

Effect of Ambulation and Heat Pack Application on Pain Perception and Labor Progress during the First Stage of Labor

Nahidah Hasan Abdullah^{1*}, Tiran Jamil Piro²

^{1*}Department of Nursing, Hawler Medical University, Kurdistan Region, Iraq. Erbil College of Nursing.
nahidah.abdullah@hmu.edu.krd

²Department of Nursing, Hawler Medical University, Kurdistan Region, Iraq. Erbil Polytechnic University, Medical
Technical Institute, Midwifery Department

Abstract

Labor pain is one of the most intense experiences encountered by women and may influence maternal comfort and labor progress. Healthcare providers recommend non-pharmacological interventions like ambulation and heat pack application to support physiological labor and improve women's experiences. This quasi-experimental pretest-posttest control-group study evaluated the effectiveness of ambulation combined with heat pack application on pain perception and labor progress during the first stage of labor. Researchers conducted the study among 104 pregnant women admitted in the active phase of labor at a maternity teaching hospital in Erbil City, Iraq. They purposively selected these women and equally allocated them to an intervention group (n = 52) and a control group (n = 52). Women in the intervention group received structured ambulation and application of a lumbosacral heat pack, in addition to routine care, while the control group received routine care only. Pain perceptions, including knowledge, attitudes, and beliefs, as well as labor progress parameters, were assessed before and after the intervention. The intervention group showed statistically significant improvements in pain knowledge, attitudes, and beliefs compared to the control group ($p < 0.001$). Ambulation and heat pack application were associated with significantly enhanced labor progress, including faster cervical dilatation, improved fetal head descent, and more effective uterine contraction patterns during the first stage of labor ($P < 0.001$). These findings suggest that ambulation combined with heat pack application may represent a safe, simple, and cost-effective non-pharmacological approach to support women during labor and promote favourable labor outcomes in routine care.

Keywords: First stage of labor; Ambulation; heat pack application; pain perception; labor progress

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INTRODUCTION

Labor pain is one of the most intense forms of pain experienced by women and represents a complex physiological and psychological phenomenon encompassing physical, emotional, psychological, and social dimensions [1], [2]. Pain during the first stage of labor is a normal physiological response that primarily results from uterine muscle ischaemia during contractions, cervical dilatation, stretching of the lower uterine segment, and distension of the pelvic structures [3]. Although labor pain is a natural process, its intensity and perception can significantly influence women's childbirth experiences and labor outcomes [4], [5].

The perception of labor pain varies considerably among women and is influenced by multiple maternal and obstetric factors, including parity, maternal age, fetal position, use of oxytocin, maternal anxiety and fear, and maternal or fetal weight [6]. Prolonged labor remains a global concern, affecting approximately 8% of women during childbirth, and is associated with negative birth experiences, increased maternal exhaustion, and a higher likelihood of requesting caesarean delivery in subsequent pregnancies [7], [8]. Effective labor pain management strategies that support both maternal comfort and

physiological labor progression are essential components of quality maternity care [9].

Labor pain management strategies are broadly categorised into pharmacological and non-pharmacological approaches. Pharmacological methods aim to reduce pain intensity directly, whereas non-pharmacological methods focus on enhancing women's coping abilities and supporting the natural physiology of labor [10], [11], [12]. In recent years, non-pharmacological interventions have gained increasing attention because of their safety, cost-effectiveness, minimal side effects, and suitability for diverse clinical and resource-limited settings.

Ambulation during the active phase of the first stage of labor has been reported to shorten labor duration, reduce the rate of operative deliveries, and improve maternal and fetal outcomes. Walking and upright positions use gravity to increase pelvic diameters, facilitate fetal descent, and enhance the frequency and effectiveness of uterine contractions, while also improving uteroplacental blood flow and fetal oxygenation [8], [13]. These physiological benefits may contribute to reduced pain perception and more efficient labor progression.

Heat pack application is another widely used non-pharmacological intervention during labor. Localised heat promotes vasodilation, increases regional blood flow, reduces ischaemia, enhances tissue metabolism, and stimulates endorphin release, leading to muscle relaxation and reduced pain perception [14]. The application of heat to the lumbosacral region has been shown to decrease labor pain intensity and support more effective uterine activity.

