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Preseason Y Balance Test Scores are Not Associated With a Lower Quadrant Sports Injury in a Heterogeneous Population of Division III Collegiate Athletes

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Functional performance tests, such as the Y Balance Test-Lower Quarter (YBT-LQ), hold promise as screening tools to identify athletes at risk for injury. The ability of the YBT-LQ to discriminate injury risk in Division III collegiate athletes is unknown. The purpose of this study was to determine if preseason YBT-LQ scores are associated with noncontact time-loss lower-quadrant (low back or lower extremities) injury in a heterogeneous population of Division III collegiate athletes. Two hundred and fourteen athletes (females = 104) performed the YBT-LQ test. Preseason YBT-LQ scores, analyzed by the total population, were not associated with noncontact time-loss lower-quadrant injury. Females with greater reach scores in some directions did have a significantly greater risk of injury. This study adds to a growing body of research demonstrating that the YBT-LQ should not be used as a preseason screening tool.

Keywords: functional performance test, lower extremity, preseason screening, prospective cohort

Nearly 200,000 student-athletes compete in sport at the National Collegiate Athletic Association (NCAA) Division-Ill (D-III) level.[1] Student-athletes who participate in sport at the D-III level report physical, emotional, social, and academic benefits.[2] However, those who participate in sport are at risk for injury. Male athletes competing at the D III level experience 6.5 time-loss injuries per 1,000 athletic exposures (AE).[3] Female athletes experience 4.7 time-loss injuries per 1,000 AE.[3] A sports injury to a D-IH athlete may negatively impact one's studies, increase one's stress, result in numerous medical and rehabilitation appointments, and affect the athlete's team's success.[4-10] Therefore, identifying athletes at risk for injury may help sports medicine professionals and coaches to intervene with training programs to reduce one's risk of sustaining a sport-related time-loss injury.

Key Points

- ▶ A recent trend in sports medicine research is to identify athletes at risk for injury based on preseason performance profiles.
- ▶ One functional performance test, the Y Balance Test-Lower Quarter, has shown promise as a preseason screening tool.
- ^ The ability of the Y Balance Test-Lower Quarter to discriminate injury risk in a heterogeneous population of Division III collegiate athletes is unknown.

The Y Balance Test is a functional performance test (FPT) designed to assess dynamic balance.[11-14] It is an instrumented device with three extensions from its weightbearing platform in the shape of a Y.[11] The Y Balance Test-Lower Quarter (YBT-LQ) shape was designed based on the results from a prospective cohort study that employed the use of the Star Excursion Balance Test (SEBT).[12] When performing the YBT-LQ, subjects are asked to maintain single-leg support with one lower extremity (LE) while simultaneously sliding the reach indicator along the anterior, posteromedial, or the posterolateral axis with the non-weightbearing LE.[1]

Initial studies reported an association between preseason YBT-LQ performance and future time-loss LE injury. Plisky et al.[12] prospectively measured reach performance with the SEBT (the precursor to the YBT-LQ) in a population of high school basketball (BB) players (n = 235) prior to the start of their season. High school BB players who presented at the start of the season with an anterior reach asymmetry greater than 4 cm had a 2.5-fold increased risk of having a time-loss LE injury during the season.[12] Female BB players (n= 105) with a composite reach score (a measure based on the distance reached in each component of the Y pattern) that was less than 94% of their LE length had a 6.5-fold increased risk of LE injury during the season.[12] Smith et al.[15] found that an anterior asymmetry >4 cm during YBT-LQ testing was associated with a two-fold increased risk of a noncontact injury, regardless of time loss, in a heterogeneous sample of Division I athletes.[15] Butler et al.[16] did not find anterior asymmetry to be associated with future injury in collegiate football players; however, a composite score less than 89.6% was associated with a three-fold increased risk of a noncontact time-loss LE injury.[16]

Since those initial aforementioned reports, several other studies have investigated preseason YBT-LQ

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performance and subsequent sport-related injury in other athletic populations.17-23 The ability of the YBT-LQ test to identify athletes at risk for injury has been equivocal. Potential reasons for the equivocal findings may be due to the operational definition of what constitutes a sport-related injury, the sample size of the study, or performance modifications to the test.

