Original Article

DOI: http://dx.doi.org/10.16926/par.2017.05.17

Bodybuilding links to Upper Crossed Syndrome

Authors' Contribution:

A – Study Design
B – Data Collection
C – Statistical Analysis
D – Manuscript Preparation
E – Funds Collection

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Abstract

Introduction: *Upper cross syndrome is becoming more prevalent in today's population. The syndrome is described as a postural disorder presenting with over active pectoralis musculature and upper trapezius musculature. Also there is inhibition of lower and middle trapezius musculature, which results in winging of scapula, elevated and abducted scapula. This scapular dyskinesia, per se, resulted in rounding of shoulders. The syndrome is often associated with bad posture in routine life or occupation of a person. Little is known about the relationship between sport participation and postural body changes of bodybuilding training. Our aim is to investigate whether bodybuilding training in trained-individuals is associated with the postural abnormalities in the upper body.* ***Methods****: 60 male, trained bodybuilders (age= 24.62±3.67 years, body weight= 82.40±9 kg, height= 175±0.067 cm, body mass index (BMI) = 26.77±2.37 Kg/m2, body fat percentage = 21.58±3.21) and 30 un-trained (age= 24.67±2.24 years, body weight= 73.33±9.42 kg, height= 175±0.06 cm, body mass index (BMI) = 23.93±3.16 Kg/m2, body fat percentage = 18.17±3.76) volunteered and were thus included in the study. Postural photographs were taken in the sagittal and frontal planes, and were analyzed by using AutoCAD software. The Flexi curve ruler was used for the assessment of thoracic kyphosis and lumbar lordosis.* ***Results****: Using an independent sample t-test, significant differences were observed in the values of forward head posture between trained and untrained groups (p=0.001) and Mann-Whitney U test showed there was significant differences between the values of uneven shoulders (p=0.001), rounded shoulder (p=0.009) and kyphosis (p=0.013), but there was no significant difference between lordosis values in two groups.* ***Conclusion:*** *It can be concluded that there is a high incidence of upper body abnormalities among bodybuilders and this should be taken as a minatory situation on behalf of bodybuilding trainers. Therefore, strength coaches should design an appropriate training program to prevent their trainees from such abnormalities.*

Keywords*: abnormality, upper crossed syndrome, forward head posture, bodybuilders*

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Recevied: 16.03.2017; Accepted: 8.04.2017; Published online: 30.08.2017

INTRODUCTION

Upper crossed syndrome is a common postural dysfunctional pattern that describes the dysfunctional tone of the musculature of the shoulder girdle/cervicothoracic region of the body [1]. There are some weakened muscles, including the rhomboids, Serratus anterior, middle and lower Trapezius and there are some tightened/overactive muscles, including upper Trapezius, pectoralis major, and Levator scapulae in this posture which can lead to some postural abnormalities (e.g. Head and shoulder shifted anteriorly) [2,3].

In other words, this posture creates some postural patterning of forward shoulders, increases kyphosis, forward head posture, and loss of cervical lordosis. These abnormalities lead to overall pattern changes in the upper quarter of the body [2]. The aforementioned pattern changes can cause strain to the muscular attachments of the shoulder and shoulder blades which producing a rounded shoulder appearance [4]. Although this posture does not necessarily lead to pain, but when prolonged, individuals do often experience upper back and neck pain. Headaches are the other common condition accompanying this posture which can have an impact on quality of life and posture that exceeds other chronic conditions (e.g. Osteoarthritis, hypertension, and diabetes) [2].

Although it is difficult to pinpoint whether regular participation in any particular sport leaves positive or negative effects on the posture but physical activity in the form of the regular trainings is nonetheless one of the factors that may affect the posture [5]. In this regard, many authors have found that excessive and/or sport-specific training loads resulted in a deviation from the proper posture [6, 7, 8]. These postural abnormalities consist of kyphosis, lordosis [9], forward head posture (FHP) and rounded shoulder (RS) [10] which are more common in certain sports than the others because of the highly repetitive nature of sports [9, 10].

