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Effect of LI4 (Hoku point) massage with ice on labor duration during the active phase of labor among women delivering at El Manial University Maternity Hospital

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Background
Childbirth is one of the most painful experiences for women during their reproductive life. The aim of this study was to assess the effect of large intestine 4 (LI4) massage with ice on labor duration during the active phase of labor. A randomized controlled trial was adopted for this study. Mothers were recruited from the labor unit at El Manial University Maternity Hospital. A total of 200 laboring women were randomly selected after admission to the labor unit according to certain criteria. The sample was divided into two groups (100 each): group A and group B. Women in group A received LI4 massage with ice on their hands and women in group B received routine care. Two tools were developed and filled by the researchers, a structured interview sheet and a partograph, to assess the labor progress and duration.
Results
We found no statistically significant differences between groups with respect to maternal sociodemographic characteristics. The duration of the active phase (4 cm dilatation to full dilatation) was shorter in the study group compared with the control group. This difference showed a highly significant difference (X=4.5±0.53 compared with 5.39±0.89) ($P \leq 0.05$).
Conclusion and recommendations
The study concluded that LI4 massage with ice on the hands is an easy, cost-effective, and noninvasive technique to reduce the duration of labor.

Keywords:
active phase, Hoku point, labor, labor duration, LI4, massage ice cold

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Introduction

Childbirth is likely to be one of the most painful events for women during their lifetime (Fahimeh *et al.*, 2013). Labor pain is due to the stimulation of nerve receptors, followed by uterine muscle contractions, and is felt in the lumbosacral, hip, and gut areas. The pain can be severe and prolonged and it might lead to confusion and loss of confidence among women (Smith *et al.*, 2010). Labor pain causes an increase in epinephrine and norepinephrine levels, which increases the blood pressure, heart rate, and oxygen consumption in women. In addition, vasoconstriction induced by catecholamine leads to a decrease in uterine blood flow, which directly increases the prevalence of dystocia and decreases the neonatal Apgar score (Esfandiari *et al.*, 2009).

Management of labor pain can be divided into two categories: pharmacological and nonpharmacological. Pharmacological measures include the administration of analgesic drugs and regional anesthesia, but these measures have side effects on the mother, such as decrease in heart rate, hypotension, and vertigo, and adverse effects on the fetus that can cause respiratory suppression and diminish the suckling reflex early after birth (National Institute for Health and Clinical Excellence (NICE), 2008). In contrast, nonpharmacological pain measures such as massage, cryotherapy, aromatherapy, and acupressure are examples of nonpharmacological methods that not only relieve pain but also relieve fear, anxiety, and drug requirement. In addition, nonpharmacological methods for reducing labor pain are superior to pharmacological methods because of ease of implementation, non-invasiveness, ability to build confidence and increase patient participation, absence of adverse impact on the delivery process, and lack of side effects on the mother and the fetus (Salehian and Safdari, 2011).

Large intestine 4 (LI4) massage (or Hoku point) is an alternative management modality at the acupoint of the energy meridian point located on the inner lateral midpoint of the first metacarpal, the area between the thumb and the forefinger, within 3–4 mm of the location

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of an LI4. Moreover, the pain relief from LI4 massages on the hand moves from the tip of the forefinger up to the face and circles the teeth and bifurcates at the shoulder to move downward, wrapping around the entire colon (Hjelmstedt and Shenoy, 2010). At term pregnancy, the colon practically encircles the upper portion of the uterus. The location of LI4 is a point where the energy flow of the meridian is close to the skin and can be easily stimulated with pressure, needles, and extreme cold. Hjelmstedt and Shenoy (2010) have evaluated the effect of LI4 massage administered during the active phase of labor among nulliparous women in India. Their study revealed reduction in labor pain in the LI4 massage group and was most noticeable immediately after treatment compared with the control group ($P<0.001$).

In addition, a randomized clinical trial was conducted by Lee *et al.* (2004) in 75 women to assess the effect of acupressure on the SP6 acupoint. From the total sample, two groups were constituted: group A included 36 participants who received SP6 acupressure and group B included 39 women who received a touch at the SP6 acupoint, both for 30 min. In both groups of participants pain intensity was measured at 30 and 60 min after completion of the intervention. The results showed that SP6 acupressure was effective for decreasing labor pain and shortening the length of labor more than mere touch. Hamidzadeh *et al.* (2012) conducted a single, blind, randomized clinical trial on 100 women at the beginning of the active phase of labor. The participants were divided into two groups: the women in the acupressure group ($n=50$) received LI4 acupressure at the onset of the active phase over a period of 20 min, and the women in the control group ($n=50$) received a touch at this point without massage. The results revealed that the active-phase duration of the first stage was shorter in the acupressure group. Also, women in the acupressure group reported greater satisfaction compared with those in the control group.

