CORRELATION OF ARM EXPLOSIVE STRENGTH WITH HANDBALL VELOCITY IN HANDBALL PLAYERS

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Abstract: Handball is a dynamic contact sport in which throwing is important skill and players improve their chance of scoring by throwing ball as fast as possible. This study has been undertaken to evaluate the correlation of arm explosive strength with handball velocity in handball players. Bench press test [1RM] is used to assess the strength of upper extremity and handball throw test is used to assess handball throwing velocity. In this study total 30 male and female handball players were included. The study concluded that there is positive correlation between arm explosive strength with handball velocity in handball players.

Key words: Arm throwing, Explosive strength, Bench press test [1RM], Handball throw test, Handball velocity.

Introduction:
Handball is outdoor game usually played on 40mx20m court between two teams of eleven players. It is a popular sport played at all from recreational to fully professional. The game's origins were in Scandinavia in the 19th century and it is played around 19 million people today and has been Olympic sports. various actions such as throws, passes, jumps, hits, blocks, pushes, runs, and dribbling make it a sport of intermittent high intensity.

Team handball is characterized by fast pace defensive and offensive actions during game with the objective of the game which is also the key to success is to score goals. for shots on goal, the offensive players attempt to establish an optimal position for the throwing player by fast movements over short distances performing changes in direction, action against defensive players and passing the ball using different offensive tactics. for the successful short on goal in handball depends on throwing ability and ball velocity. Out of the various actions like running, jumping, sprinting, throwing, hitting, blocking, pushing, throwing ability is considered as most vital element. Different types of throws in handball are overarm throw, standing throws and three step running throw etc. Phases of throwing are wind up, wind up the stride, arm cocking early, late cocking, acceleration and the deceleration. players improves their scoring chance by throwing the ball as fast as possible towards the goal, as faster the ball is thrown towards the goal, less time the goalkeeper and defender have to save shot. Over arm throwing is necessary in different sports like baseball, handball, volleyball, water polo. Various factors like Age, Gender, Muscular strength, Ball weight, and Ball size influence ball velocity.

Handball is vigorous contact sport game that requires high intensity efforts in short period of time. Therefore it seems that basic anthropometric characteristics are important to technical and tactical skills, but elite performance demands strength and power in both upper and lower limbs. Previous study have been reported positive and significant correlation between ball velocity and general anthropometric characteristics like body mass, players Height and their body mass index, arm throwing is a deciding element in handball game. Velocity of the ball, aim accuracy and shoulder joint stability are the factors that influence throwing effectiveness. Therefore, aim of this study to correlates the arm explosive strength with ball velocity.

Strength is defined as the ability to overcome resistance with high speed, explosive strength is a combination of strength and speed abilities, refers to rate of force development in minimal time. Explosive strength magnitude is a function of three factors: intermuscular coordination, intramuscular coordination, and force by which muscles react to the neurons. one repetition maximum 1RM test is recognized as standard for the evaluation of muscular strength. It is defined as maximum weight can be lifted once with correct lifting technique. 1 RM is used by athletic trainer, health and fitness professionals and rehabilitation specialist to quantify strength and assess strength imbalances.

Methodology and procedure:
No of participants – 30 players
Inclusion criteria: -
Age group – Between 15- 30 year
Both male and female players
Handball players playing since 1 year
Exclusion criteria: -
History of any injury in upper limb
Acute shoulder pain

Outcome measures:
1) To identify the explosive strength of arm Bench press test (1RM) has been used.
2) To identify the handball throwing performance, Handball throw test has been used.

Procedure:
Permission was taken from the concerned ethical committee. Various handball clubs were approached across Pune. The aim and methodology of research were explained to participants and consent form were been signed by every participant. Total number of participants were n=30. They were told to fill data collection sheet and a self-reported questionnaire which had simple question about Name, Age, Gender, Weight, Height, Years of experience etc. assessment of arm explosive strength was done by using Bench press test [1RM] and ball velocity by using handball throw test.

Result:

Result no.01: physical characteristics and assessment of handball players.

<table>
<thead>
<tr>
<th>Distribution</th>
<th>Mean ±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>18.06 ± 0.92</td>
</tr>
<tr>
<td>BMI</td>
<td>22.16 ± 2.54</td>
</tr>
<tr>
<td>Years of experience</td>
<td>3.2 ± 1.01</td>
</tr>
<tr>
<td>Bench press test [1RM]</td>
<td>39.3 ± 11.7</td>
</tr>
<tr>
<td>Handball velocity</td>
<td>0.91 ± 2.21</td>
</tr>
</tbody>
</table>

Interpretation: Table no 1 shows Mean and SD of physical characteristics and assessment of players.

Result no.02: Correlation between Arm explosive Strength (1RM) and Velocity.

<table>
<thead>
<tr>
<th></th>
<th>Strength [1RM]</th>
<th>Velocity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ±SD</td>
<td>39.33±11.69</td>
<td>9.01±2.21</td>
</tr>
<tr>
<td>P-value</td>
<td>0.0001</td>
<td></td>
</tr>
<tr>
<td>R-value</td>
<td>0.982</td>
<td></td>
</tr>
</tbody>
</table>

Graph no 01: shows correlation of arm explosive strength with handball velocity.

Interpretation: As shown in graph 1, values of velocity and strength (1RM) are noted. The results shows that correlation coefficient (r= 0.9827) and p value(p=0.0001). The graph shows positive correlation between arm explosive strength and handball velocity.

Discussion
As the handball is a game, which required good level of different physical qualities and throwing ability is considered as important element. The key factor for winning the game is to shot on goal and that is also depends on ball velocity.
The study aim was to assess the correlation of arm explosive strength with handball velocity in handball players. Initially synopsis was approved by ethical committee and permission for data collection was taken from coaches of handball club Pune.30 handball players were selected according to inclusion and exclusion criteria. After that consent was taken. The outcomes measure for the study was Bench press test(1RM) and handball throw test which were performed.
In bench press test (1RM) procedure was explained and demonstrated to the players. And after the warmup participant was asked to lift the light to moderate weight and after a rest of two minutes participants again asked to lift the weight increased by 5-10%. participant who failed to lift that weight, the weight was decreased by 2.5-5%. And the values for 1RM were noted.

Handball throw test was assessed after the warmup. Participants were asked to throw 3 sets of 3 consecutive throw the throwing time was recorded by using stop watch and distance of throwing was measured by tape used for distance measuring. After measuring distance and time velocity was measured by using formula speed = distance/time (d/t).

Table no 1 shows mean and sd of physical characteristics and assessment of participants. Mean and sd of age of participants were 18.06 ± 0.92. The mean and sd of BMI of participants were 22.16 ± 2.54. The mean and sd of years of experience of participants were 3.2 ± 1.01.

The mean and sd of Bench press test [1RM] of participants were 39.3 ± 11.7. the mean and sd of handball velocity of participants were 0.91 ± 2.21 as shown in table no 1.

As shown in graph no 1. value of Bench press test and handball velocity are noted. Correlation coefficient value of bench press test and handball velocity are r= 0.982 and P value 0.0001 which shows that there is positive correlation between Arm explosive strength and handball velocity.

As graph 1 shows there is positive correlation between arm explosive strength and handball velocity. Hence there is a similar study which also conclude that throwing velocity of team handball players is related to their maximal dynamic strength, power, peak bar velocity.

**Conclusion**

The study concluded that there is positive correlation between the arm explosive strength and handball throwing velocity in handball players.

**Acknowledgement**

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