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## Association of physiological parameters with the throwing performance among the male softball players

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### Abstract

**Purpose:** The aim of the study was to ascertain the association of physiological parameters with the throwing performance among the male softball players.

**Methods:** Total 150 male university and national level softball players of different universities and states of India were selected through purposive sampling technique. The average age of the softball players was  $20.89 \pm 1.54$  years. Physiological parameters namely vital capacity, aerobic fitness ( $VO_{2max}$ ), speed, explosive strength, flexibility and grip strength were assessed using standardized tests. Throwing skill of the players was assessed with the AAHPERD softball skill test battery. Karl Pearson's product moment co-efficient of correlation was computed to assess the relationship between physiological parameters and throwing skill test of softball among the softball players. Significance levels were set at  $p < 0.05$ .

**Results:** Physiological parameters such as aerobic fitness ( $r = 0.250$ ,  $p = 0.002$ ), speed ( $r = -0.265$ ,  $p = 0.001$ ), explosive strength ( $r = 0.369$ ,  $p = 0.000$ ), flexibility ( $r = 0.281$ ,  $p = 0.000$ ) and grip strength of both right ( $r = 0.401$ ,  $p = 0.000$ ) and left hand ( $r = 0.361$ ,  $p = 0.000$ ) had a significant relationship with throwing skill test of the male softball players whereas vital capacity did not show significant correlation with the throwing skill test in the male softball players.

**Keywords:** Physiological Parameters, Throwing, Softball, Male

### Introduction

The sport of softball has achieved worldwide popularity over the last 100 years. It is clear that the various motor skills associated with softball, such as pitching, batting, fielding, catching and throwing, place considerable perceptual and physical demands upon players [1]. These fundamental skills are keys to success for softball players. Every softball players, regardless of position, must master these skills [2]. Softball is a sport that demands basic power, strength, quickness and endurance [3]. Strength and power are the integral components of a softball and baseball player's defensive and offensive performances on the field [4].

Throwing, being a fundamental skill, play important role for success participation in softball. Softball feature three general type of throws- overhead, sidearm and underhand-overhead is most often used<sup>2</sup>. To perform the overhead throwing motion successfully, the athlete must exhibit significant flexibility, muscular strength, coordination, synchronicity of muscular firing and neuromuscular efficiency [5]. Throwing in softball is explosive action in nature that required muscular power. Power is a function of speed and strength. More specifically, softball players need throwing power. A base in overall body strength and maximal strength is also important as it serves as a foundation to build muscular power. Shoulder and back strength as well as the rotator cuff muscle group are important in throwing. The strength of legs and the core (hips and abdominals) muscles also contribute to the throwing motion [6]. Softball players need a considerable amount of upper body muscle balance because of the specificity of underarm pitching and overhead throwing activities. Coaches and athletes consider that the forearm plays an important part in hitting, pitching and throwing the ball [7].

It was reported in the previously conducted studies on softball/baseball that throwing skill/velocity was associated with different physiological variables. Spaniol [8], founded throwing velocity among the baseball players were associated with arm strength, grip strength and leg power. In other studies [9, 10] on softball it was also reported that there was a relationship

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between the strength of the upper extremities and throwing speed. Studies of other games also founded relationship between throwing velocity and physiological variable as Platanou *et al.* [11] suggested that throwing velocity in water polo was associated with swimming speed, internal-external torque of shoulder muscles and with aerobic fitness, whereas studies [12, 13] on the throwing velocity in handball suggested that strength and power of upper and lower limbs influenced the throwing velocity of the handball players. Marques *et al.* [14] indicated that throwing velocity of elite team-handball players is related to maximal dynamic strength, peak power and peak bar velocity.

Many studies had been conducted to assess the relationship between physiological variables and the throwing skills/velocity in different sports events. But there was scarcity of scientific literature regarding the association of physiological variables with throwing skills/velocity in softball. Therefore, the present study had been conducted to

assess the relationship between the physiological variables and throwing skills among the male softball players.

