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Article

Effects of Perineal Heat Stimulation Combined With Massage Pre-Adaptation on Perineal Injury and Maternal Psychological Well-Being in Primiparous Women

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Abstract

Aims/Background: Perineal injuries remain a common complication of vaginal birth, particularly among primiparous women. This study assessed the effects of a perineal heat stimulation-massage plus pre-adaptation protocol, started at 34 weeks of gestation, on perineal outcomes and maternal psychological well-being in primiparous women. **Methods**: This retrospective cohort study enrolled 500 primiparous women who delivered at Jiangxi Maternal and Child Health Hospital between May 2025 and October 2025. Participants were divided into an intervention group (n = 247) and a control group (n = 253) based on antenatal records and self-reports of receiving the structured protocol. Outcomes compared between the two groups included perineal injury, duration of all labor stages, postpartum blood loss within 2 hours, perineal pain at 48 hours, neonatal Apgar scores, and maternal psychological well-being assessed using the Childbirth Self-Efficacy Inventory (CBSEI) and the State-Trait Anxiety Inventory (STAI). **Results**: Compared with routine care, the intervention group had a significantly better rate of intact perineum (34.01% vs. 15.02%, $p < 0.001$) and lower rates of both episiotomy (36.03% vs. 46.25%, $p = 0.020$) and perineal tears (29.96% vs. 38.74%, $p = 0.039$). Labor progressed more efficiently in the intervention group, with shorter median durations of the first (439 vs. 514 min), second (55 vs. 74 min), and third stages of labor (8 vs. 12 min). The intervention group also had reduced median postpartum blood loss within 2 hours (233 vs. 244 mL) and lower perineal pain at 48 hours (Visual Analog Scale [VAS] 3 vs. 4; $p < 0.001$). Furthermore, women in the intervention group reported significantly higher childbirth self-efficacy (CBSEI, 108 vs. 94 scores, $p < 0.001$) and lower state anxiety (STAI 35 vs. 41 scores, $p < 0.001$). The two groups did not differ in neonatal outcomes, including Apgar scores. **Conclusion**: The "antenatal heat stimulation-massage combined pre-adaptation protocol" was associated with reduced perineal injury and more efficient labor, along with lower postpartum distress and improved childbirth experience through psychological empowerment, without adverse effects on neonatal outcomes. These observations support the approach as a practical, non-pharmacological antenatal care framework and inform future prospective studies assessing the integrated mind-body preparation model in maternity care.

Keywords: late pregnancy; heat stimulation; perineal injury; primiparous women; psychological well-being

1. Introduction

Vaginal delivery is widely recognized as an ideal physiological route. However, it frequently results in perineal injuries, either as spontaneous tears or a medically performed episiotomy, and remains a common source of obstetric morbidity worldwide [1]. Primiparous women are particularly vulnerable because the perineal tissues have not been previously stretched, limiting their ability to accommodate the mechanical strain of delivery. Evidence indicates that the first birth (primiparity) is the strongest and most consistent independent predictor of severe perineal trauma, with the risk of third- and fourth-degree perineal tears, including obstetric anal sphincter injuries (OASIS), being several times higher than in multiparous women [2]. Perineal injuries not only cause immediate postpartum consequences such as pain and bleeding but can also lead to long-term sequelae. Severe tears, especially OASIS, are closely associated with persistent perineal pain, dyspareunia, and fecal incontinence due to pelvic floor dysfunction, which can significantly reduce long-term quality of life [3,4].

As OASIS can have long-lasting effects, reducing its incidence has become a key quality benchmark for obstetric systems worldwide [5]. International evidence-based guidelines consistently underscore antenatal and intrapartum prevention as the most effective approach to reduce perineal trauma. For instance, the Royal College of Obstetricians and Gynaecologists (RCOG) emphasized early identification of risk factors and routine use of preventive measures in intrapartum care [6]. Similarly, the American College of Obstetricians and Gynecologists (ACOG) systematically outlines practical measures aimed at preventing obstetric lacerations [7]. Furthermore, the French National College of Gynaecologists and Obstetricians (CNGOF) explicitly recommends antenatal perineal massage for women in need, as a method to alleviate the risk of OA-

SIS [8]. Moreover, the Queensland Health Clinical Guideline on Perineal Care comprehensively outlines various antenatal interventions, which include antenatal perineal massage as a crucial option within routine perineal care planning [9].

