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Acute Effect of Static, Dynamic and Combined Static-Dynamic Stretching On Vertical Jump Performance of Volleyball Players

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Abstract – The aim of the study was to compare the acute of different stretching methods on vertical jump performance. Twelve young male volleyball players of age 18 to 21 from Lakshmibai National Institute of Physical Education, Gwalior were recruited for the study. The independent variables (stretching methods) used in the study were no stretching (NS), static stretching (SS), dynamic stretching (DS) and combined static-dynamic stretching (CSDS).General warm-up was given which was followed by experimental treatment. Treatments were randomly allocated to subjects and were performed on non-consecutive day to counter balance the order and fatigue effect the selected physiological variables respiratory rate and saturation of peripheral oxygen were used in the study. To test the significance of the mean difference Repeated Measures of Analysis of Variance (rANOVA) was used. DS and CSDS both were found to be significant with NS and SS for vertical jump performance as the p value was less than 0.05. DS and CSDS both produce better result as the mean value for DS and CSDS were greater than NS and SS. However there was no significant difference between DS and CSDS, NS and SS for vertical jump performance as the p value was greater than 0.05.So, it can be concluded that either DS or CSDS if performed prior to the vertical jump performance might help in better jump performance.

Key Words: Stretching Method, Static Stretching, Dynamic Stretching, Combined Static-Dynamic Stretching, Volleyball

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INTRODUCTION:-

Every sport across all levels in the world from amateur to professional, either teams or individuals can be observed doing warm-up to prepare their body for practice or competition. Stretching is considered as an essential component of warm-up and stretching of different form like static, dynamic or sometime combination of both are performed by the players as it is the accepted theory that stretching is a part of warm-up and it assist in preparing the body for sports as well as reduce the chances of injuries in the upcoming activity. Volleyball is also a popular sport in the world and it is player at all level (school, college, state, national as well as international). Explosive strength is one of the most essential components of fitness for volleyball players. Players need to jump high with speed to spike, block or serve the ball.

Basic science studies show that acute stretching decreases viscoelastic properties of muscles and tendons, which can work against immediate performance of athletes. However theoretically decreasing the viscoelastic properties of muscles after stretching will reduce the stiffness of tissues, resulting in less energy needed to move the limbs. This savings of energy might help to decrease fatigue which theoretically could improve performance. However, reducing the inherent stiffness of the muscles and tendon might decrease performance particularly in explosive kind of activities.

Most studies concerning acute static stretching effect on vertical jump performance has shown significant negative effect (Dalrymple et al., 2010; Handrakis et al., 2010).However, there are some studies that have failed to record significant reductions in performance when implementing static stretching (SS) (Behm, D.G et al,2004; Unick et al. 2005). By contrast, significant positive effect has been demonstrated after performing dynamic stretching (DS) or at least no adverse effect on vertical jump performance(Perrier et al., 2011). While the debate continues regarding the efficiency of SS and DS, moreover some researchers examined combined static-dynamic stretching (CSDS) (Fletcher, I.M. &Anness, R. 2007; Washif J.A et al. 2015).However, the results obtained by the researchers were inconsistent and the

applicability of the protocols used was controversial. Therefore the inconsistence in the result motivated the researcher to undertake this study. Furthermore no study was conducted on vertical jump performance on volleyball players to the researcher knowledge where SS and DS exercises had been combined.

METHOD

Subjects

Twelve young male volleyball players of age 18 to 21 from Lakshmibai National Institute of Physical Education, Gwalior were recruited for the study.All participants were elite level players and had represented the university team with full-time training and at least 3 years competitive experience. Prior to the study, written informed consent were obtained from the entire participant.

