

# A comparison of internal/external rotation strength and range of motion in the shoulder joint between zurkhaneh athletes and non-athletes

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## To cite this article:

Hamid Dehnavi, Hassan Daneshmandi, Mohammad Khajehpoor Glosalari, Hossein Shahrokhi. A Comparison of Internal/External Rotation Strength and Range of Motion in the Shoulder Joint between Zurkhaneh Athletes and Non-Athletes. *American Journal of Sports Science*. Vol. 1, No. 3, 2013, pp. 39-43. doi: 10.11648/j.ajss.20130103.13

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**Abstract:** Zurkhaneh as one the oldest sport is include many overhead movements. The purpose of this study was comparison between ratio of strength and range of motion in internal and external rotation in the shoulder joint's zurkhaneh athletes with Non-athletes. The subjects in this study included 29 zurkhaneh athletes with mean age ( $23.51 \pm 2.04$ ) and mean years of sport history ( $8.75 \pm 4.47$ ) and 30 non-athletes athletes with mean age ( $24.8 \pm 1.56$ ). Data were collected through questionnaires, and subjects' strength was measured by "Hand-held dynamometer" and ROM was measured by "Leighton flexometer" ( $r=0.90-0.99$ ) in both upper extremities. Data were analyzed by paired samples t-test and independent samples t-test. The results of this study showed significant degrees at internal/external rotation ROM ratio of zurkhaneh athletes than the non-athletes group ( $p \leq 0.05$ ). some result also was found in strength ratio in internal/external rotators in this group ( $p \leq 0.001$ ). Therefore repeated pattern of movements in the zurkhaneh sport at the long time causes imbalance in strength and range of motion shoulder joint that need to corrective exercise. It can be included due to specific demands such as repeated rotational movements in shoulder joint, they need a compensatory corrective exercises.

**Keywords:** Zurkhaneh, Strength, Range of Motion, Shoulder Joint

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## 1. Introduction

The physical demands of sport performance on the athletes' body cause certain musculoskeletal adaptation. Professional athletes spend most of their sporting life in training and competition (Crockett et al., 2002). Load placed on the musculoskeletal system may be generally classified as tensile or compressive. Repeated demands on a musculotendinous unit may cause it to shorten, decreasing normal joint range of motion (Daneshmandi et al., 2010). Musculoskeletal adaptation and some special side effects due to his or her physical demands and movement patterns in professional athletes are very important subjects in sport sciences. The musculoskeletal adaptation at this point is called maladaptation, reducing joint range of motion, changing biomechanical patterns, decreasing the efficiency of force production, and

increasing the chance of injuries to the musculoskeletal system (Anderson et al., 2002). Athletes involved in repetitive overhead activities place unique demands on the shoulder girdle (Arroyo et al., 1997). Overhead activities such as throwing, tennis, or volleyball place the athlete at considerable risk of overuse injuries (Burkhart et al., 2003). The glenohumeral joint is inherently unstable, and stability is provided predominantly by the ligamentous, capsular, and muscular structures and by the relative position of the glenoid and the arm through all arm motions (Wilk et al., 2002).

The internal rotator (IR) and external rotator (ER) muscles of the shoulder play a critical role in providing stability and mobility to the glenohumeral joint, particularly in overhead athletes (Ramsi et al., 2004).

Repetitive muscular exertion in the upper extremity required during performance of overhead activities specific movement patterns, leads to the development of sport specific muscular adaptation in overhead players. Muscular imbalance in rotator cuff and scapular musculature, coupled with inadequate muscular endurance and improper stroke biomechanics, can lead to overuse injury in the glenohumeral joint of overhead activity players (Ellenbecker *et al.*, 2003).

Zurkhaneh as traditional sport is unique and very popular in Iran and also few countries, this sport includes many physical activities and skills which performed with and without specific instruments. Most activities performed by overhead movements in shoulder. Despite of this popularity, there are no more academic research in this sport.

Therefore, the main purpose was to study the ratio of strength and range of motion (ROM) in internal and external rotation of shoulder joint's zurkhaneh athletes and compare the data with Non-athletes.

## 2. Methodology

The subjects of this study were members of league teams with more than 3 years of play in league competitions which voluntary participated in investigation. The total subjects of this study were include 59 men with mean age ( $24.16 \pm 1.91$ ). The groups of athletes included 29 zurkhaneh players with mean age ( $23.51 \pm 2.04$ ) and mean years of sport history ( $8.75 \pm 4.47$ ) and 30 non-athletes athletes with mean age ( $24.8 \pm 1.56$ ). The players completed sport injury risk factor questionnaires which asked about shoulder injuries and the causes of them during last two years. Demographics data also was gathered.

