Music Reduces Sensation and Distress of Labor Pain

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Abstract:

Labor pain is often severe, and analgesic medication may not be indicated. In this randomized controlled trial we examined the effects of music on sensation and distress of pain in Thai primiparous women during the active phase of labor. The gate control theory of pain was the theoretical framework for this study. Randomization with a computerized minimization program was used to assign women to a music group (n = 55) or a control group (n = 55). Women in the intervention group listened to soft music without lyrics for 3 hours starting early in the active phase of labor. Dual visual analog scales were used to measure sensation and distress of pain before starting the study and at three hourly posttests. While controlling for pretest scores, one-way repeated measures analysis of covariance indicated that those in the music group had significantly less sensation and distress of pain than did the control group (F (1, 107) = 18.69, p < .001, effect size = .15, and F (1, 107) = 14.87, p < .001, effect size = .12), respectively. Sensation and distress significantly increased across the 3 hours in both groups (p < .001), except for distress in the music group during the first hour. Distress was significantly lower than sensation in both groups (p < .05). In this controlled study, music—a mild to moderate strength intervention—consistently provided significant relief of severe pain across 3 hours of labor and delayed the increase of affective pain for 1 hour. Nurses can provide soft music to laboring women for greater pain relief during the active phase when contractions are strong and women suffer.

During labor, women experience a high level of pain intensity. Melzack (1993) found that 60% of women in primiparas and 40% of multiparas experienced extremely severe labor pain. Even after receiving analgesic drugs, 40% of 697 laboring women did not experience sufficient pain relief (Ranta et al., 1995). In Thailand, as in other areas of the world, analgesic medications may not be given in some hospitals because the side effects of the drugs can cause adverse effects on women and their infants. The purpose of this study was to test the effects of soft music on the sensation and distress of pain during the first 3 hours of the active phase of labor. Music is a nonpharmacologic modality that has been found effective for postoperative pain and may have some effect on labor pain.

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Pain increases significantly during the active phase of labor (Kusolleartjariya, 1997), and the sensory component of pain is reported as more severe than the affective component (Price, Harkins, & Baker, 1987). Unrelieved labor pain can have an adverse effect on the physiologic status of women. These effects include increases in cardiac output, blood pressure, respiratory rate, oxygen consumption, and catecholamine levels, all of which can have a harmful effect on both the mother and the infant (Blackburn & Loper, 1992; Bonica, 1994; Bonica & McDonald, 1990). Labor pain can also result in loss of emotional control during labor (Allen, 1998), which is a key factor in the development of an emotionally traumatic childbirth experience (Kendall-Tackett & Kantor, 1993; Reynolds, 1997) and psychologic disturbances (Allen, 1998; Fones, 1996). Pain during labor is accompanied by fear, which is related to slower progress of labor (Saisto, Ylikorkala, & Halmesmaki, 1999), requests for cesarean section (Ryding, Wijma, Wijma, & Rydhström, 1998), and often results in labor induction and pudendal block (Sjögren & Thomassen, 1997).

Research has shown that music reduced postoperative pain up to 31% in abdominal surgical patients (Good et al., 1999); as well as cancer pain (Beck, 1991), procedural pain (Davis, 1992; Megel, Houser, & Gleaves, 1998), and chronic pain in other patients (Schorr, 1993); and in a few preliminary studies, labor pain. Clark, McCorkle, and Williams (1981) found that women who used music intermittently during labor had greater pain relief than those who did not use it. However, the sample was not randomized, the group using music was small (n = 13), and pain measures were not reported. Hanser, Larson, and O'Connell (1983), in a small single group crossover study, with home training in music (n = 7), found that when laboring women used music, they had significantly less observed pain than when they did not.

Only two studies of music for labor pain in Thailand were found. In both, the investigators used music intermittently throughout the first stage of labor. One was randomly assigned (n = 15) and demonstrated that music used for 20 minutes, followed by 10 minutes of no music, improved observed pain coping behavior (Limprasirt, 1996). The other study used a quasi-experimental design with three nonequivalent groups (n = 30): Thai folk music, Thai classical music, and a no-music control group. No significant differences in pain intensity were found among the three groups (Kusolleartjariya, 1997).