The YBT-LQ has held promise as a FPT to identify athletes who may be at risk for a sport injury during a preparticipation screen. However, the equivocal findings associated with the aforementioned studies challenges the ability of clinicians to interpret the significance of an athlete's preseason scores. Therefore, additional studies, using standard testing procedures and operational definitions of injury, are warranted. There are two purposes to this study. The first purpose of this study was to evaluate the ability of preseason YBT-LQ scores to discriminate injury risk in a heterogeneous population (i.e., both sexes) of D-III collegiate athletes. It was hypothesized that athletes with a larger reach score asymmetry (in any direction), or a lower normalized reach score (in any direction), or a lower composite score, would be associated with a greater risk of a noncontact time-loss lower quadrant (LQ = low back and lower extremities) injury. The second purpose of this study was to evaluate the ability of preseason YBT-LQ scores to discriminate injury risk per sex. It was hypothesized that athletes, analyzed by sex, would have an increased risk of a noncontact time-loss LQ injury when presenting with a larger reach score asymmetry (in any direction), or a lower normalized reach score (in any direction), or a lower composite score during a preseason screening clinic.

Methods

Participants

Two hundred and fourteen D-III athletes volunteered to participate in this study. A sample of convenience was utilized by recruiting subjects from one university setting during the 2015-2016 and 2016-2017 academic years. A heterogeneous sample of 104 females (mean age 19.2 ± 1.2 years) consisted of athletes representing the following sports: soccer (n = 35), volleyball (n = 32), tennis (n = 11), and track & field (n = 26). One hundred and ten males (mean age 19.6 ± 1.2 years), representing basketball (n = 24), soccer (n = 40), tennis (n = 6), and track and field (n = 40), formed the heterogeneous male cohort. The institutional review board of George Fox University approved this study. Informed consent was obtained from each subject prior to participation.

Procedures

YBT-LQ protocol. The YBT-LQ test was performed by each athlete as part of a preparticipation screening clinic at the start of each sport season. The YBT-LQ test has both excellent intra- and interrater reliability. Plisky et al.n reported an intrarater reliability of 0.85 to 0.91 and an interrater reliability of 0.99 to 1.00. Each athlete performed a dynamic warm-up prior to performing the YBT-LQ test. The dynamic warm-up protocol was performed for a 5-min period consisting of the following active LE movements: high knee marching, forward lunging, backward lunging, walking on tip toes, and walking on heels.

An investigator provided test performance instructions followed by each athlete performing six warm-up trials in each direction.11 Athletes were instructed to stand on one limb, barefoot, with their toes positioned behind the line on the YBT stance platform." After the subjects completed their warm-up trials they were instructed to "reach" into one of three directions (anterior, posteromedial, and posterolateral) using their non-weightbearing (NWB) LE to slide the reach indicator (i.e., moveable platforms associated with each arm of the Y) as far as possible.11 Three trials were completed on the right first (i.e., right limb single-leg stance with left limb NWB) for the anterior reach followed by three trials on the left LE reaching into the anterior direction."'16 After completing the anterior reach trials, the subjects performed three 3 trials each for the posteromedial and posterolateral tests alternating between the right and left LEs."-16 A trial was considered a failure and repeated if the athlete was unable to maintain balance on the stance platform, slid the reach indicator incorrectly by touching the indicator outside of the red target area, failed to slide the reach indicator under control (e.g., pushing or flicking the indicator forward), or stepped on to the NWB limb."'16 Each reach trial was measured in centimeters (cm). An investigator, either the primary investigator (19 years of experience) or a co-investigator (5 years of experience) measured the distance reached for each successful trial.

Next, after a subject completed the YBT-LQ test, an investigator measured the athlete's limb length (cm) bilaterally. The athlete was instructed to assume a supine position on a treatment table. Limb length was measured from the anterior superior iliac spine to the distal aspect of the medial malleolus."-12 Limb length measurements were used to normalize reach distance measurements ([reach distance/limb length] X 100).11,12

Injury surveillance. The university's certified athletic trainers recorded the following information for each injured athlete: injury location (categorized by region: low back, hip, thigh, knee, leg, foot/ankle), injury diagnosis, and the mechanism of injury (e.g., noncontact or contact). The primary investigator collected injury information from the university's athletic trainers on a weekly basis. The operational definition for an injury in this study was any noncontact musculoskeletal injury to the LQ (low back or lower extremities) that occurred during a practice or game, requiring the athlete to be removed either from that day's event or preventing the ability of one to participate in the subsequent event (i.e., time loss).

