The effect of stretching exercises on flexibility for students

By Muhammad A'araf

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Abstract

Flexibility is an important basic component in sports activities, which supports the achievement of the maximum performance of an athlete. Exercises are needed for stretching proper this study aimed to determine: (1) the effect of passive static stretching on shoulder flexibility, (2) the effect of Proprioceptive Neuromuscular Facilitation (PNF) stretching on shoulder flexibility (3) determine which exercise is better on shoulder flexibility between stretching and PNF. the method used is experimental with pretest and post-test design. The research sample was 16 students of the Sport Coaching Education study program, Faculty of Sport, Sebelas Maret University, Surakarta. research data was obtained using the sit and reach test. Data analysis using an independent sample test with the help of the SPSS 22.0 program. The results of the study (1) passive static stretching effect on togok flexibility, the test results show the value of sig. 0.00 < 0.05. (2) practice PNF affects the flexibility of stakes. The study results show that both passive tactical stretching exercises and PNF exercises have a significant effect on increasing flexibility, but empirical data states that PNF exercise is more effective in increasing flexibility.

Keywords: stretching, passive static, PNF, flexibility

INTRODUCTION

Human activities in life can not be separated from physical activities, including sports. The effects of exercise, of course, will also increase strength and muscle development and impact the function of the body's organs for the better (Chen, Wang, You, & Shan, 2021). Immunity to disease due to sports activities is a mandatory requirement given to students at all levels of education to have good fitness and immunity.

A person's fitness is influenced by various components: flexibility other than cardiovascular, muscle strength, muscle endurance, and body composition (Walker, 2011). “Stretching is a fundamentally important part of sport and exercise, playing a role in improving performance, and preventing injury and rehabilitation” (Behm, 2019). Flexibility is one of the essential components of sports activities. Without flexibility, a player or athlete cannot achieve maximum performance (Ponraj & Karthikeyan, 2017). Flexibility, related to the range of motion in the joint, can be increased by stretching (Bompa et al., 2013). Increasing flexibility through

stretching increases the range of motion and sports accuracy, muscle activity, and coordination abilities (Lim, 2011).

Flexibility shows the wide range of joints or several joints (Lima et al., 2019). Therefore flexibility is needed in various sports, which require most joint space, such as gymnastics, diving, some athletics, ball games, fencing, and wrestling (Donti et al., 2018; Ponraj & Karthikeyan, 2017).

As people get older and physical activity decreases, it certainly affects a person's level of flexibility. Likewise, the level of flexibility of students at the Elementary School, Middle School to Higher Education levels, of course, will be different. MacKay et al. (2017) also confirm that children become significantly stronger with age from childhood and adolescence. Children are naturally more flexible than adults. The body becomes stiffer, less flexible, and less adaptable with age. However, as you get older, that does not mean you have to stop stretching (Berg, 2011).

The results of observations during students taking basic gymnastics lectures at the Faculty of Sports, Sebelas Maret University, Surakarta, many of them have difficulty and cannot do basic gymnastics, so the learning objectives cannot be achieved. When doing stretching, students are less than optimal in carrying out the instructions and exercise instructions given by the teacher or lecturer. As a result, the purpose of stretching, part of the warming up given to prepare physically (muscles and joints), increase flexibility, reduce the risk of injury, the results are less than optimal. In gymnastics lectures, they have difficulty doing roll and elastic movements, including various movements requiring flexibility and experiencing obstacles. Gymnastics lectures can be caused by several students who have minimal physical activity during the online learning conditions. The Covid-19 pandemic has an unfavorable contribution to students' physical condition and flexibility.

Flexibility is a factor that supports success in carrying out a movement or activity, both in sports and other activities. Lim, (2011) and Lockie, Dawes, Kornhauser, & Holmes (2019) mention that “Flexibility has

more to do with overall body function…. For instance, diminished flexibility is one indicator of an aging body. According to Jung & Yamasaki, (2016), Muscle flexibility is “the ability of the body to move in the joint space or body movement space maximally without being influenced by pressure."

Numerous studies have shown that as we age, muscle elasticity decreases, and stretching helps maintain that flexibility if appropriately done, and regularly Opplert & Babault (2018) explained that “Stretching has long been used in many physical activities to increase range of motion (ROM) around a joint. Due to a person’s age and reduced physical activity, people must continue to practice stretching or stretching muscle groups to maintain mobility and joint range of motion. Several forms of exercise can be given to training muscle flexibility, one of which does stretching exercises, as suggested by Opplert & Babault (2018) to overcome the problem of impaired flexibility (muscle shortening) and maximize muscle work optimally training is needed, which aims to stretch the shortened tissue or muscle.

