Clinical and Experimental Health Sciences

Effects of Heat and Massage Applications to the Lumbosacral Area on Duration of Delivery and Perception of Labor Pain: A Randomized Controlled Experimental Trial

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ABSTRACT

Objective: This study was carried out to determine the effects of massage and hot-pack applications in the first stage of labor on perceptions of labor pain and duration of delivery.

Methods: This randomized controlled experimental trial was conducted in an obstetrics and pediatrics hospital. The research sample comprised 120 pregnant women, 40 of whom were in the massage group, 40 of whom were in the hot-pack application group, and 40 of whom were in the control group. Patient identification forms, labor process monitoring forms, and a visual analogue scale (VAS) were used to collect data.

Results: It was determined that the massage and hot-pack applications shortened the durations of the active and transition phases of labor. The massage and hot-pack applications also reduced perceptions of pain in the active and transition phases. Mean VAS scores of the massage and hot-pack application groups were lower than those of the control group ($p<0.001$).

Conclusion: Massage and hot-pack applications decreased the duration of the active and transition phases of labor and the perceptions of pain in those phases. These results demonstrate that massage and hot-pack applications are effective nursing interventions for the treatment of labor pain and can be used confidently.

Keywords: Labor pain, pain perception, pregnant women, massage, heat application

1. INTRODUCTION

The act of delivery is one of the most important life experiences for expectant mothers, and it is expected to conclude in a problem-free way. For this reason, it is very important for the health of both the mother and the baby that the process of childbirth be remembered as a healthy and successful experience. One of the aspects of labor that women are most frightened by is pain, as the acute pain of childbirth is one of the most severe types of pain known. However, this pain is also an expected part of a natural process, it takes place in a limited period of time, it involves periods of rest and also entails a preparation period, and the mother willingly endures it for her baby. These factors separate it from other types of pain (1,2).

Nonpharmacological methods that provide sufficient pain control have various advantages when compared to pharmacological methods. Nonpharmacological methods are harmless for both the mother and the fetus and do not slow down the process of labor, and there are no risks of adverse effects or allergies (2,3). Reducing perceptions of pain during childbirth is one of the objectives of basic nursing practices. The pain perceptions of women in labor can be reduced with topical therapy methods (massage or hot-pack applications), which are among the nonpharmacological intervention methods. The effects of massage and heat applications on pain in childbirth have been explained with the gate control theory. Massage and heat applications are thought to reduce perceptions of pain by activating large-diameter fibers transmitting physical sensations, which inhibits or overpowers the small-diameter fibers that carry messages of pain (1,2). Hot-pack or massage applications during childbirth oxygenate the region to which they are applied and remove waste materials from that region as a result of vasodilation of peripheral blood vessels. They also increase the local blood flow, reduce ischemia, and increase the release of endorphins. These applications help to stimulate the sympathetic nervous system, loosen the skeletal muscles, and alleviate skeletal pain (3). Reduced perceptions of labor

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pain with heat applications occur as endorphin levels and blood flow are increased, muscle relaxation is achieved, and the cellular metabolites that stimulate painful impulses are inhibited (3-5).

There are many studies in the literature investigating the effects of nonpharmacological methods on labor pain (6-10). In previous studies, the impact of massage applied to the waist, sacrum, and hip regions on pain in the first stage of labor was investigated (11-14). Other studies have considered the effect on labor pain of applying heat to the sacral region (15-17). In another study, the effect of applying hot water and ice packs to the waist and sacral region on the severity of labor pain was evaluated (18). There are also studies in the literature that delve into the impact of massage alone or massage coupled with acupressure in relieving labor pain and shortening labor time (19,20). However, no study has been found that assesses the influence of heat applications together with massage on the duration of labor and perceptions of labor pain. Therefore, in the current study, the effects of hot-pack and massage applications on the duration of delivery and pain perception were evaluated together.

Objective and Hypotheses

This study was planned to determine the effects of massage and hot-pack applications to the lumbosacral region on perceptions of labor pain and the duration of labor.

H1. Lumbosacral hot-pack application during the active or transition phase of childbirth shortens the durations of these phases.

