CHAPTER 4

RESULTS AND DISCUSSION

The results of the study on the effects of using a yoga program during pregnancy on maternal comfort, labor pain, and birth outcomes of primiparous women are presented in this chapter. The sample profile, the study variables, hypotheses testing, and statistical significance versus clinical significance are also organized and demonstrated.

Sample Profile

Demographic Data

Seventy-four subjects were randomly assigned to treatment (n = 37) and control (n = 37) groups. For the experimental group, the average age was 23.43 years (median = 23.00, SD = 4.38) with a range from 18 to 33 years. The majority was married (91.9%) and had attained grade 12 or lower education (73.0%). They were Buddhist (64.9%) and had extended families (51.4%). Just over half (51.4%) of the subjects had incomes of between 5,001 and 10,000 Baht per month, and their occupations were housewives, office workers in companies, or merchants (59.5%, 27.0%, and 13.5% respectively). The maternal trait anxiety for the 60-80 score range was 51.4%, the 40-59 score range was 48.6% and the average score was 60.68 (median = 61.00, maximum = 74, minimum = 48, and SD = 7.13). This was established at enrollment into the study at 27- 28 weeks gestation (67.6%), and they gave birth at the 38-38^{+6} week (Table 4).

In the control group, the average age was 22.97 years (median = 22.00, SD = 4.35) with ages ranging from 18 to 34 years. Most of them were married (94.6%) and had attained grade 12 or lower education (78.4%). The majority of them were Buddhist (51.4%) with extended families (62.2%). The income ranged from 5,001 to 10,000 Baht per month (45.9%). They worked as housewives, office workers in companies, merchants or government officials (45.9%, 37.8%, 10.8%, and 5.4% respectively). The score of maternal trait anxiety averaged 60.35 (median = 61.00, maximum = 75, minimum = 49, and SD = 6.96); 51.4% had a score in the 60-80 range, and 48.6% in the 40-59 range, They enrolled into the study at $27\text{-}27^{+6}$ weeks gestation (64.9%), and the babies were born at the $39\text{-}39^{+6}$ weeks (Table 4).

There was no significant difference in the control variables of maternal age, marital status, education level, income, and maternal trait anxiety between the two groups ($p > 0.05$) (Table 4). Thus, extraneous variables were controlled with a fair degree of homogeneity. The enrolled gestational age of pregnancy and the gestational age at giving birth between two groups were also comparable.

Table 4

Comparison of the Experimental and Control Group Classified by Demographic Characteristics

Variables	Experimental group		Control group		χ^2
	Number	%	Number	%	
Maternal age (year)					
18-19	10	27.0	12	32.4	0.80
20-34	27	73.0	25	67.6	
Marital status					
Separated, divorced	3	8.1	2	5.4	1.00
Married	34	91.9	35	94.6	

Table 4 (continued)

Comparison of the Experimental and Control Group Classified by Demographic Characteristics

Variables	Experimental group		Control group		χ^2
	Number	%	Number	%	
Education level					
≤ Grade 12	27	73.0	29	78.4	0.79
> Grade 12	10	27.0	8	21.6	
Religion					
Buddhist	24	64.9	19	51.4	0.38
Muslim	12	32.4	18	48.6	
Christian	1	2.7	0	0.0	
Family type					
Nuclear family	18	48.6	14	37.8	0.48
Extended family	19	51.4	23	62.2	
Income (Baht) per month					
2,000-5,000	12	32.4	14	37.8	0.74
> 5,000-10,000	19	51.4	17	45.9	
> 10,000	6	16.2	6	16.2	
Occupation					
Housewife	22	59.5	17	45.9	0.72
Office worker in company	10	27.0	14	37.8	
Merchant	5	13.5	4	10.8	
Government official	0	0	2	5.4	
Maternal trait anxiety (Scores)					
40-59	18	48.6	18	48.6	1.00
60-80	19	51.4	19	51.4	
Enrolled gestational age (Weeks)					
$26\text{-}26^{+6}$	12	32.4	13	35.1	1.00
$27\text{-}27^{+6}$	25	67.6	24	64.9	

Table 4 (continued)

Comparison of the Experimental and Control Group Classified by Demographic Characteristics

Variables	Experimental group		Control group		χ^2
	Number	%	Number	%	
Gestational age at birth (Weeks)					
38-38^{+6}	13	39.4	11	33.3	0.88
39-39^{+6}	9	27.3	12	36.4	
40-40^{+6}	11	33.3	10	30.3	

The Study Variables

This study determined the birth outcomes, the Apgar score at 1st and 5th minute after birth in newborns, and birth duration of 1st and 2nd stage of labor, and total time in the laboring process. The confounding variable of pethidine usage for pain relief and augmentation during labor that might have been prescribed by the physician and had affected the expected outcomes of the study were compared in both groups (Table 5).

In the experimental group, more than half of the subjects (57.6%) did not receive pethidine for pain relief. The rest of the subjects received 50 mg, 75 mg, and 100 mg (30.3%, 9.1%, and 3.0% respectively) with a mean of 25.0 mg (SD = 31.25). Almost half the subjects in the control group (48.5%) did not receive pethidine, and for those who did, doses of 50 mg, 75 mg, and 100 mg were given (42.4%, 6.1%, and 3.0% respectively) with a mean of 28.79 mg (SD = 30.05). By using a chi-square test, there was no significant difference in the doses of pethidine usage between the two groups ($p > 0.05$) (Table 5).

In terms of augmentation of labor, almost half of the subjects in the experimental group did not receive augmentation of labor (42.4%). The rest of the subjects received artificial rupture of membranes (ARM) (18.2%), were given Syntocinon (12.1%), and had received ARM with Syntocinon (27.3%). Whilst nearly one-third of the subjects in the control group did not receive augmentation of labor (27.3%), the rest of the subjects received ARM (21.2%), and were given Syntocinon (18.2%), and one-third of them had received ARM with Syntocinon (33.3%). The chi-square test revealed that there was no significant difference in the confounding variable of augmentation of labor between the two groups ($p > 0.05$).

In terms of the Apgar score, at the 1st minute after birth, the majority of the subjects in the experimental group had scores of 8-10 and ≤ 7 (93.9% and 6.1% respectively). The results were the same for both groups at the 5th minute after birth (100%). The chi-square test also showed that there were no significant differences in both the 1st and 5th minute Apgar score between the two groups ($p > 0.05$).

Table 5

Comparison of the Experimental and Control Group Classified by Pethidine Usage during Labor, Augmentation of Labor, and Apgar Score at 1st and 5th minute

Variables	Experimental group (N = 33)		Control group (N = 33)		χ^2
	Number	%	Number	%	
Pethidine Usage during Labor					
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		
Augmentation					
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	
Apgar Score at 1st Minute					
≤ 7	2	6.1	5	15.2	0.43
8-10	31	93.9	28	84.8	
Apgar Score at 5th Minute					
≤ 7	0	0	0	0	1.00
8-10	33	100	33	100	

In terms of time spent in labor, the mean score of the 1st and 2nd stages of labor, and the total time in the laboring process of the experimental group were 519.88, 27.42, and 559.06 minutes (SD = 185.68, 14.84, and 203.43 respectively). In contrast, the mean score of the control group of the 1st and 2nd stages of labor, and the total time laboring were 657.79, 30.61, and 683.58 (SD = 272.79, 14.17, and 276.40 respectively). By using t-test, there were significant differences in the 1st stage and total duration time of labor ($p < 0.05$), but there was no significant difference in the 2nd stage of labor ($p > 0.05$) (Table 6).