In this context, non-pharmacological interventions applied during pregnancy are increasingly gaining focus, largely because they are simple, low-risk, and easy to introduce into a routine care framework. Among these, antenatal perineal massage is well-supported by practical evidence. Multiple systematic reviews report that regular perineal massage during the third trimester can enhance perineal tissue elasticity and is associated with lower episiotomy rates and a decreased risk of severe perineal trauma, such as third- and fourth-degree tears [10,11]. Perineal warm compresses are another promising intervention. By providing thermal effects, they can promote local blood circulation, relax perineal muscles, and help reduce tissue edema. When applied during labor, warm compresses have been reported to alleviate pain and improve tissue stretchability [12,13].

In both routine care and clinical research, perineal warm compresses and perineal massage are often treated as separate approaches. Warm compresses are mostly limited to intrapartum use, primarily for immediate pain relief, whereas perineal massage is typically provided as a standalone intervention in late pregnancy. This "fragmented" application may miss the potential benefit of combining them in a way that exploits the chronological and shared physiological and psychological effects. Advancing heat stimulation into the antenatal period and pairing it with massage in a fixed, structured "heat stimulation-massage combined pre-adaptation protocol" aims to maximize the optimization of perineal tissue flexibility and biomechanical readiness while enhancing maternal comfort, confidence, and mental preparedness ahead of childbirth, representing an important evolutionary direction for antenatal care models.

At present, high-quality clinical evidence for this complete combined protocol is limited, particularly regarding its impact on maternal psychological well-being. Therefore, the present study aims to rigorously evaluate the overall value of this innovative protocol for improving physiological outcomes and psychological well-being during childbirth in primiparous women.

2. Methods

2.1 Selection of Study Participants

The study cohort consisted of 512 pregnant primiparous women who delivered at Jiangxi Maternal and Child Health Hospital between May and October 2025. After applying the predetermined inclusion and exclusion criteria, 12 women were excluded from the study cohort. Based on antenatal care records and maternal self-reports regarding participation in the structured perineal heat stimulation-massage protocol, 500 eligible women were divided into two groups: The intervention group (n = 247) which received perineal heat stimulation and manual massage during late pregnancy, starting at 34 weeks of gestation, and the control group (n = 253) who had no record or documented information of receiving this structured care and received routine antenatal care only. Fig. 1 illustrates the flow chart for patient selection.

Inclusion criteria for patient selection were as follows: (1) No significant high-risk findings on ultrasound and routine prenatal assessment; (2) Primiparous women with singleton, term pregnancy and cephalic presentation, normal fetal position; (3) No evidence of obstructed labor risk (normal internal and external pelvimetry); and (4) Provided informed consent and voluntary participation. Exclusion criteria included: (1) Significant medical or surgical comorbidities, including history of pelvic surgery or previous perineal trauma, or major antenatal obstetric complications; (2) Fetal distress, known major fetal congenital malformations, or macrosomia (estimated fetal weight >4000 g); (3) Vaginal inflammation, perineal edema, genital herpes, or vulvar skin breakdown; and (4) Cognitive or psychiatric disorders that could interfere with protocol compliance.

2.2 Patient Treatment Protocol

The primary intervention was a structured antenatal protocol integrating perineal heat stimulation with manual massage as a pre-adaptation program. This protocol was not a simple addition of heat and massage, but a stepwise approach based on the physiological sequence of heat-induced relaxation, followed by gentle mechanical stretching, and gradual neuromuscular adaptation.

The control group received routine prenatal examinations and standard counseling in the midwifery clinic. The intervention group received the structured perineal heat stimulation-massage protocol starting at 34 weeks of gestation. Participating women and their family members received one-to-one training in the midwifery clinic.

2.2.1 Structured Antenatal Heat Stimulation-Massage Protocol

The structured antenatal heat stimulation-massage protocol was conducted as follows: (1) Pre-intervention preparation: The woman emptied her bladder and assumed a comfortable semi-recumbent position with back support using pillows. Patients were encouraged to listen to soothing music for relaxation. Ensure a quiet and private environment. The person performing the procedure (the woman herself or a family member) washed hands thoroughly and trimmed nails short. (2) Perineal heat stimulation (moist heat): A towel soaked in warm water (38–40 °C) was wrung to semi-dry, folded, and placed over the vulva area for 10–15 minutes. The towel was replaced if it cooled. (3) Perineal massage (immediately after heat application): Massage was performed right after warming, employing sterile

