CHAPTER 4

RESULTS

4.1 Reliability and standard error of measurements

Twenties subjects (4 men and 16 women) with a mean age of 28.50 ± 6.50 years (range from 21 to 40 years) participated in the session of reliability status. Characteristic and demographic data of the subjects participating in the reliability session were presented in Table 1. All participants were a healthy volunteer who reported the absence of a current musculoskeletal injury of the lumbar spine or lower limb.

Table 1 The characteristics and demographic of subjects in the reliability session.

Characteristics	Mean ± SD
Age (years)	28.50 ± 6.50
Weight (kilograms)	51.90 ± 8.07
Height (centimeters)	160 ± 8.61

An investigator or rater in this thesis project was a qualified physical therapist with 6 years of clinical experience in orthopedic physiotherapy. The investigator was trained by two experienced senior physical therapists to ensure that the standard uniform of methodology was utilized throughout the study trial.

All subjects were required to attend the Lumbo-pelvic movement control and sit-and-reach box tests. Each test was composed of two trial sessions with 1 hour

apart to allow for establishment of the test-retest reliability of the tests. The order in which the investigator assessed the participants was randomly designated. At the beginning of Lumbo-pelvic movement control test, a practice test less than 6 sessions was allowed for participant familiarization prior to the data recording (12, 44). For the sit-and-reach test, the walking warm-up for 5 minutes was allowed to prevent injury (42, 56).

Statistical procedures which were used as indicators of reliability and error for sit-and-reach test were intraclass correlation coefficients (ICCs) and standard error of measurements (SEMs), respectively (57). The Lumbo-pelvic movement control test was calculated with Kappa statistic to analyzes test-retest consistency. The results of ICCs and Kappa scores were obtained from statistical package (SPSS, version 10.0). The standard error of measurement (SEMs) values were obtained from the following formula (58)

SEMs = SD * (sqrt (1-ICCs))

Where SD is the standard deviation of the set of observed test scores, ICCs is the reliability coefficient for that measurement, and "sqrt" stands for "square root"

The summary values of ICCs and SEMs for the measurements of each dependent variable across the studies are presented in table 2 The value of the ICCs for flexibility measure used in the thesis is 0.94 which is acceptable reliability of the dependent variable under the test-retest conditions (57). The SEMs value reported for the flexibility measure used in the thesis is minimal (0.5 cm) indicating small variability between repeated measures.

Table 2 Summary table for the intraclass correlation coefficients (ICCs), standard error of the measurements (SEMs) and Kappa statistic for the dependent variables of Lumbo-pelvic movement control and sit-and-reach tests.

Dependent variables	ICCs	SEMs	Kappa
Lumbo-pelvic stability test	-	-	1.00
Sit-and-reach test	0.94	0.50	-

4.2 Characteristic of participants in the study

Subjects' characteristics and demographic data are presented in (**Table 3**) The mean age total was 31.65 ± 6.21 (20-45 years), mean weight total was 59.15 ± 11.81 (35-85 kilograms), and mean height total was 162.55 ± 6.42 (150-180 centimeters). At baseline there were no significant difference between the Pilates training and control groups in gender, mean age, mean height and mean weight.

Table 3 The characteristics and demographic of subjects.

Characteristic	Pilates group	Control group	Significance
Age (years)	33.2 ± 6.15	30.1 ± 6.03	*p*=0.116
Gender	Male=10 Female=10	Male=10 Female=10	*NS*
Weight (kilograms)	60.6 ± 10.68	57.7 ± 13.05	*p*=0.223
Height (centimeters)	163.8 ± 5.54	161 ± 7.13	*p*=0.447

4.3 Drop-out rate

All subjects completed the 8-week trial according to the study protocol. There were no complications or adverse condition reported during or after the experimental duration. All subjects strictly adhered to study protocol. Fifteen subjects well attended full session or 100% of training (16 sessions). Four subjects were presented 93.75% (15 sessions) in Pilates training attendance and only one subject appeared 75% (12 sessions) or at minimum of session training (**Table 4**). Control subjects were properly adhered to the trial protocol.

