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The Effect of Giving Dynamic Stretching Active Isolated Stretchingand Nordic Exercise on Hamstring Muscle Flexibility in SSB Jayakarta Athletes

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ABSTRACT

Background: Football is one of the most popular sports in society, sports injuries in early age soccer games can occur due to various things during training or during matches, such as physical training, techniques and tactics that are not programmed properly. Muscle flexibility plays a role as an important factor that influences the increased risk of injury. Muscle flexibility must be maintained in order to produce good flexibility.

Purpose: The purpose of this study was to analyze the benefits of dynamic stretching, active isolated stretching and nordic exercise to improve hamstring muscle flexibility in SSB athletes.

Methods: This study was conducted at the SSB Jayakarta soccer field, South Jakarta. This study was conducted for 6 weeks with a training intensity of 1 time a week in July 2024 - August 2024, with a sample of 36 SSB Jayakarta soccer players which is divided into 4 groups of 9 people each. The measuring instrument used to measure muscle flexibility is Active Knee Extension with Goneometer.

Results: The results of the study in group I were p = 0.000, group II was p = 0.002 and group III was p = 0.000 using the paired samples t-test, indicating that all three interventions had an effect on increasing hamstring flexibility in SSB athletes. The ANOVA test showed a significant effect with a value (p <0.05) meaning there was a significant effect on the pre-post test.

Conclusion: In conclusion, there was a significant difference between the Dynamic Stretching (K1) treatment group and the control group (K4), the Active Isolated Stretching (K2) treatment group and the control group (K4) and the Nordic Exercise (K3) with the control group (K4). However, in the Dynamic Stretching (K1), Active Isolated Stretching (K2) and Nordic Exercise (K3) treatment groups, there was no significant difference.

Keywords: dynamic, isolated, knee extension, nordic

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BACKGROUND

Football is a game using a ball where the athletic ability of the players is needed to fight and run on the field. To support the game, good physical condition is needed from the football players. Physical condition is one of the supporting elements that is very important to support performance on the field. Muscle flexibility is one of the physical elements that complements the basic techniques of playing football and plays a very important role in achieving optimal performance. Flexibility is the ability of a tissue or muscle to lengthen as much as possible, so that the body can move with full range of motion of the joint, without pain.

Shortened muscles must be stretched to the normal muscle length and restore the flexibility that occurs and increase the hamstring muscle function optimally, so a therapy/exercise is needed that stretches the shortened tissue/muscle and restores and restores the flexibility of the muscle which is known as stretching (Irfan, 2008 in Yusri, 2019). The prevalence of hamstring injuries in American football shows a more event type where hamstring injuries accounted for 12% of all injuries reported by 17 top European soccer teams, 13% of American Football injuries over a 10-year period, and 16% of rugby union injuries. Two Australian Football (AF) clubs have also reported 30% players over the course of a season reported varying degrees of hamstring pain (Br J Sports Med, 2020).

Stretching is done with various variations, one of which is dynamic stretching, which means movements that involve muscles and joints, this stretching movement is done slowly and in a controlled manner with the base of the movement being the base of the joint (Alter, 2019). Dynamic stretching is useful for helping to increase flexibility and can also be used as an exercise to prepare muscles before starting sports activities. In addition, there is also Active Isolated Stretching, which is a stretching technique or method that uses the adaptation of an active agonist muscle contraction and relaxes its antagonist muscles through reciprocal inhibition which causes stretching of antagonistic muscles without increasing muscle tension (Muscle Tension) (Longo, 2019). Another form of stretching exercise is Nordic exercise, where this exercise causes the muscles to contract but muscle elongation occurs. Eccentric contractions can produce greater force than concentric contractions or isometric contractions (Dufour et al., 2018). When someone runs, they need a large forward push from the feet so that they produce a fast and further running movement, the hamstring muscles work eccentrically when providing a forward push when running (Howard, C., & Harrison, 2018).

OBJECTIVE

The general purpose of this study is to determine the effectiveness of stretching exercises in improving hamstring muscle flexibility in soccer athletes at SSB Jayakarta, as a preventive effort against injury and to enhance athletic performance and achievement.

METHODS

The type of research used in this study is experimental research, with a design *true experimental pre and post with controlled design* consisting of 4 groups. Treatment group 1 was given dynamic stretching, treatment group 2 was given active isolated stretching and treatment group 3 was given nordic exercise and treatment group 4 was a control group with a total sample of 36. The frequency of exercise was 1x a week for 6 weeks. The sample in this study were SSB Jayakarta students aged 11-15 years. The aspect measured in the study was hamstring muscle flexibility which was measured using the Goneometer Active Knee Extension method.

RESULTS

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Table 1. Respondent Characteristic

Characteristic	N	Min	Max	Range	Mean	Std. Dev.
Age	36	13	15	2	14.25	0.692
Height	36	150	172	22	162.78	6.029
Weight	36	40	66	26	51.86	6.685
BMI	36	17.1	22.7	5.6	19.511	1.6398

Based on the data above, it is known that the number of samples used is 4 with sample criteria based on age, height, weight, and BMI. The number of groups is 4 with ages 13-15 years, height 150-172, body weight 40-66 kg, and BMI 17.1 – 22.7.

Table 2. Identification of Increased Flexibility in the Dynamic Stretching Group

Paired Samples Test					
					Sig.
		Mean	Std. Deviation	Std. Error Mean	
Pair 1	Pre - Post	-3.44444	1.33333	.44444	.000

Paired Simple T-Test was used to compare the effect of pre-test and post-test of group I, namely dynamic stretching (Table 2) Intervention group I, where the subjects received dynamic stretching exercises. Based on developments in the field and data collected from the results of data analysis, it shows that there is a significant effect between pre-test and post-test. on active knee extension test scores (n (9) = 0.000, p<0.05).

