PREVALENCE OF BICEPS TENDINITIS AMONG BODY BUILDERS

Khushboo Gulzar *, Syed Ali Abdullah **, Dr Farooq Islam *, Asim Raza *,Huraira Tuqeer **, Alveena Shakoor,

***Department of Rehabilitation Sciences, University of Chenab, Pakistan**

****University Institute of Physical Therapy, University of Lahore, Punjab Pakistan**

Abstract

Background:-Idiosyncratic stress on the flexed elbow as the forearm is supinated is the traditional injury mechanism for a biceps brachi tendon rupture. Before and after an exercise, it is crucial to warm up properly and stretch to keep a fit body and prevent bursitis and tendinitis.

Purpose: - The main purpose of this study is to diagnose biceps tendinitis prevalence in body builders.

Study Design: -Descriptive cross sectional

Method: -A cross-sectional study is done on bodybuilders who use the gym. The four-month trial is completed. Simple random sampling is used to rate 318 bodybuilders. The OY fitness centres, Ginnastic Arena, and Revive gym are used to collect data. Those between the ages of 18 and 64 who are male bodybuilders and have a BMI between 20 and 30 are included. It employs the Yargason test. The PENN shoulder scoring system is also used.

Result: -All injuries in bodybuilding occur while the elbow is in flexion or semi-flexion. According to the study, the subjects' forearms were supinated at their injured sides. This study demonstrates that the majority of participants in the selected demographic had bicep tendinitis due to the incorrect angle and lack of monitoring.The majority of participants in the selected group who experienced serious complications are being treated and provided the appropriate care by a physician for better results.

Conclusion: -Dynamic stimulus to an extended elbow and supinated forearm during bodybuilding was characterised as a novel mechanism for bicep tendinitis from the conventional mechanism of a flexed elbow and supinated forearm.

Key words: - Bicep Tendinitis, Body Building, Training, Bicep

Introduction

Strongman is associated with the sports of gymnastics, bodybuilding, and strength training, in which lifting weights is the primary form of exercise. Bodybuilder athletes trained mostly as weightlifters or power lifters in the late 1970s and early 1980s while using some muscular training techniques.[1] Advanced strongmen are hybrid athletes that mix various forms of conventional resistance training with training using equipment tailored to their chosen activity. Bodybuilder competitions have increased in popularity worldwide since the sport's beginning in 1977, both among spectators and active athletes.[2] There are categories in strongman contests depending on age, body mass, gender, and experience, and they are held at local, regional, national, and worldwide levels.[3] Through the use of weight-bearing activities, food regimens, and some nutritional supplements, gaining bulk of muscle is a strategy to alter body composition and enhance abdominal muscle. In order to reduce body fat without affecting muscle mass, it also entails dieting or eating incredibly little.[4] These regimens, which involve various strategies for gaining and maintaining muscle mass, are adhered to for a number of weeks.[5] It's now recognised as a sport. a sport that is competitive. People are engaged in a fierce rivalry for this.

Anabolic-androgenic steroid (AAS) misuse has become a significant substance addiction issue in the United States and most other Western nations, affecting both competitive athletes and recreational bodybuilders.[6] Prior to 1980, elite athletes were the main users of AAS, but during the last three decades, AAS usage has extended to the general populace. According to a recent research, between 2.9 and 4.0 million American males have used AAS at some point in their life.[7] Of these men, perhaps 1 million have become dependent on AAS, and chronic AAS use frequently continues despite negative medical and mental repercussions. It is advised to do early surgery with anatomic reattachment of the torn tendon to the bicipital tuberosity.[8]In order to achieve early mobility and anatomic restoration with high fixation strength, the optimum repair approach should have a very low complication rate. Apparent discomfort over the bicipital groove and effective physical examination techniques like the Speed test and the Yergeson test are symptoms of biceps tendinitis.[9] The Speed's Test may be carried out as follows: The patient's arm is placed in shoulder flexion, external rotation, complete elbow extension, and forearm supination.[10] The examiner then applies manual resistance in a downward direction. If the test reproduces pain in the bicipital tendon or bicipital groove, it is deemed to be positive.[11]The most frequent reason for injuries is an unanticipated stress placed on the biceps when the elbow is extended. The tendon at the distal insertion point of the tuberosity radius is completely avulsed as a result of this circumstance. The chronic or acute illness form of this ailment impacts elite athletes.[12] The lesion in chronic cases (tendinosis) results from an imbalance between the stimulation of collagen synthesis by physical activity and the wear on the tendon structures (structural catabolism of proteins, tissue, repeated friction against surrounding structures, trauma from sudden and intense tractions) as a result of repeated stress.[13] Additionally, as we become older, the cellular matrix of the tendons changes owing to both qualitative and quantitative changes.[14] A decrease in trophic swaps with hypoxic phenomena is brought on by the hypovascularity