H2. Lumbosacral massage during the active or transition phases of childbirth shortens the durations of these phases.

H.3. Lumbosacral hot-pack application during the active or transition phases of childbirth reduces the perception of labor pain in these phases.

H.4. Lumbosacral massage during the active or transition phases of childbirth reduces the perception of labor pain in these phases.

2. METHODS

2.1. Participants and Setting

The study was designed as a randomized controlled experimental trial and was conducted in the Maternity Ward and Postpartum Clinic of the Ministry of Health an Obstetrics and Pediatrics Hospital in Turkey. The universe of the study comprised primiparous pregnant women who had applied to the hospital to give birth for the first time. Inclusion criteria were being between the ages of 18 and 35, being primiparous with a full-term pregnancy, having a single fetus in vertex presentation, presenting for a spontaneous vaginal birth, not having a risky pregnancy, not taking any painkillers or receiving any analgesic treatment, and agreeing to participate in the study. A total of 120 pregnant women were included in the study, with 40 women in the control group, 40 in the massage group, and 40 in the hot-pack application group.

2.2. Sample Size and Randomization

The strength of the study was calculated in Power 3.1 to determine the minimum sampling size. As a result of power analysis, it was concluded that at least 38 women should be included in each group for a minimal total of 114 women at the 5% significance level with effect size of 0.81 and power (1-β) of 0.88. Thus, a total of 120 pregnant women were included, with 40 women in each of the three study groups.

Envelopes were numbered consecutively for the total study sample of 120 participants. Thereafter, based on the order of enrollment, participants were assigned to one of the three groups by way of simple randomization method using a computer. The first two participating pregnant women were assigned to the control group, the next one to the massage group, the next two to the hot-pack application group, and so on.

The groups to which the women were thus assigned were written inside the envelopes and the envelopes were sealed. These opaque envelopes, numbered according to the order of enrollment, were given to the women as they arrived for delivery. A researcher opened each woman's envelope to learn that woman's assigned group, and participants underwent applications according to the group to which they were assigned. Upon being assigned to the groups, the participants were blinded and did not know to which group they belonged. They were also unaware of the applications being performed for the other groups. However, by virtue of the nature of the interventions, the researchers could not be blinded. This process of randomization was performed in compliance with the CONSORT 2010 guidelines (Fig. 1).

2.3. Data Collection Tools

The data of the study were collected with patient identification forms, labor process monitoring forms, and a visual analogue scale (VAS).

2.3.1. Patient Information Form

This form included 13 questions related to the sociodemographic and obstetric characteristics of the pregnant women, the course of the pregnancy, prenatal check-ups, and other such information.

2.3.2. Labor Process Monitoring Forms

This form included sections about the time of onset of labor, cervical dilatation and effacement findings, vital signs of the mother, fetal heart rate, the starting time of experimental applications for relieving labor pain, the durations of the stages of labor, time of delivery, and time of separation of the placenta. A separate form was used for each participant.