**Methodology**

The subjects of the present study were purposively selected from the university level and national level male softball players. 150 male softball players of different universities and states of India were selected to participate in the study. The data for the study was collected during the 33<sup>rd</sup> Senior National Softball Championship held at Anantpur District of Andhra Pradesh from 18<sup>th</sup> to 23<sup>rd</sup> January, 2012 and All India Inter University Softball Championship held at Panjab University, Chandigarh in February 2012. The average age of the softball players was 20.89±1.54 years. The average height and weight of the softball players were 173.49±6.12 cm 65.62±8.35 kg respectively. All the players were assessed for following physiological parameters along with the tests used to measure the physiological parameters.

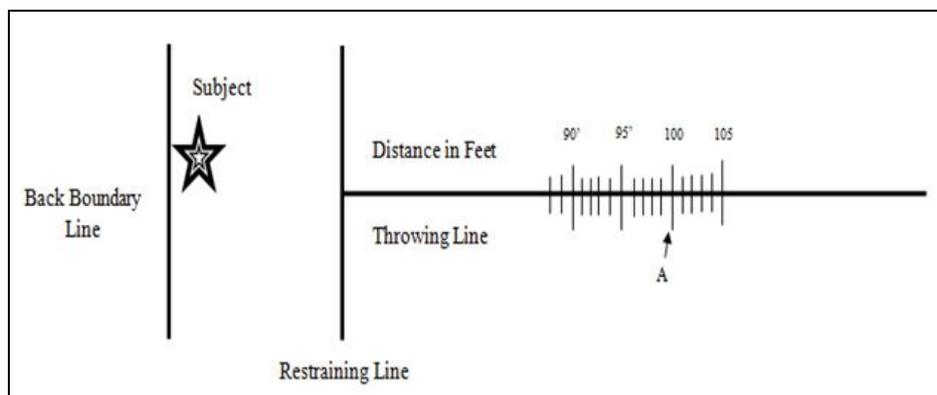
**Table 1:** Tools and measurement units of physiological variables.

Sr. No	Component	Tests	Unit of Measurement
1	Vital Capacity	Computerised spirometer	Liters
2	Aerobic Fitness (VO <sub>2max</sub> )	Cooper’s 12 minutes run/ walk test	ml/kg/min
3	Speed	50m dash	Seconds
4	Explosive Strength	Standing vertical jump	Centimeters
5	Flexibility	Sit and reach test	Centimeters
6	Grip Strength	Hand dynamometer	Kilograms

**Throwing Test**

Throwing skill of the players was assessed as given in the AAHPERD [15] softball skill test battery edited by Dr. Roberta Rikli. This test assesses the skill in the overhand ball throw by measuring distance and placement of ball. Concurrent validity has been reported by finding the correlation coefficient between the test scores and judges’ rating. The validity correlation coefficient ranged from 0.64 to 0.94. The test-

retest reliability coefficient from intra-class repeated scores ranged from 0.90 to 0.97. For this test a perpendicular line was marked from a restraining line as shown in fig. 3.4. In this test the subject was required to throw the ball as far and as straight as possible, along the throwing line. The ball was released after taking few steps and released before the restraining line. Each subject was given two trials. The better of two trials was the final score.



**Fig. 1:** Field marking for overhand throwing test

**Statistical Analysis**

Statistical analysis was performed using SPSS version 16.0 for windows (SPSS Inc, Chicago, IL, USA). Karl Pearson’s product moment co-efficient of correlation was computed to assess the relationship between physiological parameters and

throwing skill test of softball among the softball players. Significance levels were set at p<0.05.

