

Original Research Article

Comparison of shoulder and scapular parameters like mobility and endurance in bodybuilders and normal gym going people

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ABSTRACT

Background: Resistance training, including bodybuilding and regular gym workouts, has surged in popularity. However, bodybuilding is focused on muscle hypertrophy and aesthetics while regular gym workouts emphasize general fitness and strength. This may induce muscle imbalances affecting shoulder and scapular function in the bodybuilders. This study compared shoulder and scapular mobility and endurance between bodybuilders and regular gym-goers.

Methods: Participants were 62 healthy individuals aged 20-35 years (31 bodybuilders with ≥ 3 years of hypertrophy-focused training; 31 gym-goers with ≥ 1 year of general strength training; matched for age, BMI, and training frequency). Assessments included: Apley's back scratch test (shoulder flexibility via reach distance), modified scapular slide test (scapular dyskinesia at rest and loaded positions), posterior shoulder endurance test (time to fatigue in prone horizontal abduction), and scapular muscle endurance test (time to failure in prone Y-raise). Data were analyzed using Minitab software, employing the Mann-Whitney U test and an unpaired t-test. A p value of < 0.001 was considered statistically significant.

Results: Bodybuilders showed significantly reduced shoulder mobility (Apley's test), scapular mobility (modified slide test), shoulder endurance (posterior test), and scapular endurance compared to gym-goers ($p < 0.05$).

Conclusions: Bodybuilding adaptations likely cause muscle imbalances, impairing functional mobility and endurance. Bodybuilders should incorporate targeted mobility and endurance training.

Keywords: Bodybuilders, Endurance, Mobility, Scapular dyskinesia

INTRODUCTION

Exercise plays a crucial role in maintaining overall health and well-being. It not only enhances physical fitness but also has significant mental health benefits. Engaging in regular exercise can reduce stress, improve mood, boost self-confidence, and promote better sleep. Physical activity stimulates the release of endorphins, often referred to as "feel-good" hormones, which help alleviate anxiety and depression. Additionally, exercise strengthens the immune system, improves cardiovascular health, and helps maintain a healthy weight.¹

In recent years, there has been a noticeable shift in the younger generation's approach to health and fitness. With increased awareness about the importance of an active lifestyle, more people are adopting structured workout routines, including gym training. Social media, fitness influencers, and scientific research have contributed to this growing interest. Many individuals, especially young adults, prioritize exercise to achieve not just good health but also an aesthetically pleasing physique.¹

Among various forms of fitness training, bodybuilding stands out as a specialized discipline. Unlike powerlifting,

which is centered around lifting maximum weights to demonstrate strength, bodybuilding focuses on the physical appearance of muscles. Bodybuilders engage in intense resistance training to achieve muscle hypertrophy, a condition where muscle fibres grow larger due to progressive overload. The primary goal of bodybuilding is to sculpt the body, enhance muscle definition, and achieve symmetry rather than purely focusing on strength gains.²

Scientifically, bodybuilding leads to significant changes at the muscle ultrastructure level. Studies indicate that bodybuilders exhibit extreme hypertrophy compared to individuals who do not engage in heavy resistance training. This is due to repeated muscle fibre damage and subsequent repair processes, leading to increased muscle size and density. Consistent strength training, combined with proper nutrition and recovery, results in a highly developed musculature that sets bodybuilders apart from the average population.²

Overall, exercise, particularly bodybuilding, has both aesthetic and health benefits. Whether for improving mental well-being, increasing strength, or enhancing physical appearance, regular training plays a fundamental role in achieving a healthy and balanced lifestyle.

Need for the study

Previous research suggests that bodybuilders may develop certain physical changes due to their intense training routines. These changes include tighter muscles in the front of the body (like the chest and shoulders) and weaker muscles in the back (like the upper back and shoulder blades). This imbalance can reduce flexibility and make movements less efficient, especially in the shoulders and upper back, increasing the risk of injuries and fatigue.³ Since more people are getting into bodybuilding and fitness, understanding these changes is important. It can help trainers and athletes create better workout plans that prevent injuries and improve overall performance.

Objectives

This study pursued the following objectives: to evaluate shoulder mobility in bodybuilders and regular gym-goers using Apley's back scratch test; to assess shoulder endurance via the posterior shoulder endurance test; to measure scapular mobility through the modified scapular slide test; to determine scapular endurance with the scapular muscle endurance test; and to compare and analyse these parameters between the two groups.

