Assessment of Core Stability of Elite Indian Female Football Players

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ABSTRACT

Background: *Core stability is defined as the ability to control the position and motion of the trunk over the pelvis to allow optimal output transfer and control of force and motion to the terminal segment in integrated athletic activities. Decreased core stability has been reported to be associated with a higher risk of low back and lower limb injuries. Since the prevalence of lower limb injuries is high in Football, core endurance assessment is of great importance.*

Aim: *to assess core endurance profile in elite Indian female Football players in establish to preliminary normative data for Indian athletes, to compare the mean values with international standards and ratios.*

Study design: *Pilot Cross sectional study*

Materials & Methods: *26 Indian elite female Football players competing in various game positions were subjected to four endurance tests of core stability (flexor endurance, extensor endurance, left and right lateral endurance). The mean holding times were established, the ratios were determined and compared with international standard values.*

Results: *Indian female Football players have a significantly higher core endurance compared to general population.*

INTRODUCTION

Core Stability is the ability to control the position and motion of the trunk over the pelvis to allow optimal output, transfer and control of force and motion to the terminal Segment in integrated athletic activities (killer at al, 2006) or as the ability of the lumbo-pelvic hip complex, to prevent buckling and to return to equilibrium after instability (Willson et al, 2005). The question of the contribution of core stability to sport performance, injury prevention and health has been addressed recently Core stability may provide several benefits to the musculoskeltal system, ranging from maintaining low back health and preventing knee ligament injury (Willson et al, 2005) to providing a foundation for greater force production by upper and lower extremities in sport performance (Willardson, 2007). Decreased core stability was reported to be associated

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with a higher risk of injuries of low back and knee (Borghuis, 2008). The literature supports a moderate relationship between the incidence of lower extremity injuries and decreased strength and endurance of selected core muscles. A direct relationship between weakness of the core musculature and incidence of lower extremity injuries in women athletes has been found in several prospective and retrospective studies (Leetun et al, 2004). McGill, 1999, published normative data for the flexor, extensor, right and left lateral endurance tests: for young healthy male and female population. Though these functional tests do not asses the individual muscle strength they assess the muscle endurance and the ability to control the trunk by synchronous activation of different core muscles (McGill, 2001). McGill et al (2000) recommended that these tests be analyzed by using ratios, the flexor extensor ratio (FER), left lateral extensor ratio (LER), right lateral extensor ratio (RER) and the right left lateral ratio (RLR) since they have shown that the misbalance (ratio) between these muscle groups is a better indicator of decreased core strength and stability (McGill et al, 1999; McGill, 2004). The rations are expressed by the flexor (FER) or left and right lateral hold times (LER and RER) divided by the extensor bold time. The right lateral divided by left lateral hold time is also expressed (RLR). These investigators have developed normative ratios in a population of healthy young male and female adults that can be used for assessment and classification purposes to determine the sources of decreased core strength and stability in young adult population. (McGill et al, 2003) also established cut off criteria from the ratios beyond which they indicated misbalanced endurance. The misbalanced ratio are a risk factor for low back pain and lower limb injuries (McGill, 2004; McGill et al, 2003).

Football is characterized by high intensity, intermittent, non continuous exercise, and body control is required for performance (Rahnama et al, 2009). Performance in Footbal is determined by five components of health related fitness including body composition, cardio respiratory fitness, muscular strength and endurance, flexibility and sport-specific characteristics like speed and reaction time. Since the prevalence of lower limb injuries is very high in Football, there is a need to assess core stability of Football players. The assessment of core endurance holing times of individual athletes will enable to compute endurance ratios. Nesser et al (2008) published the data for male and female collegiate footballers and observed a different pattern and much longer holding times in footballers. (Nesser et al, 2008; Nesser & Lee, 2009). Both Football and female athletes are at high risk of lower limb injuries. A direct relationship between weakness of the core musculature and incidence of lower extremity injuries in women athletes have been found in several prospective and retrospective studies; hence, there is a need to establish

normative data and endurance ratios for Indian female Football players which enable the optimal exercise prescription during core training and rehabilitation.

