COMPETITOR:
JURNAL PENDIDIKAN KEPELATIHAN OLAHRAGA
e-ISSN: 2657-0734 & p-ISSN: 2085-5389 ‖ Volume 17, Number 2, 2025 ‖ P.1349-1355

The Effect of a High Volume Static Stretching Program of Hamstring Muscles on Musculoskeletal Pain to Improve Lower Extremity Flexibility of Physiotherapy Students

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ABSTRACT

Musculoskeletal pain in the lower extremities is a common complaint experienced by female physiotherapy students due to static activities and poor ergonomic posture. One of the intervention methods that can be applied is high-volume static stretching that targets the hamstring muscles to increase flexibility while reducing muscle tension. Objective: This study aims to determine the effect of a high-volume static stretching program of the hamstring muscles on musculoskeletal pain to increase lower extremity flexibility in female physiotherapy students. Method: This study used a quasi-experimental design with a pre-test and post-test approach. The sample consisted of 20 female physiotherapy students who met the inclusion criteria. The intervention in the form of a high volume static stretching program was carried out for 5 weeks for 10 therapies, and measurements were taken of lower extremity flexibility using the sit and reach test. Results: The results of the analysis showed a significant decrease in the level of musculoskeletal pain and increased flexibility of the lower extremities after participating in the intervention program. This shows that static stretching with high volume has a positive effect on the condition of the hamstring muscles. In this treatment group using the normality test using the Shapiro-Wilk test on all pre-test and post-test variables obtained a p value> 0.05, which means the data is normally distributed. Then the data of the treatment group obtained the results of the normality test before P> 0.000 which means P> 0.05 and the value after the intervention P <0.097 which means P> 0.05 then the results of the hypothesis using the paired samples t-test this study obtained a value of P = 0.000 (P <0.05) with an average value of 10.50 ± 210.00 which means that the static stretching high volume intervention is significant in increasing the flexibility of the hamstring muscles in musculoskeletal pain conditions. Conclusion: A high volume static stretching program is effective in improving lower extremity flexibility in female physiotherapists with musculoskeletal pain. This intervention can be recommended as part of a prevention or rehabilitation program.

ARTICLE HISTORY
Received: 2025/06/20
Accepted: 2025/06/26
Published: 2025/06/28

KEYWORDS
Static Stretching;
Hamstring;
Musculoskeletal Pain;
Flexibility;
Physiotherapy.

AUTHORS' CONTRIBUTION
A. Conception and design of the study;
B. Acquisition of data;
C. Analysis and interpretation of data;
D. Manuscript preparation;
E. Obtaining funding

Cites this Article : Ismaningsih, S.; Zein, Renni Hidayati; Akbar, Sandi. (2025). The Effect of a High Volume Static Stretching Program of Hamstring Muscles on Musculoskeletal Pain to Improve Lower Extremity Flexibility of Physiotherapy Students. **Competitor: Jurnal Pendidikan Kepelatihan Olahraga**. 17 (2), p.1349-1355

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INTRODUCTION

Musculoskeletal pain affects a large portion of the population. According to the Global Burden of Disease Study, musculoskeletal disorders have increased by 30% from 1990 to 2019. The World Health Organization (WHO) provides further insight into musculoskeletal conditions, noting that approximately 1.71 billion people are affected worldwide. Among these disorders, low back pain stands out, with a prevalence of 568 million people, making it a major contributor to disability globally, with low back pain being the leading cause of disability in 160 countries (Konrad et al., 2025).

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The term musculoskeletal disorders (MSD) can be defined as "a condition encompassing more than 150 diagnoses affecting the locomotor system; that is, muscles, bones, joints, and associated tissues such as tendons and ligaments, as defined in the International Classification of Diseases. Pain, limited mobility, lack of skills, and impaired functional abilities are common symptoms of musculoskeletal disorders. The capacity of people to work and collaborate in social roles is also impaired. According to a survey conducted by the Brazilian Institute of Geography and Statistics (IBGE, 2017), approximately 27 million Brazilians aged 18 years and older suffer from musculoskeletal pain, such as hamstring tightness(DM et al., 2023).