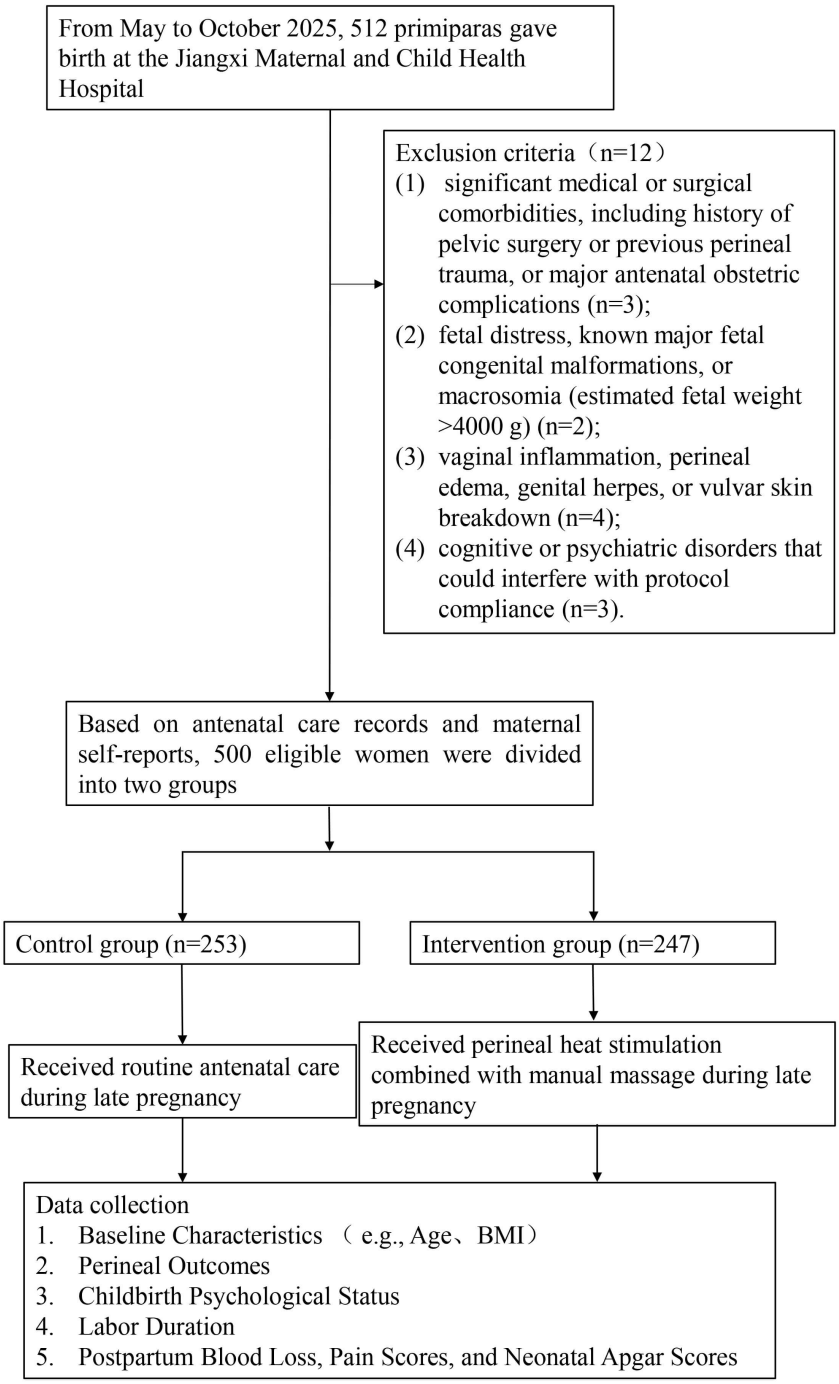

Fig. 1. A flow chart of patient selection and group allocation. BMI, body mass index.

lubricant and a gloved, lubricated finger as follows: ① Lubricate the perineum and vaginal wall thoroughly. ② Gently massage the perineum and labia to warm up the tissue. ③ Insert the lubricated thumb or index finger 3–4 cm into the vagina and apply sustained pressure towards the anus or lateral vaginal walls for 1–2 minutes until a mild stretching sensation is felt. ④ Perform U-shaped circular massage in the perineal area from the 3 to 9 o'clock positions. ⑤ Gently knead the perineal body (central tendon) between the thumb and index finger.

