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Normative Data of Dynamic Balance of Lower Extremities Using Y-Balance Test in Cricketers with 16-25 Years of Age

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Abstract
Background : *Functional reach is a predictor of dynamic balance and is assumed to determine risk of injuries and improvement in fitness level. Y balance test is a modified version of star excursion balance test (SEBT) and is designed to assess dynamic stability. The aim of this study is to give normative data about dynamic stability of lower extrimeties in cricketers between 16 – 25 years of age.*
Methods: *Overall 59 male cricketers (16 to 25 yrs) participated in the study, where functional reach of both lower extremities was assessed by using Y balance test in 3 directions i.e. Anterior (AR), Posteromedial (PM) & Posterolateral (PL) directions. Data was collected thrice from an extrimity in single direction and further average value was considered for analysis.*
DataAnalysis: *Atheletes were divided into 3 groups on the basis of age and their descriptive statistics, Mean & standared deviation was calculated. Intra-rater reliability was calculated by using intraclass correlation coefficient(ICC) for each direction and for both extremities.*
Results: *Normative Values of age groups i.e 16-18 yrs,19-21 yrs, 22-25 yrs for Anterior reach (right) were (68.13,62.47,65.55)in cms ; Anterior reach (left) were(67.8,62.95,62.18)in cms ;posterolateral reach (left) were(74.22,75.63,73.71) in cms ; posteriolateral reach (right) were(73.88,76.05,78.91) in cms ; posteriomedial reach (left) were(72.76,73.13,71.21) in cms ; posteriomedial reach (right) were(70.28,68.92,73) in cms. YBT showed good Intra-rater reliability (ICC values) at 95% of confidence intervel (CI).*
Conclusion: *Study concludes with normative data of balance in cricketers which can be considered as a guideline for injury prediction, pre-competition conditioning, and tool with minimal level of measurement error.*
Keywords: *Y balance test, Balance, cricket, Functional reach, dynamic stability.*

I. Introduction

Cricket is a sport which has repetitive nature of activities often found for longer period of time [1]. As a sport it was considered as ‘ Moderate injury risk” in 1970. But this perception has been changed as players are susceptible to wide variety of injuries during sporting activities. Injuries to lower limb accounted for 22.8 % to 50 % whereas upper limb recorded 19.82%-34.1% of total injuries, remaining were accounted for head and neck and back injuries [2-5]. Injuries in cricket are often encountered at the time of bowling, batting and fielding. Players up to 24 years of age sustained almost 57% of sport injuries; where 23.5% occurred during fielding. Young fast bowlers have more prevalence of injury due to lack of full maturation of musculoskeletal system [5-7]. The intermittent nature of the game with its long rest intervals provides recovery time between any short spells of higher intensity activity. Sprints during cricket are often covered between the wickets, the run-up and delivery during fast bowl, or fielding which lays a high demand on dynamic stability of cricketers [22].

To maintain dynamic stability both sensory and motor system contribute in maintenance of balance during activity; inputs from sensory and motor system. Sensory inputs are necessary to detect unstable conditions (i.e. perturbations to the system) whereas motor responses are vital to initiate timely and appropriate responses to counteract these perturbations. [8,22]

Impaired balance is one of the several risk factors that have been associated with increased risk of lower extremity injuries among athletes. Research suggested deficits in static and dynamic balance discern among individuals who have history of ankle sprains, chronic ankle instability, anterior cruciate ligament deficiency, and anterior knee pain. In addition, exercise programs focused on balance training have also been

associated with reduced risk of injuries. [9] Poor dynamic balance and impaired functional movement has been previously associated with sports related injury. [10]

There are different types of performance assessment tools available amongst which Y-balance test is the youngest one and has been used limitedly as a research tool till now. [8,11,12] It is one of the few field expedient tests that has shown predictive validity for injury risk in an athletic population. [14,20] It is a modified version of Star Excursion Balance Test (SEBT). Previous researches showed redundancy in 8-directions of SEBT; henceforth developed more time efficient test that evaluates dynamic limits of stability and asymmetrical balance in only 3-directions (anterior, posterolateral, posteromedial) [12,13,21,23].

As, Physical-Performance Test (PPTs) are commonly used in rehabilitation and injury prevention settings, yet Normative Values of balance using Y-Balance test have not been established in cricketers specially for players less than 24 years of age as they are more prone for injuries. The data shall be further helpful in assessing baseline balance skills of an athlete, improving performance and draft of individualized rehabilitation protocol depending upon an athlete' s age.

