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Analyzing the impact of a crippling endurance workout on younger bodybuilders' shoulder muscle strength

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ABSTRACT:

Introduction: Bodybuilders often experience shoulder muscular soreness after exercising. Fatigue may adversely harm an athlete's shoulder joints and reduce performance quality. In this research, teenage bodybuilders were tested to see how exhaustion affected their ability to exert force with their abductor, retractor, flexor, depressor, elevator, and extensor muscles after a period of crippling fatigue.

Methods: 25 active bodybuilders (age: 26.122.78 years, height: 1.820.035 m, weight: 78.924.23 kg, BMI: 23.711.40 kg / m2, and sports history: 2.960.97 years) were chosen for this quasi-experimental research using a pre-test and post-test design. Using a portable tensile-compression tachometer, the force of the shoulder's flexor, extensor, elevator, depressor, retractor, and abductor muscles was measured before and after the exhaustion. The paired samples t-test was performed to compare the fatigue regimen in order to examine the statistical component.

Results: The study's findings revealed that a recurrence of crippling tiredness decreased the force of the shoulder muscles' flexor (P=0.001), extensor (P=0.001), an elevator (P=0.001), depressor (P=0.001), retractor (P=0.001), and abductor (P=0.001) fibers.

Conclusions: In general, the findings of the present study demonstrated the impact of fatigue on the reduction of the flexor, extensor, elevator, depressor, retractor, and abductor muscles of the shoulder. This force decrease can be a factor in lowering performance quality in conditions of fatigue and possibly raising the risk of injury in athletes.

Keywords: Shoulders, Bodybuilding, Fatigue.

INTRODUCTION:

Nowadays, sports are practiced by a large number of individuals worldwide. Bodybuilding is a modern sport that has drawn the interest of several young people and sportsmen (1). Bodybuilding is a sport that aims to increase muscular mass, symmetry, and body exposure. It is akin to weightlifting, strongest man events, and Olympic weightlifting (2). The shoulder, lumbar region, elbow, spine, and knee are where bodybuilders are most likely to get injuries (3). The majority of injuries sustained during resistance training—46.1%—are muscular sprains and strains. The majority of bodybuilders lament about soreness and lack of training pauses (4). Bodybuilders are attempting to attain an ideal muscular physique. For certain players, the sport may turn into a never-ending battle to have the ideal physique. Exercise with weight often results in serious injuries such as vascularization, stress, muscle bursts, and septic shock (5). Stress fractures of the vertebrae, clavicle, and upper limb as well as rotator cuff tendon inflammation and patellar tendinopathy are frequent serious injuries (5). The process of shoulder injury in exercise, along with a better understanding of shoulder injuries, would undoubtedly help us to think about a suitable healing and treatment process for these injuries. More importantly, however, by comprehending how shoulder damage occurs, more efficient prevention protocols could be created (6). Injuries to the pectoral (chest) muscle, rotator cuff muscle rupture, supraspinatus muscular tendinitis, scapula, biceps, and triceps occur in the shoulder area as a result of inappropriate and repeated motions. Because the distal sides of the articular surface and the glenoid components do not align, the glenohumeral joint is regarded as the most movable and least robust joint (7). The existence of the joint capsule, glomerular joint ligaments, and the fibrous-cartilaginous labrum all contribute to the shoulder joint's increased stability. In addition to static stabilizers, the muscles surrounding the shoulder girdle also help the joint's stability by ensuring its dynamic stability (8). The neuromuscular coordination between the scapular muscles and the rotator cuff muscles is what gives the shoulder joint its dynamic stability. The neuromuscular control between the scapular muscles and the rotator cuff contributes to the dynamic stability of the shoulder joint. Rotator cuff muscles cause the arm to be compressed in the glenoid cavity and to shrink non-symmetrically, which causes the arm to rotate during shoulder movement. Scapular muscles reduce instability in the shoulder joint with appropriate alignment (6).