### 2.1. Range of Motion Test

Duration of dominant and non-dominant glenohumeral joints were made by Leighton flexometer ( $r=0.90-0.99$ )(figure 1) in standard position. Goniometric measurement of the glenohumeral join is difficult because of the multi-joint nature of the shoulder complex. In general, the literature would appear to indicate that the Leighton flexometer is a reliable measuring tool, especially when used by a single experienced tester.



Figure 1: Leighton flexometer

All ROMs of subjects were measured in the morning and before play or participating in warm-up drills. No goniometric measurements were taken in the afternoon or after participating in play or warm-up drills to minimize the effect of intense activity or play on range of motion. All testing took place with the subject in a standard position in special bar and plastic cast and stabilized scapula by three special wide tapes on the hip, chest and head areas. Shoulder external and internal rotations were measured with the arm positioned in  $90^\circ$  of glenohumeral abduction and  $90^\circ$  of elbow flexion (figure 2). During testing, the subjects were asked to actively move the joint as far as possible through the range of motion. For each direction, three measurements were taken and the mean measurements were calculated. We performed t-test on dominant versus non-dominant hands of subjects for all measurements. Correlation coefficients were computed to determine the strength of the relationships among variables (Daneshmandi *et al.*, 2010).

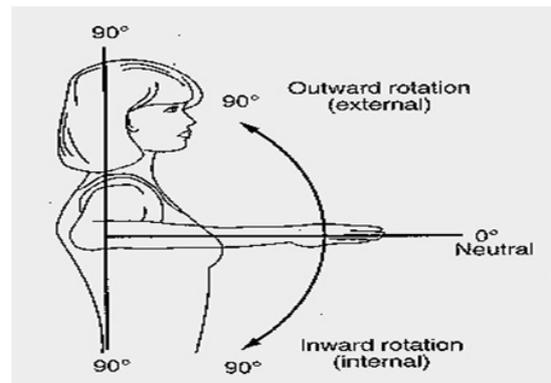


Figure 2: Measurement of internal/external ROM

### 2.2. Isometric Strength Muscle Test

Isometric force was measured with the JTech Power track II™ hand-held dynamometer (figure 3). A variety of shoulder positions have been described for isometric strength testing. Some authors (Kuhlman *et al.*, 1992) have tested in the scapular plane instead of the coronal plane, suggesting it decreases stress on the capsular-ligamentous-tendinous complex, increases the congruity between the humeral head and glenoid and keeps an optimal length-tension relationship for the abductors and rotators. The scapular rotator plane has been defined as the arm at  $45^\circ$  of forward elevation in the sagittal plane and at  $30^\circ$  anterior to the frontal plane (Leroux *et al.*, 1995). Some studies (Greenfield *et al.*, 1990), (This *et al.*, 1996) have suggested that higher torques are produced by subjects with and without shoulder pathology in this position; although others have found that there is minimal (Hartsell *et al.*, 1997) or no difference (Whitcomb *et al.*, 1995) in subjects without shoulder pathology.

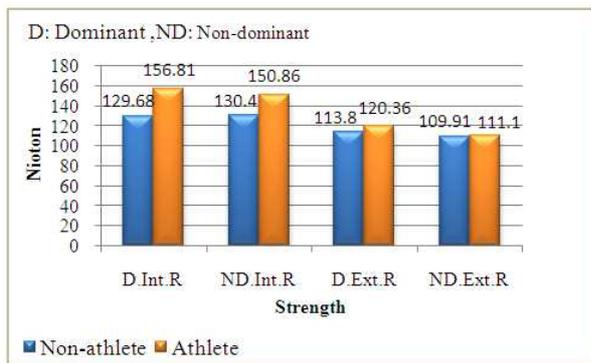


Figure 3: JTech Power track II™ hand-held dynamometer

In the present study all strength tests were performed in the prone position with the designated arm positioned in 90° of abduction and 0° of rotation with the elbow flexed to 90° (Beach et al., 1992), (Magnusson et al., 1995). The humerus was stabilized distally against the plinth, and subjects used the opposite arm to hold o to the side of the testing table for support. A JTech Powertrack II™ hand-held dynamometer was placed just proximal to the ulnar styloid process on the posterior surface of the forearm to assess external rotation strength. The dynamometer was positioned using the same anatomical landmarks on the anterior surface of the forearm to assess internal rotation strength (Beach et al., 1992), (Magnusson et al., 1995). Two maximal isometric contractions were performed, the duration of which was approximately 6-7<sub>s</sub> and 30<sub>s</sub> rests was given between trials. Subjects were instructed to hold the contraction against maximal examiner pressure and peak isometric muscle force was recorded (Cadogan et al., 2010).

