

The Effect of Pilates Stabilization Exercise and Kinesio taping on the Dysmenorrhea and Prostaglandin F2 α of Female University Students

This study, based on physical therapy interventions for menstruation disorders, observed the effect of Pilates stabilization exercises and Kinesio taping on dysmenorrhea and prostaglandin F2 α levels. Female college students (n=37) who had >70 points on the mood disorder questionnaire (MDQ) and >4 points on the visual analogue scale (VAS) were divided into three different groups, the Pilates group (PG, n= 13), Pilates and Taping group (PTG, n=12), Taping group (TG, n=12). Pilates and taping were performed 3 times a week for 6 weeks. Pre- and post-menstruation difficulties were measured through the MDQ. Changes in blood prostaglandin F2 α levels were also measured. Changes in pre- and post-menstrual pain and prostaglandin F2 α levels were significantly reduced in the PG, PTG, and TG. Changes in pre- and post-menstrual pain and prostaglandin F2 α levels resulted in significant differences in the PTG and TG. Dysmenorrhea and prostaglandin F2 α levels were significantly decreased in the TG than in the PTG. These findings suggest that Pilates stabilization exercises and Kinesio taping are effective in decreasing menstrual difficulties and pain in female college students.

Key words: *Pilates stabilization Exercise, Kinesio taping, dysmenorrhea*

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INTRODUCTION

A large percentage of women suffer from menstruation disorders before and after menstruation, and among them, 30 to 50 percent say their symptoms are minor to moderate, but 10 to 20 percent have severe pains that limit their daily activities¹⁾. Medicinal therapy for difficult menstruation comprises painkillers, inhibitors of prostaglandin synthesis, and oral contraceptives. Although the use of drugs is an effective method for pain control, long-term treatment side effects, such as misuse of drugs, are problematic²⁻³⁾. Worsening of menstrual difficulties means frequent medical treatment or increased reliance on painkillers or drugs, leading to side effects and interference in daily life⁴⁾. Alternative therapies to reduce menstrual pain include transcutaneous electrical nerve stimulation⁵⁾, mesotherapy⁶⁾, foot reflexology⁷⁾, aromatherapy⁸⁾, temperate therapy⁹⁾, taping therapy¹⁰⁾, and exercise therapy¹¹⁾. Taping

therapy has been found to reduce pain, decrease muscle mass, increase muscle strength, and change body balance¹²⁾. Kinesio taping therapy is a very safe treatment method that has few side effects, continues to work while the tape is applied to the skin, and is easy to use¹³⁾. Pilates stabilization training, which emphasizes lumbopelvic stability, can reduce menstrual fatigue by increasing active and passive lumbopelvic stability by activating deep anterior abdominal wall muscles¹⁴⁾. Hassan et al. (2013) reported that menstrual pain had reduced in 20 women with menstrual cramps after performing lumbar stability exercise¹⁵⁾. However, there is a shortage of research on the effect of Pilates and taping on menstrual pain and prostaglandin F2 α levels.

Therefore, this study intended to observe the effect of Pilates stabilization exercise and Kinesio taping on dysmenorrhea and prostaglandin F2 α levels and to provide a physical treatment for menstruation disorders.

METHODS

Subjects

The study examined female college students (n=37) at the N University in Cheonan, Korea who had experienced menstrual cramps for more than three months. These women had no prior delivery experience, no defects in the alignment of the lumbar spine, no past or present diseases, did not smoke, were not currently using pain medication or alternative therapies, did not currently exercise, did not have mental health problems, had > 70 points on the mood disorder questionnaire (MDQ), and > 4 points on the visual analogue scale (VAS). They were divided into three different groups, the Pilates group (PG, n=13), Pilates and Taping group (PTG, n=12), and Taping group (TG, n=12). The groups performed Pilates and taping 3 times a week for 6 weeks. The experiment was conducted from March 2018 to May 2018. Before commencing the study, the purpose and method of the research were thoroughly explained to the participants and a written form of consent was obtained from each individual in accordance with the Declaration of Helsinki.

