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Comparison of Upper Quarter Function and Balance between Female Students with and without Uneven Shoulders

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ABSTRACT

Background: Uneven shoulders represent a prevalent form of musculoskeletal malalignment. This study aims to investigate the differences in upper quarter function, as well as static and dynamic balance, between dominant and non-dominant sides in individuals with and without uneven shoulders.
Methods: This study involved a purposive sample of 40 female students, aged 20 to 30 years, comprising 20 individuals with uneven shoulders and 20 with even shoulders. The assessment of shoulder alignment was conducted through digital imaging, utilizing AutoCAD 2020 software for analysis. Upper quarter function was evaluated using the Upper Quarter Y Balance Test, while static and dynamic balance were assessed via the stork test and Y balance test, respectively. Statistical analyses were performed using SPSS v. 22.
Results: The analysis revealed significant differences in upper quarter function in the inferolateral direction ($p=0.048$) and static balance ($p=0.044$) between dominant and non-dominant sides in both groups. Notably, the group with uneven shoulders exhibited lower scores in these measures compared to their counterparts with even shoulders. However, no significant difference was observed in dynamic balance ($p>0.05$).
Conclusions: The findings indicate that the mean differences in upper quarter function in the inferolateral direction and static balance between dominant and non-dominant sides are more pronounced in individuals with uneven shoulders compared to those with even shoulders. The alignment of spine and normal positioning of scapula are critical factors influencing shoulder girdle function. Consequently, it is recommended that further investigations explore the functional implications for both upper and lower limbs in individuals with uneven shoulders.

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K E Y W O R D S

Dynamic balance, Static balance, Uneven shoulders, Upper quarter function,

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INTRODUCTION

The shoulder girdle exhibits a complex anatomical structure, with variations in shape and form that are unique to each individual [1]. The position and function of the scapulae are critical for the maintenance of optimal posture [2]. Ideally, when assessing the shoulder alignment in relation to a horizontal reference line, both shoulders should maintain an equal distance from this line. A deviation exceeding 2 degrees from the horizontal reference on one side is classified as "uneven shoulder complication" [3, 4]. Clinical evaluations of shoulder girdle conditions indicate that shoulder prolapse, the most prevalent postural disorder, often results from dysfunction of the upper trapezius muscle. In cases of shoulder prolapse, there is a concomitant weakening of the rhomboid, levator scapulae, and sternocleidomastoid muscles on the affected side, while the pectoralis minor and subclavius muscles exhibit shortening [5]. A significant contributing factor to this condition is the engagement in improper exercise techniques and the overuse of specific muscle groups [6]. Weakness in the scapulothoracic muscles can precipitate abnormal scapular positioning, thereby disrupting the normal scapulohumeral rhythm and impairing shoulder function [2-7]. Effective shoulder function necessitates a delicate balance between stability and mobility within the glenohumeral and scapulothoracic joints, as well as, to a lesser extent, the posterior-clavicular and sternoclavicular joints [8]. Research indicates a direct correlation between scapular positioning and the stability, range of motion, and strength or endurance of the shoulder girdle muscles. Consequently, alterations in scapular positioning, as observed in conditions such as uneven shoulders, have significant implications for the functional capacity and range of motion of the shoulder girdle, particularly affecting the scapular stabilizing muscles [9, 10].

Dynamic balance control is contingent upon the coordinated function of body joints and the sensory information received from the receptors surrounding these joints [11]. A system is considered stable when its movements remain closely aligned with the desired trajectory despite external disturbances, ensuring that its center of mass remains within the base of support [12]. Impaired postural control can result in diminished stability, asymmetrical weight distribution, compromised weight transfer capabilities, and ineffective balance responses, all of which heighten an individual's susceptibility to falls [13]. Spinal deformities significantly affect postural control and disrupt balance [14]. Javani (2017) conducted a study to explore the relationship between badminton skill techniques, specifically the smash and clear, and shoulder drop syndrome among badminton athletes in Tabriz [6]. The results indicated a negative and significant correlation between the quality and accuracy of the clear and smash techniques and the incidence of shoulder drop syndrome [6]. Similarly, Zandi et al. (2014) reported that female university volleyball players with unstable shoulders exhibited lower functional stability compared to their healthy counterparts [15]. Research by Żurawski et al. (2020) evaluated the association between postural control and sagittal spinal curvature. Their findings revealed a significant relationship between spinal morphology—specifically kyphosis and lordosis—and the maximum displacement of the center of pressure under static and gait conditions [16]. Despite these insights, there is a paucity of evidence regarding the outcomes of stability tests assessing upper quarter function and balance in individuals with uneven shoulders. A review of the existing literature indicates a pressing need for further investigation in this area, particularly given the prevalence of uneven shoulders. The primary aim of this research is to examine the upper quarter function of both dominant and non-dominant sides, as well as the static and dynamic balance in individuals with and without uneven shoulders.

MATERIAL AND METHODS

This study employs a causal-comparative design. Data were collected from subjects who were selected using a non-random sampling method in the field. The statistical population comprised young female students, aged 20 to 30 years, residing in Sanandaj city, both with and without uneven shoulders. Initially, an uneven shoulder assessment was conducted on 80 students. Among these, 22 individuals were identified as having uneven shoulders, characterized by an angle greater than 2 degrees between the line connecting the two acromions and the horizontal reference line [17, 18]. Using G-Power software, it was determined that a minimum sample size of 36 individuals is required to achieve an effect size of 0.80, with a significance level of 0.05 and a statistical power of 0.80 for the two groups. Consequently, 40 participants were purposefully selected, comprising 20 individuals with uneven shoulders and 20 individuals with even shoulders. Participants were included based on the following criteria: age between 20 and 30 years; symptoms indicative of uneven shoulders (for the group with uneven shoulders); absence of signs of uneven shoulders (for the group without uneven shoulders); no menstrual period at the time of assessment; no history of shoulder surgery; no neurological disorders; no history of accidents resulting in fractures of the upper quarter or spine; completion of a consent form to participate in the study; absence of other significant medical conditions. Participants were excluded based on the following conditions: diagnosis of scoliosis; history of surgical interventions; onset of pain or discomfort during measurements following traumatic lesions; dislocation of the glenohumeral or acromioclavicular joints; history of surgery, fractures, or previous instability; additionally, individuals who expressed a reluctance to continue participation or who developed health issues after entering the study were excluded.