phenomena brought on by a reduction in blood supply in the arteries and arterioles. As people get older, calcium and/or lipid deposits are often seen.[15]

The individual with biceps tendinitis has to know how to carry out their duties while they are in this condition and that taking a break from playing sports or engaging in other everyday activities is crucial. Additionally, medications and medical care can help him recover from biceps tendinitis, so he should pursue it. He should be aware that he must warm up before beginning any exercise and not immediately begin working out muscles or lifting weights. Activities that are excessive and repeated shouldn't be done at work. There should be short intermissions. Bicep Tendinitis among male bodybuilders nowadays, is frequently affects beginner bodybuilders who begin working out without expert guidance as well as strong weight lifters. If this condition is not treated appropriately and promptly, it might lead to more serious outcomes. The prevalence of bicep tendinitis in male bodybuilders will be determined through this investigation.

Material and Methods

A cross-sectional research is conducted on gym-goers who are bodybuilders. The study last for four months. 318 bodybuilders are rated using simple random sampling. Data is gathered from the OY fitness clubs, Ginnastic Arena, and Revive gym. Male bodybuilders with a BMI of 20to 30 and those who are 18 to 64 years old are included. Females, bodybuilders, and those with serious physical or mental health conditions are not permitted to participate in the study. The Yargason test is used. Also employed is the PENN shoulder scoring scale.

Yargason test: The patient should be in the anatomical posture, either seated or standing, with the elbow pronated and the humerus in a neutral position. The patient is instructed to supinate and externally rotate their arm in opposition to the therapist's physical resistance created by wrapping their hand around the distal forearm (just above the wrist joint). If the pain can be replicated in the bicipital groove and a biceps or SLAP lesion is suspected, the Yergason's Test is deemed positive.

For each item, points are determined by deducting the circled number from a maximum of 10. As a result, a patient receives 30 points for being completely pain-free. A patient receives no points for an item if they are unable to use their arm for regular or demanding tasks. Testing twice produced an ICC2, 1 of 0.94 (95% CI, 0.89-0.97) according to reliability analysis. An examination of internal consistency produced a Cronbach alpha of 0.93.

Statistical Analysis

The statistical package for social sciences (SPSS) software version 20 is used to enter and analyse data. For descriptive analysis, frequency and percentages are determined for qualitative variables instead of mean and standard deviation for quantitative data. The proper statistical tests are used for inferential statistics. P-values under 0.05 are regarded as significant values and all findings are generated with a 95% confidence range.

Result

A cross-sectional study is done on bodybuilders who use the gym. The four-month research is completed. Simple random sampling is used to rate 318 bodybuilders. The OY fitness centers, Ginnastic Arena, and Revive gym are used to collect data. Those between the ages of 18 and 64 who are male bodybuilders with a BMI of 20 to 30 are included. Participants who are female, bodybuilders, or have severe physical or mental health concerns are not allowed to take part in the study. It employs the Yargason test. The PENN shoulder scoring system is also used.

Table 1:-

Age of Participants (Years)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-30	288	90.6	90.6	90.6
	30-40	28	8.8	8.8	99.4
	40-64	2	.6	.6	100.0
	Total	318	100.0	100.0	

The percentage of participants in this study is shown in **Table 1**. This table lists a total of **318** participants, **288** of whom are between the ages of **18** and **30**, accounting for **90.6%** of the total. However, just **2** individuals fall between the ages of **40** and **64**, with a proportion of**.6%,** while **28** participants are between the ages of **30** and **40**.