Table 1. General features of research subject

	PG	PTG	TG
Age(y)	21.23±4.61	22.59±4.01	20.97±5.79
Height(cm)	161.81±7.37	159.46±7.94	162.47±6.61
Weight(kg)	62.47±9.69	63.91±9.32	64.19±10.74
BMI(Kg/m2)	20.18±5.30	20.27±3.78	21.07±4.27

PG: Pilates group, PTG: Pilates with taping group, TG: Taping group

Procedure

Pilates exercise and Kinesio taping were performed 3 times a week for 6 weeks by female college students who complained of menstrual fatigue. Menstruation symptoms were measured before and after the intervention through the MDQ. Changes in the concentration of prostaglandin F2α were measured in blood samples. The Pilates stabilization training program used in this study is based on prior studies, and is shown in Table 2¹⁶⁻²⁰. After sufficient training to enable the participants to accurately perform the training programs, they performed 10 repetitions, followed by 1 minute of rest, and then 3 sets of 10 minutes to give feedback on muscle contraction around the hip.

Table 2. Pilates protocol.

Type	exercise	Session/time				
Warming up	<ul style="list-style-type: none"> ▪ Whole body stretching ▪ Standing roll down ▪ Head rolls ▪ Alternate arms 	1 time/10 min				
	Supine position		<ul style="list-style-type: none"> ▪ Knee side Exhale and let your right knee open slowly to the side. Inhale and let your knee return to the center. ▪ Knee float Exhale and activate the core while gently floating leg up to 90/90. Inhale and float leg down to starting position. ▪ Single leg circle Perform while one knee is straightened and the hip joint remains bent at 90°. 	1 time/10 min		
			Main exercise		<ul style="list-style-type: none"> ▪ Elbow up Carry out with elbows bent and the tips of both fingers placed on the superior iliac spine. ▪ Single leg lift Carry out with elbows bent and hands positioned on the forehead. 	10 times/5 min
Side lying	<ul style="list-style-type: none"> ▪ Clams Straighten head, pelvis, and soles of the feet while bending the knees. 	10 times/5 min				
	Kneeling		<ul style="list-style-type: none"> ▪ Cat stretch Perform with the palm and knees supporting the floor and the spine in neutral. ▪ Hip flexor and hamstring stretch Perform with one foot positioned between the two hands placed in front, then twist and repeat. 	10 times/5 min		
Sitting		<ul style="list-style-type: none"> ▪ Mermaid Place knees in a straight line between the hips and the knee joints of the lower legs. ▪ Spine twist Spread both legs forward and with both arms wide at 90° to the side. 	10 times/5 min			
	Standing	<ul style="list-style-type: none"> ▪ Lunge Place one leg forward so that both legs are in a straightened condition, then twist and repeat. 		10 times/5 min		
Cool down	<ul style="list-style-type: none"> ▪ Kneeling hamstring stretch ▪ The star 	10 min				

Kinesio taping application

The subject sat straight in a chair and one end of the tape (5 x 5 cm, 3NS, Korea) was used to measure from above the anus to the upper edge of the pelvis. The tape was cut to one eighth of the length that was measured. One end of the tape was attached to the ulnar bone above the gate. The tape was applied diagonally by pulling it upwards and outside with a minimum height. The tape was passed along the iliac crest over the ilium, and the second end of the tape was attached so that it overlapped the base of the first piece of tape. The second piece of tape was attached in the same way as the first in the opposite direction of the ilium ²¹.

Measuring method

1) Measurement of dysmenorrhea

The dysmenorrhea measurement tool was a simplified menstrual distress questionnaire (MDQ) described by Moos (1986) and Kim (1995). This tool, consisting of 35 questions on a 6-point scale, has 6 categories (pain, decreased concentration, change of behavior, autonomic nervous system response, accumulation of moisture, and negative emotions ²²⁻²³). The measurement period was to be within 48 hours from the beginning of the menstrual period. The higher the score, the more severe the dysmenorrhea. Scores ranged from 35 to 210 points. The reliability of the MDQ was Cronbach's $\alpha = 0.97$.