Procedures

Before commencing the study, participants were given detailed information concerning the procedures involved. Following this, 2 familiarization sessions were conducted to help the participants get used to the experimental and testing protocols. Treatments consist of no stretching (NS), static stretching(SS) , dynamic stretching (DS) and combine of static- dynamic (CSDS). Vertical jump performance was tested to see the effect of treatment.The participant performed general warm-up of 4 minutes which was performed prior to each treatment that includes 2 minutes of jogging, 1 minute of sidestepping and back jogging, and 1 minute of further jogging(Thomas L. and Alun G. W., 2006). General warm-up was followed by experimental treatment. Treatments were randomly allocated to subjects and were performed on non-consecutive day to counter balance the order and fatigue effect. All subjects were divided into four groups after random allocation of treatment. All four groups were given all the treatment but on different day of testing. In the first day of treatment NS, SS, DS and CSDS was given to group I, II, III, and IV respectively. In the second testing day NS, SS, DS and CSDS was given to group II, III, IV and I respectively. In the third testing day NS, SS, DS and CSDS was given to group III, IV, I and II respectively. And on the last testing day NS, SS, DS and CSDS was given to group IV, I, II and III respectively. Six SS and DS exercises were performed of major muscles of legs and the duration of each exercise was 10 seconds. Each exercise was performed two times. Whereas in case of combine static and dynamic stretching exercises, all six SS exercise was performed first for 10 seconds (only one time) followed by DS of each exercises for 10 seconds (only one time).Each change of exercise was done within 5 seconds and the interval between general warm-up, treatment and testing of dependent variable was maximum 2 mins. Treatment and testing was done between 3: 30 pm to 5:00 pm. All subjects stay in same hostel, had same kind of food and daily routine. All subject completed the experiment with without any injury. Description about static and dynamic stretching along with intended muscle groups were given in table 1 and 2.

Table 1

The Static Stretching Protocol (stretch and the intended muscle group to be affected)

Static Stretch	Intended Muscle Group to be affected
1) Standing hurdler	knee extensors
2) Bent over hang	knee flexors and hip extensors
3) Static lunge	hip flexors
4) Butterfly	hip adductors
5) Figure 4	hip abductors
6) Calf stretch on a step	plantar flexors

Table 2

Dynamic Stretching Protocol (stretch and the intended muscle group to be affected)

Dynamic Movement Description	Intended Muscle Group to be affected
1) Frontal plane leg swings	hip adductors and abductors
2) Saggital plane leg swings	hip flexors and extensor
3) High knees	hip extensors
4) Lateral shuffles	hip adductors and abductor
5) Flick backs, "butt kickers"	knee extensors
6) Karaoke	hip adductors and abductors

Assessment of vertical jump performance

For the assessment of vertical jump performance subjects were told to stand close to the wall with any of their side (left or right) to the wall for measuring the standing reach subjects raised their hand of the wall side, elbow fully extended. After that subjects put the lime powder on finger tips and jump as high as possible so as to mark on the wall. The difference between the standing reach and jump reach was the vertical jump performance of the subject. Two trails were taken and best performance was takes for analysis.

Statistical technique:

In order to compare the mean ofvertical jump performance after different stretching methods on volleyball players, Repeated Measures of Analysis of Variance (rANOVA) with the use of the SPSS statistical software package, version 20.0 (IBM SPSS Statistics) was used. The level of significance was set at 0.05.

RESULTS

Results pertaining to vertical jump performance after selected stretching methods [No stretching, static stretching, dynamic stretching and combined static

and dynamic stretching] were presented below in the following tables:

TABLE 3

DESCRIPTIVE STATISTICS FOR THE DATA ON VERTICAL JUMP PERFORMANCE AFTER DIFFERENT STRETCHING METHODS

	Mean	Std. Deviation
No Stretching (NS)	.5817	.09971
Static Stretching (SS)	.5792	.10113
Dynamic Stretching (DS)	.6000	.10162
Combined Static-Dynamic Stretching (CSDS)	.6092	.09895

Table 3 shows the descriptive statistics for the data on vertical jump performance after selected stretching methods. The mean and standard deviation after NS, SS, DS and CSDS were found to be .58 ±.09, .57±.10, .60±.10 and .60±.09 respectively.

TABLE 4

MAUCHLY'S TEST OF SPHERICITY

Measure: Vertical Jump Performance							
Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Stretching_method	.389	9.188	5	.103	.647	.784	.333

Table 4 reveals that the assumption of sphericity has been fulfilled as the Mauchly's W for the data on vertical jump performance after selected stretching was found insignificant (Sig. value > 0.05). As Mauchley's statistic was found insignificant, Test of within-subjects effect had been employed to see the differences on performance after selected stretching method.

TABLE 5

TESTS OF WITHIN-SUBJECTS EFFECTS

Measure: Vertical Jump Performance						
Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Stretching method	Sphericity Assumed	.008	3	.003	21.855	.000
	Greenhouse-Geisser	.008	1.942	.004	21.855	.000
	Huynh-Feldt	.008	2.352	.003	21.855	.000
	Lower-bound	.008	1.000	.008	21.855	.001

Table 5 reveals that the F-value was found to be significant for the variable vertical jump performance. So, there is significance difference in at least two stretching methods.Post hoc Bonferroni test was used to compare the means pairwise.