In relation to the newborn weight, the mean weight of the newborn baby of the experimental group was 3,076.97 grams (SD = 311.22), whereas the mean newborn weight of the control group was 3,125.45 (SD = 287.40). Using the *t-test*, there was no significant difference in the newborn weight between the experimental group and the control group ($p > 0.05$) (Table 6).

Table 6

Comparison of the Experimental and Control Group Classified by Length of Labor and Newborn Weight

Characteristic	Experimental Group (N = 33)		Control Group (N = 33)		*t*
	Mean	SD	Mean	SD	
Length of Labor (minutes)					
1^{st} stage	519.88	185.68	659.79	272.79	-2.436^{*}
2^{nd} stage	27.42	14.84	30.61	14.17	-0.891
Total time	559.06	203.43	683.58	276.40	-2.084^{*}
Newborn Weight (grams)	3,076.79	311.22	3,125.45	287.40	-0.657

Note. * $p < 0.05$

Hypotheses Testing

Hypothesis 1: "The mean score of labor pain of the experimental group is lower than that of the control group." ANOVA (split-plot design) was test three times to compare pain between the two groups. The mean values of VASPS in the experimental group were 51.79, 67.24, and 83.48, and the mean values in the control group were 57.91, 71.91, and 88.03 respectively. Means and standard deviations of labor pain over time of both groups are presented in Table 7, and each time point of both groups showed a significant difference ($p < 0.05$). Bonferroni comparisons revealed that there were significant differences between pair-wise comparisons and group-wise comparisons. Both groups showed an increase of labor pain, and the scores of the experimental group were consistently lower than those of the control group (Figure 5). Repeated measures of ANOVA showed a significant difference in labor pain of the subjects in the experimental group ($F_{(1, 32)} = 2{,}134.48$, $p < 0.001$, partial $\eta^2 = 0.99$, observed power = 1.00). Post-hoc pair comparisons revealed a significant difference over the three times ($p < 0.001$). Furthermore, ANOVA (split-plot design) was also computed to test the effect of group, time, and interaction (time by group). It demonstrated that there were significant differences between the two groups ($F_{(1, 64)} = 6.47$, $p < 0.05$, partial $\eta^2 = 0.09$, observed power = 0.71) and time ($F_{(2, 128)} = 380.17$, $p < 0.001$, partial $\eta^2 = 0.86$ observed power = 1.00) but no interaction effect was found (Table 8). Thus pain assessed by VASPS over the three times in the active phase of labor of the experimental group was lower than that of the control group.

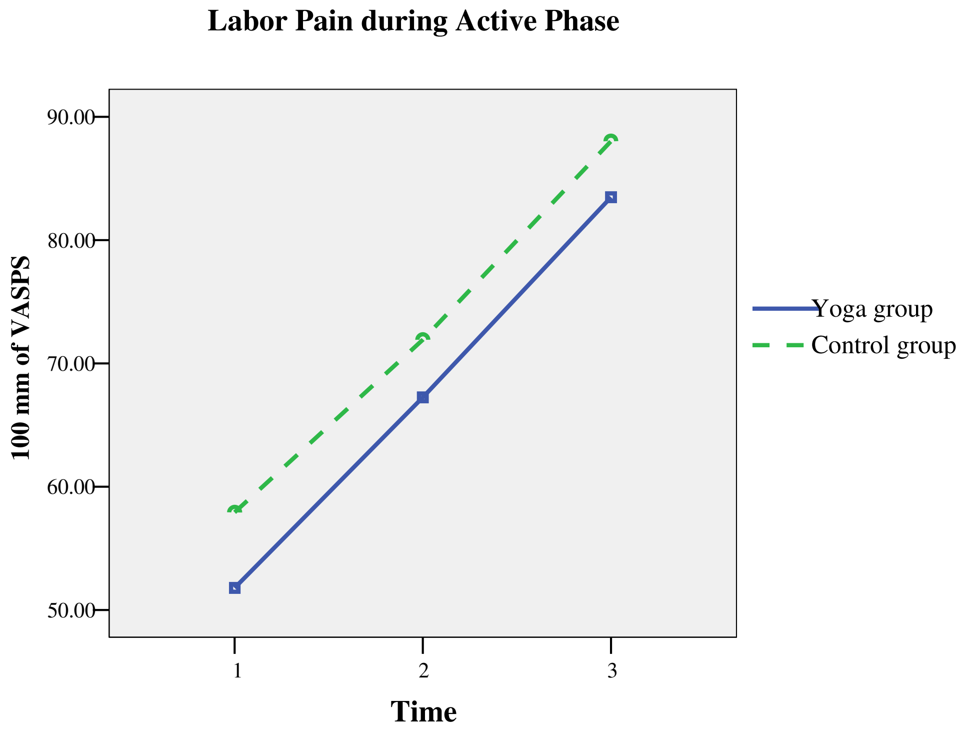

Figure 5 Mean labor pain (VASPS) during the Active Phase increased significantly at each of the three data points in both groups, and was significantly lower in the experimental group compared to the control group (N = 66).

Table 7

Comparison of the Experimental and Control Group Classified by Labor Pain (VASPS) during the Active Phase

Data Points	Labor Pain During the Active Phase				t
	Experimental Group		Control Group		
	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 *

Note. * $p < 0.05$

Table 8

Analysis of Variance for Labor Pain (VASPS) during the Active Phase

Source of Variation	SS	df	MS	F	η²	Power
Between-Subject Effects						
Group	1,293.11	1	1,293.11	6.47*	0.09	0.71
Residuals	12,788.83	64	199.83			
Within-Subject Effects						
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	5,311.41	128	41.50			

Note. * p < 0 .05, *** p <0.001

The results by VASPS were congruent with the results by PBOS. ANOVA (split-plot-design) revealed that the mean values of PBOS in the experimental group were 13.09, 11.21, and 9.82, and the mean values in the control group were 12.27, 10.42 and 8.52 respectively, with the significant difference at each time point ($p < 0.05$) (Table 9). Both groups showed a decrease of PBOS and the experimental group showed consistently higher scores of labor pain compared with those in the control group (Figure 6). For subjects in the experimental group there was a significant difference in labor pain ($F_{(1, 32)} = 2{,}501.36$, $p < 0.001$, partial $\eta^2 = 0.99$, observed power = 1.00). Three means using Bonferroni comparisons were significantly different from each other. Post-hoc pair comparisons demonstrated a significant difference over time ($p < .001$). It showed that there were significant differences between the groups ($F_{(1, 64)} = 7.37$ $p < 0.01$, partial $\eta^2 = 0.10$, observed power = 0.72) and time ($F_{(2, 128)} = 179.38$, $p < 0.001$, partial $\eta^2 = 0.74$, observed power = 1.00) but no interaction effect was found (Table 10). Therefore pain, assessed by PBOS three times in the active phase of labor, suffered by the experimental group was higher than that of the control group.