Thus, in early small studies, music was found helpful for labor pain, but no one has tested the continuous use of music during labor. In this study, we investigated the effects of continuous sedative music on labor pain with an optimal sample size and more rigorous design. Music was used in the early active phase of labor when pain coping behaviors are stronger than in the late active phase (Kusolleartjariya, 1997; Limprasirt, 1996), so that women could participate in letting music distract and relax them from pain.

The gate control theory of pain (Melzack & Wall, 1996) explains the mechanism of the effect of music on labor pain. A major proposition of the gate control theory is that the action people take to reduce pain affects brain centers serving attention, cognition, and emotion that activate descending nerve impulses to close the "gate" located in the dorsal horn of the spinal cord. This effect results in modulation of the experience of pain (Melzack & Wall, 1996). Using music to relax and distract was expected to result in cognitive and physiologic alterations that inhibit transmission of noxious impulses. A second proposition of the gate control theory is that pain is the interaction of sensory, motivational, and central control components. The sensory component of pain stimulates motivational and cognitive processes to react and cause emotional responses known as the affective component of pain. The sensory and affective components are not necessarily in a one-to-one relationship (Craig, 1984; Melzack & Casey, 1968), but can be differentiated by people experiencing pain (Good et al., 2002; Johnson, 1973; Price & Verne, 2002).

The first hypothesis was that during the first 3 hours of the active phase of labor, women who used music would have significantly lower sensation and distress of pain scores across three data points than would those who did not use music. The second hypothesis was that women who used music would not have a significant increase in sensory and affective pain across the 3 hours. The third hypothesis was that distress of pain scores would be significantly lower than sensation of pain scores. A randomized controlled trial with a pretest-posttest design and a no-music control group was used.

METHODS

Sample

A convenience sample of 144 primiparas women was recruited from two hospitals in Southern Thailand. Four women were from a small community hospital and 140 were from a large health center. Participants were married primiparas, ages 20 to 30 years old, with a singleton fetus, who had received antenatal care from the second trimester, and who had been in the latent phase of labor for no more than 10 hours. Women were excluded if, before entering the study, they had received analgesic medication, had labor in-

duced, had spontaneous membrane rupture for longer than 20 hours, or had a history of psychiatric problems, major antipsychotic medications, difficulty hearing the spoken word, infections, HIV, asthma, or any past negative reactions while listening to music. The fetal inclusion criteria were normal fetal heart rate, cephalic presentation, vertical lie, and 38 to 42 weeks' gestation with an estimated fetal weight of 2,500 to 4,000 grams.

Women who met the criteria were randomly assigned to groups using a computerized minimization program (Zeller, Good, Anderson, & Zeller, 1997) while controlling for age, education, time in the latent phase, history of painful menstruation, and ruptured membranes. Thus, with a fairly homogenous sample, randomization, and minimization of group differences, extraneous variables were controlled.

Of the 110 women enrolled, the researcher withdrew those who were unable to complete the three posttests (n = 33; 23%). These women had false labor pain (n = 8), received oxytocin between enrollment and starting the study at 3 cm dilatation (n = 3), had cesarean section (n = 3), or rapid progress of labor and delivery (n = 19, 13%). Only one woman in the control group chose to withdraw from the study, and the reason given was too much pain. No differences in demographic (i.e., religion, education, income, weight, and height) and obstetric data (i.e., membrane rupture, history of painful menstruation, and gestational age) were found between the withdrawn individuals and those who remained in the study.

Experimental Intervention

Women in the intervention group listened to their choice of soft music with earphones during the first 3 hours of the active phase of labor, starting when cervical dilation was 3 or 4 cm with uterine contraction of 30 to 60 seconds. To allow for individual preferences, the participants listened to 30 seconds of five types of sedative music and were asked to choose the most relaxing or distracting for pain. Western music without lyrics included synthesizer, harp, piano, orchestra, and jazz (Good et al., 2000). This music had a slow beat of 60 to 80 beats per minute, no strong rhythms or percussion, and sustained tones. Each type of music was recorded on a 60-minute tape. To prevent demoralization, women in the control group were told they would receive music at a later time during labor, after all pain measurements were completed.