Uneven Shoulder Measurement

The assessment of uneven shoulders was conducted from an anterior perspective using a digital camera, with the desired angles analyzed via AutoCAD 2020 software. Participants were instructed to stand on a designated mark, keeping their arms relaxed alongside their bodies and their legs positioned together [19]. They were further directed to maintain a forward gaze and remain motionless during the evaluation. The examiner marked the acromion processes of the participants' shoulders with a reference point and captured photographs using a digital camera from a predetermined distance. The camera utilized for this assessment was a Canon PowerShot SX230 HS, manufactured in Japan, positioned 265 cm away from the subject at shoulder height. In the analysis of shoulder asymmetry, the angle between the line connecting the two acromion processes and the horizontal reference line established by the marker was measured using AutoCAD 2020. Additionally, photo analysis software was employed to detect the height differential between the participants' shoulders [19, 20]. Participants were classified into the group with uneven shoulders if the angle formed between the line connecting the two acromions and the transverse line of the shoulders exceeded two degrees (see Figure 1) [1, 10, 17, 18].

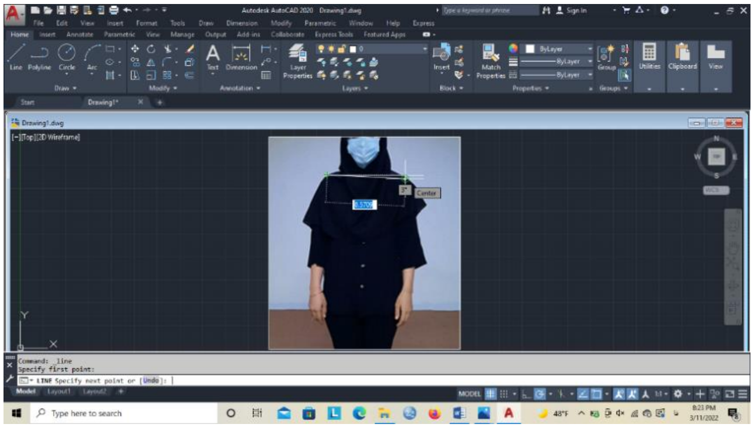

Figure 1. Measurement of Uneven Shoulder Using AutoCAD 2020 Software

Measure Upper Quarter Function

The Upper Quarter Y Balance Test (YBT-UQ) was employed to assess upper quarter stability and function. The test has demonstrated excellent reliability, with inter-rater reliability reported at an Intraclass Correlation Coefficient (ICC) ranging from 0.80 to 0.99, and intra-rater reliability achieving an ICC of 1.00 [21]. To conduct the YBT-UQ, three graduated strips were marked on the ground. The angles formed between the medial direction and the superolateral and inferolateral directions were set at 135 degrees, while the angle between the superolateral and inferolateral directions was established at 90 degrees [22]. Participants were instructed to place one hand at the center for support and assume a push-up position. Subsequently, they reached with the opposite hand in the specified directions, performing the reaching motion before returning to the initial test position. The sequence of reaching involved first extending the hand in the medial direction, followed by the superolateral direction, and finally the inferolateral direction, after which the participant returned to the starting position. The functional score for the test was calculated by averaging the reach distances achieved in each of the three directions. This average was then divided by the actual length of the hand, defined as the distance from the acromion process to the tip of the longest finger, measured while the shoulder was abducted to 90 degrees with the elbow, wrist, and fingers extended (in centimeters). The resulting value was multiplied by 100 to express the reach distance as a percentage of hand length. The total score for the YBT-UQ was derived from the cumulative scores across all three directional reaches. All testing procedures were conducted for both the dominant and non-dominant sides of the participants (see Figure 2) [15, 21-23].

Figure 2. Measurement of Upper Quarter Function Using the Y Balance Test

Measure of Static and Dynamic Balance

Static Balance:

The Stork Balance Test was utilized to assess static balance. This test has demonstrated good inter-rater reliability, with correlation coefficients ranging from 87% to 99%. However, it exhibits variable test-retest reliability, with coefficients ranging from 59% to 100%. To measure static balance, participants were instructed to place their hands on their waists while positioning the sole of the non-supporting foot in front of the medial aspect of the supporting foot. Subjects were required to maintain this posture for as long as possible while standing on the supporting leg (see Figure 3) [24-26]. The Stork Balance Test has been reported to possess 99% validity and 87% reliability, values that are considered acceptable for clinical and research applications [24].