II. Methodology

A total of 60 male cricketers with age from 16 to 25 years gave their consent and actively participated in study. The subjects were from Teerthanker Mahaveer cricket academy, Moradabad; DNS cricket academy (Amroha cricket association), Amroha, India.

2.1 Inclusion and exclusion criteria

Inclusion criteria for this study were healthy male cricketers between 16 to 25 years of age who were taking regular training in their respective cricket associations from past 6 months or more. Exclusion criteria was any history of musculoskeletal pain, injury & deformities and neurological disorders.

2.2 Measuring Tool

The Y Balance test (Fig. 1) is a reliable tool for measuring dynamic balance and may be used to predict injury. The Y-balance test (YBT) is a screening tool of dynamic balance requiring stance leg balance while the contralateral leg reaches in anterior (ANT), posteromedial (PM), posterolateral (PL) directions. It has been proposed as a screening tool for injury risk as well. It has a central raised platform with three pieces of PVC (polyvinylchloride) pipe in the three directions with a sliding plastic reach indicator that the participant pushes to determine reach distance [11,23]. This tool has been used in various populations in basketball players[12], soccer players[11], football players[19], millitary officials [9,13,14], young & adolescents athletes[16] and proved to be a reliable tool for assessing risk of musculoskeletal injuries due to lack of dynamic balance [10,15,17,18]

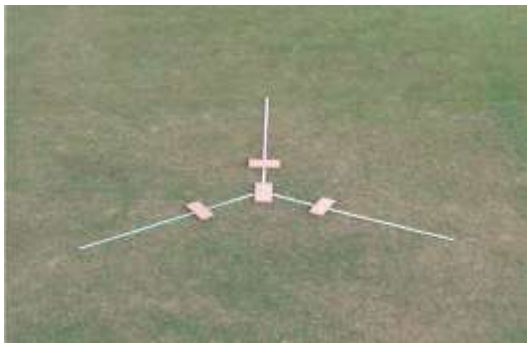

Fig no.1 Y-balance tool

1.3 Procedure

Players who consented were eligible both mentally and physically for the test. The procedure of test was explained, demonstrated to players during pre-trial sessions.

Players performed the task with shoes on. They were asked to keep their testing leg either left or right over stable platform and non-testing limb on reach indicator with toes planted on it. Further, players were asked to glide reach indicator in each direction that is anterior, posterolateral and posteromedial as far as possible without touching ground and maintaining balance as shown in fig 2 & fig 3. The same trial was repeated for other limb as well. During the trial, if an athlete stepped on ground to gain support or kicked the reach indicator in any phase of procedure, the scoring was rejected and procedure was repeated again. Consecutively, 3 trails were recorded for each direction and each extremity to get an average reach value for each direction. Reach value in each direction was measured in centimeters and near to its maximum value.

Fig .2 Player performing anterior reach for left limb

Fig. 3 Player performing posterolateral for right limb

III. Data analysis

60 cricketers were segregated amongst 3 age groups i.e 16-18 years, 19-21 years and 22-25 years respectively. Scores of 1 athlete was omitted as he aged more than 25 years. Further, data was tabulated and analyzed for descriptive statistics, Intra rater Reliability at 95% of CI with (p<=0.05) in Microsoft excel 2010 version and IBMSPSS 20.0.

IV. Results

In total 59 cricketers participated in study; where 22 cricketers fell in 16-18 years, 28 in 19-21 years and 9 in 22-25 years category of age group (TABLE NO.1).

Table no.1

S.No	Age Group (years)	No. Of Players
1.	16-18	22
2.	19-21	28
3.	22-25	9

Descriptive values for anterior, posteromedial and posterolateral reach among 3 different age groups were calculated for its minimum and maximum reach, mean and standard deviation.

TABLE NO.2 (graph no.1) reflects arithematic mean, minimum and maximum anterior reach values of right and left extremities of all age groups. It reflects that values of right and left anterior reach of 16-18 age group i.e. 68.13 & 67.8 cms are higher than the values of 19-21 year age group i.e.62.47 & 62.95 cms and 22-25 year age group values i.e 65.55 & 62.18 cms.