Patients received at least 3 sessions per week during late pregnancy; each session lasted about 10 minutes and continued for at least 3 weeks until delivery. For quality assurance of the treatment, a dedicated perineal massage support group was established, providing on-site guidance and online Q&A. Delivery-room midwives (N2–N3 level) received unified training and assessment to ensure consistent guidance, and the head nurse conducted regular quality checks. Because of the nature of the intervention, blinding of participants and treatment providers was not feasible.

Table 1. A structured perineal heat stimulation-massage protocol.

Step	Component	Key parameters/Instructions	Frequency & Timing	Duration/Repetition
1. Preparation	The woman empties her bladder, assumes a semi-recumbent position, and may listen to soothing music for relaxation. The operator (the woman herself or a family member) washes hands and trims nails short.	Ensure a quiet and private environment.	Before each intervention session.	
2. Heat stimulation	Apply a towel soaked in warm water and wrung to semi-dryness over the vulva for a moist heat application.	Water temperature: 38–40 °C.	Before each massage session.	10–15 minutes per session. Replace the towel if it cools.
3. Massage	Apply sterile lubricant and perform perineal and peri-vaginal tissue massage in sequence. ① Warm-up: Gently massage the perineal body and labia. ② Sustained Pressure: Insert the lubricated finger 3–4 cm into the vagina and apply sustained pressure toward the anus or posterolateral vaginal walls. ③ U-Shaped Massage: Perform a U-shaped circular massage along the vaginal opening from the 3 to 9 o'clock positions. ④ Kneading Central Tendon: Gently knead the perineal body (central tendon) between the thumb and index finger.	Ensure adequate lubrication; use a gloved thumb or index finger; perform gently until a mild stretching sensation is felt. Pressure direction: toward the anus or posterolateral walls.	Performed immediately after heat stimulation.	Total approx. 10 minutes per session. Hold for 1–2 minutes in each direction.
4. Overall regimen	Execute the above steps sequentially: Preparation → Heat Stimulation → Massage.	Quality control and guidance were provided by uniformly trained N2–N3 level delivery room midwives.	≥3 times per week, starting from 34 weeks of gestation.	Continue for at least 3 weeks until delivery.

Table 2. Comparison of baseline characteristics between the two groups.

Group	Total (n = 500)	Control (n = 253)	Intervention (n = 247)	Statistic	*p*-value
BMI (kg/m^2), mean ± SD	26.07 ± 2.45	26.16 ± 2.55	25.99 ± 2.33	$t = 0.772$	0.440
Estimated fetal weight (g), mean ± SD	3284.36 ± 349.67	3265.34 ± 356.32	3303.84 ± 342.36	$t = –1.232$	0.219
Age (years), M (Q_1, Q_3)	28.00 (27.00, 30.00)	28.00 (26.00, 30.00)	28.00 (27.00, 30.00)	Z = –1.635	0.102
Gestational age (weeks), M (Q_1, Q_3)	39.00 (38.00, 39.00)	39.00 (38.00, 39.00)	39.00 (38.00, 39.00)	Z = –1.634	0.102
Birth weight (g), M (Q_1, Q_3)	3484.00 (3289.75, 3680.25)	3487.00 (3287.00, 3694.00)	3477.00 (3296.00, 3674.00)	Z = –0.402	0.687
Educational level, n (%)				$\chi^2 = 0.702$	0.704
College or below	184 (36.80)	89 (35.18)	95 (38.46)		
Bachelor's degree	155 (31.00)	82 (32.41)	73 (29.55)		
Postgraduate degree	161 (32.20)	82 (32.41)	79 (31.98)		
Use of labor analgesia, n (%)				$\chi^2 = 0.186$	0.667
No	266 (53.20)	137 (54.15)	129 (52.23)		
Yes	234 (46.80)	116 (45.85)	118 (47.77)		

BMI, body mass index; SD, standard deviation. Estimated fetal weight was derived from the last ultrasound examination performed within one week prior to delivery.

However, outcome assessment was blinded: obstetricians who determined perineal tears, midwives recorded labor progress, and data analysts were blinded to group allocation. The specific protocol is summarized in Table 1.

2.2.2 Standard Intrapartum Management

To reduce the effect of variations in labor care, all participants received standardized intrapartum management according to the hospital's unified clinical guidelines.

