning perineal massage during pregnancy in Japan between 2000 and 2020 indicated that the rate of perineal massage among pregnant women was 15.1%. Furthermore, only 10.6%–11.7% of antenatal or birth hospitals recommended perineal massage.[16] These findings suggest aversion in acquiring new practices, possibly influenced by the cultural aspects of midwifery or the individual policies of hospitals in Japan.

Both episiotomy and instrumental delivery (vacuum or forceps) are often required in obstetric procedures. Studies revealed that the degree of perineal trauma and instrument delivery with episiotomy are associated with perineal pain in both primiparous and multiparous women.[17] Primiparous women with an episiotomy or obstetric anal sphincter injury during vaginal delivery frequently require an episiotomy for their next delivery and tend to suffer more postpartum perineal pain.[18,19] These findings assert the importance of minimal genital injury during the first delivery.

Here, we elucidate the relationship between postpartum perineal pain and factors during pregnancy, such as weight change and delivery-related factors, to identify strategies to prevent or reduce postpartum perineal pain in primiparous women.

METHODS

Study design

This study utilized a cross-sectional design and was a part of a larger study on the relationship between daily activities and child-rearing behavior during the early postpartum period as well as the maternal psychological factors related to child-rearing at one month postpartum.

Setting and participants

This study was conducted from May to October 2018 and from January to March 2020 at five maternity hospitals in Aichi, Japan.

We recruited pregnant women at approximately 36 gestational weeks at the outpatient ward for this study. The inclusion criteria during pregnancy were as follows: 1) primiparous women aged ≥20 years, 2) women with singleton pregnancies, 3) women who regularly underwent antenatal maternity check-ups, 4) women who were able to read and write in Japanese, and 5) women who provided written informed consent to participate in this study. The exclusion criteria during pregnancy were as follows: 1) women with a history of mental health disorders or serious medical conditions, 2) women with pregnancy complications, and 3) women who planned to undergo caesarian section. Pregnant women who met the inclusion criteria were the potential participants for our study. After they gave birth to healthy full-term infants, we carefully selected the study participants from the potential participants. The postpartum inclusion criteria were both women and infants who had no abnormalities. Meanwhile, the postpartum exclusion criteria were 1) emergency cesarean section, 2) Apgar score of <8 at both 1 and 5 mins after birth, and 3) women for whom rooming-in was not feasible during hospitalization owing to their differing practices from those who were rooming-in. Ultimately, 142 primiparous pregnant women who provided written informed consent were enrolled in the study.

We used G*Power free software version 3.1[20,21] to calculate the sample size and found that 109 pregnant women were required to explore factors related to perineal pain using multiple regression analysis, with an effective size of 0.15, alpha error of 0.05, and power of 0.8. Based on a 60% questionnaire response rate, we determined that approximately 150 pregnant women would be required for the study.

Questionnaire for the larger study on the first postnatal day

The questionnaire consisted of 26 items and took approximately 5–10 min for the participants to complete.

The intensity of perineal pain on the first postnatal day was self-evaluated using the visual analog scale (VAS) from 0 to 100 mm, wherein scores of 0 and 100 indicated “no pain” and “worst possible pain,” respectively.[3,22] Participants were asked to self-report how many times they had used painkillers within the first 24 hours after delivery.

Interference with daily life due to perineal pain was measured using the disruption of daily life scale in Japanese.[23] Prior to developing the questionnaire for the larger study, we obtained permission to use these questions. The validated questionnaire in Japanese consisted of the following four sub-scales: difficulty sitting (six items), loss of volition (six items), difficulty in moving (six items), and difficulties with excretion and cleanliness (six items) using a four-item Likert scale (1: strongly disagree; 2: disagree; 3: agree; 4: strongly agree).

Pilot study

A pilot study was conducted with 10 women who were hospitalized after vaginal birth at the first postnatal day. We assessed the respondents’ VAS scores for normal distribution and

Cronbach's alpha coefficients for the total scale score of disruption of daily life by perineal pain. Cronbach's alpha of each sub-scale was as follows: 0.81, 0.59, 0.74, and 0.86, and the total Cronbach's alpha was 0.89.

Measurements

Perineal pain. Two items were used to measure perineal pain: the VAS score and use of painkillers within the first 24 h after delivery.

