Non-Pharmacological Pain Management in Labor

Subjects: Obstetrics & Gynaecology

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Childbirth is a remarkable, life-changing process and is frequently regarded as an excruciating, physically and emotionally demanding experience that women endure. Labor pain management poses a significant challenge for obstetricians and expectant mothers.

non-pharmacological pain management | pregnancy | mothers | labor | obstetrician efficacy

1. Introduction

Historically, labor pain has been recognized as an inherent part of childbirth, although approaches to its management have varied across cultures and time periods [1]. With the advent of modern medicine, the focus shifted toward pharmacological interventions. By the late 19th century, interventions such as chloroform and ether were used for labor pain, followed by the introduction of “twilight sleep” in the early 20th century—a combination of morphine and scopolamine that induced a state of semi-consciousness [2][3].

In the latter half of the 20th century, advances in anesthesia led to the widespread use of regional analgesics, such as epidurals and spinal blocks, for labor pain [4]. These methods became the gold standard in many high-income countries due to their effectiveness in reducing pain [5]. In recent decades, the use of opioids such as fentanyl and morphine has also become common [6]. Although they do not eliminate pain, they can help to make it more manageable. However, pharmacological pain management methods (PPM) have been associated with various side effects and risks despite their effectiveness. For example, epidurals can lead to a drop in blood pressure, fever, and a raised need for assisted delivery [7]. Moreover, they lengthen the labor’s duration. Opioids induce nausea and affect the neonate (breathing and heart tracing) if admitted too soon [8][9]. Pain is the norm of childbirth; reducing pain via drugs makes laboring women lose essential feedback, potentially leading to more prolonged labor or increased intervention. Some forms of PPM reduce a woman’s motility or the ability to take different positions to alleviate discomfort; this lack of control over pain is distressing to women [10]. Over the past few decades, a growing interest has been expressed in revisiting non-pharmacological pain management techniques (NPPM) to reduce labor pain [11][12]. This shift is driven by a confluence of factors, including increasing evidence of pharmacological interventions’ side effects and risks. Additionally, there has been a broader societal shift towards more patient-centered and holistic healthcare, emphasizing personal autonomy, shared decision-making, and natural and complementary therapies [13]. These trends have led to an increased interest in NPPM, which relieves pain and empowers women to actively engage in the birth experience. NPPMs have demonstrated encouraging

outcomes in diminishing pain intensity and enhancing satisfaction and are commonly regarded as safe, with minimal adverse effects compared to pharmacological interventions [3][5][8].

2. Understanding Pain in Labor

The nature of pain experienced during labor undergoes modifications as the process progresses. During the first stage of labor, the primary source of pain is visceral in nature, originating mostly from the cervix, uterus, and adnexa. This pain is mediated by sympathetic fibers that transmit signals to the ganglia of the posterior nerve roots located at the T10-L1 spinal levels [5]. During the late first stage and early second stage of labor, pain arises from the distention and traction of the pelvic organs. The pudendal nerve is responsible for transmitting pain signals to the ganglia of the posterior nerve roots located at spinal levels S2 to S4. During the second stage of labor, the sensation of pain is elicited by the stretching of the perineal structures as the fetus descends [5][11]. Comprehending the complexities of labor pain goes beyond the physiological aspects; it necessitates an understanding of psychological and socio-cultural elements. It is crucial to grasp the multifaceted nature of labor pain to assess NPPM better. From a physiological standpoint, uterine contractions and cervical dilation are the main causes of labor pain, because they activate pain receptors (nociceptors) and send signals to the brain [11]. The intensity of labor pain can vary greatly among women, between different labors in the same woman, and it is affected by various factors such as the baby's position, size, and the speed of labor [12]. On a psychological level, labor pain is influenced by a woman's emotions, expectations, and previous experiences [13][14]. Fear and anxiety can heighten pain perception by increasing tension and resistance. As confidence, relaxation, the feeling of control in their labor, and continuous support are all less likely to result in severe pain, the women are more likely to cope and have a positive birth experience [15][16][17][18]. Psychological preparation for childbirth can reduce the need for analgesia and increase satisfaction with pain management [19][20]. Socio-cultural factors, cultural beliefs, and societal attitudes toward childbirth can influence a woman's expectations and coping strategies. In some cultures, labor pain is viewed as a natural and empowering part of childbirth, while in others, it is seen as something to be avoided or feared [21][22]. Furthermore, social support is crucial during labor. Having a supportive companion can significantly improve a woman's experience of pain and reduce her need for pharmacological analgesia [23][24].

