

Prevalence of Rotator Cuff Injury in Amateur Boxers

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Abstract: Background: Boxing is a combat sport that demands both mental and physical competencies. The aim of the amateur boxer is to score the required points and to win the round by delivering clear punches to opponent's target areas using different strategies and tactic. While performing most muscle work is done at upper limb mainly at shoulder joint. Repetitive loading can cause micro trauma of the rotator cuff tendon fibers. This micro trauma or very small tearing of the fibers can lead to partial tearing of the tendon which may gradually progress to a full tear. This may occur as a result of repetitive overhead motions, as well as when the tendon and musculature are given insufficient rest to repair damage that has accumulated. Purpose: To find out prevalence of rotator cuff injury in amateur boxers. Method: The study consist of 112 participants chosen according to inclusion and exclusion criteria, Test was performed and positive and negative finding was noted, Acquired data was entered into statistical software. Result: The result showed that prevalence of rotator cuff in amateur boxer that is (78%) The study concludes that among rotator cuff, subscapularis muscle is more affected in boxers that is (66%). Conclusion: This study determined the prevalence of rotator cuff in armature boxers.

Keywords: Boxers, Rotator cuff, Amateur, Drop arm test, Lift of sign /Gerber's test, Infraspinatus test, Teres minor test/ Hornblower test

1. Introduction

Boxing is a combat sport that demands both mental and physical competencies. In line with other active individuals, boxers should demonstrate – inter alia – optimal strength, stamina, endurance, coordination, speed and agility.

The aim of the amateur boxer is to score the required points and to win the round by delivering clear punches to opponent's target areas using different strategies and tactics. The boxing punches are three types, a) straight, using the lead arm also referred jab and with the rear arm cross, b) hook, c) uppercut. During the initial segments of the straight and hook punches we witness the engagement of the internal rotators, while external rotators are involved in the uppercut punches; the reverse occurs and to the end of these three movements.⁹

Internal and external shoulder rotators stabilize the rotator cuff and maintain shoulder joint stability and integrity throughout the range of movements, that included in the straight, hook and uppercut punches. Amateur boxers often suffer shoulder injuries, perhaps due to relatively weak musculature.

The rotator cuff is the group of tendons surrounding the top of the humerus that allow for mobility of the shoulder and are responsible for three important shoulder movements for boxers:

- Rotating the upper arm in (internal rotation) subscapularis
- Rotating the upper arm out (external rotation) infraspinatus, teres minor
- Moving the upper arm away from the body (abduction) supraspinatus

The rotator cuff muscles generate torque forces to move the humerus while acting in concord to produce balanced compressive forces to stabilize the glenohumeral joint. Thus, rotator cuff tears are often associated with loss of shoulder strength and stability, which are crucial for optimal shoulder function. The dimensions and extent of rotator cuff tears, the condition of the involved tendon, tear morphologic features, involvement of the subscapularis and infraspinatus tendons or of contiguous structures.⁽¹⁾

Rotator cuff tendonitis occurs when the rotator cuff muscles are strained and their tendons develop micro tears. This is most often caused by overexertion of the shoulder joint and results in pain, weakness, and reduced mobility in the shoulder. Rotator cuff tears can occur either over time or as the result of a sudden traumatic incident. For boxers, these injuries tend to occur as a result of small micro-tears in the rotator cuff that begin to get larger over time.⁽²⁾

Occupational demands from repetitive and/or heavy labor also influence the prevalence of rotator cuff tears. However, these injuries can also occur suddenly as the result of a missed punch or over rotating of the shoulder. Straight right punch, thrown by the rear hand in boxing, also known as reverse punch in karate, is a fundamental, score-making and powerful skill.⁽³⁾

Thrown often by dominant hand, the technique is very precise and could potentially alter competition result. The magnitude of force exerted at the point of impact is governed by a number of factors, amongst which are:

- Degree of body and arm rotation, and the distance over which the punch is thrown
- There are a number of factors that may contribute to rotator cuff tears, these include repetitive stress & micro trauma accumulation, age, practice period, and acute or traumatic events.

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A lower rest period between exercises will result in greater fatigue and consequently lower load use. When the goal of a strength and conditioning professional is to improve maximal GRF, longer rests are needed to allow for bioenergetics restoration and thus true maximal efforts. When the shoulder is not given time to properly rest, the tears in the tendons of the rotator cuff are not able to repair themselves which will weaken the entire shoulder.