The nurse has a crucial role in the assessment of the progress of labor. The nurse should carefully assess and observe women in labor and her fetal outcome and provide clear, concise information regarding the effectiveness of nonpharmacological modalities during childbirth. They should be up to date on the scientific research into alternative modalities; they should carefully assess laboring women for any incidence of a past episode that could interfere with labor progress (Ricci, 2007). Education is another important factor. The nurse should train the women to cope with childbirth to prevent adverse outcomes. The nurse can alleviate some of the anxiety associated with childbirth by explaining the natural course of the childbirth process.

Significance of the study

Labor pain and unrelieved pain can have an adverse effect on the physiological and psychological well-being of laboring women. In Egypt, there are few studies examining the effect of LI4 massage as a noninvasive method to relieve labor pain. To date, labor pain management has focused on the use of drugs that affect the sensory awareness of pain, which may have an additional effect of impeding a woman's active participation in giving birth. Also, not all nurses believe in the use of complementary and alternative approaches to provide relief from labor pain.

Aim

The aim of this study was to assess the effect of LI4 massage with ice on the hands on labor duration during the active phase of labor among women delivering at El Manial University Maternity Hospital.

Operational definition

(1) *LI4 massage*: It is an alternative modality used to relieve pain by means of ice-cold massage between the thumbs and forefingers on the palm side of the hands where the LI4 energy meridian acupoint is present.
(2) *Active phase of labor*: In laboring women active phase of labor is defined as cervical dilatation between 4 and 10 cm on a partograph.

Research hypothesis

Women who receive LI4 massage with ice on their hand during the active phase of labor will experience shorter duration of labor compared with those who receive standard routine care.

Patients and methods

This study was designed as a randomized controlled trial. A simple random sample of 200 laboring woman who attended the labor and delivery unit at El Manial Maternity Hospital were recruited for this study if they fulfilled the following inclusion criteria: they were primiparous or multiparous (not more than three deliveries), had a vertex presentation, had a singleton fetus, had full-term pregnancy, and were in the active phase of the first stage of labor (4 cm dilatation). From the total sample two groups were constituted: the first group (the study group) consisted of 100 women who received a massage on their hands with ice and the second group (the control group) consisted of 100 women who received routine standard care.

Tools

Two tools were developed to collect the relevant data: (a) the first was an interview questionnaire designed and filled out by the researcher. The content of the tool was determined through an extensive review of the literature and included questions pertaining to (i) personal demographic characteristic such as age, educational level, and occupation, (ii) obstetrical profile, such as parity, number of abortions, mode of previous delivery, and complications accompanying previous pregnancies, as well as questions assessing the present pregnancy, such as gestational age, last menstrual period, and expected date of delivery. (b) The second tool was a labor progress sheet (partograph), which included data on cervical dilatation and effacement, descent of the fetal head, and uterine contractions.

Tool validity

The tools were submitted to a panel of three medical and nursing experts in obstetrics and gynecology to test the content validity. Modifications were made according to the panel judgment for clarity of sentences and the appropriateness of content.

Ethical consideration

Official permission was obtained from the director of the El Manial Maternity Hospital. The researcher introduced herself to the women who were attending the labor and delivery unit and met the inclusion criteria and informed them about the purpose of this study to obtain their acceptance to participate in this study. The researcher assured them that the study posed no risk or hazards to the participants. All women were informed that participation in the study was voluntary. Written consent was obtained from women who were willing to participate in the study.

Pilot study

A pilot study was carried out on 10% of the total sample to check the clarity of items and determine the feasibility of the study.

Procedure

Data were collected over a period of 15 months, from July 2012 to October 2013, using the interview questionnaire, in three phases: assessment phase, implementation phase, and evaluation phase.

Assessment phase

In this phase, the researcher met the women in the labor and delivery department where they had come for delivery. The researcher asked the questions in simple Arabic language and recorded the answers in the tool. The interview took about 20 min for each woman. Progress of labor was evaluated using the partograph as baseline data before implementation of the inter vention. An abdominal examination was also performed to assess the fetal position and presentation.