3. Categorization of Non-Pharmacological Methods for Pain Relief in Labor

These can be categorized based on the mechanisms of action into physical, psychological, and complementary techniques.

3.1. Physical Modalities

There are several physical methods listed under NPPM during labor. These methods include massage, pressure on precise anatomical locations, Transcutaneous Electrical Nerve Stimulation (TENS), water immersion, heat and cold therapy, breathing techniques, positioning, and movement [25][26]. The sub-types of each method, mechanism of action, perceived benefits, and supporting references are all summarized in **Table 1**.

Table 1. Non-pharmacological pain management in labor: An in-depth analysis of physical modalities concerning the mechanism of action, perceived benefit, and the supporting references.

Methods	Methods Sub-Types	Proposed Mechanism of Action	Perceived Benefit	Authors' Name; Publication Year
Massage	▪ Vibrating ▪ Stroking ▪ Effleurage	▪ Gentle massage or counter-pressure to specific areas is effective in reducing discomfort and triggering endorphin releases, an endogenous hormone with analgesic properties. ▪ Additionally, it promotes a subjective sense of psychological relief.	▪ It proved effective in reducing lab pain, yet the character of pain and lab duration was unchanged. ▪ Combining oil with massage decreased lab pain and duration and improved satisfaction.	Pawale et al. [27]; 2020 Silva Gallo et al. [28]: 2013 Eskandari F et al. [29]; 2022
Pressure on precise anatomical locations	▪ Acupressure ▪ Acupuncture: ▪ traditional acupuncture ▪ sham acupuncture	▪ The application of pressure on precise anatomical locations potentially induces Relaxation and reduces Stress. ▪ Triggering non-painful stimuli closes spinal cord "gates," thus blocking pain signals. ▪ Triggering acupuncture spots sends signals to the brain to release endorphins.	▪ Acupressure may improve women's satisfaction and reduce labor pain and duration. ▪ There is insufficient evidence of Acupuncture's effects on labor; it seems that it decreases pain intensity but not duration and has better satisfaction rates.	Smith et al. [30]; 2020 Schlaeger et al. [31]; 2017 Eshraghi et al. [32]; 2021

Methods	Methods Sub-Types	Proposed Mechanism of Action	Perceived Benefit	Authors' Name; Publication Year
		▪ Regulation of oxytocin hormones ▪ For more details, see **Figure 1**.		
Transcutaneous Electrical Nerve Stimulation (TENS)	▪ Conventional TENS: reduces labor pain. ▪ Acupuncture TENS ▪ Intense TENS ▪ Burst mode TENS ▪ Modulated TENS	▪ Applying low-intensity electrical pulses to targeted regions of the body via electrodes affixed to the skin. ▪ It inhibits the pain signals' transmission to the nervous system.	▪ It significantly reduces pain intensity; however, the evidence was low. ▪ A significant reduction in pain score and improved women's satisfaction.	Thuvarakan et al. [33]; 2020 Gibson et al. [34]; 2019 Daniel et al. [35]; 2021
Water immersion	▪ Cold water ▪ Hot water ▪ Alternating hot/cold water bathing	▪ Immersing in a bath or utilizing a birthing pool can induce relaxation, diminish pain perception, and facilitate smoother movement during childbirth.	▪ There was low evidence that immersion reduces the need for PPM. ▪ Significant improvement in physical and psychological comfort, and the need for pain relief.	Cluett et al. [36]; 2018 Carlsson et al. [37]; 2020 Cooper et al. [38]; 2022
Heat therapy	▪ Warm pack and towels	▪ Administration of heat to a specific region	▪ Evidence confirmed an effective	Goswami et al. [39]; 2022 Akbarzadeh