Midwives play a central role in providing supportive care and facilitating non-pharmacological pain management during labor. However, in maternity teaching hospitals in Erbil City, non-pharmacological methods such as ambulation and heat pack application are not routinely implemented as part of standard intrapartum care in Erbil City. Despite evidence supporting these interventions individually, limited research has examined their combined effects on pain-related perceptions and labor progress during the first stage of labor, particularly within resource-limited maternity settings. Therefore, this study aimed to evaluate the effectiveness of ambulation combined with heat pack application on pain perceptions and labor progress among women during the first stage of labor.

MATERIALS AND METHODS

Study Design

A quasi-experimental pretest-post-test control group design was employed to evaluate the effect of ambulation combined with heat pack application on pain perceptions and labour progress during the first stage of labour. This design was selected because of practical and organisational constraints within the labor unit that prevented random allocation of participants.

Study Setting

The study was conducted in the labor and delivery unit of the Maternity Teaching Hospital in Erbil City, Kurdistan Region of Iraq. This hospital serves as a major referral centre for obstetric care and provides maternity services to women in both urban and rural areas.

Sampling Technique and Sample Size

A purposive non-probability sampling technique was used to recruit eligible pregnant women admitted to the labor unit during the data collection period. A total of 104 participants were included and equally allocated to an intervention group ($n = 52$) and a control group ($n = 52$). The sample size was determined using G*Power software (version 3.1.9.2) to ensure adequate statistical power to detect significant differences between the groups.

Eligibility Criteria

Women were eligible for inclusion if they were full-term pregnant women with a live singleton fetus in cephalic presentation, admitted during the active phase of the first stage of labor (cervical dilatation of 3–4 cm), primigravida or second gravida, able to communicate effectively in the Kurdish language, and willing to participate in the study. Women were excluded if they had high-risk pregnancies (such as eclampsia, antepartum

haemorrhage, gestational diabetes, or malpresentation), preterm or post-term labor, multiple pregnancies, contraindications to vaginal delivery, or if they had received pharmacological analgesia during labor.

Data Collection Instruments

Two instruments were used for data collection.

Tool I: Structured Interview Questionnaire

This researcher-developed questionnaire was designed following an extensive review of the relevant literature. The questionnaire comprised three sections: (1) sociodemographic characteristics, including age, education level, residence, occupation, height, and weight; (2) obstetric and clinical characteristics, including parity, antenatal care registration, number of antenatal visits, and previous mode of delivery; and (3) pain-related perception domains, including women's knowledge, attitudes, and beliefs regarding ambulation and heat pack application during labor.

Tool II: Labor Progress Assessment Tool

This tool was developed based on existing literature to assess labor progress parameters, including cervical dilatation (4 cm, 5–7 cm, and 8–10 cm), fetal head descent relative to the ischial spine (–3 to –1, 0, and +1 to +3), uterine contraction frequency (≤ 3 , 4–5, or 6–7 contractions per 10 minutes), and uterine contraction duration (<20 seconds, 20–40 seconds, and >40 seconds).

Validity and Reliability

The content validity of the study instruments was established through evaluation by a panel of 12 experts in maternal health nursing and obstetrics. Internal consistency reliability was assessed using Cronbach's alpha. The knowledge, attitudes, and beliefs subscales showed good reliability ($\alpha = 0.82$, 0.74, and 0.83, respectively), while the labor progress assessment tool showed excellent reliability ($\alpha = 0.90$).

Pilot Study

A pilot study was conducted on 10% of the total sample ($n = 20$) to evaluate the clarity, feasibility, and applicability of the data collection tools, and to estimate the time required for data collection. Minor modifications were made, and participants included in the pilot study were excluded from the final analyses.

Ethical Considerations

Ethical approval was obtained from the Ethics Committee of the College of Nursing, Hawler Medical University. Written informed consent was obtained from all participants prior to enrollment. Confidentiality and anonymity were ensured, and the participants were informed of their right to withdraw from the study at any time without affecting their care.

Study Procedure

Data collection was conducted over four months from December 2024 to March 2025, four days a week. The study was implemented in two phases: an assessment phase and an intervention phase. During the assessment

phase, participants were interviewed to collect sociodemographic and obstetric data, and baseline assessments of pain-related perceptions and labor progress were performed. Each interview lasted approximately 20–40 minutes. The researcher remained with participants throughout the observation period to complete assessments and, for the intervention group, to administer the intervention.

