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Survey on joint range of motion of hockey and archery players in Punjab: An observational study

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Abstract

Background: Range of motion around the joint is the flexibility, which is important for sports performance and injury prevention. Normative data are obtained from a reference population that establishes the baseline distribution for a measurement against which the assessed measurement can be compared. However, studies on normative joint range of motion in India are not widely available.

Objective: To obtain the normative data of shoulder and elbow joint range of motion in archery and hockey players of age group 11-40 years of Punjab.

Method: A sample of 402 players consisting 210 hockey (92 males and 118 females) and 190 archery (102 males and 90 females) players was selected through convenient sampling. Joint range of motion measurement was done using a universal goniometer.

Result: The normative data of shoulder joint range of motion of hockey players for flexion, extension, abduction, internal rotation, and external rotation are (177-178), (76-77), (176-177), (73) and (84-85) in degrees, respectively. The corresponding values for archery players are (175-177), (74-75), (174-175), (68-86), and (86-87) in degrees, respectively.

Conclusion: The archery players demonstrated slightly larger shoulder ROM in comparison to hockey players. The hockey players demonstrated higher elbow ROM in comparison to archery players.

Keywords: normative data, joint range of motion, archery, hockey

Introduction

Joint range of motion (ROM) refers to the motion available at different joints in the body. Range of motion around the joint is considered as flexibility, which is an important component of physical fitness (Bradley, 2007) [2]. Joint ROM is an essential physical aspect for sports persons during their performance (Park, 2010) [8]. The ROM of different joints greatly influences the ability of a sports person to execute various skills and techniques in the field.

There are many factors that affect joint ROM, which include internal as well as external factors. Some of the internal factors that affect joint ROM are types of joint, elasticity of muscle tissue, ligaments, tendons, and length of musculature. Some external factors such as height, weight, and body mass index. (Sawale, 2016) [9] have also been shown to affect the range of motion available in a joint.

Among these factors, age, gender, injury, side of dominance, and the activity pattern of the individual stand predominantly (Wright, 2006) [20]. The time of day, different sports techniques (Daneshmandi, 2010) [3], race, and cultural habits also influence the joint ROM (Hallaceli, 2014) [6].

Range of motion quantifies joint flexibility, which greatly affects the physical capabilities and performance of the sport persons (Park, 2010) [8].

Normative data are the data which are obtained from a reference population that establishes the baseline distribution for a measurement against which the assessed measurement can be compared. Normative joint ROM data can serve as a very useful reference to quantify an individual's performance quality (Park, 2010) [8].

However, to our knowledge, no study exists based on normative data of the range of motion of shoulder and elbow joints in different games such as archery and hockey is still rare in Indian literature. Thus, a study in the Indian context in the northern region (Punjab) will help as a reference of shoulder & elbow joint range of motion in archery and hockey players in Punjab.

Methodology

Design

The design of the study is a survey using questionnaire and clinical examination. The Research Proposal of the study was approved by Institutional Clinical Ethical Committee (I.C.E.C) of Punjabi university, Patiala vide letter no IEC/01-2018/015.

Sampling

The nature of sampling for the present study is convenient sampling using snow ball technique with the intention to include as many players as possible. The sample consisted of 402 sports players, 210 hockey (92 male and 118 females), and 190 archery (102 male and 90 female) players.

Questionnaire

The demographic and training profile of hockey and archery players were obtained using a questionnaire consisting of (Name, age, sex, contact no, email I'd, game, year of entry to game) questions focusing on the types of playing equipment (type of bow used by archery players), their training schedule (how many days a week they practice their regular game), their level of play (district, state, national and international players), and playing position (in hockey forward players, defenders and goal keepers) these were analyzed.

Measurement of joint range of motion

Universal goniometer

The universal goniometer was used for the measurement of shoulder and elbow joint range of motion.

Statistical Analysis

Mean, standard deviation, standard error, and percentage were used to prepare summary statistics. Student t-test and Pearson correlation coefficient test of correlation were the tools of data analysis. Data was analyzed using Microsoft Excel and SPSS version 20.

Results

Normative data for shoulder joint range of motion

The normative joint range of motion of Hockey players for left shoulder joint flexion, extension, abduction, internal rotation, and external rotation were 177.80 ± 4.47 , 76.63 ± 9.88 , 176.90 ± 3.66 , 73.13 ± 8.87 and 84.59 ± 7.39 degrees, respectively. The corresponding values for archery players are 175.52 ± 7.26 , 74.53 ± 11.04 , 174.77 ± 4.56 , 68.79 ± 10.38 and 86.08 ± 6.14 degrees, respectively. Shoulder flexion, abduction, and internal rotation showed statistical significance with less ($p < 0.001$) in both hockey and archery players.

The range of motion of female hockey players for right shoulder flexion, extension, abduction, internal rotation and external rotation, are 179.22 ± 3.801 , 80.08 ± 7.728 , 177.95 ± 3.279 , 75.48 ± 7.687 and 87.20 ± 6.489 degrees, respectively. The corresponding values for male hockey players are 177.59 ± 5.62 , 74.49 ± 10.708 , 177.60 ± 4.393 , 71.14 ± 9.202 and 83.83 ± 7.192 degrees, respectively. Shoulder flexion, extension, internal rotation, and external rotation showed statistical significance with less ($p < 0.001$) for both males and females.