In the first stage of labor, oxytocin induction or augmentation was initiated under standardized indications (for example, prolonged latent phase or arrest of dilation) and followed a uniform protocol. Neuraxial labor analgesia (epidural) was offered upon maternal request and typically when cervical dilation was $\geq$3 cm, with the same policy applied to both groups. Amniotomy was performed when clinically indicated at the discretion of the attending team. Labor progress was recorded using a standardized partogram.

In the second stage of labor, women were encouraged to adopt their preferred position (semi-recumbent, lateral, or squatting) under guidance. Spontaneous pushing was supported, and coached pushing was provided when clinically appropriate. There was no time-based restriction policy for non-assisted deliveries unless fetal compromise was suspected.

During the third stage of labor and postpartum hemorrhage prevention, active management of the third stage of labor (AMTSL) was routinely applied for all vaginal deliveries. This included: (1) administration of a prophylactic uterotonic (10 IU oxytocin intramuscularly) immediately after delivery of the anterior shoulder; (2) controlled cord traction following signs of placental separation; and (3) uterine massage after placental delivery.

All managing midwives and obstetricians were from the same unit and followed the same institutional protocols.

2.3 Observation Indicators

Various observation indicators were assessed as follows:

2.3.1 Perineal Injury and Labor Duration

Perineal outcomes were recorded as an intact perineum, perineal tear of any degree, or episiotomy. Labor duration was documented in minutes for each stage of labor: first, second, and third stages. Perineal integrity was defined as an intact perineum with no damage to the skin or mucosa after delivery. An episiotomy was defined as a surgical incision of the perineum made to enlarge the vaginal opening. Cases were classified as 'episiotomy' regardless of whether an extension or additional spontaneous tearing occurred. Perineal tear was defined as a spontaneous laceration of the perineum occurring in the absence of an episiotomy.

2.3.2 Perineal Blood Loss, Pain and Neonatal Apgar Scores

Postpartum blood loss: Total blood loss within the first 2 hours postpartum was measured using a combination of volumetric, weighing, and area assessment methods. Furthermore, perineal pain was assessed at 48 hours postpartum using the Visual Analog Scale (VAS, score 0–10) [14], with higher scores indicating greater pain intensity. Similarly, neonatal outcomes were measured as Apgar scores, which were documented at 1 and 5 minutes after birth [15]. Scores of 8–10 were considered normal, 4–7 indicated mild asphyxia, and 0–3 indicated severe asphyxia.

2.3.3 Maternal Psychological Status

Maternal psychological indicators were assessed by research nurses who were blinded to group allocation. All research nurses received standardized training in the use of these evaluation tools to ensure consistent and reliable assessments. Data were collected through structured interviews performed by the designated research nurse. Data were collected at two time points: at enrollment during the 34-week gestational visit (pre-intervention) and upon hospital admission for labor (at which time cervical dilation had typically reached approximately 3 cm). The following validated tools were used during these assessments:

(1) Childbirth self-efficacy: Assessed using the Childbirth Self-Efficacy Inventory (CBSEI-C32), which includes dimensions of outcome expectancy and self-efficacy expectancy, with higher scores indicating greater confidence [16]. (2) State anxiety: Assessed using the state anxiety subscale of the State-Trait Anxiety Inventory (STAI), which involves immediate, situation-specific anxiety, such as fear and tension, with higher scores indicating more severe anxiety [17].

2.4 Statistical Analysis

Statistical analysis was performed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA) software. Normality across continuous variables was assessed using the Shapiro–Wilk test. Normally distributed continuous variables were presented as mean $\pm$ standard deviation (mean $\pm$ SD), and baseline comparisons between groups were conducted using independent-samples *t*-tests. Non-normally distributed data were presented as median with interquartile range [M (Q_1, Q_3)], and between-group comparisons were performed using the Mann–Whitney U test. Categorical variables were presented as counts and percentages and were analyzed using the χ^2 test. For within-group comparisons of pre- and post-intervention psychological scores (e.g., CBSEI and STAI) that were non-normally distributed, the Wilcoxon signed-rank test was used. All statistical analyses were two-tailed, and a p-value < 0.05 was considered statistically significant.

Table 3. Comparison of perineal outcomes between the two groups.

