

## The Effect of Abdominal Stretching, Yoga, and Dysmenorrhea Exercises on Prostaglandin Levels and Pain

Eka Suryaning Tyas<sup>1\*</sup>, Soetanto Hartono<sup>2</sup>, Endang Sri Wahyuni<sup>3</sup>, Heryanto Nur Muhammad<sup>4</sup>, Fika Indah Prasetya<sup>5</sup>, Priyo Sasmito<sup>6</sup>

<sup>1</sup> Sports Sciences Doctoral Program, Sports Sciences and Health Faculty, Universitas Negeri Surabaya, Indonesia

<sup>2</sup> Sports Sciences and Health Department, Sports Sciences and Health Faculty, Universitas Negeri Surabaya, Indonesia

<sup>3</sup> Medical Department, Sports Sciences and Health Faculty, Universitas Negeri Surabaya, Indonesia

<sup>4</sup> Sports Sciences Department, Sports Sciences and Health Faculty, Universitas Negeri Surabaya, Indonesia

<sup>5</sup> Nursing Department, STIKes Bhakti Al-Qodiri, Indonesia

<sup>6</sup> Nursing Department, Ichsan Satya University, Indonesia

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#### Corresponding Author:

Sports Sciences Doctoral Program, Sports Sciences and Health Faculty, Universitas Negeri Surabaya, Indonesia  
Email : tyascca11@gmail.com

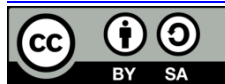
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### ABSTRACT

**Introduction:** Dysmenorrhea, or pain during menstruation, affects a high percentage of women of reproductive age. It can disrupt learning activities at school, cause a lack of concentration, and lead to frequent absences, ultimately decreasing the quality of life for young women. The purpose of this study was to analyze the effect of abdominal stretching, yoga, and dysmenorrhea exercises on prostaglandin levels and pain in school-age adolescents. **Method:** A quasi-experimental study with an experimental laboratory design was used, with pretest and posttest control groups. The sampling technique used was probability sampling with simple random sampling of 32 female students divided into four groups, with three groups receiving abdominal stretching, yoga therapy, and dysmenorrhea exercises, respectively, and one group serving as the control group. Data was analyzed using one-way ANOVA and the Kruskal-Wallis test. **Results:** The average prostaglandin levels after treatment were highest in the abdominal stretching group at 31.7 pg/mL and lowest in the dysmenorrhea group at 19.0 pg/mL. The difference in prostaglandin levels was highest in the dysmenorrhea exercise group at 42.5 pg/mL and lowest in the control group at 14.4 pg/mL. Most participants who experienced moderate pain before and after the intervention generally complained of mild pain. **Conclusion:** The study found a significant effect of abdominal stretching therapy, yoga therapy, and dysmenorrhea exercises on prostaglandin levels and pain. Dysmenorrhea exercises were found to be the most effective therapy in reducing prostaglandin levels and dysmenorrhea pain, compared to abdominal stretching and yoga therapy.

**Keywords:** Abdominal stretching, dysmenorrhea, dysmenorrhea exercises, prostaglandin, yoga.

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## 1. INTRODUCTION

Dysmenorrhoea is discomfort or pain during menstruation that occurs due to excessive prostaglandin production in the endometrium during the menstrual cycle, resulting in myometrial hypertonus and vasoconstriction of blood vessels, the lower abdomen so that oxygen supply is reduced in the uterus [13]. Primary dysmenorrhea lasts a few days before menstruation comes and continues for 12 to 72 hours and sends pain that lasts with marked cramps in the lower abdomen [14]. Symptoms shown include back pain, nausea, vomiting, diarrhea, headache, fatigue, and feeling trembling or anxious. Symptoms like this are called

premenstrual symptoms, usually felt 1 to 2 weeks before the day menstruation comes every month [16]. As many as 60% to 93% of women experience dysmenorrhea pain, and 10% to 15% have severe *dysmenorrhoea* that disrupts daily activities. As many as 45% to 50% of dysmenorrhea in Indonesian women occurs in adolescents aged 14-19 years [24].

Adolescence is one of the most influential population-based stages of growth and development in Indonesia. The number of adolescents in Indonesia is more than 23 million. The age of adolescent growth and development is a human stage that starts from 10 to 24 years old and has never had a marriage. Juveniles have an energetic character. The incidence of dysmenorrhea they experience can reduce productivity [29].

