



Yoga during pregnancy: Effects on maternal comfort, labor pain and birth outcomes

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KEYWORDS

Yoga;
Maternal comfort;
Labor pain;
Birth outcomes

Summary This study examined the effects of a yoga program during pregnancy, on maternal comfort, labor pain, and birth outcomes. A randomized trial was conducted using 74-primigravid Thai women who were equally divided into two groups (experimental and control). The yoga program involved six, 1-h sessions at prescribed weeks of gestation. A variety of instruments were used to assess maternal comfort, labor pain and birth outcomes. The experimental group was found to have higher levels of maternal comfort during labor and 2 h post-labor, and experienced less subject evaluated labor pain than the control group. In each group, pain increased and maternal comfort decreased as labor progressed. No differences were found, between the groups, regarding pethidine usage, labor augmentation or newborn Apgar scores at 1 and 5 min. The experimental group was found to have a shorter duration of the first stage of labor, as well as the total time of labor.

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Introduction

Childbirth pain evokes a generalized stress response, which has widespread physiological effects on a woman's parturient and fetus. Maternal catecholamine production increases, which affects the labor process by reducing the strength, duration and coordination of uterine contractions. The

fetus also is affected, as demonstrated by non-reassuring changes in fetal heart rate patterns.^{1,2} As a result of these changes, an increase in the length of labor, as well as a decrease in the Apgar score of the newborn can occur.³

Review of literature

Pain relief in labor is a unique problem.⁴ Relieving labor pain requires the use of analgesics and anesthesia, as well as monitoring of possible

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undesirable side effects. For example, epidural analgesia can lead to a prolonged first and second stage of labor, an increase in administration of oxygen, malrotation of the fetus, an instrumental delivery or a cesarean section.⁵ Thus, the possible presence of such medication side effects suggests analgesics and anesthesia alone may not adequately manage labor pain.^{6,7} It behooves health-care providers to deal with labor pain via use of a multiple convergent approach that includes both pharmacological and non-pharmacological methods.^{8,9}

Non-pharmacological methods address physical aspects of pain, as well as psycho-emotional and spiritual factors. A woman's ability to maintain control of her pain, emotions, decisions and actions, while in the labor and delivery process, is an important aspect of a good childbirth experience.^{10,11} Facilitation of a good childbirth experience requires use of self-comforting techniques that can help relieve pain and enhance labor progress. Research has suggested women, who perceive they have successfully coped with the pain and stress of labor, have been able to transcend pain and experience psychological and spiritual comfort.¹²

Alleviation of pain has been identified as a major source of comfort and support to women in labor.¹³ Regardless of whether pain medication is needed during labor, comforting techniques may enhance a woman's resolve and provide her with an appreciation of personal capabilities.^{14,15} It is known that when pharmacological and non-pharmacological methods for pain relief are combined, the total dosage of narcotics required for pain relief may be lessened.¹⁶ For example, a pregnant woman, who is aware of the mechanics of labor, is less likely to become tense and frightened during labor, which may facilitate a decrease in her labor pain.^{17,18} To achieve pain relief in labor, childbirth preparation classes can teach women how to maintain control of pain.¹⁹ Because of the synergism that exists

among mind, body and spirit,²⁰ childbirth preparation classes require a holistic approach to the sensory aspects of the birth experience.

Yoga, an intervention based on mind and body interconnectedness,²¹ is one non-pharmacological method that can be used for assisting with pain reduction during labor. Prenatal yoga can help women become accustomed to the natural, instinctive yoga-like positions often preferred during labor and delivery. When the pain of contractions exceeds one's usual pain threshold, yoga provides an opportunity to explore one's response to pain and to develop relaxation and coping strategies.²² Therefore, yoga can be an effective way to empower women during labor and to assist in attaining and maintaining their optimal level of functioning.¹⁷

Yoga is guided by five sheaths of existence, or *koshas*, including the: physical body (*Anna-maya-kosha*); energy body (*Prana-maya-kosha*); mind body (*Mano-maya-kosha*); higher intellect body (*Vijnana-maya-kosha*); and, bliss body (*Ananda-maya-kosha*).²³ Imbalance in any of these sheaths may lead to illness or problems, i.e. pain or discomfort. The five sheaths of existence interact with each other. Thus, something that affects the mind can spread to the body and, subsequently, the five sheaths of existence. To achieve harmony or balance within, one utilizes five components of yoga practice (yoga asanas, chanting om, breathing awareness, yoga nidra and dhyana). The model, used in this study (see Figure 1), helps explain how the required actions, for each of the five components of practice, might influence outcomes of labor pain, maternal comfort and birth outcomes.