Intervention Protocol

Participants in the intervention group received ambulation and heat pack application besides routine labor care. Educational pamphlets were developed based on relevant literature and translated into Kurdish to ensure standardised instruction. Women were encouraged to ambulate outside their rooms near the midwives' station, maintaining an upright position. Each ambulation session lasted approximately 20 minutes per hour, followed by a 10-minute rest period in the left lateral position. Subsequently, a reusable electronic heat pack covered with soft cotton fabric was applied to the lumbosacral region for 20 minutes when cervical dilatation reached 4–5 cm. This intervention cycle was repeated hourly for two consecutive hours or until progression to the next stage of labor.

Pain intensity was assessed using a visual analogue scale before the intervention, after ambulation, and after heat pack application. Labor progress parameters, including cervical dilatation, fetal head descent, and uterine contraction characteristics, were assessed at regular intervals during the first stage of labor.

Control Group

Participants in the control group received routine labor care according to hospital protocols, without additional intervention from the researcher.

Statistical Analysis

Data were analysed using the Statistical Package for the Social Sciences (SPSS), version 26. Descriptive statistics, including frequencies and percentages, were used to summarise participants' characteristics. Because of the use of non-probability sampling and non-normal data distribution, non-parametric statistical tests were applied. The Wilcoxon signed-rank test was used to assess within-group differences, and the Mann–Whitney U test was used to compare outcomes between the intervention and control groups. Effect sizes were calculated, and a p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 104 pregnant women participated in the study, with 52 women allocated to the intervention group and 52 to the control group. The results are presented in relation to participants' sociodemographic characteristics, pain-related perception domains, and labor progress outcomes during the first stage of labor.

Sociodemographic Characteristics

The sociodemographic characteristics of women in the intervention and control groups are presented in Table 1. Most participants in both groups were aged 18–23 years, representing 61.5% of the intervention group and 46.2% of the control group. Regarding educational level, the highest proportion of women in the intervention group had completed intermediate school (30.8%), while a similar proportion in the control group had completed high school (26.9%). Most participants in both groups were stay-at-home parents (92.3% in the intervention group and 90.4% in the control group) and lived in urban areas. Overall, the sociodemographic profiles of the two groups were comparable. Regarding the residential area, approximately two-thirds of women in the control group (65.4%) and more than half in the intervention group (53.8%) lived in urban areas.

Table 1. Sociodemographic Characteristics of Pregnant Women in the Intervention and Control Group

Variable	Category	Control Group (N = 52)	Intervention Group (N = 52)
		No. (%)	No. (%)
Age group (years)	18–23	24 (46.2)	32 (61.5)
	24–28	19 (36.5)	13 (25.0)
	29–35	9 (17.3)	7 (13.5)
Women Educational level	Illiterate	2 (3.8)	2 (3.8)
	Primary school	10 (19.2)	11 (21.2)
	Intermediate school	11 (21.2)	16 (30.8)
	High school	14 (26.9)	14 (26.9)
	Diploma	6 (11.5)	4 (7.7)
	Bachelor's degree	9 (17.3)	5 (9.6)
Pregnant Women's occupation	Housewife	47 (90.4)	48 (92.3)
	Government-employed	5 (9.6)	4 (7.7)
Current Place of residence	Urban	34 (65.4)	28 (53.8)
	Rural	4 (7.7)	6 (11.5)
	Township	14 (26.9)	18 (34.6)

Effect of Ambulation on Pain-Related Perception Domains

Table 2 illustrates changes in pain perception domains (knowledge, attitudes, and beliefs) before and after ambulation in the intervention and control groups. In the intervention group, there was a statistically significant increase in median

total knowledge scores following ambulation ($p < 0.001$), with a large effect size ($r = 0.882$). Similarly, attitudes toward ambulation improved significantly in the intervention group ($p < 0.001$; $r = 0.874$). Belief scores also showed a highly statistically significant increase after the intervention ($p < 0.001$; $r = 0.873$). In contrast, the control group showed no statistically significant differences in knowledge or attitudes between pretest and post-test assessments ($p > 0.05$), with small effect sizes. However, a slight but statistically significant decrease in belief scores was observed in the control group ($p = 0.03$), with a small effect size ($r = 0.294$).