Methods	Methods Sub-Types	Proposed Mechanism of Action	Perceived Benefit	Authors' Name; Publication Year
	▪ Hot water bags ▪ Warm shower ▪ Thermal and infra-red belt	experiencing pain enhances blood circulation, induces muscle relaxation, and alleviates pain perception.	reduction in labor pain intensity and labor duration. ▪ Significant reduction in post-labor pain	et al. [40]; 2018 Akbarzadeh et al. [41]; 2016 Dastjerd et al. [42]; 2023
Cold therapy	▪ Ice packs ▪ Ice massage	• Utilization of cold packs or ice to induce numbness in a specific area, thereby mitigating inflammation and offering temporary pain alleviation.	▪ Significant reduction in pain intensity and duration.	Shirvani et al. [43]; 2014 Emine et al. [44]; 2022 Serap et al. [45]; 2022
Breathing techniques	▪ Deep, slow, and patterned breathing.	▪ Effective in diverting attention from pain and facilitating a state of relaxation.	▪ Effective reduction in labor pain added to a shorter labor duration. ▪ Ineffective in reducing pain in the 1st stage.	Baljon et al. [46]; 2022 Issac et al. [47]; 2023 Yuksel H et al. [48]; 2017 Boaviagem et al. [49]; 2017
Positioning and Movement	▪ Changing positions frequently, such as walking, squatting position, ▪ Birthing ball rocking	▪ Helps manage pain by utilizing gravity and promoting optimal fetal positioning.	▪ Effective in reducing pain and duration of labor. ▪ Upright positions and free mobility reduce labor duration and pain and improve	Huang et al. [50]; 2019 Ondeck et al. [51]; 2019 Borges et al. [52]; 2021 Ali SA et al. [53]; 2018

Methods	Methods Sub-Types	Proposed Mechanism of Action	Perceived Benefit	Authors' Name; Publication Year
			women's satisfaction.	

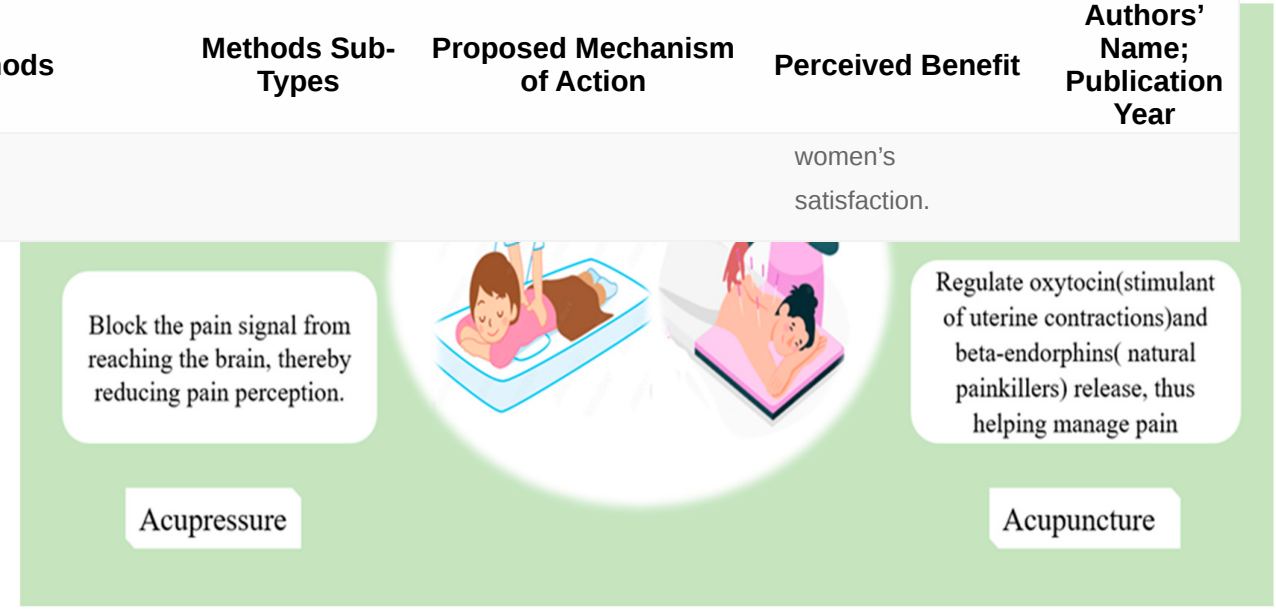

Figure 1. The mechanisms that underlie acupressure's positive effect in reducing labor pain.