The first component of yoga practice, *yoga asanas*, is designed as a sequence of set postures, which work at the *anna-maya-kosha*, or the physical body level. For pregnant women, *yoga asanas* can improve physical strength, maintain and enhance flexibility, and increase endurance and energy. In addition, the practice of *asanas*

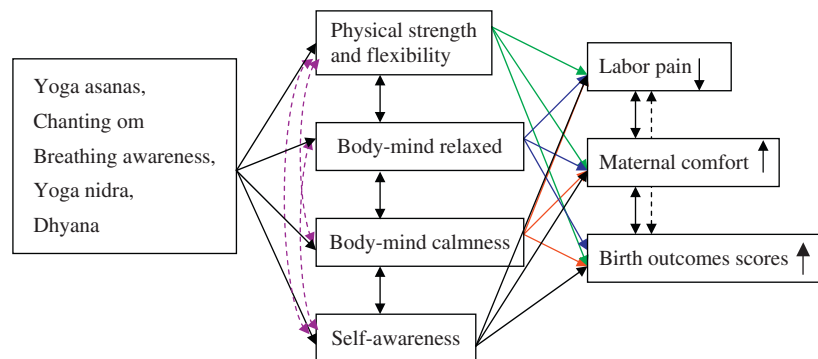


Figure 1 The sequential effect of the pathways of yoga on outcomes.

influences secretion of hormones from the endocrine glands, as a result of pressure applied to the glands during set postures. Each set posture assumed, during practice, creates awareness of the body and its function. During the resting period between each pose, the mind becomes stabilized (*sthira*) so it is able to distinguish between a state of relaxation or calmness, and a state of tension or stress. This technique teaches body awareness by identifying areas of tension and imbalance, and increases one's suppleness and ability to relax from the discomfort of pregnancy and delivery.

The second component of yoga practice, *chanting om*, involves the pronunciation of the sound-series, "ah uh mmm and om," which are essential for creating vibrating and pulsing energy that activate the chakras in the abdomen, throat and head, respectively. This practice has effects on the autonomic nervous system²⁴ and can result in tension and emotions being eased (*sukha*) or released from the body.²⁵

The third component of yoga practice, *breathing awareness*, works at the *prana-maya-kosha* (bioenergetics body) through the *ananda-maya-kosha* (blissful body). For a woman, the labor experience may depend on how well her physical, psychological and spiritual energies are balanced and harmonized. By cultivating breathing patterns during her pregnancy, breathing patterns during labor will come about on their own, producing a state of altered consciousness.¹⁸ Simple breathing patterns, using slow and deep breaths during the early phase of uterine contractions and panting breathes through the mouth in transitional phase of labor, can assist pregnant women in controlling themselves. These breathing actions can help women stay calm and relaxed; increase their oxygen supply, thereby helping to maintain the well-being of the fetus; and facilitate easier delivery.¹⁸ Breathing awareness not only enables women to remain calm and centered during labor, but also allows them to welcome the rhythm of contractions, instead of resisting them, so as to avoid negatively affecting their perception of labor pain and level of comfort.

The fourth component of yoga practice, *yoga nidra*, is a specialized practice that generates deep relaxation. *Shavasana* is the most important yoga posture for becoming totally relaxed. It works to calm the body and focus the mind in preparation for the posture to follow. This posture allows energy that has been created and released, during the various yoga postures, to flow freely through the body for the purpose of healing and nourishment. It also releases stress and tension from the body,

allowing the body and mind to become still and peaceful.²⁶

The fifth and final component of yoga practice, *dhyana* or meditation, is the state whereby the mind becomes concentrated and focused with a deep sense of relaxation. This practice, either by itself or in conjunction with *asanas* and *breathing awareness*, reduces excessive thinking and phases out extraneous sensory stimuli, or withdraws the senses from things that stimulate (*pratyahara*). In so doing, relaxation and a heightened sense of spirituality may be achieved. In summary, all aspects of yoga practice lead to preparation of physical strength–flexibility–energy, a state of body–mind relaxation, and development of self-awareness. Yoga practice consists of harmonious flow of *prana* through *chakra*, and leads to a balance of the five sheaths of human existence.