Some of the consequences of dysmenorrhoea during school age are learning activities at school will be disrupted, lack of concentration on lessons and they will often miss school, so the quality of life in adolescent girls will decrease [24]. In general, dysmenorrhea can be overcome by pharmacological and non-pharmacological methods. Pharmacological therapy is carried out by taking painkillers. While non-pharmacologically it can be done using warm compresses, baths or warm baths, massage, exercise, distraction, and relaxation methods [14].

Yoga exercises, abdominal stretching, and aerobics are some non-pharmacological methods that are believed to be able to relieve pain during menstruation [14]; [28]; [23]. This study was conducted to analyze the effect of abdominal stretching, dysmenorrhea gymnastics, and yoga on prostaglandin levels and pain due to dysmenorrhea.

## 2. METHOD

This research is a quasi-experimental quantitative research with experimental laboratories with a pretest and posttest control group design. The study was conducted at Al Qodiri Medical Center for 4 months from May 2023. The population in this study is female students at the Al Qodiri Islamic boarding school with a population of 96 students. A sample of 32 individuals was calculated according to the Slovin formula. This sample was divided into 4 groups consisting of 8 people taken by simple random sampling.

Inclusion criteria include aged 11 to 17 years with regular menstrual cycles, and not taking pain medication. Participants who stopped participating in the program at least 3 times and took pain medication during the research were excluded from the study.

Prostaglandin hormone levels were measured using an Enzyme-linked immunosorbent assay (ELISA) kit. Pain scales were measured using a questionnaire sheet with statement indicators that can be classified according to the degree of pain. The research data were analyzed with one-way ANOVA and Kruskal-Wallis using SPSS version 23.

This research was conducted with the approval of the Ethical Committee of Medical Research Faculty of Dentistry at the University of Jember (No. 2178/UN25.8/KEPK/DL/2023). Before participating in the study, all participants were informed about the research and were required to fill out an informed consent form. Participants who withdrew from the study were not subjected to any form of penalty.

## 3. RESULTS AND DISCUSSIONS

### Results

A total of 32 participants were involved in this study. All participants were measured prostaglandin levels and pain scales before and after the intervention. Based on the results of prostaglandin measurements before the intervention, the highest average in the dysmenorrhea exercise group was 61.5 pg / mL, and the lowest in the control group was 38.7 pg / mL. The average prostaglandin levels after treatment were highest in the abdominal stretching group at 31.7 pg/mL and lowest in the dysmenorrhea group at 19.0 pg/mL. The difference in prostaglandin levels was highest in the dysmenorrhea exercise group at 42.5 pg/mL and the lowest in the control group at 14.4 pg/mL. The results of statistical tests with Kruskal Wallis

during the pretest and posttest resulted in a p-value of > alpha 0.05. Therefore, it can be stated that during the pretest and posttest, there is no significant difference in prostaglandin levels. However, there were significant differences between interventions and reduced prostaglandin levels (Table 1).

**Table 1. Prostaglandin level pretest and posttest analysis (N=32)**

Test	Prostaglandin level (Mean + SD (Range)) (pg/mL)				p-value
	Stretching Abdominal	Yoga	Dysmenorrhea exercise	Control	
Pretest	56.12 ± 14.56 (35.00 – 76.00)	56.50 ± 12.92 (30.00 – 77.00)	61.50 ± 9.50 (52.00 – 78.00)	38.75 ± 18.77 (20.00 – 58.00)	0.049
Posttest	31.75 ± 25.72 (10.00 – 74.00)	18.00 ± 18.93 (6.00 – 64.00)	19.00 ± 13.61 (8.00 – 48.00)	24.37 ± 13.18 (8.00 – 40.00)	0.389
Δ	-24.37 ± 14.04 (-45.00 – -2.00)	-38.50 ± 13.16 (-49.00 – -13.00)	-42.50 ± 9.29 (-55.00 – -30.00)	-14.37 ± 15.30 (-48.00 – 0.00)	0.001*

The analysis results of pain scales in participants found that most participants complained of moderate pain before the intervention and after the intervention generally complained of mild pain. The results of statistical tests with the Kruskal Wallis during the pretest and posttest on the pain variable showed a p-value of > alpha 0.05. Therefore, it can be stated that during the pretest and posttest, there is no significant difference. Because the two tests did not produce significant differences between groups, the difference test continued on Δ, namely the value of changes in the pain scale during the pretest and posttest. The results of Δ analysis on the pain variable showed a p-value of < alpha 0.05. It can be concluded that there is a significant effect between interventions (abdominal stretching, yoga, and dysmenorrhoea exercise) on reducing pain levels (Table 2).