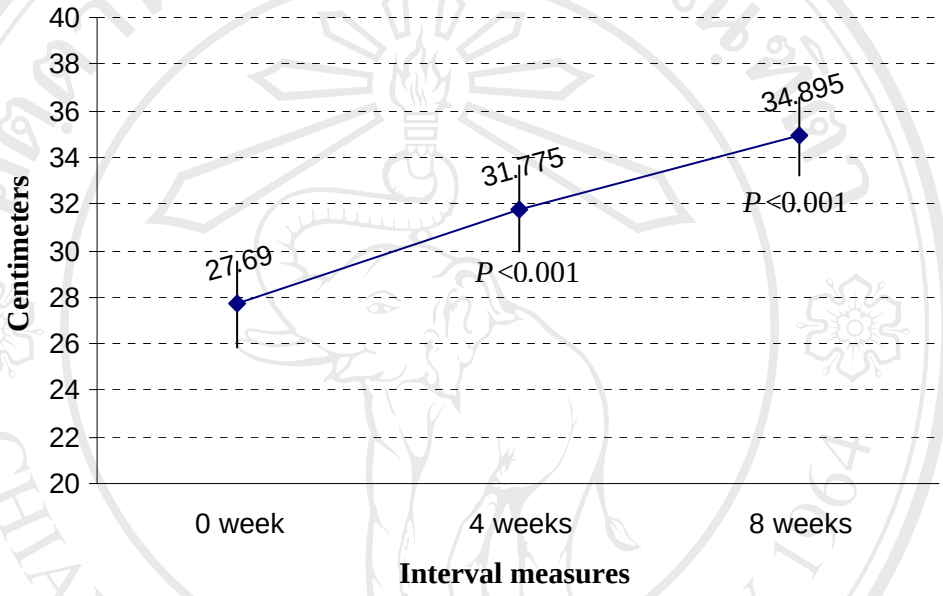
Table 4 Pilates training attendance.

Numbers of subjects	Numbers of sessions for training	Percent of attendance
15	16	100%
4	15	93.75%
1	12	75%

4.4 Flexibility (sit and reach box test)

In the Pilates group, the measure score of sit and reach box test from baseline (0 week), 4, and 8 weeks were 27.69 cm, 31.77 cm, and 34.89 cm, respectively. Pilates group improved flexibility significantly ($F_{(2,38)}=54.71$; $p<0.001$) during the time interval of 0, 4, and 8 weeks (**Fig 7**). In the control group, the mean baseline (0 week) of sit and reach box test was 22.74 cm. The sit and reach box test at 4 and 8 weeks for the period of study were 22.51 cm and 22.91 cm, respectively. However, the data showed that there was no significant ($F_{(2,38)}=0.165$; $p=0.849$) difference in flexibility for the control group from baseline (0 week), 4, and 8 weeks

interval study (**Fig 8**). The improvement of flexibility in Pilates group was also significantly greater than control group in both 4 and 8 weeks training sessions ($F_{(1,38)}$>15.06; p<0.001) (**Fig 9**).



*Statistical significant level when comparing to baseline data at week 0 (post-hoc analysis with Tukey's HSD**)**

Figure 7 Data of Mean ± SD in flexibility at baseline (0 week), 4, and 8 weeks of the Pilates training group.