However, these injuries can also occur suddenly as the result of a missed punch or over rotating of the shoulder. When rotator cuff injuries occur they are immediately followed by pain, weakness, and reduced mobility of the shoulder⁷

Rotator cuff tear may occur due to repetitive stress and micro trauma accumulation.⁽⁴⁾

Repetitive loading can cause micro trauma of the rotator cuff tendon fibers. This micro trauma or very small tearing of the fibers can lead to partial tearing of the tendon which may gradually progress to a full tear. This may occur as a result of repetitive overhead motions, as well as when the tendon and musculature are given insufficient rest to repair damage that has accumulated. Hand dominance has also been identified as a risk factor for rotator cuff tears. The dominant hand tends to be used more, therefore tends to undergo more repetitive stress, which may contribute to tearing.

The rotator cuff is also placed under considerable stress in athletes that participate in overhead or throwing activities.

With repetitive throwing motions, the arm undergoes large amounts of internal and external rotation in which the rotator cuff tendon fibers are subject to twisting, which can lead to torsional overload and shear failure.⁽⁴⁾

The rotator cuff contributes to both stability and movement of the glenohumeral joint (GHJ) and is integral to appropriate functioning of the upper limb. It is a myotendinous complex formed by four muscle-tendon units: the supraspinatus superiorly, the subscapularis anteriorly and the teres minor and infraspinatus posteriorly.

The tendons of the rotator cuff are composed primarily of type 1 collagen fibers tightly packed in a parallel configuration with small numbers of long, thin tenocyte cells in between the rows of collagen. The collagen fibers and cells are embedded in a matrix of proteoglycans, glycosaminoglycans, and water. A commonly held view is that the four rotator cuff tendons are separate entities. However, Clark and Harryman showed that these four tendons fuse together approximately half an inch from the point of the insertion of the tendons into the humerus.⁽⁵⁾

As the four rotator cuff tendons are separate entities, so we use different special test for each of them to know the rotator cuff injury in amateur boxers.

Punch force averaged 3427 (standard deviation (SD) 811) N, hand velocity 9.14 (SD 2.06) m/s, and effective punch mass 2.9 (SD 2.0) kg. Punch force was higher for the heavier weight classes, due primarily to a higher effective mass of the punch. Jaw load was 876 (SD 288) N. The peak

translational acceleration was 58 (SD 13) g, rotational acceleration was 6343 (SD 1789) rad/s², and neck shear was 994 (SD 318) N.

Boxers deliver straight punches with high impact velocity and energy transfer.

The severity of the punch increases with weight class.⁽⁶⁾

2. Need of Study

Shoulder problems are very common in boxers which alters the shoulder kinetics and kinematics and movement which leads to weakness of the rotator cuff it become difficult in boxers to extend, medially rotate, and retract with each punch.

This repetitive action tends to occur as result of small micro tear to get larger over time,

It is important to know the dimensions and characteristics of rotator cuff injury in boxers to understand how it is and to increase awareness to design interventions among them.

As no study is been done on rotator cuff injury in boxers.

This prevalence study will act as a base for further interventional studies to treat rotator cuff injury in professional boxers.

3. Review of Literature

- 1) **De Maeseneer, Gandikota Girish Conducted a study on MRI IMAGING OF ROTATOR CUFF INJURY (2006) rotator cuff muscle** generate torque forces to move the humerus while acting into produce balance compression force to stabilize glenohumeral joint rotator cuff associate with loss of shoulder strength, the dimensions and extent of rotator cuff tears, the condition of the involved tendon, tear morphologic features, involvement of the subscapularis and infraspinatus tendons.
- 2) **David W. Altchek, Daniel M. Veltri conducted a study on Traumatic tear of the subscapularis tendon and they have clinical diagnosis, magnetic resonance imaging finding (1997)** study population consist 14 in 13 consequent patient with surgically confirmed isolated subscapularis tendon tear, all patient reported pain and weakness in affected shoulder.
- 3) **Field T. Blevins, William M. Hayes conducted a study on Cuff Injury in Contact Athletes (1996)** cases and incident of rotator cuff injury in patient under age 40, present study focus on 10 male contact athletes with injury (age 24-36) diagnosed for where 5 partial thickness tear, 3 full thickness tear. Diagnosis of rotator cuff injury considered in contact athletes shoulder pain, weakness, positive shrugging sign positive. Arthroscopic debridement of sub acromial space followed by degradant or repair of rotator cuff muscle.
- 4) **Huseyinozkaz, İbrahim Yanmis, Mustafa Kurklu conducted a study on Arthroscopic shoulder assessment in Turkish amateur boxers (2009)** 10 amateur boxers with complaints of pain in shoulder

region and decrease performance during sportsplay , They were evaluated by physical examination, radiology and arthroscopy. There were no clinical findings of instability. One patient was found to have subacromial impingement; six had crepitation at various degrees during shoulder movements. In conclusions, although the injury mechanism of the shoulder during boxing is unknown, this study shows that shoulder complaints in boxers should be considered as possible indicators of serious intra-articular lesions.

