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A Study on the Association Between Core Strength and Shoulder Pain in Badminton Players

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ABSTRACT

Background: The prevalence of dominant shoulder pain was 57% in badminton players. The coordinated movement of the shoulder helps in the proximal to distal activation of the kinetic chain. Overhead motion in badminton players requires coordinated movement from feet to hand, which is activated by core muscles.
Objectives: To find out the association between shoulder pain and core strength.
Methodology: sixty-two badminton players were randomly included in the study. Demographic Data (name, age, gender) were considered. SPADI was used to assess shoulder pain and core strength was assessed by Dynamic abdominal endurance (DET) and isometric Flexion test (IFT), Biering- Sorensen fatigue test (BSFT), Dynamic horizontal right side support test (DHRS) and Dynamic horizontal left side support test (DHLS). All participants completed the entire study duration and treatment parameters are measured before and after the study.
Results: Results show a moderate association between shoulder pain and core strength using SPAI and IFT (phi Cramer's V = - 0.229, whereas a strong association was found between shoulder pain and DET (phi Cramer's V = -0.418), BSFT (phi Cramer's V = -0.306), DHRS (phi Cramer's V = -0.324), and DHLS (phi Cramer's V = -0.376).
Conclusion: This study concludes that there is a strong association between shoulder pain and core muscles strength in badminton players.

KEY WORDS: shoulder pain, core strength, SPADI, badminton players.

INTRODUCTION

Badminton is a racket sport that is played throughout the world[1]. Badminton world federation estimated that about 150 million people play the game worldwide and more than 2000 players participated in international competitions[2]. This sport requires jumps, lunges, quick changes in direction and rapid arm movements from a wide variety of postural positions[3]. There are many factors influencing the game like technique, tactics, physiological, psychological, strength, and injury[4].

Studies suggest that 57% of the players had previous or present dominant shoulder pain. Previous shoulder pain was reported by 37% of the players and ongoing shoulder pain by 20% of the players. There were no significant differences in the prevalence of shoulder pain between men and women[5].Another study suggests that overhead throwing motion requires coordination from the feet to the hand in a single kinetic chain. The kinetic chain activates from the external oblique's, and later it proceeds to the shoulder and core

and hip musculature are needed for both generating and absorption of force during the throwing motion. The kinetic chain requires alternation in one area that creates change throughout the entire system this is known as a catch-up phenomenon. The changes in the interactive moments alter the forces in the distal segments, these increased forces place extra stress on the muscles, which often result in the sensation of pain or actual anatomical injury[6].

Core strength training plays an important role in badminton sports, also its connection between the upper and lower limb can improve stability, improve the ability of athletes to improve work efficiency, maintain the single kinetic chain coordination and prevent future injuries[7].

There is a myofascial continuity between the serratus anterior muscle and also there is a distal attachment of the pectoralis muscles passing on the humerus. These two fasciae have links with the external oblique muscle of the abdomen. The serratus anterior and external oblique are both parts of the large sling of the upper spiral line that wraps around the torso[8].

MATERIALS & METHODS

A cross-sectional study was conducted using competitive sampling among competitive badminton players from various sports clubs and recreational clubs and university sports clubs in and around, Raichur and Amalapuram. After getting permission from the clubs, the purposes of the study were explained to all the participants and informed consent was taken from each participant. Then after the therapist demonstrated the core stability exercises and strength self-test to the participant. Each participant was given SPADI questionnaire to evaluate the pain and disability after performing core strengthening exercises.

All participants performed the core strength and stability test procedures in the following manner:

[1] Dynamic abdominal endurance and isometric test[18]

The subject will be in supine with the hip at 45^{o} and knees at 90^{o} and hands at sides. A line is drawn 12 cm [for subject under the 40 years if age] distal to the fingers. The subject tucks in the chin and curls the trunk to touch the line with the fingers, and maintain for maximum time and time will be recorded. Analysis will be done by the grading. NORMAL [5] = hands behind neck, until scapulae clear table [20 to 30 second hold], GOOD [4] = arms crossed over chest, until scapula clear table [15 to 15second hold], FAIR [3] = arms straight, until scapulae clear table [10 to15 seconds hold], POOR [2] = arm extended, toward knees, until] top of scapulae lift from table [1 to 10 seconds hold], TRACE [1] = unable to raise more than end off table.

[2] Biering- Sorensen fatigue test.[18]

The subject will be in prone lying with the hips and iliac crest resting on the end of the examining table and hips and pelvis stabilize with straps. Initially subject's hands support the upper body in 30^{o} flexion on chair or bench. Then ask to subject the lift the upper body and maintain for maximum time and time will be recorded. Analysis will be done by the grading. NORMAL [5] = with hands clasped behind the head extends the lumbar spine, lifting the head, chest, and ribs from the table [20 to 30 seconds hold]. GOOD [4] = with hands at the side, extends the lumbar spine, lifting the head, chest and ribs from the table [15 to 20 seconds hold]. FAIR [3] = with hands at the side, extends the lumbar spine, lifting the sternum off the table. [10 to 15 seconds hold]. POOR [2] = with hands at the side, extends the lumbar spine, lifting the head off the table [1 to 10 seconds holds]. TRACE [1] = only slight contraction of the muscle with the no movements.

Dynamic horizontal side support test.[18] – to be done on both sides (right, left).

The subject will be in lying position resting the upper body on his or elbow, to begin the subject side lies with knee flex with 90^{o}.

then therapist ask to the subject to lift the pelvis off from the table or mat and straighten the spine and maintain for maximum time and time will be recorded and analysis will be done by grading. NORMAL [5] = able to lift pelvis off examining table and hold spine straight for 10 to 20 seconds. GOOD [4] = able to lift pelvis off examining table but has difficulty holding spine straight for 5 to 10 seconds. FAIR [3] = able to lift pelvis off examining table and cannot hold spine straight for less than the 5 seconds. POOR [2] = unable to lift pelvis off examining table.