Hamstring tightness is a common musculoskeletal problem among college students. The prevalence of hamstring muscle tension among college students aged 18-25 years was found to be very high, namely 68%. Sitting for a long time is a predisposing factor for hamstring muscle tension (Hamstring Tightness). Hamstring muscle tension can cause hamstring muscle strains and other injuries that can hinder student activities(Liyanage et al., 2024).

Hamstring tightness is generally defined as decreased range of motion with a feeling of restriction in the back of the thigh. It can occur as a result of several factors, including muscle injury, genetic predisposition, and compensatory shortening resulting from chronic deformity. Hamstring tightness causes little knee flexion during activity and exerts a relatively high quadriceps force against passive hamstring resistance. This can increase the reaction force at the patellofemoral joint and cause knee joint pain that interferes with gait (Allam et al., 2023).

Hamstring tightness is caused by nerve structures that cause severe pain in the posterior thigh, knee, leg, and also in the cervical and thoracic regions, which is relieved by cervical extension to reduce discomfort. Hamstring tightness can also cause patellofemoral pain. Pain occurs in the front of the knee and around the patella; this may

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be caused by strong use in athletics or training. Tightness can also occur in students who are not involved in any physical activity. Their habit of sitting with their knees bent all day causes the hamstring muscles to shorten, which causes the pelvic bone to tilt backwards. The backwards tilt increases the lumbar lordosis, which causes tension in the back muscles, resulting in mechanical low back pain(Kamalakannan et al., 2020).

The hamstring muscle group is located on the back of the thigh. It is made up of three different muscles. This muscle group is located between the hip and the knee in the back. These muscles are the semitendinosus, the semimembranosus in the middle, and the long head of the biceps femoris laterally. The hamstring muscles function to extend the hip and flex the knee joint. Muscle flexibility is the ability of muscle tissue to lengthen, which is an important factor in health-related physical fitness(Allam et al., 2022).

Muscle flexibility is considered an essential element of normal biomechanical function and optimizing physical activity performance. Reduced flexibility not only reduces the range of motion but can also lead to a variety of other musculoskeletal problems. It is well known that sedentary behaviour in developed countries can worsen muscle dysfunction and cause musculoskeletal discomfort(Abbas et al., 2024).

Static stretching is a type of exercise that is done in a static state without any additional movements other than muscle stretching movements. Stretching exercises that are done without any movement are called static stretching. In addition, static stretching causes a person to be in a stretching position and hold it for a certain period (Shaharuddin & Mondam, 2017).

Regular stretching increases range of motion, reduces discomfort or pain, and improves the viscoelastic properties of the muscle-tendon unit. Stretching is therefore an attractive, inexpensive, and noninvasive option for improving musculoskeletal pain and optimizing the health of each individual(Gelfman et al., 2024).

High volume static stretching intervention on hamstring muscles was performed 6 sets with 5-minute intervals, with 60 seconds; total 30 minutes in each session, 60 minutes per week. The high volume static stretching program was performed 2 days/week for 5 weeks with 3–4-day intervals (10 sessions; total program volume 300 minutes). This weekly volume is approximately 2 to 13 times greater than that tested in the literature(Yahata et al., 2021).

METHODS

The type of research used is quasi-experimental research with a pre- and post-test research design without a control group design, involving one group of subjects given high-volume static stretching treatment on the hamstring muscles. Evaluation measurements were carried out using sit and reach test measurements, which are physical fitness tests used to measure flexibility, especially in the hamstrings and lower back muscles. This test involves sitting with your legs straight in front, then trying to reach your toes or further with straight arms. The measurement results show how far a person can reach, which is an indication of flexibility.

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The population in this study were female physiotherapy students who experienced musculoskeletal pain in the lower extremities. All female students with musculoskeletal pain who received physiotherapy services totalled 20 people. The study was conducted by providing treatment 10 times for 5 weeks from April 27 to May 31, 2025. Based on the inclusion criteria, a sample of 20 people was obtained.

