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Original research article

EVALUATING THE EFFICIENCY OF NON-PHARMACOLOGICAL PAIN MANAGEMENT TECHNIQUES DURING LABOR AND DELIVERY

KAKAR PK[1], ANILA[2], KHAN AGM[3], SINDHU S[4]

[1]*Department of Gynaecology, Civil Hospital Quetta Balochistan, Pakistan*
[2]*Department of Gynaecology, Civil Hospital Karachi, Pakistan*
[3]*Department of Gynaecology and Obstetrics, Unit 1 Civil/SPH Quetta, Pakistan*
[4]*Civil Hospital Hyderabad, Pakistan*
**Correspondence author email address:* drpkakar@yahoo.com

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Abstract: *Labor and delivery is a natural procedure that causes women significant pain and discomfort. Many women choose pharmacological pain management techniques, yet there is growing interest in non-pharmacological pain management techniques, viewed as safer and more natural than pharmacological methods. This study aimed to assess the efficacy of non-pharmacological pain management techniques during labor and delivery. In a randomized controlled trial, we randomly assigned 246 expectant women to either a non-pharmacological intervention or a control group. During labor and delivery, the non-pharmacological intervention group received a combination of relaxation techniques, including massaging and physical therapy, aromatherapy, TENS, and mixed interventions. The control group received standard care devoid of non-pharmaceutical interventions. Pain levels were measured using a visual analog scale at 30-minute intervals. Additionally, the length of labor, delivery mode, and birth outcomes were recorded using the APGAR score system. The demographic characteristics of patients in both groups were comparable and non-significant in variations (p>0.05). Forty participants utilized each non-pharmacologic technique. Comparing VAS pain scale scores at 30-minute intervals, the distribution of pain intensity levels was comparable between the groups. The larger fraction of neonates in the non-pharmacological group had higher APGAR scores, indicating no need for immediate medical attention. Based on a reasonable comparison of the effectiveness of various interventions for managing labor pain and distress, it was found that 9 (22.5%) of 40 patients who received massaging therapy reported low efficacy in managing labor pain, 13 (32.5%) reported moderate efficacy, and 28 (70%) reported high efficacy. In the aromatherapy of 40 patients, 16 reported low efficacy, 21 reported moderate efficacy, and 13 reported high efficacy in managing labor pain. Ten patients (25%) reported low efficacy, 12 patients (30%) reported moderate efficacy, and 28 patients (70%) reported high efficacy in managing labor pain through TENS. It provided cost-effective and safe alternatives to pharmaceutical interventions during labor and delivery. When properly implemented, these techniques reduced pain intensity comparable to commercial medicines while significantly improving the birthing experience and potentially contributing to better maternal and neonatal outcomes.*

Keywords: Alternative therapeutics; Aromatherapy; Labor; Medicinal treatment; obstetrics; Pain management.

Introduction

Labor pain is a normal and unavoidable aspect of childbirth, indicating the progression of labor and the impending delivery of a new life (Aziato et al., 2017). It is a singular and profoundly personal experience encompassing physical sensations, emotions, and psychological obstacles. Understanding and effectively managing labor pain is essential for assuring a positive birthing experience for women, thereby promoting their and their babies' health (Labor and Maguire, 2008; Olza et al., 2020).

During labor, numerous hormones and neurotransmitters are released, which contribute to the sensation of pain. Oxytocin stimulates uterine contractions, whereas prostaglandins sensitize the neurons, amplifying pain signals (Uvnäs-Moberg et al., 2019; Walter et al., 2021). In addition, the elongation of tissues and pressure on nerve endings intensify the pain sensation. Effective labor pain management focuses on providing women with relief, comfort, and support while respecting their preferences and choices. (Thomson et al., 2019). Methods ranging from non-pharmacological techniques to pharmacological interventions can be utilized. Each woman's optimal pain management strategy should be tailored to her specific requirements and circumstances (Konlan et al., 2021).

Recognizing that each woman's labor pain experience is unique, a holistic and individualized approach to pain management is necessary 8. Healthcare professionals must listen attentively, provide empathetic support, and respect women's preferences and choices. Educating women about pain management options, facilitating birth plans, and involving support individuals or doulas can greatly improve the childbirth experience (Czech et al., 2018; da Matta Machado Fernandes et al., 2021; Konlan et al., 2021; Thomson et al., 2019).

