The Effect of Premenstrual Exercise on PMS Score, Perceived Stress Score, Body Image Score, and Cortisol Level for Premenstrual Syndrome

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Abstract--Background:*Premenstrual syndrome (PMS)might impacts on individual personal relationship, behavioral changes, social interaction, lifestyle, school performance, and emotional wellbeing. The prevalence of PMS varies around 50% to 80% on reproductive women. The purpose of this study was to prove that premenstrual exercise as an alternative therapy for PMS in decreasing PMS score, perceived stress score (PSS), the level of cortisol, and increasing body image score (BIS).*

Methods: *This is an experimental study with randomized pre-test post-test controlled group design. The subject was 116 PMS women which was 56 women as the treatment group and 60 as the control group. They experienced PMS, which were screened with SPAF questionnairesduring 3 month beforehand. The intervention was a 45 minutes premenstrual exercisefor five days during lutheal phase. Intervention in the control group was a form of habits when they suffered PMS. Posttest was done after five days during the luteal. The questionnaires of perceives stress, body image, and blood sample for cortisol level were gained pretest and posttest. The data was analyzed by using paired test, Wilcoxon, independent t test, and Man Whitney.*

Results:*The prevalence of PMS was 76.1%. The mean age of treatment and control groups were 17 and 18 year respectively. The menarche both of two groups were same at 12 years. Mean of the length of menstruation in both two groups were 7 days.Premenstrual exercise has an effect on Hb level and BMI score (p=0.005 and 0.007 respectively). Moreover, exercise reducedPMS score (p=0.001), PSS (p=0.001), and cortisol level (p= 0.001).Premenstrual exercise increased body image score with p=0.001.*

Conclusion: *Premenstrual exerciseproved significantly on decreasingPMS score, PSS and cortisol level, and improving BIS. It is recommended that exercise should be encouragedfor PMS women in promoting healthy lifestyle.*

Keywords--*Premenstrual exercise, perceived stress, body image, cortisol level*

I. INTRODUCTION

Premenstrual syndrome (PMS) is symptoms related to psychological, physical, and behavioral changes. These occur during luteal phase and related to the menstrual cycle. PMS happen in women at reproductive age. PMS arises often between 7 and 10 days before the first day of menstruation.The incidence of PMS varies greatly for certain age groups and in certain regions. The prevalence of PMS events is in the mild to moderate category of more

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than 75%. As many as 30-60% of young women in Iran who experience PMS with significant disruption of daily activities. As many as 80% of women of reproductive age in America experience at least 1 or more symptoms of PMS. PMS may persist from menarche to menopause or until the age of 50 years or approximately 480 months of the menstrual cycle. The most severe PMS occurs in the late 20s and early 30s. PMS contributes to an increase in cases of Premenstrual Dysphoric Disorder (PMDD) and postpartum blues even postpartum depression.

The impact of PMS is most severe in women during productive periods. The period where the activity is learning and working. PMS is significantly associated with increased rates of absence from work and study. This has an impact on decreasing work productivity, quality of education, and household activities.PMS has an impact on increasing health costs. In addition, cases of PMS that are not handled properly will cause PMDD which can result in an increase in suicide and postpartum depression.

The exact cause of PMS is uncertain. Some of the causes of PMS are related to physical and hormonal changes. The highest percentage of disorders they experience is a decrease in mood, irritability, anxiety, unstable emotions, low self-esteem, and lazy doing physical activities. PMS usually starts in the luteal period and disappears after menstrual blood comes out. The intensity of the disturbances varies between individuals with each other.

The diagnosis of PMS is established on the basis of complete obstetric and gynecological history, physical examination, and the presence of psychiatric symptoms of prospective quesionnair PMS ratings, including the pattern and severity of PMS. Measurement of PMS diagnosis is done in several ways including: the American Psychiatric Association with DSM IV. DSM IV is most often used to diagnose PMS.

Symptoms in PMS vary by individual. These symptoms are mood disorders and behaviors which include irritability, anxiety, tension, mood swings, crying easily, anger, depression, felling blue, loss of self-control, self-esteem or low self-esteem, difficulty concentrating, confused, forgetful, social isolation or withdrawal, flatulence, tense mamae, dizziness, headache, extreme swelling, muscle and joint pain, the appearance of pimples, increased appetite, weight gain, hypersomnia or insomnia, lower abdominal pain, back pain, irritability, mood fluctuations, sleep disorders, thigh pain, breast pain, and difficulty concentrating.[7] Anxiety is also experienced by 65% of women who experience PMS.