Statistical Analysis

Descriptive statistics (mean [± SD]) were calculated for demographic data (e.g., age, years in school, age starting sport) per sex. Mean (± SD) reach distance scores were calculated per limb for the total population, per sex, and per injury status. Reach distance was normalized as a percentage of limb length ([reach distance/limb length] x 100).11,12 A composite reach score, which is a measure of each distance normalized to leg length, was also calculated. The formula to calculate the composite reach score was: ([mean anterior-!-mean posteromedial + mean posterolateral]/[limb length X 3])x 100."'12 Independent r-tests were performed to compare reach scores between athletes who were injured or not injured during the season. Cumulative incidence was calculated by dividing the number of injuries by the sample population (e.g., total injuries/total population).

Statistical analysis of injury risk was performed per each sex. Receiver operator characteristic (ROC) curves were constructed per sex for each reach distance and for each composite score. The purpose of performing a ROC curve analysis is to identify a cutoff score that maximizes test sensitivity and specificity. ROC curves were constructed based on reach asymmetry into each direction of the Y, normalized reach distance per each direction of the Y, and the composite score (Figure 1). The area under the curve (AUC) associated with each ROC curve were evaluated for significance. Reach measures that were found to be significant were analyzed for potential cutoff scores that maximize sensitivity and specificity. Identified cutoff scores were used to dichotomize athletes into at-risk and reference groups. Relative risk (RR) was calculated based on group dichotomization. Statistical analyses was performed by using SPSS 24.0 (IBM Inc., Chicago, IL) for all calculations.

Results

Baseline demographic measures and sport representation for each sex is presented in Table 1. A total of 38 (19 per sex) noncontact time-loss LQ injuries occurred during this study (Table 2). Thirty-seven of the 38 injuries were traumatic in nature (e.g., sprains, strains), with one injury resulting from an overuse mechanism (medial tibial stress syndrome). The cumulative incidence of injury for the total population was 17.75 per 100 athletes, 18.2 per 100 female athletes, and 17.27 per 100 male athletes. Normalized reach distances and composite score distances for each lower extremity, dichotomized by injury status, are presented in Table 3. There were no differences in YBT-LQ scores between injured and noninjured individuals for the total population or for male athletes. There were three reach measures that were significantly different between injured and noninjured female athletes. Injured females had significantly greater reach scores into the left (L) posteromedial, (L) posterolateral, and the (L) composite score than their noninjured female counterparts (p-values = .001, .033, and .020, respectively).

There were only four ROC curves that had significant AUC (Table 4): right posteromedial reach for female athletes, left posteromedial reach for female athletes, left posterolateral reach for female athletes, and the left composite score for female athletes. The cutoff scores for each of the aforementioned reach measures are presented in Table 4. Table 5 presents the relative risk of injury for the aforementioned four reach measures. Female athletes were dichotomized into an at-risk group and a reference group; the reference group consisted of athletes with greater reach scores. Female athletes with shorter reach scores were significantly less likely to experience a noncontact time-loss LQ injury. In other words, female athletes with a greater right (R) posteromedial reach were five times more likely to get injured (RR = 5.3; 95% CI: 1.3, 21.8; p-value = .008); were four times more likely to be injured with a greater (L) posteromedial (RR = 4.1; 95% CI: 1.0, 17.0; p-value = .02) or (L) posterolateral reach score (RR = 4.2; 95% CI: 1.8, 10.3; p-value = .001); and three times more likely to be injured with a greater (L) composite score (RR = 3.1; 95% CI: 1.1, 8.7; p-value = .023).

Discussion

The purpose of this study was to determine if the YBT-LQ test could be used as a screening tool to identify D-III collegiate athletes at risk for a noncontact time-loss LQ injury. Prior studies had reported a relationship between preseason scores and injury.[12,15–18] However, contrary to those studies, this study found no association between preseason YBT-LQ scores and subsequent noncontact time-loss LQ injury in a heterogeneous population (i.e., male and female athletes) of D-III athletes or in a heterogeneous sample of male athletes representing four sports. Interestingly, there were statistically significant associations between some reach scores and injury in the sample of D-III female athletes; however, contrary to our hypothesis, athletes with greater reach scores had an increased risk of injury.