3.2. Psychological Techniques

Cognitive Behavioral Therapy (CBT) aims to identify and modify maladaptive thoughts, emotions, and behaviors. Moreover, CBT assists individuals in cultivating a perception of control in managing pain, fostering the acquisition of pain-coping strategies, and enhancing self-esteem [54]. CBT was used to manage labor pain; there was inconsistency in the reported literature; some discussed reduced psychological aspects of pain and improved satisfaction [55]. However, pain medication was still needed.

Others have discussed how CBT techniques significantly reduced pain intensity and labor duration [54].

Cognitive behavioral therapy helps individuals have a sense of control in coping with pain, develop pain-coping behaviors, and increase self-respect [54][56]. The main methods of CBT include:

- Relaxation techniques;
- Virtual reality (VR);
- Music;
- Distraction technique.

The main mechanism and benefits of each are summarized in **Table 2**.

Table 2. Summary of non-pharmacological pain management in labor: An in-depth analysis of psychological modalities, concerning the mechanism of action, perceived benefit, and the supporting references.

Methods	Methods Sub-Types	Proposed Mechanism of Action	Perceived Benefit	Authors' Name; Publication Year
Relaxation technique	• Relaxation, Yoga, and Music • Mindfulness and audio-analgesia	Progressive muscle relaxation, guided imagery, and visualization have been found to be effective in mitigating anxiety and fostering tranquility throughout labor.	• Reduction in pain intensity. Empowers women with sense of control. • Improves satisfaction with the birth experience	Smith et al. [15]; 2018 Zhang et al. [57] Jahdi et al. [58]; 2017
Virtual reality (VR)	• Interactive VR game • VR meditation • VR-guided meditation • VR mindfulness	• Modulating pain perception by interfering with psychological factors • Distraction which reduces the perception of pain	• Reduces pain intensity and anxiety during childbirth. • Enhanced satisfaction with the birth experience. • No effect on labor duration.	Massov et al. [59]; 2021 Musters et al. [60]; 2023 Baradwan et al. [61]; 2022Xu et al. [62]; 2022
Music	--	• Modulation of pain responses and neuronal activity in CNS while engaging with music. • Increases pain tolerance and lowers pain intensity. • For further details, see **Figure 2**.	• They experience natural delivery with less stress and less medication. • Reduces pain score by 3.4 times.	Timmerman et al. [63]; 2023 Estrella-Juarez et al. [64]; 2023 Chehreh et al. [65]; 2023 García González et al. [66]; 2018

Methods	Methods Sub-Types	Proposed Mechanism of Action	Perceived Benefit	Authors' Name; Publication Year
Distraction	• Counting numbers • Remembering poetry, a pleasant memory, or a joke • Using vulgar cards	• Minds occupied by excitement are distracted from the excitement of the pain senses. • he technique reduces the pain effect on the CNS and nerve transmitters	• Reduction in labor pain and stress • No reduction in labor duration	Ireland et al. [67]; 2016 Amiri et al. [68]; 2019 Melillo et al. [69]; 2022

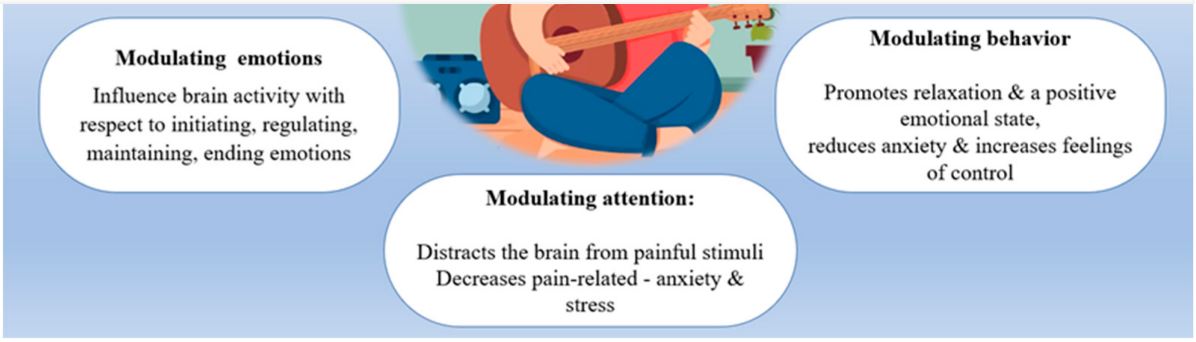

Figure 2. The main pathways by which music conducts its beneficial effect in alleviating labor pain.