TABLE 6

PAIRWISE COMPARISONS OF DIFFERENT STRETCHING METHODS

Measure: Vertical Jump Performance				
(I) Stretching_method	(J) Stretching_method	Mean Difference (I-J)	Std. Error	Sig.
No Stretching	Static Stretching	.003	.004	1.000
	Dynamic Stretching	-.018	.003	.001
	Static-Dynamic combined	-.027	.003	.000
Static Stretching	No Stretching	-.003	.004	1.000
	Dynamic Stretching	-.021	.005	.014
	Static- Dynamic combined	-.030	.006	.002
Dynamic Stretching	No stretching	.018	.003	.001
	Dynamic Stretching	.021	.005	.014
	Static-Dynamic combined	-.009	.004	.159
Static-Dynamic combined	No Stretching	.027	.003	.000
	Static Stratching	.030	.006	.002
	Dynamic Stretching	.009	.004	.159

Table 6 revealed the pairwise comparison and there was a significant difference between NS with both DS and CSDS methods, as the p value was less than 0.05. The pairwise comparison also reveals that there was a significant difference between SS with both DS and CSDS methods, as the p value was less than 0.05. However there was no significance of NS method with SS method and DS with CSDS methods because the p value was greater than 0.05.

DISCUSSION OF FINDINGS

The present research work had been conducted with the purpose to test the effect of different stretching method on vertical jump performance of volleyball players. The result of the study reveals that there was a significant difference between NS, SS with both DS and CSDS methods on vertical jump performance. DS and CSDS were found to be better as the mean was higher than both NS, SS. However there was no significance difference between NS and SS, DS and CSDS. The similar result was obtained by Yamaguchi and Ishii (2005) who tested leg extension power after different stretching protocols and concluded the static stretching protocol decreased power and the dynamic protocol increased power. The no stretching group also experienced a decrease in power from the before and after testing but not to the same extent as the static stretching protocol.Better performance from DS may be associated with the stretch reflex mechanism. Rapid and dynamic muscle actions during DS may have activated the stretch reflex as well as improved storage of elastic energy in the tendons and muscles, thus increasing force

production during subsequent concentric actions (Potach, D.H. & Chu, D.S, 2008). Conversely, during SS muscles are stretched until excessive tension for a prolonged period possibly causing an inverse stretch reflex by Golgi tendons if tension were excessive (Washif J. A et al., 2015). This may have subsequently reduced the muscles' springy action and therefore affected ensuing contractions. Moreover the decrease in power performance following SS may also be related to the theory of musculotendinous unit (MTU) compliance. SS may modify the structure of the MTU when a force is applied (Alter, 2004), making the structures more compliant which may lead to a lower rate of force production (Kubo k, 2001). The efficacy of DS on vertical jump performance and other variables also corroborated the findings from previous studies (Gourgoulis et al. 2003, Yamaguchi and Ishii 2005, McMillan et al. 2006, Yamaguchi et al. 2007). However decrease in vertical jump performance and other variablesafter SS was found similar with some of the previous study (Young and Behm 2003, Wallmann et al. 2005, Vetter 2007).The unique finding of the study was that CSDS was significant with NS and SS. The result of the study was similar with one of the study where vertical jump performance was found significant (Faigenbaum et al. 2006). However the study with combination of static stretching and dynamic exercises, when examined, it was seen that the results are actually conflicting. Wallmann et al. (2005) reported that a combination ofstatic stretching and dynamic activities applied on gastrocnemiusmuscle had neither a positive nor a negative effect onvertical jump performance. Fletcher and Anness (2007) reported in their studies that static passive stretch combined with active dynamic stretch and static dynamic stretch combined with active dynamic stretch protocols decrease 50-m sprint performance. Faigenbaum et al. (2006) observed that as a result of a pre-event combination of static stretching exercises and dynamic exercises, a meaningful increase in vertical jump, medicine-ball toss, and 10-y sprint is observed. As it can be observed that, the results of the studies are conflicting. This conflict is expected to be solved by future studies on combination of static stretching and dynamic exercise. However the duration of CSDS may be the possible reason behind the outcome of the result, moreover the DS after SS might have diluted the effect SS which could be another possible reason behind the result, yet lot many research with varying duration and sample could give better answer regarding CSDS.

CONCLUSIONS

DS and CSDS both were found to be significant with NS and SS for vertical jump performance. However there was no significant difference between DS and CSDS, NS and SS for vertical jump performance. Thus, it could be concluded that DS and CSDS is better than NS and SS for vertical jump performance as the mean value is higher for DS and CSDS. So the players, coaches can go for either DS or CSDS prior to vertical jump performance rather than NS and SS for better performance on the basis of the result of the present study.

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