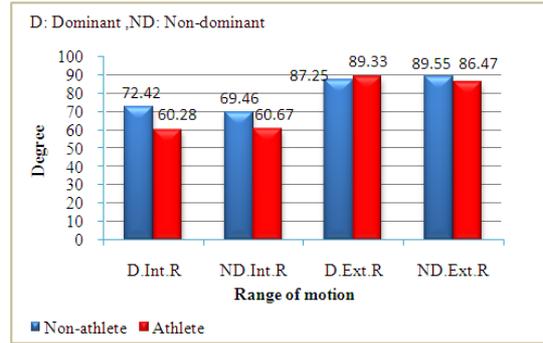
### 3. Results

The results of this study showed that the strength of internal rotation of zurkhaneh athletes were more than non-athletes, but this deference were less in external rotation (p<0.001) (Graph 1).



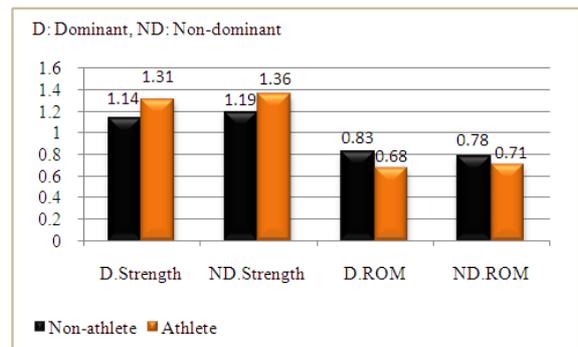
Graph 1: Internal/external rotation shoulder strength

Also the results showed that range of motion of athletes were less than non-athletes for internal rotation (p<0.001) (Graph 2).



Graph 2: Internal/external rotation shoulder Range of motion

The results of this study showed significant differences at internal/external rotation ROM ratio between zurkhaneh athletes and non-athletes group (p<0.05)(Graph 3). Likewise, the results of this study showed significant degrees at internal/external rotation strength ratio between zurkhaneh athletes and non-athletes group (p<0.001)(Graph 3).



Graph 3: Internal/External strength and ROM ratios

### 4. Discussion

There is controversy in the literature as to whether absolute strength or the IR:ER strength ratio should be used to quantify optimal levels of dynamic shoulder stability, particularly in overhead athletes (McMaster, 1992) Although similar studies have examined strength values of various levels of overhead athletes, this is the first study to examine ratio of strength and range of motion over the zurkhaneh athletes. The increased strength of IR without comparable increases in ER strength has been found in tennis players (Chandler, 1990), swimmers (Ramsi, 2004), water polo players (McMaster, 1992) and baseball pitchers (Brown, 1998) and has been attributed to the repetitive IR motions involved in this overhead sports. In our study, IR strength consistently increased throughout repetitive IR motions in zurkhaneh players. The reliance on IR muscles for power, coupled with the high number of repetitions, encourages progressive increases in IR strength over the Shoulder Joint's Zurkhaneh. If a strength imbalance ratio develops between the IR and ER muscles, however, chronic upper extremity overuse pathologies

might ensue.

Also In this study, the ratio of range of external and internal shoulder rotations was different in zurkhaneh athletes, which can be related to their specific sport demands and emphasizes this point that flexibility is very specific in any joint, Glenohumeral internal rotation of zurkhaneh athletes was less than other groups in this study. A reduction in shoulder internal rotation, can be explained as an adaptation of the anterior shoulder musculature to the overhead movements in this sport. Current research has convincingly showed that deficits of internal rotation of shoulder occur as the athlete adapts to the demands of the sport. It is unclear whether these are normal adaptations that are beneficial, either locally or throughout the kinetic chain, or whether these are mal-adaptations that create potentially harmful local or kinetic chain biomechanics. Also, the role this adaptation may play in injury causation or risk is unclear. Several recent papers suggest that decreased internal rotation and total rotation may adversely affect shoulder performance, and this effect may increase the risk of injury. There are studies which show that inflexibility is a risk factor for further injury (Chandler, 1990). Achievement of full range of motion is one of the first goals in rehabilitation programs (Wilk, 2002). Most shoulder rehabilitation protocols now emphasize on a corrective exercise for internal rotation of shoulder of athletes. This paper showed degrees of asymmetry in dominant and non-dominant hands of zurkhaneh athletes. If we do not note it carefully and do not use correct stretch exercise program, this imbalance in musculature of shoulder girdle leads the athletes to decrease their performance or an increase in the chance of injury.

## 5. Conclusion

Elite Zurkhaneh athletes without shoulder injury have shoulder rotation muscle strength imbalances that alter the normal functional ratio between the rotator cuff muscles. These differences in strength do not seem to affect athletic performance, but detection and prevention with exercise programs at an early age are recommended.

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