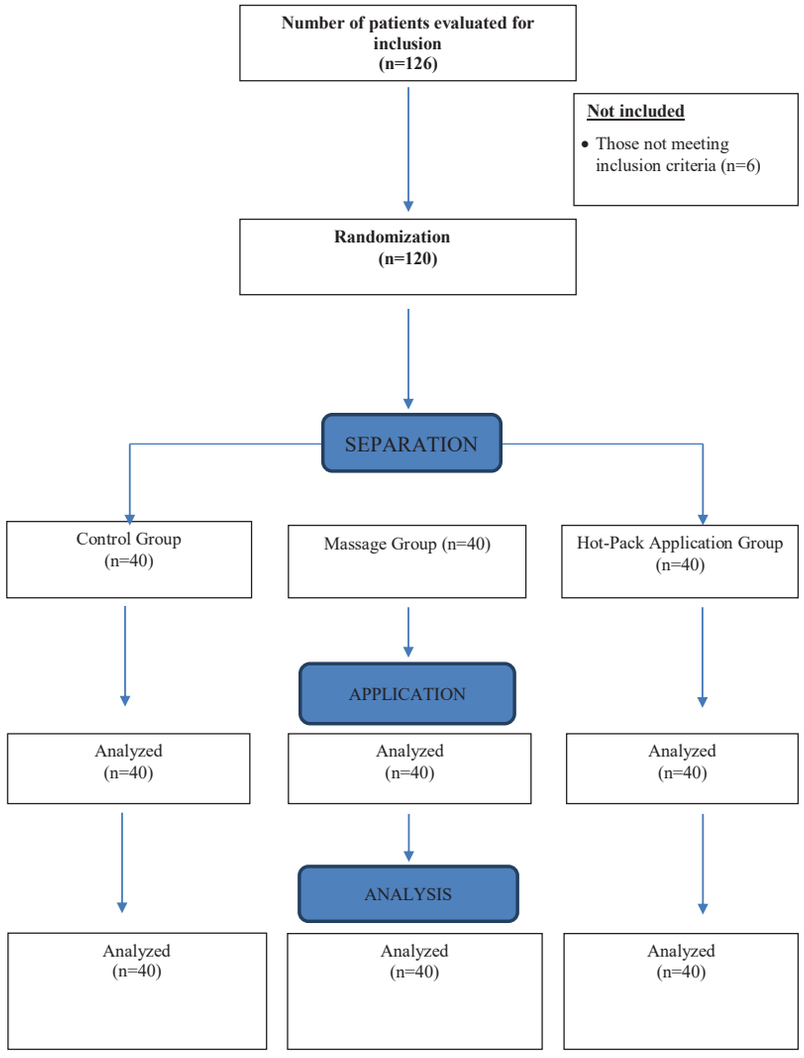

Figure 1. *CONSORT diagram*

2.3.3. Visual Analogue Scale (VAS)

A VAS is a one-dimensional measurement tool most commonly used to determine pain severity. It gives fast results, evaluates pain in a subjective way, and is sensitive and reliable in measuring pain severity. This approach was first developed by Bond and Pilowsky in 1966, and its sensitivity and validity in Turkey were determined by Aslan in 1998 (21). The scale consists of a 10-cm line upon which the severity of pain is marked, with "No Pain" at one end and "Unbearable Pain" at the other end. A VAS thus resembles a ruler of 0-10 cm and can be used vertically or horizontally. The distance between the spot indicated by the participants and the "No Pain" point was measured in centimeters and recorded. Since it is stated in the literature that vertical applications of the VAS are better understood by patients, a vertical form was used in the present study. A higher score indicates more pain.

2.4. Collection of Data for Experimental Applications

In addition to the routine clinical procedures, the pregnant women in the experimental groups were administered either hot-pack or massage applications by a researcher. In the health institution where the study was conducted, the same dose of oxytocin is routinely administered to primiparous pregnant women in the course of delivery. To evaluate the health of the mother and the fetus, the number of fetal heart beats was recorded at 15-minute intervals and the vital signs of the mother were evaluated at 1-hour intervals. Participants in all groups were asked to mark their pain at the most appropriate point on the VAS before any treatment was administered in the latent phase (VAS I), and that response was measured and recorded on the labor process monitoring form.

2.4.1. Hot-Pack Application Procedure

Materials used for hot-pack application

Hot packs: The hot packs contained special compounds such as silicon dioxide and silicate gel that absorb heat and retain the heat in the hot pack for 30 minutes. A total of 10 hot packs of 33 × 26 cm were used in the study. Hot packs were heated in a boiler with temperature set to 70-80 °C and they were kept in the boiler when not in use.

Hot-pack boiler: The stainless-steel electrical boiler had double walls, a thermostat, and automatic heat control with a capacity of 10 hot packs.

Towels: Towels of 50 × 90 cm in size were used to wrap the hot packs during hot-pack applications and a separate towel was used for each patient. Hot packs were applied after being wrapped in a towel. The temperature of the hot packs as felt through the towel was 40-42 °C.