The risk of flexibility exercises is minimal if done according to the proper guidelines. Skeleton flexibility in various sports activities has a significant role in contributing to athlete performance. Passive and active static stretching and dynamic stretching techniques were developed to increase ROM levels and improve the method of certain sports (Lima et al., 2019). Flexibility or flexibility of muscles, especially the elasticity of muscles and tissues in the trunk, provides positive support for the appearance of athletes (McGinnis, 2013). Bompa et al., (2013) state that regular stretching offers several significant benefits, such as increased flexibility, reduced muscle pain, better muscle, and joint mobility, and greater efficiency in muscle movement and fluidity of motion.

Four types of stretching or flexibility exercises can be done: static stretching, dynamic stretching, Propioceptptive Neuromuscular Facilitation (PNF), and ballistics (Opplert & Babault, 2018; Ayers & Sariscsany, (2011); Shorty & Train, (2012). Meanwhile, according to Laughlin, (2014), there are three types of flexibility: dynamic, statically active, and statically

passive. However, in practice, stretching or stretching, both passive-active stretching and PNF, are often skipped and considered not so important. Stretching exercises do not take a long time, but it must be remembered that the benefits and positive values of the practices do have a perfect influence on the perpetrator. Static Stretching exercises and PNF have an excellent effect on RoM in the hips and knees related to step mechanics during high-speed walking (Caplan et al., 2009; Lim, 2011).

Based on the description above, it can be stated that proper stretching or flexibility exercises are needed for students, according to age and to support their activities. Passive static stretching exercises are the most frequent and joint stretching exercises done by students, while PNF exercises are still rarely done, considering that their implementation requires special attention. Therefore, this exercise is interesting to be tested in a study. The basis of this study stems from previous findings investigating the effect of stretching exercises on flexibility, but not yet specific on what kind of stretching exercises, only stretching exercises performed three times a week (MacKay et al., 2017), active stretching programs on knee flexors (Batista, et al., 2019), and static stretching exercises on hamstring flexibility (Funk, et al., 2003). Based on this, this study seeks to investigate the effect of stretching exercises on flexibility. This study examines whether passive stretching exercises and PNF affect flexibility and investigates which exercises are more significant in increasing flexibility. Knowing the impact of the two exercises has implications for choosing the right exercises that others will use to increase flexibility. The relevance, good flexibility makes the body more dynamic and ready to accept loads in various conditions. Without compromising the role of other body flexibility, togok flexibility has very dominant support in various human movement activities. Flexibility helps muscle elasticity and provides a wider range of motion in the joints (Bompa et al., 2013).

Various work activities and sports activities do not escape the contribution of flexibility. Flexibility has an important role in every human movement. Flexibility is where the joint can move in the maximum space

according to the range. Optimal flexibility allows a joint or group of joints to move freely and efficiently (Ayers & Sariscsany, 2011). Several factors influence differences in a person's flexibility ability. According to Bompa & Buzzichelli (2015), "a person's flexibility depends on the structure of the joints, the muscles that pass through the joints, age, sex, body temperature, muscle tone, muscle strength, fatigue, and emotions.

Ayers & Sariscsany (2011) and Opplert & Babault (2018) classify the types of stretching (stretching) that encourage flexibility consisting of active by relying on antagonistic muscles, passive with the help of people, partners, gravity, or tools that provide the power of stretching. Static stretching is done slowly and continuously held for 10 to 30 seconds on the muscles-tendons until it is felt to the point of discomfort (Laughlin, 2014), While dynamic stretching and PNF (proprioceptive neuromuscular facilitation) are static stretchings that use a combination of active and passive stretching.

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METHODS

The study used an experimental method with a pre-test-post-test design. Due to the COVID-19 pandemic, the previously planned research on campus at The Faculty of Sports, Sebelas Maret University, Surakarta, was finally carried out independently in their respective homes while still observing health, social and physical distancing protocols. Subjects who received passive stretching exercise treatment did the exercises independently at home, as did the group of subjects who received PNF exercise treatment. All groups did exercise regularly three times a week in the morning for 15 minutes. Control of the treatment is carried out by monitoring exercise activities through virtual meetings (Zoom Meeting) so that researchers can know firsthand the training process from beginning to end. The exercise program carried out is a program that an expert has validated. Treatment is carried out for 6 (six) weeks, from November 11, 2020, to December 23, 2020, with 3 (three) exercises a week, namely on Monday, Wednesday, and Friday.