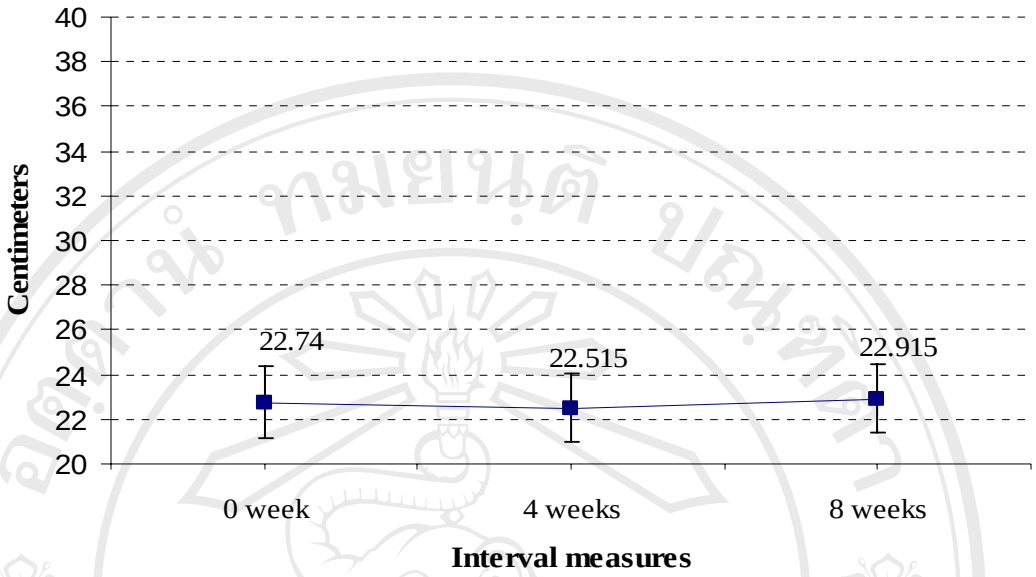
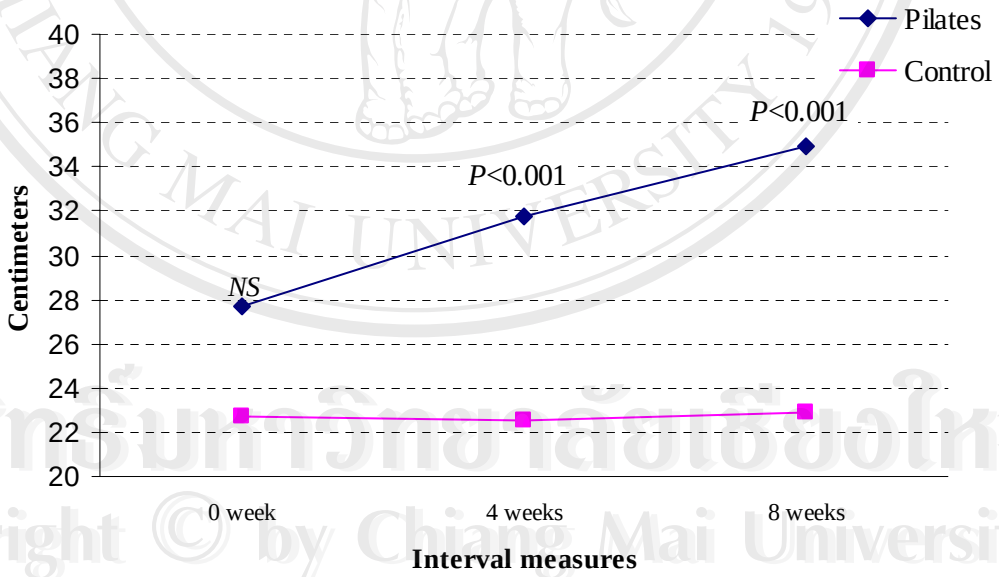


Figure 8 Data of Mean ± SD in flexibility at baseline (0 week), 4, and 8 weeks of the control group.



*Statistical significant level between groups (post-hoc analysis using t-test with correction for family wise error rate (*P<0.016*)

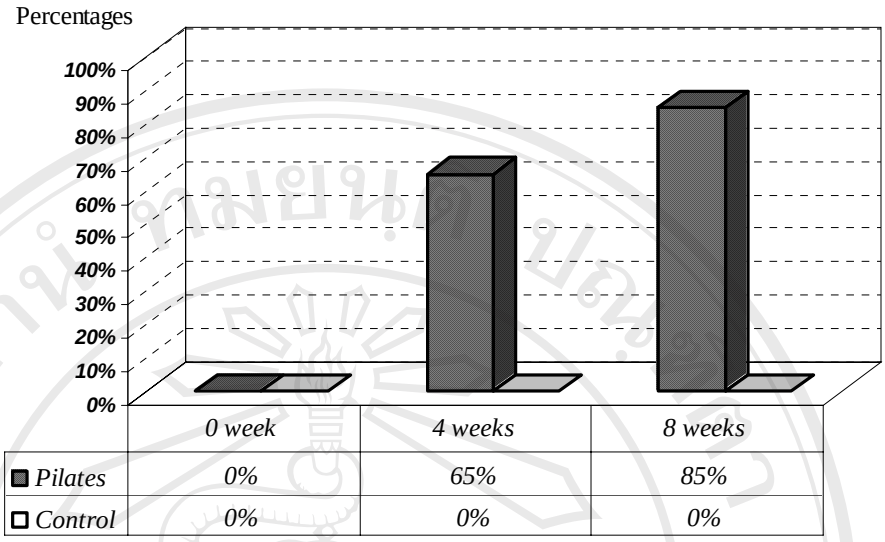
Figure 9 Data of Mean ± SD in flexibility at baseline (0 week), 4, and 8 weeks between Pilates training and control groups.