In spite of the operation being completed, fatigue is characterized as an unidentified phenomenon that reduces the capability of power production. The interruption of events from the central nervous system to the muscle fibers is also linked to fatigue (9, 10). Exercise both during and after a workout involves wearing yourself out (9). Exercise often results in muscle tiredness from exhausting activities, which reduces people's ability to move with accuracy and speed (9). It is unavoidable that muscle tiredness is a significant risk factor in the incidence of sports injuries, thus recognizing its significance in injury prevention is essential. On the other hand, a significant portion of the shoulder joint's strength comes from the muscles that surround it, and the importance of the muscles in this joint's dynamic strength cannot be overstated. The stability of joints may be significantly impacted by muscular fatigue. For instance, rotator cuff fatigue may impair the glenohumeral joint's ability to move in rhythm. When the desired exercise involves repetitive movements of the upper limb with the exercise of high force, consideration of the endurance and strength of the shoulder girdle muscles as well as, more importantly, coordination and balance between the different muscle groups involved becomes more crucial.

There is a flaw in the studies that look at how overusing the arm contributes to shoulder discomfort, even if there is evidence to support the link between excessive arm usage and the development of shoulder pain. Changes in the scapula and arm's kinematics as a result of the shoulder girdle muscles' exhaustion are one of the biomechanical processes that might explain this connection. According to studies, when shoulder muscles weaken, the joint's mechanics alter, which may cause pathologies such as tendon inflammation, impingement, and even dislocations or partial dislocations. Additionally, the scapula and arm movement are directly impacted by shoulder muscle exhaustion. As a result, the muscles around the shoulder play a significant role in its kinematics. A change in the arm's and shoulder's typical kinematics might result from fatigue in either of these muscles depressor, Therefore, the purpose of this research was to examine how young bodybuilders' retractor, retractor, flexor, elevator, extensor, and abductor shoulder muscles responded to intense exhaustion.

METHODS: The current research was a quasi-experimental investigation without a control group that used a pre-test and post-test strategy. Using G*Power software, a statistical sample of 25 professional bodybuilders from Lahore, aged 18 to 30, was chosen (Quantitative power 0.8, Prob value 0.05, effect size 0.24). The inclusion requirements included having competed in at least two provincial tournaments in the last five years, being between the ages of 18 and 30, and not having any shoulder-related orthopedic injuries. Utilizing prohibited supplements, on the day of the test, as well as any discomfort or injury in the neck, shoulder, upper breast region, back, or arm, were exclusion factors. One experimental group was used in the current investigation (25 individuals). Compact compression and tension equipment was used to measure the force before the exercise began and again after the exhaustion regimen was finished. All health advice was followed because of the Covid-19 Pandemic during the trial.

The subjects were warmed up under the observer's control after marking morphological points that identify the locations of the tension and compression machines (such as the midpoint of the inner edge of the scapula, the acromion appendage, the elbow appendage, and the pisiform wrist bone) and after explaining how to conduct the test. After implementing the fatigue procedure, the subject was placed on the bed to measure the force applied. The researcher used transportable tension and compression equipment to measure the forces. In this method, the subject was requested to execute each action once in a sub-maximum condition before recording the force amount in each motion. The power of each motion was then assessed by repeating it twice, no more than twice, for a total of four seconds, with a two-second break in between. In the data registration procedure, the first repetition (training repeat) was eliminated. The motions of protraction, elevation, flexion, depression, extension, and flexion in both shoulders were chosen to measure the force.