Despite the widespread use of pharmacological pain management options such as epidurals and analgesics, there is a developing interest in non-pharmacological techniques as alternatives or complements. These techniques seek to alleviate pain and improve the birthing experience without relying solely on medication. It is essential to assess the efficacy of non-pharmacological pain management techniques during labor to determine their role in enhancing maternal care and comprehend their effectiveness (Chang et al., 2022; Heim and Makuch, 2022; Ingram et al., 2022).

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Non-pharmacological pain management encompasses various interventions to provide physical and psychological support to laboring women. These techniques include relaxation exercises, acupuncture, breathing techniques, hydrotherapy, massage, visualization, positioning, and aromatherapy (Czech et al., 2018). Each technique targets distinct aspects of pain perception and coping mechanisms to reduce pain intensity, enhance relaxation, and foster a sense of control and empowerment during labor (Jones et al., 2012; Smith et al., 2018).

Multiple studies have examined the efficacy of non-pharmaceutical pain management techniques in enhancing childbirth experiences. According to research, these techniques can reduce pain intensity, reduce the need for pharmacological interventions, and improve maternal satisfaction (Zuarez-Easton et al., 2023). By activating the body's natural pain-relieving mechanisms, relaxation techniques such as deep breathing, guided imagery, and progressive muscle relaxation have alleviated pain and promoted relaxation (Jones et al., 2012; Thomson et al., 2019).

Massage and hydrotherapy have also demonstrated promise in reducing labor discomfort. Massage techniques, such as effleurage and counter-pressure, can promote the release of endorphins, the body's natural painkillers, while providing physical solace and relaxation (Daries, 2023). Hydrotherapy, which involves massaging, has been shown to alleviate pain, promote relaxation, and expedite labor (Mooventhan and Nivethitha, 2014). Acupuncture is a non-pharmaceutical treatment that entails the insertion of fine needles into specific body points. Studies indicated that acupuncture can effectively alleviate labor pain and reduce the need for pharmaceutical pain alleviation (Vickers and Zollman, 1999). Although these techniques have promise, their efficacy may vary based on individual preferences, cultural context, and labor stage variables. In addition, institutional policies and healthcare resources can impact the accessibility and availability of these techniques (Kruk et al., 2018).

In light of the expanding interest in non-pharmacological pain management techniques, additional research is required to assess their efficacy and influence on maternal outcomes. This evaluation should consider pain reduction, maternal satisfaction, neonatal health, and long-term consequences on post-partum recovery. Understanding the advantages and disadvantages of these techniques will assist healthcare providers, policymakers, and expectant mothers make informed decisions (Hu et al., 2021; Pietrzak et al., 2022).

The objective of the research evaluating the efficacy of non-pharmacological pain managing modus operandi during labor and delivery is to fill several knowledge gaps. First, comparative studies explicitly comparing the efficacy of various non-pharmacological techniques are required. Individual studies have examined specific techniques, but a comprehensive comparison would reveal which techniques are most advantageous in various labor and delivery scenarios. Second, research on the long-term effects of these techniques is lacking. Most studies concentrate on immediate outcomes, such as pain reduction and maternal satisfaction, but more research is required to examine the long-term effects on post-partum recovery, breastfeeding success, maternal mental health, and the well-being of the neonate. Pursuing these research objectives, we provided evidence-based recommendations for non-pharmacological techniques to enhance women's childbirth experiences..

Methodology

This multicenter randomized control study was performed at Dera Ismail Khan maternity centers from February 2022 to April 2023. We randomly assigned 246 expectant women, calculated through the WHO sample calculator, to either a non-pharmacological intervention or control group in a randomized controlled trial (Figure 1). During labor and delivery, the non-pharmacological intervention group received a combination of relaxation techniques, including massaging and physical therapy, aromatherapy, TENS, and mixed interventions. The control group received standard care devoid of non-pharmaceutical interventions. Pain levels were measured using VAS at 30-minute intervals during labor and delivery. Additionally, the labor length, delivery mode, and birth outcomes were recorded.