Aim

The aim of the study is to assess the core endurance profile of elite Indian female Football players in order to establish preliminary normative data, to calculate the mean holding times and endurance ratios and to compare the mean values of female Indian footballers with international standards and ratios.

METHODOLOGY

Study Design: Pilot, cross sectional study

Elite Indian female (N=26) Football players of the national Football team playing in different positions and preparing for 3rd SAFF Women championship at Netaji subhas National Institute of Sports, in October 2014, participated in the study. The study was conducted in the department of sports medicine along with their pre participation screening. The demographic characteristics of the footballers are depicated in Table 1.

Table -1: Demographic data of Indian Female Football players (mean= SD)

Demographic Data	Female football players
Age (years)	23±3.7
Height (cm)	157.8±4
Weight (Kg)	53±3.8
BMI	22.1±1.4
Training age (years)	10.3±3.5

Inclusion criteria

The female footballers without any history of back pain and lower limb injuries at the time of study are included. None of the 26 athletes suffered from back pain and lower limb injuries. Hence, none of the footballers are excluded from the study. Written informed consent is taken from the athletes before the assessment.

Core testing

The protocol established by Mc Gill et al (1999) was used to determine muscle endurance of the torso stabilizer muscles. The protocol consists of four tests that measure all aspects of the torso via isometric muscle endurance: flexor endurance test, ICC=0.98, extensor endurance test, ICC=0.93, and left and right lateral endurance test, ICC=0.95 (Nesser et al, 2008). The athletes were allowed to practice each position. To prevent fatigue, they were not allowed to hold any one position for more than five seconds. A stopwatch was used to measure the length of time participants were able to hold each isometric position. Individuals were given a minimum of five minutes rest between each test.

Flexor endurance test

The flexor endurance test begins with the person in a sit-up position with the back resting against a jig angled at 60 degrees from the Table. Both knees and hips are flexed 90 degrees, The arms are folded across the chest with the hands placed on the opposite shoulder, and the feet are secured (Fig.1). To begin, the jig

is pulled back and the person holds the isometric posture as long as possible Failure is determined when the athlete falls back or is not able to hold the position.

Extensor endurance test

The back extensors are tested with the upper body cantilevered out over the end of the test bench and with the pelvis, knees, and hips secured. The upper limbs are held across the chest with the hands resting on opposite shoulders (Fig.2) Failure occurs when the upper body drops below the horizontal position.

Lateral endurance test

The lateral musculature is tested with the person lying in the full side-bridge position (e.g., left and right side individually). Legs are extended, and the top foot is placed in front of the lower foot for support. Subjects support themselves on one elbow and on their feet while lifting their hips off the floor to create a straight line from head to toe. The uninvolved arm is held across the chest with the hand placed on the opposite shoulder (Fig.3 and Fig.4) Failure occurs when the person loses the straight-back posture and/or the hip returns to the ground.

