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Comparison between passive stretching and static cycling in male athletes in improving vertical high jump performance

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Abstract
Aim: To compare the effects of warm up protocols of passive stretching and static cycling in vertical jump performance in male athletes.
Methodology: Group A and B having 15 subjects each.
Result: Significant Results were found.
Conclusion: Warm up before vertical high jump or any other sports activities is effective to improve the sprinting performance of athletes

Keywords: passive stretching, static cycling, vertical high jump performance, male athletes

Introduction

The ability to improve one's speed and agility are of primary importance in athletics; improvement in these areas will allow these athletes to earn more playing time and make more plays. The implications of improved speed and agility can be seen in any sport: an outfielder in baseball who has to sprint to catch a fly ball, or change direction if he misreads the ball; a soccer forward trying to run downfield for a fast break and get around a defender; or a basketball player making quick cuts to get an easier shot are all of great benefit to their team. In order for coaches and athletes to monitor improvements in these physical parameters, maximal performance testing is conducted.[1] Athletes spend many weeks preparing for the maximal performance testing in an effort to improve physical conditioning. In addition to this training, recent research suggests that there may be other means to acutely improve performance during the day of testing between warm-up protocols.[2]

A vertical jump is a complex movement that requires a coordination of several muscles in the trunk, arms, and legs. This type of movement is the key component frequently used during blocking and spiking in a volleyball game, and could contribute significantly to the match success. From a clinical perspective, the ability to perform a vertical jump is a reliable indicator of the lower limb power which has been validated across a wide range of populations. In addition, the measurement of vertical jump is recommended to be used for predicting levels of mobility and the risk of falls in the elderly [2]. There are two vertical jumping styles, squat jump (SJ) and vertical stop jump (VSJ). The former is a form of jumping without countermovement starting from stationary, semi-squatting position without arm swing and no countermovement of the lower legs [2]. The latter, on the other hand, is a form of jumping with countermovement where a person runs a few steps before landing on both legs and jumps with preparatory countermovement. The countermovement of arm swing with rapid flexion of hip, knee, and ankle joints in vertical stop jump before jumping commonly known as stretch shortening cycle creates larger joint moments at the start of taking off [2]. Most of the studies indicated that the primary muscles contributing to jumping performance are the knee extensor muscles. In contrast, the primary muscles in vertical stop jump are not only knee extensors but also ankle plantar flexors that provide the breaking force before taking off. Furthermore, the momentum from running, countermovement, and the use of arm swing are required for successful VSJ jumping. Several studies indicated that stretch-shortening cycle and countermovement of lower limb muscles generated additional benefits on VSJ jumping performance, resulting in higher vertical jump compared to SJ. The use of arm swing also builds up an extra-energy for increasing the velocity of the take-off allowing the person to attain larger joint momentum useful for vertical jump. Although there are several mechanisms that operate together to enhance the jumping performance, muscle function is a key factor of its ability to create the upward force to pull the trunk up. To date, it is still unclear which muscle plays the most significant role in producing effective jumping.[2] Several previous research investigations focused their studies on the muscles of lower extremities. However, the act of vertical jump requires the whole body participation. Hence the information regarding the contributions of arm and trunk muscles is lacking, even though these muscles seem to play an important part in the vertical jump. [3]

Stretching prior to vigorous activity has also been shown to have no effect on the risk of muscular injury. The most important thing a coach can do is teach athletes that proper warm-up is essential for maximum performance and decreasing the risk of injury. [4]. This is difficult for people to understand because they can feel the lower passive tension in the muscle group at a certain joint angle. Strength and conditioning professionals should instruct athletes and other exercisers that the primary benefits of stretching are maintenance of ROM and a decrease in the passive tension in

the muscle. The stiffness or elasticity of muscle and tendon is a complex mechanical variable that is not easily understood or experienced. Muscle strains (pulls) usually occur in eccentric muscle actions rather than passive elongation [5].

Subjects and Methods

The subjects were selected according to the inclusion & exclusion criteria, and enrolled into the study after taking consents from subjects about participation in this study. They were randomly divided into two groups group A and group B by Simple Random Sampling Method. Before the experimental procedure whole previous medical data was collected and the participants did not perform any warm-up activity and stretching. Only vertical jump performance test was recorded. GROUP A was allotted to passive stretching for specific muscles (Quadriceps, hamstring and calf) with pre (before) and post (after) vertical jump performances recordings. After the procedure all 3 days vertical jump performances recordings were compared and evaluated. GROUP B was allotted to general warm-up performance followed with pre and post vertical jump performance recordings. The general warm-up (GW) consisted of 10 minutes on a stationary upright cycle pedaled at the rate 60-70 Rotation per Minute (rpm). In the Vertical Jump Test (Sergeant Jump) Procedure: The subjects were instructed to stand side on to a wall and to reach up with the hand closest to the wall. With the feet flat on ground, the point on the middle fingertips was marked. This is called as the Standing Reach. The subjects were then made to stand away from the wall. Then, squat down in such a way that knee flexion angle is 90-100 degree, till his buttock touches to seat of chair and then jump vertically as high as possible using both arms and legs to assist in projecting the body upwards, with an attempt to touch the wall at the highest point of the jump. This method was same for both groups and the difference in distance between the standing reach height and the jump height were recorded as score. The subjects performed 3 trials of vertical jump test of their maximum efforts (pre -stretching) and then maximum (best of 3 trials) vertical jump height values was recorded. (Maximum vertical jump height without stretch/warm up)

Group-A received passive stretching for Quadriceps, Hamstrings, and Calf muscles of both limbs. This treatment protocol of consist of 1 set of stretching before vertical jump in a day, with each stretch hold for 30 second. Group-B received proper warm up protocol as instructed the procedure of 10 minute of warm-up on a stationary upright cycle pedaled at the rate 60-70 Rotation per Minute (rpm). After respective treatment protocol subjects were made to perform 3 trials of vertical jump as explained by Sergeant maximum vertical jump test and score was recorded. The Pre and post stretching maximum vertical jump were compared and analyzed on day 1 and day 2 of treatment protocol.