Obstetrical variables. Data on the following obstetrical variables were collected based on medical records: age, height, pre-pregnancy weight, weight on admission for delivery, administration of oxytocin or prostaglandin to accelerate labor, administration of epidural anesthesia during labor, duration of labor, mode of birth, episiotomy use, degree of perineal trauma, gestational weeks, and birth weight. All data were obtained from medical and midwifery records by the research midwife (AY).

The degree of perineal trauma[2] (Table 1) was diagnosed by an obstetrician who attended the delivery.

Table 1 Classification of perineal trauma

Degree of perineal trauma	Definitions
First-degree tear	Injury to perineal skin only
Second-degree tear	Injury to perineum involving perineal muscles but not involving anal sphincter
Third-degree tear	Injury to perineum involving anal sphincter complex
Fourth-degree tear	Injury to perineum involving anal sphincter complex (external anal sphincter and internal anal sphincter) and anal epithelium

Data collection

After childbirth, the research midwife (AY) assessed whether the potential participants fulfilled the selection criteria. Next, consent of the potential participants to participate in the study was sought with the permission of the chief nurses on the first postnatal day. Subsequently, the research midwife (AY) visited the participants to distribute the questionnaire from 11 am to 4 pm on the first postnatal day. We provided the participants with a choice to return their survey forms either to a collection box at the hospital or by mail to rule out any interference with their resting time, breastfeeding, and caretaking of their newborns. To enable women to respond at a time when they could, we ensured that the questionnaire could be returned by mail.

Statistical analyses

The pre-pregnancy body mass index (BMI) was calculated from the pre-pregnancy weight and height. The participants were classified as underweight (BMI <18.5 kg/m^2), normal weight ($18.5 \leq$ BMI < 25.0 kg/m^2), and overweight or obese (BMI ≥ 25.0 kg/m^2) based on the World Health Organization criteria.[24] Gestational weight gain was also calculated by subtracting the pre-pregnancy weight from the weight on admission. The 2006 Dietary National Guideline for Japanese pregnant women[25] set the ideal gestational weight gain for each category (underweight, normal weight, and overweight or obese) as follows: 9–12 kg for underweight, 7–12 kg for normal weight, and approximately 5 kg with the need for individual attention for overweight or obese. Finally, participants were categorized into weight gain below, within, or above the recommended range groups based on their gestational weight gain.

All statistical analyses were conducted using SPSS Statistics for Windows, version 27.0, (IBM, Japan). Continuous variables are shown as mean ± standard deviation or median (25–75 percentile). The VAS score had an approximately normal distribution; however, there was a larger difference in each woman. Therefore, Spearman's rank-correlation coefficient was used. Meanwhile, the Mann–Whitney *U* test and Kruskal–Wallis test were used to compare two and three groups, respectively. Bonferroni correction was applied as a post-hoc test to compare multiple groups. Additionally, multiple linear regression analysis was performed to derive factors related to perineal pain on the first postnatal day. The VAS score for perineal pain on the first postnatal day was set as the dependent variable. Variables involved in the relationship between perineal pain after delivery ($P < 0.1$ in the univariate analyses) and obstetric factors (as indicated by previous studies) or those considered to be clinically important to perineal pain were selected as independent variables. Three groups of gestational weight gain below, within, and above dummy variables were created (with gestational weight gain within as a reference). We categorized the study participants into two groups based on whether or not they underwent episiotomy, with the group not undergoing episiotomy as the reference. Similarly, we also categorized them into two groups based on birth weight (<3,500 g and ≥3,500 g), with the group having weight <3,500 g as the reference. Previous studies have shown that the degree of perineal trauma affects the intensity of perineal pain after delivery.[17] The distribution of the degree of perineal trauma in the study was as follows: intact perineum (n = 1, 1.1%), first-degree tear (n = 2, 2.2%), second-degree tear (n = 86, 93.5%), third-degree tear (n = 3, 3.3%), and fourth-degree tear (n = 0); therefore, we considered the study population to be the second-degree tear cohort. For this reason, we did not select the degree of perineal trauma as an independent variable; instead, whether or not the participant underwent episiotomy was selected as an independent variable. We calculated β, standardized coefficient β, and 95% confidence intervals using a multiple regression analysis with the forced entry method. Statistical significance was set at $P < 0.05$.

Ethical considerations

The study protocol was approved by the ethics review committee of the Nagoya University Graduate School of Medicine (approval number: 19-133-3). Furthermore, permission to conduct the study was obtained from all involved hospitals. The study was carried out in accordance with the 1964 Declaration of Helsinki and its later amendments.