Figure 3. Measurement of Static Balance Using the Stork Test

Dynamic Balance:

The Y Balance Test (YBT) was employed to assess dynamic balance. This assessment tool is derived from the Star Balance Test, which Gribble has identified as a valid measurement instrument. The inter-rater reliability coefficients for various directions range from 0.85 to 0.91, while intra-rater reliability coefficients range from 0.99 to 1.00. Additionally, Plisky reported total score reliability coefficients of 0.91 and 0.99. In the Y Balance Test, three directions—anterior, posteromedial, and posterolateral—are arranged in a Y formation, with angles of 135 degrees and 90 degrees between the arms. Participants were allowed to practice the test three times to familiarize themselves with the procedure. If the participant's right leg was dominant, the test was performed in a counterclockwise direction; conversely, if the left leg was dominant, the test was executed in a clockwise direction [26]. To perform the test, the participant stands at the center of the designated directions, balancing on one leg while reaching with the opposite leg. The individual then returns to the starting position with both feet on the ground. The subject is instructed to touch the farthest possible point with the toe in any of the specified directions. The distance from the contact point to the center is recorded as the reach distance, measured in centimeters. The dynamic balance score is calculated by averaging the reach distances from the three trials in each direction, dividing this average by the actual leg length, and multiplying by 100 to express the reach distance as a percentage of foot length. The total score for the test is obtained by summing the reach distances across all three directions (see Figure 4) [26-28].

Figure 4. Measurement of Dynamic Balance Using the Y Balance Test

Statistical Analysis

Descriptive and inferential statistics were employed to analyze the collected data. Descriptive statistics included the calculation of the mean and standard deviation. To compare functional performance and balance between the groups with even and uneven shoulders, an independent t-test was utilized; in cases where the data distribution did not meet the assumptions of normality, the Mann-Whitney U test was applied. The normality of the data distribution was assessed using the Wilk-Shapiro test. All statistical analyses were conducted at a significance level of $p < 0.05$, employing SPSS version 22 software for the computations.

RESULTS

Subject's individual characteristics

The individual characteristics of the participants, including age, height, weight, and body mass index (BMI), are presented in Table 1. A total of 40 subjects were included in this study, divided equally into two groups: those with even shoulders (n = 20) and those with uneven shoulders (n = 20). Statistical analysis revealed no significant differences in the characteristics between the two groups ($p > 0.05$).

Table 1. Mean and Standard Deviation of the Subjects' Individual Characteristics (n=40)

	Even Shoulder Group (n=20)	**Uneven Shoulder Group (n=20)**	**Total (n=40)**	
Variable	M ± S.D	M ± S.D	M ± S.D	P
Age (years)	26.80 ± 2.35	26.50 ± 1.70	26.65 ± 2.03	0.655
Height (cm)	159.77 ± 7.49	164.17 ± 6.72	161.97 ± 7.37	0.058
Weight (kg)	58.10 ± 9.32	60.27 ± 11.84	59.18 ± 10.58	0.523
BMI (kg/m²)	22.85 ± 3.67	22.29 ± 3.83	22.57 ± 3.71	0.640

Significance Level: $P<0.05$.

The results of the Shapiro-Wilk test for the normality of data distribution are presented in Table 2. For variables that demonstrated normal distribution ($p > 0.05$), parametric tests, specifically independent t-tests, were employed. Conversely, for variables that did not conform to a normal distribution ($p < 0.05$), non-parametric tests, namely the Mann-Whitney U tests, were utilized.

Table 2. Shapiro-Wilk Test Results for Normality of Data Distribution

Variable	**Even Shoulder Group**		**Uneven Shoulder Group**	
	Statistic	Sig	Statistic	Sig
Total Function (percentage of arm length)	0.915	0.078	0.929	0.149
Medial Functional (percentage of arm length)	0.827	0.002	0.883	0.020
Superolateral Functional (percentage of arm length)	0.936	0.201	0.888	0.024
Inferolateral Functional (percentage of arm length)	0.840	0.004	0.825	0.002

Static Balance (seconds)	0.750	0.000	0.835	0.003
Total Y Balance (percentage of leg length)	0.910	0.065	0.823	0.002
Anterior Balance (percentage of leg length)	0.910	0.063	0.957	0.485
Posteromedial Balance (percentage of leg length)	0.820	0.002	0.940	0.235
Posterolateral Balance (percentage of leg length)	0.939	0.233	0.804	0.001

Significance Level: P<0.05.

The results comparing the differences in upper quarter function and balance between the two groups are detailed in Tables 3 and 4. The independent t-test indicated no significant difference in the average total function of the upper quarter between the dominant and non-dominant sides in individuals with uneven shoulders compared to those with even shoulders ($p = 0.620$). Moreover, the Mann-Whitney U test revealed no significant differences in the average functional disparities for the medial and superolateral directions between the dominant and non-dominant sides in both groups ($p = 0.394$ and $p = 0.330$, respectively). However, a significant difference was identified in the average functional difference in the inferolateral direction between the dominant and non-dominant sides of individuals with and without uneven shoulders ($p = 0.048$). Specifically, the group with uneven shoulders exhibited a greater functional difference in the inferolateral direction on both the dominant and non-dominant sides compared to the group with even shoulders, resulting in lower overall functional performance.

The Mann-Whitney U test revealed a significant difference in the average static balance between the dominant and non-dominant legs of individuals with and without uneven shoulders ($p = 0.044$). The group with uneven shoulders exhibited a greater disparity in static balance compared to the group with even shoulders, indicating that static balance is influenced by the presence of uneven shoulders.

No significant differences were observed in the average total balance scores, as well as in the balance measurements for the posteromedial and posterolateral directions, between the dominant and non-dominant legs of individuals with and without uneven shoulders ($p = 0.372$, $p = 0.989$, and $p = 0.229$, respectively). Furthermore, the results of the independent t-test, as presented in Table 3, confirmed that there were no significant differences in the average balance differences in the anterior direction between the dominant and non-dominant legs of the two groups ($p = 0.632$).