The population in the study were students of the Sports Coaching Education (PKOR) study program, FKOR UNS, for the 2019/2020 academic year. The sample was taken by purposive random sampling technique with 16 students. All participants were male. Furthermore, 16 subjects were divided into two groups, namely the passive static stretching treatment group and the PNF exercise treatment group. Research data was obtained from the test-retest results before and after treatment by measuring the flexibility of the togok, using a modified sit and reach (Narlan & Juniar, 2020). The collected data were analyzed by an independent sample test with a significance level of a = 0.05 using the SPSS 22.0 program.

RESULTS

The collected data were then tabulated to make them easier to analyze. The results of the data analysis according to the groups being compared and then described in the following table 1.

Table 1. Summary of Descriptive Statistics Data Flexibility Stalks for each Group based on Research Variables

Treatment	Statistical	Pre-test	Post-test	Difference
Static Stretching Passive	N	8	8	-
	Total	282.5	325.0	42.5
	Mean	35.31	40.62	5.31
	SD	3.27	3.40	0,13
PNF	N	8	8	-
	Total	283.0	329.5	46.5
	Mean	35.38	41.19	5.81
	SD	3.03	3.26	0.23

A comparison of the average value of trunk flexibility for each group, test results before and after treatment, and the increase in value can be seen in the following diagram:

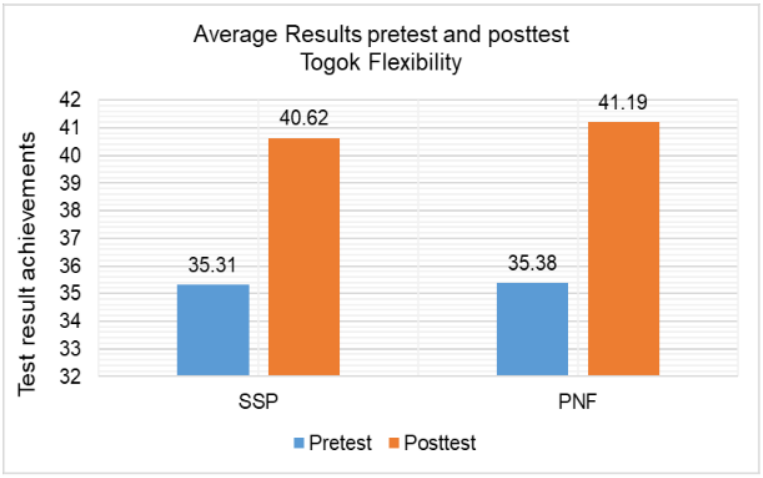

Figure 1. Histogram of the comparison of mean flexibility of the trunk on the initial and final tests of the passive static stretching and PNF (SSP = passive static stretching, PNF = Proprioceptive Neuromuscular Facilitation)

The requirement to be met before conducting an independent sample test is that the normality test was carried out with Shapiro-Wilk at a significance level of 5% with the SPSS 22.0 program. The results of the analysis are presented in the table below:

Table 2. Reliability Statistics Pretest and Posttest

Pre-test (before treatment)		Post-test (after treatment)	
Cronbach's Alpha	N of Items	Cronbach's Alpha	N of Items
.856	3	.934	3

The retest test results on the initial test (before treatment) obtained Cronbach's alpha 0.856, and the results of the retest test on the final test (after treatment) got Cronbach's alpha 0.934. Furthermore, the results of the normality and homogeneity test are as follows:

Table 3. Normality Test Results

	Stretching Exercises	Kolmogorov-Smirnov[a]			**Shapiro-Wilk**		
		Statistics	df	Sig.	Statistics	df	Sig.
Fleksibility of togok	Pretest SSP	.178	8	.200*	.965	8	.855
	Posttest SSP	.218	8	.200*	.946	8	.674
	Pretest PNF	.134	8	.200*	.958	8	.787
	Posttest PNF	.150	8	.200*	.947	8	.685

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

From the normality test results, it is known that in the Shapiro-Wilk initial test and post-test, both the passive static stretching group and the PNF group, the sig value is greater than 0.05 (value> 0.05), which indicates that the research data is normally distributed. The homogeneity test was carried out using the SPSS 22 program using a variance test. The test results can be seen in the following table:

Table 4. Homogeneity test results (Test of Homogeneity of Variance)

		Levene Statistic	df1	df2	Sig.
Fleksibility of togok	Based on Mean	.014	3	28	.998
	Based on Median	.014	3	28	.998
	Based on Median and with adjusted df	.014	3	26.991	.998
	Based on trimmed mean	.014	3	28	.998

From the results of the homogeneity test analysis in table 4, a significance value (Sig.) of 0.998 is more significant than 0.05 (Sig > 0.05), meaning that the sample is taken from a population with the same variance or homogeneous. Furthermore, from the independent test sample test results for testing the hypothesis.

