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Prevalence of unilateral hypertrophy of trapezius muscle in boxers

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Abstract
Background: Boxers may be particularly prone to developing hypertrophy of the trapezius muscle, particularly on one side of the body, due to both the nature of their sport and the training methods they employ. While the prevalence of trapezius muscle hypertrophy in boxers remains largely unexplored, there are indications that this condition may be common. So, this research seeks to provide valuable insights and documentation regarding its occurrence.
Methodology: An observational study was conducted on 50 male boxers aged 18-30 years. Boxers with at least three years of consistent exercise experience, with at least five to six sessions each week were chosen randomly for this investigation. The outcome measures were hypertrophy and strength measurements.
Results: According to the findings of this study, 48% of 50 boxers had unilateral trapezius muscle hypertrophy. To investigate the relationship between unilateral hypertrophy and trapezius muscular strength, a Chi-square test was used with SPSS software, and the Pearson value was 0.370. The test results show that there is no statistically significant relationship between hypertrophy and strength.
Conclusion: The study concludes that the prevalence of unilateral trapezius muscle hypertrophy was 48%. Irrelevant to the side of hypertrophy, the subject having unilateral side greater trapezius muscle strength, and this study could not establish an association between unilateral hypertrophy and trapezius muscle strength, and there was also no association between unilateral side hypertrophy and dominance.

Keywords: Boxers, hypertrophy, prevalence, trapezius muscle

Introductions

Boxing is a high-intensity intermittent combat sport relying mostly on the aerobic energy pathway over the combat's duration. In fact, this energy system contributes to the boxers' ability to repeat attacks with the highest strength and speed over the total duration of the combat. There are three primary techniques utilized in boxing to attack an opponent: the cross, hook, and uppercut. The cross involves a forward translation of the body, while the hook and uppercut require an overall rotation of the body [4]. In all attacking and defensive techniques, the shoulder is held in an elevated position, the elbow is flexed, and the hand is placed in front of the face for protection. When delivering punches, boxers typically rely more on their dominant arm to repeatedly throw powerful strikes, while their non-dominant arm remains in a retracted and elevated position for defence. This stance is mainly maintained throughout the game and can result in hypertrophy of the muscle on the non-dominant side. The trapezius muscle is a crucial component of the neck and shoulder musculature [5] and plays a key role in optimizing scapular position and scapulohumeral rhythm during movement. It is widely recognized that hypertrophy of individual muscle fibers represents the primary mechanism responsible for muscle enlargement following strength training. [2, 8, 12] The prevalence of trapezius muscle hypertrophy in boxers has not been extensively studied, but there are indications that it may be a common occurrence. Boxing is a sport that requires repetitive movements of the arms, shoulders, and upper back, which can potentially lead to muscle imbalances and overuse injuries. Despite the potential for unilateral hypertrophy of the trapezius muscle in boxers, there has been a paucity of research on this topic. To the best of our knowledge, the present study represents the first attempt to examine the incidence of unilateral trapezius muscle hypertrophy in boxers. This is a crucial area of investigation for preventing muscle imbalances and developing targeted exercises and training regimens.

Methods

Population and Sample

The present study was observational in nature in which individuals were randomly selected. The participants were selected as per inclusion criteria. A total of 50 male boxers with age group 18-30 years, and with State, national and international level with at least 3 years of regular exercise experience. Subjects of non-participating population, Past shoulder injury (in the last 6 months), Visual acute swelling in the region of the shoulder, soft tissue injury and fracture, and Inflammatory shoulder joint were excluded from the study. Prior to participation, written informed consent was taken from all individuals. Weighing Machine, Anthropometric Rod, Photographic method (Adobe Photoshop), Image Map, and Aone Sphygmomanometer Marker were used as tools for the study [6, 11].

Procedure

To measure hypertrophy, two distances were marked on the player's body using a marker pen while they looked straight ahead: one between the base of the neck and the inferior point of the mastoid process, and the other between the base of the neck and the shoulder. The photographic method was then used to evaluate hypertrophy. This involved taking photos of the player standing upright from both the sagittal and frontal plane, which were later examined (Figure 1). Using Photoshop, the level and size of the trapezius muscle depicted in the image needed to be determined (Figure 2). Finally, the photoshopped image was analyzed using an image map application to obtain the accurate percentage value of the muscle size on both sides. The results were analyzed using percentage (Figure 3). To analyze the association of unilateral hypertrophy with the strength of trapezius muscle Chi-square test was applied.