- 5) **Todd May; Gus M. Garmel. Conducted a study on Rotator Cuff Injury (JULY 26,2021)** Rotator cuff pathology is a commonly encountered condition, and the natural history suggests tears increase with increasing age, Rotator cuff injury runs the full spectrum from injury to tendinopathy to partial tears, and finally complete tears. Age plays a significant role. Injuries ranged from 9.7% in those 20 years and younger increasing to 62% in patients 80 years and older, Ultrasound has become an excellent tool for evaluating the rotator cuff.
- 6) **T J Walilko 1, D C Viano, C A Bir conducted study on Biomechanics of the head for Olympic boxer punches to the face (2004)** Objective: Seven Olympic boxers from five weight classes delivered 18 straight punches to the frangible face of the Hybrid III dummy. High speed video recorded each blow and was used to determine punch velocity. Equilibrium was used to determine punch force, energy transfer, and power. Results: Punch force averaged 3427 (standard deviation (SD) 811) N, hand velocity 9.14 (SD 2.06) m/s, and effective punch mass 2.9 (SD 2.0) kg. Punch force was higher for the heavier weight classes, due primarily to a higher effective mass of the punch. Jaw load was 876 (SD 288) N. The peak translational acceleration was 58 (SD 13) g, rotational acceleration was 6343 (SD 1789) rad/s², Conclusions: Olympic boxers deliver straight punches with high impact velocity and energy transfer. The severity of the punch increases with weight class

Aim

To find prevalence of rotator cuff injury in Amateur boxers.

Objective

- To find the prevalence of rotator cuff injury in amateur boxers by using special test ;
 - Drop arm test (supraspinatus)
 - Teres minor test (teres minor)
 - Infraspinatus test (infraspinatus)
 - Lift off test (subscapularis)
- To find, out of four muscle group which one is affected more for injury?

Reserch Question

Which rotator cuff muscle injury is commonly injured in amateur boxers?

4. Methodology

Type of study- Observational study
 Sampling Technique- Convenient Sampling
 Sample size- 112
 Study Area- Urban Area

Study duration- 6 months
 Study material- Pen, Paper, chair.

Inclusion and Exclusion Criteria

Inclusion Criteria:

- Both gender
- Practice period : more than 2 years
- Age (18-24yr)

Exclusion Criteria:

- Any previous musculoskeletal disorder or deformities of shoulder or arm
- Any other systemic illness
- Any recent surgery

Procedure

- Ethical approval was taken.
- Prior permission was taken from coach.
- Procedure was explained to subjects.
- Informed consent was taken from coach.
- Informed consent was taken from subject.
- Test was performed and positive and negative finding was noted
- Acquired data was entered into statistical software

Outcome Measure

Special test for Rotator cuff muscle

- Drop arm test (sensitivity-73%; specificity-77%)
- Lift of sign /Gerber's test (sensitivity-50%, specificity-84%)
- Infraspinatus test (sensitivity-90%, specificity-74%)
- Teres minor test/Hornblower test (sensitivity-100, specificity-62)

1) Drop Arm Test

Technique: Stand behind the seated patient and passively abduct the patient's arm to 90 and full external rotation, while supporting the arm at the elbow, Release the elbow support and ask patient to slowly lower the arm back to neutral.

Interpretation: The test is negative if the patient is able to control the lowering of the arm slowly and without their symptoms occurring.

It is a positive test if there is a sudden dropping of the arm or weakness in maintaining arm position during the eccentric part of abduction, there may also be pain present while lowering the arm, suggesting a full thickness tear to the supraspinatus⁽⁴⁾



2) Infraspinatus Test

The patient stands with the arm at the side with the elbow at 90° and the humerus medially rotated to 45°. The examiner then applies a medial rotation force that the patient resists. Pain or the inability to resist medial rotation indicates a positive test for an infraspinatus strain.



4) Lift of test /Gerberstet

This test is performed in a standing position, with the examiner observing and testing from standing behind the patient. To perform this test, the patient is asked to place the back of the affected arm (dorsum of the hand) in the mid lumbar spine area. The testing movement involves the patient performing internal rotation (IR), by lifting the hand off the back while the examiner places pressure on the hand. The test is considered to be positive if the patient cannot resist, lift the hand off the back or if she/he compensates by extending the elbow and shoulder



3) Teres Minor Test.(Horn blower’s sign)

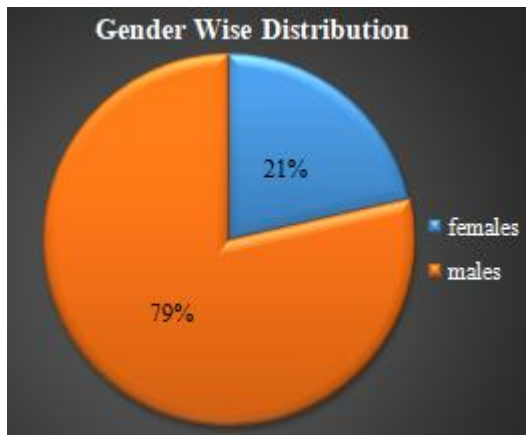
The patient is seated or standing. The examiner places the patient's arm to 90° in the scapular plane and flexes the elbow to 90°. The patient is then asked to externally rotate against resistance. The test is positive if the patient is unable to perform external rotation.