This study's inclusion criteria were: gestational age over 37 weeks, single fetus, cephalic fetal position, spontaneous labor onset, appropriate uterine contractions, physiological pregnancy, and at least 18-year-old women who had undergone vaginal delivery participated in the study. These subjects voluntarily consented to participate in the study by signing an informed consent form. However, the study did not include women who had a cesarean section during labor, had hypersensitivity to any product to be used, and were contraindicated to epidural analgesia.

After reviewing relevant literature, a structured, self-administered checklist questionnaire was devised for this study. The reliability of the questionnaire was determined through preliminary testing. Expert obstetricians and public health professionals evaluated the content validity of the questionnaire. The questionnaires were constructed in English. The questionnaire included sections for collecting data on demographic information, past medical history, and outcomes related to infant birth, as well as questions about pain management techniques selected by the participants and assessing pain levels during each stage of labor using a visual analog scale (VAS). Post-partum, personal interviews with each woman were conducted.

The VAS for pain is a tool for measuring pain intensity. It typically consists of a horizontal or vertical line with the endpoints "no pain" and "worst pain imaginable." The evaluator requests that the individual indicate a point along the line that corresponds to their pain perception. Pain intensity was determined by measuring the distance between "no pain" and the marked point. The VAS provides a continuous scale for subjective pain assessment and is applied in various medical and scientific settings. VAS pain scale ranges from 0-10, with 0 signifying "no pain" and 10 representing "worst pain imaginable." Individuals can designate their pain perception by marking a point on the scale.

Overall health and well-being of newborns were measured by the APGAR score, which is a quick evaluation performed immediately after delivery to evaluate a newborn. It required evaluating particular criteria and designating a score between 0 and 10.

Appearance (color): Examining the pinkness of the infant's epidermis.

Pulse (heart rate): The infant's pulse rate should be greater than 100 beats per minute.

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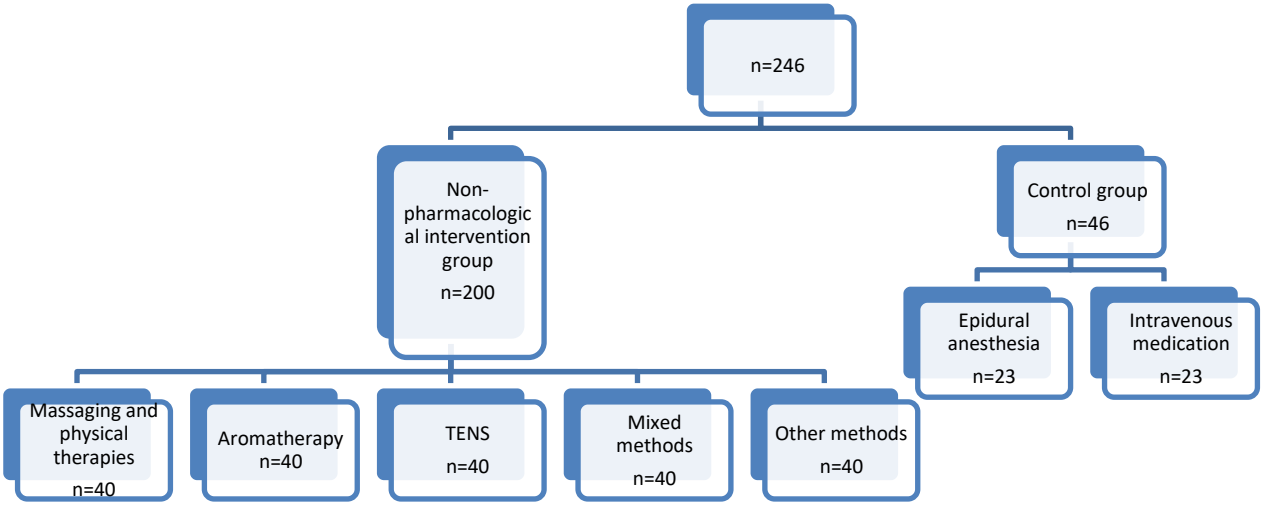
Grimace (reflex irritability): Observing the infant's reaction to stimulation, such as a delicate pinch or a light suction in the nose.
Activity (muscle tone): Evaluating the muscle tone of a neonate by observing active movement and flexed arms and legs.
Respiration (breathing): Evaluating the infant's respiratory effort and rate.
Each criterion is assigned a score of 0, 1, or 2, and the total Apgar score was the sum of these scores. Lower scores indicated the need for medical attention or intervention. A score of 10 indicated that the newborn was in outstanding condition.
Quantitative variables were summarized using median, upper, and lower quartile, while categorical variables were presented as frequencies and percentages. The Chi-square test determined the deviation from normality in the distribution of all quantitative variables. Using the results of simple linear regression models, independent variables for the final multivariable model were selected using a stepwise forward approach with an entry and removal probability of 0.05. Regression coefficients and 95% confidence intervals (CI) were calculated for each predictor variable. All statistical analyses were conducted utilizing SPSS 23.0 software.
Before conducting an investigation, relevant institutes granted ethical approval. Before conducting each interview, the researchers verified that each participant provided written informed consent. This ensured that participants were well-informed about the study, and they voluntarily consented to participate by providing written consent. Respecting ethical guidelines and obtaining informed consent are essential components of conducting research responsibly and safeguarding the rights and welfare of participants.
Figure 1: The participants' group allocation into Non-pharmacological intervention and control group