Implementation phase

In this phase, the sample was divided into two groups: group A and group B. Group A consisted of 100 women who received an LI4 massage on the hand with ice and group B consisted of 100 women who received standard routine care. The implementation phase started at the end of the assessment phase and continued until the end of the first stage of labor. The LI4 massage was applied on the hands using ice between the thumb and forefinger where the large intestine energy point is found (LI4). The ice bag was wrapped in cotton before application to avoid any discomfort and skin damage to the patients. The researcher applied the ice alternatively on both hands every 10 min during each uterine contraction and discontinued at the end of the contraction (Fig. 1). The researcher assessed labor duration using the partograph until the woman's cervix had completely dilated and effaced (10 cm). This is the end of the first stage of labor and the beginning of the second. In group B, the researcher provided standard routine care that is provided to women in labor as per hospital care in the hospital.

Evaluation phase

In this phase, data on the effectiveness of LI4 massage on the hands on labor duration was assessed by using the partograph sheet every hour by the researcher.

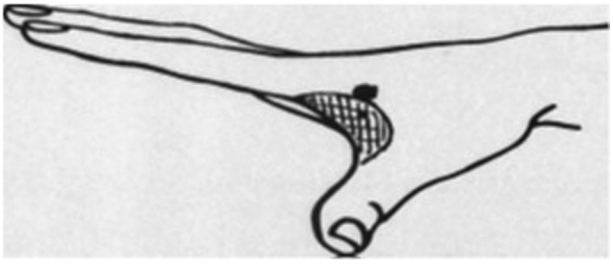
Statistical analysis

The collected data were coded, tabulated, and analyzed using the Statistical Package for the Social Science (SPSS, Armonk, New York, US), version 20. Descriptive and parametric inferential statistics were utilized to analyze data pertinent to the study. Statistical significance was considered at *P*-values less than 0.05.

Results

The results of this study are presented in three main sections: (a) description of the sample; (b) findings

Figure 1



Large intestine energy point four, also known as LI4 or Hoku point.

related to maternal assessment on admission; (c) effect of LI4 massage on hands on labor duration.

(1) *Description of the study sample*: This section includes (a) demographic characteristics of the study sample and (b) obstetric profile.
   (a) *Demographic characteristics of the study sample*: The age range of the sample was 25 years, with a mean of 26.37±4.73 in the LI4 massage group and 26.39±4.27 in the control group. Thirty-eight percent of the study group had primary education compared with 27% of the control group. Three percent of both groups had university education. Fifty-two percent of the study group were housewives compared with 59% of the control group. Sixty-six and 64% of the study and control groups resided in rural areas compared with 63 and 34% in urban areas, respectively, with no statistically significant difference between the two groups, which denotes homogeneity between them.
   (b) *Obstetrical profile*: The mean gestational age was 38.65±0.91 in the study group compared with 39.07±0.83 in the control group, with statistically significant differences (t=−3.379, P=0.001). Fifty-nine and 71% of the study and control group had a ruptured membrane compared with 41 and 29% with intact membranes. This finding was not statistically significantly different between the two groups (χ^2=3.165, P=0.075). In addition, 54% of the study group was multiparous compared with 61% of the control group; 46 and 39% of the study group and control group were primiparous with no statistically significant differences between the two groups (χ^2=1.003, P=0.317).

(2) *Maternal assessment on admission*: This section includes (a) vaginal assessment and (b) pattern of uterine contraction.
   (a) *Vaginal assessment*: In 48 and 67% of the study and control group the fetal presentation was −2 station compared with 17 and 10% with station 0, with a statistically significant difference between the two groups (t=7.43, P=0.02). In relation to cervical effacement, the study findings revealed that 60% cervical effacement was found in 54% of the study group compared with 22% of the control group. This finding showed a statistically significant difference between the two groups (χ^2=21.73, $P\leq0.05$) (Table 1).
   (b) *Pattern of uterine contraction*: The mean duration of uterine contraction in seconds in the study group was 35.9±1.23 compared with the mean duration of uterine contraction in the control group of 34.11±2.80, with significant differences between them (t=5.90, $P\leq0.05$). However, no significant differences were found between the study and control groups in relation to the frequency of uterine contraction (Table 2).