RESULTS

Overall, 136 women met the inclusion criteria; however, 6 newborns were excluded due to a low Apgar score (<8). Meanwhile, 125 women responded to the questionnaires and had their medical records collected (n = 125/136, 91.9%). Of these, 33 women did not complete the questionnaire, left one or more questions unanswered, or had missing medical records. Finally, 92 women (n = 92/125, 73.6%) completed and returned fully completed questionnaires.

The participants' characteristics are presented in Table 2. The mean age of the participants was 30.3 ± 4.6 years. The median self-evaluated perineal pain as indicated by the VAS score on the first postnatal day was 54.0 (interquartile range: 37.3–77.8 mm). The proportion of women who underwent episiotomy was 82.6%. The distribution of perineal pain on the first postnatal day is presented in Figure 1.

Table 2 Characteristics of participants (n=92)

	Mean ± SD	(Minimum – Maximum)
Maternal age (years)	30.3 ± 4.6	(20 – 40)
Gestational age	39w4d ± 7.7d	(37w0d – 41w4d)
Second stage of labor (min) [a]	60.8 ± 61.7	(2 – 390)
Number of painkillers used (times)	2.0 ± 1.3	(0 – 5)
	Median	(25% tiles – 75% tiles)
Perineal pain on the first postnatal day (mm)	54.0	(37.3 – 77.8)
	Number	(%)
Pre-pregnancy BMI		
BMI<18.5 kg/m^2	18	(19.6)
18.5≤BMI<25.0 kg/m^2	67	(72.8)
BMI≥25.0 kg/m^2	7	(7.6)
Gestational weight gain based on pre-pregnancy BMI		
Below	19	(20.7)
Within	46	(50.0)
Above	27	(29.3)
Mode of birth		
Spontaneous	73	(79.3)
Vacuum	19	(20.7)
Onset of labor		
Spontaneous	56	(60.9)
Induction	36	(39.1)
Epidural analgesia		
Yes	6	(6.5)
No	86	(93.5)
Degree of perineal trauma		
Intact perineum	1	(1.1)
First-degree tear	2	(2.2)
Second-degree tear	86	(93.5)
Third-degree tear	3	(3.3)
Fourth-degree tear	0	(0)
Episiotomy		
Yes	76	(82.6)
No	16	(17.4)
Birth weight		
<3500 g	86	(93.5)
≥3500 g	6	(6.5)

SD: standard deviation
BMI: body mass index
[a] Second stage of labor: data for one woman was missing.

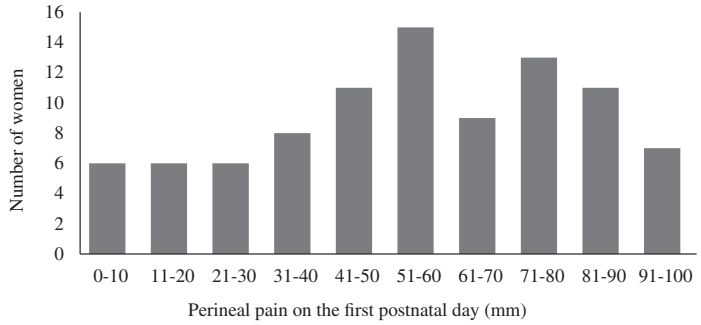

Fig. 1 Distribution of perineal pain corresponding to the visual analog scale score on the first postnatal day
The number of women included in each level of the visual analog scale, separated by 10 mm, is displayed.

Factors related to perineal pain and VAS scores on the first postnatal day are shown in Table 3. There was no significant difference in perineal pain among the three pre-pregnancy BMI groups (P = 0.69). Regarding gestational weight gain classified according to the recommended Japanese gestational weight gain range, women with gestational weight gain above the recommended range reported more severe perineal pain (Bonferroni correction: above vs below, P = 0.01; above vs within, P = 0.01).