The hot packs were applied to the area of the lumbosacral vertebrae while the women were sitting or lying on their left sides. Hot-pack application was begun in the active phase of labor (cervical dilatation of 4-7 cm) between contractions and continued uninterruptedly for 20 minutes. There was an average of 5 contractions in the active phase during this period. After the hot-pack application was concluded and at least one more contraction was experienced, pain severity was measured for the second time between contractions time (VAS II). In the transition phase, where labor progresses and cervical dilatation reaches 8-10 cm, the hot-pack application was begun again between contractions and continued to be applied for 20 minutes without interruption. There was an average of 10 contractions during this time. Pain severity was measured for the third time (VAS III) between contractions after the hot-pack application was concluded in the transition phase and at least one further contraction was experienced.

2.4.2. Massage Application Procedure

Materials used for massage application

Liquid Vaseline: Liquid Vaseline that did not contain any active substances was used in the massage application. With the patient sitting or lying on her left side, liquid Vaseline was applied to the area where the lumbosacral vertebrae were located (lower back region) and the right and left lateral parts of the midline (4-5 cm) were massaged for 30 minutes with effleurage and friction techniques. The massage was first begun between contractions in the course of the active phase of labor (cervical dilatation of 4-7 cm). After 30 minutes of massage and at least one contraction, pain severity was measured for the second time (VAS II) between contractions. In the transition phase, where labor progresses and cervical dilatation reaches 8-10 cm, massage was begun again between contractions and continued to be applied for 30 minutes without interruption. After 30 minutes and at least one contraction, pain severity was measured for the third time (VAS III) between contractions.

2.4.3. Procedure for the Control Group

In the control group, only the routine clinical procedures were applied. Pain levels of the participants were measured between contractions in the active (VAS II) and transition (VAS III) phases of labor. Furthermore, the pain levels of all mothers included in the study were measured postpartum in the service ward without any painkillers within the first 2 hours of leaving the maternity ward (VAS IV).

2.5. Statistical Analyses

The data obtained in this study were evaluated using SPSS 16.0 (SPSS Inc., Chicago, IL, USA). The results were evaluated in the 95% confidence range and at a statistical significance level of 0.05%. Percentages, means, standard deviations, and chi-square tests were used for comparisons between groups. Comparisons of cervical dilatation, effacement, fetal heart rate, vital signs of mothers, duration of labor, and VAS pain scores were performed by one-way analysis of variance. When a difference was determined between the groups, the post hoc least significant difference (LSD) test was used to determine from which group(s) the difference originated.

2.6. Ethical Considerations

Before the study was begun, the approval of the Ethics Committee of the Atatürk University Institute of Health Sciences was obtained (date: 24.07.2012, number: 2012.3.1/21). Subsequently, written permission was obtained from the a Provincial Health Directorate, where the hospital in which the study was conducted was located. Written consent forms were signed by all pregnant women who met the inclusion criteria of the study and agreed to participate. The purpose, duration, and procedures to be applied were explained to all women who agreed to participate in the study, and they were informed that they could leave the study at any time they wanted and that the ethical principles of consent, volunteerism, and respect for life would be observed.

3. RESULTS

The sociodemographic and obstetric characteristics of the pregnant women in the hot-pack application group, massage application group, and control group were statistically similar (Table 1). Vital signs (systolic and diastolic blood pressure, pulse rate, body temperature, and respiratory rate) of the pregnant women in the active and transition phases of labor were also statistically similar among the three groups ($p>0.05$), as was fetal heart rate ($F=0.108$, $p>0.05$ and $F=1.321$, $p>0.05$, respectively). In addition, hot-pack application and massage during labor were not found to affect cervical dilatation or effacement. Cervical dilatation and effacement rates in the active and transition phases of labor were similar among the three groups ($F=0.096$, $p>0.05$; $F=1.626$, $p>0.05$ and $F=2.583$, $p>0.05$; $F=1.321$, $p>0.05$, respectively).

For the duration of the latent phase of labor of the women in all three groups, no significant difference was observed. However, the average durations of the active and transition phases of labor in the hot-pack and massage application groups were shorter than those of the control group. While a significant difference was found between the groups for the duration of the active phase of labor (F=5.571, p<0.005), the difference observed for the transition phase was not significant. As a consequence of the post hoc LSD test, it was determined that the difference in the durations of the active phase of labor was due to the control group. While the durations of the second and third stages of labor were shorter in the hot-pack and massage application groups, these differences were not significant (Table 2).