5. Data Analysis and Interpretation

Table 1: Gender Wise Distribution

Gender	No. of participants
Females	24
Males	88

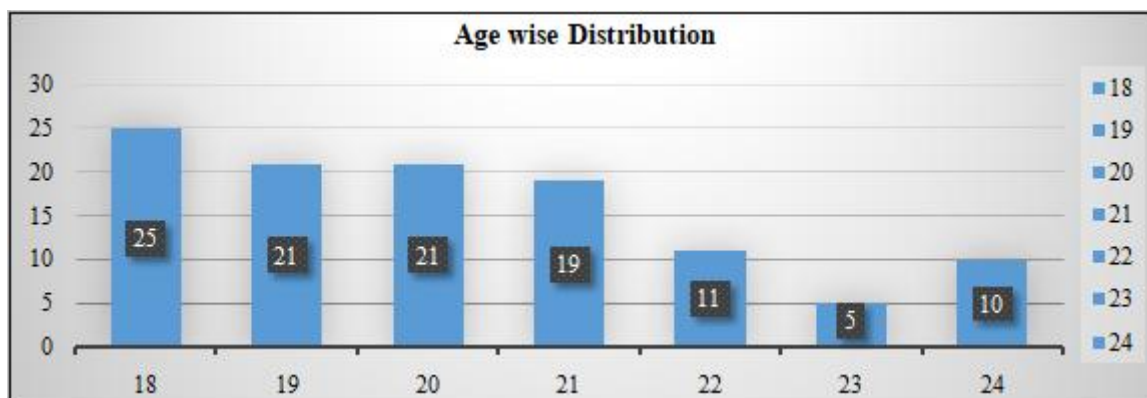


participated with 24 female participants and 88 male participants, hence 21% are female and 79% are male.

Table 2: Age Wise distribution

Age	Age wise Distribution
18	24
19	21
20	21
21	19
22	11
23	5
24	10
	112

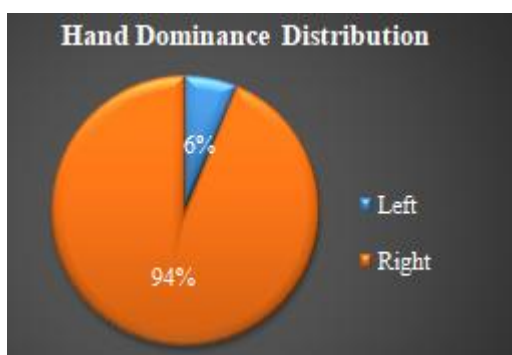
Interpretation: Graph 1 shows the number of individuals who participated in the study. A total of 112 subjects



Interpretation : Graph 2 shows age related classification where 25 subject are in age group of 18, 21 subject are in age group of 19 , 21 subject are in age group of 20, 19 subject are in age group of 21, 11 subject are in age group 22, 5subject are in age group 23, 10 subject are in age group 24.

Table 3: Hand Dominance Wise Distribution

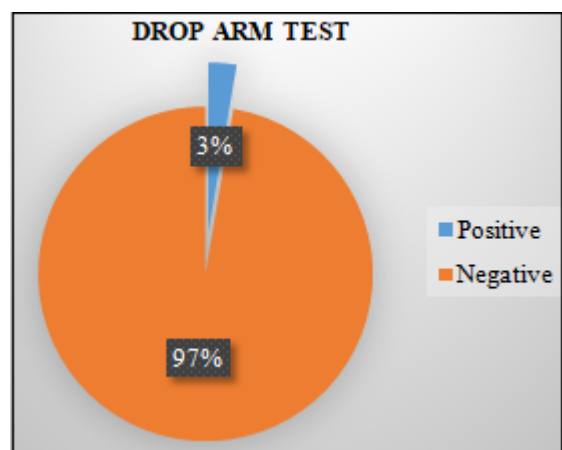
Hand Dominance	No. of Participants
Left	7
Right	105
	112



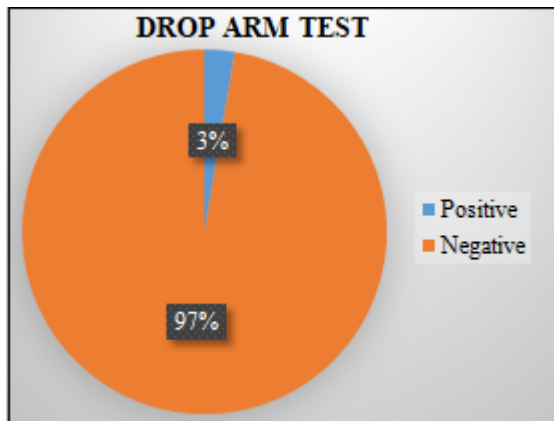
Interpretation: Graph 3 shows hand dominance wise distribution where 6% subjects are left handed and 94% subjects are right handed.