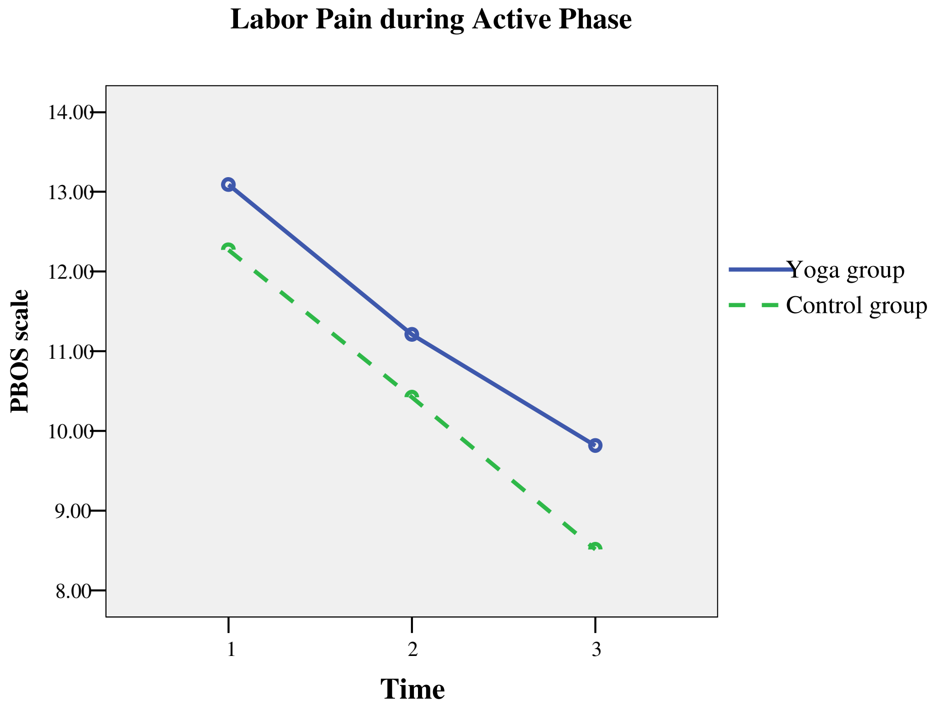

Figure 6 Mean labor pain (PBOS) during the Active Phase decreased significantly at each of three data points in both groups, and was significantly higher for the experimental group which indicated less pain compared to the control group (N = 66).

Table 9

Comparison of the Experimental and Control Group Classified by Labor Pain (PBOS) during the Active Phase

Data Points	Pain Behavioral Observation Scale				*t*
	Experimental Group		Control Group		
	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 *

Note. * $p < 0.05$

Table 10

Analysis of Variance for Labor Pain (PBOS) during the Active Phase

Source of Variation	SS	df	MS	F	η²	Power
Between-Subject Effects						
Group	46.55	1	46.55	7.37^{**}	0.10	0.76
Residuals	404.34	64	6.32			
Within-Subject Effects						
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			

Note. $^{**}p < 0.01$, $^{***}p < 0 .001$

To sum up, though the labor pain was increasing throughout the laboring process, VASPS and PBOS demonstrated that the experimental group had better scores in labor pain than the control group. Therefore, the hypothesis that “the mean score of labor pain of the experimental group is lower than that of the control group” was supported.

Hypothesis 2: “The mean score of maternal comfort during labor of the experimental group is higher than that of the control group.” By using ANOVA (split-plot design), both groups showed a decrease of maternal comfort, and the maternal comfort scores of the experimental group were consistently higher than that of the control group (Figure 7). The mean values of comfort in the experimental group were 52.88, 40.03 and 29.64, and at the same time the mean values in the control group were 45.00, 33.33, and 23.67 respectively (Table 11). Bonferroni comparisons showed that the means were significantly different from each other. Maternal comfort of subjects in the experimental group was reduced significantly ($F_{(1, 32)} = 436.56$, $p < 0.001$, partial $\eta^2 = 0.93$, observed power = 1.00). Post-hoc pair comparisons revealed a significant difference over the times ($p < 0.001$). It was revealed that there were significant differences between groups ($F_{(1, 64)} = 6.61$, $p < 0.05$, partial $\eta^2 = 0.09$, observed power = 0.72) and times ($F_{(2, 128)} = 433.65$, $p < 0.001$, partial $\eta^2 = 0.87$, observed power = 1.00), but there was no interaction effect (Table 11). As a result, maternal comfort assessed by VASTC over three times in the active phase of labor of the experimental group was higher than that of the control group.

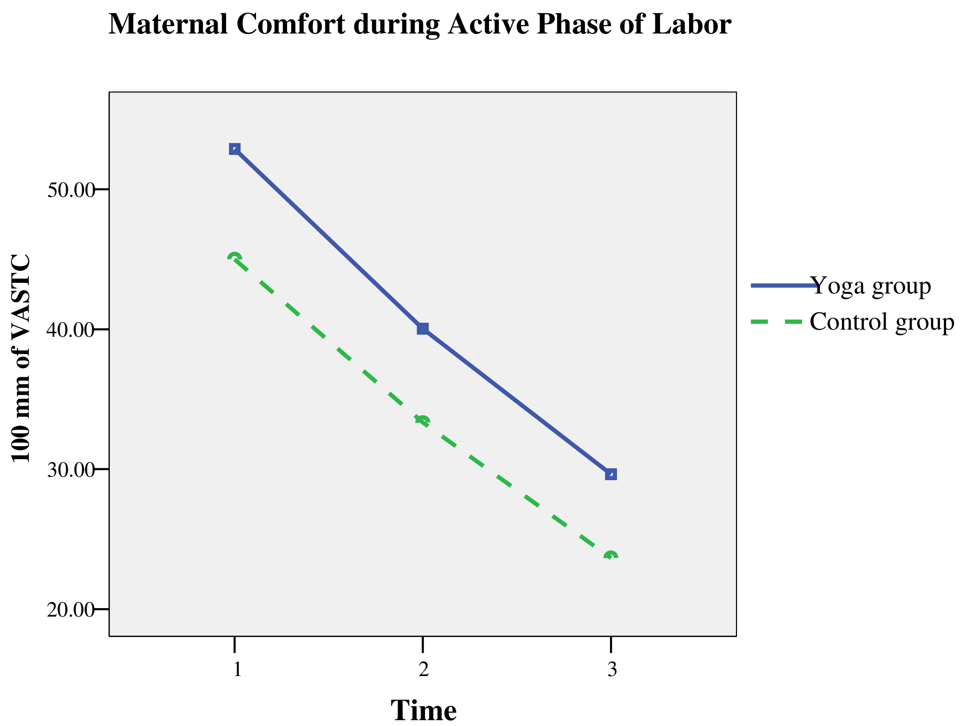

Figure 7 Mean maternal comfort (VASTC) during the Active Phase of labor decreased significantly at each of three data points in both groups, and was significantly higher in the experimental group compared to the control group (N = 66).

Table 11

Comparison of the Experimental and Control Group Classified by Maternal Comfort (VASTC) during the Active Phase

Data Points	Maternal Comfort During Labor				t
	Experimental Group		Control Group		
	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 *

Note. * $p < 0.05$

Table 12

Analysis of Variance for Maternal Comfort (VASTC) during the Active Phase

Source of Variation	SS	df	MS	F	η²	Power
Between-Subject Effects						
Group	2,321.64	1	2,321.64	6.61*	0.09	0.72
Residuals	22,485.39	64				
Within-Subject Effects						
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	2,427.39	128	23.34			

Note. * $p < 0.05$, *** $p < 0.001$

In additional, a *t*-test was used to consider the difference in the maternal comfort by MCDL between the two groups at two hours after giving birth (Table 13). The results showed a statistically significant difference in the mean score of maternal comfort ($p < 0.05$ with the effect size of 0.50). Thus, maternal comfort assessed by MCDL of the experimental group was higher than that of the control group.

