WJPMR, 2026, 12(6), 49-59

Review Article

Impact Factor: 7.555

WORLD JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.wjpmr.com

ISSN (O): 2455-3301

ISSN (P): 3051-2557

Coden USA: WJPMBB

ANATOMICAL AND BIOMECHANICAL REVIEW OF SHOULDER REGION MUSCLES WITH SPECIAL REFERENCE TO ROTATOR CUFF

Dr. Shan Ahmad*[1], Dr. Jitender Kumar[2], Dr. Aaditya Bhardwaj[3]

[1]P.G. Scholar, Department of Rachana Sharir, Quadra Institute of Ayurveda, Roorkee.
[2]Professor and HOD, Department of Rachana Sharir. Quadra Institute of Ayurveda, Roorkee.
[3]Assistant Professor, Department of Rachana Sharir. Quadra Institute of Ayurveda, Roorkee.

***Corresponding Author: Dr. Shan Ahmad**

P.G. Scholar, Department of Rachana Sharir, Quadra Institute of Ayurveda, Roorkee.

DOI: https://doi.org/10.5281/zenodo.20444660

How to cite this Article: Dr. Shan Ahmad*[1], Dr. Jitender Kumar[2], Dr. Aaditya Bhardwaj[3]. (2026). Anatomical and Biomechanical Review of Shoulder Region Muscles With Special Reference To Rotator Cuff. World Journal of Pharmaceutical and Medical Research, 12(6), 49–52.

Article Received on 15/04/2026 **Article Revised on 05/05/2026** **Article Published on 01/06/2026**

ABSTRACT

Background: The shoulder joint is the most mobile joint of the human body, allowing a wide range of movements. This mobility is mainly supported by a complex arrangement of muscles, especially the rotator cuff muscles. These muscles play a key role in maintaining joint stability while permitting dynamic movements. Understanding their anatomical structure and biomechanical functions is essential for clinical diagnosis and management of shoulder disorders. **Aim:** To study the anatomical structure and biomechanical functions of shoulder region muscles with special reference to the rotator cuff. **Objectives:** To describe the anatomy of shoulder region muscles. To analyze the components of rotator cuff muscles. To evaluate the biomechanical role of rotator cuff in shoulder movements. To understand the stabilizing function of rotator cuff muscles. **Materials and Methods:** This study is a conceptual and literature-based review. Data were collected from standard anatomical textbooks, peer-reviewed journals, and classical Ayurvedic texts. The anatomical details of shoulder muscles and their biomechanical roles were analyzed and correlated with Ayurvedic concepts wherever applicable. **Results:** The rotator cuff consists of four muscles—Supraspinatus, Infraspinatus, Teres Minor, and Subscapularis—which collectively stabilize the glenohumeral joint. These muscles maintain the humeral head within the glenoid cavity during movements such as abduction, rotation, and flexion. Biomechanically, they function as dynamic stabilizers, preventing dislocation and ensuring smooth joint motion. Dysfunction or injury to these muscles leads to conditions like rotator cuff tears, impingement syndrome, and reduced range of motion. **Discussion:** The coordinated action of shoulder muscles ensures both mobility and stability, which is a unique feature of the shoulder joint. Any disturbance in these factors can result in pain, stiffness, and functional impairment of the shoulder joint. **Conclusion:** The rotator cuff muscles are vital for the functional integrity of the shoulder joint. A thorough understanding of their anatomy and biomechanics is crucial for effective clinical evaluation and management of shoulder pathologies.

KEYWORDS: Rotator Cuff, Shoulder Joint, Biomechanics, *Mamsa Dhatu*, *Vata Dosha*, Musculoskeletal System.

INTRODUCTION

The shoulder region is one of the most structurally complex and functionally important parts of the human body. It is specially designed to provide maximum mobility to the upper limb, allowing a person to perform a wide variety of movements required in daily life, such as lifting, pushing, pulling, throwing, and rotating the arm.[1] Unlike other joints that depend mainly on bony architecture for stability, the shoulder achieves its remarkable range of motion through a coordinated interaction of bones, joints, ligaments, capsules, and muscles.[2] Therefore, proper understanding of the muscles of the shoulder region is essential for explaining both normal function and pathological conditions.