Table 1 Distribution of the two groups in relation to vaginal assessment on admission

	Study group (n=100) [N (%)]	Control group (n=100) [N (%)]	χ^2	P
Variable/station				
−2	48 (48)	67 (67)	7.43	<0.05
−1	35 (35)	23 (23)		
0	17 (17)	10 (10)		
Effacement				
50%	46 (46)	78 (78)	21.73	<0.05
60%	54 (54)	22 (22)		

Table 2 Distribution of the sample in relation to pattern of uterine contraction on admission

Variables	Study group (n=100)		Control group (n=100)		t	P
	Mean	SD	Mean	SD		
Duration of uterine contraction in active acceleration in 10 min	35.92	1.23	34.11	2.803	5.90	<0.05
Frequency of uterine contraction in active acceleration in 10 min	3.05	0.219	3.03	0.171	0.71	0.47

Table 3 Mean changes of frequency of uterine contraction in the two groups

Variables	Study group (mean±SD)	Control group (mean±SD)	F	P
Frequency of uterine contraction in active acceleration in 10 min for the first time	3.03±0.18	3.03±0.16	5.51	0.021 (significant)
Frequency of uterine contraction in active acceleration in 10 min for the second time	3.18±0.39	3.57±0.50		
Frequency of uterine contraction in active acceleration in 10 min for the third time	3.97±0.18	4.00±0.00		
Frequency of uterine contraction in active acceleration in 10 min for the fourth time	4.00±0.00	4.00±0.00		
Frequency of uterine contraction in active deceleration in 10 min	4.05±0.229	4.13±0.34		

(3) Effect of LI4 massage with ice on hands on labor duration: Findings of this study revealed improvement in labor progression in the study group. Regarding the frequency and duration of uterine contraction, there was a statistically significant difference between the two groups over time (F=5.51, P=0.021). A repeated measures analysis of variance (ANOVA) found that the mean frequency of uterine contraction differed statistically significantly between time points (F=814.914, P≤0.05) (Table 3 and Fig. 2).

Regarding the duration of uterine contraction, theresultsrevealedthat there was a statistically significant difference between the two groups over time (F=5.20, P=0.025). A repeated measures ANOVA showed that the mean duration of uterine contraction differed statistically significantly between time points (F=7513.122, P=0.05 (Table 4 and Fig. 3).

The results also showed a statistically significant difference between the two groups over time in relation to station (F=12.38, P≤0.05) (Table 5). A repeated measures ANOVA revealed that the mean station differed statistically significantly between different time points (F=1642.78, P=0.05) (Fig. 4).

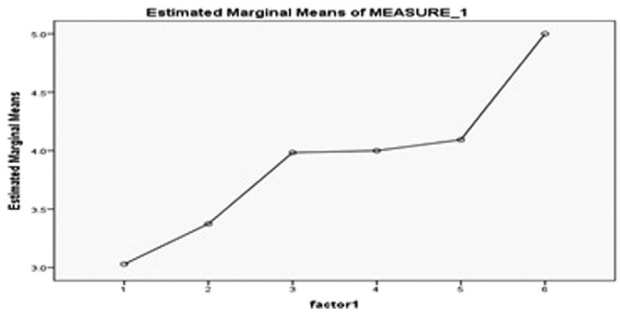
Effacement

Results indicated a statistically significant difference between the two groups over time in relation to effacement (F=71.25, P<0.05) (Table 6). A repeated measures ANOVA showed that mean effacement differed statistically significantly between time points (F=7171.11, P=0.05) (Fig. 5).

Cervical dilatation

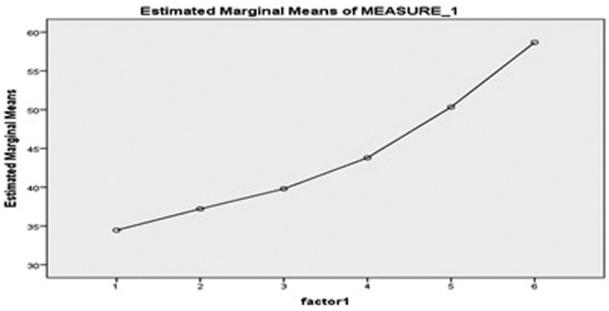
There was a statistically significant difference between the two groups over time in terms of cervical dilatation (F=119.91, P≤0.05) (Table 7). Figure 6 shows that

Figure 2



Repeated measures analysis of variance (ANOVA) for frequency of uterine contraction change over time.