Table 3. Independent T-Test Results Comparing Upper Quarter Function and Balance of the Dominant and Non-Dominant Side between Groups (n=40)

Variable	Levene's Test for Equality of Variances		t-Test for Equality of Means			
	F	Sig.	t	Mean Difference	df	Sig.(2-tailed)
Total Function (percentage of arm length)	1.095	0.302	-0.501	-0.55	38	0.620
Anterior Balance (percentage of leg length)	0.015	0.903	-0.483	-0.600	38	0.632

Significance Level: P<0.05.

Table 4. U-Mann-Whitney Test Results Comparing Upper Quarter Function and Balance of the Dominant and Non-Dominant Side Between Groups (n=40)

Variable	Number		Average Rank		Z	Sig.(2-tailed)
	Even Shoulder	Uneven Shoulder	Even Shoulder	Uneven Shoulder		
Medial Functional (percentage of arm length)	20	20	18.93	22.08	-0.853	0.394
Superolateral Functional (percentage of arm length)	20	20	18.70	22.30	-0.974	0.330
Inferolateral Functional (percentage of arm length)	20	20	16.85	24.15	-1.975	0.048
Static Balance (seconds)	20	20	16.78	24.23	-2.016	0.044

Total Y Balance (percentage of leg length)	20	20	22.15	18.85	-0.893	0.372
Posteromedial Balance (percentage of leg length)	20	20	20.48	20.53	-0.014	0.989
Posterolateral Balance (percentage of leg length)	20	20	22.73	18.28	-1.204	0.229

Significance Level: P<0.05.

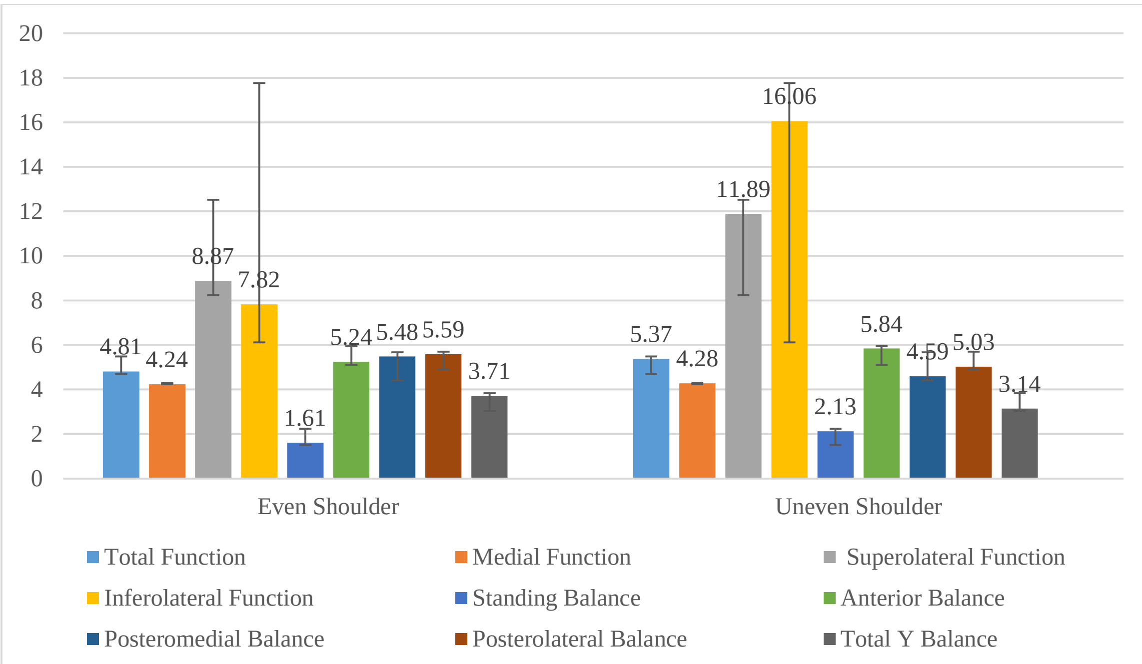

Diagram 1. Difference in the Average Scores of Upper Quarter Function and Static and Dynamic Balance of the Dominant and Non-Dominant Side Between Even Shoulder and Uneven Shoulder Groups