STATISTICAL ANALYSIS

A total of 62 subjects (41 male, 21 female) with mean age of (19.6±4.8) were recruited in our study. The data including demographic and all parameters were recorded on a data collection form and then converted into tabular form. The data was entered into the software SPSS 16 (statically package for social science) in windows. Descriptive analysis was done by finding the mean and standard deviation of all the variables and then it was subjected for finding normality and then to find out the association between SPADI and core strength chi-square test was used. To find out of degree of association we used (Phi Cramer's) in SPADI and core strength.

RESULT

The demographic profile of the players in our study was distributed normally, Table 1. The level of performance of core strengthening exercises in shoulder pain subjects is described in table 2. Conversely, the chi-square test value shows SPADI scores when associated with DET, DHLS, SBFT, and DHRS values there was statistically significant ($p<0.05$) but the IFT score was not significant ($p>0.05$). whereas the degree of association using Phi Cramer's V test showed a negative less moderate degree of association of Shoulder pain and disability index (SPADI) with IFT (X2=3.52, phi Cramer's V = - 0.229 and a negative strong degree of association with Shoulder pain and disability index (SPADI) with DET (X2= 10.82, phi Cramer's V = -0.418), BSFT (X2=5.79, phi Cramer's V = -0.306) and DHRS (X2=6.49, phi Cramer's V = -0.324), DHLS (X2=8.75, phi Cramer's V = -0.376) table 3.

Table1. Shows descriptive statistics of demographic data

Characteristics	Mean Score
Age	19.6± 4.8
Male/Female	41/21
Experience in years	3.88±3.45
Right/Left dominance	53/9

Table.2 shows mean values with standard deviations of measurement variables

Characteristics	Mean Score	P Value
DET	1.52	0.50
IFT	1.42	0.49
BSFT	1.48	0.50
DHRS	1.71	0.45
DHLS	1.69	0.46
DET=dynamic endurance test, IFT=isometric flexion test, BSFT=Biering- Sorensen fatigue test, DHRS=dynamic horizontal right-side test, DHLS= Dynamic horizontal left side test.		

Table.3 shows chi square test and PHI CRAMER'S V for shoulder pain and core strength exercise

CHI SQUARE and PHI CRAMER'S V values for shoulder pain and core strength Association			
	PEARSON CHI- SQUARE	PHI CRAMER'S V VALUE	P- value
SPADI- DET	10.82	-0.418	0.01
SPADI-IFT	3.52	-0.229	0.71
SPADI-BSFT	5.79	-0.306	0.01
SPADI-DHRS	6.49	-0.324	0.01
SPADI-DHLS	8.75	-0.376	0.03
SPADI= shoulder pain and disability index, DET=dynamic endurance test, IFT=isometric flexion test, BSFT= Biering- sorensen fatigue test, DHRS= dynamic horizontal right side test, DHLS= dynamic horizontal left side test.			

DISCUSSION

This study was conducted to find out the association between shoulder pain and core strength in badminton players among 62 healthy competitive badminton players aged 14 to 40 years. All the participants separately underwent evaluation of SPADI and core strength exercises. The results showed that a negative, moderate association between SPADI and IFT (X2=3.52, Cramer's V = - 0.229) and a negative, strong association of SPADI with DET (X2= 10.82, phi Cramer's V = -0.418), a negative, strong association of SPADI with BSFT (X2=5.79, phi Cramer's V = -0.306), a negative, strong association of SPADI with DHRS (X2=6.49, phi Cramer's V = -0.324), a negative, strong association of SPADI with DHLS (X2=8.75, phi Cramer's V = -0.376).

According to studies, the prevalence of shoulder pain is 57%. Athletes who routinely assume the overhead arm position i.e. maximal external rotation of the arm with shoulder abduction and elevation are vulnerable to internal impingement from micro-instability of the glenohumeral joint and overuse or fatigue of the shoulder girdle muscle. 6

Core muscles and hip musculature strength are required for generation and for absorption of force during the throwing motion. Core muscles and hip musculature can be trained with single-leg exercises, including a single-leg squat. The throwing athlete should have enough flexibility in the planting leg to allow for proper throwing biomechanics and if there is a ROM restriction in the lower extremity, the deficiency is compensated elsewhere along the kinetic chain. This compensation may occur at the shoulder joint complex, potentially resulting in shoulder dysfunction, pain, and injury.9

Motimath et al. found a positive correlation between the scapulohumeral rhythm and core stability. This study included 40 badminton players. Core stability and strength testing were performed to assess the core stability. An inclinometer was used to assess scapulohumeral rhythm.6

Ibrahim et al in his study, the effects of core training on dynamic and smash stroke performance, included 20 badminton players and they underwent eight weeks of core stability training. The results showed that core training causes improvement in maintaining optimum lower limb dynamic balance and increases the performance level of smash stroke in young badminton players.9

The present study identified that overhead throwing movement requires coordination from the feet to the hand in a single kinetic chain. Kinetic chain activates from the external obliques to the serratus anterior, and the pectoral muscle to the shoulder. Hence the study identified that shoulder pain is related to core muscle strength.

CONCLUSION

The present study assessed the relationship between core muscle strength in badminton players with shoulder pain. Statistically, the results showed that a strong degree of association is present between core muscle strength and shoulder pain in badminton players. However, the present study is limited to small sample size. Further studies must be performed using large sample.

Declaration by Authors

Ethical Approval: Approved

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Conflict of Interest: The authors declare no conflict of interest.

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