4.5 Lumbo-pelvic movement control

Lumbo-pelvic movement control was test in both Pilates training and control groups using Pressure Biofeedback Unit (PBU). The percentage of subjects from both groups for passing or failing the test was presented in **Table 5.** Pre-training or at the baseline period, there were no subjects in both Pilates and control groups passed the lumbo-pelvic movement control test. In Pilates group, there were 65% (13 subjects) and 85% (17 subjects) of the subjects passing the lumbo-pelvic stability test in 4 weeks and 8 weeks of training period, respectively (Fig 10)**.** It was found that there were significant differences between the percentage of passing the test during 4 weeks and 8 weeks of training in comparison to the baseline data (0 week) **(Table 5)**. There were no subjects in control group passed the lumbo-pelvic test at any stages of study (0, 4, 8 weeks) **(Fig 11)**. The results were identified that number of subjects passing the Lumbo-pelvic movement control test from the Pilates training group was significantly greater than that of the control group (p<0.001) **(Fig 10, 11)**.

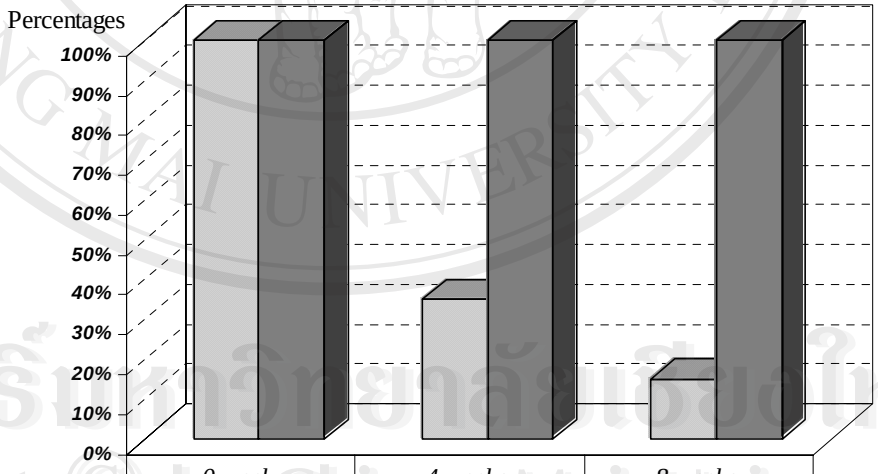
Table 5 Percentage (number) of subjects passing the lumbo-pelvic stability test from the Pilates training and control groups during the period of study (0, 4, and 8 weeks).

Groups	**Interval measures**		
	0 week	**4 weeks**	**8 weeks**
Pilates training	0%(0)	65%(13)	85%(17)
Control	0%(0)	0%(0)	0%(0)
Chi-square comparing between groups (sig. level)	NS	(x^2=19.25) p<0.001	(x^2=29.56) p<0.001



	0 week	4 weeks	8 weeks
Pilates	0%	65%	85%
Control	0%	0%	0%

Figure 10 The bar graph represents the percentages of the Pilates training and control groups passing the lumbo-pelvic stability test.



	0 week	4 weeks	8 weeks
Pilates	100%	35%	15%
Control	100%	100%	100%

Figure 11 The bar graph represents the percentages of the Pilates training and control groups failing the lumbo-pelvic stability test.

4.6 Stress level

Psychological stress level was assessed by Stress Inventory questionnaire as previously described in chapter 3. The stress level of Pilates and control groups at pre-training (0 week), post training 4 and 8 weeks was demonstrated in the **Table 6.** In Pilates group, the level of stress scores were declined from 11.65 to 9.40 and to 8.20 during 0, 4, and 8 weeks of participation in Pilates training, respectively. The result indicated that the stress level in week 8th for the Pilates training group significantly decreased (p<0.05) when comparing to the baseline score (o week). In contrast, the stress level of the control group was not significantly different during the interval measures at 0, 4, and 8 weeks (p>0.05). Although, the psychological stress level of Pilates training group seems to decrease, the statistical significance was not reached when comparing against the control condition (p>0.05). This may be the fact that the effect size in psychological stress level is quite low (Eta squared=0.139).

Table 6 The scores of psychological stress level of Pilates and control groups at 0, 4, and 8 weeks for the period of experiment (Mean ± SD).

Groups	**Interval measures**		
	0 week	**4 weeks**	**8 weeks**
Pilates training	11.65 ± 5.57	9.40 ± 3.64	8.20* ± 3.31
Control	12.45 ± 9.84	10.30 ± 6.22	11.55 ± 8.98

***** Statistical significance (p<0.05) in comparison to 0 week.