DISCUSSION

The results of the current research indicate a significant difference in inferolateral function between the dominant and non-dominant sides of individuals with and without uneven shoulders. An assessment of young girls revealed that 27.5% exhibited uneven shoulders, with 75% of these individuals presenting a prolapsing dominant shoulder. This condition may not solely arise from injury or trauma; it can also be attributed to overuse and alterations in muscle length. Muscle damage may disrupt the feed-forward and feedback mechanisms of muscle spindle receptors, impairing coordinated contraction patterns and resulting in functional instability of the joint. Consequently, shoulder stability is compromised during the Y Balance Test for Upper Quarter (YBT-UQ) [29]. The findings are consistent with those of previous studies, including those by Javani (2017), Hazar et al. (2014), Abshenas et al. (2020), Beyranvand et al. (2017), and Zandi et al. (2014). Specifically, Javani (2017) identified a negative and significant relationship between the quality and accuracy of skills (such as clear and smash skills) in badminton athletes and the presence of dropped shoulder syndrome [6]. Effective posture, movement, stability, muscle function, and motor control of the shoulder are significantly influenced by scapular function. Thus, dysfunction in any shoulder muscle may lead to abnormal positioning or movement disorders, ultimately resulting in shoulder dysfunction [30]. Hazar et al. (2014) examined the results of the YBT-UQ test in two groups of 15 individuals, one with shoulder impingement syndrome and the other without, and found results that align with those of the present study, particularly in the medial and inferolateral directions [31]. Additionally, the findings of Abshenas et al. (2020) indicated a significant difference between symmetric and asymmetric scapula groups in the normalized scores for each direction and the combined score for each hand [32]. Asymmetry of the scapular bones, resulting from positional disorders, can diminish stability and optimal performance, serving as a predictor of shoulder injury. Beyranvand et al. (2017) reported that specific musculoskeletal abnormalities, such as rounded shoulders, can impair the functional stability of shoulder girdle muscles by altering their activity, which subsequently leads to decreased scores on the Upper Quarter Y Balance Test (UQYBT) [33]. Furthermore, Zandi et al. (2014) found that functional stability in the unstable shoulders of female university volleyball players was lower compared to that of healthy subjects [15]. Daneshjoo and colleagues demonstrated a significant negative relationship between the total score of the Functional Movement Test and the incidence of scoliosis and uneven shoulders among athletes with a history of injuries [34]. Proper positioning of the scapula is crucial for shoulder joint function, facilitating accurate targeting in upper quarter activities and optimal performance in daily tasks. The majority of the shoulder's range of motion is attributed to movements of the scapulothoracic joint [30]. Haji Hosseini et al. (2018) observed that functional stability in the shoulders of volleyball players with scapular dyskinesia was lower than that of healthy subjects in the superior-lateral, medial, and combined directions [23]. Although this research indicated a decrease in function, the differences in directional stability may be attributed to variations in the types of complications present among the subjects. The normal positioning of the scapula significantly influences the function of the shoulder girdle, a relationship that is contingent upon at least two factors: during arm movements, the scapula must provide a stable base for the glenohumeral joint while maintaining mobility relative to the arm's position throughout its range of motion [35]. If the scapula fails to stabilize effectively, the rhythm of scapular movements is disrupted, resulting in compromised shoulder joint function and diminished performance of the neuromuscular system [30].

The results of this research indicate a significant difference in static balance between the dominant and non-dominant legs in individuals with and without uneven shoulders. While maintaining balance may appear to be a straightforward motor skill, it presents considerable challenges for individuals with musculoskeletal dysfunction [36]. Even minor deviations from an upright position necessitate corrective torque from the lower body to counteract instability. The standing position of the trunk is inherently unstable, and any disturbances within this system can adversely affect balance [34]. The findings align with those of several studies, including those by Khalaghi et al. (2022), Lee et al. (2016), Salehi et al. (2012), Larni et al. (2023), Zurawski et al. (2020), Leteneur et al. (2021), and Norsteh et al. (2013). Khalaghi et al. (2022) demonstrated a significant relationship between left and right shoulder sagging and static balance in boys aged 7 to 10 years [37]. Similarly, Lee et al. (2016) and Salehi et al. (2012) concluded that forward head posture negatively impacts static postural control, leading to impaired motor control [38, 39]. Furthermore, Żurawski et al. (2020) identified a relationship between spinal shape—specifically kyphosis and lordosis—and maximum center of pressure displacement under both static and gait conditions [16]. The current research corroborates these findings, suggesting that the relationship between spinal abnormalities and balance may arise from these conditions imposing movement restrictions on the spine. Such restrictions can alter the positioning of the vertebrae and the interactions between agonist and antagonist muscles. Consequently, the center of mass shifts forward and downward, modifying the initial position of the head relative to the spine. This alteration may lead the vestibular system, a critical component of balance control, to transmit inaccurate information to the central nervous system, potentially resulting in increased instability during balance maintenance [40, 41]. The study conducted by Larni et al. (2023) demonstrates that adolescents with idiopathic scoliosis exhibit greater postural instability compared to their healthy counterparts [42]. Similarly, the findings of Letnoor et al. (2021) indicated that, under both sway conditions, the center of pressure excursion parameters and altered balance states for the scoliosis group were, on average, 28% higher than those of able-bodied girls [43]. According to reaction theory, the progression of scoliosis can result in the transfer of abnormalities to both distal and proximal body segments. Secondary complications of scoliosis often include deformities of the chest, uneven shoulders, and lateral trunk deviations. In individuals with scoliosis, biomechanical alterations in the spine can affect the positioning of the center of gravity relative to the support base, thereby diminishing balance and movement control [40]. Norasteh et al. (2013) reported a significant negative relationship between kyphosis and static balance; however, they found no significant difference between lordosis and static balance, which contrasts with the findings of the current study [14]. This discrepancy may be attributed to the sample in Norasteh et al.'s research, which did not include individuals with uneven shoulders but rather focused on those with spinal abnormalities. In cases of uneven shoulders, the positioning of the scapula and shoulder complex undergoes alterations, prompting the entire motor system to compensate for localized instability by modifying movement patterns. It is important to note that there is no singular movement pattern; for instance, the stabilizing muscles of the trunk are activated prior to movements of either the upper or lower extremities. Consequently, it is plausible that shoulder pathology is related to trunk stability, or conversely, that trunk pathology influences shoulder movement [41]. Therefore, variations in shoulder positioning and pathology among individuals with uneven shoulders may contribute to differences in balance when compared to those with symmetrical shoulder alignment.