As previously mentioned, female athletes with greater reach scores were significantly more likely to experience a noncontact time-loss LQ injury than female athletes with shorter reach scores. This is counter to what was hypothesized. Clinicians should view

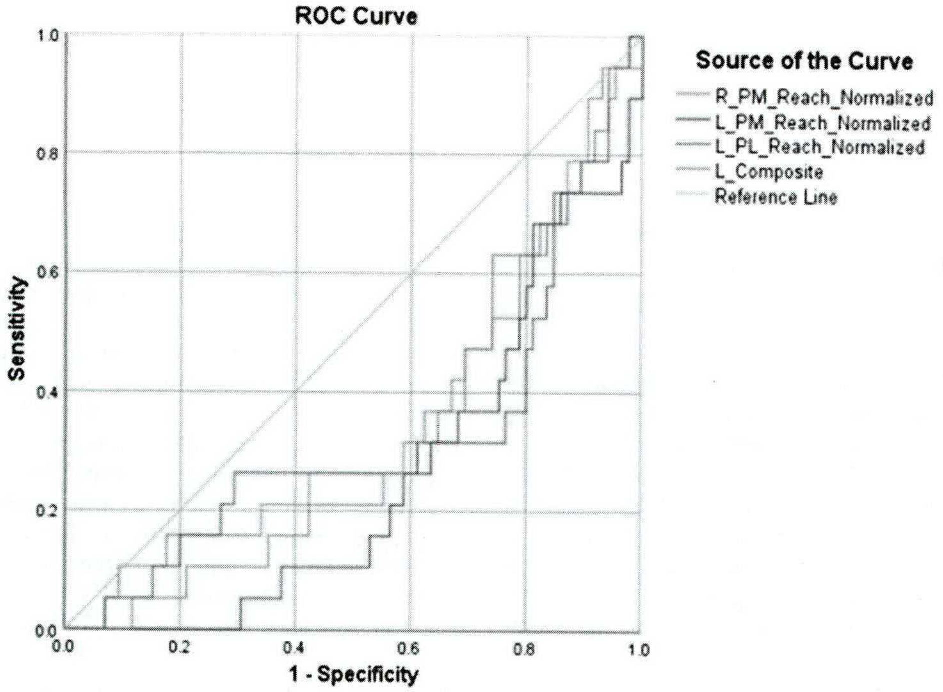

Figure 1 — Receiver operator characteristic (ROC) curves depicting significant area under the curve (AUC) for four reach measures in the female cohort (see Table 4 for entire list of reach measures evaluated by ROC curves). R = right; L = left; PM = posteromedial; PL = posterolateral.

Table 1 Baseline Demographic Measures and Sport Representation for All Athletes and per Sex

Characteristic	All Athletes (n = 214)	Female Athletes (n = 104)	Male Athletes (n = 110)
Age	19.4 (1.2)	19.2 (1.2)	19.6 (1.2)
Years in school (y)	2.1 (1.1)	2.2 (1.1)	2.0 (1.1)
Age starting sport (y)	10.5 (3.6)	11.1 (3.0)	10.0 (4.0)
Sport			
Basketball	24	0	24
Soccer	75	35	40
Volleyball	32	32	0
Tennis	17	11	6
Track & field	66	26	40

Table 2 Noncontact Time-Loss Injuries per Sex

Body Region	Females (Frequency of Injury; Range of Time Loss)	Males (Frequency of Injury; Range of Time Loss)
Torso		Lumbar strain (1; 13)
Hip	Adductor strain (2; 4–12) Hip flexor strain (1; 5)	Hip flexor strain (2; 6–21)
Thigh	Quadriceps strain (2; 3–9) Hamstring strain (5; 2–9)	Hamstring strain (5; 8–22)
Knee	ACL sprain (3; 36–54)	Meniscus sprain (1; 28) ACL sprain (1; 65) PCL sprain (1; 95)
Leg, ankle, foot	Lateral ankle sprain (4; 2–20) Medial tibial stress syndrome (1; 6) Fibularis muscle strain (1; 9)	Lateral ankle sprain (4; 3–15) Gastrocnemius strain (1; 3) Achilles strain (2; 4–7) Midfoot sprain (1; 7)
Total number of injuries per sex	19	19

Abbreviations: ACL = anterior cruciate ligament; PCL = posterior cruciate ligament.