Some studies mentioned that PMS might change the biological, metabolic, and psychological regulation. There is an increasing in the Tyroid Stimulating Hormon in respon to Thyrotropin Releasing Hormone (TRH), decreased sleep waves, impaired melatonin secretion, decreased magnesium in blood cells, increased hormone cortisol, decreased plasma beta endorphin, decreased pain threshold, increased blood pressure at rest in severe cases of PMS.

PMS might impact on imbalance of hormonal level. Stress and heavy physical activity affect the levels of the hormone cortisol and endhorphin. Implementation of a treatmill for three months can reduce prolactin, estogen,andprogesterone levels in PMS cases. Changes in estrogen levels affect the central neurotransmitters, serotonin. The disturbance of hormonal level might results in mood depression, irritability, aggression, poor impulse control, disturbances of psychological status. An increase in the estrogen ratio of progesterone is associated with a

decrease in endorphins in the brain causing a change in mood. Psychological changes include anxiety, irritability, irritability, mood swings, tension, and mood changes.

Several factors that might influence PMS are age, family history, history of postpartum depression, age of menarche, food intake including chili and chocolate, weight gain, stress management, reproductive disorders, exercise habits. Changes in several factors will affect the hormonal balance that can trigger the severity of premenstrual syndrome.

Handling of PMS is done pharmacologically and non-pharmacologically. A non-pharmacological manner in overcome PMS is growing rapidly. Some researchers cite behavior modification, diet regulation and food supplementation, relaxation, and exercise programs. Dietary arrangements for caffeine, alcohol, salt, carbohydrate, and non-refined sugar intake have a positive effect. Consumption of carbohydrates as an alternative can increase blood serotonin synthesis in the brain. Exercise can increase brain tryptophan and serotonin synthesis. A study stated that exercise can increase the levels of βeta Endorphins in premenstrual syndrome. Premenstrual exercise can reduce pain intensity. There are significantly differences in the levels of βeta Endorphins and pain intensity which are significant between after exercise.[14]Other studies suggest research and scientific evidence regarding sports to reduce PMS symptoms.

The aim of this study is to prove the effect of premenstrualexerciseon the BMI, Hb level, PMS Score, PSS, BIS, and the level of Cortisol on PMS woman.

II. METHOD

This is a quasy experimental study with pre-test post-test controlled group design. This study was conducted on May until October 2018. It was 184women who were interested in this study. There were 141 PMS women (76.6%)from four locations. They were screened pMSwith SPAF questionnaires during 3 month beforehand (May until July 2018). They were 136 women who gave sign in the informed consent. Twentywomen(14.7 %) dropped out because of getting period, the blood sample were lysis, and another reasons of educational activities. Only 116 women finished the study and the data was analyzed. It consisted of 56 women as the treatment group and 60 women as the control group. The intervention was a 45 minutes premenstrual exercise for five days during luteal phase. This was run on July until October 2018.

Intervention in the control group was a form of habits when they suffered PMS. Posttest was done after five days during the luteal phase. The study was conducted on four places, in Central Java Province of Indonesia. This was involved high school teenagers at Batang District and Semarang,and undergraduate students from two universities in Central Java. The subjects were living in dormitory orboarding school. These assumed that they consumed the same kinds of foods. However, it is still difficult to maintain the same kinds of exactly foods during collecting data. The questionnaires of perceives stress, body image, and blood sample for cortisol level were gained pretest and posttest. The data was analyzed by using paired t testand Wilcoxon test between pretest and posttest in a group. The data between two groups were analyzed by independent t test and Mann Whitney. The study gained an

ethical clearance from the Health Research Ethics Committee of Medical Faculty ofDiponegoro UniversityanddrKariadi Hospital of Semarang number531/EC/FK-RSDK/VII/2018 on August 09th 2018.