Figure 3

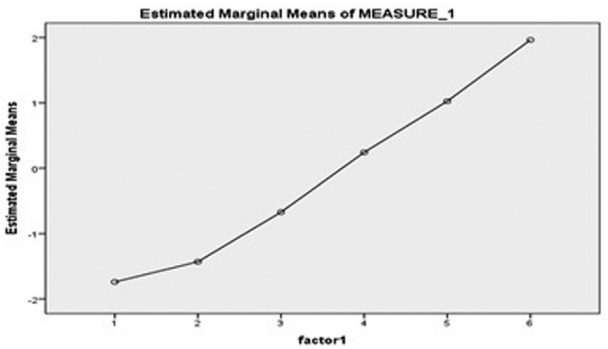


Repeated measures analysis of variance (ANOVA) for duration of uterine contraction change over time.

Table 5 Mean changes in the study and control groups in the level

Variables	Study group (mean±SD)	Control group (mean±SD)	*F*	*P*
Station −2	1.65±0.65	1.83±0.38	12.38	0.001
Station −1	1.21±0.62	1.65±0.48		
Station 0	67±0.47	0.67±0.50		
Station +1	0.20±0.40	0.28±0.50		
Station +2	1.0±0.00	1.05±0.21		
Station +3	1.95±0.21	1.97±0.15		

Figure 4



Repeated measures analysis of variance (ANOVA) for level of station changes over time.

Table 4 Mean changes in the study and control groups in the duration of UC

Variables	Study group (mean±SD)	Control group (mean±SD)	*F*	*P*
Duration of uterine contraction in active acceleration to first time	33.45±2.32	35.49±1.09	5.20	0.025
Duration of uterine contraction in active acceleration to second time	36.45±1.89	37.97±1.01		
Duration of uterine contraction in active acceleration to third time	39.35±2.13	40.24±1.51		
Duration of uterine contraction in active acceleration to fourth time	43.22±3.65	44.83±1.84		
Duration of uterine contraction in active deceleration to first time	48.49±1.62	52.18±3.32		
Duration of uterine contraction in active deceleration to second time	55.65±1.56	61.72±3.01		

on repeated measures ANOVA the mean cervical dilatation differed statistically significantly over time (F=4627.52, P≤0.05).

Labor duration

The results indicated that mothers in the control group had a longer mean duration of the active phase (5.39 h) compared with those in the study group (4.5 h). This difference was statistically significant (t=−9.103, P≤0.05) (Table 8).

Discussion

Findings of this study supported the research hypothesis that LI4 massage lowered labor duration among women during the active phase of labor. This findings was supported by an experimental study conducted by Kaviani et al. (2012) to compare the effect of two methods of acupressure and ice massage in point LI4 on pain intensity, anxiety levels, and labor duration. The results showed that the duration of labor reduced significantly after the intervention in the experimental group compared with the control group (P≤0.001), which is similar to the results of the present study. A clinical trial by Salehian and Safdari (2011) to evaluate the effects of acupressure at the Hoku point (LI4) on labor pain and duration of delivery in nulliparous women revealed that applying pressure on the Hoku point can reduce labor duration.

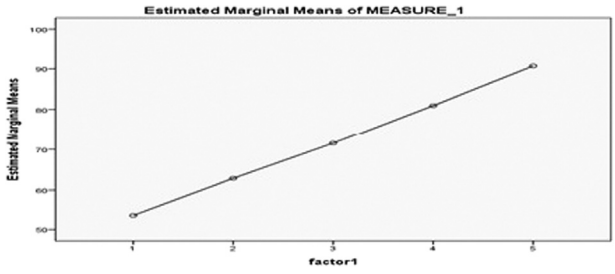
This finding was supported by Hamidzadeh *et al.* (2012), who reported that massage on LI4 decreases the subjective labor pain scores immediately and 20, 60, and 120 min after intervention (P<0.001). The active-phase duration of the first stage was shorter in the acupressure group. In addition, Rana and Chopra (2013) studied the effect of acupressure on the intensity of labor pain and duration of first stage of labor among primigravida mothers. The results showed that there was a significant difference in mean labor pain during the early active phase and late active phase and in the duration of first stage of labor between the experimental and control group. In contrast, a randomized clinical trial by Heydari *et al.* (2008) to determine the effect of SP6 acupressure on labor pain and duration found that acupressure on SP6 alone did not lessen labor pain or the duration of labor. An explanation for the above finding could be related to sample size, types and duration of acupressure application, as well as compliance to using acupressure rather than medications.