Table 3 Comparison of YBT-LQ Preseason Scores Between Injured and Noninjured Athletes

	All Athletes (n = 214)			Female Athletes (n = 104)			Male Athletes (n = 110)		
Reach Direction	Injured (n = 38)	Noninjured (n = 176)	*p*-value	Injured (n = 19)	Noninjured (n = 85)	*p*-value	Injured (n = 19)	Noninjured (n = 91)	*p*-value
Right lower extremity									
Anterior	69.7 (6.9)	69.9 (9.3)	.884	69.6 (4.8)	68.4 (7.0)	.492	69.8 (8.6)	71.3 (10.9)	.565
Posteromedial	111.9 (15.3)	108.9 (16.3)	.288	109.3 (17.5)	101.8 (18.6)	.110	114.5 (12.8)	115.4 (10.0)	.726
Posterolateral	109.2 (12.3)	107.6 (10.9)	.407	109.3 (10.0)	106.1 (10.2)	.231	109.2 (14.6)	108.9 (11.4)	.922
Composite	96.9 (9.6)	95.4 (10.0)	.403	96.0 (8.6)	92.1 (9.4)	.097	97.8 (10.7)	98.6 (9.7)	.772
Left lower extremity									
Anterior	72.9 (11.0)	72.7 (12.9)	.930	75.3 (13.3)	74.2 (15.2)	.757	70.6 (7.7)	71.4 (10.3)	.730
Posteromedial	114.4 (9.5)	111.2 (10.9)	.090	116.2 (7.0)	107.6 (10.4)	.001	112.7 (11.3)	114.5 (10.4)	.495
Posterolateral	109.3 (10.7)	107.1 (10.3)	.244	110.2 (8.3)	105.3 (9.2)	.033	108.4 (12.8)	108.9 (11.0)	.861
Composite	98.9 (8.3)	97.0 (9.1)	.243	100.6 (7.2)	95.7 (8.4)	.020	97.2 (9.2)	98.3 (9.5)	.658

this finding with caution. The authors of this study are not recommending to "detrain" an athlete so that she has shorter reach scores or to have athletes with greater reach scores avoid sport participation. Rather, there are three potential reasons for this finding. First, it is possible that athletes with greater reach scores experienced more exposure to injury. For example, a study reporting YBT-LQ scores for female collegiate volleyball players (n = 134) found that starters had significantly greater reach scores

Table 4 Area Under the Curve, Asymptotic Significance, Identified Cutoff Score, and Sensitivity/1-Specificity for Each ROC Curve

Category	Area Under the Curve (95% CI)	Asymptotic Significance	Cutoff Score per ROC	Sensitivity/1-Specificity per ROC
ROC curve analysis based on normalized scores				
All subjects (n = 214)				
(R) Anterior reach	0.493 (0.399, 0.587)	0.892	Not significant*	N/A
(R) Posteromedial reach	0.435 (0.336, 0.534)	0.207	Not significant*	N/A
(R) Posterolateral reach	0.467 (0.362, 0.573)	0.529	Not significant*	N/A
(R) Composite score	0.457 (0.357, 0.556)	0.402	Not significant*	N/A
(L) Anterior reach	0.471 (0.376, 0.565)	0.571	Not significant*	N/A
(L) Posteromedial reach	0.405 (0.314, 0.496)	0.067	Not significant*	N/A
(L) Posterolateral reach	0.434 (0.330, 0.538)	0.202	Not significant*	N/A
(L) Composite score	0.433 (0.336, 0.530)	0.196	Not significant*	N/A
Anterior reach difference	0.565 (0.469, 0.660)	0.212	Not significant*	N/A
Posteromedial reach difference	0.584 (0.482, 0.687)	0.103	Not significant*	N/A
Posterolateral reach difference	0.588 (0.485, 0.692)	0.088	Not significant*	N/A
Female subjects (n = 104)				
(R) Anterior reach	0.445 (0.323, 0.567)	0.457	Not significant*	N/A
(R) Posteromedial reach	0.346 (0.205, 0.487)	0.037	112.66	0.316/1–0.647
(R) Posterolateral reach	0.406 (0.259, 0.553)	0.201	Not significant*	N/A
(R) Composite score	0.375 (0.233, 0.518)	0.090	Not significant*	N/A
(L) Anterior reach	0.410 (0.279, 0.540)	0.067	Not significant*	N/A
(L) Posteromedial reach	0.254 (0.146, 0.363)	0.001	106.17	0.263/1–0.424
(L) Posterolateral reach	0.323 (0.177, 0.468)	0.016	110.56	0.316/1–0.741
(L) Composite score	0.325 (0.199, 0.452)	0.017	95.75	0.211/1–0.506
Anterior reach difference	0.510 (0.369, 0.651)	0.890	Not significant*	N/A
Posteromedial reach difference	0.570 (0.427, 0.713)	0.342	Not significant*	N/A
Posterolateral reach difference	0.590 (0.454, 0.727)	0.221	Not significant*	N/A
Male subjects (n = 110)				
(R) Anterior reach	0.527 (0.388, 0.667)	0.707	Not significant*	N/A
(R) Posteromedial reach	0.526 (0.376, 0.677)	0.719	Not significant*	N/A
(R) Posterolateral reach	0.522 (0.365, 0.678)	0.767	Not significant*	N/A
(R) Composite score	0.530 (0.380, 0.681)	0.678	Not significant*	N/A
(L) Anterior reach	0.529 (0.397, 0.661)	0.695	Not significant*	N/A
(L) Posteromedial reach	0.538 (0.404, 0.672)	0.605	Not significant*	N/A
(L) Posterolateral reach	0.525 (0.378, 0.672)	0.731	Not significant*	N/A
(L) Composite score	0.532 (0.390, 0.673)	0.667	Not significant*	N/A
Anterior reach difference	0.641 (0.516, 0.765)	0.055	Not significant*	N/A
Posteromedial reach difference	0.418 (0.272, 0.564)	0.262	Not significant*	N/A
Posterolateral reach difference	0.591 (0.433, 0.748)	0.216	Not significant*	N/A