Hypothesis

H₀: There will be no significant difference in shoulder and scapular parameters (mobility and endurance) in bodybuilders and normal gym going people.

H₁: There will be significant difference in shoulder and scapular parameters (mobility and endurance) in bodybuilders and normal gym going people.

METHODS

Study design and participants

Operational definition of bodybuilding

Use of progressive resistance exercises in the gym and diet to control and develop one's muscle by muscle hypertrophy for aesthetic purpose mostly for competitive exhibition.

This study followed an observational design and was conducted in local gyms in Pune, India. A total of 62 participants (31 bodybuilders and 31 regular gym-goers) were recruited based on specific inclusion and exclusion criteria.

The study was conducted from September 2023 to March 2023 over the course of 6 months.

The inclusion criteria for the study comprised male and female bodybuilders aged 20-35 years who had been engaged in consistent bodybuilding training for a duration exceeding two years, as well as male and female regular gym-goers within the same age range who had been attending the gym for less than six months and did not follow a structured bodybuilding training regimen. Participants were excluded from the study if they had a history of recent physical injury or surgery, or if they presented with any pre-existing musculoskeletal disorders affecting the shoulder complex, to ensure that the findings reflected training-related adaptations rather than pathological conditions.

Procedure

Ethical approval for the study was obtained from the institutional ethics committee, and informed consent was secured from all participants prior to data collection. Demographic information, including age, training history, and exercise routines, was recorded for each participant. Shoulder mobility and endurance were evaluated using standardized assessment tools. Shoulder flexibility and range of motion were assessed using the Apley's back scratch test, which evaluates upper arm external rotation and abduction as well as lower arm internal rotation and adduction by measuring the distance between the fingertips when the hands are placed behind the back, with smaller distances indicating better flexibility. Scapular mobility was assessed using the modified scapular slide test, in which the distance between the inferior angle of the scapula and the nearest spinous process was measured in three arm positions (0°, 45°, and 90° of abduction), with side-to-side differences greater than 1.5 cm indicating potential scapular dyskinesis or muscular imbalance. Posterior shoulder endurance was

evaluated using the posterior shoulder endurance test, where participants lay prone with the arm elevated to 90° of abduction and held the position, with or without a 0.5 kg weight, for as long as possible until fatigue caused the arm to drop. Scapular muscle endurance was further assessed using the scapular muscle endurance test, in which participants maintained a prone “Y” position with scapular retraction and depression while holding a 0.5 kg weight, and the duration was recorded until fatigue or compensatory movements occurred. These assessments

provided a comprehensive evaluation of shoulder flexibility, scapular mobility, and muscular endurance.

Statistical analysis

Data were analysed using Minitab software, employing the Mann-Whitney U test and an unpaired t-test. A p value of <0.001 was considered statistically significant (Table 1).

Table 1: Statistical analysis.

Tests of normality							
	Group	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Right Shoulder flexibility (cm)	Normal gym goers	0.301	31	0.000	0.797	31	0.000
	Bodybuilders	0.109	31	0.200*	0.922	31	0.027
Left Shoulder flexibility (cm)	Normal gym goers	0.199	31	0.003	0.943	31	0.099
	Bodybuilders	0.150	31	0.072	0.942	31	0.096
Right Shoulder endurance (sec)	Normal gym goers	0.167	31	0.028	0.910	31	0.013
	Bodybuilders	0.130	31	0.199	0.955	31	0.218
Left Shoulder endurance (sec)	Normal gym goers	0.180	31	0.012	0.903	31	0.009
	Bodybuilders	0.156	31	0.053	0.922	31	0.027
Scapular mobility at 0° (cm)	Normal gym goers	0.464	31	0.000	0.252	31	0.000
	Bodybuilders	0.522	31	0.000	0.343	31	0.000
Scapular mobility at 45° (cm)	Normal gym goers	0.406	31	0.000	0.389	31	0.000
	Bodybuilders	0.343	31	0.000	0.669	31	0.000
Scapular mobility at 90° (cm)	Normal gym goers	0.359	31	0.000	0.557	31	0.000
	Bodybuilders	0.198	31	0.003	0.848	31	0.000
Right Scapular endurance (sec)	Normal gym goers	0.224	31	0.000	0.872	31	0.002
	Bodybuilders	0.093	31	0.200*	0.959	31	0.269
Left Scapular endurance (sec)	Normal gym goers	0.093	31	0.200*	0.956	31	0.229
	Bodybuilders	0.154	31	0.059	0.836	31	0.000

*This is a lower bound of the true significance. ^aLilliefors Significance Correction.