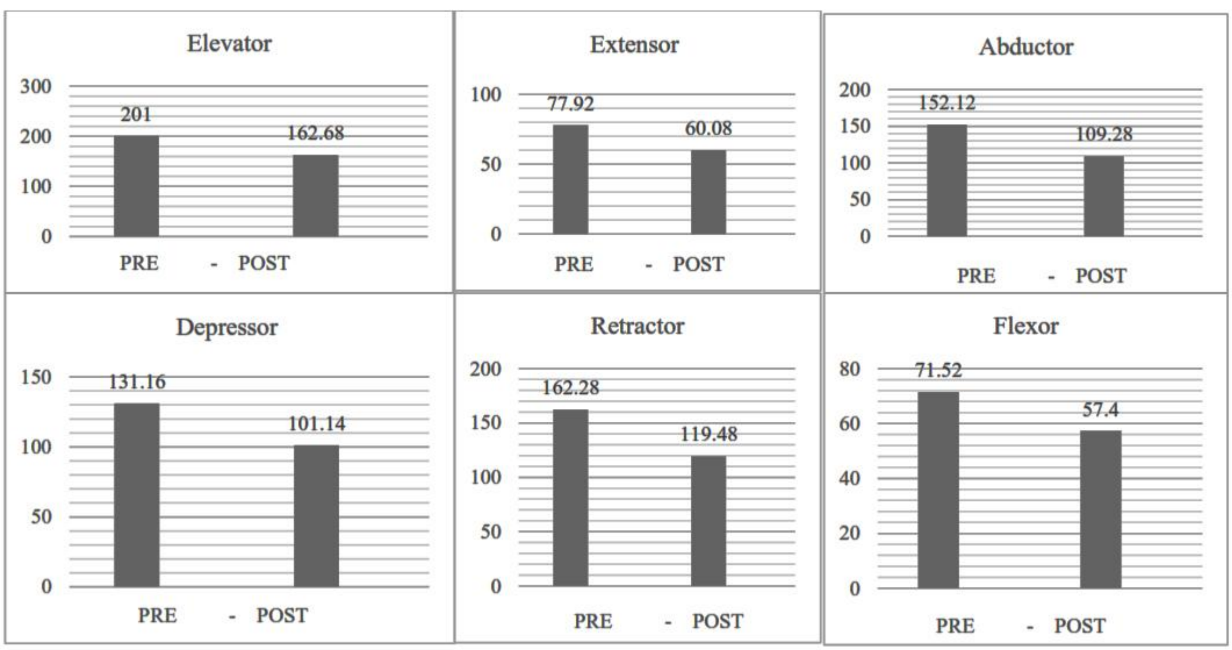

Figure 1. Pre- Post test results of force in the experimental group

Abduction, extension, Elevation, flexion, protraction, and depression were the hand movements used to measure the force. The force calculation was in the following state:

To measure the workout force for flexion, extension, and abduction, the connected belt was put on top of the elbow's Olecranon process. The push pad was positioned directly at the inner side of the acromion process during the elevation action. The researcher used the examiner to hold the fingers closed while dragging the loop linked to the machine during the depression and retraction activities. With the help of this tool, catching the device loop will be easier and less strenuous on the fingers and wrist flexor muscles (11). The researcher sterilized each gadget after usage since the investigation was carried out during the Covid-19 pandemic.

Table 1: The results of paired t-test

	Pre-test		Post-test					
Variable	**Mean**	**SD**	**Mean**	**SD**	**Change (%)**	**D.F**	**t-test**	**p-value**
Abductor	152.12	26.14	109.28	13.5	- 26.53 ±	24	10.1	0.001
Retractor	162.28	18.07	119.48	22.28	- 26.87 ±	24	13.42	0.001
Depressor	131.16	12.25	101.14	10.04	- 22.35±	24	10.74	0.001
Elevator	201	20.2	162.68	20.73	- 18.53 ±	24	7.65	0.001
Extensor	77.92	10.31	60.08	12.65	- 23.17 ±	24	10.44	0.001
Flexor	71.52	11.4	57.4	8.85	- 19.05± 0.09	24	8.16	0.001

The paired sample t-test was utilized in the current investigation, as shown in Table 1 and Figure 1 since the data distribution was normal.

Table 2: Individuals demographics data

Variables	**Age**	**Height**	**Weight**	**BMI**	**Sport History (years)**
Mean	26.12	1.82	78.92	23.71	2.96
SD	-2.78	-0.03	-4.23	-1.4	-0.97

Weights used in the fatigue regimen included a horizontal bar, shoulder press, front- and back-shoulder barbell lifts, and Lat pulldown exercises. Each person's maximum strength for each exercise (Lat Pulldown, Shoulder Press, Barbell Shoulder from Front and Back) was determined for all items, and the maximum strength of 60% was then repeated six times. The participant had to do the strenuous activity of the bar's ultimate workout (pull-ups). Every action was separated by a 30-second interval (12).