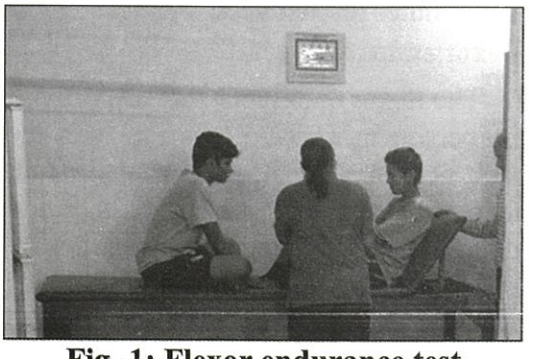


Fig.-1: Flexor endurance test

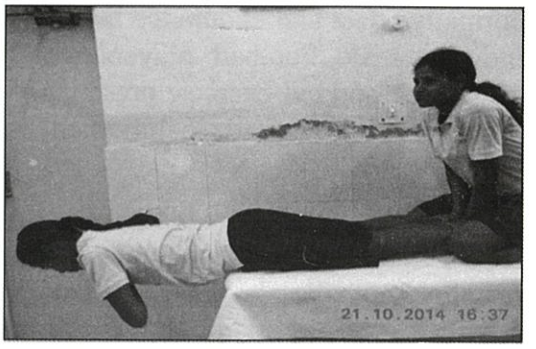


Fig.-2: Extensor endurance test

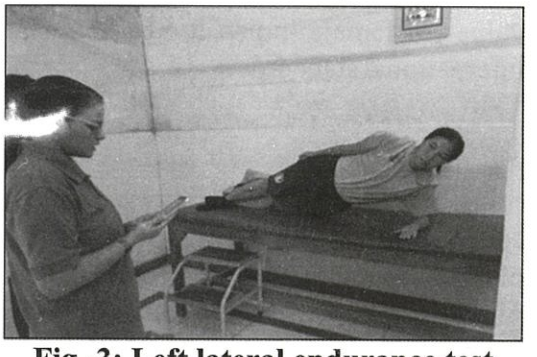


Fig.-3: Left lateral endurance test

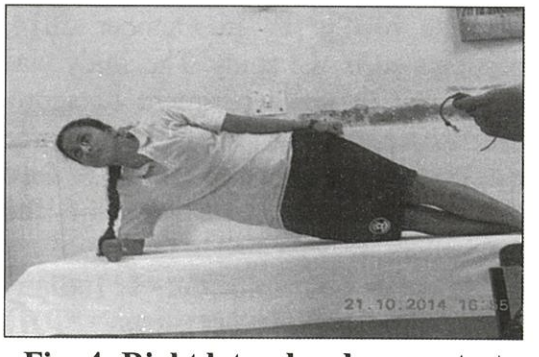


Fig.-4: Right lateral endurance test

Data Analysis

The mean values, standard deviation for the individual holding times are calculated in seconds. The three endurance ratios with mean extensor time as the denominator are computed along with right

to left lateral endurance ratio. SPSS pro software was used for data analysis.

RESULTS & DISCUSSION

The mean core endurance values including flexor holding time, extensor holding time left lateral and right lateral holding times of the footballers are depicted in Table 2. The mean flexor endurance ratio, Right lateral extensor endurance ratio, left lateral extensor endurance ratio and right to left lateral endurance ratios are calculated and are depicted in Table 3. The mean endurance times are compared with the mean core endurance times of untrained female population as published by McGill (1999) and mean core endurance times of female collegiate footballers from data by Nesser (2008) and depicted in Table 4. The mean endurance ratios of Indian female footballers are compared with McGill and Nesser's ratios and depicted in Graph 1. the mean endurance ratios are then compared with cut off criteria established by Mc Gill (2003) to determine unbalanced core endurance and are depicted in Table 5 and Graph 2.

Table-2: Mean core endurance times Seconds of Indian female footballers

S No	Test	Mean±SD
1	Flexor endurance	253±60
2	Extensor endurance	205±43
3	Left lateral endurance	103±35
4	Right lateral endurance	99±26

Table-3: Mean core endurance ratios of Indian female footballers

S No	Endurance Ratios	Mean
1	FER	1.28
2	RER	0.48
3	LER	0.51
4	RLR	0.96

The mean flexor endurance time is significantly higher in Indian footballers than right and left lateral endurance times ($p<0.05$). Indian footballers have significantly high endurance times compared to untrained female population. The untrained female

Table-4: Comparison of mean endurance times (Seconds) with international values

Test	Mean±SD	Foot ballers	Nesser
Flexor endurance	134±81	253±60	216±83
Extensor endurance	185±60	205±43	182±70
Left lateral endurance	78±32	103±35	123±36
Right lateral endurance	75±32	99±26	129±57