Group	Total (n = 500)	Control (n = 253)	Intervention (n = 247)	Statistic	*p*-value
Rate of perineal tears, n (%)				$\chi^2 = 4.265$	0.039
No	328 (65.60)	155 (61.26)	173 (70.04)		
Yes	172 (34.40)	98 (38.74)	74 (29.96)		
Rate of episiotomy, n (%)				$\chi^2 = 5.381$	0.020
No	294 (58.80)	136 (53.75)	158 (63.97)		
Yes	206 (41.20)	117 (46.25)	89 (36.03)		
Rate of intact perineum, n (%)				$\chi^2 = 24.429$	<0.001
No	378 (75.60)	215 (84.98)	163 (65.99)		
Yes	122 (24.40)	38 (15.02)	84 (34.01)		

Table 4. Comparison of CBSEI scores between the two groups.

Group	Total (n = 500)	Control (n = 253)	Intervention (n = 247)	Statistic	*p*-value
Pre-intervention (scores), M (Q_1, Q_3)	89.00 (82.00, 97.00)	90.00 (82.00, 97.00)	88.00 (82.50, 96.00)	Z = –1.254	0.210
Post-intervention (scores), M (Q_1, Q_3)	102.00 (94.00, 108.00)	94.00 (86.00, 100.00)	108.00 (103.00, 112.00)	Z = –16.601	<0.001
Statistic		Z = –3.756	Z = –18.215		
p-value		<0.001	<0.001		

CBSEI, Childbirth Self-Efficacy Inventory.

Table 5. Comparison of STAI scores between the two groups.

Group	Total (n = 500)	Control (n = 253)	Intervention (n = 247)	Statistic	*p*-value
Pre-intervention (scores), M (Q_1, Q_3)	42.00 (40.00, 44.00)	42.00 (40.00, 44.00)	42.00 (40.00, 44.00)	Z = –0.796	0.426
Post-intervention (scores), M (Q_1, Q_3)	38.00 (35.00, 41.00)	41.00 (39.00, 43.00)	35.00 (34.00, 36.00)	Z = –19.412	<0.001
Statistic		Z = –2.798	Z = –19.303		
p-value		0.005	<0.001		

STAI, State-Trait Anxiety Inventory.

3. Results

3.1 Comparison of Baseline Characteristics Between Groups

This retrospective study analyzed the medical records of 500 parturients. There were no statistically significant differences between the two groups in age, body mass index (BMI), gestational age, estimated fetal weight, neonatal birth weight, educational level, or use of labor analgesia ($p > 0.05$). These results indicate that the control and intervention groups were well balanced at baseline characteristics and were therefore comparable for further analyses (Table 2).

3.2 Comparison of Perineal Outcomes Between Groups

As shown in Table 3, the number of individuals with an intact perineum was significantly higher in the intervention group than in the control group (34.01% vs. 15.02%; $\chi^2 = 24.429$, $p < 0.001$). Perineal tears occurred less frequently in the intervention group than in the control group (29.96% vs. 38.74%; $\chi^2 = 4.265$, $p = 0.039$). Furthermore, the episiotomy rate was significantly lower in the intervention group compared with the control group (36.03% vs. 46.25%; $\chi^2 = 5.381$, $p = 0.020$).

3.3 Comparison of Maternal Psychological Status Between Groups

CBSEI and STAI assessments were performed at two time points: at enrollment during the 34-week gestational visit (pre-intervention) and again during active labor when cervical dilation reached 3 cm (post-intervention) (Tables 4,5). Within each group (intra-group), pre-intervention and post-intervention scores changed significantly ($p < 0.05$). Baseline (pre-intervention) scores did not differ considerably between groups, suggesting comparable baseline levels. Post-intervention CBSEI and STAI scores differed significantly between groups. The intervention group showed significantly higher childbirth self-efficacy ($p < 0.001$) and substantially lower state anxiety ($p < 0.001$) compared with the control group.

3.4 Comparison of Labor Duration Between Groups

As shown in Table 6, patients in the intervention group experienced significantly shorter durations of the first, second, and third stages of labor than those in the control group (all $p < 0.001$).

Table 6. Comparison of labor duration between the two groups.

Group	Total (n = 500)	Control (n = 253)	Intervention (n = 247)	Statistic	*p*-value
First stage of labor (min), M (Q_1, Q_3)	476.50 (386.00, 563.00)	514.00 (412.00, 604.00)	439.00 (360.50, 519.50)	Z = –6.586	<0.001
Second stage of labor (min), M (Q_1, Q_3)	62.00 (52.00, 75.00)	74.00 (60.00, 90.00)	55.00 (45.00, 65.00)	Z = –12.015	<0.001
Third stage of labor (min), M (Q_1, Q_3)	10.00 (8.00, 12.00)	12.00 (11.00, 13.00)	8.00 (7.00, 9.00)	Z = –18.607	<0.001

Table 7. Comparison of postpartum blood loss, VAS scores, and Apgar scores between the two groups.