Table 5. Summary of Results Independent Sample T-Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Togok Flexibility	Equal variances assumed	.048	.830	-3.69	14	**.002**	-5.8125	1.5746	-9.189	-2.435
	Equal variances not assumed			-3.6	13.926	**.002**	-5.8125	1.5746	9.191	-2.434

Based on table 5, it is known that the results of the independent sample T-Test passive static stretching obtained the value of Sig. 0.002 < 0.05 means that H_0 is rejected, it means that there was a significant difference between the passive static stretching treatment group and the

PNF exercise treatment group. The Mean Difference value is -5.8125, and the negative value means that the first group, namely the passive static stretching treatment, has a lower average value than the second group, the PNF exercise treatment group. This means that the PNF exercise treatment significantly affects flexibility compared to the passive static strain treatment.

DISCUSSION

From the analysis results, it is known that the PNF exercise treatment significantly affects flexibility compared to the passive static strain treatment. A study conducted by Cini, de Vasconcelos, & Lima, (2017) reported that stretching for 30 seconds was sufficient to increase the flexibility of adolescent girls. A study conducted by López-Bedoya, Vernetta-Santana, Robles-Fuentes, & Ariza-Vargas, (2013) also reported that passive static stretching affects the passive and active range of motion of hip flexion after 9 weeks of flexibility training. Ibrahim et al. (2015) stated that the best way to increase flexibility is by stretching exercises, so the results of this study can be accepted as true.

Passive static stretching exercises slowly stretch certain muscle parts to a certain point (pain limit point) and hold for 20-30 seconds. During exercise, the antagonist muscles will relax, and because the implementation is not accompanied by movement, the trained muscles do not contract. The training load with a static attitude that is maintained causes muscle elongation so that it will get an increase in flexibility as a result of the exercise.

The results of this study are also in line with the study reported by Arif (2017) which reported that PNF stretching had a significant effect on the flexibility of 36 people who were the subjects of his research. The benefits derived from good flexibility because of the PNF training effect were also reported to positively impact the speed of the sickle kick in Pencak silat (Pratama, 2016).

PNF exercises are carried out based on increasing muscle work combined with contraction-relaxation movements. The achievement of this

position will be maximized so that the training load can be better because it is assisted by pressure from a partner. Isometric contraction of muscle groups is carried out for 6 seconds, and then relaxation is carried out with the help of friends passively on the same muscle group for 20-30 seconds. The muscle will be longer after being contracted than before with an isometric contraction.

Both stretching exercises (passive static stretching and PNF) have the same effect on increasing the flexibility of the togok. Based on the mean results, it turns out that the difference in the average value obtained by the PNF group is greater than the passive static stretching exercise group. So, it can be concluded that the PNF exercise has a better effect on increasing the flexibility of the student's trunk.

Flexibility indicates the amount of space in the joint. With adequate flexibility a person can carry out a task of motion with adequate performance (performance), therefore flexibility is an important element of physical fitness related to health and physical fitness related to performance. The results of this study report that PNF training tends to have a better effect on increasing flexibility. Coaches can adopt PNF training to improve the flexibility quality of the athletes they train. This study also has limitations: only testing passive static stretching and PNF to increase flexibility. Furthermore, this study only involved 16 students. Future research is expected to involve many subjects and test other forms of exercise that are more effective in increasing flexibility.

Stretching performed prior to exercise (acutely) or as a long-term intervention has traditionally been thought to improve the performance of endurance runners (Baxter et al., 2017). Stretching has been considered a tool to reduce the risk of injury for endurance athletes and is an additional reason why stretching is often used by endurance runners (Baxter et al., 2017).

CONCLUSION

The study results show that both passive tactical stretching exercises and PNF exercises have a significant effect on increasing

flexibility, but empirical data states that PNF exercise is more effective in increasing flexibility.

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