Table 4: Drop Arm Test

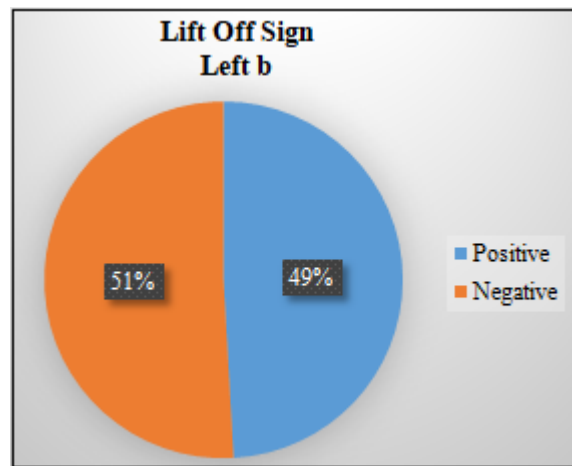
Drop Arm Test	No. of Participants	
Right	Positive	3
	Negative	109
Left	Positive	3
	Negative	109
	112	



Interpretation: Graph 4 a shows the distribution of drop arm test for right hand, where 3% participants showing positive test and 97% participants showing negative test .



Interpretation: Graph 4 b shows the distribution of drop arm test for left hand, where 3% participants showing positive test and 97% participants showing negative test.



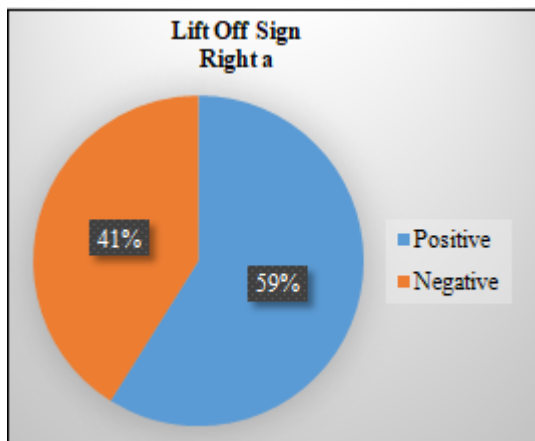
Interpretation: Graph 5 b shows the distribution of Lift off sign for left hand, where 49% participants showing positive test and 51% participants showing negative test.

Table 5 (a): Lift Off Sign

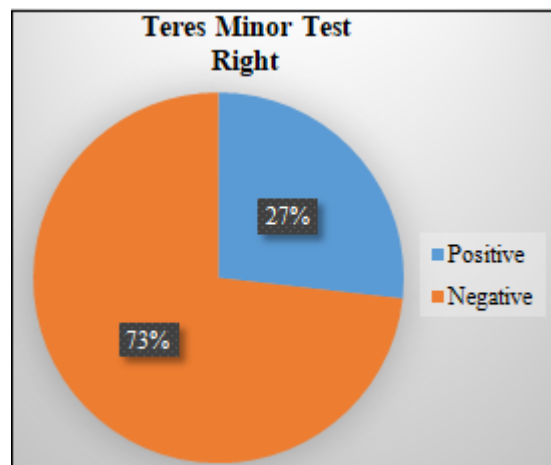
Lift Off Sign		No.
Right	Positive	66
	Negative	46
		112

Table 6 (a): Teres Minor Test

Teres Minor Test		No.
Right	Positive	30
	Negative	82
		112



Interpretation: Graph 5 a shows the distribution of Lift off sign for right hand, where 59% participants showing positive test and 41% participants showing negative test.