Table no.2

	Right extremity			Left extremity		
Age Group (yrs)	Mean Anterior reach (±SD)	Minimum value (cms)	Maximum value (cms)	Mean Anterior reach (±SD)	Minimum value (cms)	Maximum value (cms)
16-18	68.13(±10.10)	58	106	67.8 (±10.83)	55.93	112.73
19-21	62.47(± 8.13)	51.07	80.13	62.95(± 9.01)	50.30	93.63
22-25	65.55(± 8.51)	49.73	76.47	62.18(± 6.57)	47.2	67.18

Graph no.1

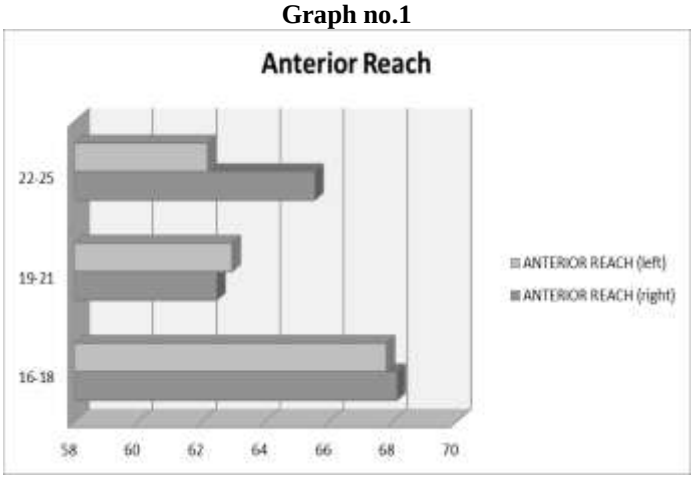

TABLE NO.3 (graph no.2) reflects arithematic mean, minimum and maximum posterolateral reach values of right and left extremities of all age groups. The value of right posterolateral reach of 22-25 age group i.e 78.91 cms is higher than 76.05 cms of 19-21 year age group and 73.88 cms of 16-18 year age group. Whereas, values of left posterolateral reach of 19-21 age group i.e 75.63 cms is higher than 74.22 cms of 16-18 year age group and 73.71 cms of 22-25 age group.

Table no.3

	Right extremity			Left extremity		
Age Group (yrs)	Mean Posterolateral reach (±SD)	Minimum value (cms)	Maximum value (cms)	Mean Posterolateral reach (±SD)	Minimum value (cms)	Maximum value (cms)
16-18	73.88(± 11.79)	57.87	109.60	74.22(± 11.66)	62.73	119.20
19-21	76.05(± 9.32)	60.60	101.40	75.63(± 9.62)	56.97	103.63
22-25	78.91(± 11.13)	64.83	95.70	73.71(± 13.44)	56.70	101.83

Graph no.2

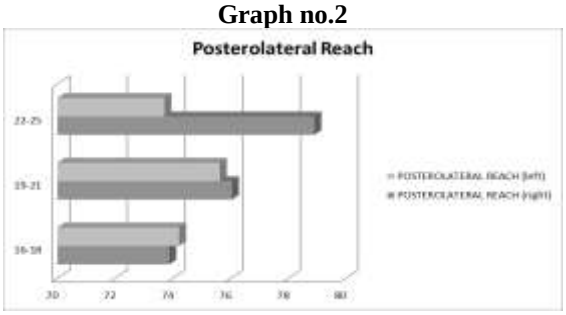

TABLE NO.4 (Graph no.3) reflects arithmetic mean, minimum and maximum posteromedial reach values of right and left extremities of all age groups. The values of right posteromedial reach of 22-25 age group i.e. 73 cms is higher than 70.28 cms from 16-18 year age group and 68.92 cms of 19-21 years age group. The values of left posteromedial reach of 19-21 age group i.e. 73.13 is higher than that of values form 16-18 year age group i.e 72.76 cms and 71.21 cms od 22-25 age group.

Table no.4

	Right extremity			Left extremity		
Age Group (yrs)	Mean Posteromedial reach (±SD)	Minimum value (cms)	Maximum value (cms)	Mean Posteromedial reach (±SD)	Minimum value (cms)	Maximum value (cms)
16-18	70.28(± 10.16)	57.47	103.60	72.76(± 8.39)	58.77	97.10
19-21	68.92(± 8.49)	52.30	84.37	73.13(± 10.06)	51.13	90.50
22-25	73(± 10.85)	57.07	87.80	71.21(± 6.40)	59.77	83.43

Graph no.3

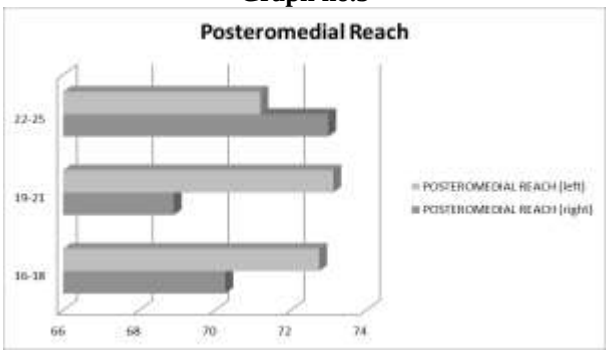

TABLE NO.5 shows strength of Intrarater reliability of scores using Intraclass correlation coefficient (ICC) and Cronbach' s Alpha at 95% of CI for each direction assessed in YBT