Table 1: Comparison of ROM (in degree) of the right shoulder between hockey and archery players

Range of motion (shoulder)	Hockey N=210	Archery N=198	t	Mean diff.	CI
Flexion	178.50 ± 4.74	177.17 ± 6.68	2.32*	1.33	0.20-2.46
Extension	77.63 ± 9.54	75.27 ± 10.47	2.36	2.36	0.40-4.32
Abduction	177.80 ± 3.80	175.17 ± 5.29	5.74***	2.62	1.72-3.52
Internal rotation	73.58 ± 8.63	70.64 ± 10.12	3.14***	2.94	1.10-4.78
External rotation	85.72 ± 6.99	86.35 ± 6.22	0.95	0.63	1.93-0.67

* $p < (0.05)$

** $p < (0.01)$

*** $p < (0.001)$

The range of motion of female hockey players for left shoulder flexion, extension abduction, internal rotation and external rotation are 178.42 ± 3.43 , 79.24 ± 7.64 , 176.78 ± 3.23 , 74.93 ± 8.48 and 86.19 ± 6.93 degrees, respectively. The corresponding values for male hockey players are 177.0 ± 5.44 , 73.28 ± 11.36 , 177.0 ± 4.16 , 70.82 ± 8.87 and 82.53 ± 7.50 degrees, respectively. Shoulder flexion, extension, internal rotation and external rotation showed statistical significance with less ($p < 0.001$) in both males and females.

The range of motion of female archery players for right shoulder flexion, extension, abduction, internal rotation and external rotation are 178.91 ± 6.64 , 78.02 ± 9.90 , 176.67 ± 5.13 , 72.98 ± 9.79 and 87.45 ± 5.35 in degrees, respectively. The corresponding values for male archery players are

175.66 ± 6.37 , 72.89 ± 10.41 , 173.87 ± 5.10 , 68.62 ± 10.01 and 85.41 ± 6.77 degrees, respectively. Shoulder flexion, extension, abduction, internal rotation, and external rotation showed statistical significance with less ($p < 0.05$) in both males and females.

The range of motion of female archery players for left shoulder flexion, extension abduction, internal rotation, and external rotation, are 176.94 ± 7.76 , 77.53 ± 10.61 , 175.84 ± 4.48 , 69.74 ± 10.57 and 86.24 ± 6.40 degrees, respectively. The corresponding values for male archery players are 174.29 ± 6.60 , 71.94 ± 10.80 , 173.84 ± 4.44 , 67.96 ± 10.20 and 85.95 ± 5.93 degrees, respectively. Shoulder flexion, extension, and abduction showed statistical significance with less ($p < 0.01$) in both males and females.

Table 2: Comparison of ROM (in degree) of the left shoulder between hockey and archery players

Range of motion (shoulder)	Hockey N=210	Archery N=198	t	Mean diff.	CI
Flexion	177.80 ± 4.47	175.52 ± 7.26	3.81***	2.27	1.10-3.44
Extension	76.63 ± 9.88	74.53 ± 11.04	2.00	2.09	.045-4.15
Abduction	176.90 ± 3.66	174.77 ± 4.56	5.18***	2.13	1.32-2.94
Internal rotation	73.13 ± 8.87	68.79 ± 10.38	4.51***	4.34	2.45-6.23
External rotation	84.59 ± 7.39	86.08 ± 6.14	2.19	1.49	2.83-0.157

* $p < (0.05)$

** $p < (0.01)$

*** $p < (0.001)$

Normative data for elbow joint range of motion

The range of motion of hockey players with right elbow flexion is 129.49 ± 7.76 degrees. The corresponding value for

archery players is 131 ± 7.19 degrees. The hockey players demonstrated statistical significance of ($p < 0.001$) with higher ROM in comparison to archery players.

Table 3: Comparison of ROM (in degree) of right elbow flexion between hockey and archery players

Range of motion (Elbow)	Hockey N=210	Archery N=198	t	Mean diff.	CI
Flexion	129.49 ± 7.76	131.56 ± 7.193	2.76***	2.07	3.54-0.60

* $p < (0.05)$ ** $p < (0.01)$ *** $p < (0.001)$

The range of motion of hockey players for left elbow flexion is 128.44 ± 7.58 degrees. The corresponding value for archery

players 127.87 ± 7.69 degrees.

Table 4: Comparison of ROM (in degree) of the left elbow flexion between hockey and archery players

Range of motion (Elbow)	Hockey N=210	Archery N=198	t	Mean diff.	CI
Flexion	128.44 ± 7.58	127.87 ± 7.69	0.751	0.57	0.92-2.07

* $p < (0.05)$ ** $p < (0.01)$ *** $p < (0.001)$

The range of motion of female hockey players with right elbow flexion is 132.82 ± 4.66 degrees. The corresponding values for male hockey players 125.30 ± 8.81 degrees. Elbow flexion showed statistical significance with less ($p < 0.001$) in both males and females.