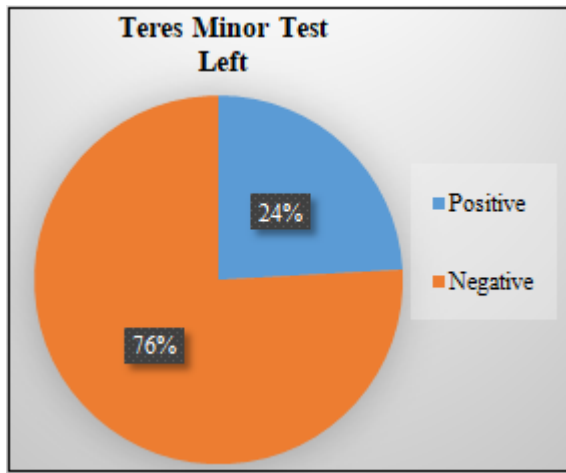
Interpretation: Graph 6 a shows the distribution of teres minor test for right hand, where 27% participants showing positive test and 73% participants showing negative test

Table 5 (b): Lift Off Sign

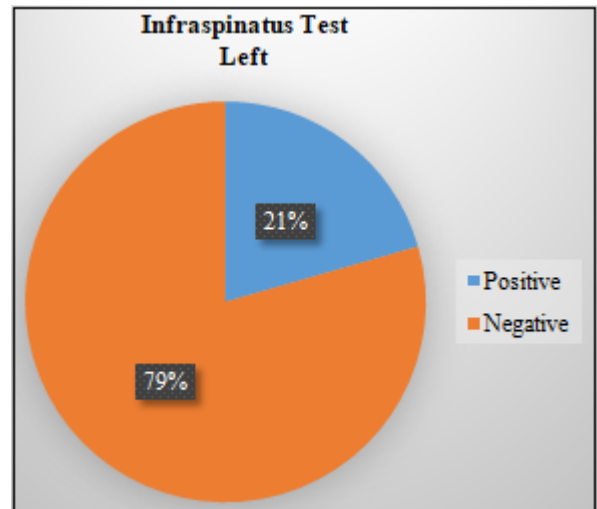
Lift Off Sign		No.
Left	Positive	55
	Negative	57
		112

Table 6 (b): Teres Minor Test

Teres Minor Test		NO.
LEFT	Positive	27
	Negative	85
		112



Interpretation: Graph 6 b shows the distribution of teres minor test for left hand, where 24% participants showing positive test and 76% participants showing negative test



Interpretation: Graph 7 b shows the distribution of infraspinatus test for left hand, where 21% participants showing positive test and 79% participants showing negative test.

Table 7 (a): Infraspinatus Test

Infraspinatus Test		No.
Right	Positive	25
	Negative	87
		112

6. Result

Graph 1 shows the number of individuals who participated in the study. A total of 112 subjects participated with 24 female participants and 88 male participants, hence 21% are female and 79% are male.

Graph 2 shows age related classification where 25 subject are in age group of 18, 21 subject are in age group of 19, 21 subject are in age group of 20, 19 subject are in age group of 21, 11 subject are in age group 22, 5 subject are in age group 23, 10 subject are in age group 24.

Graph 3 shows hand dominance wise distribution where 6% subjects are left handed and 94% subjects are right handed.

Graph 4 a shows the distribution of drop arm test for right handed, where 3% participants showing positive test and 97% participants showing negative test

Graph 4 b shows the distribution of drop arm test for left hand, where 3% participants showing positive test and 97% participants showing negative test

Graph 5 a shows the distribution of Lift off sign for right hand, where 59% participants showing positive test and 41% participants showing negative test.

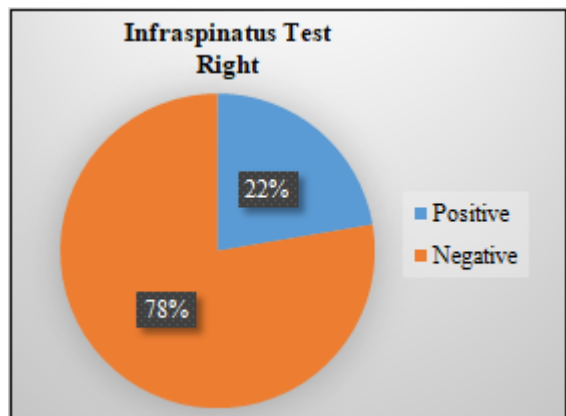
Graph 5 b shows the distribution of Lift off sign for left hand, where 49% participants showing positive test and 51% participants showing negative test.

Graph 6 a shows the distribution of teres minor test for right hand, where 27% participants showing positive test and 73% participants showing negative test

Graph 6 b shows the distribution of teres minor test for left hand, where 24% participants showing positive test and 76% participants showing negative test.

Graph 7 a shows the distribution of infraspinatus test for right hand, where 22% participants showing positive test and 78% participants showing negative test.

Graph 7 b shows the distribution of infraspinatus test for left hand, where 21% participants showing positive test and 79% participants showing negative test.



Interpretation: Graph 7 a shows the distribution of infraspinatus test for right hand, where 22% participants showing positive test and 78% participants showing negative test.

Table 7 (b): Infraspinatus Test

Infraspinatus Test		No.
Left	Positive	23
	Negative	89
		112

So the overall result was that prevalence of rotator cuff injury in boxers by using various manual test was found

positive during study ,and in that subscapularis muscle is more prone for injury by using lift off test.