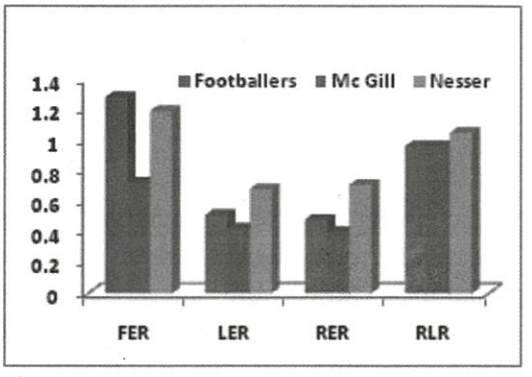
Table-5: Mean endurance ratios compared with Mc Gill's cut off criteria for unbalanced endurance

S No	Endurance Ratios	Mean
1	FER	1.28
2	RER	0.48
3	LER	0.51
4	RLR	0.96

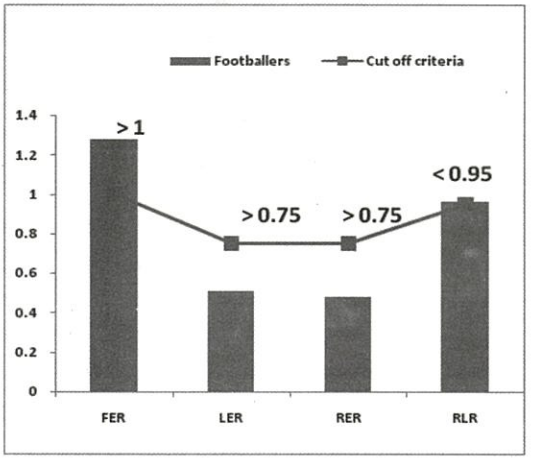
population showed a different pattern from that of our footballers in the form of greater extensor time followed by flexor and lateral endurance time as published by Mc Gill et al (2000). The data of female collecgiate footballers published by Nesser et al (2008) showed similar pattern as our extensor endurance times. The Indian footballers i.e. higher mean flexor and extensor endurance times. The Indian footballers have higher mean flexor and extensor holding times but lower lateral holding times than collegiate athletes as published by Nesser (2008). The flexor extensor ratio of Indian footballers observed is 1.28 and exceeded the cut off criteria normalised by Mc Gill, (2003) (>1) and indicated unbalanced endurance. The FER from Nesser (2008). data also is> 1 which exceeded the cut off criteria. Similar ratios (>1) are observed in a study on elite Indian women wrestlers conducted by the same author in 2010 (unpublished). No right to left lateral ratio imbalance is observed in Indian footballers, though the mean left and right holding times are less than those that of means in collegiate footballers (Table 4).

Few questions arose from these results-whether the higher FER seen in athletes is as a result of flexor biased training, or due to demands of the game. Whether such imbalance plays any role in enhancing performance or to what extent such an imbalance can predispose the athlete to low back and lower limb injuries in the future.

Graph-1:Comparison of mean endurance ratios with international indices



Graph-2: Mean endurance ratios compared with cut off criteria by Mc gill et al



CONCLUSION

The study shows significantly higher endurance times in elite Indian female footballers than untrained female and male population indicating football training improves core endurance. The posture of footballers specifically goal keepers and flexor biased football training could explain the high flexor endurance times than extensor times in our footballers.

LIMITATIONS

Core endurance was assessed only by isometric tests. Isotonic or dynamic testing and isokinetic testing of core endurance could not be done in clinical set up.

Hip muscle stability which also plays a role in maintaining lumbopelvic control during movement and is a risk factor for lower limb injuries could not be assessed.

FUTURE RESEARCH

Rrandomised control studies in this area are needed to identify the impact of Football training on core stability tests. Assessment needs to be done in various sports and to be compared to develop the sport specific normative data in female athletes. Similar studies need to be carried out in Indian male athletes also.

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