

## Research Article

### Role of Post-Isometric Relaxation of Quadriceps and Core Stability Exercises in Vertical Jump Performance

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#### Abstract

**Background:** Vertical jump is a critical activity for performance in different sports. Different types of interventions showed effects on vertical jumps. Still there is lack of comparative evidence between Post-isometric relaxation of Quadriceps and core stability exercises in vertical jump performance.

**Objective:** To determine the role of post isometric relaxation of quadriceps and core stability exercises in vertical jump performance.

**Methods:** A Randomized Clinical Trial, conducted in Islamic International University after having the ethical permission from Institutional review Board of Riphah International University Islamabad. Sampling technique was Non-probability convenience sampling with the sample size of 30 athletes, that were divided by sealed and envelop method into core stability exercise treated group (n=17) and Post isometric relaxation treated group (n= 13). Male Athletes within age range of 20-35 years and playing at the domestic level were included and athletes with history of sprain or strain in lower limbs within last 6 month, having neuro-musculoskeletal and cardiovascular pathology were excluded from the study. Force plate was used to measure the different parameters of jump. Data were entered and analyzed through SPSS version 22.

**Results:** The mean age of group A and B was  $20.35 \pm 2.01$  and  $20.03 \pm 2.42$  in years respectively. BMI of core stability exercise treated group and Post isometric relaxation treated group was  $22.35 \pm 2.32$ ,  $22.58 \pm 1.95$  respectively in kg/m<sup>2</sup>. Comparison between core stability exercise treated group and Post isometric relaxation treated group showed that there was no significant immediate effects ( $F = 1.235$ ;  $p = 0.852$ ) of treatment on three style of jumps.

**Conclusion:** No significant immediate effects of treatment on three styles of jumps was found.

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#### Introduction:

The vertical jump height has been widely used by sports performance professionals as an alternative to direct assessment of maximal force and power.<sup>1</sup> In depth knowledge of muscle characteristics is really vital in order to produce ideal jumping outcomes and may allow awareness regarding strength training achieve-

ment protocols in athletes.<sup>2</sup> In addition of vertical jump as a performance tests, variety of training sessions which are applied to enhance explosive power like strengthening session, plyometric and periodization training, vertical jump testing can be used to assess their effectiveness.<sup>3</sup>

Various studies related to jumping have used standard

jumping procedures and tests instead of sport specific.<sup>4</sup> There are number of theories that illuminate the increased jump height when comparing jump with arm swing and jump without arm swing. One of the study said that, Participants who jumped with arm swing were reordered as higher height jumpers (0.086 m) compared with those who didn't use arm swing, due to increased height (28%) and velocity (72%) of the center of mass at take-off.<sup>5</sup>. For overall improvement of sports performance, ability of vertical jump height importance can never be neglected. Vertical jump height can be from a static start, counter movement jump and in response of landing.<sup>6</sup> One of the study said that most effective way to increase vertical jump height is to involve players first in training programme comprising of regular jumps then with weight-training sessions and lastly with drop jump training session.<sup>7</sup>

The muscle energy technique (MET) in which muscle experiences reduced tone for short period of time after isometric contraction is termed as post isometric relaxation. For increasing muscles' flexibility it is one of the most unfailing method.<sup>8</sup> In other words, after an isometric contraction, placement of a muscle while stretching against slight resistance, relaxing a muscle after which muscle is released with slight stretch is called post isometric relaxation technique.<sup>9</sup>

But still there is evident proved research work that endorses core training sessions and performance advancement exercises. Various rehabilitation settings support low back treatments in various kinds of lower back injuries with the help of core stability exercises. Insufficient studies focused on sports related improvement of performance regardless of focusing on core stability enhancement and core strength followed by core training sessions. For more efficient and effective transfer of sports related skills to actual sports related activities, one must have very fine know how of the characteristics of particular muscles involved in core stability and core strength exercises.<sup>10</sup> An obvious relation exists between muscles of trunk and lower extremity movements. Latest evidence proved inverse relation of core stability with injury and with the help of proper training injury risk can be reduced. With the help of isokinetic, isometric and iso-inertial methods core stability can be tested.<sup>11</sup> Evidence suggests that variety of Swiss ball abdominal exercises can be used to train core muscles, but little data supports the role of these exercises in recruitment