Summary for Procedure

Table 1

	Group A	Group B
Age	18-25 years	18-25 years
Number of subjects	15	15
Protocol	Passive Stretching (Quadriceps, Hamstring, Calf)	Warming Up with Stationary cycle
Duration of Protocol	30 seconds Hold	10 minutes
Repetitions	3 sets	60-70 rpm

Results

Table 2: Comparison of Mean and S.D. of all parameters of study.

Parameters	N	Mean		Std. Deviation
		Statistic	Std. error	
Age	30	21.2	0.4218	2.3104
Height	30	165.55	1.4043	7.6914
Weight	30	62.51	1.1509	6.3034
SRHT	30	212.34	1.8715	10.251
Pre_VJH	30	38.34	1.5197	8.3238
Post_VJH	30	38.477	1.5094	8.2675
Valid N (listwise)	30			

SRHT: Standing Reach Height, Pre VJH: Pre Vertical Jump Height,
Post VJH: Post Vertical Jump Height.

Table showing mean & SD Values for both the groups A & B. Pre-test &Post Test reading of vertical Jump of both the groups A & B.

Table 3: Analysis of variance

Descriptive Statistics								
Groups	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
A	15	44.2133	4.17028	1.07676	41.9039	46.5228	37.60	54.30
B	15	46.8400	3.88032	1.00189	44.6912	48.9888	41.10	52.80
Total	30	45.5267	4.17719	.76265	43.9669	47.0865	37.60	54.30

Table showing mean & SD values of group A & B at 95 % of confidence interval at descriptive statistical analysis.

Table 4

Anova Reaults					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	51.745	1	51.745	3.189	0.085
Within Groups	454.273	28	16.224		
Total	506.019	29			

This is a table that shows the output of ANOVA analysis. The p value of 0.59 is greater than the alpha significance level 0.05. we also have statistical significant difference between our group means. This shows there is a statistically significant difference in the course of warm up protocol using static cycling and passive stretching in vertical high jump.

This study shows that the mean of the vertical high jump test score of warm up by static cycling has been increased considerably as compared to that of passive stretching, which shows that the warm up by static cycling helps to increase the muscular power so as to increase the maximum vertical high jump.

Discussion

The purpose of this study was to review the evidence relating to performance improvement using a warm-up. According to this study we have found out the warm up before doing the vertical jump performance is much more effective than doing passive stretching in male athletes.

30 subjects from Ujjain Sports Arena, Ujjain (M.P.) were selected according to the inclusion & exclusion criteria, and enrolled into the study after taking consents from subjects about participation in this study. They were randomly divided into two groups group A and group B by Simple Random Sampling Method. Before the experimental procedure whole previous medical data was collected and the participants did not perform any warm-up activity and stretching. Only vertical jump performance test was recorded Group A received passive stretch for Quadriceps, Hamstrings, and Calf muscles of both the limbs. This protocol of consist of 1 set of stretching before vertical jump in a day, with each stretch hold for 30 second. Group B received warm up protocol by static cycling as instructed the procedure of 10 minute of warm-up on a stationary upright cycle pedaled at the rate 60-70 Rotation per Minute (rpm). After respective treatment protocol subjects were made to perform 3 trials of vertical jump as explained by Sergeant maximum vertical jump test and score was recorded. The Pre and post stretching maximum vertical jump were compared and analyzed on day 1 and day 2 of protocol. The comparison of pre and post values of vertical high jump in male athletes of warm up and passive stretching shows that there is a significant difference in the scores for A group (Mean=44.21, SD=4.17028) and B group (M=46.84, SD=3.880) conditions; t (28) =0.823, p = 0.085. These differences revealed that the Mean for the group B is greater than the Mean for the group A. The Mean square between the groups is 51.74 and within the group is 16.22; the P value calculated by ANOVA is p=0.085, which is a non-significant data.

The main muscles involved in a vertical jump are the calf, quadriceps and hamstrings. These muscles were part of the static stretching protocol of the warm up. On the other hand, we can see an increase in the vertical jump height between second and third jumps, this change could be because of the ten minutes rest period in between the jumps. And this rest period would have given time for the muscles to recover after the period of static stretching.

A warm-up helps you prepare both mentally and physically for exercise, and reduces the chance of injury. During a warm-up, any injury or illness you have can often be recognized, and further injury prevented. Other benefits of a proper warm up include increased blood circulation which increases the delivery of oxygen and nutrients to your muscles. This prevents and prepares your muscles for high intensity sports.

Conclusion

The objective of this study was to determine the effect of warm up by static cycling and passive stretch in vertical high jump performance in male athletes. After statistical analysis of each group this was found out that neither the warm up by static cycling increases the vertical high jump performances nor the passive stretch has made any difference in the performance in vertical high jump(p=0.085). After comparing both the pre & post score of vertical high jump score by ANOVA test. Also duration of protocol shall be in long term basis for better results. This study concluded that warm up before vertical high jump or any other sports activities is effective to improve the sprinting performance of athletes. But statistically it plays a non significant role when both the warm up protocols of passive stretching and static cycling is compared.

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