Bodybuilding is an activity that, categorically, falls between sport, entertainment, and physical activity. Bodybuilders participate in this field aiming to develop an overall symmetrical physique, increase muscle mass, and body definition [11]. However, some athletes have a baseless insistence on spending hours in the gym, abnormal eating patterns, or even substance abuse for perfection [12] which expose them to injury, abnormalities and chronic conditions.

Though postural deviations may be aesthetically unfavoring and can influence muscle efficiency and predispose individuals to musculoskeletal or neurological pathologic conditions, seldom have been done on the assessment of the effect of bodybuilding training on posture; so this crucial question remains unanswered, Can bodybuilding adversely affect the posture, especially upper crossed syndrome as a simple musculoskeletal imbalance, in those who practice it? Therefore, this study sets to evaluate the Upper crossed syndrome in bodybuilders.

MATERIAL AND METHODS

Subjects

A total of 90 Individuals including 60 trained bodybuilders were volunteered for this study (table 1). Bodybuilder athletes exercised 2–3 h daily, 5–6 days a week, and their training experience amounting to 2-5 years. All the volunteers signed written consent and were informed about purpose, nature, possible risks, and benefits of the present study which was approved by the Ethics Committee of the Department of Sports Sciences in University of Guilan (Rasht city).

Procedures: Height was measured using a tape measure, and weight using digital weight scale. Based on these values, the body mass index (BMI) was calculated. Prior to measurements, the subjects were informed of the testing procedure and all participants signed an informed consent form before participation. All measurements were taken in the evening of each testing day (between 5:00 and 8:00 PM), to control for diurnal variations in spinal curvature. No warm-up or stretching exercises were performed by the participants prior to the test measurements. All the participants were tested by an examiner in the gym.

Forward head and Forward Shoulder angle assessment

In order to measure forward head imaging the subjects were placed in a standing position from the sagittal view. Pictures were taken by a digital camera (Canon power shot A1200 HD), and the angle between the seventh cervical spine and the appendage tragus of the ear horizon line, and the angle between the line passing through the seventh cervical vertebra and the acromion process was measured in order to assess the Forward Shoulder angle in which the seventh cervical vertebra and acromion process were marked by the markers. This process was accomplished in AutoCAD 2007 [13, 14].

Thoracic kyphosis assessment

Thoracic kyphosis was measured in each subject using the flexicurve ruler (Staedtler Mars, Inc, Nurnberg, Germany), which is a malleable band of metal covered with plastic and approximately 60 cm in length. The ruler can be bent in only one plane and retains the shape to which it is bent. It is available in most drafting supply stores. The subject was instructed to stand up straight and as tall as possible, and the flexicurve ruler was aligned to the anterior-posterior curves of the spine from T2 to T12 and T12 to S2. The ruler was then placed flat on paper and its outline was traced. A straight line was then drawn from the ruler position of T2 to T12 and T12 to S2 that corresponded to the length of thoracic kyphosis and lumbar lordosis (l) and was measured in cm. The height of the thoracic kyphosis (h) in cm was determined by drawing a perpendicular line from the highest point in the thoracic curve to the point at which it intersected the straight line drawn from T2 to T12. The index of kyphosis was calculated by applying the formula [14]: Kyphosis Angle = 4 × [arc tan (2H/L]. Measurement was conducted three times. The Intraclass Correlation Coefficient (ICC) was 0.90 and 0.92 for lumbar curvature and head and shoulder, respectively.