Table no. 5

s.no	Direction/side	ICC value	CI at 95%	Cronbach' s alpha
1.	Anterior (right)	0.91	0.86-0.94	0.91
2.	Anterior (left)	0.96	0.94-0.97	0.96
3.	Postero lateral (right)	0.95	0.92-0.96	0.95
4.	Postero lateral (left)	0.94	0.91-0.96	0.94
5.	Postero medial(right)	0.94	0.90-0.96	0.94
6.	Posteromedial (left)	0.94	0.88-0.95	0.93

V. Discussion

In this study quantitative data regarding balance of cricketers using YBT among 18 – 25 years of age was established as balance plays a vital role in performance. The YBT is a reliable tool among raters with various experience and background of younger players and prevention of early injuries due to fall. Normative data reflects differences in YBT performance related to sex, age, injury, geographic location, and competition level. The YBT may be used to predict injury risk; however, clear cut-points have not been sufficiently defined.[5]

Teyhen et al & Shaffer SW et al. provided evidence that YBT is a reliable tool with good to moderate ICC values and measured dynamic stability in basketball players and military occupational. [9,13] Further adding more information regarding dynamic balance in young first class cricketers, this study concluded that YBT is a reliable tool with good intra rater reliability scores (ICC>0.90) at (p<=0.05) with normative data.

Gonell P et. al. stated that YBT is a Functional test that requires physical strength, flexibility and neuromuscular control, stability, range of movement , balance and proprioception. YBT is good solution for testing of speed, efficiency, consistency and objectivity. [15] In support of this study, we too found that YBT is a reliable tool with its ICC value (>0.90) at 95% of CI and can be used as pre-competition conditioning of the players and whosoever fails to meet average values of reach may be susceptible to musculoskeletal and neuromuscular system injuries in future. This study also infers that age of the athlete plays a vital role in sporting event which demands dynamic balance; as variation has been seen in all 3 directions of 3 different age groups. These variantions in reach values may be accounted due to lack of equal number of players distributed in 3 groups on the basis of their age.

Results from a study conducted by Faigenbaum et. al. showed moderate to good interrater reliability of YBT in children from 1st to 5th grades with ICC values ranging from moderate-to-good for the anterior (right=0.82; left=0.82), posteromedial (right=0.77; left=0.75), and Posterolateral (right 0.80; left=0.77) reach directions [16] . Whereas, our results showed good Intrarater reliability with ICC values for anterior (right=0.91; left=0.96), posteromedial (right=0.94; left=0.93), and posterolateral (right = 0.95; left=0.94) at 95%CI from this study positively supports result of this study but they checked reliability for one or more sessions with different age group where we did for single session with adolescents

In this study, impact of increase in age and dynamic reach balance does not reflect any linear relationship between them. Hence forth, further research work should emphasize more on relationship between reach scores, limb dominance, limb length and age in cricketers of both genders with larger sample size.

As, data for the study was collected from players with shoes on. Which may in addition have had an impact on the YBT score as shoes provide more ankle stability and increase area of foot contact on reach indicator. Hence forth it can serve as a limitation of this study. Along with that limited research done on usage of Y- balance test also served as bottleneck for gaining more information regarding validity and reliability for this tool.

Strength of this study is optimum sample size of young cricketers; who were assessed on the basis of systematized protocol. Each athlete and testers underwent training session prior to commencement of study in order to avoid errors during trial period. This study also throws light over the impact of growth & puberty on musculoskeletal system directly or indirectly on players who are trained and conditioned through skill training.

VI. Conclusion

At the end, we conclude with the normative data for dynamic balance and reach among cricketers, with an age group of 16 -25 years using YBT as an outcome measure, perhaps it is a reliable tool to assess dynamic balance. Results of this study shall in turn be considered as baseline scores for injury prediction, pre-competition conditioning, and a tool with minimal level of measurement error. We also found that there was increase in mean reach (Posterolateral, posteromedial) of subjects from all ages except 16 -18 years of age group. The age-group of 16-18 years showed highest mean reach anteriorly (both right and left leg) than relating other age-groups.

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