Mat Pilates Exercise Increase Hip Flexibility in Young Adults with Obesity

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MAT PILATES EXERCISE INCREASE HIP FLEXIBILITY IN YOUNG ADULTS WITH OBESITY

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ABSTRACT

Background : Young adult with obesity may experience in decreased hip flexibility. Decreased hip flexibility can be caused by excessive fat mass around the joints and lack of physical activity, resulting in muscle stiffness. Flexibility can be improved by Mat Pilates exercise which combined static and dynamic movements. **Objective :** To prove that Mat Pilates exercise can increase hip joint flexibility of young adult with obesity. **Methods :** This study used quasi-experimental study with comparison group pre-test and post-test design. The participants were 38 young adults with obesity lived in Semarang selected by purposive sampling technique. The participants were divided into experiment group and control group. The experiment group was instructed to do Mat Pilates (3 times a week) for 4 weeks and the control group was instructed to do their usual activity. The hip flexibility was measured with sideward leg splits before and after experiment. The collected data was analyzed using paired t and independent t-test. **Results :** There was a significant increase in the value of sideward leg splits after doing Mat Pilates (P<0,05), from 98,46±9,73 to 112,82±11,22 for left sideward leg splits and from 99,63±10,20 to 111,39±12,99 for right sideward leg splits. The increase in the value of sideward leg splits in the experiment group was higher than the control group (P<0,05). It was occured for both left sideward leg splits and right sideward leg splits. **Conclusion :** Mat Pilates increased hip joint flexibility of young adult with obesity
Keywords : *Mat Pilates, hip flexibility, sideward leg splits, young adult with obesity*

INTRODUCTION

Obesity has been a global public health problem continously.[1] According to the World Health Organization (WHO), in 2016, more than 1.9 billion people aged over 18 years were overweight, of which 650 million were obese.[2] Obesity put young adults at risk of long-term health problems, such as high blood pressure, high cholesterol levels, early coronary heart disease, and last but not least, musculoskeletal problems.[1,3]

Musculoskeletal problems affect functional abilities due to problems such as joint pain and decreased joint range of motion. Decreased joint range of motion is a specific sign that a person has decreased flexibility.[4] Decreased flexibility in obesity often occured in several joints such as the lumbar, knee, and hip joint.[5] Decreased flexibility in these joints can be caused by fat mass excess in and around the joint, and lack of physical activity. The accumulation of fat mass around the joint and muscle caused a mechanical resistance to the joint motion.[6] The lack of physical activity in obesity can also result in muscle stiffness so that the joint flexibility decreased.[7]

The hip joint plays an important role in supporting body weight and performing various daily activities.[8,9] Decreased flexibility of the hip joint can affect the daily activities of young adult with obesity, especially movements that involve a wider range of motion such as squatting, getting up from a chair, walking fast, and bowing.[10,11]

Flexibility can be improved by stretching exercises such as pilates exercise.[12] Pilates exercise is appropriate for all people, both healthy and sick people of all ages.[13] Pilates exercise is safe because there is no jumping or running movement and it is done without excessive pressure of movement therefore reducing the risk of trauma or injury. Pilates exercise combines static and dynamic stretching performed slowly resulting in muscle lengthening. Pilates exercise can increase the distance between filaments, and decrease the fibrous tissue, resulting elongation of the muscles.[14]

There are two forms of Pilates exercise, the Pilates Apparatus, which combines movement and body posture in several variations using tools for exercise, and Mat Pilates which is an exercise on the floor in supine, sitting, or prone position.[15] The exercises in Mat Pilates strengthen and stretch the

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muscles.[16] All exercises in Mat Pilates are done with a typical breathing technique. Mat Pilates is recommended for someone who wants to start Pilates exercise because the movements during exercise are well-controlled, practical, and approachable.[14,17]

Based on researcher's knowledge, the studies on the effect of Mat Pilates in increasing hip joint flexibility is limited to athletes, women over 60 years, and specific study on young adult with obesity has not been found.[17,18] Thus, the researcher wanted to know whether Mat Pilates could increase hip joint flexibility in young adults with obesity.

METHOD

Design and Variables

This research is an experimental study with comparison group pre-test and post-test design carried out in August-September 2020. This research was conducted in Semarang city. The independent variable in this study is mat pilates exercise. While the dependent variable is the flexibility measured by sideward leg splits test.

Subject

Participants in this study were young adult with obesity who lived in Semarang who met the inclusion and exclusion criteria. Inclusion criteria included aged 18-23 years, BMI 25,0 – 29,9 and willing not to do any exercise while the research conducted. Exclusion criteria included a history of hip joint pain, and lower extremity deformity (osteoarthritis, genu valgus, genu valrum).

Participants were selected by purposive sampling and divided to 2 groups randomly using table of random numbers. The total participants were 38 people consisted of 20 people in treatment group and 18 people in control group. The treatment group was instructed to do Mat Pilates for 3 times a week, for 4 weeks. The control group was instructed not to do any type of exercise for 4 weeks.