Figure 2 depicts the progression of weight training to develop the exhaustion regimen.

In this research, demographic information on the subjects was reported using descriptive statistics. The normality of the variables was assessed using the Shapiro-Wilk normality test. The Paired T-test and the percentage of variations were determined for comparisons among participants, and the Paired Sample T-test was used as well. This research made use of SPSS software. 0.01 was a significant level.

RESULTS: Table 2 presents the findings for the descriptive data. The fatigue protocol had a significant effect on the magnitude of coercion in people as well as reduced the amounts of force in shoulder flexion (p-value$\leq$ 0.01), abduction (p-value$\leq$ 0.01), retraction (p-value$\leq$ 0.01), depression (p-value$\leq$ 0.01), elevation (p-value$\leq$ 0.01), and extension (p-value$\leq$ 0.01), according to the results of a Paired T-test in all factors for force evaluation. Therefore, the shoulder muscles' force after the treatment was greatly impacted by the fatigue regimen that was used in the current investigation. We can observe the post-intervention changes by looking at the averages in the preceding chart.

DISCUSSIONS: The goal of this research was to ascertain how young bodybuilders' shoulders would react to exhaustion after a one-moment period of intense training. Before and after the strenuous exhaustion exercise, the strength of the flexor, extensor, elevator, depressor, retractor, and abductor shoulder muscles was assessed. According to the findings, muscular force in the shoulder's elevator (P=0.001), depressor (P=0.001), retractor (P=0.001), abductor (P=0.001), flexor (P=0.001), and extensor (P=0.001), was significantly reduced as a consequence of tiredness.

The results of the current research suggested that muscular force reduction in bodybuilding athletes may be related to weariness. These findings corroborated those of a previous study, which noted that fatigue reduced the strength of the shoulder muscles in handball players (13), they noted that fatigue decreased muscle strength and increased muscle frequency to make up for the fatigue-induced weakness

One of the most well-liked and effective sports that involve repetitive motions of the upper limb at various angles and conditions is bodybuilding exercise. Muscle fatigue and the development of repeated actions result in weakness, a decrease in muscular endurance, and joint injury (14). In the various tissues of this organ, particularly during the competition, this results in micro damage that eventually creates macro trauma (15). The bicep tendon, deltoid muscles, and shoulder-supporting muscles are some of the crucial muscle groups in the kinetic strength of this joint. These muscles are crucial for maintaining the arm bone, maintaining the dynamic strength of the shoulder joints, and enabling the shoulder bone to move smoothly and precisely against the chest (16). On the other hand, the placement and activity of the shoulder bone on the chest are directly tied to the shoulder's ability to move freely and smoothly. In actuality, there is a complex interaction between muscle imbalance, shoulder impingement, and dysfunction or alteration of the shoulder bone's function. It can be deduced, in general, that the shoulder bone's positioning irregularities and its true mobility changes happen after fatigue, which is typically linked to shoulder injuries, impingement, tear, rotator cuff tendon damage, lack of glenohumeral bone joint strength, shoulder sealant capsule, and shoulder joint dryness. The most crucial elements for effective shoulder training are shoulder joint stability and muscular strength, according to various researchers who have examined these elements (17) To avoid joint injury, joint fixation and muscular strength are also crucial (18). Recent research suggests that certain athletes may have an imbalance between the internal and external rotator muscles of the shoulder, which might contribute to the joint's instability. Major stability workouts are recommended in order to lessen this strength imbalance (19). Another intriguing literary discovery is that competition harm increases at the finish rather than at the beginning. As a consequence, agonist muscles may show signs of muscular tiredness brought on by recurrent activity more so than antagonist muscles. The balance of muscle strength may be impacted by a chosen exhaustion program, stabilizing the shoulder joint and resulting in greater injury during late training and competition. Joint deterioration may also be brought on by the involvement of the majority of elastic tissues when muscles are fatigued, which decreases the necessity for muscle activity. Additionally, the weariness itself could impair a person's performance. In order to avoid the loss of muscle strength and consequent lack of muscular joint balance at the conclusion of exercise, rehabilitation programs or damage prevention programs focused on enhancing shoulder muscles' endurance may be helpful.