The findings of this research indicate that there is no significant difference in the dynamic balance of the dominant and non-dominant legs among individuals with and without uneven shoulders across all directions. Body balance is maintained through the integrated functions of the visual, vestibular, and somatosensory systems. Any deficiency in one of these systems can be compensated for by the others. In our study, we did not exclude the potential involvement of some or all of these systems [16]. Sedaghati et al. (2019) observed a weak yet significant relationship between postural control and certain anthropometric and balance indices, which aligns with the findings of the present research. This suggests that anthropometric and postural indicators, in isolation, may not significantly influence the postural control of active and healthy male college students [44]. Norasteh et al. (2013) reported a significant negative relationship between kyphotic abnormalities and dynamic balance, while finding no significant difference between lordosis and dynamic balance, which is consistent with the current study [14]. The lack of significance in dynamic balance observed in this research may be attributed to the compensatory fluctuations exhibited by individuals during the testing process to maintain balance. Furthermore, the study conducted by Khaleghi et al. (2022) indicated a relationship between right shoulder prolapse and dynamic balance in students aged 7 to 10 years [37]. Additionally, findings from studies by

Anbarian et al. (2022), Khayati (2022), Abbasi (2022), and Eshraghi (2009) demonstrated that although static balance is adversely affected by changes in the natural alignment of the spine, such alterations severely diminish the ability of individuals with spinal deformities, forward head posture, and hyperkyphosis to control dynamic balance [45-48]. A critical distinction between the results of this research and those of the aforementioned studies may reside in the specific types of abnormalities examined, as well as the measurement tools and methodologies employed.

CONCLUSION

The findings of this study reveal that the differences observed between individuals with uneven shoulders and those with symmetrical shoulder alignment did not significantly influence dynamic balance. However, these differences were found to impact upper quarter function and static balance. Notably, the variations in inferolateral function and static balance between the dominant and non-dominant sides were significantly more pronounced in individuals with uneven shoulders than in those with even shoulders. Analysis of average scores indicated that individuals with uneven shoulders demonstrated diminished inferolateral function and static balance. This study concludes that abnormal postural alignment alters the typical positioning of the shoulders, likely leading to a restricted range of motion. Such changes contribute to functional impairments in the upper quarter, which were especially evident in tests comparing the dominant and non-dominant sides of individuals with uneven shoulders. Additionally, muscle imbalances associated with uneven shoulders, along with a lateral shift in the body's center of gravity, result in increased instability. When the symmetry of muscles and the alignment of joints deviate from their optimal configuration, the proprioceptive system becomes disrupted, leading to a reduction in balance.

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Conflict of Interest: The authors declare that there is no conflict of interest in the present study and that the present study was carried out at the expense of the authors.

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REFERENCES

1. Yari A, Mirnasuri R, Hemati F. Assessment of uneven shoulder and its related factors among high school Boys aged 15 -18 years in Ilam city. journal of ilam university of medical sciences. 2014;22(2):125-31.

2. Rahmani D. Evaluation of shoulder girdle muscles biomechanical characteristics in adolescent girls with asymmetric (dropped) shoulder: Bu-Ali Sina University; 2011.

3. Esmaeilvandi R, Shokri B, Babadi M, Khodadadi M. Impact of 10 weeks of exercises of the American National Academy of Sports Medicine (NASM) On upper quadrant syndrome (kyphosis, forward head, unequal shoulder) Female students 15 to 18 years old. Journal of sport science and Educational Applied Researches without borders. 2018;2(7):61-.

4. Rasouli Saray M. Comparison of upper body structural snip and its relationship with some anthropometric dimensions in young volleyball athletes, handball players, basketball players and non-athletes: Public - Ministry of Science, Research, and Technology - University of Guilan - Faculty of Physical Education and Sport Sciences; 2016.

5. Mahmoodi F, Sahebozamani M, Sharifian I, Sharifi. S. The effect of corrective exercises on the pain and degree of uneven shoulder deformity. Journal for Research in Sport Rehabilitation. 2014;1(2):1-9.

6. Javani H, Aqdasi Mt. The relationship between accuracy and quality of dice skill and unequal shoulder complications in badminton athletes in Tabriz. 2nd National Conference on Achievements in Sport Science and Health of Ahvaz2018.

7. Sobush DG, Simoneau GG, Dietz KE, Levene JA, Grossman RE, Smith WB. The Lennie Test for Measuring Scapular Position in Healthy Young Adult Females: A Reliability and Validity Study. Journal of orthopaedic and sports physical therapy : the official publ of the Orthopaedic and Sports Medicine Section of the American Physical Therapy Association. 1996;23(1):39-50.

8. MohammadPanah S. The relationship between range of motion, strength, pain and shoulder disability in athletes with and without history of injuries. Ministry of Science, Research and Technology: University of Guilan; 2012.

9. Heshmati S, Daneshmandi H, Hosseini sH. Comparing the Electrical Activity of Serratus Anterior and Upper Trapezius Muscles and the Scapular Symmetry in Three Fields of Shooting. Journal of Sport Biomechanics. 2018;3(4):39-49.

10. Daneshjoo A, Hosseini T. Strength and Range of Motion of Internal and External Rotator Muscles in Volleyball Players With and Without Uneven Shoulders. Journal of Sport Biomechanics. 2019;5(3):134-45.

11. Naderi S, Naserpour H, Mohammadi Pour F, Seyfaddini A. A Comparative Study on the Effects of Functional and Non-Functional Fatigue Protocols on Dynamic Balance of Amateur Basketball Players. Journal of Sport Biomechanics. 2020;5(3):168-77.

12. Hosseini R, Norasteh AA, Nemati N. Comparing the Balance of Male Athletes Aged 11-14 Years With and Without Genu Varum. Journal of Sport Biomechanics. 2019;4(4):54-65.

13. Baharlouei H, Shafizadegan Z, Khoshavi O, Fereshtenejad N, Garmabi Z. omparison of the Short Term Effects of Kinesiotaping and Muscle Stretching of Gastrocnemius on Postural Balance in Young Adults. The Scientific Journal of Rehabilitation Medicine. 2019:1-11.

