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INTRODUCTION

Professional basketball related injuries have not declined over the last decade despite improvements in training and conditioning or medical advancements in diagnostics, surgery, or rehabilitation. A descriptive epidemiological study of 80% of the National Basketball Association (NBA) teams over 17 years reported an injury incidence of 19.1 per 1000 athlete exposures, and 59,179 games missed due to injury.[9] Starkey found that the there has been a 12.4% increase in game-related injuries in the NBA in a 10-year period from the 1988 - 1997 seasons.[38] It is suspected that increased contact within the NBA along with improved player athleticism, size, power, and speed have contribute to the rise in injuries.[9,38] The most commonly reported injuries in the NBA as reported via the greatest number of days missed include ankle sprains, patellofemoral inflammation, knee sprains, and lumbar strains.[9,38] Recent trends involve less focus on specific physical or clinical measures and increased attention on the assessment of functional movement patterns for the purpose of predicting the likelihood of injury.[6] The Functional Movement Screen (FMS™) was introduced as a pre-participation examination intended to evaluate the quality of seven basic movement patterns that require a balance of both mobility and stability.[6] The functional movements tested include: deep squat, hurdle step, in-line lunge, shoulder mobility, active straight leg raise, trunk stability push-up, and rotary stability. It is designed to assess the extremes of specific movements and positions for the purpose of identifying potential limitation, compensation, and asymmetry in individuals without obvious pathology.[6,14] Recent literature has linked this screen to injury prediction in numerous populations that may be predisposed to injury, including professional football players, firefighters, collegiate female athletes, elite track and field athletes, military personnel.[29,4,19] The majority of reliability studies conclude that the FMS™ has good intra-rater reliability. While some researchers conclude that reliability increases with additional training and clinical experience, others claim that the FMS intra-rater reliability was not improved with FMS certification.[13,37] Inter-rater reliability was reported in recent studies to range from moderate and good to high.[40,24] The Y-balance Test (YBT) is pre-participation assessment used to screen individuals who may have potential for lower extremity injury. This test involves the examination of dynamic balance and postural control. While research is still lacking regarding the validity and utility of the YBT-LQ, the SEBT has been reported to have a moderate to strong effect size and that this test was reliable and valid as a dynamic predictor to lower extremity injuries.[13] No studies have investigated the outcomes of YBT as an injury predictor in professional basketball athletes or the relationship of these factors with functional movement screens.

PURPOSE:

The purpose of this study was to investigate the relationship between the Functional Movement Screen, the Y-balance test, and injury and performance in professional basketball players

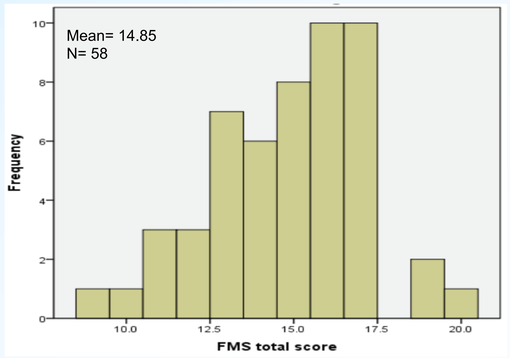
METHODOLOGY

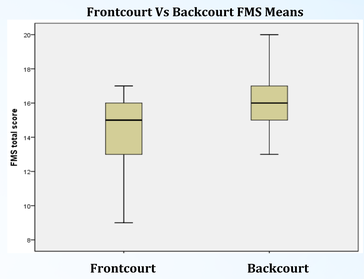
58 Athletes from 2 professional NBA teams were screened with the Functional Movement Screen (FMS) and the Y-Balance Test before the 2008-09, 2009-10, 2010-11, and 2011-12 NBA seasons. The results were pooled and retrospectively correlated with injury and performance data with SPSS.

RESULTS

The mean FMS score was 14.85 although a dichotomous injury outcome revealed no significant results. A continuous total of dichotomous outcome revealed an r-value of .594. The mean right and left composite Y-balance were 99.73 and 100.44 respectively but no correlation to injury was revealed. There was a direct correlation with Left Posterior-Lateral Stance with the Y-Balance Test and points per game (r = .936) and an indirect correlation between composite FMS score with free throws was found. This correlation increased when steals were included. A linear regression of number of games missed due to injury and FMS scores did not show significance with an r-value of 0.15. Components of the FMS also did not show significance with the highest r-value coming from left shoulder mobility at 0.265.

FMS Composite Histogram





Relationship	Statistical Analysis	Result
FMS, Y-Balance (all components) & Injury	Logistic Regression	r = 0.594
Left PL Stance & PPG	Linear Regression	r = 0.936
FMS Score & Games Missed	Linear Regression	r = 0.15
Shoulder Mobility & Games Missed (FMS Components)	Linear Regression	r = 0.265
Frontcourt vs Backcourt Injury	Mann-Whitney U	p = 0.293
Frontcourt vs Backcourt FMS Means	Mann-Whitney U	p = 0.014

Common FMS Compensations

DISCUSSION

The current study demonstrated that the mean FMS score for players on two NBA teams was 14.85 and that there was no significant relationship between FMS and missed games due to injury. This investigation did not find a significant relationship between the YBT and injury; although, a stepwise analysis of all components of the FMS and YBT did demonstrate an increase in predictive power with regard to injury. The findings were not statistically significant. While the mean FMS score (14.85) for NBA players study was lower compared to previous investigations (Avg =15.65), we did not find significant evidence that a cut score was predictive of injury for this population. Other studies suggest that a score less than or equal to 14 (active duty, NFL players) or 16 (firefighters) was predictive of injury. Subject pool homogeneity may be a factor related to the ability to find differences in a specific population. Perry presented normative data on the FMS in middle-aged adults and found that higher FMS scores were significantly correlated with higher levels of exercise participation while there was an inverse relationship with older individuals with a higher BMI. We did calculate the mean FMS scores according to position and found that the backcourt players averaged 15.95 and the frontcourt players averaged 14.14. There was a significant difference between the group's scores (p= 0.014) but while 64% of frontcourt players and 50% of backcourt players experienced an injury during the season, there was no significant difference between injury means (p=0.293). The current study did not show a significant correlation between YBT and injury or games missed; however, a direct relationship with Left-Posterior Lateral stance in the YBT and points per game was found. This has not been previously reported and could potentially be used to predict performance in athletes. There are limitations to the current study. Foremost, the NBA players continued to undergo training and preparation for the season after testing. This intervention can certainly affect a players potential for injury. Also, as athletes have become more aware of the utilization of functional assessments, they may not verbalize when they are experiencing pain during the FMS if they are concerned with the potential repercussions. Practice may also be a factor related to score improvement. Frost et al. found that although there was not a significant difference in total FMS scores (in firefighters), subjects may learn better techniques to perform the test, along with getting knowledge on scoring/results.[10] Other studies have found that when reaching in the same direction eight times the participant had greater efficiency. In other words, the possibility that athletes are "training for the test" may relate to the fact that earlier studies demonstrated a relationship between FMS and injuries while the current study did not. Certainly, there may be other factors that are predictive of injury that are not encompassed in the functional tests we utilized.

CONCLUSIONS

It is difficult to assess the effectiveness of the FMS or Y-Balance Scale in predicting injury in professional basketball players. Factors that may confound the utility of these measures include: elite level of performance, physical homogeneity of the subject pool, trainer and strength/conditioning coach intervention, and pre-test training and preparation. Additionally, subjects may be reluctant to share pain ratings with FMS testing due to perceived negative implications on player value.

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