III. RESULT

Table 1. Distribution of Respondent Characteristics Based on age, age of Menarche, and Duration of Menstruation

Variable	n	Min – max	Mean- SD
Age (year)			
Treatment group	56	12.4 - 24.2	17.11 ± 2.44
Control group	60	12.9 - 25.9	18.64 ± 3.72
Menarche Age (year)			
Treatment group	56	8.9 - 14.8	12.37 ± 1.19
Control group	60	8.8 - 15.0	12.41 ± 1.27
Duration of menstruation (day)			
Treatment group	56	4 – 13	7.21 ± 1.46
Control group	60	4 - 14	6.78 ± 1.67

The results from the table above can be seen that respondents in the control group, the youngest was 12 years old and the oldest was 24 years old. The youngest control group was 12.9 years and the oldest was 25.6 years. From the table above it can be seen that the age of the treatment group and the control group are almost the same, including in the teen age group and the young adult age group. Even so the mean age of the control group was 1 year older than the average age of the treatment group. The mean age of menarche was almost the same in both treatment and control at 12 years of age. The length of menstruation in the treatment group was longer than the length of menstruation (7.21 SD ± 1.46 and 6.78 SD ± 1.67 respectively).

Table 2. Distribution of respondents based on exercise and family history of PMS

Variable	categeory	Treatment		Control		Total	
		n	%	n	%	n	%
Frequency of exercise perweek							
	Rarely	9	36.0	16	64.0	25	100
	1 - 2 times a week	38	55.1	31	44.9	69	100
	Minimum 3 times a week	9	40.9	13	59.1	22	100
		56		60		116	

History of PMS of biological mothers							
	Yes	42	44.2	53	55.8	95	100
	No	14	66.7	7	33.3	21	100
		56		60		116	

The proportion of subjects who rarely did exercise (1-2 times/week) (55.1%) more than respondents who didexerciseoften (minimum 3 times/week) (59.1%) and a few women rarely do exercise. The proportion of subjects who did not exercise (64%) in the control group was more than those who did not do exercise as much as 1-2 times per week. The highest proportion in the treatment group tended to do exercise 1-2 times, while the subjects in the control group tended not to do exercise.The highest proportion of subjects in the treatment group tended to not have a family history of PMS, which was 66.7% compared to the control group which had more family history of PMS, which was 55.8%.

There were normally distributed data which were hemoglobin level and basal metabolic rate both pretest and posttest respectively in the treatment and control groups with p=> 0.05 (0.10 to 0.20). While other data that is the level of PMS, perceived stress score (PSS), body image score (BIS), and cortisol levels are not normally distributed with p values <0.05 (p=0.000 to 0.038).

Table 3. Analysis of differences in BMI and Hemoglobin levels for pretest and posttest in the intervention and control groups

	n	Mean ±SD	Difference Mean ± SD	IK 95%	p
BMITreatment Group Pretest Posttest	56 56	22.707 ± 2.9394 22.570 ± 2.8373	0.1375± 1.7016	0.3182- 0.5932	0.548*
BMIControl Group Pretest Posttest	60 60	20.755 ± 2.7998 21.150 ± 2.7116	0.5555± 4.0731	0.4972 – 1.055	0.296*
Hb Level Treatment Group Pretest Posttest	56 56	13.79 ± 1.21 12.1 ± 1.79	1.6804± 2.4174	1.0330 – 2.3277	0.001*
Hb Level Control Group Pretest Posttest	60 60	13.3 ± 0.95 13.0 ± 1.54	0.4367± 1.6458	0.0115 – 0.8618	0.004*

*paired t test

The results indicated that the mean pretest BMI in the treatment group decreased at posttest from 22.7 to 22.5. The opposite happened where the mean pretest and posttest BMI in the control group actually increased from 20.7 to

21.2. This is still within the normal BMI. There was a difference between the pretest and posttest BMI in the treatment group p=0.1375. There was no significant difference between pretest BMI and posttest BMI in the treatment group and the control group (p=0.548 and p: 0=296 respectively).