2) Prostaglandin F₂ α measurement

Urine was collected in an Eppendorf specimen container at the most painful point within 48 hours of

the menstrual period and was then cooled to below -25°C . The Neodin VLAB analyzed prostaglandin F₂ α by an ELISA (enzyme-linked immunosorbent assay).

Data Analysis

Data analysis was performed using the statistical analysis program, SPSS version 20. Technical statistics were used to identify the general characteristics of the target, and normal distribution of data was demonstrated by K-S test. Additionally, the homogeneity of the study subjects was identified. Paired *t*-test was used for the prior-post comparisons within each group for prostaglandin F₂ α and menstrual discomfort. Multivariate analysis of variance (MANOVA) was used to compare the non-winding effect on the period before and after inter-group intervention with the difference between prostaglandin F₂ α . If significant differences were found, the least significant difference (LSD) method was used as a post-test. The statistical significance level was set to $\alpha = .05$.

RESULTS

Changes in pre- and post-menstrual pain and prostaglandin F₂ α levels were significantly reduced in the PG, PTG, and TG (Table 3). The changes in the pre- and post-menstrual pain and prostaglandin F₂ α levels resulted in significant differences in the PTG and TG. As a result, dysmenorrhea and a significant decrease in prostaglandin F₂ α in the TG compared with that in the PTG was observed (Table 3).

Table 3. Pre and post comparison of the MDQ and Prostaglandin F₂ α in a Group by intervention methods

variable	group	pretest M \pm SD	posttest M \pm SD	p
Menstrual Distress Questionnaire (MDQ)	PG	121.74 \pm 32.47	70.95 \pm 35.84	.00*
	PTG	125.36 \pm 30.81	66.57 \pm 30.08	.00*
	TG	124.27 \pm 35.28	72.47 \pm 33.87	.04*
Prostaglandin F ₂ α	PG	1.29 \pm .37	.81 \pm .29	.00*
	PTG	1.35 \pm .20	.74 \pm .41	.00*
	TG	1.33 \pm .41	.83 \pm .33	.02*

*p<.05, PG: Pilates group, PTG: Pilates with taping group, TG: Taping group

Table 4. Pre and post comparison of the MDQ and Prostaglandin F2α in between Groups

variable	group	pretest M±SD	posttest M±SD		p
Menstrual Distress Questionnaire (MDQ)	PG	121.74±32.47	70.95±35.84	group	.02*TG<PTG
	PTG	125.36±30.81	66.57±30.08	time	.03*
	TG	124.27±35.28	72.47±33.87	group*time	.31
Prostaglandin F2α	PG	1.29±.37	.81±.29	group	.04*TG<PTG
	PTG	1.35±.20	.74±.41	time	.04*
	TG	1.33±.41	.83±.33	group*time	.09

*p<.05, PG: Pilates group, PTG: Pilates with taping group, TG: Taping group

DISCUSSION

Difficult menstruation, which is not caused by any disease in the uterus and lasts for 2–3 days from the start of menstruation, results in pain in the anterior abdominal muscles and lumbopelvic cramps. This hinders a woman's quality of life ^{24, 25}. In addition, medication that blocks the secretion of prostaglandin F2α and the antidiuretic hormone is applied to relieve menstrual dysfunction, but side effects of these medications, such as headaches, stomach disorders, vomiting, nausea, and dizziness are experienced after administration ^{26–28}. Therefore, this study wanted to observe changes in the severity of menstrual pain and prostaglandin F2α levels by the application of Pilates and Kinesio taping to female college students who complained of menstrual cramps. Menstrual pain and prostaglandin F2α were both significantly reduced in the PG, PTG, and TG. Kim and Kim (2012) reported a significant reduction in dysmenorrhea from 117±30 points to 72.93±18.26 points in the group that performed stabilization exercise of the lumbar spine ²⁹. Denise et al (2008) reported a significant decrease in overall abdominal and back pain as a result of applying cervical cures to girls suffering from menstruation.