When numerous muscles contract at once, the voluntary activation of a muscle reduces, which has been mentioned as a way that tiredness influences how the expressed muscle functions. This is probably due to spinal oligosynaptic networks limiting feedback to alpha-spinal motor neurons.

Rarely does pathological or physiological weariness result from loss of neuromuscular function as assessed by the combined potential of muscles. People exert extra effort to continue doing their own activities before they get physically exhausted. Because the central drive is increased with muscle exhaustion to sustain the force, the rise in perceived effort occurs more quickly shortly before failure in the task. As a result, weariness slows down and lengthens the time required to complete repeated actions like walking.

On the other hand, weariness impairs the ability to generate force and govern muscular action, increases the risk of musculoskeletal problems associated with the workplace, and reduces nerve movement to motor units (20). The peripheral (muscle surface) or central nervous system might get fatigued (central fatigue). The central fatigue in neuromuscular connection might manifest as voluntary decreases in motor neurons as a result of neuronal drive failure, signal propagation failure, motor unit partial activation, and unmotivating or pain tolerance. On the other hand, environmental fatigue is a reduction in the body's ability to burn off energy despite optimum motor neuron activation of the muscle fibers (21). Although the neural system is appropriately activated in peripheral fatigue, the muscle fibers are unable to react as fully. Inadequate excitation-contraction coupling, changes in the cross-sectional area of lean muscle, variances in muscle contractile characteristics, and oxidative muscle metabolism all contribute to environmental fatigue. Following the fatigue protocol, decreased maximum muscular contraction is seen as a marker of environmental weariness (22). In general, it can be claimed that tiredness is linked to a reduction in shoulder muscle strength, and this reduction in strength might impair ideal sports performance.

One of the study's shortcomings was the absence of additional variables including a range of motion and shoulder proprioception. It is advised that future research examine the effects of tiredness on bodybuilders' athletes' shoulder proprioception and function. The researchers advise using more precise laboratory equipment to investigate how tiredness affects bodybuilding competitors' deep feelings and shoulder function as well as their continued muscular activity. It is also advised to carry out more research to ascertain how exhaustion affects a certain exercise's performance in other sports like swimming and volleyball.

CONCLUSIONS: The current study's findings showed that muscular exhaustion had a negative impact on the strength of the abductor, retractor, flexor, depressor, elevator, and extensor muscles. This decline in strength may contribute to bodybuilder athletes' decreased performance under situations of exhaustion and increased injury risk.

REFERENCES:

1. Bonilla, D. A., Cardozo, L. A., Vélez-Gutiérrez, J. M., Arévalo-Rodríguez, A., Vargas-Molina, S., Stout, J. R., ... & Petro, J. L. (2022). Exercise selection and common injuries in fitness centers: a systematic integrative review and practical recommendations. *International journal of environmental research and public health*, *19*(19), 12710.
2. Hackett, D. A. (2022). Training, supplementation, and pharmacological practices of competitive male bodybuilders across training phases. *Journal of Strength and Conditioning Research*, *36*(4), 963-970.
3. Li, J., Davies, T. B., & Hackett, D. A. (2022). Self-Reported Training and Supplementation Practices Between Performance-Enhancing Drug-User Bodybuilders Compared with Natural Bodybuilders. *The Journal of Strength & Conditioning Research*, 10-1519.