Results

In a randomized controlled trial, we randomly assigned 246 pregnant women to either a non-pharmacological intervention or a control group. During delivery, the non-pharmacological intervention group received relaxation techniques, breathing exercises, massage therapy, and aromatherapy. In contrast, the control group received standard care devoid of non-pharmaceutical interventions and was treated using commercial allopathic medicines. Pain levels were assessed using the VAS scale at 30-minute intervals throughout labor and delivery. In addition, the labor duration, delivery mode, and birth outcomes were recorded.
Comparing the non-pharmacological intervention group (n=200) and the control group (n=46), the demographic characteristics of the expected study participants, their age distribution revealed that 107 (53.5%) of the women in the non-pharmacological intervention group and 27 (58.69%) of the women in the control group were between the ages of 18 and 30, for women over 30 years old, non-pharmacological intervention group had 93 (46.5%). In comparison, the control group had 19 (41.31%). It was indicated that there was no statistically significant difference between the groups' age distributions ($p>0.05$). 72.5 percent of the women in the non-pharmacological intervention group were from urban areas, compared to 63.04 percent in the control group. In the rural category, the non-pharmacological intervention group comprised 55 women (27.5%), while the control group consisted of 17 women (36.95%). The chi-square test results reveal no statistically significant difference in the distribution of locations ($p>0.05$). According to the physical activity distribution, 41 (20.5%) of the women in the non-pharmacological intervention group had low activity, 128 (64.0%) had moderate activity, and 31 (15.5%) had high activity. In contrast, the control group consisted of eight (17.39%) women with low activity, thirty-one (67.39%) women with moderate activity, and seven (15.21%) women with high activity. In the non-pharmacological intervention group, 26.50% of women were illiterate, 56.50% had completed high school, and 17.0% were graduates. In the control group, five women (10.86%) were illiterate, thirty (65.21%) were high school graduates, and eleven (23.91%) were college graduates. The chi-square test indicated no statistically significant difference between the groups' distributions of education ($p>0.05$). The parity distribution

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revealed that 61 (30.5%) women in the non-pharmacological intervention group were primipara, and 139 (69.5%) were multipara. There were 21 (45.65%) primipara and 25 (54.35%) multipara women in the control group. Thus, the demographic characteristics of the anticipated women were contrasted between the non-pharmaceutical intervention group and the control group. Distributions of age, location, education, and parity did not differ significantly between groups. However, the distribution of physical activity varied significantly between groups (Table 1).

According to the data, during labor and delivery, 40 participants received a massaging as a non-pharmacological intervention, 40 participants received aromatherapy, 40 participants received TENS (Transcutaneous Electrical Nerve Stimulation) as a non-pharmacological intervention during labor, and 40 participants received a combination of non-pharmacological intervention techniques. Moreover, forty participants received other non-pharmacological intervention techniques indicating a variety of interventions like relaxation through the presence of relatives, companions, inspiration, etc. These findings suggest that the study utilized a balanced distribution of participants across non-pharmacological intervention techniques (Figure 2).