**Table 2. Pain scale pretest and posttest analysis (N=32)**

Test	Pain scale	Stretching Abdominal		Yoga		dysmenorrhoea exercise		Control		p-value
		n	%	n	%	n	%	n	%	
		Pretest	No pain	0	0.0	0	0.0	0	0.0	
	Mild	3	37.5	1	12.5	0	0.0	4	50.0	
	Moderate	3	37.5	6	75.0	6	75.0	4	50.0	
	Severe	2	25.0	1	12.5	2	25.0	0	0.0	
Posttest	No pain	3	37.5	1	12.5	2	25.0	2	25.0	0.853
	Mild	3	37.5	5	62.5	5	62.5	3	37.5	
	Moderate	1	12.5	2	25.0	1	12.5	3	37.5	
	Severe	1	12.5	0	0.0	0	0.0	0	0.0	
Δ										0.005*

To determine the group that significantly affects the reduction in prostaglandin levels and pain, a double comparison test was carried out using the Tukey and Pairwise Comparison methods. The results of the double comparison test showed that the dysmenorrhoea exercise group was significantly different from the abdominal stretching group and the control group in reducing prostaglandin levels, but not significantly different from the yoga therapy group. The dysmenorrhea gymnastics group also differed significantly from the control group in reducing pain, but there was no significant difference in the other two groups.

The yoga therapy group was significantly different in reducing prostaglandin levels than the control group, but there was no significant difference when compared to abdominal stretching and dysmenorrhea exercises. No significant difference between yoga therapy and

the other groups in reducing pain. While in the abdominal stretching group, there was no difference with control in reducing prostaglandin levels and pain. Compared to the control group, dysmenorrhea exercises had the most significant differences compared to abdominal stretching, and yoga therapy in reducing prostaglandin levels and pain (Table 3).

**Table 3. Double comparison test results (N=32)**

Intervention		Prostaglandin	Pain
		p-value	p-value
Dysmenorrhoea exercise	Abdominal stretching	0.047*	0.089
	Yoga	0.928	0.089
	Control	0.001*	0.000*
Yoga	Abdominal stretching	0.162	1.000
	Control	0.005*	0.058
Abdominal Stretching	Control	0.438	0.058

## Discussion

This study showed that there was a significant relationship between interventions (abdominal stretching, yoga, and dysmenorrhea exercise) on reducing prostaglandin levels and pain scales.

### Effects of abdominal stretching, yoga, and dysmenorrhea exercise on decreasing prostaglandin levels

Prostaglandins are a part of the eicosanoids, along with thromboxane and prostacyclin. Prostaglandins carry signals that result in constriction and relaxation of smooth muscles, including vascular smooth muscle [8]; [10]; [31] During the menstruation period, part of the endometrial cells slough off and produce certain prostaglandin compounds, namely prostaglandin F2 $\alpha$  (PGF2 $\alpha$ ) from uterine endometrial cells. Prostaglandin F2 $\alpha$  is a strong stimulant of myometrial smooth muscle contraction and causes uterine blood vessel constriction. From the results of previous studies, it is known that measurements made by biopsy and using menstrual blood resulted in prostaglandin levels in people who have dysmenorrhoea are higher than in women who do not have dysmenorrhoea or amenorrhea [2]. The higher the level of prostaglandins in the blood of menstruating women will increase the scale of menstrual pain.

Based on the results, the abdominal stretching group during the pretest showed an average prostaglandin of 56.12 pg/mL and at the time of the posttest produced an average prostaglandin of 31.75 pg/mL. This suggests that stretching abdominal may lower prostaglandin levels, although the results are not significant. The results of this study are equivalent to the previous research which concluded that abdominal stretching exercise performed for 4 days before menstruation was proven to affect reducing prostaglandin hormone levels and pain intensity in primary dysmenorrhea [19]; [22]; [25]; [30].