Tools and Materials

The tools and materials used in this study were a letter of informed consent, weight scale, height meter, mat, tape measure, and questionnaire for research subject.

Procedure

Subjects who had been given explanation about the study and had signed the informed consent form were then randomly allocated into two groups using the table of random numbers. The treatment group was instructed to do Mat Pilates for 3 times a week, for 4 weeks. The control group was instructed not to do any type of exercises for 4 weeks. The subjects flexibility was measured 2 times, before (pre-test) and after the intervention (post-test). The flexibility measurement was directly measured by meeting the subjects using door-to-door method to avoid the crowd and still following the COVID-19 protocol prevention.

Mat Pilates was conducted for 60 minutes including 5 minutes of warm-up, 16 core movements, and 5 minutes of cooling. Each movement is repeated 3-5 times. Due to COVID-19 pandemic, Mat Pilates exercise was carried out online and monitored through online meeting application.

Data Analysis

The data was processed, coded, and entered into computer for descriptive analysis and hypothesis testing. The data normality test was analyzed using Saphiro-Wilk test. Hypothesis test regarding the difference in sideward leg splits before and after intervention was analyzed using paired t-test. Hypothesis test regarding sideward leg splits difference between the groups was analyzed using independent t-test. Hypothesis test results were considered significant if the *P* value was < 0.05 with 95% confidence interval.

RESULTS

Table 1. Subject Characteristics

Element	Groups		*P*
	Control (n=18)	Treatment (n=20)	
Age	21,00±0,91	20,70 ±0,87	0,350‡
Gender			
Men	8 (44,4%)	7 (35%)	0,552¥
Women	10 (55,6%)	13 (65%)	
Physical activity			
Sedentary	8 (44,4%)	11 (55%)	0,516¥
Nonsedentary	10 (55,6%)	9 (45%)	
BMI	27,88±0,76	27,26±0,67	0,011§*

Significant (*P*<0,05);
§ *Independent* t; ‡ *Mann-whitney*; ¥ *Chi square*

Subject characteristics were consisted of age, gender, physical activity, and body mass index as shown in Table 1. There is no difference in age, gender, and physical activity between the groups. (*P* > 0,05).

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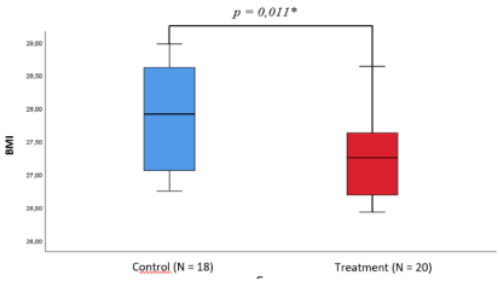
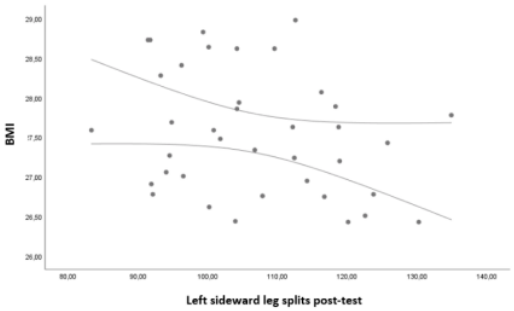


* = Mann-Whitney test

Figure 1. Boxplot of BMI in the control and treatment group

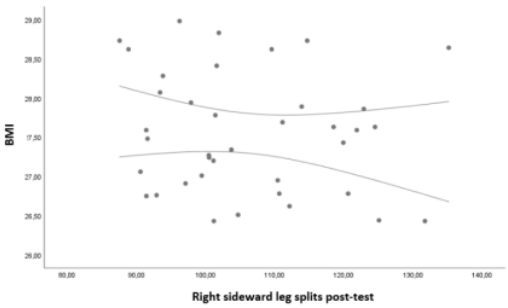
Based on figure 1, it was found that the BMI of the control group was significantly different compared to the treatment group (*P*=0,011; independent t-test).



Pearson's correlation r = -0,020 *P* = 0,907 n = 38

Figure 2. Scatterplots of BMI to left sideward leg splits post-test

Based on figure 2, it shows that the position of data points did not formed a clear pattern. It shows that there was no correlation between BMI and *left sideward leg splits post-test. Pearson's* test result showed that there is no correlation between BMI and *left sideward leg splits post-test* (*P*=0,148).



Pearson's correlation r = -0,020 *P* = 0,907 n = 38

Figure 3. Scatterplots of BMI to right sideward leg splits post-test

Based on figure 3, it shows that the position of data points did not formed a clear pattern. It shows that there was no correlation between BMI and *left sideward leg splits post-test. Pearson's* test result showed that there is no correlation between BMI and *left sideward leg splits post-test* (p=0,148).