Statistical analysis

The Data were analyzed using SPSS version 23. The results are presented using descriptive statistics by calculating the arithmetic mean and standard deviation. The normal distribution of the data set was evaluated with statistical testing, including the Shapiro–Wilk test. After testing the normality of data, since the FHP values were normal, therefore, independent sample-t-test was used in order to compare FHPs, and Mann-Whitney U test was used in order to compare uneven shoulders, rounded shoulder, kyphosis and lordosis among two groups (trained and untrained) because the distribution of the dada in these variables were not normal. The statistically significant values were accepted at $p<0.05$. Cohen’s method was used for calculating the effect size and the differences between groups. We assumed the Cohen's d effect size values as small for (0.2), medium (0.5) and large (0.8) and the r values as for small (0.3), medium (0.3 to 0.5) and large (≥ 0.5).

RESULTS

Average values (mean±SD) of age, the body height, body mass, BMI (body mass index) and BFP (body fat percentage) set for the trained and untrained athletes are presented in Table 1.

Table 1. General Characteristics of participants

Variables	Trained Group (N=60)	Untrained Group (N=30)	P-value
Age (years)	24.6±3.7	24.7±2.2	0.485
Height (cm)	175.0±0.1	175.0±0.1	0.979
Weight (kg)	82.4±9.0	73.3±9.4	0.001*
BMI (kg/m²)	26.8±2.4	23.9±3.2	0.001*
BFP (%)	21.6±3.2	18.2±3.8	0.001*

where: BMI – body mass index, BFP - body fat percentage

Table 2. Independent samples t-test for mean values of FHP in trained and untrained subjects

Variable	Group	N	Mean±SD	Mean Difference	t	P-value	d
Forward head posture	Trained	60	43.85±7.72	7.15	5.164	0.001*	1.08
	Untrained	30	36.70±5.26				

Table 3. Mann-Whitney U test for Uneven Shoulders, Rounded shoulder, Kyphosis, Lordosis

Variables	Group	Mean±SD	U-Mann Whitney	P-value	r
Uneven Shoulders	Trained	1.93±1.44	494.50	0.001*	0.38
	Untrained	0.83±0.87			
Rounded shoulder	Trained	41.78±11.95	596.50	0.009*	0.27
	Untrained	34.33±5.89			
Kyphosis	Trained	40.49±9.17	610.00	0.013*	0.26
	Untrained	35.73±5.13			
Lordosis	Trained	41.55±9.40	729.50	0.144	0.15
	Untrained	38.12±7.12			