Measures

Sensory pain was defined as the unpleasant feeling of hurt in the abdomen and back related to the intensity of uterine contractions and was measured by self-report on a horizontal 100 mm Visual Analog Sensation of Pain Scale. Affective pain was the reported emotional distress related to the sensation of labor pain and was measured by self-report on a horizontal 100 mm Visual Analog Distress of Pain Scale (Good et al., 1999). Good et al. (2002) demonstrated 15-minute test-retest reliability for the dual VAS in postoperative patients (r = .73 to .92). In comparison to a 0 to 10 numeric rating scale, Good et al. demonstrated support for convergent validity, r = .90 to .92 as well as construct, r = .72 to .85 and discriminant validity, r = .65 to .78. In the present labor study, there was concurrent validity of .73 to .95 between the VAS scales and a categorical question asked each hour: whether their pain was worse, the same, or better than the preceding hour. Reliability of the VAS scales was estimated by comparing the hourly change in the VAS score to the categorical report. In the first hour, there was 95% reliability (congruence), decreasing to 89% in the second, and to 73% in the third hour. In addition, there was a small ceiling effect in the second hour for 4% of women in the control group, and in the third hour for 7% of controls and 5% of those in the music group.

Pain was measured at the start of the study before the treatment was started, and then every hour during the study for 3 hours. Women were asked to mark the scales in relation to the contraction that just ended. The total score ranged from zero (no sensation or no distress) to 100 (the most sensation or distress imaginable). To prevent response bias, the women were not allowed to see the scales they had marked previously (Huskisson, 1983).

Procedure

The Case Western Reserve University Institutional Review Board and the directors of the community hospital and the health center in Thailand approved the study. A poster was displayed at antenatal clinics inviting mothers to participate in the study. Women were screened and approached after they were admitted to the labor room, where written informed consent was obtained. The researcher collected demographic and obstetric data by interview and chart review, and instructed the participants in rating their sensation and distress on the dual VAS scales. After randomization, women in the experimental group listened to each kind of music and chose the type of music that they thought would relax or distract them during labor. They were taught to use the tape recorder. The starting point of the study was when the cervical dilation was 3–4 cm and uterine contractions were of 30 to 60 seconds' duration. Music was used for 3 hours, but women could stop for 10 minutes as

TABLE 1.
Means and Standard Deviations of Sensation and Distress Pain by Group

	Sensation of Pain				Distress of Pain			
	Control		Music		Control		Music	
Data Points	***M***	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***
Pretest	59.09	14.84	59.15	16.70	56.02	17.74	49.29	16.75
First hour posttest	70.95	15.68	64.73	15.87	65.00	18.24	52.91	19.86
Second hour posttest	80.05	14.42	70.53	20.27	76.27	17.39	59.09	23.66
Third hour posttest	88.29	11.67	78.13	18.72	83.25	16.60	65.98	25.78

needed if they wished. Pain was measured at the starting point and at the end of each hour during the 3-hour study. In addition, the researcher observed the women every 10 minutes and recorded whether the earphones were on and whether relatives and nurses were at the bedside. In an interview at the end of the study, the investigator asked about the perceived helpfulness of the music, the patients' liking for it, and whether or not they grew tired of either the music or the earphones during the 3 hours.

RESULTS

Sample Characteristics

The 110 primiparas in the final sample were an average age of 24 ± 3 years. Ninety-four (85%) women were Buddhist and 16 (15%) were Islamic. The majority of the women (58%) had a high school education or higher; one-third (30%) had a postsecondary diploma (14 years), and one-fourth (24%) had only 9 years of education. Two-thirds were either housewives or employed, with a fifth owning a small business; and nearly half had a moderate income. Most were 38 to 40 weeks' gestation (86%) and had received antenatal care a mean of eight times. The majority (61%) had a history of painful menstruation. Before or during the study, one third had their membranes ruptured (30%) and a few received oxytocin (5%). Nearly three-fourths had a normal vaginal delivery without instrumentation or cesarean section (71%), and nearly all had a fetus in the left or right occipital anterior position (97%). More than one-third (40%) had a short active phase of 3 to 5 hours and had significantly higher pain scores (72–92 mm) than those with longer labors (65–78 mm; $p <$ .05–.001).

Only two women in the control group used an analgesic during the study because the standard of care in those hospitals was to rarely give analgesics out of concern about the effect of opioids on neonatal Apgar scores and respiratory status. However, both hospitals had a policy that allowed the relatives to stay at the bedside to support and give pain-coping assistance to the women. Therefore, 79% of the women had relatives at the bedside.