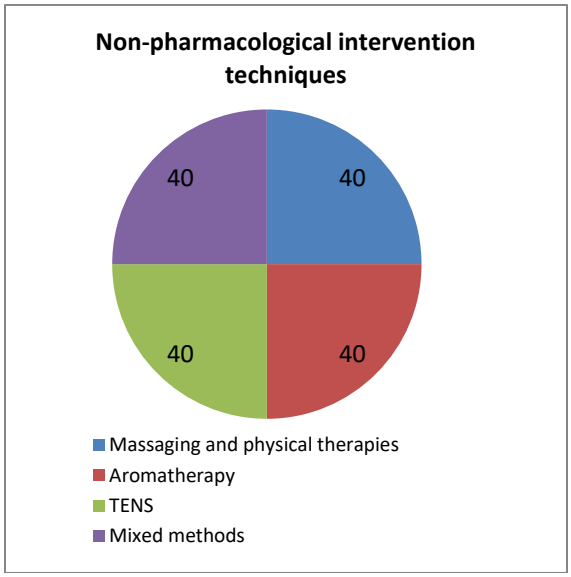

Figure 2: Types of Non-pharmacological intervention techniques used in the subjects

Comparing the VAS pain scale scores at 30-minute intervals between the non-pharmacological intervention group and control group, Score of 0 on the VAS, both groups reported minimal or no discomfort. The non-pharmacological intervention group had seven pain-free participants (3.5%), while the control group had one (2.17%). Scores 1-3 on the VAS indicate mild discomfort. In the non-pharmacological intervention group, 47 participants (23.5%) experienced mild discomfort, compared to 7 participants (15.21%) in the control group. The chi-square test revealed no statistically significant difference in the distribution of this score between the two groups (p-value = 0.4214). VAS Score 4 to 6: Participants in both groups reported moderate pain at this score. The non-pharmacological intervention group comprised 55 individuals (27.5%), while the control group comprised 12 (26.08%). The chi-square test revealed no statistically significant difference between the two groups in the distribution of this score (p-value = 0.9760). Scores 7-9 on the VAS indicate severe discomfort. In the non-pharmacological intervention group, 30 percent of participants experienced severe pain, compared to 36.95 percent in the control group. The chi-square test revealed no statistically significant difference between the two groups in the distribution of this score (p-value = 0.6253). VAS Score 10: This represented the most excruciating agony imaginable. At this pain intensity, the non-pharmacological intervention group had 31 participants (15.5%), while the control group had 9 participants (19.56%). The chi-square test revealed no statistically significant difference between the two groups in the distribution of this score (p-value: 0.7267). At 30-minute intervals, the distribution of pain intensity levels measured by the VAS pain scale was comparable between the non-pharmacological intervention and control groups. There were no statistically significant differences between the two groups regarding the interpretation of pain scores (Table 2).

Based on Table 3, which displays the APGAR scores used to evaluate the health of neonates in the non-pharmacological intervention group and the control group, the following conclusions can be drawn: The range of APGAR scores (0-3) indicated a medical emergency for the newborn. Six participants (3%) in the non-pharmacological intervention group and four (8.69%) in the control group fell into this category. APGAR Score 4 to 6: Newborns with APGAR scores in this range may require medical treatment. The non-pharmacological intervention group had 19 (9.5%) participants in this category, whereas the control group had 5 (10.86%) participants. The chi-square test found no statistically significant difference between the two groups in the distribution of this score range (p-value: 0.9854). Score 7-10: This range of APGAR scores indicated that newborns are robust and do not require immediate medical attention. The non-pharmacological intervention group had 175 participants (87.5%) in this category, whereas the control group had 37 (80.43%). The chi-square test revealed a statistically significant difference between the two groups in the distribution of this score range (p-value = 0.0021*). The distribution of APGAR scores, which assess the health of newborns, was distinct between the non-pharmacological intervention group and the control group. Compared to the control group, a greater proportion of neonates in the non-pharmacological intervention group had APGAR scores indicating a robust status and no need for immediate medical attention. This difference was statistically significant (p-value = 0.0021*), indicating that non-pharmacological interventions may have positively affected the neonates' well-being (Table 3).