Table 2. Comparison of Pregnant Women's Pain-Related Perception Domains Before and After Ambulation in the Intervention and Control Groups

Pain-Related Perception Domains	Group	Pretest Median (IQR)	Post-test Median (IQR)	Z-value	p-value	Effect Size (r)
Total Knowledge	Control	2 (1–3.75)	2 (1–3)	–0.939	0.340	0.13
	Intervention	2 (2–3)	8 (8–8)	–6.359	<0.001	0.882
Total Attitudes	Control	21 (19–22)	21 (20–23)	–1.630	0.100	0.226
	Intervention	20 (19–21)	28 (28–28)	–6.299	<0.001	0.874
Total Believe	Control	10 (9–11)	9 (7–12)	–2.123	0.030	0.294
	Intervention	9.5 (8–11)	20 (20–20)	–6.296	<0.001	0.873

Effect of Heat Pack Application on Pain-Related Perception Domains

As shown in Table 3, women in the intervention group exhibited statistically significant improvements in pain knowledge, attitudes, and beliefs following heat pack application compared with pre-intervention assessments ($p < 0.001$), with large effect sizes across all domains. No statistically significant changes were observed in the control group for any of the pain perception domains during the same assessment period ($p > 0.05$). The intervention group demonstrated a statistically significant increase in total knowledge scores following heat pack application ($p < 0.001$), with a large effect size ($r = 0.90$). Attitude scores also increased significantly in the intervention group ($p < 0.001$; $r = 0.914$), as did belief scores ($p < 0.001$; $r = 0.906$).

Table 3. Comparison of Pregnant Women's Pain-Related Perception Domains Before and After Heat Pack Application in the Intervention and Control Groups

Pain-Related Perception Domains	Group	Pretest Median (IQR)	Post-test Median (IQR)	Z-value	p-value	Effect Size (r)
Total Knowledge	Control	3 (1–5)	3 (1.25–4)	–0.816	0.410	0.113
	Intervention	3 (2–5)	10 (10–10)	–6.489	<0.001	0.900
Total Attitudes	Control	10 (9–12.75)	9 (8–12)	–1.414	0.150	0.196
	Intervention	9 (8–12)	28 (27–28)	–6.589	<0.001	0.914
Total Beliefs	Control	7 (6–8)	6 (4–8)	–0.775	0.440	0.107
	Intervention	7 (5–8)	24 (23–24)	–6.534	<0.001	0.906

Effect of the Intervention on Labor Progress Outcomes

The effect of ambulation combined with heat pack application on labor progress outcomes during the first stage of labor is presented in Table 4. After 2 hours of intervention, women in the intervention group showed significantly greater progression in cervical dilatation, fetal head descent, uterine contraction frequency, and uterine contraction duration than women in the control group ($p < 0.001$). A substantially higher proportion of women in the intervention group entered the advanced phase of labor or progressed to the subsequent stage of labor within the observation period, whereas most women in the control group remained in the active phase of the first stage of labor. These findings indicate that ambulation and heat pack application were associated with enhanced physiological labor progress during the first stage of labor.

Table 4. Effect of Two Hours of Intervention on Labor Progress Outcomes in the Intervention and Control Group

Labor Progress Domains	Category	Before Intervention		p-value	Two Hours After Intervention		p-value
		Control Group (N = 52) No. (%)	Intervention Group (N = 52) No. (%)		Control Group (N = 52) No. (%)	Intervention Group (N = 52) No. (%)	

Cervical dilatation	4 cm	52 (100)	52 (100)	**	2 (3.8)	0 (0.0)	<0.001 *
	5–7 cm	0 (0.0)	0 (0.0)		50 (96.2)	0 (0.0)	
	8–10 cm	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	
	Progressed to the next stage	0 (0.0)	0 (0.0)		0 (0.0)	52 (100)	
Fetal head descent	Above ischial spine (–3 to –1)	52 (100)	52 (100)	**	52 (100)	0 (0.0)	<0.001 *
	At the ischial spine (0)	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	
	Below ischial spine (+1 to +3)	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	
	Progressed to next stage	0 (0.0)	0 (0.0)		0 (0.0)	52 (100)	
Uterine contraction frequency	≤3 contractions / 10 min	51 (98.1)	52 (100)	0.35	26 (50.0)	0 (0.0)	<0.001 *
	4–5 contractions / 10 min	1 (1.9)	0 (0.0)		19 (36.5)	0 (0.0)	
	6–7 contractions / 10 min	0 (0.0)	0 (0.0)		7 (13.5)	0 (0.0)	
	Progressed to next stage	0 (0.0)	0 (0.0)		0 (0.0)	52 (100)	
Uterine contraction duration	<20 seconds	0 (0.0)	0 (0.0)	0.31	0 (0.0)	0 (0.0)	<0.001 *
	20–40 seconds	52 (100)	51 (98.1)		37 (71.2)	0 (0.0)	
	>40 seconds	0 (0.0)	1 (1.9)		15 (28.8)	0 (0.0)	
	Progressed to next stage	0 (0.0)	0 (0.0)		0 (0.0)	52 (100)	