RESULTS

Statistical analysis revealed a significant reduction in shoulder mobility among bodybuilders compared to regular gym-goers, particularly in internal rotation (Figure 1). This limitation is likely due to the hypertrophic development of the anterior deltoid and pectoral muscles, leading to tightness and restricted movement.⁵

Shoulder and scapular endurance deficits were observed in bodybuilders, with lower scores recorded in both the posterior shoulder endurance test and scapular endurance test (Figure 2 and 3). The reduced endurance may be attributed to the hypertrophy-focused training style, which prioritizes maximal muscle growth over sustained muscular endurance.⁶

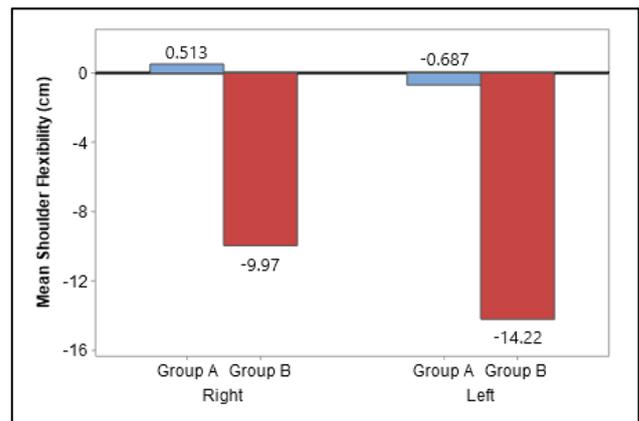


Figure 1: Shoulder mobility.
Group A- Normal gym-goers; Group B- Bodybuilders.

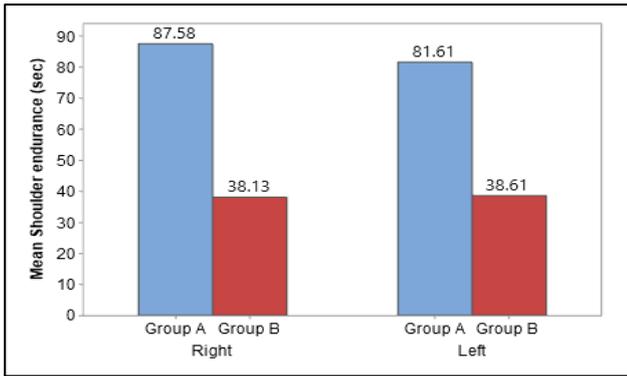


Figure 2: Shoulder endurance.

Group A- Normal gym-goers; Group B- Bodybuilders.

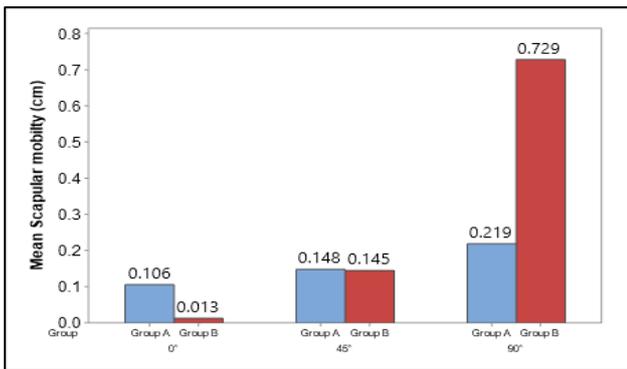


Figure 3: Scapular mobility.

Group A- Normal gym-goers; Group B- Bodybuilders.