The following steps are taken in this research flow, which are divided into several (3) parts, namely: (1) initial administration, (2) sample selection and (3) the research implementation stage is as follows: first, random selection is carried out based on inclusion and exclusion criteria, second, the number of selected samples is selected based on inclusion criteria, and finally, the selected samples become research subjects. The following are the steps taken in the research.

RESULTS AND DISCUSSION

Result

Normality Test Analysis on Sample

Description of the data on the characteristics of the research sample subjects, including age (years), weight (kg), height (cm), and BMI data, tested using descriptive analysis in SPSS, are shown in Tables 1 and 2:

Table 1.
Sample distribution based on descriptive data in the treatment group

N=20	Minimum	Maximum	Mean	Std. Deviation
Umur	19	22	20.55	0.686
Berat Badan	39	81	56.65	10.007
Tinggi Badan	146	165	155.65	5.334
BMI	17	32	23.330	3.699

I respond to groups based on age, weight, and height. In the treatment group with a sample size (n = 20), it was found that the average age was 20.55 + 0.686. In this study, the average age obtained was 20 years, the Average weight 56.65 + 10.007, Average height 155.65 + 5.334.

Table 2.
Normality Test

Data Group (n = 20)	Uji Normalitas *Shapiro-Wilk*	
	Group Average±SB	P
Before	18.30±0.733	0. 000
After	24.75±1.482	0.097

Table 2 explains the results of the Normality Test based on the Shapiro-Wilk test on all pre-test and post-test variables. In the data group, the average value before was 18.30 ± 0.733 and the P value = 0.000, while the average value after was 24.75 ± 1.482 and the P value = 0.097 was obtained, then P < 0.05, the data was concluded to be abnormally distributed, so that in this treatment group the Wilcoxon test was used.

Hypothesis Test of Pre- and Post-Intervention Values in Increasing Hamstring Muscle Flexibility Using the Sit and Reach Test.

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Table 3.
Uji Hipotesis

Variable (n=20)	Rerata±SB	P
Sebelum dan sesudah intervensi	10.50±.210.00	0.000

Table 3 explains the results of the differences before and after the intervention in the Treatment Group with a significant value of P = 0.000 (P <0.05) with a mean value of 1-10.50 ± .210.00.

The hamstring muscle is one of the important muscles in the lower extremities. As part of the tonic muscle group, it consists of 3 two-joint muscles (TJM), the leg joint extensors, and the knee joint flexors. Flexibility in the TJM is very important. Flexibility of the hamstring muscle group is essential in knee extension and for many daily activities where the above-mentioned muscles simultaneously extend above the 2 hip and knee joints. If flexibility is inadequate, muscle function will be impaired(Heshmatipour et al., 2019).

Stretching is a common activity performed by athletes, seniors, rehabilitation patients, and anyone following a fitness program. Although the benefits of stretching are well-known, there is controversy about the best type of stretching for a particular purpose or outcome. Three muscle stretching techniques are often described in the literature: static, dynamic, and precontraction stretching. The most common and traditional type of stretching is static stretching, in which a specific position is held with the muscle tensed until a stretch is felt and repeated. This stretching can be performed passively by a partner or actively by the subject (Page, 2014)

Static stretching (SS) is an activity that involves maintaining a still position for some time, where certain joints are locked in a position that places the muscles and connective tissues at their maximum length. This stretching method usually involves actively or passively moving the limb to the limit of ROM and maintaining the stretched position for 15 to 60 seconds. In several studies, a period of 15 to 30 seconds is effective in increasing flexibility and ROM(Mašić et al., 2024)

CONCLUSION

Based on the results of the study and discussion, it can be concluded that there is an increase in the flexibility value of the lower limbs in musculoskeletal pain conditions with the provision of Static stretching high volume intervention. This can be seen from the difference in results before and after the intervention, which means that the static stretching high volume treatment intervention has a very good effect in increasing the flexibility value of the hamstring muscles. The researcher suggests that in the future, there will be further research developments conducted with a larger number of sample groups and research conducted to determine the influence or effects of variations in time and intensity of static stretching, high volume.

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