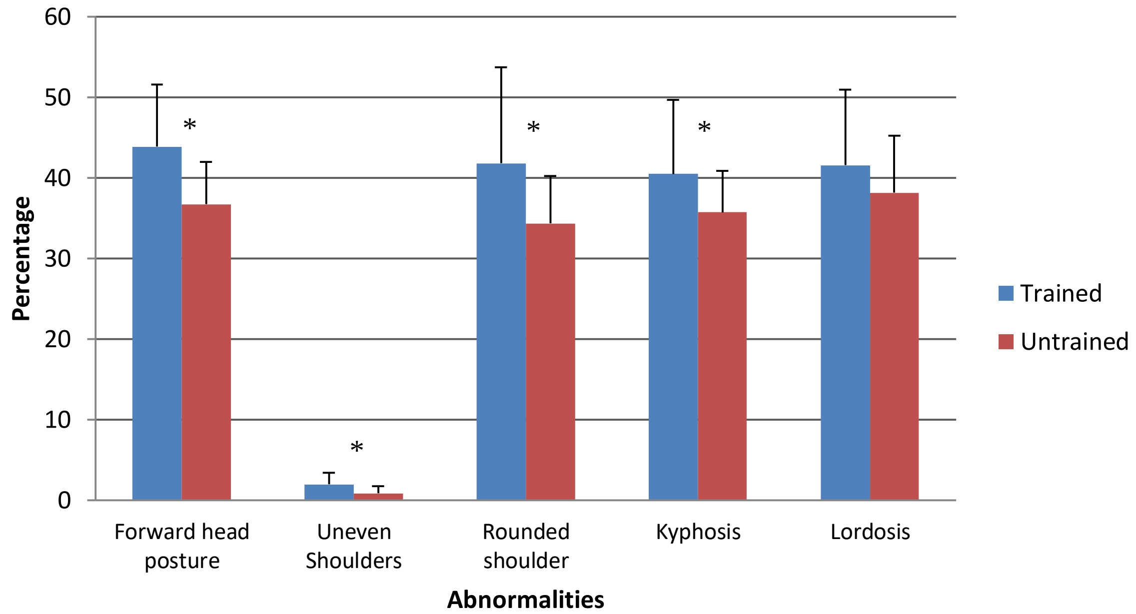

Figure 1. Comparing of postural abnormalities between trained and untrained groups; * p<0.05

The effect size, which expresses the mean difference between the two groups in standard deviation units, is 1.08. This is considered to be a large difference between the means.

Mann-Whitney U test showed there was significant differences between the values of uneven shoulders (p=0.001), rounded shoulder (p=0.009) and kyphosis (p=0.013), but there were no significant differences between lordosis values between groups. Also, the effect size values are presented in the table as medium and small for the significant variables and the non-significant, respectively.

DISCUSSION

This study aimed to assess, identify and describe the Upper crossed syndrome in bodybuilders. This said, we assessed and compared the upper body postures, including head and neck, shoulder and spinal curvature, of trained bodybuilders and untrained individuals. The present study showed that bodybuilders not only had greater values of thoracic kyphosis (p=0.013) but also forward head posture (p=0.001), rounded shoulder (p=0.009) and uneven shoulders (p=0.001) compared with untrained individuals. It seems that kyphosis is among the most common postural abnormalities that occur in most sports; while lordosis occurs to a slightly smaller extent [9]. Our study, confirms this fact. In agreement with the present study, Ślężyński and Rottemund [15] showed that volleyball players usually have kyphotic body posture with a prominent thoracic kyphosis. Wojtys et al [16] reported a significant increase in thoracic kyphosis in wrestlers compared with non-athletes. Förster et al found that the kyphosis angle was significantly greater in sport climbers than recreational climbers [17]. Furthermore, other authors have found the same results as the present study [9]. On the other hand, Asadi et al [18]has found that there is no significant difference in the kyphosis mean between master football players and non-athletes. Moreover, the football players had a better position in FHP angle than non-athletes. Since their participants were older adults and the kyphosis angle increases through lifetime, perhaps the discrepancy can be explained by the age of subjects. In terms of FHP, the difference is probably because of the nature of the football in which players have to keep good head posture for better performance [18]. The present study has shown that bodybuilders have higher rates of FHP and RSP which were similar in the other athletic groups such as swimmers, pitchers, gymnasts, and volleyball players [10,19]. The same findings in this study for swimmer groups can be explained by the fact that in swimming, eighty percent of practice time is spent on performing the freestyle stroke which results in repetitive stress and overuse, which all in all, cause shoulder pain [20]. Similarly, it seems that the same condition exists in bodybuilding due to the higher rate of injury which has been mentioned earlier regarding the upper body of bodybuilders [12]. In terms of Lordosis (p=0.144), there was no difference between the groups which were similar with those of Förster et al [17]. The degree of lordosis was higher for sport climbers compared to recreational climbers, but it was not statistically significant. Optimum alignment of each component of the kinetic chain depends on good posture; therefore, any alteration in posture, caused by overloaded or repetitive movements, will place the entire system at a disadvantage and will create predictable patterns of overloaded and tissue dysfunction which in turn initiate the cumulative injury cycle and can be detrimental to an athlete's participation [21].