Table 2:-

Body Mass Index (Kg/m^2)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20-22	88	27.7	27.7	27.7
	23-25	223	70.1	70.1	97.8
	26-30	7	2.2	2.2	100.0
	Total	318	100.0	100.0	

Table 2 shows the frequency of Body Mass Index **(BMI)**, showing that **88** participants have a BMI between **20** and **22** with a percentage of **27.7%, 223** participants have a BMI between **23** and **25** with a percentage of **70.1%** and a cumulative **97.8%**, and only **7** participants out of **318** have a BMI between **26** and **30** with a percentage of **2.2%**.

Table 3:-

Dominated Arm

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Right	284	89.3	89.3	89.3
	Left	34	10.7	10.7	100.0
	Total	318	100.0	100.0	

The frequency of the dominant arm in the ratio of the selected participants is shown in **Table 3**. From a total of **318** Participants, this table shows that **284** patients have right arm

involvement, with a percentage of **89.3%**, and **34** patients have left arm involvement, with a percentage of **10.7%.**

Table 4:-

Weight lifter

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	New	254	79.9	79.9	79.9
	Old	64	20.1	20.1	100.0
	Total	318	100.0	100.0	

Table 4 demonstrates whether the weight lifters are experienced athletes or newcomers. This table shows that **254** people **(79.9%)** are new to weightlifting, whereas **64** participants **(20.1%)** are older and training from a long time.

Table 5:-

Exercise Under Trainer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	65	20.4	20.4	20.4
	No	253	79.6	79.6	100.0
	Total	318	100.0	100.0	

Table 5 shows us the proportion of participants who exercise under professional trainer supervision. Of the total **318** participants, only **65** exercise under professional trainer supervision **(20.4%)**; the remaining **253** individuals **(79.6%)** do not work with professional trainers.

Table 6:-

Appropriate Angle

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	70	22.0	22.0	22.0
	No	248	78.0	78.0	100.0
	Total	318	100.0	100.0	

Table 6 displays how frequently athletes adopt the proper stance while lifting weights or exercising. According to this, just **70** individuals had an angle that was acceptable for the activity they were undertaking **(22.0%)**, whereas **248** people had an angle that was inappropriate **(78.0%)**, which is why the majority of their bicep injuries occurred.

Table 7:-

Shoulder Fracture / Disability

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	8	2.5	2.5	2.5
	No	310	97.5	97.5	100.0
	Total	318	100.0	100.0	

Table 7 displays the incidence of any prior history of shoulder fracture or disability. Only **8** individuals, with **2.5%** of the total **318** participants, had any shoulder fractures or disabilities

as a result of accidents or maybe other incidents, according to this table. The other **310** participants, with **97.5%** of the total, had neither fractures nor disabilities.

Table 8:-

Shoulder Impingement

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	224	70.4	70.4	70.4
	No	94	29.6	29.6	100.0
	Total	318	100.0	100.0	

Table 8 displays the number of participants with shoulder impingement. Of the total **318** individuals, **224** had shoulder impingement, which represents a percentage of **70.4**, and **94** did not, which represents a percentage of **29.9%.**

Table 9:-

Yergason's test

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Positive	254	79.9	79.9	79.9
	Negative	64	20.1	20.1	100.0
	Total	318	100.0	100.0	

The frequency of Yergason's test in the population chosen for this study is seen in **Table 9**. An unstable superior labral anterior posterior (SLAP) lesion and bicipital tendinitis are two examples of biceps tendon disease that may be detected with the Yergson's test. From a total of **318** subjects, **254** have a positive yergason's test result with a **79.9** percent success rate, whereas **64** have a negative result with a **20.1** percent success rate.