Table 13

Comparison of the Experimental and Control Group Classified by Maternal Comfort (MCDL) at two hours After Birth

Group	Mean (SD)	Effect size	Mean difference and 95% CI	*t*
Experimental	156.70 (13.43)	.50	6.34 (0.14, 12.53)	.045*
Control	150.36 (11.70)			

Note. * p < 0.05

In summary, there was a significant difference in maternal comfort between the three times of measurement during the active phase. These results were similar to the t-test result of maternal comfort at two hours after birth. Accordingly, the hypothesis that "the mean score of maternal comfort during labor of the experimental group is higher than that of the control group" was supported.

Hypothesis 3: "The mean score of birth outcomes (length of labor, Apgar score) of the experimental group are better than that of the control group." In addition there were sub-hypothesis 3.1, that the "the length of labor of the experimental group is shorter than that of the control group", and sub-hypothesis 3.2 that the "The Newborns in the experimental group are not at higher risk than that the newborns in the control group." The results in Table 6 showed that there were statistically significant differences in the 1st stage and total duration time of labor at $p < 0.05$, but there was no significant difference in the 2nd stage of labor ($p > 0.05$). The t-test results from Table 5 showed no significant differences in both the 1st and 5th minute Apgar score between the two groups ($p > 0.05$). Thus, these research hypotheses were partially supported.

Hypothesis 4: "The mean score of maternal comfort during pregnancy of the experimental group is higher than that of the control group." By using ANOVA (split-plot design), VASTC revealed that there were significant differences between the groups ($F_{(1, 72)} = 11.69$, $p < 0.01$, partial $\eta^2 = 0.14$, observed power = 0.92) and times ($F_{(5, 360)} = 28.73$, $p < 0.001$, partial $\eta^2 = 0.29$, observed power = 1.00), but no interaction effect was found (Table 15). The mean values of maternal comfort in the experimental group were 76.51, 72.49, 71.16, 69.30, 66.84, and 68.38, whereas those in the control group were 74.14, 68.51, 66.35, 63.38, 60.59, and 59.43 respectively (Table 14). At Time1, the *t-test* demonstrated that there was no significant difference between to groups, but the rest of time points were significant difference of both groups. As pregnancy advanced, both groups showed a decrease in maternal comfort. However, the maternal comfort scores of the yoga group were consistently higher than those of the control group (Figure 8). Post-hoc pair comparisons revealed a significant difference between Time 1-Time 4 ($p < 0.01$), Time 1-Time 5, and Time 1-Time 6 ($p < 0.001$).

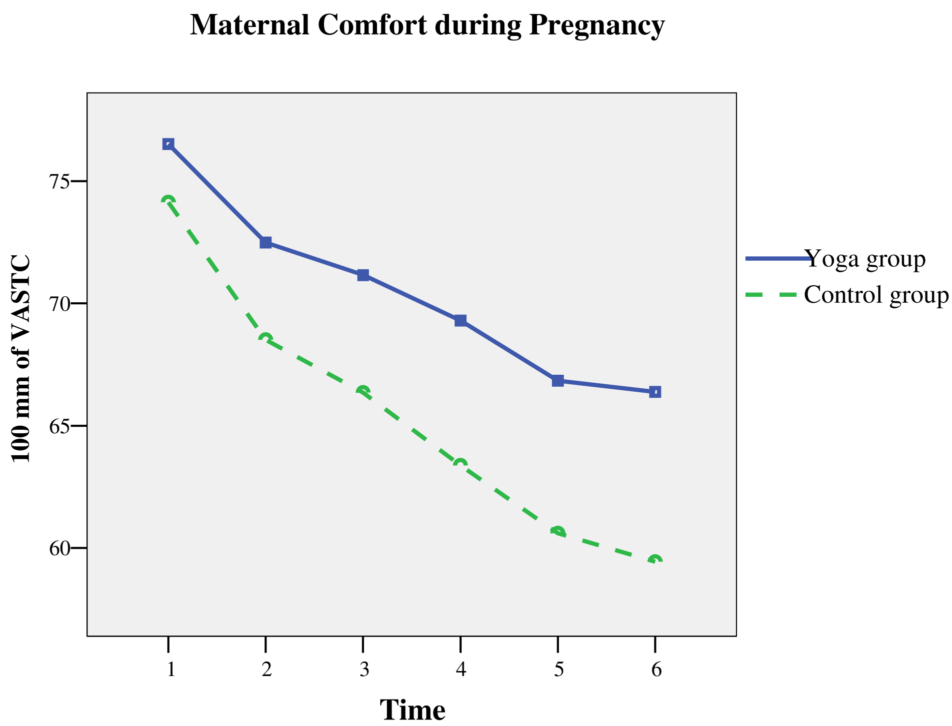

Figure 8 Mean maternal comfort (VASTC) during pregnancy decreased significantly at each of six data points in both groups, and was significantly higher in the experimental group compared to the control group (N = 74).

Table 14

Comparison of the Experimental and Control Group Classified by Maternal Comfort (VASTC) during Pregnancy

Data Points	Maternal Comfort During Pregnancy				t
	Experimental Group		Control Group		
	M	*SD*	*M*	*SD*	
26-28 weeks (Time 1)	76.51	6.23	74.14	11.80	1.084
30 weeks (Time 2)	72.49	7.89	68.51	9.11	2.005*
32 weeks (Time 3)	71.16	8.80	66.35	10.77	2.104*
34 weeks (Time 4)	69.30	9.14	63.38	9.11	2.790**
36 weeks (Time 5)	66.84	8.31	60.59	11.46	2.683**
37 weeks (Time 6)	66.38	6.08	59.43	10.80	3.410**

Note. * $p < 0.05$, ** $p < 0.01$

Table 15

Analysis of Variance for Maternal Comfort (VASTC) during Pregnancy

Source of Variation	SS	df	MS	F	η^2	Power
Between-Subject Effects						
Group	2,825.23	1	2,825.23	11.69**	0.14	0.92
Residuals	17,398.51	72	241.65			
Within-Subject Effects						
Time	7,955.13	5	1,784.35	28.73***	0.29	1.00
Time*Group	261.37	5	58.63	0.94	0.01	0.32
Residuals	19,937.17	360	62.11			

Note. ** $p < 0.01$, *** $p < 0.001$

The results of MCDP were similar to those of VASTC. Table 16 shows that the mean values of maternal comfort measured by MCDP in the experimental group were 155.22, 146.59, and 141.59, while those in the control group were 152.81, 140.97, and

134.68 respectively. There was no significant difference at Time 1, but there were significant difference at Time 2 and Time 3 between both groups. The use of Bonferroni comparisons showed that the three means were significantly different from each other. Both groups showed a decrease in maternal comfort as pregnancy progressed, and the maternal comfort scores of the experimental group were consistently higher than those of the control group (Figure 9). Subjects in the experimental group had significantly different scores in maternal comfort ($F_{(1, 36)}$ = 6,033.19, $p < 0.001$, partial $\eta^2 = 0.99$, observed power = 1.00). Post-hoc pair comparisons revealed a significant difference of Time 1-Time 2 ($p < 0.01$), and Time 1-Time 3 ($p < 0.001$). It was also revealed that there were significant differences between the groups ($F_{(1, 72)} = 4.04$, $p < 0.05$, partial $\eta^2 = 0.05$, observed power = 0.51), and time ($F_{(2, 144)} = 60.75$, $p < 0.001$, partial $\eta^2 = 0.46$, observed power = 1.00), but no interaction effect was found (Table 17).