From the Ayurvedic point of view, the structure and function of shoulder region muscles can be interpreted through the concepts of *Mamsa Dhatu*, *Snayu*, and *Vata Dosha*. *Mamsa Dhatu* provides form, covering, strength, and support to the body, while *Snayu* helps in binding and stabilization of joints and musculoskeletal structures.[3] Movement in the body is mainly governed

by *Vata Dosha*, especially its role in neuromuscular coordination and functional activity. When *Mamsa Dhatu* remains healthy and *Vata Dosha* stays in a balanced state, normal movement and stability of the shoulder are maintained. On the other hand, derangement of *Vata* and weakness or depletion of *Mamsa* may lead to pain, stiffness, restricted movement, wasting, and functional disability in the shoulder region.[4] Therefore, a combined anatomical and biomechanical review of shoulder region muscles with special reference to the rotator cuff becomes important not only from the modern musculoskeletal perspective but also from the Ayurvedic understanding of structural support and movement. This integrated view may help in better academic understanding as well as in the clinical interpretation of shoulder disorders.

AIM AND OBJECTIVES

AIM

To study the anatomical structure and biomechanical functions of shoulder region muscles with special reference to the rotator cuff.

OBJECTIVES

- To describe the anatomy of shoulder region muscles.
- To analyze the components of rotator cuff muscles.
- To evaluate the biomechanical role of rotator cuff in shoulder movements.
- To understand the stabilizing function of rotator cuff muscles.

MATERIAL AND METHODS

This study was carried out as a conceptual and literature-based review. Relevant information related to the anatomy and biomechanics of shoulder region muscles, especially the rotator cuff, was collected from standard anatomy textbooks, physiology books, orthopaedic literature, research articles, and indexed journals. Along with this, Ayurvedic literature was also reviewed to understand the concepts related to muscular structure and movement, mainly through *Mamsa Dhatu* and *Vata Dosha*. The collected material was compiled, analyzed, and presented in a descriptive manner to explain the anatomical features, biomechanical functions, and clinical importance of the shoulder region muscles with special reference to the rotator cuff.

CONCEPTUAL STUDY

The shoulder region is a highly mobile and complex region of the body. It connects the trunk with the upper limb and helps in wide movements of the arm.

ANATOMICAL FRAMEWORK

The shoulder region is formed by the clavicle, scapula, humerus, joints, ligaments, capsule, bursae, tendons, nerves, blood vessels, and muscles.

SHOULDER JOINT COMPLEX

The shoulder complex includes the sternoclavicular joint, acromioclavicular joint, glenohumeral joint, and scapulothoracic articulation. These joints work together for smooth upper limb movement.

MUSCLES OF SHOULDER REGION

The main muscles include Deltoid, Trapezius, Latissimus Dorsi, Serratus Anterior, Pectoralis Major, Pectoralis Minor, Rhomboids, Levator Scapulae, Teres Major, and rotator cuff muscles.

ROTATOR CUFF MUSCLES

The rotator cuff is formed by Supraspinatus, Infraspinatus, Teres Minor, and Subscapularis. Their tendons blend with the capsule and stabilize the head of the humerus.

CAPSULAR RELATION

The rotator cuff strengthens the capsule from superior, anterior, and posterior sides. The inferior capsule is comparatively weak, making the shoulder prone to dislocation.

NEUROVASCULAR SUPPLY

Supraspinatus and Infraspinatus are supplied by the suprascapular nerve, Teres Minor and Deltoid by the axillary nerve, and Subscapularis by upper and lower subscapular nerves.

BIOMECHANICAL ASPECT

The shoulder allows flexion, extension, abduction, adduction, medial rotation, lateral rotation, and circumduction. Its wide mobility depends mainly on muscular control.

The rotator cuff acts as the main dynamic stabilizer. It keeps the humeral head centered in the glenoid cavity during shoulder movements.