The present study showed better labor progress between the two groups over time in cervical dilatation. The results revealed shorter duration of the active phase of the first stage of labor among

Table 6 Mean changes in the study and control groups in effacement

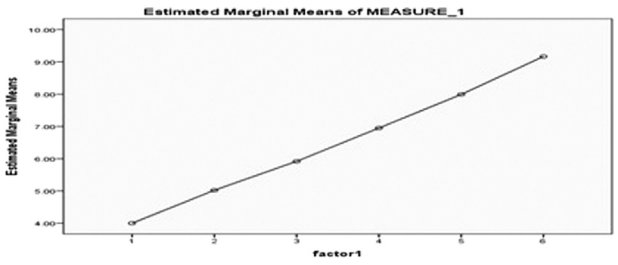
Variables	Study group (mean±SD)	Control group (mean±SD)	*F*	*P*
In the first hour of effacement	52.20±4.16	55.35±5.01	71.25	0.05
In the second hour	60.50±5.75	65.25±5.01		
In the third hour	67.80±7.18	75.25±5.21		
In the fourth hour	76.60±7.41	85.25±5.21		
In the fifth hour	86.10±8.02	95.25±5.21		

Figure 5



Repeated measures analysis of variance (ANOVA) for cervical effacement changes over time.

Figure 6



Repeated measures analysis of variance (ANOVA) for cervical dilatation changes over time.

Table 7 Mean cervical dilation changes in the study and control groups

Variables	Study group (mean±SD)	Control group (mean±SD)	*F*	*P*
In the first hour of cervical dilatation	4.00±0.00	4.00±0.00	119.91	<0.05
In the second hour	4.96±0.30	5.07±0.18		
In the third hour	5.73±0.52	6.10±0.37		
In the fourth hour	6.53±0.51	7.36±0.44		
In the fifth hour	7.47±0.51	8.50±0.36		
In the sixth hour	8.48±0.59	9.84±0.36		

Table 8 Mean labor duration in the study and control groups

Labor duration	Study group (n=100)		Control group (n=100)		*t*	*P*
	Mean	SD	Mean	SD		
Active acceleration phase	3.21	0.38	4.13	0.78	–10.593	<0.05
Active deceleration phase	1.24	0.36	1.26	0.41	–0.514	0.608
Active phase total	4.5	0.53	5.39	0.89	–9.103	<0.05

women who received LI4 massage with ice on the hand. The mean labor duration was 4.5 h in the study group compared with a mean of 5.39 h in the control group. The possible explanation for the shorter duration was offered by Holey and Cook (2003) that ice massage stimulates the endogenous oxytocin to be released, which in turn increases the frequency of the uterine contractions. Further, the shorter duration may be related to the continuous support that the laboring women received when ice massage was applied with each contraction from admission up to delivery. This may have played a role in achieving better tolerance and better coping.

This finding is in line with the study by Kim *et al*. (2002) that both LI4 and SP6 acupressure was effective in lessening the duration of labor in nulliparous women. The use of analgesic drugs by laboring mothers also differed between the two groups: mothers who received LI4 massage on their hands were able to tolerate the labor pain and did not request analgesia, compared with the control group. This could be because some women may have felt that having a healthy baby compensates for any distress experienced during the birthing process or because the majority of mothers were multiparous and could tolerate labor pain more than primiparous mothers. In contrast, Brown *et al*. (2001) found that primiparous women were significantly more likely to receive pain medication compared with multiparous women as a result of lack of confidence and fear of the unknown. This finding is also supported by Alder *et al*. (2007), who reported that elevated levels of anxiety were associated with an increased demand for pain relief drugs during labor among primiparous woman.

Conclusion

LI4 massage by ice on the hands as a type of noninvasive modality is effective in shortening the duration of the active phase of labor. The findings of the present study are applicable in nursing practice for laboring mothers to promote comfort by reducing the labor pain intensity. LI4 massage has been shown to be an effective measure and can be used in clinical practice to improve the quality of care in labor and delivery. LI4 massage with ice can be used as an alternative predominantly in early labor when resources are limited. Ice-cold massage could be an important option for women with labor pain.

Recommendations

(1) Further studies of efficacy as well as of effectiveness are needed to determine the clinical applicability of LI4 massage in other types of pain.
(2) Further investigations are necessary to replicate the beneficial findings of LI4 massage in a large sample.

Limitation of the study

Collection of data from one setting hinders the generalizability of the study findings.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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