Table 3 Factors related to perineal pain on the first postnatal day (n=92)

	Median (25% tiles – 75% tiles)	P-value
Pre-pregnancy BMI		
BMI<18.5 kg/m^2	53.0 (45.3 – 78.3)	
18.5≤BMI<25.0 kg/m^2	53.0 (36.0 – 77.0)	
BMI≥25.0 kg/m^2	73.0 (37.0 – 80.0)	0.69
Gestational weight gain based on pre-pregnancy BMI [a]		
Below	49.0 (32.0 – 66.0)	
Within	51.0 (29.5 – 72.3)	
Above	76.0 (52.0 – 85.0)	0.02
Mode of birth		
Spontaneous	55.0 (41.5 – 76.5)	
Vacuum	49.0 (17.0 – 80.0)	0.26
Onset of labor		
Spontaneous	56.0 (31.5 – 78.8)	
Induction	53.0 (38.3 – 75.3)	0.83
Epidural analgesia		
Yes	76.0 (30.8 – 91.8)	
No	53.0 (37.8 – 76.3)	0.30
Degree of perineal trauma		
Intact perineum	17.0 (17.0 – 17.0)	
First-degree tear	72.5 (72.0 –)	
Second-degree tear	53.0 (37.8 – 79.3)	
Third-degree tear	72.0 (36.0 –)	0.45

Episiotomy			
Yes	54.0 (	38.3 – 80.0)	
No	57.0 (	26.8 – 73.0)	0.70
Birth weight			
<3500 g	53.0 (	36.8 – 76.0)	
≥3500 g	89.0 (	39.8 – 98.5)	0.08

	Correlation coefficient	*P*-value
Maternal age (years)	–0.18	0.09
Gestational age	0.19	0.07
Second-stage of labor (min)	0.05	0.62
Number of painkillers used (times)	0.09	0.37

BMI: body mass index
Kruskal–Wallis test, $P<0.05$, Multiple comparison is Bonferroni.
Mann–Whitney U test, $P<0.05$.
Spearman's correlation coefficient, $P<0.05$.
[a]Bonferroni correction: Gestational weight gain; Above vs Below $P=0.01$, Above vs Within $P=0.01$.

The association of perineal pain with the VAS score on the first postnatal day as determined by multiple linear regression analysis is presented in Table 4. After performing multiple regression analysis with the forced entry method, gestational weight gain above the recommended Japanese range (β [95% confidence interval], 16.09 [3.21–28.98]; standardized coefficient $\beta = 0.28$, $P = 0.01$) was independently and positively associated with perineal pain on the first postnatal day ($F = 2.304$, $R^2 = 0.140$, adjusted $R^2 = 0.079$). Multiple regression analysis with the degree of perineal tear as the independent variable did not modify the significant association between gestational weight gain above the recommended Japanese range and the VAS score for perineal pain on the first postnatal day.

Table 4 Factors associated with perineal pain on the first postnatal day according to multiple linear regression analysis (n=92)

	β	95% confidence interval	Standardized coefficient β	*P*-value
Maternal age (years)	–0.82	(–2.00 – 0.36)	–0.14	0.17
Gestational weight gain; Below [a]	–0.05	(–13.84 – 13.74)	–0.001	0.99
Gestational weight gain; Above [a]	16.09	(3.21 – 28.98)	0.28	0.01
Episiotomy [b]	2.21	(–11.67 – 16.10)	0.03	0.75
Number of painkillers used (times)	3.23	(–1.18 – 7.63)	0.16	0.15
Birth weight [c]	10.33	(–12.23 – 32.90)	0.10	0.37

Forced entry method was performed, $P<0.05$.
$F=2.304$, $R^2=0.140$, Adjusted $R^2=0.079$.
The dependent variable: perineal pain on the first postnatal day.
[a]Gestational weight gain, 3 groups (Below, Within, Above): dummy variable was created based on "Within".
[b]Episiotomy, 2 group (yes, no): no episiotomy as a reference.
[c]Birth weight, 2 group (less than 3500 g, greater than or equal to 3500 g): birth weight less than 3500 g as a reference.

DISCUSSION

This study elucidated the relationship between gestational weight gain and postpartum perineal pain in primiparous women. Our results may contribute to improving the quality of life of postpartum mothers.

In this study, the median perineal pain on the first postnatal day according to the self-evaluated VAS (0–100 mm) was 54.0 (37.3–77.8) mm. A study conducted in northern Taiwan that included women on the first postnatal day showed that the mean score for perineal pain, measured using the 10 cm VAS, was 4.63 ± 2.08 cm for primiparous women.[3] The median perineal pain score in this study was higher than that in the previous study; however, the rates of episiotomy (93.6%), third-degree tears (17.2%), and fourth-degree tears (4.0%) were higher in the northern Taiwan study than in our study. This difference may be associated with their higher rate of epidural analgesia (40.5%) use than that in our study (6.5%).