There have been limited studies regarding yoga in the area of maternal and child healthcare. Narendran and colleagues²⁷ studied the efficacy of yoga on successful outcomes of pregnancies. The primary outcomes measured included: gestational age at delivery; mean birth weight; mode of delivery; intrauterine growth retardation; and obstetric complications, such as pregnancy-induced hypertension and intrauterine death. Swami Maharana²⁸ found yoga practice during pregnancy improved birth weight; decreased labor duration, complications and anesthesia requirements; and, facilitated normal delivery. However, outcomes of maternal comfort and labor pain, which are individually subjective and require a holistic approach from antenatal to the delivery period, have not yet been investigated. Thus, the current study's aim was to determine, in primiparous women, the effects of using a yoga program during pregnancy on maternal comfort, labor pain and birth outcomes.

Method

Design and sample

A randomized controlled trial was conducted between January 2005 and February 2006. Primiparous women were recruited from two public hospitals in southern Thailand. The participants were: at least 18 years old; able to communicate and write in Thai; without serious illness or high-risk complications during pregnancy; receiving antenatal care from the start, or at least from the second trimester, of pregnancy; and, without prior experience of practicing yoga. Subjects were

assured their data would be kept anonymous and confidential, and they could withdraw from the study anytime without repercussions. To maintain anonymity and confidentiality, completed questionnaires were given a code number, kept in a locked file and viewed only by investigators. The study was approved by the Ethical Research Committee of the researchers' academic institution and the Ethical Research Committees at the study sites. All participants provided written informed consent.

Procedure

Subjects who met the selection criteria were administered, prior to being randomly assigned to either the experimental or control group, the demographic questionnaire, which also contained the *State-Trait Anxiety Inventory*. Group assignment was determined via use of a computerized-minimization program that automatically controlled for maternal age, marital status, education, income and trait-anxiety.²⁹ Thus, extraneous variables were checked to ensure homogeneity between groups.

Experimental group: Subjects in the experimental group received a series of six, 60-min yoga practice sessions at the 26–28th, 30th, 32nd, 34th, 36th, and 37th week of gestation. The yoga program was a combination of: (a) educational activities, giving a brief description of basic anatomical structures related to pregnancy and birth and (b) yoga, explaining the concepts related to each session. *Yoga asanas*, a *chanting om*, *breathing awareness*, *yoga nidra*, and *dhyana* were practiced harmoniously and in an orderly manner. The women were provided a booklet and tape cassette, for self-study, that explained the principles and benefits of each yoga practice. All were asked to practice at home at least three times a week, starting after the first yoga practice session and continuing for a period of 10–12 weeks. The number of weeks of practice (10, 11 or 12) depended upon whether the women started their first yoga practice session at the 26th, 27th or 28th week of gestation. Subjects were informed they could practice, at home, more than three times a week. So investigators could monitor subjects' involvement in each yoga session they performed at home, they were asked to maintain a record, in diary format. In addition, to ensure compliance with the research protocol, weekly telephone calls were made by investigators to each subject.

Control group: Subjects in the control group received routine nursing care from hospital staff

nurses. The researchers engaged in causal conversation, with subjects in the control group, for about 20–30 min during each of their scheduled hospital visits. Yoga practice was not provided to the control group. To ensure compliance with the research protocol, weekly telephone calls were made by the investigators to each subject.

Instruments

The demographic questionnaire was a researcher-constructed questionnaire, used to obtain data on age, marital status, educational level, religion, and income. As part of the demographic questionnaire, the *State-Trait Anxiety Inventory*, a trait anxiety subscale, developed by Spielberger,³⁰ was added. This scale contains statements, for respondents to select, that describe how they generally feel. The instrument provides a stable assessment of individual differences in proneness to anxiety. As previously stated, it was used at the beginning of the study to assess anxious attributes that may have confounded the outcome variables.