Based on a reasonable comparison of the effectiveness of various interventions for managing labor pain and distress, it was found that 9 (22.5%) of 40 patients who received massaging as an intervention reported low efficacy in managing labor pain, 13 (32.5%) reported moderate efficacy, and 28 (70%) reported high efficacy. In the aromatherapy of 40 patients, 16 reported low efficacy, 21 reported moderate efficacy, and 13 reported high efficacy in managing labor pain. Ten patients (25%) reported low efficacy, 12 patients (30%) reported moderate efficacy, and 28 patients (70%) reported high efficacy in managing labor pain through the TENS technique. Of patients who received mixed therapy, 8% reported low efficacy, 16% reported

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moderate efficacy, and 65% reported high efficacy in managing labor pain. Of 40 patients who received other interventions, as mentioned above, 15 (37.5%) reported low efficacy, 25 (62.5%) moderate efficacy, and 10 (25%) reported high efficacy in managing labor pain. In managing labor pain, among the 23 patients who received epidural anesthesia, 2 patients (8.7%) reported low efficacy, 11 patients (47.8%) reported moderate efficacy, and 10 patients (43.5%) reported high efficacy. Twenty-three patients who received intravenous medications for the management of labor pain, 3 patients (13%) reported low efficacy, 15 patients (65.2%) reported moderate efficacy, and 8 patients (34.8%) reported high efficacy. These results provide a comprehension of the reported efficacy levels of various labor pain management interventions (Table 4). .

Table 1: Demographic characteristics of the expected women

S. No	Demographic characteristics	Non-pharmacological intervention (n=200)	Control group (n=46)	$\chi 2$	p-value
1	Age (years) 18-30 >30	 107 (53.5) 93 (46.5)	 27 (58.69) 19 (41.31)	 0.0427 0.061	 0.8363 0.8049
2	Location n(%) Urban Rural	 145 (72.5) 55 (27.5)	 29 (63.04) 17 (36.95)	 0.1652 0.565	 0.6844 0.4522
3	Physical activity n(%) Low Moderate High	 41 (20.5) 128 (64.0) 31 (15.5)	 08 (17.39) 31 (67.39) 07 (15.21)	 0.0361 0.0049 0.0334	 0.8493 0.9441 **0.0150***
4	Education n(%) Illiterate Matriculate Graduate	 53 (26.50) 113 (56.5) 34 (17.0)	 05 (10.86) 30 (65.21) 11 (23.91)	 2.7309 0.1716 0.4742	 0.0984 0.6787 0.4910
5	Parity n(%) Primipara Multipara	 61 (30.5) 139 (69.5)	 21 (45.65) 25 (54.35)	 1.4068 0.5969	 0.2355 0.4397
***indicated that the value is significant at p<0.05**					

Table 2: VAS pain scale for measuring the intensity of pain between the groups at 30-minute intervals

VAS score	Interpretation	Non-pharmacological intervention	Control group	$\chi 2$	p-value
0	No pain	07 (3.5)	01 (2.17)	0.0003	0.9854
1-3	Mild pain	47 (23.5)	07 (15.21)	0.6461	0.4214
4-6	Moderate	55 (27.5)	12 (26.08)	0.0009	0.9760
7-9	Severe	60 (30.0)	17 (36.95)	0.2384	0.6253
10	Worst pain	31 (15.5)	09 (19.56)	0.1221	0.7267

Table 3: APGAR score for measuring the well-being of neonate

APGAR score	Interpretation	Non-pharmacological intervention	Control group	$\chi 2$	p-value
0-3	Medical emergency	06 (3.0)	04 (8.69)	1.5844	0.2081
4-6	Moderate score needs medical treatment	19 (9.5)	05 (10.86)	0.0003	0.9854
7-10	Healthy and needs no medical aid	175 (87.5)	37 (80.43)	0.4575	**0.0021***

Table 4: Reasonable comparison of the efficacy in managing labor pain and discomfort using both interventions

Intervention	No. of patients (n)	Efficacy in managing labor pain		
		Low	Moderate	High
Massaging and physical therapy	40	09	13	28
Aromatherapy	40	16	21	13
TENS	40	10	12	28
Mixed therapy	40	08	16	26
Others	40	15	25	10
Epidural anesthesia	23	02	11	10
Intravenous medications	23	03	15	08