The mean pain scores measured in the latent phase of labor (VAS I) were similar among the three groups with no statistical significance (p>0.05). The mean pain scores in the active phase of labor (VAS II) were lower in the hot-pack and massage groups than the control group with statistical significance (p<0.001). In the transition phase of labor (VAS III), mean pain scores were lower in the hot-pack and massage groups than in the control group, and this difference was statistically significant (p<0.001). The pain levels measured 2 hours after leaving the maternity ward (VAS IV) were similar among the three groups (p>0.05) (Table 3).

Table 1. *Sociodemographic and obstetric characteristics of participants*

	Hot-pack application group		Massage application group		Control group		Test value	p
Characteristics	Mean±SD		Mean±SD		Mean±SD			
Age	23.95±3.83		23.45±3.82		23.45±3.06			
Prenatal examinations	13.00±4.86		11.73±4.32		11.40±4.68		F=1.336	0.267
	n	**%**	**n**	**%**	**n**	**%**		
Educational level								
Primary school	23	57.5	26	65.0	21	52.5	χ^2=5.417	0.247
High school	12	30.0	9	22.5	15	37.5		
University	5	12.5	5	12.5	4	10.0		
Employment status								
Unemployed	33	82.5	38	95	38	95	χ^2=5.004	0.082
Employed	7	17.5	2	5.0	2	5.0		
Abortion history								
No previous abortion	34	85.0	37	92.5	37	92.5	χ^2=1.667	0.435
Previous abortion	6	15.0	3	7.5	3	7.5		
Knowledge about delivery obtained in prenatal appointments								
No	35	87.5	37	92.5	32	80.0	χ^2=2.740	0.254
Yes	5	12.5	3	7.5	8	20.0		
From whom that knowledge was obtained								
Nurse/midwife	0	-	0	-	4	10.0	χ^2=5.333	0.069
Doctor	5	12.5	3	7.5	4	10.0		

Table 2. *Comparison of the mean delivery durations of the participants*

	Patient groups					
Durations of first phase of labor (min)	**Massage application group (n=40)**	**Control group (n=40)**	**Hot-pack application group (n=40)**	**Test p**		
	Mean±SD	**Mean±SD**	**Mean±SD**	**F**	**p**	**Difference**
Latent phase duration	235.25±149.20	196.25±131.34	199.88±145.40	0.919	0.402	–
Active phase duration	209.63±74.55	223.88±79.44	173.38±52.29	5.571	0.005	1, 3 < 2
Transition phase duration	72.28±41.68	83.75±56.23	66.75±42.68	1.343	0.265	–
Duration of the second phase of labor (min)	52.38±23.78	58.13±33.98	51.75±27.26	0.602	0.550	–
Duration of the third phase of labor (min)	8.75±3.88	10.00±4.08	8.63±3.75	1.514	0.224	–
Total labor duration	578.28±198.69	572.00±196.92	500.38±160.30	2.162	0.120	–

Table 3. *Comparison of participants' mean VAS scores during labor*

	Patient groups					
Mean VAS Scores in the 1st Phase Delivery (min)	**Massage application group (n=40)**	**Control group (n=40)**	**Hot-pack application group (n=40)**			
	Mean±SD	**Mean±SD**	**Mean±SD**	**F**	**p**	**Difference**
VAS I (pain level measured in latent phase)	2.70±1.83	3.63±2.10	2.85±1.94	0.570	0.081	-
VAS II (pain level measured in active phase)	6.43±1.47	8.20±1.28	4.95±1.63	4.916	0.000	1 > 3 2 > 1, 3
VAS III (pain level measured in transition phase)	8.63±1.84	9.75±1.59	7.60±1.06	6.406	0.000	1 > 3 2 > 1, 3
VAS IV (pain level measured 2 hours after leaving maternity ward)	1.05±0.50	1.13±0.69	0.73±0.55	5.257	0.007	
Total mean pain score	18.80±2.73	22.70±3.73	16.13±4.07	37.755	0.000	1 > 3 2 >1, 3