These results are due to the contraction of the uterus, increase of blood flow in the pelvis, and correction of abnormal joint movements, and it is said that the stabilization exercise in the pelvic region reduces menstrual pain by enhancing stability of the hip joints ³⁰. Kim Mun-Jeong et al, (2017) stated that after giving Pilates stabilization training to women with primary menstrual pain for 12 weeks, the thickness of the anterior abdominal wall muscles, which provides active stability to the pelvis, gradually increased along with that of the transverse abdominal and internal and external oblique muscles. Additionally, 6 to 12 weeks after the intervention,

there was a significant difference in the thickness of the front wall muscles between groups, and a significant correlation was reported in the mediation group, relative to the control group after the intervention ²⁰. Juliani et al, (2016) confirmed that menstruation pain was significantly reduced by applying Pilates stabilization training, consisting of 50 minutes of exercise 3 times a week for 7 weeks, to women with primary menstrual cramps ¹⁴. In another study among 50 women with primary menstruation, 25 women underwent only Pilates training and the other 25 underwent traditional preservation therapy for 12 weeks, and the trachea were measured with visual analog scale (VAS), which showed a significant decrease in pain in the Pilates training group than in the other group ³¹. In this study, the PG and PTG showed a decrease in menstrual pain and prostaglandin F2α before and after intervention, which is the same correlation between the amount of transverse abdominal and external oblique muscles after Pilates stabilization exercise. The Pilates stabilization training is thought to have been reduced by an increase in the active stability of the lumbopelvic muscles with the influence of the transverse abdominal and external oblique muscles ^{14, 30}. Pilates stabilization exercise is also thought to activate the contraction of the pelvic floor muscles to increase blood flow in the pelvis and to decrease prostaglandin F2α levels due to changes in blood flow ^{26, 28, 30}. Do et al, applied tape to the sacroiliac joint and the lower abdominal muscle, which is located near the uterus, and reported that MDQ and VAS points significantly decreased following taping³². Seo and Kwon surveyed 3 women and found that one Numeric Rating Scale (NRS) score, in terms of two people, and it ranged from 8 to 3 in one person and 10 to 6 in the other one that was applied 5 days before menstruation. Han reported that 46 middle school students were mediated by dividing them into controls, Tylenol, and

taping groups, which resulted in a greater decline in menstrual pain in the taping group. Lee et al. (2015) reported that women in their 20s experienced a reduction in menstrual pain for up to 4 hours in both the taping and drug groups, but the pain continued to decrease 24 hours later in the taping group than in the drug group³⁵. In this study, a decrease in pre- and post-intervention of menstrual pain and prostaglandin F2 α levels were found in the PTG and TG due to the continuous stimulation of muscle blood flow through the application of taping^{12, 36}. As muscle tone decreases due to these positive stimuli, it is believed that the effect of the autonomic nervous system has been reduced, resulting in a reduction of the monthly impulses and prostaglandin F2 α ^{12, 37}. The limitations of this study are that the subjects were their 20s, which makes it difficult to generalize their findings to all ages of people with menstrual disorders, and it is difficult to judge the effects of exercise after only 3 times a week. Therefore, more research on the lasting effects will be necessary for various age groups with menstrual difficulties in the future.

CONCLUSION

For female college students who complain of dysmenorrhea, pilates stabilization exercise and kinesio taping showed reduced dysmenorrhea and menstrual pain. In addition, a higher reduction was observed in the group with Pilates stabilization exercise and taping than in the group with only taping. In view of the above results, I believe that Pilates stabilization movement and taping will be an effective intervention for female college students who complain of menstrual dysfunction.