Pain and Its Relationships

In the music group, sensation means ranged from 59 mm at pretest to 78 mm at the third posttest, a gain of 19 mm; in the control group sensation ranged from 59 mm to 88 mm, a gain of 29 mm (Table 1). Thus, although the control group started similarly, they reported more severe posttest pain and had greater gains than the music group. Distress means in the music group ranged from 49 to 66 mm, gaining 17 mm, whereas the control group started higher, remained higher (56 to 83 mm), and gained more (27 mm).

The two groups were comparable in demographic and obstetric variables. These included age, weight, height, religion, education, gestational age, antenatal care, membrane rupture, history of painful menstruation, oxytocin, maternal position, fetal position, weight/height ratio, characteristics of labor at the start study, and complications during labor or delivery. In addition, there was no significant difference in presence or assistance of relatives and nurses at the bedside. Further, none of these factors were strongly correlated with posttest pain scores. The music and control groups were similar in pretest sensation scores, but the music group had significantly lower pretest distress of pain than the control group (t = 2.05, p = .043). Only pretest sensation and distress scores were significantly correlated with sensation and distress at the three posttests at each time point, r = .41 to .60 for sensation and r = .51 to .59 for distress, $p <$ .001. The music group had significantly less pretest distress pain than the control group. Therefore, only pretest sensation and distress scores were used as covariates in the analysis.

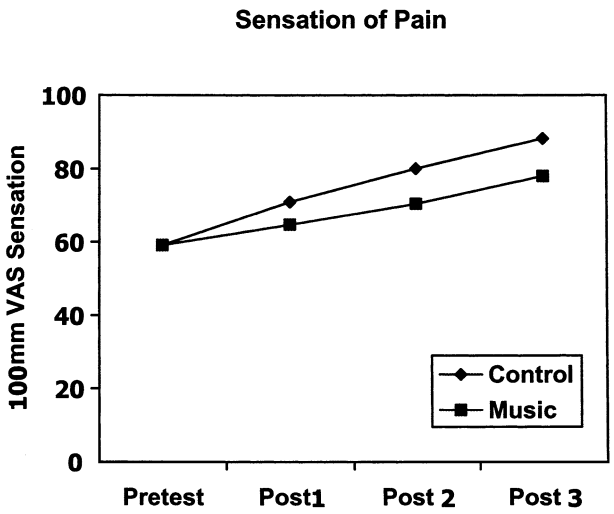

FIGURE 1. ■ Mean sensation of pain increased significantly at each data point in both groups, and was significantly lower in the music group compared to the control group. $N = 110$.

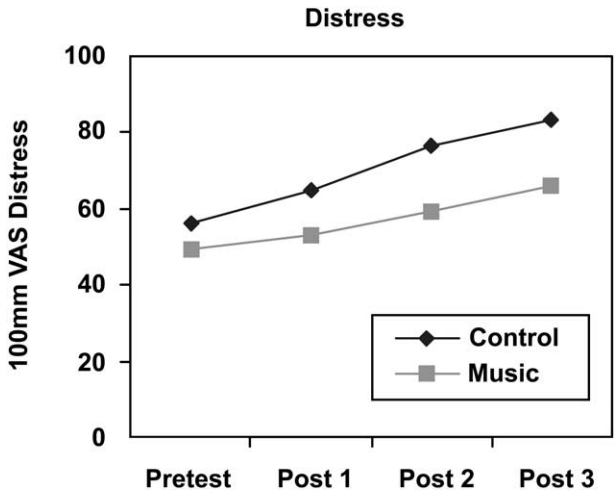

FIGURE 2. ■ Mean of distress of pain increased significantly at each data point in both groups, and was significantly lower in the music group compared to the control group. $N = 110$. Similar results of *t*-tests were found with the inclusion of all enrolled subjects who had posttest pain scores at any of the posttests.