The visual analogue scale to total comfort (VASTC), a researcher-modified version of the Visual Analogue Scale (VAS) for Comfort,³¹ was completed by subjects to assess maternal comfort during the first stage of active labor. The first measurement was taken when cervical dilatation was 3–4 cm and uterine contractions were 30–60 s in duration. The second measurement was taken 2 h after the first, with the third measurement being taken 2 h after the second. With each measurement, participants placed a mark, along a 100 mm horizontal line, to reflect the level she currently was experiencing comfort. One end of the line indicated “strong agreement”, the other end of the line indicated “strong disagreement” that comfort existed at that moment. The further the distance (in mms.) she marked from the “strong disagreement” end of the line, the greater her degree of comfort. Total scores could range from 0 to 100. The higher the total score, the higher the comfort level. To prevent response bias, subjects were not allowed to see their previously marked scales.³² Internal consistency of VASTC, during labor, by test-retest method, was 0.80.

The maternal comfort questionnaire (MCQ) was a researcher-modified version of the General Comfort Questionnaire³¹ that was completed, by each respondent 2 h post-delivery, to indicate her level of comfort. This 35-item questionnaire consists of both positively and negatively stated items that have been generated from a two-dimensional grid of the three states of relief, ease, and transcen-

dence and the four contexts of physical, psycho-spiritual, social and environment, as described by the theory of holistic comfort.³¹ Items were scored on a 6-point Likert scale ranging from “strongly agree” = 6 to “strongly disagree” = 1. A total score was obtained by summing all 35 items. The possible range for total scores was from 35 to 210. The higher the total score, the higher the level of maternal comfort. Internal consistency of the MCQ, in the current study, was found to be 0.86.

The *visual analogue sensation of pain scale* (VASPS) was used to assess labor pain^{33,34} and completed, by each subject, at the three times they completed the VASTC. The VASPS consists of a 100 mm horizontal line anchored by two extremes of pain, “no pain” and “worst imaginable pain”. Each respondent was asked to mark through the horizontal line to indicate intensity of pain being experienced from uterine contractions (start of uterine contraction until uterine relaxation). The pain score was determined by measuring the distance, in millimeters, from “no pain” to the subject’s mark. The higher the number of millimeters, the greater the amount of labor pain being experienced. Internal consistency of the VASPS was found to be 0.74.

The *pain behavioral observation scale* (PBOS) was used to record investigator observed parturient behavior related to pain.³⁵ This assessment was carried out at the same three time the VASTC and VASPS were completed by each subject. The PBOS consists of a five-item checklist: vocalization, body movement, breathing control, facial expression and communication. Each item was scored using a 3-point Likert scale, with 3 = a description of behavior manifesting pain free moments to 1 = a description of behavior manifesting intense pain. Scores were computed by summing all items. Total scores range from 5 to 15. Low scores indicate severe pain, while high scores indicate mild pain. The reliability coefficient was found to be 0.80.

Birth outcomes were measured using Apgar scores and length of labor. Apgar scores are a systematic measurement of the neonate’s physical condition at 1 and 5 min after birth. Measurements include the neonate’s heart rate, respiratory effort, muscle tone, reflex irritability and skin color. The higher the score, the better the newborn’s physical condition.³⁶ Length of labor refers to duration (in hours) from onset of labor to after delivery of the baby and placenta.³⁷ The newborn’s weight (which may influence duration of labor)³⁸ was considered when comparing length of labor between groups (experimental and control). Birth outcome data were obtained from the subjects’ medical records.

Specific confounding variables, that might have affected APGAR scores and length of labor, were augmentation³⁸ and the usage of the drug, pethidine.³⁹ These conditions were assessed in both the experimental and control groups.

Data analysis

Descriptive statistics were used to assess demographic characteristics and trait anxiety scores. Independent-sample *t* tests and χ^2 or Fisher’s exact tests were applied to determine if there were differences in the demographic variables and anxiety trait scores between the experimental and control group.⁴⁰

Repeated measures analysis of variances (ANOVA) was used to determine if changes in maternal comfort scores and pain in active phase of labor occurred over time and whether these changes differed between the groups. Bonferroni comparisons were employed in the analysis for pair comparisons to control for inflating Type I errors.⁴⁰ No adjustments were made for missing data. Therefore, the cohort for each analysis was dependent on the largest complete set of data across the groups. A *p*-value of less than 0.05 was considered statistically significant.

Results

Demographic characteristics and trait anxiety scores

Seventy-four primiparous women were included in the analysis. See Table 1 for a comparison of the subjects’ demographic characteristics and trait anxiety scores. No significant differences were found, in any of the demographic characteristics or trait anxiety scores, between the two groups.