*: Fisher's Exact Test

**: No statistics are computed because Levels of Pretest Cervix Dilatation is a constant

DISCUSSION

This study aimed to determine the effectiveness of ambulation and heat pack application on pain perception and labor progress in the first stage of labor. The first part of the questionnaire revealed that most of the mothers in both groups were in the age group 18 to 23 years old. These results agree with those got by [15], [16] [16], who studied the effectiveness of ambulation versus semi-Fowler's position. According to the researcher, all participants in both groups were statistically homogeneous in terms of age, 20 to 25 years old.

Concerning the participants' occupations, the results are that most of the women are in both groups [17], who conducted a study on 150 parturient women in labor, found that the highest level of mother was a stay-at-home parent. Their findings were in line with this study's findings of stay-at-home parents. Regarding total knowledge of non-pharmacological methods (ambulation and heat pack application) of pain perception during the first stage of labor among pregnant women. This study showed that there was a highly statistically significant

difference in a median increase in the intervention group, with a large effective size. The results are in line with [18], who studied the Effect of an Educational programme on women's knowledge level regarding non-pharmacological labor pain management. They found the programme increased the pregnant women's knowledge regarding applying non-pharmacological methods for labor pain management. In addition, [19] studied the effectiveness of a teaching programme on knowledge regarding non-pharmacological pain management during labor. They found that there was a significant gain in knowledge after intervention. Concerning total attitudes of non-pharmacological methods (ambulation and heat pack application) of pain perception during the first stage of labor among pregnant women.

The test determined that there was a statistically significant difference in median increase with a large effect size in the intervention group. This result is matched by those of [20], who studied the effectiveness of a structured teaching programme on attitudes of pregnant women regarding non-pharmacological

methods. They reported that there is a statistically significant difference in pregnant women's attitudes regarding non-pharmacological labor pain management in the intervention group compared to the control group. Regarding total believe of non-pharmacological methods (ambulation and heat pack application) of pain perception during the first stage of labor among pregnant women. The test determined that there was a highly statistically significant difference in median increase with a large effect size in the intervention group. This study agreed with [21][22], [23], who studied the effect of implementing an educational programme for pregnant women about childbirth preparation on coping with the labor process. They showed that there were significant increases in the mean scores of believe the study group outcome expectancy and in the self-efficacy expectancy at the 1st stage of labor post intervention and in the follow-up, compared to the control group, with a highly statistically significant difference between both groups. labor progress' outcome of intervention and control groups, which included cervical dilatation, descendant fetus head level, uterine contraction frequency levels, and uterine contraction duration levels. After two hours of intervention in the intervention group, there was a highly statistically significant difference found in all domains of labor progress outcome. The results are in line with [24], who studied the effectiveness of heat therapy and cold therapy in labor pain intensity. They found that there was a statistically significant difference in the intervention group two hours after the programme. All participants were sent to the delivery room, which means all pregnant women had cervical dilatation of over 8 cm. Besides that, this result is in the same line as [25], who studied the influence of three delivery positions on pain intensity. They found that women who assumed an ambulation position during the first stage of labor had improved cervical dilation compared to those who assumed a control position, which is justified by the effect of the downward force of gravity.

Uterine contractions are intensified in frequency, strength, and regularity. Regarding the finding of the earlier study agreed upon by [6], who studied the effect of Change of position and Back massage on pain perception during the first stage of labor. What they found there was a statistically significant difference between the control and intervention groups regarding cervical dilatation two hours after the programme. The test determined that there was a very high statistically significant difference in median increase with a large effect size in the intervention group. This result is in congruence with [23]. They found that there was a statistically significant difference between the intervention and control groups regarding the descent of the fetus's head after the programme.