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Discussion

This study aimed to assess the efficacy of non-pharmacological pain management techniques during labor and delivery. Analysis of the groups' demographic characteristics revealed no statistically significant differences in age, location, education, or parity. At 30-minute intervals, pain levels were assessed using the VAS scale. The distribution of VAS-measured pain intensity levels was comparable between the non-pharmacological intervention and control groups. At different time intervals, the groups had no statistically significant differences in pain scores. In addition, the APGAR scores, which evaluated the health of neonates, revealed that a greater proportion of neonates in the non-pharmacological intervention group had APGAR scores indicating a healthy condition and no need for immediate medical attention. This difference was statistically significant, suggesting that non-pharmacological interventions may positively impact the well-being of newborns. Comparing the efficacy of various interventions for managing labor pain and distress revealed varying levels of effectiveness. Each intervention demonstrated a combination of low, moderate, and high labor pain management efficacy. This study provides insightful information regarding the efficacy of non-pharmacological pain management techniques during labor and delivery. While there were no significant differences in pain scores between the non-pharmacological intervention group and the control group, the distribution of APGAR scores suggested that the non-pharmacological intervention group may have benefited neonatal well-being.

Our findings were in close liaison with the study whereby a survey was conducted using a questionnaire and VAS scale for assessing the pain levels in 258 women. These women were divided into six groups based on the labor pain relief method they selected: epidural anesthesia (EA; n = 42), Massaging and physical therapy (MPT; n = 40), nitrous oxide gas (G; n = 40), transcutaneous electrical nerve stimulation (TENS; n = 50), multiple management (MM; n = 42), and no pain relief (N; n = 44). The average age of the women was 29.4 3.74 years, and 60.47 percent (n = 156) were childless. During the first, second, and third stages of labor, average pain intensity scores were 6.81+2.26, 7.86+2.06, and 3.58+2.46, respectively. During the first stage of labor, there was no significant difference in pain levels between the epidural analgesia and gas groups ($p = 0.74$). However, epidural analgesia reduced pain levels substantially during the second and third stages ($p<0.01$). Women who underwent massaging and physical therapy reported the greatest satisfaction (n = 38; 95%). While epidural analgesia was considered the gold standard for labor pain relief, massaging and physical therapy were associated with the highest level of satisfaction among the women surveyed (Czech et al., 2018). Another study reported that Nitrous gas was extensively used in labor analgesia in Western nations using a mixture of 80% N2O and 20% oxygen. Compared to placebo or no treatment, it was discovered that inhaling nitrous oxide provided superior pain relief; however, N2O inhalation provided less effective pain relief than epidural analgesia (Likis et al., 2014).

Another study demonstrated that women who delivered in hospitals with greater medical expertise and resources have greater access to pharmacological pain management techniques, among which epidural anesthesia was regarded as the gold standard for labor pain relief 21. However, it is crucial to note that although epidural anesthesia is effective in managing labor pain, it may be associated with potential newborn complications and lower APGAR scores. On the other hand, non-pharmacological pain management techniques were found to provide comparable pain relief and extremely advantageous for neonatal health, as indicated by markedly higher APGAR scores.

About 29.17% of women opted for non-pharmacological pain alleviation methods, such as acupuncture and its variants, acupressure, and auriculotherapy. 25% of women opted for hydrotherapy, while 16.67% preferred ball exercises. 8.33% of women selected heat and cold for pain alleviation, while the remaining 20.83 % selected various non-pharmacological methods (Mascarenhas et al., 2019). It was found that respondents with higher levels of education were more likely to plan for massaging and physical therapy as a form of labor pain relief. However, the number of previous births had no bearing on the delivery method chosen (Harkins et al., 2010). According to Lindholm et al., the preferable pain relief methods among women were also the most frequently used, including nitrous oxide, massaging, water immersion, breathing techniques, epidural anesthesia, and massage (Lindholm and Hildingsson, 2015).

Conclusion

In conclusion, non-pharmacological pain management techniques provide cost-effective and safe alternatives to pharmaceutical interventions during labor and delivery. When properly implemented and individualized, these techniques reduced the pain intensity comparable to commercial medicinal pain alleviation, but non-pharmacological pain management techniques significantly improved the birthing experience and potentially contributed to better maternal and neonatal outcomes. However, additional research is required to investigate their long-term effects and optimize their efficacy.**Declarations**

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate.

Approved by the department Concerned.

Consent for publication

Approved

Funding

Not applicable

Conflict of interest

The authors declared an absence of conflict of interest.

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