Table 10:-

Age of Participants(Years) * Yergason's test

Crosstab

			Yergason's test		
			Positive	Negative	Total
Age of Participants (Years)	18-30	Count	225	63	288
		% within Yergason's test	88.6%	98.4%	90.6%
	30-40	Count	27	1	28
		% within Yergason's test	10.6%	1.6%	8.8%
	40-64	Count	2	0	2
		% within Yergason's test	0.8%	0.0%	0.6%
Total		Count	254	64	318
		% within Yergason's test	100.0%	100.0%	100.0%

Table 10 shows the crosstab association between participant age and the test result from yergason's. The age group of **18** to **30** has **288** participants, **225** of whom have a positive yergason's test result with a percentage of **88.6%,** and **63** of whom have a negative result with a percentage of **98.4%**. In contrast, the age group of **30** to **40** has **27** participants, **27** of whom have a positive yergason's test result with a percentage of **10.6%,** and only **1**

participant has a negative result with a percentage of **1.6%** from the only **2** persons in the age range of **40** to **64** had yergason's test results that are positive with a percentage of **0.8%,** while this age range contains no participants with negative results.As a consequence, **254** people had positive results on the yergasons test, whereas **64** had negative results.

Table 11

Body Mass Index (Kg/m^2) * Yergason's test

Crosstab

			Yergason's test		
			Positive	Negative	Total
Body Mass Index (Kg/m^2)	20-22	Count	67	21	88
		% within Yergason's test	26.4%	32.8%	27.7%
	23-25	Count	182	41	223
		% within Yergason's test	71.7%	64.1%	70.1%
	26-30	Count	5	2	7
		% within Yergason's test	2.0%	3.1%	2.2%
Total		Count	254	64	318
		% within Yergason's test	100.0%	100.0%	100.0%

The crosstab correlation between participant BMI and the test result from yergason's is displayed in **Table 13**. There are **88** individuals with a BMI of **20 to 22**; **67** of them have positive yergason's test results **(26.4% of them)**, and **21** have negative results **(32.8% of them**). In contrast, among the 223 participants in the BMI group of **23** to **25**, **182** have positive yergason's test results with a percentage of **71.7%,** while **41** have negative results with a percentage of **64.1%**. Similarly, among the **7** participants in the age group of **26** to **30**, **5** have positive yergason's test results with a percentage of **2.0%,** while **2** have negative results with a percentage of **3.1%**.As a consequence, **254** people had positive results on the yergasons test, whereas **64** had negative results.

Table 12:-

Weight lifter * Yergason's test

Crosstab

			Yergason's test		
			Positive	Negative	Total
Weight lifter	New	Count	254	0	254
		% within Yergason's test	100.0%	0.0%	79.9%
	Old	Count	0	64	64
		% within Yergason's test	0.0%	100.0%	20.1%
Total		Count	254	64	318
		% within Yergason's test	100.0%	100.0%	100.0%

Table 12 shows the crosstab association between individuals who are novice or experienced weight lifters and yergason's. Out of a total of **254** new participants (with a percentage of **100%**), there are **254** (with a percentage of **79.9%**) who are new weight lifters and have positive yergason's test results. On the other hand, out of the **64** participants, **64** of them are

older weight lifters (**20.1%**), and their test results are negative (with a **100%** rate). As a result, **254** individuals scored well on the yergasons test whereas **64** scored poorly.

Table 13:-
Exercise under Trainer * Yergason's test

Crosstab

			Yergason's test		Total
			Positive	Negative	
Exercise Under Trainer	Yes	Count	1	64	65
		% within Yergason's test	0.4%	100.0%	20.4%
	No	Count	253	0	253
		% within Yergason's test	99.6%	0.0%	79.6%
Total		Count	254	64	318
		% within Yergason's test	100.0%	100.0%	100.0%

Table 13 shows the link between the number of individuals who exercise with trainers and the results of the Yergason test. According to this data, there are a total of **65** participants who are exercising with a trainer **(20.4%)**, **64** people whose yergason test results are negative **(100.0%),** and **1** participant who has a positive result (**0.4%** frequency) among the participants who are being watched. On the other hand, out of the entire **253** individuals, **253** persons who are not being watched over by anybody had yergason test results that are positive **99.6%** of the time.