14. Norasteh AA, Hosseini R, Daneshmandi H, Shah Heidari S. Balance Assessment in Students with Hyperkyphosis and Hyperlordosis. Journal of Exercise Science and Medicine. 2014;6(12):57-71.

15. Zandi Sh, Rajabi R, Minoonejad H, Bandpei AM. Upper quarter functional stability in female volleyball players with and without anterior shoulder instability, with consideration of arm dominance. Archives of rehabilitation (journal of rehabilitation). 2016;16(4):-. (in persian)

16. Żurawski A, Kiebzak WP, Kowalski IM, Śliwiński G, Śliwiński Z. Evaluation of the association between postural control and sagittal curvature of the spine. PLoS One. 2020;15(10):e0241228.

17. Raine S, Twomey LT. Posture of the head, shoulders and thoracic spine in comfortable erect standing. The Australian journal of physiotherapy. 1994;40 1:25-32.

18. Grabara M, Hadzik A, editors. Postural variables in girls practicing volleyball2009.

19. Iranpour M, shamsi majalan A, Hossin Hs. The comparison of head, shoulder, and spine position in Iranian Mountaineering and rock climbing. Journal for Research in Sport Rehabilitation. 2020;7(14):13-24.

20. Thigpen CA, Padua DA, Michener LA, Guskiewicz K, Giuliani C, Keener JD, et al. Head and shoulder posture affect scapular mechanics and muscle activity in overhead tasks. Journal of Electromyography and Kinesiology. 2010;20(4):701-9.

21. Gorman PP, Butler RJ, Plisky PJ, Kiesel KB. Upper Quarter Y Balance Test: Reliability and Performance Comparison Between Genders in Active Adults. The Journal of Strength & Conditioning Research. 2012;26(11):3043-8.

22. Tabasi S R. Comparison of the balance and proprioception in elite male wrestlers freestyle and greco: Department of physical Educationsand Sport Science Specialization: Sport Injury and Corrective Exercises 2017.

23. Hajihosseini E, Norasteh A A, Daneshmandi H. Comparison of Isometric Strength and Functional Stability of Shoulder Girdle Muscles in Volleyball Women Players with and without Scapular Dyskinesia. Journal of Health Promotion Management. 2019;8(5):24-32.

24. Kazemzadeh H, Ebrahimi Atri A, Hashemi Javaheri S A A, Susan k. Comparison of dynamic and static balance in superior and non-superior feet of female students with flexible flat foot abnormalities in the first high school in North Khorasan province. 4th National Student Conference on Sport Sciences, Shahid Beheshti University2015.

25. Bahram Mohammad E, Pouroughar MJ. The Effect of 12 weeks of Selected Physical Activity on Static and Dynamic Balance in Children Suffering from Hyperactivity Disorder / Attention Deficit. Research on Biosciences and Physical Actiuity. 2015;2(3):9-18.

26. Alamouti G, Letafatka A. Effect of Movement Pattern Correction on Performance, Balance, and Proprioception in Active Females Prone to Anterior Cruciate Ligament Injury. Scientific journal of rehabilitation medicine. 2020;9(1 #a00988):-. (in persian)

27. Jalili S, Nasab E. Effect of Six Weeks of CX WORX Training on Core Muscles Endurance, Balance, and Upper Extremity Function in Athletic Girls with Trunk Deficiency. Scientific journal of rehabilitation medicine. 2020;8(4 #a001002)

28. Younesi Ramdani Anahita, Alizadeh Mohammad Hossein, Minoonejad Hooman Ehsa. Comparison of the static and dynamic balance of female and male methadone-maintained opioid dependents with healthy subjects. Scientific journal of rehabilitation medicine. 2016;4(4):-.

29. Javdaneh N, Letafat kar A, Kamrani Faraz N, Shokri B. Investigation Stability of Upper Limb Function in Handballers with Glenohumeral Internal Rotation Deficit. Journal of Sport Biomechanics. 2017;3(2):51-9.

30. Gholizadeh R, Mohammad Ali Nasab Firouzjah E. The Effect of a Period of Scapular Stabilization Exercises on Shoulder Joint Proprioception, Function of the Upper Extremity and Scapulahemural Rhythm of Volleyball Players with Scapular Dyskinesia. Journal of Paramedical Sciences & Rehabilitation. 2023;12(1):75-87.

31. Zeynep H, Naime U, Inci Y. Upper Quarter Y-Balance Test Score of Patients with Shoulder Impingement Syndrome. Orthopaedic Journal of Sports Medicine. 2014;2(11_suppl3):2325967114S00275.

32. Abshenas E, Karimi Zadeh Ardakani M, Takhtaei M, Naderi Beni M. Comparison of Functional Stability of Shoulder Girdle Between Individuals With Symmetric and Asymmetric Scapula. Physical Treatments - Specific Physical Therapy. 2020;10(2):99-106.

33. Beyranvand R, Mirnasouri R, Mollahoseini S, Mostofee S. The functional stability of the upper limbs in healthy and rounded shoulder gymnasts. Science of Gymnastics Journal. 2017;9:279-90.

34. Daneshjoo A, Hoseini B, Ghasemi F. Investigating the Relationship Between FMS Test Scores and the Occurrence of Injury in Elite Female Shooter. Journal of Sport Biomechanics. 2022;8(1):2-14.

35. Ghasemi V, Ahmadi A, Dashti C, Savor-Elya M. Evaluation of kyphosis angle changes, scapular position and upper extremity range of motion after 8 weeks of corrective exercises in kyphotic students. Journal of Applied Exercise Physiology. 2017:-.

36. Ahmadi H, Yalfani A, Gandomi F. Effect of Eight Weeks of Corrective Exercises Carried Out in Water on Static and Semi Dynamic Balance on Students with Upper Crossed Syndrome)Janda approach. The Scientific Journal of Rehabilitation Medicine. 2020;9(3):286-96.