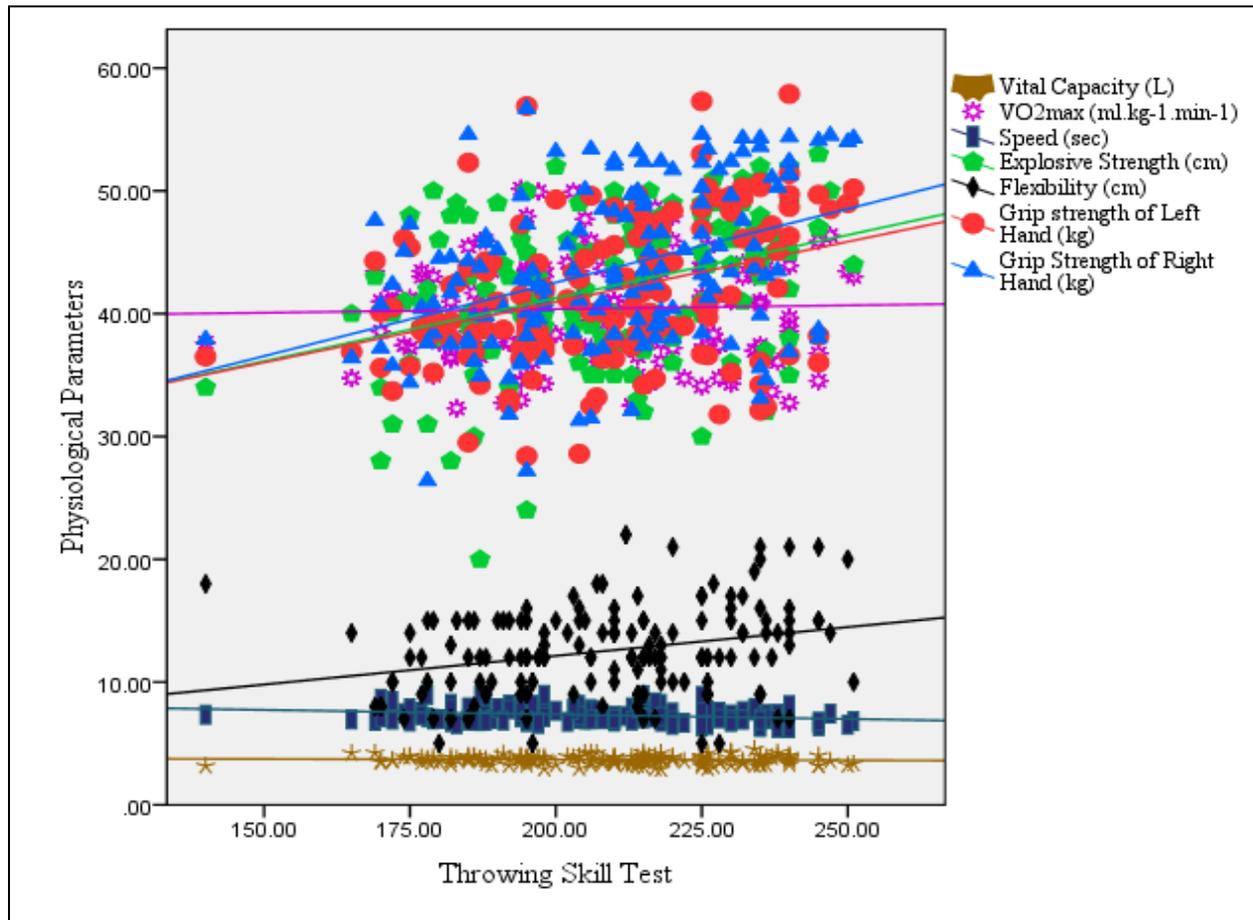
**Results**

**Table 2:** Relationship of various physiological parameters with the throwing skill test in male softball players

Variables	N	Pearson Correlation Coefficient (r)	Sig. (2-tailed)
Vital Capacity (L)	150	-0.071	0.391
VO <sub>2max</sub> (ml.kg <sup>-1</sup> .min <sup>-1</sup> )	150	0.250	0.002*
Speed (sec)	150	-0.265	0.001*
Explosive Strength (cm)	150	0.369	0.000*
Flexibility (cm)	150	0.281	0.000*