7. Discussion

The aim of present study was to find out the prevalence of rotator cuff injury in boxer and if injury is there then which rotator cuff muscle injury is common.

This study concludes that there is high prevalence of rotator cuff in boxers that is (78%). The study concludes that among rotator cuff, subscapularis muscle is more affected in boxers that is (66%) by using lift off test.

The rotator cuff muscles generate torque forces to move the humerus while acting in concord to produce balanced compressive forces to stabilize the glenohumeral joint. Thus, rotator cuff injury are often associated with loss of shoulder strength and stability, which are crucial for optimal shoulder function.⁽¹⁰⁾

The anatomic status of the rotator cuff tendons is one of a number of factors that must be taken into account when planning the treatment/strengthening of rotator cuff injury. The rotator cuff is important in shoulder movement; initiation of Shoulder abduction relies on the function and integrity of the supraspinatus muscle and tendon and other rotator cuff tendon⁽¹¹⁾

Our shoulder is made up of three bones: the upper arm bone (humerus), the shoulder blade (scapula), and the collarbone (clavicle). The shoulder is a ball-and-socket joint: The ball, or head, of the upper arm bone fits into a shallow socket in the shoulder blade. Our arm is kept in our shoulder socket by the rotator cuff. The rotator cuff is a group of four muscles that come together as tendons to form a covering around the head of the humerus. The rotator cuff attaches the humerus to the shoulder blade and helps to lift and rotate your arm.¹⁷

The rotator cuff consists of the supraspinatus, infraspinatus, subscapularis, and teres minor muscles and tendons.¹² At the distal aspect of the rotator cuff, the supraspinatus and infraspinatus tendons splay out and interdigitate, forming a common continuous insertion on the middle facet of the humeral greater tuberosity, thus the rotator cuff is a functional anatomic unit rather than four unrelated tendons, and injury to one component may have an influence on other region of the rotator cuff.¹³

Repetitive loading can cause micro trauma of the rotator cuff tendon fibers. This micro trauma or very small tearing of the fibers can lead to partial tearing of the tendon which may gradually progress to a full tear This may occur as a result of repetitive overhead motions, as well as when the tendon and musculature are given insufficient rest to repair damage that has accumulated. Hand dominance has also been identified as a risk factor for rotator cuff tears.¹⁴ The dominant hand tends to be used more, therefore tends to undergo more repetitive stress, which may contribute to tearing.

A lower rest period between exercises will result in greater fatigue and consequently lower load use. When the goal of a strength and conditioning professional is to improve

maximal GRF, longer rests are needed to allow for bioenergetic restoration and thus true maximal efforts.⁽¹²⁾

During the initial segments of the straight and hook punches we witness the engagement of the internal rotators, while external rotators are involved in the uppercut punches; the reverse occurs and to the end of these three movements.⁹

Internal and external shoulder rotators stabilize the rotator cuff and maintain shoulder joint stability and integrity throughout the range of movements, that included in the straight, hook and uppercut punches . Amateur boxers often suffer shoulder injuries, perhaps due to relatively weak musculature.

The rotator cuff musculature imparts dynamic stability to the glenohumeral joint. In particular, the balance between the subscapularis anteriorly and the infraspinatus posteriorly, often referred to as the rotator cuff "force couple," is critical for concavity compression and concentric rotation of the humeral head. Restoration of this anterior-posterior force balance after chronic, massive rotator cuff tears may allow for deltoid compensation, but no in vivo studies have quantitatively demonstrated an improvement in shoulder function

Rotator cuff tears are more common in the dominant arm — the arm you prefer to use for most tasks. If you have a degenerative tear in one shoulder, there is a greater likelihood of a rotator cuff tear in the opposite shoulder — even if you have no pain in that shoulder.

Several factors contribute to degenerative, or chronic, rotator cuff tears.

Repetitive stress: Repeating the same shoulder motions again and again can stress your rotator cuff muscles and tendons. Baseball, tennis, rowing, and weightlifting are examples of activities that can put you at risk for overuse tears. Many jobs and routine chores can cause overuse tears, as well.

One of the study done by Jae woo junu et al: (2021) proposed Scapular Dyskinesia in Elite Boxers with Neck Disability and Shoulder Malfunction Boxers with scapular dyskinesia showed decreased internal rotation ROM and strength.

One more study conducted by DarijanUjsasi et al: (2022) proposed The Applicability of Provocative Functional Tests in the Diagnosis of Rotator Cuff Muscle Injuries of the Best University Athletes showed Based on the obtained and presented research results, it can be concluded that PFTs are good indicators of changes in soft tissues and different degrees of damage, and that they can be used as initial indicators of these conditions.