Hypothesis Testing

The first hypothesis that music would reduce both the sensation and distress of pain was supported. While controlling for the corresponding pretest measure, one-way repeated measures analysis of covariance (ANCOVA) showed that the music group had significantly less sensation and also distress of pain than did the control group over the 3 hourly posttests ($F(1,107) = 18.69$, $p < .01$, effect size = .15, and a power = .99, and $F(1,107) = 14.87$, $p < .001$, effect size = .12, a power = .97, respectively; Figures 1 and 2). Independent *t*-tests of group differences at each data point indicated that the music group had significantly lower sensation of pain scores at each posttest, compared to the control group: first posttest, $t = 2.07$, $p < .05$; second posttest, $t = 2.84$, $p < .01$; third posttest, $t = 3.42$, $p < .01$.

The second hypothesis that music would result in not having a significant pain increase over time was partially supported by distress that did not increase significantly during the first hour in the music group. Using repeated measures analysis of variance across the four data points, significant differences in sensation were found in the music group ($F(3,52) = 31.40$, $p < .001$) and also in the control group ($F(3,52) = 79.31$, $p < .001$). Overall differences in distress were also significant ($F(3, 52) = 13.44$, $p < .001$, and $F(3,52), = 45.81$, $p < .001$, respectively). However, post-hoc analysis with paired *t*-tests at each posttest time point supported the increase ($p < .01$ to $< .001$), except for distress in the first hour that did not increase significantly. These data indicate that although sensation increased significantly each hour of labor in each group, music delayed the increase in distress until the second hour.

The third hypothesis that distress of pain scores would be significantly lower than sensation was supported. As seen in Table 2, distress was consistently rated as significantly less severe than sensation in each group ($t = 2.25$ to 4.83, $p < .05$ to .01, control group) and ($p < .001$, music group). However, women in the music group had less pain, and differences between sensation and distress at each hour (10–12 mm) were significantly larger and correlations were weaker ($r = .50$ to $.52$, $p < .05$) than in the control group (3–6 mm; $r = .63$–$.72$, $p < .05$). Lower means with larger differences, but weaker relationships between sensation and distress in the music group suggest that music had a heterogeneous effect on distress, reducing it more for some than for others.

TABLE 2.
Correlations and Differences between Sensation and Distress by Group

	Control		Music	
Posttest	***t***	***r***	***t***	***r***
First hour	3.43**	.72*	4.82***	.50*
Second hour	2.25*	.71*	3.91***	.52*
Third hour	2.89*	.63*	3.95***	.51*

Note: df = 54. *$p < .05$, **$p < .01$, ***$p < .001$, one-tailed.

Improved pain control was supported by perceived helpfulness. Nearly all women in the music group reported at the end of the study that the music was helpful (98%); the majority of them reported that music was moderately to very helpful (63%), whereas the rest said music helped a little. Further, investigator observations every 10 minutes indicated that less than half took the suggested 10-minute break in listening to music during the first hour and less than three fourths took a break in the second and third hours.

Nearly all of the women (92%) reported that they liked the music that they heard. The piano music tape was the most frequently chosen, followed by harp music, and no one chose orchestra music as their favorite. Choices among these types of music differed from those in other cultures (Good et al., 2000). The mean time women used music was 2 hours and 39 minutes ± 15 minutes, ranging from 2 to 3 hours. Only a few reported that they grew tired of the music (5%) or the earphones (15%).

DISCUSSION

Soft music decreased both sensation and distress of active labor pain in the first 3 hours; it also delayed increases in distress of pain for an hour, and for some, relief was fairly substantial. Women listened to music for a mean of nearly 3 hours and found it helpful for pain, with two thirds reporting it helped moderately to a lot. The sedative quality of the music helped women to relax and distract themselves from increasingly severe pain. The high power of nearly one was due to the rigor of a randomized controlled trial with a large sample and minimization to balance and equalize the groups. The groups were homogeneous and no confounding variables were found. Use of the pretest score as a covariate decreased the error term and thus increased the power.

Although music reduced pain, the small effect size may have been related to the severity and variability of increasing labor pain. However, some women had considerable relief. This study was the first to test music in a largely unmediated population having intense pain. The findings demonstrate that music can ease severe pain and delay the emotional escalation as sensation increases.

Distress of pain was found to be significantly less than sensation in this sample, perhaps because contractions caused severe sensation pain (hypothesis 2). However, desire and expectation have been reported to reduce affective pain (Price, 1999). In these women, a desire to deliver their baby, expectations that labor pain would end, and support of relatives at the bedside may have helped both groups to cope with distress. Those who used music may have experienced emotion-moderating effects, resulting in less affective pain. The greater variation in distress in the music group indicated that there was fairly solid relief for some.