To measure strength, the Modified Sphygmomanometer Test (MST) was used to assess the upper trapezius muscle on both sides, using a single brand A one sphygmomanometer with a measurement range of 0 to 300 mmHg for both the right and left sides. During the MST with fixed stability evaluation, the modified sphygmomanometer was first inflated to 100mmHg with the valve closed to ensure there were no folds in the inflatable section. Next, the pressure was reduced to 20 mmHg, and the valve was resealed to prevent any leakage, thus providing a range of 20 to 304 mmHg[10]. The modified sphygmomanometer was placed parallel to the muscle being tested to prevent movement, and the force exerted was calculated by reading the manometer.

Statistical Analysis

Data analysis was done using SPSS Version 20. The Chi-square test was used for association of unilateral hypertrophy with the strength of the trapezius muscle.

Fig 1: Photo of the player in the orthostatic position

Fig 2: Image edited by photoshop

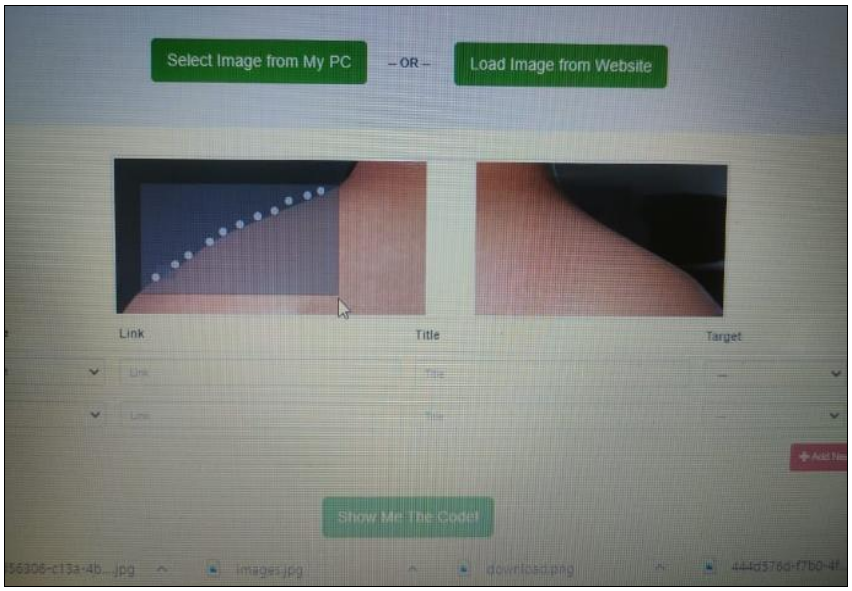

Fig 3: Picture analysis in image map application.

Results

Prevalence of unilateral hypertrophy in the trapezius muscle. The data of 50 subjects were analyzed using the mean percentage, and it was discovered that 24 of the subjects had muscular hypertrophy, with a 10% (5) prevalence on the right side and a 38% (19) prevalence on the left. The remaining 52% (26 participants) did not have hypertrophy as shown in Table 1.

Table 1: Prevalence of unilateral hypertrophy in the trapezius muscle

Hypertrophy	Prevalence of Hypertrophy		Absence of Hypertrophy
Sides	Right Side	Left Side	
No. of subjects	5	19	26
Percentage (%)	10%	38%	52%

Comparison in Right and Left side for trapezius muscle strength. The percentage of both sides of the trapezius muscle strength of 50 subjects was analyzed using the mean percentage in order to determine the strength as shown in Table 2. It was found that out of 50 subjects, 38% (19) showed greater strength on the left side than the right which is 28% (14) and 34% (17) have equal strength on both sides.

Table 2: Comparison in Right and Left side for trapezius muscle strength

Side	Right	Left	Equal strength
No. of subjects with greater strength	14	19	17
Muscle Strength (%)	28%	38%	34%

Association of unilateral hypertrophy with the strength of the trapezius muscle. The association of unilateral hypertrophy with the strength of the trapezius muscle in Boxers was calculated using the Chi-square test and the obtained Pearson value was found to be 0.370. This shows a statistically insignificant relationship between hypertrophy and strength (table 3).

Table 3: Association of unilateral hypertrophy with the strength of the trapezius muscle

Hypertrophy	Strength			
	Equal	Right	Left	Total
Absent	9(18%)	6(12%)	11(22%)	26(52%)
Right	2(4%)	3(6%)	0(0%)	5(10%)
Left	6(12%)	5(10%)	8(16%)	19(38%)
Total	17(34%)	14(%)	19(%)	50(100%)
Pearson chi-square(p-value)	0.370			
Linear-by-linear association	0.02			

Relationship between the dominant side and Unilateral Hypertrophy of the trapezius muscle. Table 4(a) depicts the relationship between the right dominant side and unilateral trapezius muscle hypertrophy. A total of 42 subjects had right-side dominance, of which four had right-side hypertrophy, 17 had left-side hypertrophy, and 21 had equal muscle size on both sides. Right, left, and equal had mean percentages of 9.52%, 40.47%, and 50%, respectively.