The yoga therapy and dysmenorrhea exercise group also showed significantly reduced prostaglandin levels. By doing exercise the body releases endorphins. Endorphins work as neurotransmitters in the brain to reduce the distribution and perception of pain [12]. The endogenous opioids, namely enkephalin, and endorphins increase by 4 to 5 times when someone does exercise. These enkephalin and endorphins produced by the brain and spinal cord can suppress pain or have an analgesic impact [1]; [3]; [9]. This natural analgesic property forms nerve terminal synapses and binds to each other so that it can be an inhibitor of tachykinin release which functions as a conductor or transmission of pain (Bernardi et al.,

2017). The highest endorphin levels occur in the afternoon, therefore it is advisable to exercise in the afternoon to get optimal results (Kannan et al., 2019).

### **Effects of abdominal stretching, yoga, and dysmenorrhea exercise on pain levels**

According to the International Association for the Study of Pain (IASP), pain is a sensory, emotional discomfort associated with actual and potential tissue damage. In addition, pain is one of the vital signs of the body as protection from the body and support from diagnostics. Dysmenorrhea is caused because during menstruation the ovaries produce more progesterone hormone than usual. This progesterone hormone increases the tension in the cervix so that the cervix becomes narrower. As a result, the uterine muscles will contract stronger to remove menstrual blood. This uterine muscle contraction results in muscle spasms and results in pain [4]; [5]; [31].

When someone does exercise, like abdominal stretching, dysmenorrhea exercise, or yoga, the brain will produce endorphin compounds. The body will increase the secretion of the hormone estrogen and produce beta-endorphins that make the body relax, and comfortable. The brain becomes happy so that the supply of oxygen to the muscles becomes more maximal including the pelvis and reproductive organs, especially the uterus. This condition has impacts on reducing pain or pain due to menstruation [27].

Some movements that focus on the abdomen can help increase blood perfusion to the uterus. So that anaerobic metabolism that produces lactic acid does not occur. As we know, lactic acid will cause fatigue, pain, and muscle cramps [10].

Another mechanism is by relaxing endometrial muscles. Endometrial muscles are spasms and ischemia due to an increase in prostaglandins resulting in vasodilation of blood vessels. This causes increased blood flow in organs that experience spasms and ischemia so that the pain can decrease [11]; [17]; [26].

### **The significance of interventions for prostaglandins and pain reduction**

Based on the results of statistical analysis, it is shown that treatment with abdominal stretching therapy, yoga therapy, and dysmenorrhea exercise has the same profound influence in reducing pain levels. This result is in line with other studies that reported similar results. There have been many studies that report that abdominal stretching is significant in reducing pain in cases of dysmenorrhea [19]; [22]; [25]; [30]. Likewise, the effectiveness of yoga and dysmenorrhea exercise respectively in overcoming menstrual pain [11]; [12]; [15]; [21].

Yoga therapy and dysmenorrhoea exercises have the same effectiveness in lowering prostaglandin levels. This result is similar to other studies that reported no difference between dysmenorrhea exercise and yoga in managing dysmenorrhea pain and decreased prostaglandin levels [28]. However, only dysmenorrhoea exercises have a significant difference from the control group in lowering prostaglandin levels and pain at the same time.

Yoga therapy differed significantly from the control group only in lowering prostaglandin levels. While abdominal stretching therapy did not differ significantly from the control group in reducing prostaglandin levels and pain. The results of this study are different from previous studies that reported a significant reduction in prostaglandin levels and pain after abdominal stretching [7]; [18]; [19]. This is possible due to the small number of samples in the abdominal stretching group in this study. This is also a limitation of the study. However, it seems that studies that analyze the effectiveness of abdominal exercise compared to other methods are still not widely conducted. However, abdominal exercise is the easiest and simplest method to apply compared to other methods [23].

#### 4. CONCLUSION

This study found that there was a significant relationship between interventions (abdominal stretching, yoga, and dysmenorrhea gymnastics) on reducing prostaglandin levels and pain scales. Dysmenorrhea exercise is the most significant method of lowering prostaglandin levels and pain compared to yoga and abdominal stretching. Yoga is a significant method of lowering prostaglandin levels, but not significantly lowering pain scales. While abdominal stretching can reduce prostaglandin levels and pain scales but not significantly. The results of this study can be used as a basis for preventive efforts to reduce pain due to dysmenorrhea and minimize the use of chemical drugs in adolescent girls.

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