During abduction, Deltoid pulls the humerus upward, while the rotator cuff stabilizes and depresses the humeral head. This prevents impingement and allows smooth movement.

SCAPULOHUMERAL RHYTHM

During arm elevation, movement occurs at both glenohumeral joint and scapula. Normally, 2 degrees occur at the glenohumeral joint and 1 degree through scapular rotation.

CLINICAL IMPORTANCE

Proper knowledge of shoulder anatomy and biomechanics helps in understanding rotator cuff injury, impingement, instability, dislocation, pain, restricted movement, and rehabilitation planning.

BIOMECHANICAL ASPECT OF SHOULDER REGION

The shoulder region is the most mobile part of the upper limb. It allows movements in different directions such as flexion, extension, abduction, adduction, medial rotation, lateral rotation, and circumduction.

MOBILITY AND STABILITY

The shoulder joint has a shallow glenoid cavity and a large humeral head. Due to this, it provides wide mobility but less bony stability. Therefore, muscles, capsule, ligaments, and labrum are important for maintaining stability.

ROLE OF ROTATOR CUFF

The rotator cuff muscles, namely Supraspinatus, Infraspinatus, Teres Minor, and Subscapularis, act as dynamic stabilizers of the shoulder joint. They keep the head of the humerus centered in the glenoid cavity during movement.

FUNCTION OF SUPRASPINATUS

Supraspinatus helps in initiating abduction of the arm, especially the first 15 degrees. It also stabilizes the superior part of the shoulder joint and prevents downward displacement of the humeral head.

FUNCTION OF INFRASPINATUS AND TERES MINOR

Infraspinatus and Teres Minor mainly perform lateral rotation of the arm. They also support the posterior aspect of the shoulder joint and help in controlling rotational movements.

FUNCTION OF SUBSCAPULARIS

Subscapularis is the main medial rotator of the shoulder. It provides anterior stability and prevents forward displacement of the humeral head.

FORCE COUPLE MECHANISM

During abduction, Deltoid pulls the humerus upward, while the rotator cuff compresses and slightly depresses the humeral head. This balanced action prevents impingement and allows smooth shoulder movement.

ROLE OF SCAPULAR STABILIZERS

Trapezius, Serratus Anterior, Rhomboids, and Levator Scapulae maintain proper scapular position. Proper scapular movement is necessary for smooth and pain-free shoulder motion.

FLOW CHART

Shoulder Region
↓
Shoulder Muscles
↓
Rotator Cuff Muscles
↓
Supraspinatus + Infraspinatus + Teres Minor + Subscapularis
↓
Structural Support + Dynamic Stability
↓
Smooth and Controlled Shoulder Movement
↓
Normal Shoulder Function
↓
Any Disturbance
↓
Pain + Weakness + Restricted Movement

RESULT AND FINDINGS

- The shoulder region was found to be a highly complex anatomical and functional unit, designed to provide maximum mobility along with essential stability.
- The main structural components of the shoulder region included clavicle, scapula, humerus, and associated joints, which together formed the shoulder complex.
- The muscles of the shoulder region were observed to play a major role in maintaining both movement and stability of the upper limb.
- Common consequences of rotator cuff dysfunction included pain, impingement, instability, weakness, and restriction of shoulder movements.
- From an integrated viewpoint, the anatomical and biomechanical study of shoulder muscles showed that structure and function are closely interrelated.
- From the Ayurvedic perspective, the findings could be correlated with *Mamsa*, *Snayu*, and *Vata*, which are responsible for support, stability, and movement of the shoulder region.
- Overall, the review found that the rotator cuff plays a central role in preserving the normal anatomy, biomechanics, and functional efficiency of the shoulder joint.