Maternal comfort

See Table 2 for comparison of mean scores, between the two groups, for maternal comfort (VASTC) at three points in time. The experimental group demonstrated significantly higher maternal comfort during labor than did the control group. See Table 3 for the ANOVA (split-plot-design) between the two groups, which shows maternal comfort of the experimental group to be significantly higher, over the three assessment times during active labor, compared to the control group. In addition, a statistically significant difference, in the mean scores of maternal comfort, was found by

Table 1 Demographic characteristics.

Demographic characteristics	Experimental group		Control group		χ^2
	Number	%	Number	%	
<i>Maternal age (year)</i>					
18–19	10	27.0	12	32.4	0.80
20–35	27	73.0	25	67.6	
<i>Marital status</i>					
Separated/divorced	3	8.1	2	5.4	1.00
Married	34	91.9	35	94.6	
<i>Education level</i>					
≤ Grade 12	27	73.0	29	78.4	0.79
> Grade 12	10	27.0	8	21.6	
<i>Religion</i>					
Buddhist	24	64.9	19	51.4	0.38
Muslim	12	32.4	18	48.6	
Christian	1	2.7	0	0.0	
<i>Income (Baht)</i>					
2000–5000	12	32.4	14	37.8	0.74
5001–10,000	19	51.4	17	46.0	
10,001–15,000+	6	16.2	6	16.2	
<i>Maternal trait anxiety</i>					
40–59 score	18	48.6	18	48.6	1.00
60–80 score	19	51.4	19	51.4	

Table 2 Comparisons of maternal comfort (VASTC) during labor.

Data points	Maternal comfort during labor				<i>t</i>
	Experimental group (<i>n</i> = 33)		Control group (<i>n</i> = 33)		
	Mean	SD	Mean	SD	
Time 1	52.88	13.57	45.00	12.84	2.422*
Time 2	40.03	11.84	33.33	10.85	2.396*
Time 3	29.64	9.31	23.67	9.22	2.618*

**p* < 0.05.

the MCQ, 2 h after birth (see Table 4), with the experimental group scoring higher than the control group.

Labor pain

As reflected in Table 5, each of the three times pain was assessed, the experimental group demonstrated significantly lower scores in labor pain (VASPS) than the control group. Both groups showed an increase in pain throughout active labor. However, pain scores for the experimental group were

consistently lower than those of the control group. ANOVA demonstrated significantly lower labor pain scores (VASPS), over the three assessment times, when the experimental group was compared to the control group (see Table 6).

The mean values of labor pain, assessed by the PBOS, showed significant differences, at all three points in time, between the two groups (see Table 7). Although both groups showed a decrease in pain, over the three time periods, the experimental group demonstrated consistently higher scores compared with those in the control group, indicating lower pain. Table 8 reflects significant

Table 3 Analysis of variance of maternal comfort (VASTC) during labor (experimental group = 33; control group = 33).

Source of variation	SS	df	MS	F	η^2	Power
<i>Between-subject effects</i>						
Group	2321.64	1	2321.64	6.61*	0.09	0.72
Residuals	22,485.39	64				
<i>Within-subject effects</i>						
Time	16,447.30	2	10,122.89	433.65***	0.87	1.00
Time*Group	30.64	2	18.86	0.81	0.01	0.17
Residuals	2427.39	128	23.34			

* $p < 0.05$.*** $p < 0.001$.**Table 4** Comparison of maternal comfort (MCQ) 2 h after delivery.

Group	Mean (SD)	Effect size	Mean difference 95% CI	t
Experimental (n = 33)	156.70 (13.43)	0.50	6.34 (0.14, 12.53)	0.045*
Control (n = 34)	150.36 (11.70)			

* $p < 0.05$.**Table 5** Comparisons of labor pain (VASPS).

Data points	Pain during labor				<i>t</i>
	Experimental group (<i>n</i> = 33)		Control group (<i>n</i> = 33)		
	Mean	SD	Mean	SD	
Time 1	51.79	10.46	57.91	12.83	−2.125*
Time 2	67.24	9.41	71.91	7.70	−2.204*
Time 3	83.48	8.89	88.03	8.05	−2.178*

* $p < 0.05$.**Table 6** Analysis of variance of labor pain (VASPS) (experimental group = 33; control group = 33).