Group	Total (n = 500)	Control (n = 253)	Intervention (n = 247)	Statistic	*p*-value
Postpartum blood loss within 2 hours (mL), M (Q_1, Q_3)	240.00 (213.00, 265.00)	244.00 (224.00, 269.00)	233.00 (199.00, 261.00)	Z = –4.420	<0.001
VAS (scores), M (Q_1, Q_3)	4.00 (3.00, 4.00)	4.00 (3.00, 5.00)	3.00 (2.00, 4.00)	Z = –11.622	<0.001
1-min Apgar (scores), M (Q_1, Q_3)	10.00 (9.00, 10.00)	10.00 (9.00, 10.00)	10.00 (9.00, 10.00)	Z = –0.238	0.812
5-min Apgar (scores), M (Q_1, Q_3)	10.00 (10.00, 10.00)	10.00 (10.00, 10.00)	10.00 (10.00, 10.00)	Z = –1.713	0.087

VAS, Visual Analog Scale.

3.5 Postpartum Blood Loss, Pain Scores, and Neonatal Apgar Scores

Postpartum blood loss within 2 hours was significantly lower in the intervention group than in the control group ($p < 0.001$). At 48 hours postpartum, women in the intervention group also reported significantly lower VAS scores ($p < 0.001$). However, neonatal outcomes were similar between the two groups: Apgar scores at 1 and 5 minutes did not differ substantially ($p > 0.05$), and all neonatal scores were within the normal range (Table 7).

4. Discussion

This study is the first to comprehensively evaluate a structured perineal heat stimulation-massage combined pre-adaptation protocol during late pregnancy. Compared with routine antenatal care, the protocol was associated with a significant decrease in perineal injury among primiparous women undergoing vaginal delivery. However, it shows consistent benefits across several clinically crucial outcomes, including shorter labor duration, less postpartum blood loss, lower postpartum pain, and improved maternal psychological well-being. Rather than assessing the traditional objective of antenatal perineal massage, these findings indicated a broader, integrated approach: revealing an innovative pathway to optimize the preparation of women physiologically and psychologically before labor begins through a structured antenatal pre-adaptation method, with the potential to enhance both the birth process and the overall childbirth experience.

Traditional views suggest that antenatal perineal massage primarily increases tissue compliance through mechanical stretching [10,11]. However, the pattern of benefits observed in this study, particularly the comprehensive shortening of the first, second, and third stages of labor, strongly suggests that the combined protocol acts through broader and more integrated pathways. Our proposed "heat stimulation plus massage" protocol builds on existing practice by advancing heat stimulation from the intrapartum setting into late pregnancy and embedding it as the first step in a fixed, sequential intervention. In this setting, heat stimulation is not only a comfort measure. Evidence indicates that local heat therapy can promote tissue blood flow and reduce neuromuscular excitability, thereby effectively relieving muscle tension and spasm [18,19,20]. By improving local circulation and reducing baseline muscle tone, heat may create a more receptive tissue environment for the subsequent massage, with less resistance and better tolerance. Under these conditions, the mechanical effects of massage can likely be implemented more effectively, improving adherence while promoting significant pre-adaptation of pelvic floor muscles and related neural reflex pathways through repeated, structured "heat relaxation followed by mechanical stretching". This synergistic mechanism aligns with the contemporary approaches that aim to optimize normal childbirth physiology using non-pharmacological interventions [21,22].

The significant reduction in episiotomy in the intervention group is clinically crucial. Episiotomy is a common iatrogenic intervention, and in practice, it is often performed when the attending midwife predicts a high risk of severe tearing. Our results indicate that, after antenatal pre-adaptation with heat and massage, the perineum may exhibit better biomechanical stretch and tolerance. This likely supports "protective midwifery" by increasing clinicians' confidence that birth can proceed safely without routine episiotomy. This finding aligns with the global advocacy for "reducing unnecessary obstetric interventions" and supporting the physiology of natural birth [23,24].