Table 4(b) presents the relationship between the left dominant side and unilateral trapezius muscle hypertrophy. A total of eight subjects exhibited left-side dominance, out of which one displayed right-side hypertrophy, two had left-side hypertrophy, and five had equal muscle size on both sides. The mean percentages for hypertrophy were 12.5% for the right side, 25% for the left side, and 62.5% for equal muscle size.

Table 4 (a): Relationship between the right dominant side and unilateral hypertrophy of the trapezius muscle

Sides	Right side Hypertrophy	Left side Hypertrophy	No Hypertrophy (equal)	Total
No. of subjects with hypertrophy	4	17	21	42
Percentage (%)	9.52	40.47	50	84

Table 4 (b): Relationship between the left dominant side and unilateral hypertrophy of the trapezius muscle

Sides	Right	Left	Equal	Total
No. of subjects with Hypertrophy	1	2	5	8
Percentage (%)	12.5	25	62.5	16

Discussion

The study involved 50 participants, and it was found that 24 of them exhibited unilateral hypertrophy of the trapezius muscle. Among these participants, 5 showed hypertrophy on the right side with a prevalence of 10%, while 19 showed hypertrophy on the left side with a prevalence of 38%. The remaining 26 participants did not show any hypertrophy. These findings provide valuable insights into the prevalence of unilateral trapezius muscle hypertrophy in boxers and highlight the need for further research in this area.

In this study, the association between the dominant side and unilateral trapezius muscle hypertrophy was observed and mean percentages were calculated. A total of 42 subjects had right-side dominance, of which 4(9.52%) subjects had right-side hypertrophy, 17(40.47%) subjects had left-side hypertrophy, and 21(50%) subjects had equal muscle size on both sides, and in the case of left dominant side and unilateral trapezius muscle hypertrophy. A total of 8 subjects had right-side dominance, of which only 1(12.5%) subject had right-side hypertrophy, 2(25%) subjects had left-side hypertrophy, and 5(62.5%) subjects had equal muscle size on both sides. The possible explanation for these findings lies in the technique of this particular sport in which the technique cross involves a forward translation of the body, while the hook and uppercut require an overall rotation of the body [4]. In all attacking and defensive techniques, the shoulder is held in an elevated position, the elbow is flexed, and the hand is placed in front of the face for protection. When delivering punches, boxers typically rely more on their dominant arm to repeatedly throw powerful strikes, while their non-dominant arm remains in a retracted and elevated position for defence. This stance is mainly maintained throughout the game and can result in hypertrophy of the muscle on the non-dominant side.

The evaluation of muscular strength from the manual muscle strength test has been the most widely used method to evaluate muscle strength in the clinical context [3]. Studies have been carried out evaluating muscle strength through the Modified Sphygmomanometer Test (MST), which combines the advantages of the manual muscle strength test and the portable dynamometer [10, 7, 1]. The MST is a useful test for clinical practice and research [17]. To date, no research has been conducted to assess the strength of the trapezius muscle in boxers. In the current study, the modified sphygmomanometer test (MST) was done to assess the strength of the upper trapezius muscle on both sides utilizing a single-brand aneroid sphygmomanometer with a measurement range of 0 to 300 mmHg (Right and Left).

The mean percentage were used to analyse the data from 50 participants. It was found that out of 50 subjects, 38% (19) have shown greater strength on the left side than the right which is 28% (14) and 34% (17) have equal strength on both sides. These results offer valuable insights into the distribution of trapezius muscle strength in boxers which may have implications for the development of training programs aimed at addressing any observed imbalances and muscle hypertrophy. The chi-square test yielded a Pearson value of 0.370, indicating no significant relationship between unilateral hypertrophy and trapezius muscular strength in our study. While a common positive connection exists between hypertrophy and strength, our findings align with other research showing instances of discordance: muscle size can increase without strength gain, and vice versa [9]. To summarize, in the current study, the prevalence of unilateral hypertrophy of the trapezius muscle in Boxers was found to be 48%. It has also been found that this hypertrophy was not statistically significantly associated either with dominance or the muscle.

Conclusion

According to the conclusions of this study, the prevalence of unilateral trapezius muscle hypertrophy in boxers is 48%. Irrelevant to the side of hypertrophy, the individual has unilaterally stronger trapezius muscular strength. The current study was unable to show an association between unilateral hypertrophy and trapezius muscular strength, and there was no association between unilateral hypertrophy and dominance.

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