Source of variation	SS	df	MS	F	η^2	Power
<i>Between-subject effects</i>						
Group	1293.11	1	1293.11	6.47*	0.09	0.71
Residuals	12,788.83	64	199.83			
<i>Within-subject effects</i>						
Time	31,550.55	2	17,108.59	380.17***	0.86	1.00
Time*Group	25.37	2	13.76	0.31	0.01	0.10
Residuals	5311.41	128	41.50			

* $p < 0.05$.*** $p < 0.001$.

Table 7 Comparisons of observed labor pain (PBOS).

Data points	Pain behavioral observation scale				<i>t</i>
	Experimental group (<i>n</i> = 33)		Control group (<i>n</i> = 33)		
	Mean	SD	Mean	SD	
Time 1	13.09	1.53	12.27	1.81	1.986*
Time 2	11.21	1.36	10.42	1.66	2.108*
Time 3	9.82	1.76	8.52	1.97	2.835*

p* < 0.05.Table 8** Analysis of variance of observed labor pain (PBOS) (experimental group = 33; control group = 33).

Source of variation	SS	df	MS	<i>F</i>	η^2	Power
<i>Between-subject effects</i>						
Group	46.55	1	46.55	7.37**	0.10	0.76
Residuals	404.34	64	6.32			
<i>Within-subject effects</i>						
Time	408.25	2	233.59	179.38***	0.74	1.00
Time*Group	2.76	2	1.58	1.21	0.02	0.24
Residuals	145.66	128	1.30			

p* < 0.01.*p* < 0.001.

differences between the groups, as well as within the groups regarding labor pain (PBOS), with the experimental group scoring higher (demonstrating lower pain) than the control group.

Birth outcomes

Significant differences (see Table 9) in the duration of the first stage of labor and the total duration of labor were found, between the groups, with the control group scoring higher than the experimental group. No significant difference in duration was found at the second stage of labor. Table 10 shows no significant differences, between the two groups, in both the first and fifth minute newborn Apgar scores. In addition, no differences, in the use of augmentation and pethidine, were found between the two groups.

Discussion

The chances, of providing one-to-one labor support, are unlikely in today's obstetrical units, since

staffing ratios often do not permit such patient care.⁴¹ Childbirth is a time of enormous stress for many women, especially for those who give birth to their first child without childbirth preparation,⁴² or attention to practicing techniques that can increase maternal comfort and decrease pain during labor. Therefore, the purpose of this study was to investigate the effects of using a yoga program during pregnancy on enhancing maternal comfort and reducing pain during labor, and improving birth outcomes.

Throughout the childbirth experience, pain affects the level of comfort women achieve during active labor. Women usually feel slight intermittent pain during uterine relaxation, but increasing pain as labor progresses. The findings suggest that yoga practice, during pregnancy, may have facilitated the comfort level of those in the experimental group, both during active labor and 2 h post-delivery. The experimental group consistently rated their comfort level higher than the control group. This finding was not surprising, since yoga involves synchronization of breathing awareness and yoga relaxation, which leads to a state of deep relaxation. Thus, the experimental group remained relatively comfortable and "in control" even though labor intensified. Yoga allowed the women to be in control of themselves, which facilitated their ability to be more active in their childbirth experience.^{43,44}

In relation to pain perception, yoga body movements of *asana*, breathing awareness, as well as the use of chanting om, have been shown to be beneficial to spine flexibility and circulation of cerebrospinal fluid (CSF) around the brain and spinal cord. The increased availability of CSF endorphins and serotonin, as a result of increased CSF circulation, assists in raising the threshold of the mind-body relationship to pain.⁴⁵ Thus, the finding that the experimental group manifested lower investigator observed pain behavior (higher mean scores), than the control group, would be expected.

Table 9 Comparisons of length of labor and newborn weight.

Characteristic	Experimental group (n = 33)		Control group (n = 33)		t
	Mean	SD	Mean	SD	
<i>Length of labor (minutes)</i>					
1st stage	519.88	185.68	659.79	272.79	−2.436*
2nd stage	27.42	14.84	30.61	14.17	−0.891
Total time	559.06	203.43	683.58	276.40	−2.084*
<i>Newborn weight (grams)</i>	3076.79	311.22	3125.45	287.40	−0.657

* $p < 0.05$.**Table 10** Comparisons of pethidine usage, augmentation of labor and Apgar scores.