Grip Strength of Left Hand (kg)	150	0.361	0.000*
Grip Strength of Right Hand (kg)	150	0.401	0.000*

\* Indicates  $p < 0.05$



**Fig 2:** Scatter plot for association of physiological parameters with throwing skill test in male softball players

Table 2 and fig. 2 presents the relationship between the throwing skill and various physiological parameters of the male softball players. The statistical results showed that the vital capacity did not show significant correlation with the throwing skill test in the male softball players. The aerobic fitness ( $VO_{2max}$ ) demonstrated a significant correlation ( $r = 0.250$ ,  $p=0.002$ ) with the throwing skill test amongst the male softball players. The speed was also found to have a significant association ( $r = -0.265$ ,  $p=0.001$ ) with the throwing skill. The explosive strength of the male softball players ( $r = 0.369$ ,  $p=0.000$ ) showed a significant correlation with the throwing skill test. The flexibility also demonstrated a significant correlation ( $r = 0.281$ ,  $p=0.000$ ) with throwing skill test. The grip strength of both right ( $r = 0.401$ ,  $p=0.000$ ) and left hand ( $r = 0.361$ ,  $p=0.000$ ) also showed a significant relationship with throwing skill test of the male softball players.

### Discussion

The knowledge of physiological parameters of elite level players in a given sport may be beneficial for optimizing training programs specific to the requirements of that particular sport and achieving higher performance level. The softball players in the present study were assessed for many physiological parameters i.e. vital capacity,  $VO_{2max}$ , speed, explosive strength, flexibility and grip strength. The correlation analyses revealed that physiological parameters such as explosive strength, grip strength, speed and flexibility were observed to have significant association with throwing

skill test among male softball players. Softball is an anaerobic sport because running is made up primarily of short bursts of speed and the action in a single play lasts less than 7 seconds on an average. Therefore, the anaerobic energy system primarily provides the energy but a good base of aerobic endurance serves as a foundation to develop anaerobic energy system [6]. The aerobic endurance is an important component of fitness of softball players as it reduces the effect of fatigue during the long periods of play.

Softball is a fast game and softball players require multi-directional quickness, first step quickness, lateral movements, acceleration and linear speed to be successful [6]. Therefore, running speed and agility are very important in softball for moving between bases and in fielding. All the actions in softball such as pitching, hitting, throwing, base running, jumps off the bases and other movements are explosive in nature. To perform all these actions explosive strength is required which is a function of speed and strength [6]. Softball players require dynamic flexibility which is the ability to move through a full range of motion and contributes to improved performance and is associated with a reduced risk of injury [6].

The findings of the present study showed association of physiological parameters with throwing performance among softball players. These findings are in line with many previous studies reported on softball and baseball players in the literature. Till *et al.* [16], reported the relationship between strength and throwing velocity in NCAA Division-I female softball players. Lehman *et al.* [17] also reported the

relationship between vertical jump and throwing velocity in the college baseball players. Terbizan *et al.* [3] also reported the importance of strength in softball in specific muscle groups viz. biceps, shoulders, triceps, quads, and hamstrings etc. as these muscles formed into task-specific coordinative structures within sport. Arzola [18] also gave the importance of medium-high strength requirements in softball pitching through the accurate observation that a stronger and faster arm motion applies more energy, thus increasing arm strength and swing speed increases ball speed. Nakata *et al.* [19] studied the young baseball players and found that strength and 10m sprint performance were associated with the pitching performance.

### Conclusion

On the basis of the results of the study, conclusions were drawn that throwing skill among male softball players was associated with physiological parameters such as aerobic fitness, speed, explosive strength, flexibility and grip strength of both right and left hand. These physiological parameters would be given due weightage while framing training programs for softball payers and during the talent selection process.

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