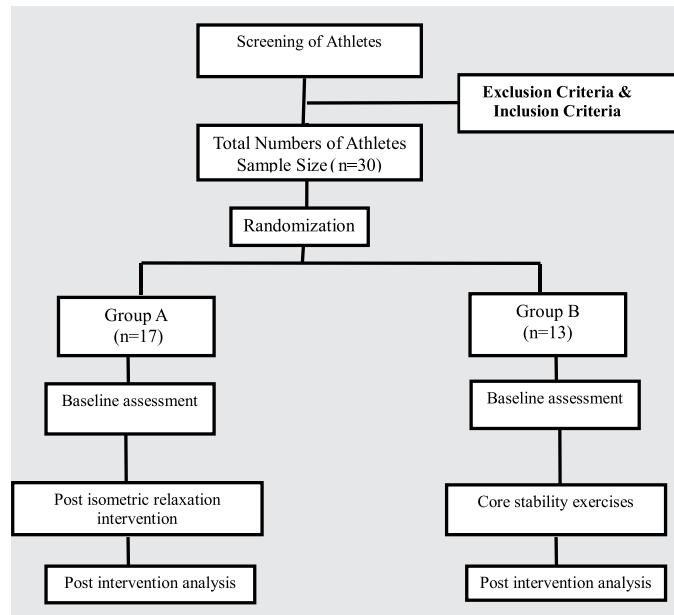
of core muscles.<sup>12</sup>

Previous studies mainly focus on plyometric training, generalized strength training and relative importance of strength and power to jump performance. Mostly researchers just work on significant gains in muscle strength and power to improve vertical jump height. Research lacking in improving vertical jump height with the help of post isometric relaxation exercises or core stability exercises. This study focused on role of post-isometric relaxation of quadriceps and core stability exercises in vertical jump performance.

### **Methods:**

It was a Randomized Control Trail study and the study conducted and data collected from Islamic International University, Islamabad, Pakistan. Ethical Permission was taken from Research ethical Committee of Riphah International University, Islamabad (RIPHAH/RCRS/ Rec/Letter-00373). Sampling technique was Non-Probability Purposive sampling with total sample size of 30 athletes using openepi tool 20 who fulfill the inclusion criteria. Random allocation of athletes was done through sealed and envelops method into two groups. As Inclusion criteria was: 1. Athletes (basketball players) playing at domestic level 2. Athletes age between 20-35 Years. 3. Male athletes and Exclusion criteria was athletes having history of sprain or strain in lower limbs within last 6 month and athletes having any neuro-musculo-skeletal, cardiovascular pathology. Group A Athletes were instructed to perform core stability exercises which include 8 common Swiss ball exercises (roll-out, pike, knee-up, skier, hip extension right, hip extension left, decline push-up, and sitting march right). They have to perform 5 repetitions of each exercise. Group B athletes underwent post-isometric relaxation technique, for which athlete was in prone lying and technique was applied to quadriceps muscles. The process started by assessing end range of the quadriceps muscle and athletes were directed to put 20% of their maximum voluntary contraction, which was resisted by the physical therapist and this isometric contraction of quadriceps muscle was held for 6-10 seconds. Instantly after this process the muscle went for the new range and the same procedure was repeated 4 times without any rest interval. During this period athletes were guided to avoid jerky movements, inhale during contraction phase and exhale during relaxation phase. Pre and Post-reading assessment taken immediately with the help of force plates for ground reaction forces which is a valid method for obtaining reactive strength measures, and several underpinning force-time variables, from unloaded countermovement

vertical jump.<sup>21</sup> And vertical jump height measurement by performing vertical jump with and without arm swing. Data were entered and analyzed through SPSS version 22. Shapiro-Wilk Test was used to check normal distribution of data. On the basis of data distribution, repeated measure ANOVA was used to check the results and data was presented in mean and Standard deviation in graph forms.