4. Abdelraouf, O. R., Abdel-Aziem, A. A., Ghally, S. A., Osama, L. A., Dawood, R. S., Yehia, A. M., ... & Radwan, R. E. (2022). Innovative Use of Biodex Balance System to Improve Dynamic Stabilization and Function of Upper Quarter in Recreational Weightlifters: A Randomized Controlled Trial. *Medicina*, *58*(11), 1631.
5. Zahabi, G., García-Ramos, A., & Ilic, V. The effect of Creatine Supplementation During Strength Training on the development of Physical Performance and Hypertrophy in Wrestlers.
6. Pritchard, J., & Cross, M. R. (2022). STRENGTH AND POWER TRAINING. *The Science of Alpine Ski Racing*, 59.
7. Kruszewski, M., & Aksenov, M. O. (2022). Association of Myostatin Gene Polymorphisms with Strength and Muscle Mass in Athletes: A Systematic Review and Meta-Analysis of the MSTN rs1805086 Mutation. *Genes*, *13*(11), 2055.
8. Colville, T. (2022). Strength and power training for runners. *Training*.
9. de Camargo, J. B. B., Brigatto, F. A., Zaroni, R. S., Trindade, T. B., Germano, M. D., Júnior, A. C. T., ... & Lopes, C. R. (2022). Manipulating Resistance Training Variables to Induce Muscle Strength and Hypertrophy: A Brief Narrative Review. *International Journal of Exercise Science*, *15*(4), 910-933.
10. Chinzara, T. T., Buckingham, G., & Harris, D. J. (2022). Transcranial direct current stimulation and sporting performance: A systematic review and meta-analysis of transcranial direct current stimulation effects on physical endurance, muscular strength and visuomotor skills. *European Journal of Neuroscience*, *55*(2), 468-486.
11. Sandow, E. (2022). *Strength and how to obtain it*. DigiCat.
12. Buoncristiani, N. (2022). The Validity of Perceptual Recovery Status on Monitoring Recovery During a High-Intensity Back Squat Session.
13. Iafelice, R. (2023). *Hold On to Your MUSCLE, Be Free of Disease: OPTIMIZE YOUR MUSCLE MASS TO BATTLE AGING AND DISEASE WHILE PROMOTING TOTAL FITNESS AND LASTING WEIGHT LOSS*. Gatekeeper Press.
14. Molloy, C. L. (2022). *EXPLORING THE EMPOWERING AND DISEMPOWERING ASPECTS OF COMPETITIVE FEMALE BODYBUILDING* (Doctoral dissertation, University of Saskatchewan).
15. Nugusa, L. M., Mekonnen, S. P., & Ayelew, A. P. (2022). *EFFECT OF PLYOMETRIC EXERCISE ON POWER AND AGILITY OF U-17 MALE FOOTBALL PROJECT TRANEES IN DUKAM TOWN, OROMIA REGIONAL STATE, ETHIOPIA* (Doctoral dissertation).
16. López, A. O., Valverde, A. G., & Solana, R. S. (2022). Resumen de la evidencia sobre respuestas y adaptaciones derivadas del entrenamiento de CrossFit: Una revisión sistemática. *Retos: nuevas tendencias en educación física, deporte y recreación*, (46), 309-322.
17. Meigh, N. J. (2022). Promoting Healthy Ageing with Kettlebell Training: A Pragmatic Controlled Trial and Qualitative Study.
18. Dorsen, P. J. (2022). *Men Over 60: Don't Quit Now!*. Austin Macauley Publishers.
19. Morrison, J. (2022). *Anti-Doping Policy: The Emperor's New Clothes* (Doctoral dissertation, The Open University).
20. Tucker, R. (2022). *Vagus Nerve: How to Relieve Anxiety, Reduce Chronic Inflammation, and Prevent Illness by Stimulating Vagal Tone to Restore Balance*. Rhys Tucker.
21. Seppänen, N. (2022). Beginners' gym training guide for Kuntokeskus Balance.

22. Michel, J. M. (2022). *The Effects of Graded Protein Intake in Conjunction with Resistance Training on Skeletal Muscle Outcomes in Older Adults* (Doctoral dissertation, Wake Forest University).