4. DISCUSSION

The acute pain of labor is one of the most severe known types of pain (1,2). Pain in the first stage of labor is mostly characteristic of visceral pain, being felt in the lower region of the abdominal wall, the lumbar region, and the sacrum (22,23). Management of labor pain is one of the primary targets of obstetric nursing care and it may be provided by pharmacological and nonpharmacological methods (24,25). In this study, hot-pack or massage applications, as examples of nonpharmacological methods, were applied to the lumbosacral region, where pain is felt most in the first stage of labor. Throughout those applications, the vital signs (systolic and diastolic blood pressure, pulse rate, body temperature, respiratory rate) of the mothers and fetal heart rates were similar among the three groups (p>0.05). In studies conducted in other countries, it has been determined that hot-pack application and massage have no effects on pregnant women's systolic and diastolic blood pressure, pulse rate, or body temperature or on fetal heart rate (8,13,17,26,27). The fact that the vital signs of the women and the heart rates of the fetuses were not affected by the applications in this study is thus consistent with the findings of previous studies. Furthermore, in this study, the duration of cervical dilatation and effacement in the active and transition phases of labor did not differ among the groups (p>0.05). In other words, massage and hot-pack applications during labor did not affect the time to completion of cervical dilatation or effacement in pregnant women. Gönenç and Terzioğlu (19) and Kaçar and Özcan (28) reported that massage applied to the sacral region in the first stage of labor did not impact the mean duration of cervical dilatation, consistent with the findings of the present study. In this study, no applications were performed in the latent phase of labor and no differences were found in the durations of the latent phase among the groups (p>0.05).

It is recommended in the literature that hot-pack applications be carried out for a period of 20-30 minutes to ensure the therapeutic effect (2,29). In this study, the hot-pack application was continued uninterruptedly for 20 minutes and massage was continued for 30 minutes. The duration of the active phase of labor was found to be significantly shorter in the hot-pack and massage groups than in the control group (p<0.005). The durations of the transition phase of labor were also shorter in the hot-pack and massage groups than in the control group, although the difference was not statistically significant. Thus, in this study, it was found that hot-pack and massage applications both shortened the durations of the active and transition phases of the first stage of labor. This finding confirmed the first and second hypotheses of

the research, that massage and heat applications to the lumbosacral region during labor shorten the durations of the active and transition phases. In previous studies investigating the effects of hot-pack application on the duration of labor, it was reported that the application of heat to the sacral region shortened the latent, active, and transition phases of labor (4,30). The finding of shortened active and transition phases of labor with massage and heat applications in the present study corresponds to the findings of previous research (6,9,20). There are studies in the literature indicating that massaging the lower back region shortens the duration of the phases of the first stage of labor (6,9,20). Similar to the literature reviewed here, it was found in the current study that massage shortened the active and transition phases of labor. However, Akköz Çevik and Karaduman reported that, contrary to the findings of this study, massage applied to the sacral region during labor did not affect the duration of the phases of the first stage of labor (13). The reason for this difference is likely the type of massage performed. In the study conducted by Akköz Çevik and Karaduman, massage was administered with 15 minutes of effleurage and 15 minutes of vibration during labor (13). In the present study, massage was performed with uninterrupted effleurage and friction techniques for 30 minutes. The fact that the active and transition phases of labor were shorter in the hot-pack and massage groups is congruent with the findings of most other previous studies.

In the current study, although the durations of the second and third stages of labor in the hot-pack and massage groups were shorter than those in the control group, the differences were not significant ($p>0.05$). In the literature, there are studies showing that applications of heat and massage both shorten and do not shorten the duration of the stages of labor. Similar to our findings, Bolbol-Haghighi et al. reported that massage applied to the sacral region shortened the duration of the second stage of labor (20). Behmanesh et al., on the other hand, reported that heat application shortened the duration of the third stage of labor but did not shorten the duration of the second stage (4). In the study of Behmanesh et al., the fact that the duration of the second stage of labor was not shortened may have been due to the fact that the heat application was applied to the perineum during this stage. Contrary to the findings of the present study, Kaur et al. concluded that the application of heat to the lumbosacral region did not affect the duration of the three stages of labor (17). Similarly, Karami et al. (2007) reported that massage applied to the sacral region did not affect the duration of the second stage of labor (6).