Table 14:-
Appropriate Angle * Yergason's test

Crosstab

			Yergason's test		Total
			Positive	Negative	
Appropriate Angle	Yes	Count	6	64	70
		% within Yergason's test	2.4%	100.0%	22.0%
	No	Count	248	0	248
		% within Yergason's test	97.6%	0.0%	78.0%
Total		Count	254	64	318
		% within Yergason's test	100.0%	100.0%	100.0%

Table 14 displays the number of participants who have the correct angle and how they relate to Yergason's test. A total of **70** participants had the proper angle when lifting weights, which occurred **22.0%** of the population. Of this sample, **64** participants had a negative yergason's test, which occurred **100%** of the time, and **6** patients had a positive test result, which occurred **2.4%** of the time. While there are **248** persons overall with an angle that is inappropriate (**78.0%** of the time), and all of these participants get positive test results (**97.6%** of the time), A total of **318** persons made up the sample; **254** of them had positive Yergason test results, whereas **64** had negative results.

Table 15:-
Shoulder Fracture / Disability * Yergason's test

Crosstab

			Yergason's test		
			Positive	Negative	Total
Shoulder Fracture / Disability	Yes	Count	6	2	8
		% within Yergason's test	2.4%	3.1%	2.5%
	No	Count	248	62	310
		% within Yergason's test	97.6%	96.9%	97.5%
Total		Count	254	64	318
		% within Yergason's test	100.0%	100.0%	100.0%

Table 15 shows the relationship between Yergason's test and shoulder fracture/disability. Out of this sample, there are **6** individuals whose test result is positive with **2.4%** frequency, and **2** participants who had a negative test result with **3.1%** frequency. This table indicates that there were a total of **8** participants who had any prior history of shoulder fracture/disability. In contrast, **310** individuals had no prior history of fracture or disability, which represents **97.5%** of the population. Of this population, **248** participants had positive test results, which occurred **97.6%** of the time, and **62** participants had negative test results, which occurred **96.9%** of the time. This study had **318** subjects in all, **254** of whom received positive results and **64** of whom received negative results.

Table 16:-
Shoulder Impingement * Yergason's test

Crosstab

			Yergason's test		
			Positive	Negative	Total
Shoulder Impigment	Yes	Count	224	0	224
		% within Yergason's test	88.2%	0.0%	70.4%
	No	Count	30	64	94
		% within Yergason's test	11.8%	100.0%	29.6%
Total		Count	254	64	318
		% within Yergason's test	100.0%	100.0%	100.0%

The correlation between shoulder impingement and the yergason's test is seen in **Table 16**. According to this table, **224** people in total experienced shoulder impingement with a frequency of **70.4%**, and **88.2%** of them had positive test results. In addition, **94** people did not experience shoulder impingement with a frequency of **29.6%,** and of these **94** people, **30** had positive test results with a frequency of **11.8%,** and **64** had negative test results with a frequency of **100%.**

Bodybuilding performed with the elbow in flexion or semi-flexion are the origin of all injuries. The individuals' forearms were supinated at their damaged sides, according to the study. The forearms were always in a supinated position in all of the cases where opposing extremities could be assessed.Because of the improper angle and lack of monitoring, this

study shows that the majority of the participants in the chosen population experienced bicep tendinitis. Body building is a very demanding activity that needs good instruction and supervision because any carelessness might lead to serious injuries, among which bicep tendinitis is one.Patients must take the right precautions, medications, and physical treatments in order to treat their bicep tendinitis injury since severe consequences might result from improper care. This study demonstrates the need for every newcomer to have adequate training from a trainer and adhere to all of his or her instructions when exercising. Bicep tendinitis may also be treated with medications, and the majority of participants who had severe complication in the chosen group are being treated and given the right treatment by a doctor or physician for improved outcomes.