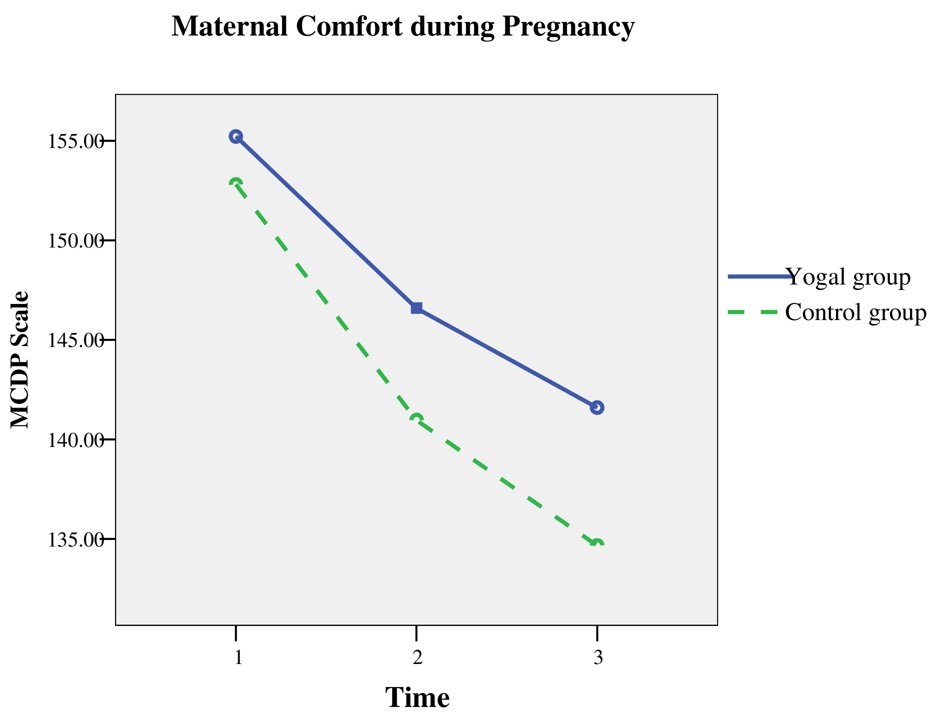

Figure 9 Mean maternal comfort (MCDP) during pregnancy decreased significantly at each of three data points in both groups, and was significantly higher in the experimental group compared to the control group (N = 74).

Table 16

Comparison of the Experimental and Control Group Classified by Maternal Comfort (MCDP) during Pregnancy

Data Points	Maternal Comfort During Pregnancy				*t*
	Experimental Group		Control Group		
	M	*SD*	*M*	*SD*	
26-28 weeks (Time 1)	155.22	19.47	152.81	17.32	0.561
34 weeks (Time 2)	146.59	9.41	140.97	8.69	2.671**
37 weeks (Time 3)	141.59	9.59	134.68	7.90	3.386**

Note. **$p < .01$

Table 17

Analysis of Variance for Maternal Comfort (MCDP) during Pregnancy

Source of Variation	SS	df	MS	F	η^2	Power
Between-Subject Effects						
Group	1,377.52	1	1,377.52	4.04^{*}	0.05	0.51
Residuals	24,546.70	72	340.93			
Within-Subject Effects						
Time	9,587.38	2	7,024.51	60.75^{***}	0.46	1.00
Time*Group	199.79	2	146.39	1.27	0.02	0.23
Residuals	11,362.16	144	115.62			

Note. * $p < 0.05$, *** $p < 0.001$

In conclusion, the results by VASTC were in accord with the results by MCDP. Therefore, the hypothesis that "the mean score of maternal comfort during pregnancy of the experimental group is higher than that of the control group" was supported.

Hypothesis 5: "Pregnant women who undertake a greater quantity of yoga practice (more frequently and for a longer period of time in minutes) have higher maternal comfort than those who undertake a lesser quantity of yoga practice." The descriptive statistics of the "quantity" of yoga practiced are shown in Table 17. The possible range of index scores of the frequency and duration in minutes of yoga practice were 10-30. There was a positive correlation between frequency and duration of yoga practice ($r = 0.326$, $p < 0.05$). According to regression analysis, there were no significant linear relationships between maternal comfort and the frequency and duration of yoga practice, ($F_{(2, 36)} = 1.902$, $p = 0.165$ (Table 18). Therefore, the hypothesis proposed was not supported.

Table 18

Descriptive Statistics of the Index Score of Frequency and Duration of Yoga Practice

Variable	Frequency				Duration			
	Max.	Min	Mean	SD	Max.	Min.	Mean	SD
Quantity	19.33	9.67	14.48	3.00	19	11	14.66	2.18

Table 19

Regression Analysis of Quantity of Yoga Practice on Maternal Comfort

Predictor	R^2	Adjusted R Square	b	SE	Beta	t
Frequency	0.101	0.048	-0.862	0.709	-0.209	-1.216
Duration			1.795	0.977	0.316	1.838

$F_{(2, 36)} = 1.902$, $p = 0.165$

Discussion

The results of the study be discussed and compared with previous studies. Discussion of the study findings is presented and organized according to the research hypotheses. The Yoga-Sutra of Patanjali and the Kolcaba's theory of comfort are addressed in the discussion.

Hypothesis 1: "The mean score of labor pain of the experimental group is lower than that of the control group." The study revealed that the experimental group had VASPS scores as well as PBOS scores that were consistently better than those of the control group (Tables 7-10, Figures 5-6). Those who participated in the experimental group had significantly lower pain levels, from both self-reports

(VASPS) and observational scoring (PBOS), than those of the control group over the time schedule. Pair-wise comparisons indicated that both of these pain scales changed significantly from the 1st, 2nd, and 3rd of the data points in both groups. The results of the study were comparable with studies of yoga intervention for other types of pain such as osteoarthritis of the hands. In one study the yoga treated group improved significantly more than the control group with less pain during activity, less tenderness, and better range of motion in the fingers (Garfinkel, Schumacher, Husain, Levy, & Reshetar, 1994). As a result of a yoga-based regimen improvement in grip strength (increased from 162 to 187 mm Hg; p = .009) and pain reduction (decreased from 5.0 to 2.9 mm; p = .02) was found in subjects suffering from carpal tunnel syndrome (Garfinkel et al., 1998). The results of this study were similar to others that investigated dealing with pain in relation to yoga programs.