37. Khalaghi K, Rajabi R, Minoonejad H, Shojaei M. Relationship Between Posture and Balance in 7 to 10 Year Old Students. Journal of Paramedical Sciences & Rehabilitation. 2022;10(4):39-53.

38. Lee JH. Effects of forward head posture on static and dynamic balance control. J Phys Ther Sci. 2016;28(1):274-7.

39. Salehi S, Hedayati R, Bakhtiyari AH, Ghorbani R, Sanjari MA, Far AA. The relationship between forward head deviation and balance parameters in young females. Koomesh. 2012;14(1):76-85.

40. Gheitasi M, Pasandideh Z, Lordgouie M, Samavi M, Allafan N. Effect of Eight -Weeks Pilates Exercises on Non-Structural Scoliosis Deformity and Improve Balance in Female Students. Journal of Applied Exercise Physiology. 2018;13(26):78-90.

41. page p, Frank CC, Lardner R. Assessment and Treatment of Muscle Imbalance: The Janda Approach hatmi; 2015. 18-30 p.

42. Larni Y, Mohsenifar H, Ghandhari H, Salehi R. Investigation of Static Balance Differences between Adolescents with Idiopathic Scoliosis and Healthy Age-matched Adolescents: A Cross-sectional Study. Journal of Iranian Medical Council. 2023.

43. Leteneur S, Crémoux S, Allard P, Simoneau-Buessinger É, Stylianides G, Barbier F. Untreated adolescent idiopathic scoliotic girls display altered balance modalities during self-paced voluntary body sways compared to able-bodied girls. J Bodyw Mov Ther. 2021;27:1-8.

44. Sedaghati P, Zolghadr H, Daneshmandi H. Postural Control Status in Relation to Anthropometric and Postural Indices of Active People. Journal of Sport Biomechanics. 2019;5(1):50-61.

45. Anbarian M, Mokhtari M, Zareie P, Yalfani A. A Comparison of Postural Control Characteristics between Subjects with Kyphosis and Controls. Avicenna Journal of Clinical Medicine. 2010;16(4):53-60.

46. Khayati F, Saremi M, Firoozeh M, Kavousi A. Evaluation of the relationship between forward head posture with static and dynamic postural stability impairment among dentists. Razi Journal of Medical Sciences. 2016;23(4):1-11.

47. Abbasi H, Alizadeh MH, Rajabi R, Mohammadi F. Comparison of Static and Dynamic Postural Stability Between Individuals With and Without Forward Head Posture. Physical Treatments - Specific Physical Therapy. 2020;10(3):127-34.

48. Eshraghi E, Maroufi N, Sanjari MA, Keyhani MR, Saeedi H. Static & dynamic balance of schoolgirls with hyperkyphosis. Scoliosis. 2009;4.

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«مقاله پژوهشی»

مقایسه عملکرد اندام فوقانی و تعادل در بین دختران دانشجو با و بدون شانه نابرابر

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چکیده

هدف: شانه نابرابر یکی از شایع‌ترین اختلالات اسکلتی _ عضلانی است. پژوهش حاضر باهدف مقایسه میزان اختلاف عملکرد اندام فوقانی سمت برتر و غیر برتر و تعادل ایستا و پویا بین افراد با و بدون شانه نابرابر انجام شد.

روش شناسی: در این مطالعه توصیفی مقایسه‌ای، ۲۰ دانشجوی دختر مبتلابه شانه نابرابر و ۲۰ دانشجوی با شانه های نرمال ۲۰ تا ۳۰ سال به‌صورت هدفمند انتخاب و باهم مقایسه شدند. برای ارزیابی شانه نابرابر از تصویربرداری توسط دوربین دیجیتال و تحلیل آن با نرم‌افزار اتوکد استفاده شد. همچنین برای اندازه‌گیری عملکرد اندام فوقانی از آزمون عملکرد وای اندام فوقانی و برای ارزیابی تعادل ایستا و پویا به ترتیب از آزمون لک‌لک و آزمون عملکرد وای استفاده شد. داده‌ها در نرم‌افزار اس پی اس اس تحلیل شد.

نتایج: نتایج این مطالعه نشان داد که در اختلاف میانگین عملکرد اندام فوقانی در جهت خارجی تحتانی (p=۰/۰۴۸) و تعادل ایستا (p=۰/۰۴۴) بین سمت برتر و غیر برتر در افراد با و بدون شانه نابرابر تفاوت معنی‌داری وجود دارد و گروه شانه نابرابر دارای نمرات پایین‌تری نسبت به گروه با شانه های نرمال بود؛ اما در تعادل پویا تفاوت معناداری یافت نشد (p=۰/۳۷۲).

نتیجه گیری: به‌طورکلی می‌توان نتیجه گرفت که اختلاف میانگین در عملکرد اندام فوقانی در جهت خارجی تحتانی و تعادل ایستا بین سمت برتر و غیر برتر افراد با شانه نابرابر نسبت به افراد با شانه های نرمال بیشتر است. راستای ستون مهره‌ها و وضعیت طبیعی کتف روی عملکرد کمربند شانه‌ای تأثیر می‌گذارند. بر همین اساس پیشنهاد می‌شود عملکرد اندام فوقانی و تحتانی در افراد شانه نابرابر بررسی شود زیرا علیرغم این نتایج، بررسی های بیشتری نیاز است.

استناد به این مقاله:

واژه‌های کلیدی

تعادل ایستا، تعادل پویا، شانه نابرابر، عملکرد اندام فوقانی

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