The present study has shown that bodybuilders have forward head and rounded shoulder posture along with other abnormalities such as kyphosis, uneven shoulder and loss of lordosis which are probably interlinked with each other in a kinetic chain and can be seen in the upper crossed syndrome [1,4]. These abnormalities can predispose bodybuilders to the *above mentioned conditions.*

According to the previous studies on the higher rate of injuries among bodybuilders in the upper body and pain complaint in shoulder and elbow [12] and also many abnormalities which have been observed in the present study, it seems that bodybuilders are probably more willing to do the upper body exercise rather than lower body exercise which can lead to abnormalities in an extended period of time. Accordingly, the causes which will result in upper crossed syndrome, such as chronic postural stress to the upper body, performing tasks in front of our body [1] are similar to certain exercises, e.g. bench press, curl up etc, as the most common exercises used even for warming-up that bodybuilders practice [12, 22]. These types of exercises usually involve a high volume of sets, and repeated many times per week, e.g. five different exercise for chest with 4 or 5 and 6 to 16 repetitions for each exercise [23]. Therefore, such exercises can cause imbalance in the upper body, especially shoulder girdle. Furthermore, Šimončičová et al. stated that muscle imbalance can lead to faulty posture or change movement patterns with subsequent overloading ligaments, tendons, and joints, which all in all form syndromes that are characterized by shortened and weakened muscle groups, poor postures, pain, etc. [24].

To sum up, contrary to general belief that bodybuilding is a sport for developing an overall symmetrical physique and creating an improved muscular shape, the present study claims that the emphasis on certain programs which are regularly performed by bodybuilders on a specific part of the body, like the popular chest and biceps, can cause imbalance and result in abnormalities, and thus may become a source of injury. Moreover, researchers have shown that most bodybuilders spend little or no time stretching and they have decreased shoulder range of motion. They also emphasized that flexibility and stretching exercise are crucial not only for encouraging a better blood flow, but also for the posture, muscle growth, joint ROM etc. [23, 22]. The present study showed that bodybuilders are susceptible to abnormalities regarding long term participation in bodybuilding that may make them prone to injury. This finding is consistent with Barlow et al [22] which showed bodybuilders were not significantly stronger in isometric shoulder-strength values for the lower trapezius.

The results suggest that strength coaches and athletes target less visible muscles at the back of the shoulder joint, the examples are the middle and lower trapezius, rear deltoids, rotator cuff muscles and scapular muscles. Thus, a well-rounded program which trains both the agonist and antagonist muscles is vital for the long-term health of the individuals. Moreover, stretching exercise must be done by bodybuilders in their training sessions. Lastly, due to the abnormalities seen in the upper body, which this study claims that contribute to imbalance, e.g. lower trapezius, and adversely affect the shoulder, it is recommended to add some stabilization exercise for shoulder girdle.

The present study confirmed the findings by Rostami & Rahnama who assessed the postural abnormalities in the group of bodybuilders [25]. More specifically, we focused on Upper crossed syndrome as a possible result of various exercises and routines performed by bodybuilders; although its design is not without limitations. We used BMI as a standard metric level of fatness, but this is not the best measure of fat, and highly muscular people, usually professional athletes or body builders, may register as overweight using the BMI scale. Therefore, future investigators should use more accurate and useful indices like WHR, the skinfold method etc. for estimating body fat. Oftentimes, both lower and upper cross syndrome can work together, but we could not evaluate lower crossed syndrome. The authors recommend future studies to monitor and compare possible changes in the upper and lower body in both sexes, especially, with different levels of practice and long term period of time.

CONCLUSION

In conclusion, the present study showed that bodybuilding training can expose bodybuilders to upper crossed syndrome in a long period of time. This syndrome can expose them to other chronic conditions and injuries. Therefore, the authors recommend strength coaches to add appropriate corrective exercise programs which train both the agonist and antagonist muscles in order to minimize the possible adverse effects of bodybuilding training on posture.

ACKNOWLEDGMENTS

The authors would like to thank Sahar Soheili, Baset Maroofi, Saeid Bahiraei and all who helped and participated in the completion of this study.

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Cite this article as:
Daneshmandi H, Harati J, Poor SF. Bodybuilding links to Upper Crossed Syndrome, Phys Activ Rev 2017, 5: 124-131