In relation to pain perception, the body movements of the asanas, pranayama, and meditation techniques are beneficial to the spine and enhance the circulation of the largest volume of cerebrospinal fluid (CSF) within the cranial and spinal bones. Glassey (2002) has explained that yoga practice places great emphasis on the spine because of the flow of CFS around and within the brain and spine, and its value to neuropeptides, especially endorphins or serotonin concentrated in the CSF that raises the threshold of the mind-body to pain. In addition, asanas or postural patterns are initiated slowly and with attention to internal proprioception and maintaining a full diaphragmatic breath. These patterns are performed using a minimum amount of voluntary effort and energy expenditure for its maintenance and adjustment. The increased perception of proprioceptive information, awareness of thoughts and emotions, and the development of non-reactivity to physical sensation result in the attainment of positive functional outcomes. It modifies the parasympathetic autonomic nervous system to avoid cortical stimulation and sub-cortical compensatory motor patterns (Taylor, 2003). Thus, yoga intervention for pain acts to either create competing impulses in the central nervous system (CNS) preventing painful stimuli from proceeding through the gate mechanism or stimulate the release of endogenous endorphins and serotonin.

Evidence from observational and experimental research shows that in human pregnancy, pain threshold would be expected to increase gradually from 30 weeks, accelerate during the last 3-4 weeks of pregnancy and rise further during active labor and birth until 24 hours following birth (Gintzler & Liu, 2001; Cogan & Spinnato, 1986; Whipple, Joimowich, & Komisaruk, 1990; Gintzler & Komisaruk, 1991). Therefore, prenatal yoga practice offers, through relaxation techniques, methods that help to relieve conditions creating and sustaining the pain, focus on decreasing pregnant women's perception of pain, and assist them to develop deep breathing. This releases the physical tension in the body as well as the emotional tension felt in anticipation of labor and delivery.

Hypothesis 2: "The mean score of maternal comfort during labor of the experimental group is higher than that of the control group." Pregnant women in the experimental group had significantly higher comfort scores during the active phase over the three times assessed by the VASTC (Tables 11-13, Figure 7), and by MCDL two hours after giving birth (Table 13), compared with those in the control group This was in spite of their overall comfort decreasing as the labor progressed. This is similar to the following studies.

Kardong-Edgren (2001) recently observed that in busy labor and delivery units today, nursing care means providing bed rest, electronic fetal monitoring and epidural anesthesia when a woman reaches active labor. The chances of providing one-to-one labor support are unlikely, as staffing ratios do not permit such support. Therefore, childbirth is a time of enormous stress for many women, especially for those who give birth to their first child without childbirth preparation (Lowe, 1993) or not having paid attention to practicing techniques used for coping with the actual labor pain.

Throughout the childbirth experience, pain modifies and affects the level of comfort, which women achieve during labor pain. Women feel little intermittent pain during the uterine relaxation, but increasing pain is felt as labor progresses. Yoga practice involves the synchronization of pranayama and yoga nidra, which is mostly used from the beginning of the active phase, leads to a state of deep relaxation in which the mind and body experience calmness. At this point, laboring women in the experimental group evaluate whether the comfort outcomes had been met. A feeling of comfort indicated that positive tensions were being restored, leading to more constructive behavior, and described as a sense of renewal that could strengthen women even though they might be experiencing discomfort. Through this technique, the experimental group remained relatively comfortable and “in control” although labor intensified. This might serve to enhance feelings that empowered the women to control themselves and so be more active in their childbirth experience (Koehn, 2000). That means that when one comfort is met, other needs are positively affected and total comfort is enhanced.

Hypothesis 3: "The mean score of birth outcomes (length of labor, Apgar score) during labor of the experimental group is better than that of the control group." Findings from this current study showed that women in the experimental group had a significantly shorter duration of the first stage of labor and of total labor time than did women in the control group, although the duration of the second stage of labor did not differ between the two groups (Table 6). These results were similar to a previous study of the efficacy of yoga on birth outcome during pregnancy. In that RCT study, 21 women in the yoga group and 19 women in the control group were enrolled. Women were matched for age, gravida and gestational age. The yoga group practiced physical postures, breathing and meditation, one hour daily, from the date of entry into the study (18-20 weeks) until delivery. The control group practiced standard antenatal exercises one hour twice a day during the study period. In the yoga group compared to the control group the number of hours of labor was significantly lower ($p < 0.01$) and the baby's birth weight heavier ($p < 0.01$), there was less anesthesia required ($p < 0.001$), and there was a higher number of normal deliveries ($p = 0.05$) (Maharana, 2006).

A study describing the relationship between exercise during the last trimester of pregnancy and physiological outcomes of mothers and newborns was undertaken to determine whether differences exist between active and sedentary exercise patterns on these variables. It revealed that brisk walking was the preferred physical activity among 47% of the participants, whereas women in the sedentary group tended to consider work-related activity as their main source of exercise. Findings demonstrated no differences between the active and sedentary groups on maternal weight gain, the baby's birth weight, gestational age, or duration of labor. It was noted that the length of labor was longer in the sedentary group (Horns, Ratcliffe, Leggett, & Swanson, 1996).

Liamputtong and colleagues (2005) explained that Thai women were advised by their mothers or women and men of older generations how to prepare for the birth of the baby. Women mentioned the activities that would facilitate an easy birth, and that they should keep doing their normal routines or working throughout pregnancy. Alternatively, idleness could make birth difficult. Performing ongoing activities during pregnancy was a way to exercise, such as carrying on with housework or walking. These daily life activities would help make the abdomen 'loose' to facilitate an easy rotation of the baby's head downward so that an easy birth would follow. (Liamputtong, Yimyam, Parisunyakul, Baosoung, & Sansiriphun, 2005). This cultural practice might impact on the duration of birth, particularly in the control group in the study under review.

Some researchers found that the newborn of women who exercised during pregnancy did not differ from the newborn of sedentary women on Apgar scores (Horns, et al., 1996; Lokey, Tran, Wells, Myers, Tran, 1991). In the study being discussed there were no significant differences at 1st minute or 5th minute on the Apgar score between the experimental group and the control group (Table 5). However, augmentation and pethidine for pain relief during labor, factors known to influence Apgar scores, were also examined. There were no significant differences in the confounding variable of augmentation of labor and pethidine between the experimental and control groups (Table 5).

In summary, the findings from this present study confirmed those of previous studies in terms of significant differences of length of labor in the first stage, and total duration of labor of mothers who receive yoga programs as opposed to those who receive routine care.

Hypothesis 4*:* "The mean score of maternal comfort during pregnancy of the experimental group is higher than that of the control group." Pregnant women in the experimental group had significantly higher comfort scores over the six times assessed by VASTC (Tables 14-15, Figure 8), and over the three times assessed by the MCDP (Table 16-17, Figure 9) during their pregnancy than did those in the control group, even though their overall comfort was decreasing as the pregnancy progressed. At these stages the body goes through many fluctuations that can cause instability and discomfort during pregnancy. The provision of strategies, like yoga techniques, used in antenatal training empowered the women to control themselves and so be more active during their labor experience and this developed ease and stability that enabled pregnant women's comfort needs to be met. Thus, yoga can help the pregnant woman by giving her the tools that she will need to have an enjoyable pregnancy. Other explanations of how yoga leads to a state of deep relaxation have been documented in many studies (Raghuraj & Telles, 2003; Smith et al., 2006; Telles & Desiraju, 1991; Vempati & Telles, 2002). These effects, it has been hypothesised, may have similar mechanisms that operate in pregnant women and have direct effects on their nervous system and indirectly on the hypothalamus-pituitary-adrenal cortex system (HPA) axis (Narendran et al., 2005). This results in pregnant women gaining stress relief, which leads to higher comfort levels.