DISCUSSION

The present review shows that the shoulder region is a highly specialized anatomical functional unit in which mobility and stability must work together in a very fine balance.[7] and Unlike many other joints of the body, the shoulder does not depend mainly on bony congruity for stability because the glenoid cavity is shallow and the head of the humerus is relatively large. Due to this structural arrangement, the surrounding muscles become the main supporting elements of the joint.[8]

This clearly indicates that normal shoulder function is not possible by muscular power alone, but depends on an organized coordination between different muscle groups.[9] Therefore, any study of the shoulder region remains incomplete unless both anatomical arrangement and biomechanical contribution of these muscles are considered together.[10]

When these factors are disturbed, symptoms such as pain, stiffness, weakness, wasting, and restricted shoulder movement may appear, which closely matches the functional disturbances seen in rotator cuff disorders.[11]

Thus, this review supports the idea that the shoulder should be understood as a dynamic musculoskeletal unit where structure and function are inseparably linked.[12] The discussion also suggests that better understanding of

the anatomical and biomechanical role of shoulder region muscles can improve academic interpretation, clinical examination, rehabilitation planning, and integrated management of shoulder disorders from both modern and Ayurvedic viewpoints.[13]

CONCLUSION

The present review concludes that the shoulder region is a highly complex and functionally important part of the body in which anatomical arrangement and biomechanical coordination work together to maintain normal upper limb movement. Among all shoulder muscles, the rotator cuff holds special importance because it not only supports the glenohumeral joint structurally but also acts as the main dynamic stabilizer during different movements of the arm. The coordinated action of Supraspinatus, Infraspinatus, Teres Minor, and Subscapularis is essential for maintaining joint congruity, smooth motion, and prevention of instability. Any disturbance in these muscles can lead to pain, weakness, restricted movement, and functional impairment. Thus, a proper understanding of the anatomical and biomechanical role of shoulder region muscles with special reference to the rotator cuff is important for academic knowledge, clinical application, and integrated interpretation from both modern and Ayurvedic perspectives.

REFERENCES

1. Standring S, editor. Gray's Anatomy: The Anatomical Basis of Clinical Practice. 42nd ed. London: Elsevier, 2021; 789-812.
2. Moore KL, Dalley AF, Agur AMR. Clinically Oriented Anatomy. 9th ed. Philadelphia: Wolters Kluwer, 2023; 658-682.
3. Sharma RK, Dash B, editors. Charaka Samhita of Agnivesha, Sutra Sthana, Sharira Vichaya Adhyaya, Chapter 6, Verse 4. 1st ed. Varanasi: Chowkhamba Sanskrit Series Office, 2014; 144-146.
4. Shastri AD, editor. Sushruta Samhita of Sushruta, Sharira Sthana, Garbhavyakarana Sharira Adhyaya, Chapter 4, Verse 29. Reprint ed. Varanasi: Chaukhambha Sanskrit Sansthan, 2018; 45-47.
5. Snell RS. Clinical Anatomy by Regions. 10th ed. Philadelphia: Wolters Kluwer, 2019; 380-405.
6. Neumann DA. Kinesiology of the Musculoskeletal System: Foundations for Rehabilitation. 3rd ed. St. Louis: Elsevier, 2017; 121-172.
7. Rockwood CA, Matsen FA, Wirth MA, Lippitt SB, Fehringer EV, Sperling JW. The Shoulder. 5th ed. Philadelphia: Elsevier, 2017; 45-92.
8. Halder AM, Itoi E, An KN. Anatomy and biomechanics of the shoulder. Orthop Clin North Am., 2000; 31(2): 159-176.
9. Lugo R, Kung P, Ma CB. Shoulder biomechanics. Eur J Radiol, 2008; 68(1): 16-24.
10. Inman VT, Saunders JB, Abbott LC. Observations on the function of the shoulder joint. J Bone Joint Surg Am., 1944; 26(1): 1-30.
11. Morag Y, Jacobson JA, Miller B, De Maeseneer M, Girish G, Jamadar D. MR imaging of rotator cuff injury: what the clinician needs to know. Radiographics, 2006; 26(4): 1045-1065.
12. Burkhart SS, Esch JC, Jolson RS. The rotator crescent and rotator cable: an anatomic description of the shoulder's suspension bridge. Arthroscopy, 1993; 9(6): 611-616.
13. Kapandji IA. The Physiology of the Joints. Vol. 1, Upper Limb. 6th ed. Edinburgh: Churchill Livingstone, 2007; 2-76.