REFERENCES

1. De Sanctis V, Soliman A, Bernasconi S, et al. Primary Dysmenorrhea in Adolescents: Prevalence, Impact and Recent Knowledge. *Pediatr Endocrinol Rev*. 2015; 13(2): 512–20.
2. Dawood MY. Primary dysmenorrhea: advances in pathogenesis and management. *Obstet Gynecol*. 2006; 108(2): 428–41.
3. Ryan SA. The treatment of dysmenorrhea. *Pediatr Clin North Am*. 2017 ; 64(2): 331–42.
4. Lee SK, Park SH, Kim MK. Effects of kinesio taping on female athletes' perceived discomfort, pain and daily activity during menstruation. *J Sport Leisure studies*. 2012; 47: 1013–21.
5. Lee WJ, Um SH. R & D of smartwear built-In TENS device for relief of dysmenorrhea. *The Research Journal of the Costume Culture*. 2009; 17(2): 320–9.
6. Lee IS. Effect of moxibustion heat therapy on menstrual cramps, dysmenorrhea, and activities of daily living. *Kor Soc Public Heal Nurs*. 2004; 18(1): 39–49.
7. Lee YM. Effects of aroma-foot-reflexology on premenstrual syndrome, dysmenorrhea and lower abdominal skin temperature of nursing students. *Kor J Adult Nurs*. 2011; 23(5): 472–81.
8. Han SH, Nor YJ, Hur MH. Effects of aromatherapy on menstrual cramps and dysmenorrhea in college student woman. *J Kor Acad Soc Adult Nurs*. 2001; 13(3): 420–30.
9. Potur DC, K m rc  N. The effects of local low-dose heat application on dysmenorrhea. *J Pediatr Adolesc Gynecol*. 2014; 27(4): 216–21.
10. Forozeshfard M, Bakhtiary AH, Aminianfar A, et al. Short term effects of kinesio taping on pain and functional disability in young females with menstrual low back pain: A randomised control trial study. *J Back Musculoskelet Rehabil*. 2016; 29(4): 709–15.
11. Brown J, Brown S. Exercise for dysmenorrhoea. *Cochrane Database Syst Rev*. 2010; 17; (2): CD 004142.
12. Lim EC, Tay MG. Kinesio taping in musculoskeletal pain and disability that lasts for more than 4 weeks: is it time to peel off the tape and throw it out with the sweat? A systematic review with meta-analysis focused on pain and also methods of tape application. *Br J Sports Med*. 2015; 49(24): 1558–66.
13. Parreira Pdo C, Costa Lda C, Hespanhol LC Jr, et al. Current evidence does not support the use of Kinesio Taping in clinical practice: a systematic review. *J Physiother*. 2014; 60(1): 31–9.
14. Juliany MA, Caroline SR, Fabiana de Carvalho, et al. The influence of the Pilates method on muscular flexibility, symptoms, and quality of life in women with primary dysmenorrhea. *Sci Med*. 2016; 26(2): 1–7.
15. Shakeri H, Fathollahi Z, Karimi N, et al. Effect of functional lumbar stabilization exercises on pain, disability, and kinesiophobia in women with menstrual low back pain: a preliminary trial. *J Chiropr Med*. 2013; 12(3): 160–7.
16. Mannion AF, Helbling D, Pulkovski N, et al. Spinal segmental stabilisation exercises for chronic