Hypothesis 5: "Pregnant women who undertake a greater quantity of yoga practice (more frequently and for a longer period of time in minutes) have higher maternal comfort than those who undertake a lesser quantity of yoga practice." The result of the current study shows that the variance in the maternal comfort was not accounted for its linear relationship with the quantity of yoga practice (Table 19). However, there was a positive correlation between frequency and duration of yoga practice (r = 0.326, $p < 0.05$), indicating that the pregnant women with higher frequency have higher durations of yoga practice. The evidence that there is a relationship between the intervention strength of yoga practice and outcomes is inconclusive. Engagement in the process of a behavioral intervention is a prime consideration when analyzing the intervention strength or the quantity of practice. Although participants can be mandated into a behavioral intervention program, it is probable that their outcomes will be strongly associated with their degree of initiative and participation in the intervention program (Huber et al., 2003). However, according to Beck (1995 as cited in Dowd, Kolcaba, & Steiner, 2003) in order for a new health seeking behavior to achieve outcome, especially a behavior requiring a cognitive shift, it requires sufficient and timely support. Beck' s postulation may explain why the quantity of yoga practice (increasing frequency and duration) did not further improve expected outcomes.

A practice of at least 3 times per week and 30 minutes per time was a minimum requirement to achieve maternal comfort in this current study. This finding is similar to previous studies. Waelde et al. (2004)' s study of a yoga and meditation intervention (average weekly yoga-meditation practice set at 30 minutes of practice a day at least six days per week for a total of 180 minutes per week) in dealing with the stress experienced by dementia caregivers, it was revealed that adherence to the program was significantly associated with improvements in the levels of depression. The majority of caregivers reported that the intervention was useful and they reported subjective improvements in physical and emotional function, in spite of the fact that caregivers averaged time of practice fewer than the suggested 180 minutes of practice per week (mean = 91, SD = 61.1, and range of 0-173). Another study of a yoga program investigated non-directive somatic arousal, utilizing heart-rate data of trained and novice yoga practitioners before, during and following an auditory distraction in shavasana. The intervention consisted of a one and a half hour yoga sequence. No difference was found between trained and novice yoga practitioners (Burkett, Todd, & Adams, 2006). Additionally, a study looked at using yoga and exercise for multiple sclerosis sufferers. It found that there was no relative improvement of cognitive function in the intervention groups, though there was improvement in relation to secondary measures of fatigue compared to the control group (Oken et al., 2004). Therefore, the findings of the study under discussion regarding the relationship of maternal comfort were not associated with the frequency and duration of yoga practice supported by previous findings.

The effects of yoga practice during pregnancy on maternal comfort, labor pain, and birth outcomes in the present study can possibly be explained through the psychoneuroimmunology (PNI) interaction. Yoga practice is connecting with PNI as a holistic system. The neuroendocrine and immune systems operate in a bi-directional communication system. Bi-directionally, the immune system influences brain activity by many immune peptides, including the endorphins (Watkins, 1995; Zeller, McCain,

& Swanson, 1996). PNI demonstrates the physical manifestation of human experiences such as emotions, thinking, and spiritual experiences. These relationships are not unidirectional or linear cause-effect relations, but are circular complex networks of interdependent phenomena (Taylor, 2003). There is reasonable evidence that thoughts, feelings, emotions, and perceptions alter immunity. Relaxation training and meditation has been identified as bolstering the immune system (Starn, 1998). These forms of energy healing are addressed to a person's body as an energy field that interacts with other energy fields, which leads to health flowing freely in forms of energy, through and out of the body in a balanced manner (Bronstein, 1996). During illness or in an imbalanced state, the energy flow is obstructed, disordered, or depleted.

All components in yoga practice work and stimulate the *chakra* system. Each *chakra* is composed of seven levels related to the seven levels of the human energy field, and also of several vortices, each connected to a different organ or system of the body near to the *chakra* (Starn, 1998). When the *chakras* are open and spinning in a clockwise position the individual is receiving energy from the universal energy field in a healthy manner. Thus, the *chakra* or human energy vortices that take in energy are balanced through the practice of yoga (Hover-Kramer, 1996). Cultivating an intuitive awareness of the *chakras* during pregnancy can help shed inhibitions and release tension (Teasdill, 1999). The synchronized *asanas* with relaxation breathing, *bandha*, or *chanting the mantra* focuses the energy field in the body, which results in consciousness expansion. This helps pregnant women to participate knowingly in methods of reducing anxiety, stress, pain, and discomfort.

The program used in this study was composed of *yoga asanas, pranayama, yoga nidra, dhyana* or meditation, and a combination of *chanting mantras* leading to a meditative state. First, *yoga asanas* were designed in a sequence of set postures, which work at the *anna-maya-kosha* or the physical body level. They improve the physical functions by stretching, twisting, and toning the muscles of the body, which results in relieving muscle tension and improving the circulation. They massage and squeeze the inner organs, improving the functioning of each organ and toning them so that they are regular and balanced in the effective operation of the body. They also influence the endocrine gland secretion of hormones into the body by applying pressure to them, and they articulate the joints to remove stiffness or joint pains. They create awareness of the body and its function, and stabilize (*sthira*) the mind so that it can distinguish between the state of relaxation or calmness and tension or stress during the resting period between each pose. Moreover, the practice of *chanting a mantra* while holding a yoga posture has its effects on the autonomic nervous system (Telles, Nagarathna, & Nagendra, 1995) and can result in tension and emotions being eased (*sukha*) or released from the body (Taylor, 2003).

A study comparing yoga with progressive muscle relaxation has been undertaken. Yoga intervention accompanied the bodily postures that addressed mind-body breath coordination, whereas, the participants using progressive muscle relaxation listened to the tape-recorded voice of the yoga teacher to guide them through their relaxation. Following the 10-week intervention, yoga was found to be as effective as relaxation in reducing stress and anxiety, and in improving health status. Yoga was more effective than relaxation in improving mental health (Smith, Hancock, Blake-Mortimer, 2006). For pregnant women, *yoga asanas* benefit them in improving physical strength, in maintaining and enhancing flexibility, and in increasing endurance and energy. Using some *asanas* in preparing for an easier delivery resulted in shortening the length of labor. These techniques teach body awareness by identifying the area of tension and imbalance, and by increasing suppleness and the ability to relax from discomfort occurring during the pregnancy or delivery period.

Second, *pranayama* works at the *prana-maya-kosha* (vital or bioenergetic body) through to the *Anada-maya-kosha* (bliss body). From the yogic perspective, if energy flow is constricted or separated, mother and fetus could suffer. Labor pain is viewed as a consequence of imbalanced body energy. Thus, for a woman in labor, her experience may depend on how well her physical, psychological, and spiritual energies are balanced and harmonized. The benefits of *pranayama* include the increasing of oxygen to the blood, which is important to the metabolic process of regeneration in the entire body. The retention of the breath is needed for vitality and raising the energy levels of the body-mind or harmonizing the free flow of *prana* for women and the fetus during labor. By cultivating breathing patterns while pregnant, women can control anxiety, insomnia, and lethargy. In labor the breath will come of its own accord, producing a state of altered consciousness (Teasdill, 1999). It will help women stay calm and relaxed, increase the supply of oxygen to both mother and baby, especially in relation to fetal well-being and the Apgar scores of the newborn after birth, and it makes delivery easier. Breathing awareness enables women to stay calm and centered during labor, allowing them to welcome the rhythm of contractions instead of resisting it, which affects the perception of labor pain and comfort levels. A previous study of pranayama and shavasana showed that they might be valuable as adjuncts to the other medical therapy in patients with benign ventricular ectopics (Ravindra, Madanmohan, & Pavithran, 2005).