Table 2. Left sideward leg splits pre-test dan post-test

Left sideward leg splits	Groups		*p*
	Control (n=18)	Treatment (n=20)	
Pre-test	98,67 ± 9,73	98,46 ± 9,73	0,947§
Post-test	100,24 ± 10,39	112,82 ± 11,22	0,001§*
p	0,191¶	<0,001¶*	

* Significant (p < 0,05); § Independent t; ¶ Paired t

Table 2 shows that there was a increase in left sideward leg splits in the treatment group after doing Mat Pilates (*P*=0,001; paired t-test). There was no increase in left sideward leg splits in control group (*P*=0,191; paired t-test). The sideward leg splits value in the treatment group after doing Mat Pilates were higher than the control group. (*P*=0,001; independent t-test).

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Table 3. Right sideward leg splits pre-test dan post-test

Right sideward leg splits	Groups		*P*
	Contro (n=18)	Treatment (n=20)	
Pre-test	99,63 ± 8,51	99,63 ± 10,20	0,998§
Post-test	100,22 ± 9,78	111,39 ± 12,99	0,005§*
P	0,855¶	0,007¶*	

* Significant ($P < 0,05$); § Independent t; ¶ Paired t

Table 3 shows that there was a increase in right sideward leg splits in the treatment group after doing Mat Pilates (P=0,007; paired t-test). There was no increase in left sideward leg splits in the control group (P=0,855; paired t-test). The sideward leg splits value in the treatment group after doing Mat Pilates were higher than the control group (P=0,005; *independent t-test*).

DISCUSSION

In this study, there were no significant difference in gender and physical activity of the groups so it was considered that both gender and physical activity did not affect the result of the study. There was a significant difference in BMI between the groups. Further analysis showed that there was no correlation between BMI and sideward leg splits post-test value so that the BMI difference between the groups did not affect the result of the study.

Significant result were obtained that there is an increase in sideward leg splits in the treatment group after doing Mat Pilates exercise. The value of sideward leg splits in the treatment group after doing Mat Pilates was higher than the control group. The increase in sideward leg splits in the treatment group occured in both legs. A study conducted by Kyranoudis, *et al.* (2016), which examined the effect of Mat Pilates on increasing acute flexibility in female soccer players, showed a synergistic result that Mat Pilates increased the flexibility of the hip joint, knee joint, and heel joint.[17] Similar result in a study conducted by De Oliveira, *et al.* (2016), which examined the effect of Mat Pilates on the flexibility of elderly women, showed that Mat Pilates increased hip joint flexibility as indicated by an increase in range of motion of flexion and extension of the hip joint after doing Mat Pilates.[18]

Obesity may decrease the flexibility due to the excess of fat mass in and around the joints and the muscles, causing mechanical resistance in the joint motion. The fat accumulation occured in certain body parts resulting in decreased flexibility of several joints such as the shoulder, knee, and hip joint.[6] In this study, obesity was categorized using BMI criteria. BMI does not specifically indicate the fat accumulation around the hip joint. BMI was widely utilized as an anthropometric estimation of general adiposity, not to identify differences in body composition and body fat distribution around the joints or the muscles. The fat distribution around the joints or body parts such as abdominal circumference, hip circumference of the subjects in this study was not measured so that the fat accumulation that can contribute the flexibility was unknown.

Obesity is closely related to lack of physical activity resulting in muscle stiffness. Mat Pilates exercise which combines static and dynamic movements caused an increase in viscoelasticity of the connective tissue resulting a change of the extensibility so that the length and elasticity of the connective tissue of the joint increased resulting in increased flexibility.[17,19]

Mat Pilates movements build muscle strength and flexibility. Stretching in Mat Pilates affects priopioseptic input thereby modulating reflex during streching. The movements cause slow stretching then activate the muscle spindles and trigger the stretch reflex, resulting in muscle contraction reflex. It will cause a pressure change in the muscle connected to the tendon where mechanoreceptor, Golgi Tendon Organ (GTO) are located. Golgi tendon organ will detect a tension change during stretching then inhibit alpha motor neuron activity, resulting in inhibition of the muscle contraction reflex so that the muscles elongation occured. When the movement exercise was stopped, the sarcomere continued to elongate as an adaptation response of new tissue elongation so that hip joint flexibility increased.[14,20] This mechanism caused Mat Pilates exercise significantly increased the hip joint flexibility as measured by sideward leg splits.

This study has limitation which did not measure abdomen circumference, hip circumference of the subjects so that the fat accumulation in these area is unknown.

CONCLUSION

Mat Pilates increased hip joint flexibility of young adult with obesity indicated by increased

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value of sideward leg splits.The hip flexibility in the group given Mat Pilates exercise was significantly higher than the group that was not given exercise.

Further research on the effect of Mat Pilates exercise on the hip flexibility is needed by measuring and considering abdomen circumference, hip circumference to know the fat accumulation in these area.

ETHICAL APPROVAL

This research has received ethical permission from the KEPK (Commission on Ethics for Medical and Health Research) Faculty of Medicine UNDIP with No. 78/EC/KEPK/FK-UNDIP/V/2020.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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AUTHOR CONTRIBUTIONS

Writing-original draft preparation, Naufal Prima Wianto; writing-review and editing, dr. Tanti Ajoe Kesoema, Sp. KFR(K), M.Si.Med.

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