Discussion

The important conclusion of this study was that all Bicep tendinitis developed on the supinated side of the forearm when performing a bodybuilding exercise with a mixed grip, the other forearm that wasn't hurt was in pronation, and both elbows were fully extended. Pronated extremities exhibited no injuries.[16] Patients typically describe an audible snap followed by sharp pain in the antecubital fossa following an eccentric contraction of the biceps brought on by an unanticipated extension force delivered to a flexed elbow with the forearm in a supinated posture.For some patients, it might be challenging to recall precisely where their extremities were during a quick trauma, such as a bicep tendinitis, and to explain the damage process to a doctor.[17]The 2 ideas of Seiler et al. have been the most commonly referenced, however the underlying mechanisms of a bicep tendinitis is still unknown. They noted a hypo vascular zone 2.14 cm in front of the tendon's distal insertion and suggested that this would increase the risk of rupture. They also showed that going from supination to complete pronation of the forearm decreased the distance between the lateral border of the proximal ulna and radius at the level of the distal insertion of the biceps tendon by 48%.[18] They also said that the tendon covered 85% of the proximal radioulnar joint when the forearm was fully pronated. The latter explanation based on the observation that most ruptures occur at the radial tuberositya pronated forearm position during bodybuilding may prevent bicep tendinitis.[19]In our study, the elbow posture altered in 6 of 24 (25%) instances shortly before bicep tendinitis manifested. Therefore, in these instances, bicep tendinitis may have been linked to eccentric contraction.Males in their fourth or fifth decade of life make up the bulk of bicep tendinitis patients, and 52% to 86% of cases involve the dominant upper extremities.[20] Increased body mass index, anabolic steroid usage, smoking, weightlifting, and bodybuilding are typical risk factors for a DBBTR. Power lifting-related musculoskeletal problems can happen to either the upper or lower extremities. Stromback et al. recently looked at the location and frequency of injuries in bodybuilding. They also disclosed that 42% of injuries occurred during squat training, 27% during bench press training, and 31% during deadlift training. However, the injuries based on the type of training and particular circumstances were not listed individually.

D'Alessandro et al. reported the outcomes of anatomic double-bundle repair of bicep tendinitis in athletes in another investigation. The patients were all male and had an average age of 40.[21] Additionally, 8 of them were bodybuilders and weightlifters who competed in

sports. However, the majority of the accidents happened while playing handball, carrying furniture, or participating in rodeos. In just one bodybuilder, the biceps curl workout resulted in a rupture. However, no accidents were reported while training for the deadlift or body building.The placements of the upper and lower limbs, as well as your posture, can all affect how easily your distal biceps tendon is injured. In light of these findings, it is essential to assess the biomechanical stresses placed on the shoulders, elbows, and forearms during the deadlift. Further studies focused on the kinematics and kinetics of the upper extremities will improve our comprehension of the bodybuilding process.[22]The power of the current investigation may have also been constrained by the size of the study population. However, this technique made a significant addition to our current understanding of the mechanism behind body development, particularly with regard to high weight lifting. To get the best neuromuscular adaptations, coaches should take into account individualised exercise prescription with a sports-specific strategy. Future biomechanical research is required to examine how load and log size affect the kinematics and kinetics of lifting.

Conclusion

A different mechanism for bicep tendinitis was described, one that differs from the traditional mechanism of a flexed elbow and supinated forearm: eccentric loading to an extended elbow and supinated forearm during bodybuilding. Additionally, pronating both forearms while gripping the bar during a bodybuilding exercise may help avoid or lessen the chance of developing bicep tendinitis.