- low back pain: programme adherence and its influence on clinical outcome. *Eur Spine J*. 2009; 18(12): 1881–91.
17. Jull GA, Richardson CA. Motor control problems in patients with spinal pain: a new direction for therapeutic exercise. *J Manipulative Physiol Ther*. 2000; 23(2): 115–7.
 18. Giacomini MB, da Silva AM, Weber LM, et al. The Pilates method increases respiratory muscle strength and performance as well as abdominal muscle thickness. *J Bodyw Mov Ther*. 2016; 20(2): 258–64.
 19. Kliziene I, Sipaviciene S, Vilkiene J, et al. Effects of a 16-week Pilates exercises training program for isometric trunk extension and flexion strength. *J Bodyw Mov Ther*. 2017; 21(1): 124–32.
 20. Kim, MJ. The effects of pilates stabilization training on cervix location and PGF_{2α}, ADH in women with primary dysmenorrhea. Catholic University of Pusan(in korea). 2017.
 21. Langendoen J, Sertel K. *Kinesiology Taping The Essential Step-By-Step Guide: Taping for Sports, Fitness and Daily Life*. Robert Rose, 2014, pp.142–3.
 22. Moos RH. The development of a menstrual distress questionnaire. *Psycho med*. 1968; 30(6): 853–67.
 23. Kim JE. Comprehensive understanding of perimenstrual discomfort : A triangulation of methods and perspectives. Seoul National University. 1995.
 24. Banikarim C, Chacko MR, Kelder SH. Revalence and impact of dysmenorrhea on Hispanic female adolescents. *Arch Pediatr Adolesc Med*. 2000; 154(12): 1226–9.
 25. Hillen TI, Grbavac SL, Johnston PJ, et al. Primary dysmenorrhea in young Western Australian women: prevalence, impact, and knowledge of treatment. *J Adolesc Health*. 1999; 25(1): 40–5.
 26. Chan WY, Dawood MY, Fuchs F. Prostaglandins in primary dysmenorrhea. Comparison of prophylactic and nonprophylactic treatment with ibuprofen and use of oral contraceptives. *Am J Med*. 1981; 70(3): 535–41.
 27. Milsom I, Minic M, Dawood MY, et al. Comparison of the efficacy and safety of nonprescription doses of naproxen and naproxen sodium with ibuprofen, acetaminophen, and placebo in the treatment of primary dysmenorrhea: a pooled analysis of five studies. *Clin Ther*. 2002; 24(9): 1384–400.
 28. Valentin L, Sladkevicius P, Kindahl H, et al. Effects of a vasopressin antagonist in women with dysmenorrhea. *Gynecol Obstet Invest*. 2000; 50(3): 170–7.
 29. Kim JH, Kim NS. The effect of lumbo-pelvic stabilization exercise on menstrual pain and premenstrual syndrome. *Kor Soc Phys Ther*. 2012; 7(1): 29–35.
 30. Holtzman DA, Petrocco-Napuli KL, Burke JR. Prospective case series on the effects of lumbosacral manipulation on dysmenorrhea. *J Manipulative Physiol Ther*. 2008; 31(3): 237–46.
 31. Paithankar SM, Deepali H. Effectiveness of Pilates over Conventional Physiotherapeutic Treatment in Females with Primary Dysmenorrhea. *Journal of Dental and Medical Sciences*. 2016; 1(15): 156–63.
 32. Do ES, Park KM, Lee SH. A study on the effects of the kinesio tape method on perimenstrual discomforts. *J Kor Commun Nurs*. 2003; 14(3): 415–23.
 33. Seo HK, Kwon WA. A case study of taping therapy against menstrual pain. *J Kor Soc Phys Ther*. 2000; 12(1): 129–32.
 34. Han HJ. The effect of balance taping on menstrual pain in female middle school students. Kyonggi University. 2013.
 35. Lee SH, Kim YH, Park JS. The effect of taping therapy on reducing menstrual pain of women about Age 20s. *J Advanced Engineering and Technology*. 2015; 8(1): 39–43.
 36. Montalvo AM, Cara EL, Myer GD. Effect of kinesiology taping on pain in individuals with musculoskeletal injuries: systematic review and meta-analysis. *Phys Sportsmed*. 2014; 42(2): 48–57
 37. Sawkins K, Refshauge K, Kilbreath S, et al. The placebo effect of ankle taping in ankle instability. *Med Sci Sports Exerc*. 2007; 39(5): 781–7.