[26], who studied the effectiveness of ambulation versus birthing ball, who clarified that the descent of the fetus's head is slow before the programme in both groups, while after the programme, there was a very high statistically significant difference found in post-test levels of the fetal head between both groups. It means the fetal head has descended below the ischial spines. The current study illustrated that there was a very high statistically

significant difference found in post-test levels of uterine contraction duration between the control and intervention groups, which was because all the participants in the intervention group were sent to the delivery room two hours after the programme. [25] Supporting the result regarding the duration of uterine contraction per second after eight hours of intervention, they showed that almost all pregnant women were sent to the delivery room.

Also, the results concurred with [23]. Who reported that the frequency of uterine contraction 10 minutes, intensity, and duration of uterine contractions in the intervention group increased compared with the frequency, intensity, and duration of the control group after the programme. [27] focused on walking during labor. The results revealed that ambulation and upright position had improved the progress of uterine contractions regarding the increase in the number of uterine contractions/10 minutes, intensity, and duration compared to the recumbent position. The findings of this study agreed upon by [27][28]

, who studied to assess the effectiveness of ambulation on the progress of labor during the first stage. They found there was a highly statistically significant difference between the control and intervention groups regarding uterine contraction frequency and uterine contraction duration. The test determined that there was a statistically significant difference in median increase, with a large effect size in the intervention group.

CONCLUSION

The findings of this study show that ambulation combined with heat pack application showed promising effectiveness as a non-pharmacological approach for supporting women during the first stage of labor. Women who received the intervention showed significant improvements in pain-related knowledge, attitudes, and beliefs, along with enhanced physiological indicators of labor progress, including cervical dilatation, fetal head descent, and uterine contraction patterns, compared with those who received routine care alone. These results suggest that simple supportive interventions may positively influence both women's cognitive perceptions of labor pain management and the physiological progression of labor.

Although the study employed a quasi-experimental design, the findings highlight the potential value of integrating ambulation and heat pack application into routine maternity care as safe, low-cost, and non-invasive strategies. Such interventions may contribute to improved maternal comfort and support the natural progress of labor, particularly in settings where access to pharmacological pain relief is limited. Further research using randomised controlled designs and larger, more diverse populations is recommended to confirm these findings and to clarify the independent and combined effects of ambulation and heat therapy on labor outcomes.

STUDY LIMITATIONS

Several limitations of this study should be considered when interpreting the findings. First, the use of a quasi-experimental design with purposive non-probability

sampling may limit the generalizability of the results beyond the study setting and increase the potential for selection bias. Second, the study was conducted in a single maternity teaching hospital, which may restrict the applicability of the findings to other healthcare settings or populations with different clinical practices. Third, pain-related perceptions were partially assessed using self-reported measures, which may be influenced by individual expectations, emotional states, and social desirability bias during labor. In addition, the intervention combined ambulation and heat pack application, which prevented the examination of the independent effects of each component. The continuous presence of the researcher during the intervention period may also have contributed to enhanced emotional support, potentially influencing outcomes through a Hawthorne effect. Finally, the study focused on short-term intrapartum outcomes, and long-term maternal satisfaction and neonatal outcomes were not assessed.

FUTURE RESEARCH DIRECTIONS

For external validity, future research should use randomised controlled trials with larger and more heterogeneous populations from different healthcare institutions. Studying the individual and synergistic effects of ambulation and heat therapy might help clarify their effects. Future studies may investigate mom satisfaction, neonatal outcomes, breastfeeding start, and postpartum healing. A qualitative study can provide women's perceptions of non-pharmacological labour pain therapy.

CLINICAL IMPLICATIONS AND RECOMMENDATIONS

This study affects maternity care clinically. With no special equipment or training, walking and utilising a heat pack are safe, affordable, and non-invasive labour management techniques. Midwives and nurses should promote walking and heat therapy during early labour regularly. Healthcare institutions should promote non-drug pain management through clinical guidelines and training. Educating women during antenatal visits may boost their confidence and readiness to use these methods during delivery. In resource-poor areas, walking and utilising heat packs may make moms more comfortable, shorten labour, and improve delivery satisfaction.

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