**Figure 1:** Data Collection Procedure Flow Chart

## Results:

Total sample size was 30 male athletes and they were randomly divided into core stability exercise treated group ( $n=17$ ) and Post isometric relaxation treated group ( $n=13$ ). The mean age of both groups was  $20.35 \pm 2.01$  and  $20.03 \pm 2.42$  respectively. BMI of core stability exercise treated group and Post isometric relaxation treated group was  $22.35 \pm 2.32$ ,  $22.58 \pm 1.95$  respectively as given in the table 1.

**Table 1:** Demographic data

Variable	Post isometric relaxation Mean + SE	Core stability exercise Mean + SE
BMI (KG/m <sup>2</sup> )	$22.58 \pm 1.95$	$22.35 \pm 2.32$
Age (Years)	$20.03 \pm 2.42$	$20.35 \pm 2.01$

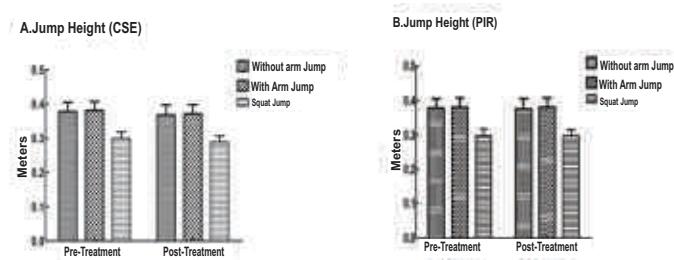
Base line comparison of jump height between without arm jump, with arm and squat jump showed that there was significant difference ( $F = 3.716$ ;  $p = 0.027$ ) among them. Squat jumps gain more height ( $p < 0.05$ ) then other jumps (Figure 2)

Base line comparison of force applied at the time of stance phase, between without arm jump, with arm and

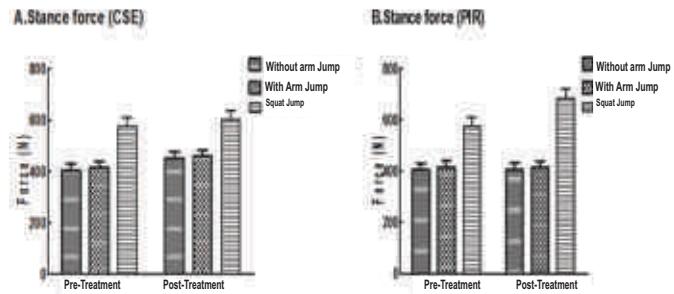
squat jump showed that there was significant difference ( $F = 9.525$ ;  $p < 0.001$ ) among these jump styles. Squat jumps exerted more force at the time of stance phase ( $p < 0.05$ ) then other jumps (Figure 3)

Base line comparison of time take off from plate form, between without arm jump, with arm and squat jump showed that there was significant difference ( $F = 20.653$ ;  $p < 0.001$ ) among these jump styles. Squat jumps take significant less time to take off for jump ( $p < 0.05$ ) then other jumps (Figure 4)

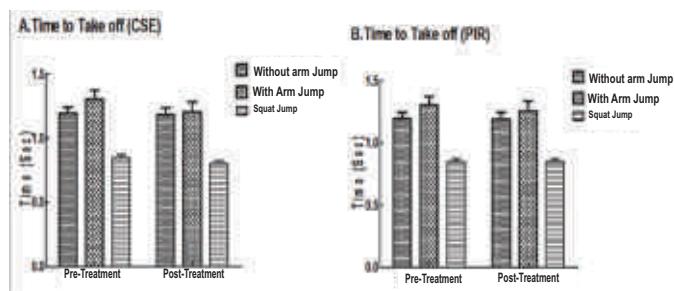
Base line comparison of total time from stance phase to get full stable posture, between without arm jump, with arm and squat jump showed that there was significant difference ( $F = 15.125$ ;  $p < 0.001$ ) among these jump styles. Squat jumps take significant less total time from stance phase to get full stable posture ( $p < 0.05$ ) then other jumps (Figure 5)