Abbreviations: (L) = left; N/A = not applicable; (R) = right; ROC = receiver operator characteristic. *No cutoff score selected based on ROC curve analysis due to a nonsignificant area under the curve.

in five out of eight measures.[24] However, in this study, 72% of the athletes who were injured were not primary starters from their team. Second, it is possible that this finding is unique to this sample and would not be validated in a second sample of female D-III athletes. Brumitt et al. observed this when prospectively evaluating injury risk based on preseason performance of the lower extremity functional test (the LEFT is an agility drill performed over a diamond-shaped course).[25,26] An initial study found that faster male D-III athletes had a greater risk of a noncontact time-loss LQ injury; however, a subsequent study found no relationship between preseason scores and injury.[25,26] A third potential reason is that the YBT-LQ may not be useful at dichotomizing injury risk. FPTs, such as the YBT-LQ, have held promise as screening tools to discriminate athletes at risk for injury. As previously mentioned, some studies have demonstrated an association between preseason YBT-LQ scores and subsequent injury.[12,15–18] However, the findings from those aforementioned have not been validated in subsequent studies. There are several reasons that may explain why initial studies found an association between preseason dynamic balance scores and injury whereas subsequent studies have not.

Table 5 Relative Risk of Injury Based on Reach Measures Associated With Significant ROC Curves

Category	N	LQ Injury Counts and (%) per Category	Relative Risk (95% CI)	*p*-value
Females (n = 104)				
(R) Posteromedial reach				
112.66 or less	40	2 (1)	0.2 (0.05, 0.8)	.008
112.67 or more	64	17 (27)	1.0 (Reference)	
(L) Posteromedial reach				
106.17 or less	37	2 (5)	0.2 (0.05, 0.9)	.02
106.18 or more	67	17 (25)	1.0 (Reference)	
(L) Posterolateral reach				
110.56 or less	69	6 (9)	0.2 (0.1, 0.6)	.001
110.57 or more	35	13 (37)	1.0 (Reference)	
(L) Composite score				
95.75 or less	47	4 (9)	0.3 (0.1, 0.9)	.023
95.76 or more	57	15 (26)	1.0 (Reference)	

Abbreviations: L = left; LQ = lower quadrant; R = right; ROC = receiver operator characteristic.