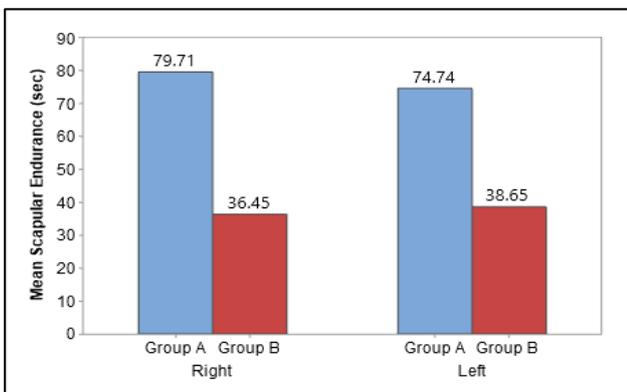
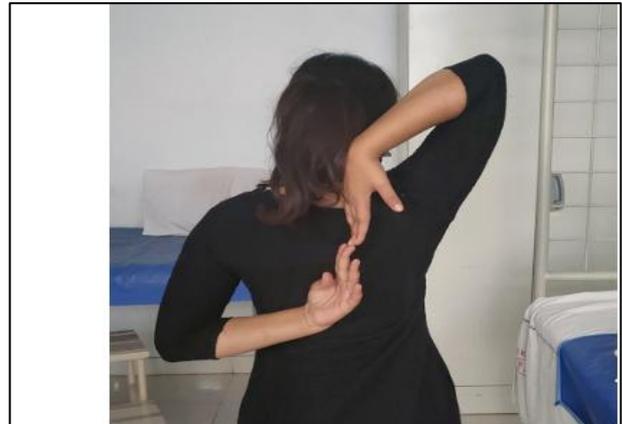


Figure 4: Scapular endurance.

Group A- Normal gym-goers; Group B- Bodybuilders.

The findings highlight distinct biomechanical differences between bodybuilders and regular gym-goers, characterized by decreased shoulder range of motion-primarily affecting internal rotation- scapular dyskinesia (Figure 4), and lower shoulder and scapular endurance. These adaptations arise from bodybuilding's emphasis on high-intensity, short-duration resistance training with heavy loads, which prioritizes hypertrophy over endurance and often neglects scapular stabilizer training, leading to dyskinesia through imbalanced rotator cuff and periscapular muscle development. Such results align with

previous studies indicating that bodybuilding-specific changes can contribute to restricted mobility and muscular imbalances.⁴



Apley's back scratch test in normal gym going



Apley's back scratch test in Bodybuilder

Figure 5: Apley's back stretch test in normal gym goers versus bodybuilders.



Figure 6: Posterior shoulder endurance test.



Figure 7: Scapular endurance test.

DISCUSSION

The findings of the study indicate that long-term participation in bodybuilding leads to distinct structural and functional adaptations that may negatively influence shoulder joint mobility and muscular endurance. One of the primary contributing factors is muscle hypertrophy accompanied by joint tightness, which commonly develops due to the repetitive loading and shortening of anterior muscle groups such as the pectoralis major and anterior deltoid. This selective hypertrophy can restrict normal shoulder range of motion and reduce flexibility, particularly in overhead and rotational movements.⁷ Furthermore, bodybuilding training often creates imbalances between agonist and antagonist muscle groups, as greater emphasis is placed on aesthetic-driven anterior muscles while posterior stabilizing muscles—including the rotator cuff, trapezius, rhomboids, and serratus anterior—are relatively undertrained.⁸ Such imbalances can alter scapulohumeral rhythm and compromise shoulder joint stability. In addition, the typical bodybuilding focus on low-repetition, high-intensity resistance training prioritizes strength and muscle size over endurance, which may gradually diminish the endurance capacity of the shoulder stabilizers responsible for maintaining prolonged postural and dynamic control. Over time, the combination of reduced mobility, muscular imbalance, and decreased endurance may increase susceptibility to overuse injuries such as shoulder impingement syndrome, rotator cuff tendinopathy, and scapular dyskinesis.⁹ To reduce injury risk and enhance long-term shoulder health, it is recommended that bodybuilding programs incorporate regular mobility drills, including dynamic stretching and

rotational exercises, to maintain joint flexibility.¹⁰ Strength training routines should be balanced by emphasizing posterior chain musculature to restore muscular symmetry and improve joint mechanics. Additionally, integrating endurance-based exercises using lower resistance and higher repetitions for the shoulder stabilizers may enhance fatigue resistance, promote functional stability, and support injury prevention.¹¹

The study's cross-sectional design only included a specific portion of the population, which may limit the generalizability of the study findings to a broader population.

Male and female participants were not analysed separately, which may overlook sex-based biomechanical and physiological differences in shoulder and scapular function

CONCLUSION

The findings indicate that bodybuilders have significantly lower shoulder and scapular mobility and endurance compared to regular gym-goers. These differences are attributed to the hypertrophy-oriented nature of bodybuilding training, which may neglect joint mobility and endurance. Incorporating targeted mobility and endurance exercises can mitigate these deficits and reduce the risk of musculoskeletal injuries.

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Conflict of interest: None declared

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