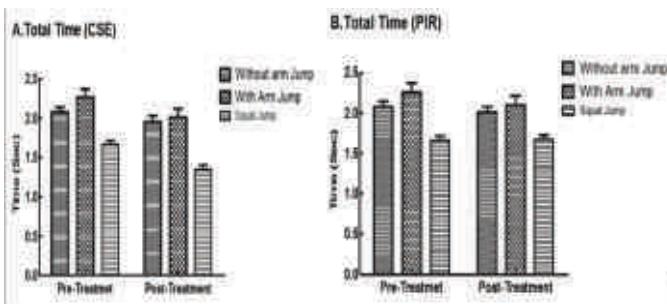
**Figure 2:** Shows vertical jump height with and without arm swing



**Figure 3:** Shows force distribution during vertical jump height with and without arm swing



**Figure 4:** Shows take off phase time during vertical jump height with and without arm swing



**Figure 5:** Shows total time of vertical jump height with and without arm swing (in seconds)

Comparison between core stability exercise treated group and Post isometric relaxation treated group showed that there was no significant immediate effects ( $F=1.235$ ;  $p=0.852$ ) of treatment on three style of jumps.

## Discussion:

The result of this study shows that there is no significant effects occur immediately after application of post-isometric relaxation technique ( $F=1.23$ ;  $p=0.452$ ). A study conducted by Sambandam CE et al in 2011 and concluded that there is no immediate effect of post-isometric relaxation technique on muscle muscular tightness of lower extremity.<sup>13</sup> Another study conducted by Talapalli R et al in 2014 and concluded that there is no significant effect occur on lower limb muscular tightness.<sup>14</sup> It is suggested by the result of current study that muscle tightness can be the factor that can reduce the performance of vertical jump in athletes. Muscle energy technique hold the position for few seconds just like static stretch and it is already proven by the literature that immediate effect of static stretching reduced the performance of athletes. A study conducted by Dalrymple et al in 2010 concluded that there was no significant effects occur in vertical jump after static and dynamic stretching in collegiate players.<sup>15</sup> Another study conducted by Fattahi A et al on comparison of two warm up protocol on vertical jump performance and concluded that dynamic stretching show significant effect in vertical jump height as compared to static stretching.<sup>16</sup> Another study conducted and claimed that static stretching as warm up reduces the performance.<sup>17</sup>

Within group comparison of core stability exercise group showed that there was no immediate effects of treatment ( $F=2.352$ ;  $p=0.102$ ) on three style of jumps. But A slight improvement in force exerted on plate form, jump height, time to take off, time from stance to landing phase and

total time from stance to gaining full stable posture but statistically there was no significant difference ( $p>0.05$ ) in three styles of jumps. Numerous studies were conducted to evaluate the contributing factors of vertical jump with respect to skills but productive results were not found. However, strong correlation was found with strength and performance, some studies showed moderate, some low while some showed no relationship.<sup>18</sup>

A study conducted by Zachary J et al examined the influence of enhanced performance of jumping with arm swinging. The study evaluated all the strategies of arm swinging that could influence jumping. The two important strategies that could increase jumping were: production of additional energy or slow leg extension. Hence was concluded that these two strategies greatly improved the jump performance.<sup>19</sup>

In our study ,When comparison was done between jump height after applying post isometric relaxation exercise and core stability exercise it was observed that there was no significant instant effect of these protocols on three different styles of jumps.

## Conclusion:

The conclusion of this study is that post isometric relaxation exercise and core stability exercise shows no significant effect in vertical jump height in domestic athletes. Core stability shows slight improvement in force exerted on plate form, jump height, time to take off, time from stance to landing.

**Ethical Approval:** Given

**Conflict of Interest:** The authors declare no conflict of interest.

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