First, the operational definition (OD) of a qualifying injury used for statistical analysis varies between studies. In this study only noncontact time-loss injuries to the LQ region were counted. This OD of an injury was selected for two reasons. First, loss of time from sport is an objective measure of injury severity. The inclusion of non-time-loss injuries introduces a level of subjectivity. Smith et al.[15] included non-time-loss injuries in their study. It is possible that the reported relationship between injury and anterior reach asymmetry of > 4 cm would not have been significant had the authors only included noncontact time-loss injuries in their analysis (Note: This is speculative, the authors[15] did not report different odds ratios for only time-loss injuries).[15] Second, only noncontact injuries were included in the analysis. There is evidence in the literature that the risk of experiencing a noncontact injury (e.g., hamstring strains, noncontact anterior cruciate ligament sprains) may be reduced with training programs.[27–30] To our knowledge there is no evidence that suggests injuries due to contact mechanisms can be reduced with training programs. One prospective cohort study evaluating the ability of the YBT as a screening tool included injuries resulting from a contact mechanism. Hartley et al.[18] reported that a shorter anterior reach score was associated with an ankle sprain. It is possible that they would not have reported a significant association between scores and injury had they only included injuries resulting from noncontact mechanisms (Note: This is speculative; Hartley et al.[18] did not provide data in their study to allow for an analysis based on injury mechanism).

Second, the sample size used in some studies may have resulted in a type I error (i.e., false positive conclusion). For example, Butler et al.[16] evaluated YBT-LQ performance in only 59 collegiate football players. Gonell et al.[17] reported an association between asymmetry in the posteromedial reach direction and injury in male soccer players; however, the sample in that study was 74. There have been no follow-up studies to date validating these findings. Recent studies, consisting of larger sample sizes, have failed to identify an association between scores and injury.[19,20,22]

Third, YBT-LQ test modifications or performing the "Y" on a SEBT grid may affect the findings of a study. For example, Hartley et al. reported an association between a shorter anterior reach score and ankle sprain injury.[18] However, Hartley et al. required the athletes to maintain their hands on their hips during performance of the test.[18] This is a modification from the testing protocol as described by Plisky et al.[11] Clinicians who screen athletes applying the cutoff score from Hartley et al.[18] may do so incorrectly if they use the testing protocol described by Plisky et al.[11] The SEBT inspired the creation of the YBT. One might assume that performance during the SEBT is similar to performance of the YBT. Plisky et al. originally reported an association between SEBT performance and injury in high school BB players.[12] Subsequent research utilizing the SEBT in the "Y" pattern has found associations between scores and injury in football players, netball athletes, and college-aged individuals.[13,31,32] However, clinicians should be advised to not assume that the two tests are identical. Athletes demonstrate different postural control strategies when performing the two tests.[33,34] (Note: Even though the aforementioned studies[13,30,31] evaluating the ability of the SEBT to discriminate injury risk found significant associations between scores and injury, these studies included contact injuries in the statistical analysis.)

The YBT-LQ does not appear to be effective at discriminating injury risk in athletic populations. However, for athletic trainers and other sports medicine professionals, the YBT-LQ can be used clinically to track improvements in balance after a sports conditioning program, evaluate the severity of an injury, or to quantify improvements in dynamic balance during clinical rehabilitation. Benis et al.[35] used the YBT-LQ test to evaluate improvements in postural control in elite female BB players who completed an 8-week body-weight neuromuscular training program. Ryu et al.[36] reported anterior reach asymmetry was greater in injured professional baseball players when compared to uninjured counterparts. The YBT-LQ has been used during clinical rehabilitation to track changes in balance in athletes post ACL reconstruction.[37]

There are strengths and weaknesses to this study that should be addressed. A strength of the study is that it had a large sample size for the total population. The sample sizes, per sex, can also be viewed as a strength. The sample sizes, per sex, were larger than some of the prior studies that reported an association between injury and preseason scores.[16,17] Another strength is the use of an OD of an injury that was restricted to noncontact time-loss LQ injuries. This is also the first study to our knowledge that analyzed YBT-LQ scores prospectively in a D-III collegiate population.

Even though this sample utilized a heterogeneous population, a weakness of this study is that it did not include athletes from all varsity-level sports. While the authors do not feel that the inclusion of athletes from other sports would have changed the results, it is worth noting.

Conclusion

Preseason YBT-LQ scores in a heterogeneous population of D-III collegiate athletes or in a population of D-III male athletes were not associated with a sport-related LQ noncontact time-loss injury. There were four reach scores that were associated with a greater risk of injury in female athletes; however, this finding should be viewed with caution and is likely the result of the sample. This study adds to a growing body of literature demonstrating that the YBT-LQ does not discriminate injury risk in athletes.

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