The observed benefits were not limited to episiotomy. The combination of less severe perineal injury and shorter labor duration was associated with significantly reduced

postpartum pain and lower blood loss. Postpartum pain is a core determinant of recovery, and severe perineal pain can hinder early mobilization and functional rehabilitation [25]. The reduced blood loss within 2 hours postpartum in the intervention group is also significant and may be explained through two pathways: First, the reduction in perineal injury likely decreases bleeding from soft-tissue trauma. Second, the shortened second stage may have contributed indirectly, as a prolonged second stage has been found as an independent risk factor for postpartum hemorrhage [26]. Overall, by reducing tissue trauma and optimizing labor progress, this approach may promote early postpartum comfort and recovery. This reflects the potential positive systemic effects of the pre-adaptive model and highlights the core value of the midwife-led continuity of care model in integrating such preventive [27].

This study also revealed the positive impact of the combined protocol on maternal psychological well-being. Compared with the control group, women who received the protocol reported significantly higher childbirth self-efficacy and lower state anxiety levels before delivery. This clearly indicates that the benefits of this intervention extend beyond the purely physiological realm, achieving psychological support and reassurance. A likely explanation is that structured antenatal pre-adaptation involves repeated, guided exposure to stretching and pressure sensations around the perineum in a safe and controlled setting. Over time, this process acts as both physical preparation and a form of cognitive rehearsal for childbirth. It can enhance body familiarity, reduce fear of the unknown, and increase confidence to cope with the stress associated with labor.

The improved psychological preparation and readiness may be closely related to better cooperation during labor, particularly more effective pushing and coordinated effort during the second stage. The intervention may create a virtuous cycle in which physiological preparation supports psychological confidence, which in turn supports more efficient labor progress. By achieving these psychological well-being along with clinical measures, the study objective is consistent with a central aim of contemporary obstetrics: improving not only “safe delivery”, but also a “positive childbirth experience”.

The primary contribution of this study is the development and initial validation of a standardized, practical, and structured antenatal pre-adaptation protocol that can be implemented as a clear clinical pathway rather than a general form of health education. The combined approach and sequential design of heat stimulation followed by massage, along with detailed implementation steps and a basic quality-control framework, support the protocol’s replicability and scalability. This study has inherent limitations of a retrospective design. Similarly, non-randomized group allocation may result in selection bias, and the single-center design may limit the generalizability of the results. Additionally, although compliance to intervention was emphasized, adherence was largely based on self-report. Future studies could enhance measurement accuracy by using objective tools such as electronic diaries or digital monitoring systems. Based on these findings, large-scale, multicenter, prospective randomized controlled trials are recommended to further validate these findings. Future studies should focus on exploring long-term outcomes of this protocol, such as pelvic floor muscle function, sexual function, and quality of life at 6 months and 12 months postpartum. Finally, health economic evaluations are needed to determine cost-effectiveness, thereby providing a stronger justification for promoting this protocol within public health and clinical policy.

5. Conclusion

In summary, this retrospective study suggests that receiving perineal heat stimulation combined with massage during late pregnancy may serve as a safe and effective pre-adaptation strategy with multiple advantages. Among primiparous women undergoing vaginal delivery, the intervention was significantly associated with less severe perineal injury, shorter labor duration, reduced postpartum blood loss and pain, and improved maternal psychological state, without any pronounced adverse effect on neonatal safety. These results support the clinical significance of this non-pharmacological, midwife-led nursing protocol and provide strong empirical evidence for future validation in comprehensive prospective studies.

Key Points

- This study demonstrates that a structured perineal heat stimulation combined with massage during late pregnancy can reduce perineal injury and shorten the duration of labor in primiparous women.
- The protocol also improved maternal childbirth self-efficacy and reduced state anxiety levels, highlighting its psychological benefits.
- The intervention was safe, without any adverse effects observed on neonatal outcomes.
- These findings support the integration of this non-pharmacological intervention into routine antenatal care.

Availability of Data and Materials

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions

TW, JY and JYW designed the research study. TTW, ZNA, YN and YW performed the research. TW, JY, TTW and YW analyzed the data. JYW and ZNA drafted the article. All authors contributed to the important editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated suffi-

ciently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

All participants provided written informed consent. The study protocol was approved by the Jiangxi Maternal and Child Health Hospital Ethics Committee (approval No. EC-KY-2024164) and strictly adhered to the ethical principles outlined in the Declaration of Helsinki.

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Conflict of Interest

The authors declare no conflict of interest.

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