The results revealed that the average pretest Hb levels in the treatment group decreased from 13.79 gr% to 12.1 gr% with a difference of 1.6804 gr%. Likewise, the mean pretest and posttestHb levels in the control group also decreased from 13.3 gr% to 13.0 gr% with a mean difference of 0.4303. Both groups have normal mean of Hb levels. The results of the bivariate analysis for HB level showed that there were differences between pretest and posttest in the intervention group and the control group with the results of p = 0.001 and p = 0.004

Table 4. Analysis of paired in PMS score, PSS, BIS, and cortisol levels at pretest and posttest

	n	Median (Min – Max)	Mean ± SD	p
PMS Score Treatment Group				
Pretest	56	6(1 – 12)	6.29 ± 2.728	0.001**
Posttest	56	2 (1 – 6)	2.75 ± 1.392	
PMS Score Control Group				
Pretest	60	3 (1 – 9)	2.92 ± 1.565	0.001**
Posttest	60	5 (1 – 9)	5.47 ± 2.038	
PSS Treatment Group				
Pretest	56	13 (3 – 29)	12.93 ± 5.595	0.001**
Posttest	56	3 (1 – 7)	3.32 ± 1.653	
PSS Control Group				
Pretest	60	3 (1 -6)	2.92 ± 1.133	0.001**
Posttest	60	15 (5 – 40)	15.62 ± 6.028	
BIS Treatment Group				
Pretest	56	7 (4 – 21)	8.16 ± 3.846	0.001**
Posttest	56	19 (9 – 23)	18.84 ± 3.468	
BIS Control Group				
Pretest	60	19 (11 – 26)	18.87 ± 3.286	0.001**
Posttest	60	8 (2 – 21)	9.30 ± 4.175	
Cortisol Treatment Group				

Pretest	56	111.6 (19.9 – 283.0)	122.323 ± 57.002	0.001**
Posttest	56	73.15 (12.5 – 184.0)	83.575 ± 39.421	
Cortisol Level Control Group				
Pretest	60	84.150 (14.5 – 256.0)	88.097 ± 42.294	0.001**
Posttest	60	136.5 (54.5 – 299.5)	147.53 ± 68.277	

**Uji Wilcoxon

The studydisplayed that the mean PMS score pretest-posttest in the treatment group decreased from 6.29 to 2.75. The opposite happened where the mean PMS score pretest and posttest in the control group actually increased from 2.92 to 5.47. The Wilcoxon Test shows that there is a significant difference between the mean PMS pretest score and PMS posttest score in the treatment and control groups (p= 0.001 and p=0.001).

This presented that the mean PSS pretest-posttest in the treatment group decreased from 12.93 to 3.32. On the other hand, the mean pretest and posttest PSS in the control group significantly increased from 2.92 to 15.62. There is a significant difference between the mean pretest PSS and posttest PSS in the treatment group and the control group (p=0.001 and p=0.001 respectively)

The analysis showed that the mean pretest-posttest BIS in the treatment group had increased from 8.16 to 18.84. The opposite occurred where the mean pretest and posttest BIS in the control group decreased from 18.87 to 9.30. There is a significant difference between the mean BIS pretest and BIS posttest in the treatment group and the control group (p=0.001 and p=0.001 respectively)

The analysis indicated that the mean pretest-posttest cortisol hormone levels in the treatment group decreased from 122.323 to 83.575. The opposite happened where the mean pretest and posttest cortisol hormone levels in the control group actually increased from 88.097 to 147.53. There was a significant difference between the mean pretest cortisol hormone levels and the posttest cortisol hormone level mean in the treatment group and the control group (p= 0.001 and p= 0.001 respectively).

Table 5. The effect of exercise on Hb levels and BMI between the treatment and control groups

	n	Mean ±SD	Difference mean (IK 95%)	p
Hb				
Treatment Group	56	12.116 ± 1.7939	0.8839 ± (0.2695 – 1.4984)	0.005***
Control Group	60	13.000 ± 1.5443	0.8839 ± (0.2660 – 1.5019)	
BMI				
Treatment Group	56	22.570 ±	1.4196 ± (0.3990 – 2.4403)	0.007***

Control Group	60	2.8373 21.150 ± 2.7116	1.4196 ± (0.3972 – 2.4421)	

***Independent t test

The results of the independent t test analysis showed that the mean hemoglobin level in the treatment group was lower than that of the control group's Hb level (12.1 gr% and 13.0 gr% respectively). It proved significantly that there was a difference on Hb levels between both groups (p=0.005). This showed that the mean of BMI of the treatment group was higher than of that in the control group (22.6 and 21.2 respectively). The independent t test showed that premenstrual exercise affected the average BMI in the treatment group and the average BMI in the control group with a p value of 0.007