Multiple linear regression analysis showed that gestational weight gain above the recommended Japanese range was positively and significantly associated with perineal pain on the first postnatal day. A previous study[26] reported that greater gestational weight gain is associated with a higher risk of severe perineal tears. Due to weight gain, women have increased amounts of soft tissue deposits, which may cause relative narrowing of the pelvis and genital tract.[27] Furthermore, greater gestational weight gain is associated with heavier birth weight and a higher risk of macrosomia and shoulder dystocia, which may result in more severe perineal tears at delivery. However, in our study, more than 80% of the study participants underwent episiotomy. We found no significant difference in the degree of perineal trauma among the three groups divided according to gestational weight gain based on pre-pregnancy BMI (data not shown). Additionally, our study revealed that gestational weight gain above the recommended Japanese range was positively and significantly associated with perineal pain on the first postnatal day even after adjusting for episiotomy and birth weight.

Tashani et al[28] revealed that men (n = 37) and women (n = 37) with obesity are more sensitive to pressure pain than those with a normal BMI. Furthermore, these findings indicate the involvement of adiponectin, which may explain the association between gestational weight gain and perineal pain. The skin comprises the epidermis, dermis, and subcutaneous adipose tissue, where wound healing occurs. Adipose tissue, once simply considered as an energy storage site, is now regarded as a major endocrine organ that maintains homeostasis by secreting several bioactive factors known as adipokines.[29] Adiponectin, which is an adipokine, plays a crucial role in wound repair. Animal studies have shown that wound closure is remarkably delayed in adiponectin-deficient mice compared with that in wild-type mice. Additionally, systemic or local administration of adiponectin ameliorates impaired wound healing in adiponectin gene knockout and diabetic mice.[30] In a human study examining adiponectin gene expression in the adipose tissues of women with normal or delayed wound healing after abdominal plastic surgery, adiponectin expression was significantly decreased in the adipose tissues of women with obesity, resulting in delayed healing.[31] Plasma adiponectin levels were also reportedly decreased in pregnant women who are obese and overweight.[32,33] This suggests that gestational weight gain above the recommended range as well as obesity may delay wound healing in perineal tears due to childbirth, leading to intense pain due to local immune inflammation.[34] Conclusively, our results suggest that gestational weight gain within the recommended range leads to less severe perineal pain in the early postpartum period in primiparous women.

Limitations

Our study has a few strengths and limitations. We examined factors related to postpartum

perineal pain that were not only limited to the course of delivery but also those related to the course of pregnancy such as weight changes during pregnancy. Regarding gestational weight gain within the recommended Japanese range based on pre-pregnancy BMI, Japanese women are smaller and leaner than Western women, and the prevalence of obesity is considerably lower. Consequently, our results indicate that there may be certain limitations regarding gestational weight gain above the recommended Japanese range and associated perineal pain after birth. Furthermore, our study involved Japanese women presenting at full-term; therefore, our results may not be applicable to pregnant women with complications and women in occidental countries. Thus, a similar study on multiparous women is warranted. Second, we did not examine the modifications in perineal pain; factors reducing perineal pain may also need to be examined. Third, the response time after delivery differed for each participant; however, it was clinically difficult to set the time depending on their individual circumstances (resting time, breastfeeding, and caretaking of their newborns) after delivery. Furthermore, we did not investigate the type of pain for which painkillers were used; therefore, it was not possible to distinguish whether it was used for perineal pain or for pain related to postpartum uterine contractions. Additionally, we did not conduct alternative methods of evaluations, such as interviews, to reveal the perception of perineal pain or individual women's experiences. Fourth, the degree of perineal tear was not selected as an independent variable in multiple regression analysis with the intensity of perineal pain as the dependent variable, and the association between the degree of perineal tear and perineal pain on the first postnatal day could not be clarified.

CONCLUSIONS

Gestational weight gain above the recommended Japanese range was associated with perineal pain on the first postnatal day in primiparous women, regardless of maternal age, episiotomy, frequency of painkillers intake, and birth weight. This finding corroborates evidence regarding gestational weight gain within the recommended Japanese range based on pre-pregnancy BMI to reduce perineal pain on the first postnatal day.

Prospectively, there is a need to develop a midwives' guidance program during pregnancy to achieve the recommended weight gain based on pre-pregnancy BMI. This may contribute to reducing postpartum perineal pain that affects the quality of life of women and evaluating the effectiveness of weight gain guidance.

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