Another study conducted by R Doyscher et al: (2014) proposed Acute and overuse injuries of the shoulder in sports showed In general acute lesions of the shoulder caused by sudden sport injuries, such as secondary forms of impingement along with rotator cuff tears and labral lesions.

One other study done Mohanraj and Karthik Ganesh et al: (2018) proposed rotator cuff tear –a review showed rotator cuff tear is the common tear occurring in shoulder, the main muscle involved are supraspinatus, teres major, subscapularis, infraspinatus

While performing assessment we came across that there is less awareness of scapular muscle among boxers and coaches and they don't train these muscle group

This study provides important information for coaches to specifically design better training strategies to improve punching impact.

8. Conclusion

This study determined the prevalence of rotator cuff in armature boxers.

This study concludes that there is high prevalence of rotator cuff in boxers that is (78%).

The study concludes that among rotator cuff, subscapularis muscle is more affected in boxers that is (66%).

9. Clinical Implication

The study can be used for treatment purpose.

This prevalence study can be used as awareness of injury and can be used for treatment.

Boxers need to be made aware of importance of rotator cuff strengthening in preventing further complication like muscle strain, fatigue.

The result can be used as a basis for the further interventional studies.

10. Limitation

The study was done only in a restricted geographical area.

The limitation of study is provocative functional test (PFT) were not conformed with MRI, US.

11. Further Scope of Study

Specific and correct muscle strength training can prevent further complication.

Strengthening exercise of rotator cuff can be taught to prevent muscle weakness.

Future investigations into the physical and physiological attributes of boxers help create a suitable training program.

References

[1] Field T. Blevins et al: "Rotator cuff injury in contact athletes" The American journal of sports medicine May 1 1996, 24(3):263-267.

- [2] Yoavmorg et al: "MR Imaging of Rotator cuff injury" RSNA education exhibits July 1, 2006, 26(4):286-292
- [3] Allen Deutsch et al: "Traumatic tears of the subscapularis tendon" The American journal of sports medicine Jan 1 1997, 25(1):13-22.
- [4] Peter Edwards et al: "Exercise rehabilitation in the non-operative management of rotator cuff tears" IJSPT April 2016, 11(2):279-301.
- [5] Huseyinozkaz et al: "Arthroscopic shoulder assessment in Turkish amateur boxers" Open Medicine 2009, 4(3):358-362.
- [6] T J Walilko et al: "Biomechanics of the head for Olympic boxer punches to the face" BrJ Sports medicine Oct 2005, 39(10):710-9
- [7] Orthopedic physical assessment book by David j.Magee fifth edition pg.no 311, Special test:
- [8] Baechle TR, Earle RW, eds. Essentials of Strength Training and Conditioning. Champaign, IL: Human Kinetics, 2008.
- [9] Ioannis Tasiopoulos ,et al; "The greater the number of wins the greater the peak torque levels of shoulder internal rotators power of dominant hand in amature boxing athletes" Biology of exs. 2015, 11(1): 65-67.
- [10] jae woo jung et al : "scapular dyskinesis in elite boxers with neck disability and shoulder malfunction ,2021
- [11] Atha J, Yeadon MR, Sandover J, Parsons KC. The damaging punch. Br Med J 291: 1756–1757, 1985.
- [12] Potter, M.R.; Snyder, A.J.; Smith, G.A. Boxing injuries presenting to US emergency departments, 1990–2008. *Am. J. Prev. Med.* **2011**, *40*, 462–467.
- [13] Zazryn, T.R.; Finch, C.F.; McCrory, P. A 16 year study of injuries to professional boxers in the state of Victoria, Australia. *Br. J. Sports Med.* **2003**, *37*, 321–324.
- [14] Kibler, B.W.; McMullen, J. Scapular dyskinesis and its relation to shoulder pain. *J. Am. Acad. Orthop. Surg.* **2003**, *11*, 142–151. [
- [15] Yoav morg et al: "MR Imaging of Rotator cuff injury" RSNA education exhibits July 1, 2006, 26(4):286-292
- [16] Allen Deutsch et al: "Traumatic tears of the subscapularis tendon" The American journal of sports medicine Jan 1 2005, 25(1):13-22.
- [17] Peter Edwards et al: "Exercise rehabilitation in the non-operative management of rotator cuff tears" IJSPT April 2016, 11(2):279-301.
- [18] Huseyinozkaz et al: "Arthroscopic shoulder assessment in Turkish amateur boxers" Open Medicine 2009, 4(3):358-362.
- [19] T J Walilko et al: "Biomechanics of the head for Olympic boxer punches to the face" BrJ Sports medicine Oct 2005, 39(10):710-9
- [20] Orthopedic physical assessment book by David j.Magee fifth edition pg.no 311,314