Table 3. Identification of Increased Flexibility in the Active Isolated Stretching Group

Paired Samples Test					
		Paired Differences			Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	
Pair 1	Pre - Post	-5.55556	3.60940	1.20313	.002

The result of the paired samples t-test calculation is p = 0.002 (p <0.05) which means that Ha is accepted, so hypothesis II which states that there is an effect of Active Isolated on increasing hamstring muscle flexibility in SSB Jayakarta athletes is accepted.

Table 4. Identification of Increased Flexibility in the *Nordic Exercise* Group

Paired Samples Test				
	Paired Differences			Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	

Pair 1	Pre - Post	-4.66667	1.11803	.37268	.000

The result of the paired samples t-test calculation is p = 0.000 (p <0.05) which means that Ha is accepted, so that hypothesis III which states that there is an effect of Nordic exercise on increasing hamstring muscle flexibility in SSB Jayakarta athletes is accepted.

Table 4. Comparison of the Effects of DS, AIS, NE and Control Group on Hamstring Muscle Flexibility

Control Group	*n*	M±SD	Paired T-Test	Simple
				p
Pre	9	17.625±0.3059		0.110
Post	9	17.250±0.5318		

The significance value in the two-way ANOVA data above shows a value of 0.000 (<0.05) which means that there is a significant difference in the average flexibility of the hamstring muscles in the four groups.

DISCUSSION

Research conducted by Zemková & Hamar (2019) on the relationship between age and flexibility concluded that flexibility will decrease with age, where the decrease first occurs at the age of 7 – 10 years, the decline secondlly at the age of 10 - 14 years, and there is a slowing down of the decline in adolescence, namely 14 - 18 years, so that the age range where a person has the best level of flexibility is in the age range of 14 - 18 years.

In Body Mass Index (BMI) weight plays an important role in flexibility. Excess weight is direct will reduce flexibility due to the friction of fat tissue on muscle fibers so that muscle contractions are reduced, reduced muscle contractions result in decreased speed and agility (Rudiyanto & Sugiharto, 2012).

Dynamic Stretching (K1) is defined by the National Strength and Conditioning Association (NSCA) as a functional stretching exercise that uses sport-specific movements to prepare the body for activity. Research on the acute effects of Dynamic Stretching has shown improvements in sprint performance, leg extension power, and muscle flexibility performance. (H. Van Gelder & Shari, 2021). Technically, playing football generally relies on muscle flexibility, the better the muscle flexibility, the more difficult it will be for the opponent to chase the ball or the faster the player approaches the goal, the momentum when approaching the goal will usually be maximized by the player by sprinting, flexibility is also one of the exercises that does not ever separated from the training set of futsal or soccer players (Hisdal et al., 2013).

Dynamic stretching is often used for warm-up because its effects help to avoid hamstring muscle injuries, increase joint flexibility, and optimize performance. DS has been shown to improve proprioceptive knee joint position, increase O2 uptake, decrease lactate concentration and to improve thermoregulation efficiency (Little & Williams, 2006).

According to Wismanto (2021), providing active isolated stretching can reduce irritation to the Aδ nerve and type C nerves that cause pain due to abnormal cross links. When active isolated stretching is given, the muscle fibers are pulled out to the full sarcomere length so that it will help straighten some fibers or abnormal cross links in the shortened muscles. Disrupted muscle fibers will cause decreased elasticity due to the presence of taut band in muscle fibers. Sarcomeres as elastic components in muscle fibers will experience disruption. Giving active isolated stretching that is done slowly will result in stretching of the sarcomeres so that stretching will restore the elasticity of the disturbed sarcomeres. Active isolated stretching can prevent and/or reduce stiffness and uncomfortable feelings. Active isolated stretching is an effective stretching, because it affects all hamstring muscles that limit movement.

One type of eccentric exercise is contraction where when muscle length increases, muscle tension increases. There is an increase in the length of the knee flexor and knee extensor muscles after doing Nordic hamstring exercise. This exercise also has the nature of stretching and strengthening muscles. Muscle fiber tension when the muscle is elongated (eccentric) very strong in comparison when the muscle shortens or concentrically (Sasaki and Ã, 2018). When the muscle fibers are stretched to their maximum capacity, the tendon will respond to lengthen due to the stimulus from the Golgi tendon organ, so that the hamstring muscle will be stretched perfectly because there is no resistance from the antagonist muscle (quadriceps does not contract) then muscle extensibility increases. Oxygen consumption in eccentric movements is very small because the contractions released result in a slowdown in the muscles, but the force generated by the eccentric movement is large because there is a movement against gravity so that there is a decrease in muscle tension at the end of the movement, which causing the muscles to lengthens and the joint space increases.

The main results of this study support our hypothesis that dynamic stretching, active isolated *stretching, nordic exercise* significantly improved the flexibility performance of the hamstring muscles compared to the control group. The data also revealed that there was no significant difference in the time performance of the flexibility test in the control group. Therefore, we conclude that compared to the control group, dynamic stretching, active isolated stretching, nordic exercise significantly improved the flexibility of the hamstring muscles.

CONCLUSION

After treatment was administered to three groups of athletes at SSB Jayakarta using *Dynamic Stretching*, *Active Isolated Stretching*, and *Nordic Exercise*, each group showed a significant improvement in hamstring flexibility (100% improvement in each group). Although some athletes initially experienced a decrease in flexibility during the early assessment phase, the final results demonstrated the effectiveness of all three methods in enhancing flexibility. However, comparative test results among the treatment groups did not show any significant differences, except when compared to the control group, which displayed different outcomes.

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