In parallel with the progression of labor, the severity of labor pain gradually increases (3). As less pain is perceived in the latent phase of labor than in other phases and this early pain can be tolerated by most pregnant women, no application was performed in the latent phase of labor in the current study. In the active and transition phases of labor, hot-pack and massage applications were found to be effective in reducing labor pain. The perceived severity of the pain was found to be lower among the women who underwent hot-pack application compared to the massage and control groups. The perceived pain severity in the massage group was also lower than that in the control group. This study thus revealed that both hot-pack and massage applications in the first stage of labor are effective in relieving labor pain, but hot-pack application is more effective. This finding confirmed the third and fourth hypotheses of the study. Previous studies have also reported that applying heat to the lumbosacral region during the active and transition phases of labor is effective in reducing labor pain. Taavoni et al. stated that applying heat to the sacrum and perineum during the active phase of labor alleviated labor pain (15). Kaur et al. showed that applying heat to the lumbosacral region in the first stage of labor was effective in reducing labor pain (17). Similarly, Ahmad-Shirvani and Ganji (27) and Yazdkhasti et al. (30) found that applying heat in the first stage of labor was effective in reducing labor pain. The literature also contains studies confirming that massage applied to the sacral region in the first stage of labor is effective in reducing labor pain. For example, Akköz and Karaduman examined the effects of sacral massage on labor pain and anxiety and found it to be effective in reducing pain in the active and transition phases of labor (13). Mortazavi et al. (9) and Kaçar et al. (28) similarly demonstrated that massage applied in the first stage of labor was effective in decreasing perceptions of labor pain. Erdogan et al. determined that massage applied to the sacral region during the latent, active, and transition phases of labor reduced the perception of labor pain (14). In another study, Sadat et al. found that manual massage performed during the active phase of labor significantly reduced the severity and duration of labor pain (31). In the present study, it was found that massage applied to the lumbosacral region during the active and transition phases of labor was effective in relieving labor pain, consistent with the findings of previous studies.

5. CONCLUSIONS

The primary findings of this study are that, in the active and transition phases of labor, hot-pack and massage applications shorten labor times and reduce the perceived severity of labor pain. In addition, it has been determined that hot-pack applications are more effective than massage in relieving labor pain. The secondary findings of this study are that hot-pack and massage applications for women in labor do not affect the systolic or diastolic blood pressure, pulse rate, body temperature, respiratory rate, or cervical dilatation and effacement times of the mother or the fetal heart rate. It has been determined that hot-pack applications and massage do not pose any risk in terms of maternal and fetal health and can be safely applied as routine care during labor. Thus, it is concluded that hot-pack and massage applications are effective nursing interventions during labor.

In line with the results obtained in this study, it is suggested that nurses and midwives working in delivery rooms be trained in applications of heat and massage that reduce the perception of pain during labor. Furthermore, pregnant

women should be informed about the safety and advantages of heat applications and massage before birth, and hot-pack applications and massage should be added to routine care during labor.

These methods can be added to routine care during labor, as it has been proven that hot-pack and massage applications to the lumbosacral area in childbirth are effective nursing interventions. Both methods are effective in relieving labor pain, easy to apply, cheap, and harmless.

Limitations

This study has a few limitations. First of all, the pregnant women participating in the study were blinded to the assignment of groups, but due to the nature of the interventions, it was not possible to blind the researchers. In addition, oxytocin, which stimulates uterine contractions and accelerates birth to a certain extent, was administered to all women participating in the study. Therefore, the delivery times calculated in this study may have been slightly affected by oxytocin. Since the findings of this study were specifically obtained from the pregnant women who participated in the study, they cannot be generalized to all pregnant women.

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