Pain escalation during labor is due to increasing cervical dilation and uterine contractions. It was hypothesized that music would moderate increases in both sensation and distress of pain (hypothesis 3). For distress, this effect did occur during the first hour in the music group, but not in the control group. Conversely, sensation increased significantly across the 3 hours in both groups, whereas distress increased during the second and third hours. Thus music was strong enough to keep affective labor pain from increasing in the first hour. Because music has mild to moderate potency for pain, it may not have been as helpful for the 40% who had rapid progression of labor and, consequently, more pain.

The effect of music on the sensation of labor pain is consistent with three previous small studies (Clark et al., 1981; Hanser et al., 1983; Limprasirt, 1996). Clark and colleagues found that music decreased sensation pain during labor and delivery, but the effect was not clear because of the small value of the *t*-test. They did not measure the affective component of pain, but reported that anxiety, measured only once by questionnaire, was significantly lower in the music group. Hanser and colleagues and Limprasirt found that music decreased behavioral measures of labor pain. This is the first study to demonstrate that music reduced reported sensory pain and report an effect size in a randomized study with an adequate sample. It is the first to show that music slowed the escalation of affective pain.

The results of the current study differed from those of Kusollearjariya (1997) who found that neither Thai classical music nor Thai folk music in Northeast Thailand significantly reduced labor pain in women (n = 30 per group). However, the groups were not randomly assigned. In addition, Thai music is high pitched and tones are not sustained, and although probably familiar, it may not have been relaxing to participants.

There are several limitations to this study. First, pain measured at four time points may have been a burden to some women during the latter part of labor, when increased unreliability of the VAS scales was found. Approximately 10 participants marked their VAS scales quickly, seemingly without much thought. Second, the restriction to only five types of music also may have had an effect on the choices of a few women; the music that they selected may not have helped as much as a more preferred selection. Third,

the ceiling effect on the VAS in the latter part of the study may have occurred because the primiparas reported their pain was fairly severe during early labor, but had not experienced the greater pain of advanced labor; they may have prematurely marked close to "the most pain imaginable" anchor. Finally, significant box tests indicated that the assumption of equality of variance was violated for both sensation and distress across time, however the repeated measures ANCOVA was considered robust because the groups were randomized and equal in size (Green, Salkind, & Akey, 2000; Stevens, 1996).

The results of this study supported the gate control theoretical proposition that descending nerve impulses from the brain close the gate to pain in the spinal cord (Melzack & Wall, 1996). The distinction that laboring women made between sensation and distress and the differential effects of music support the proposition that sensory and affective components of pain are not necessarily in a one-to-one relationship (Melzack & Casey, 1968).

It is recommended that future research continue to investigate the effect of music on labor pain. Researchers should start testing music in the latent phase or even before, and continue through the active phase. The earlier start may decrease pain longer by providing practice and a more relaxed state during early labor. An interesting second outcome to measure could be level of fatigue because calmness may be less tiring than anxiety, crying, and moving in response to pain. In future studies, music can be tested in combination with other methods, such as a warm bath or shower, relaxation, or lower doses of analgesics. Music can be tested comparing multiparas and primiparas, but it is recommended that researchers find an appropriate pain measure because these groups might differ in their estimate of "the worst pain imaginable." Future studies could test stimulating music in the second stage of labor: music that encourages self-control, active pushing, and decreases fear such as marches and cheerful or triumphant music.

The results provide evidence that nurses can use soft music to help decrease both sensation and distress of pain in the first 3 hours of the active phase of labor. Although music is often not used in the labor room either in Thailand or around the world, some individuals bring in their favorite music to play during labor. There is now evidence for nurses to provide a variety of soothing music that would appeal to their patients and include some culturally relevant selections. Music can be started early in labor to help women to respond to their contractions with relaxation and distraction. They can use headphones, pillow speakers, in-ear speakers, or "in-room" music, as they prefer.

In this study of music in laboring women, soft instrumental music had a significant effect in decreasing both the sensation and distress pain in the first 3 hours of the active phase of labor. The effect was small but consistent, and it slowed the increase of distress despite increasingly severe sensation. Future investigators should identify additional strategies to supplement the effect of music in relieving labor pain.

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