The range of motion of female hockey players with left elbow flexion is 131.35 ± 4.69 degrees. The corresponding values for male hockey players 124.78 ± 8.87 degrees. Elbow flexion showed statistical significance with less ($p < 0.001$) in both males and females.

The range of motion of female archery players for right elbow flexion is 134.72 ± 7.36 degrees. Corresponding value for male archery players' is 128.87 ± 35.82 in degrees. Elbow flexion

showed statistical significance with less ($p < 0.001$) in both males and females.

The range of motion of female archery players with left elbow flexion is 130.34 ± 6.941 degrees. Corresponding value for male archery players were 125.74 ± 7.70 degrees. Elbow flexion showed statistical significance with less ($p < 0.001$) in both males and females.

The range of motion of hockey players with right elbow extension is 2.31 ± 1.40 degrees. The corresponding value for archery players were 3.53 ± 1.66 degrees. Elbow extension showed statistical significance with less $p < (0.05)$ in both archery and hockey players.

Table 5: Comparison of ROM (in degrees) of right elbow extension between archery and hockey players

Range of motion (Elbow)	Game		t	Mean diff.	CI
	Hockey N=16	Archery N=17			
Extension	2.31 ± 1.40	3.53 ± 1.66	2.26*	1.21	2.31-0.12

* $p < (0.05)$ ** $p < (0.01)$ *** $p < (0.001)$

The range of motion of hockey players with left elbow extension is 3.44 ± 1.50 degrees. The corresponding values for

archery players was 3.41 ± 2.57 degrees.

Table 6: Comparison of ROM (in degrees) of left elbow extension between archery and hockey players

Range of motion (Elbow)	Game		t	Mean diff.	CI
	Hockey N=16	Archery N=17			
Extension	3.44 ± 1.50	3.41 ± 2.57	0.03	0.02	1.48-1.53

* $p < (0.05)$ ** $p < (0.01)$ *** $p < (0.001)$

Discussion

The normative data emerged from this study for shoulder joint ROM of hockey player's flexion, extension, abduction, internal rotation and external rotation were 178.50, 77.63, 177.80, 73.58, 85.72 in degrees, respectively. The respective values of shoulder ROM of archery players were 177.17, 75.27, 175.17, 70.64 and 86.35 degrees, respectively. The shoulder range of motion values of hockey players are found significantly greater than the archery players.

Ellenbecker *et al.* (2002) [4] reported ROM measures in elite junior tennis player's external rotation, internal rotation and total rotation are 103, 45 and 149 in degrees and respective values for baseball pitchers are 103, 42, and 145 in degrees. Although Ellenbecker *et al.* (2002) [4] did not evaluate the shoulder flexion, extension and the abduction ROM, summing

the measures of internal rotation and external rotation, greater external rotation 103° and a lesser internal rotation 42° - 45° which is similar to the present study findings.

Findings of the present study with greater external rotation and lesser internal rotation is similar to Boone *et al.* (1979) [1] who reported the ROM values of internal rotation and external rotation to be 70° and 90° respectively. In this study we observe the range of elbow flexion to be 129° - 131° which less than that reported by Boone *et al.* (1979) [1]. Boone *et al.* (1979) [1] reported the elbow flexion ROM 146° , however Wright *et al.* (2006) [15] reported the elbow flexion ROM (130°) in their cross-sectional study on Elbow Range of Motion in Professional Baseball Pitchers which is Similar to the findings of the present study. Wright *et al.* (2006) [20] investigated 33 Professional Pitchers for Elbow ROM during

spring training pre-season and measured the elbow joint ROM of flexion, extension, supination and pronation.

The findings of the present study contradict the results of these studies. Vidhi *et al.* (2017) ^[19] in their study found no significant differences between the left and right side values. Boone *et al.* (1979) ^[1] also reported that the amplitudes of joint motion of both left and right were similar. However in the present study a statistically significant difference has been observed between the left and right side shoulder ROM. In general the right side demonstrated greater joint ROM values in comparison to the left side.

Findings the present study observed the shoulder range of motion of male players for flexion, extension, abduction, internal rotation and external rotation were (175-177), (73-74), (177-178), (70-71) and (82-83) in degrees respectively which is significantly lesser than the corresponding values of females. Greater female joint ROM can be attributed to structural differences that are different musculature at different joints in comparison to male and developmental changes in ligaments for more stability requiring increase in collagen fibres and reduction in elastin fibres in females.

In contrast Vidhi *et al.* (2017) ^[19] reported no significant difference between male and female elbow joint ROM. However they did not report shoulder joint ROM. This makes it difficult to compare the findings. Varangaonkar *et al.* (2014) ^[18] reported that males had greater values of lumbar extension ranges as compared to the females.

Conclusion

In comparison between male and female, females were having a greater joint ROM than the male counterparts. Correlation between the age and shoulder and elbow joint ROM shows a positive relationship, with growing age there is increase in shoulder and elbow joint ROM values.

Conflict of interest: There is no conflict of interest

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