Table 6. Analysis of the effect of exercise on PMS Score, Perceived Stress Score (PSS), Body Image Score (BIS), and Cortisol hormone levels in the treatment and control groups

Variable	n	Median (Min – Max)	Mean ± SD	p
PMS Score				
Treatment Group	56	2 (1 – 6)	2.75 ± 1.392	
Control Group	60	5 (1 – 9)	5.47 ± 2.038	0.001****
PSS				
Treatment Group	56	3 (1 – 7)	3.32 ± 1.653	
Control Group	60	15 (5 – 40)	15.62 ± 6.028	0.001****
BIS				
Treatment Group	56	19 (9 – 23)	18.84 ± 3.468	
Control Group	60	8 (2 – 21)	9.30 ± 4.175	0.001****
Cortisol Level				
Treatment Group	56	73.15 (12.5 – 184.0)	83.575± 39.421	
Control Group	60	136.5 (54.5 – 299.5)	147.53± 68.277	0.001****

**** Mann Whitney test

The results showed that the mean PMS Score of the treatment group was lower than the retention of the PMS Score of the control group (2.75 and 5.47). The Mann Whitney test shows that premenstrual exercise affects the PMS Score in the treatment group and the PMS Score in the control group (p=0.001). This showed that the mean of PSS treatment group was lower than the PSS mean of the control group (3.32 and 15.62). The Mann Whitney test showed that premenstrual exercise affects the PSS average in the treatment group and the PSS average in the control group (p= 0.001).

Mann Whitney analysis test results showed that the mean BIS of the treatment group was higher than the BIS mean of the control group (18.84 and 9.30). The Mann Whitney test showed that premenstrual exercise influenced the average BIS in the treatment group and the average BIS in the control group (p= 0.001). Mean of cortisol hormone levels in the treatment group were lower than the cortisol hormone level mean in the control group (83.575 and 147.53). Premenstrual exercise influenced the average cortisol hormone level in the treatment group and the average cortisol hormone level in the control group (p=0.001).

IV. DISCUSSION

The prevalence of PMS in this study was 76.6 %. The results of the study in Egypt found that the prevalence of PMS was greater at 86%. Research in Turkey from 316 health students who experienced PMS was 72%. Likewise the prevalence of PMS in Iran reaches 75%. A study at Turkey stated that there were 38% prevalence of PMS among 134 nurses at Trakya University Medical Faculty Hospital, Edirne, Turkey. They were screened by the Premenstrual Syndrome Scale (PMSS) questionnaire. PMSS uses the basis of DSM III and DSM IV. The study involving 1699 undergraduate and postgraduate students in Taiwan found that 39.85% experienced PMS. This illustrates that the prevalence of PMS varies greatly between countries. This difference may be influenced by various conditions such as sample size, age, race, level of stress, variations in diagnostic methods, working force, and culture.

The results showed most of the subjectswerethe late teenagers and young adult women. The age between two groups is similar. It showed that they have the same proportion and chance to get PMS. All subjects in this study were not married. This is in line with Arafaet all research in 2018 which stated that PMS attacks women with an average age of 19 years with the most opportunities at the age of 18 to 24 years. Arafa further said that the highest percentage of 91% of PMS cases was experienced by unmarried women. Research in Iran concluded that out of 236 subjects, the average age of students experiencing PMS was 21.49 (± 2.3) years. This is consistent with research that states that premenstrual syndrome can occur during the reproductive cycle.

The results showed that the average age of menarche was 12 years in both treatment and control groups. This is in line with research conducted in Indonesia and in Egypt which concluded that in the last two decades the average menarche occurred in women aged 11 to 12 years. However, other studies conducted in the Middle East as many as 4122 women showed that the average age of menarche was 13.1 years. Likewise, other studies average age of menarche is 13 years.

The results of BMI in the treatment and control groups decreased. This research indicates that exercise can reduce BMI and make weight more balanced. This is different from the research conducted at Massachusetts America that there was no correlation between physical activity and PMS symptoms after being controlled by BMI variables. Another study stated that women with excess body weight were more likely to experience PMS than women who were underweight (OR = 2.9, 95% CI: 1.1-7.5).