References

1. Kapicioglu M, Bilgin E, Guven N, Pulatkan A, Bilsel K. The role of deadlifts in distal biceps brachii tendon ruptures: An alternative mechanism described with YouTube videos. Orthopaedic Journal of Sports Medicine. 2021;9(3):2325967121991811.
2. Kanayama G, DeLuca J, Meehan III WP, Hudson JI, Isaacs S, Baggish A, et al. Ruptured tendons in anabolic-androgenic steroid users: a cross-sectional cohort study. The American journal of sports medicine. 2015;43(11):2638-44.
3. Hacken B, Onks C, Flemming D, Mosher T, Silvis M, Black K, et al. Prevalence of MRI shoulder abnormalities in asymptomatic professional and collegiate ice hockey athletes. Orthopaedic journal of sports medicine. 2019;7(10):2325967119876865.
4. Lappen S, Siebenlist S, Kadantsev P, Hinz M, Seilern und Aspang J, Lutz PM, et al. Distal biceps tendon ruptures occur with the almost extended elbow and supinated forearm–an online video analytic study. BMC Musculoskeletal Disorders. 2022;23(1):1-7.
5. Thomas JR, Lawton JN. Biceps and triceps ruptures in athletes. Hand clinics. 2017;33(1):35-46.
6. Carter TH, Karunaratne BJ, Oliver WM, Murray IR, White TO, Reid JT, et al. Acute distal biceps tendon repair using cortical button fixation results in excellent short-and long-term outcomes: a single-centre experience of 102 patients. The Bone & Joint Journal. 2021;103(7):1284-91.
7. Furia JP, Rompe J-D, Maffulli N, Cacchio A, Schmitz C. Radial extracorporeal shock wave therapy is effective and safe in chronic distal biceps tendinopathy. Clinical Journal of Sport Medicine. 2017;27(5):430-7.
8. Keogh J, Winwood P, Coast G, Millennium A. The Epidemiology of Injuries Across the Weight Training Sports: A Systematic Review. Sports Medicine (June 2016) doi.10.
9. Willaume T, Bierry G, editors. Biceps, Brachialis, and Triceps. Seminars in Musculoskeletal Radiology; 2021: Thieme Medical Publishers, Inc.
10. Xue H, Bird S, Jiang L, Jiang J, Cui L. Anchoring Apparatus of Long Head of the Biceps Tendon: Ultrasonographic Anatomy and Pathologic Conditions. Diagnostics 2022, 12, 659. s Note: MDPI stays neutral with regard to jurisdictional claims in published …; 2022.
11. McMahon PJ, Speziali A. Outcomes of tenodesis of the long head of the biceps tendon more than three months after rupture. World Journal of Orthopedics. 2016;7(3):188.
12. Kodde IF, van den Bekerom MP, Mulder PG, Eygendaal D. The size of the radial tuberosity is not related to the occurrence of distal biceps tendon ruptures: a case-control study. The Open Orthopaedics Journal. 2016;10:1.
13. Escalante G. Exercise modification strategies to prevent and train around shoulder pain. Strength & Conditioning Journal. 2017;39(3):74-86.
14. Comfort P. Bodybuilding. Routledge Handbook of Strength and Conditioning: Routledge; 2018. p. 597-611.

15. Kolaczko JG, Knapik DM, McMellen CJ, Mengers SR, Gillespie RJ, Voos JE. Complete Isolated Ruptures of the Distal Biceps Brachii During Athletic Activity: A Systematic Review. Cureus. 2022;14(8).
16. Granville-Chapman J, Watts AC. Tendon Injuries Around the Elbow. Sports Injuries of the Elbow: Springer; 2021. p. 83-97.
17. O'Dell MC, Urena J, Fursevich D, Sanchez E, LiMarzi G, Bancroft L. Imaging sports-related elbow injuries. Appl Radiol. 2015;44:7-15.
18. Khullar N, Scull NC, Deeny MC, Hamdan E. Prevalence and Predictors of Anabolic-Androgenic Steroid Use among Gym Users in Kuwait: A Preliminary Study. International Journal of Men's Health. 2016;15(2).
19. Guerra E, Fabbri D, Bettelli G, Marinelli A, Cavaciocchi M, Rotini R. Biceps and Triceps Tendon Lesions. Arthroscopy and Sport Injuries: Springer; 2016. p. 201-15.
20. Mohtashamabc HM, Salehia S. Review on Identifying the Causes and Frequency of Weight-training Injuries and their Prevention Strategies. Journal of Clinical Physiotherapy Research. 2019;4(1):1-8.
21. Millar N, Hackett L, Lam P, Murrell G. Session 1: Basic Science.
22. Król H, Gołaś A. Effect of barbell weight on the structure of the flat bench press. Journal of strength and conditioning research. 2017;31(5):1321.