3.3. Complementary and Alternative Approaches

Over the past decade, there has been a growing scholarly focus on literature examining the role of Complementary and Alternative Approaches (CAA) in mitigating pain during childbirth [70]. CAA exhibits a higher prevalence among women within the reproductive age range [71]. The utilization of this intervention during childbirth is quite prevalent, as indicated by a survey conducted in Australia, with a reported rate of 75% [72]. Complementary and Alternative Medicine is a term employed by the U.S. National Center for Complementary and Integrative Health to denote a range of practices that can be utilized in conjunction with conventional and established medical care (complementary) or as a substitute for it (alternative) [73]. An in-depth analysis of complementary and alternative approaches concerning the mechanism of action, perceived benefit, and the supporting references [74][75][76][77][78][79][80][81][82][83][84][85][86][87][88][89] are summarized in **Table 3**.

Table 3. Summary of non-pharmacological pain management in labor: An in-depth analysis of complementary and alternative approaches concerning the mechanism of action, perceived benefit, and the supporting references.

Methods	Methods Sub-Types	Proposed Mechanism of Action	Perceived Benefit	Authors' Name; Publication Year
Hypnosis	▪ Natural hypnosis ▪ Self-hypnosis ▪ Stage hypnosis ▪ Hypnotherapy	▪ Modulates pain intensity caused in the primary somatosensory cortex. ▪ Relaxes and distracts attention from the pain sensation.	▪ Reduces net use of analgesia during childbirth. ▪ No clear evidence of pain satisfaction relief or coping sensation	Madden et al. [74]; 2016 Cyna et al. [75]; 2013 Downe et al. [76]; 2015
Integration of religion/health and well-being	▪ Praying, ▪ Reciting the Quran, ▪ Fasting, ▪ Islamic meditation (dhikr) has been shown to relieve stress, improve health, increase productivity, and enhance quality of life.	▪ Distracts and inhibits the pain perception.	▪ It efficiently reduced labor pain and improved the score of pain behaviors.	McLaren H et al. [77]; 2021 Desmawati et al. [78]; 2019 Kocak et al. [79]; 2022
Dancing	--	▪ Dancing combines the beneficial effects of music and the effects of upright position and movements, such as	▪ Mean scores of pain were lower. ▪ The level of birth	Abdolahian et al. [80]; 2014 Akin et al. [81]; 2020

Methods	Methods Sub-Types	Proposed Mechanism of Action	Perceived Benefit	Authors' Name; Publication Year
		pelvic tilting and rocking.	satisfaction was significantly higher.	
Aromatherapy	Essential oils may be given as: ▪ Massage into the skin, ▪ In a warm bath, ▪ Diffused into the air using a diffuser	▪ Limbic system stimulation; releases serotonin and endorphins. Thereby reduces anxiety and tension, leading to lower pain perception. ▪ Augmenting the production of endogenous stress-alleviating substances within the human body. Such as decreasing cortisol and/or increasing serotonin. ▪ Some essential oils possess direct pain-relieving effects, such as rosemary.	▪ Trend decrease in labor pain. ▪ Trend decrease in anxiety during labor	Tabatabaeichehr et al. [82]; 2020 Sirkeci et al. [83]; 2023 Hamdamian et al. [84]; 2018
Photomodulation	--	Irradiation induces. ▪ Neural block and modulates neurotransmitters. ▪ Reduced muscle spasms. ▪ Reduced interstitial edema, thereby	▪ Pain reduction ▪ Analgesic effect	Traverzim et al. [85]: 2021 Traverzim et al. [86]; 2018

Methods	Methods Sub-Types	Proposed Mechanism of Action	Perceived Benefit	Authors' Name; Publication Year
		exhibiting anti-inflammatory effects		
Support therapy	▪ Emotional Support ▪ Advocacy ▪ Informational Support	▪ Reduces stress and anxiety by providing reassurance and empathy, thus decreasing pain perception. ▪ Supports women's autonomy and decision-making, understanding of the labor process, promoting feelings of control and confidence	▪ Reduced perception of pain via reduced stress and anxiety ▪ Decreased use of analgesics, ▪ ncreased overall satisfaction with the birthing process.	Akbas et al. [87]; 2022 Bohren et al. [88]; 2017 Ip et al. [89]; 2009

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