Variables	Experimental group (n = 33)		Control group (n = 33)		χ^2
	Number	%	Number	%	
<i>Pethidine usage during labor</i>					
None	19	57.6	16	48.5	0.61
50 mg	10	30.3	14	42.4	
75 mg	3	9.1	2	6.1	
100 mg	1	3.0	1	3.0	
	$\bar{x} = 25.0$, SD = 31.25		$\bar{x} = 28.79$, SD = 30.05		
<i>Augmentation</i>					
None	14	42.4	9	27.3	0.28
Artificial rupture of membrane (ARM)	6	18.2	7	21.2	
Syntocinon	4	12.1	6	18.2	
ARM and syntocinon	9	27.3	11	33.3	
<i>Apgar score at first minute</i>					
≤7	2	6.1	5	15.2	0.43
8–10	31	93.9	28	84.8	
<i>Apgar score at fifth minute</i>					
≤7	0	0	0	0	1.00
8–10	33	100	33	100	

In addition, *asanas* or the postural patterns used during yoga practice are initiated slowly with attention paid to internal proprioception and maintenance of full diaphragmatic breathing. These patterns are performed with a minimum amount of voluntary effort and energy expenditure. The increased perception of proprioceptive information, awareness of thoughts and emotions, and development of non-reactivity to physical sensation, brought about by *asanas*, can lead to attainment of positive functional outcomes, such as an increase in pain threshold. The development of non-reactivity to physical sensation is brought about by changes in the parasympathetic nervous system, whereby it works to avoid cortical stimulation and sub-cortical compensatory motor patterns.²⁵ Therefore, yoga intervention for pain

appears to create competing impulses in the central nervous system (CNS), prevent painful stimuli from proceeding through the gate mechanism, and stimulate release of endogenous endorphins and serotonin.

The fact both the experimental and control group had an increase in pain throughout active labor was anticipated. Both observational and experimental research findings show in human pregnancy, one's pain threshold is expected to gradually begin at 30 weeks of gestation, accelerate during the last 3–4 weeks of pregnancy, rise during active labor and birth, and subside over 24 h following delivery.^{46–49} As reflected from the subjects' self-reports (VASPS) during the three pain assessment periods, the experimental group had lower pain levels than the control group. Such a

finding was expected since prenatal yoga practice, through the use of relaxation techniques, can help to: (a) relieve conditions (i.e. muscle tightening) that create and sustain pain, (b) decrease one's perception of pain, and (c) develop relaxing deep breathing patterns. These actions can assist in relieving physical body tension, as well as emotional tension, felt in anticipation of labor and delivery.

In terms of birth outcomes, findings showed the experimental group, when compared to the control group, demonstrated shorter durations of time both for the first stage of labor and total labor. However, duration of the second stage of labor did not differ between the two groups. These results are somewhat similar to prior findings that showed the number of hours of labor to be significantly lower for those practicing yoga during pregnancy.²⁸

No significant differences, between the experimental and control group, were found for newborn first or fifth minute Apgar scores. Augmentation and pethidine for pain relief during labor are factors known to influence Apgar scores in a negative manner. There were no significant differences, between the two groups, regarding augmentation of labor and pethidine, which may explain why no differences were found in Apgar scores between the two groups.

Conclusions

The study findings suggest that 30 min of yoga practice at least three times per week for 10 weeks is an effective complementary means for facilitating maternal comfort, decreasing pain during labor and 2 h post delivery, and shortening the length of labor. Therefore, the results provide evidence of the benefit of using yoga as an alternative nursing intervention to improve the quality of maternal and child health care. This study provides ideas for future research on integrating the yoga philosophy in caring for pregnant women with other health conditions. In addition, further investigations are necessary to replicate the beneficial findings of this yoga program in larger populations and to better elucidate physiological mechanisms underlying pain relief during labor and delivery.

Acknowledgments

This study was partially funded by the Faculty of Graduate Studies, Prince of Songkla University, Hat Yai, Songkhla, Thailand. The authors wish to thank

Miss Molthira Timjinda, the nurses in the labor units of the hospitals used for data collection, and Dr. Vickie Lambert and Dr. Clinton Lambert for their critical review of the manuscript.

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