Third, *yoga nidra* is a specialized yoga practice that generates deep relaxation. *Shavasana* is the most important yoga posture becoming totally relaxed, as if one were dead. At the beginning, it works to calm the body and then focuses the mind in preparation for the posture to follow. *Shavasana* posture allows the energy that was created and released in the yoga postures to flow freely through the body allowing it to heal and be nourished; thus this pose releases stress and tension from the body or profoundly relaxes the individual (Coulter, 2001). A study by Sharma, Mahajan and Sharma (2007) also revealed that a person practicing *shavasana* could successfully reduce the physiological effects of stress. For pregnant women in this study, at the end of yoga practice, they would sit in a comfortable position and practice relaxation, by listening to a tape cassette guiding them in relaxing and releasing body awareness in stages. In this situation relaxation involves allowing the body and mind to become completely still and peaceful.

Fourth, *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 pranayama, reduces excessive thinking and phases out extraneous sensory stimuli, or withdraws the senses from the things that stimulate them (*pratyahara*). This achieves relaxation and a heightened sense of the spiritual. Waelde, Thompson, and Gallagher-Thompson (2004) studied the effect of yoga-meditation practice on stress suffered by dementia caregivers. The result showed improvement in levels of depression, anxiety, and perceived self-efficacy. In the present study, pregnant women were enabled to learn how to monitor the flow and effect of their thoughts, and how to direct their minds toward calmness despite the stress of outer circumstances.

In summary, all aspects of yoga practice lead to the preparation of physical strength-flexibility-energy, a state of body-mind relaxation in which the mind-body experiences calmness, and the development of self-awareness. Yoga practice consists of the harmonious flow of *prana* through *chakra*, and leads to a balance of the five sheaths of human existence. The effects of the Yoga program on the variables of labor pain, maternal comfort, and birth outcomes for this study are illustrated in Figure 10.

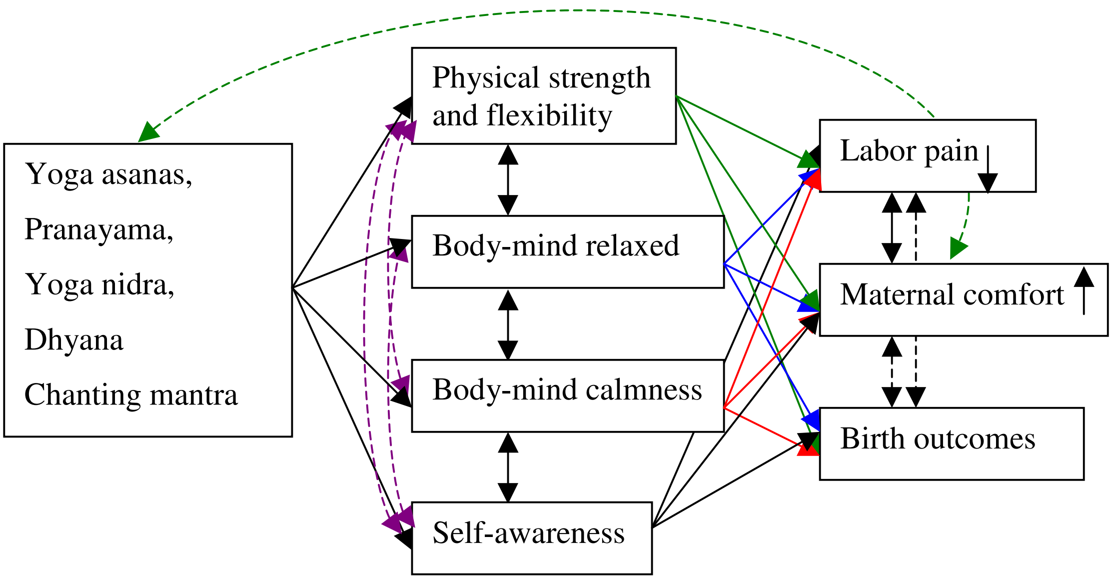

Figure 10 The Sequential Effect of the Pathways of Yoga on the Outcomes

Figure 10 shows the pathways of the sequences of yoga practice on the outcomes of the study. The components of yoga practice are connected; they encourage relaxation, flexibility and strength in a non-strenuous way. They bring the body into balance postural as a mechanical structure, and help to release some of the accumulated tension and stiffness in muscles and joints. They are also a way of re-educating the body to regain comfort from problems such as tiredness, back pain, nausea, anxiety, headaches and many other common complaints suffered in pregnancy.

Yoga practice provides ease from these discomforts, which may disappear altogether (Balaskas, 2003).

The focusing of the breathing exercise of pranayama releases tension in the body, and the attention turns inwards and allows a person to experience and become more aware of feelings. They become more familiar with their thoughts, more in touch with their emotions and understand more clearly how the body expresses them. Therefore, yoga calms the mind and reduces anxiety, it brings more feeling to the body and this leads to a feeling of greater emotional stability, calmness, and equilibrium. As a result yoga can help a person to make the most of the sense of contentment and well-being which women can experience when they are pregnant. It motivates the pregnant women to sustain such behavior and practice in order to fulfill their comfort needs.

Practicing yoga while pregnant is an effective way of assisting women to relax. It helps them trust and have confidence in the power of their body, and so helps them go through the natural process that occurs during childbirth. The inner connections gained from yoga practice will help women to access their intuition, and give it time to rise up into conscious awareness. This benefits them when going through the labor experience. Thus, the synchronization of yoga practice used in this program can enhance maternal comfort and alleviate labor pain. It can also modify pain and affect the level of comfort a woman achieves during childbirth, and this comfort can diminish pain. This further correlates to the birth outcomes of length of labor and the Apgar score.

Statistical Significance Versus Clinical Significance

The findings of this current study support that yoga program during pregnancy significantly enhanced maternal comfort of the experimental group during pregnancy and during labor. It also significantly reduced labor pain with no adverse effects to mother and newborn, and improved the birth outcomes during labor. This statistical significance may also have clinical significance as yoga practice harmoniously contributes to the holistic nature of both a woman and her baby. Offering yoga as a nursing therapeutic means not only contributes benefits to the clients, but also increases a trust relationship between the nurses and their clients.

Conclusion

The women who were in the yoga program had less pain, and more maternal comfort as measured over three times during the active phase of labor and two hours after birth than those who were not in it. They also had more maternal comfort over time during pregnancy. The comparisons from post-hoc testing revealed less labor pain and more maternal comfort in the experimental group. There were no group differences in the confounding variables of the study. However, there were some findings that did not support this in terms of the Apgar scores, and there was some conflicting evidence regarding the length of labor in the second stage. Although there was a positive correlation between frequency and duration of yoga practice, there was no relationship between maternal comfort and the quantity of yoga practice.