The average Hb level in both treatment and control in the normal (>12gr%). This study showed that the average Hblevels in the treatment and control groups decreased during posttest. This refers to study of women aged 17 to 25 years in India which is concluded that PMS women had lower Hb levels than non-PMSwomen.This different with

astudies that PMS is very closely related to the incidence of anemia. A previous study stated that maximal exerciseincreasedsignificantlyerythrocytes, hematocrit, and Hb levels in volleyball players. Hb levels is probably caused by various external factors which might be difficult in controlling for example the subject consumes nutrients beyond the ability of researchers to control. Subjects live in dormitories and boarding schools, even though there are rules in food consumption, it does not rule out the subject of certain food snacks during data collection. This is different in subjects given calcium mg 1200 mg/day, vitamin B6 50 mg per day, and treadmill for 3 months compared to subjects without aerobic exercise for 3 months who did not change Hb levels significantly. This may occur where there are differences in the number of samples, the length of time the study is for 3 months, and the number of other factors such as nutritional status that affect Hemoglobin levels.

The results showed that more adult groups routinely exercise 3 times a week. This shows that awareness of doing sports is mostly experienced by adult women's groups. This is different from research in America where physical activity was not related to standard and PMS symptoms after being controlled by BMI variables.This study illustrated that someone who has PMS has a history of biological mothers experiencing PMS. In this study, it was indicated that 95% of sub-subjects had a history of biological mothers experiencing PMS. Although there is still a 5% chance that subjects do not have a history of biological mothers of PMS. Research in Iran with 236 subjects randomly concluded that 74% (n=151) had a family history of PMS. Another study stated the incidence of premenstrual syndrome was 2x higher in the twin births of one egg (monozygotic) than the twinning of two dizygotic eggs.

The results showed that exercise in the treatmentgroupreducedPSS. On the other hand, PSSincreased in the control group. It proved that premenstrualexercise effects on decreasing perceived stress score (p=0.001). Research on the PSS for women who experience PMS is very difficult to find. Research in Iran in 2012 said that there was a relationship between the level of anxiety and the incidence of PMS with a value of p=0.000 (r=0.261) of the subjects as many as 236 students with an average age of 21 years. Another study revealed that 15 subjects received calcium treatment 1200 mg/day, vitamin B6 50 mg/day, and treadmill for 3 months decreased anxiety levels with 5 scores with p=0.0001 compared with subjects who received 1200 calcium mg/day, vitamin B6 50 mg/day, and treadmill for 3 months which actually experienced an increase in anxiety score 1 point.

The results of the study showed that the average score of the body image score doing exercise in treatment group increased. However, the body image score in the control group decreased. This indicates that the level of confidence in treatment group is higher. Increasing the difference in body image scores in might contributed to the perceived stress score. Studies regarding body image in women who experience PMS are still very few. Research involving 100 adolescent subjects aged 15 to 18 years concluded that there was a strong correlation between self-esteem scores and the tendency of the occurrence of body dimorphic disorders (BDD) (with a value of p=0.000 and r=0.405). Another study revealed that of the 200 girls who had PMS in Iranian Shiraz, the average age was 16.34 (±1.06) years, with a moderate self-esteem score (53%), and a high self-esteem score (47%). Furthermore, the study revealed the relationship between self-esteem scores and PMS.

The results of the study showed that the average cortisol levels of women who did exercisedecreased. On the other hand, the average of cortisol level at control group was significantly increased. Studies on cortisol level for premenstrual women is few. Premenstrual exercise can contribute to balance female hormonal level. This might prevent and reduce symptoms both psychological and physical complaints during the luteal period. Promotion and prevention should be the main point to improve health status of woman.

V. CONCLUSION

The prevalence of PMS was 76.1%. The mean age of treatment and control groups were 17 and 18 year respectively. The menarche both of two groups were same at 12 years. Mean of the length of menstruation in both two groups were 7 days.Premenstrual exercise has an effect on Hb level and BMI score (0.005 and 0.007 respectively). Moreover, exercise proved significantly on reducing PMS score (p=0.001), PSS (p=0.001), and cortisol level (p=0.001). Premenstrual exercise proved significantly on increasing BIS (p=0.001).

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