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Functional Movement Screen and its Link to Sports Injury in Butler University Division I Student Athletes

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Functional Movement Screen and its Link to Sports Injury in Butler University Division I Student Athletes

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Sarah Dickinson

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INTRODUCTION

The Functional Movement Screen (FMS) is a physical assessment made up of seven fundamental movements which are designed to evaluate an individual's functional movement patterns. The seven subtests target mobility and stability to identify limitations or asymmetries in normal movement (O'Conner et al., 2011). It is suspected that individuals who continue to use substandard movements during training are more susceptible to musculoskeletal injury (Chorba et al., 2010).

In this study, FMS data from Butler University's Division I men's and women's basketball, soccer, and cross-country teams were analyzed to investigate potential correlation with injury prevalence, sports team, and gender. Research from the past 15 years has assessed the use of FMS data as a tool to predict sports related injury along with other variables. Since injury can be both physically and mentally detrimental for student athletes, it would be ideal to avoid it. This would allow athletic trainers to target areas of weakness specific to each sport and incorporate corrective movements into strength training to improve mobility and stability.

Other studies have been done on the relationship between athletic injury prevalence and FMS scores. Increased risk of injury was found in individuals who scored lower than or equal to 14 out of 21 on FMS testing and participated in professional football, collegiate soccer, collegiate volleyball, collegiate basketball, and mixed martial arts athletes (Kiesel et al., 2007; Chorba et al., 2010; Bodden et al., 2015). The FMS website stated their investigation of the cutoff score of 14 and concluded that it was consistent (Kiesel 2017). It was found that injury risk raised as high as an 11-fold increased chance in NFL football players compared to players who scored greater than 14

on the FMS (Kiesel et al., 2007). This would suggest that scores lower than or equal to the score of 14 could result in a greater risk of future injury for student athletes among the basketball, soccer, and cross-country teams at Butler University as well. In addition, one study specifically analyzing FMS as a tool to determine injury risk in female collegiate athletes reported a significant correlation with scores less than 14 and injury risk, including a 4-fold increased rate for lower extremity injuries (Chorba et al., 2010). While investigating more literature regarding gender, it was found that there was no significant difference between male and female athletes and overall FMS scores. However, females scored significantly lower than males on the Trunk Push Up subtest while males scored significantly lower than females on the Right and Left Shoulder Mobility and Left Active Straight Leg Raise subtests (Teixeira et al., 2019).

This study will analyze the use of the Functional Movement Screen (FMS) to determine if pain or compensation during the seven fundamental movements is related to injury prevalence of Butler University's Division I student athletes. The effect of injury on FMS scores will also be evaluated along with the individual's team sport and gender. Conclusions will be drawn on whether these variables impact FMS scores, and if the test could be used to predict sports related injuries. It is hypothesized that the 122 participants of the basketball, soccer, and cross-country teams at Butler University will experience an increased risk for injury with FMS scores less than or equal to 14. In addition, it is predicted that there will be significant differences in test scores between males and females.

METHODS

This study includes secondary data analysis from Butler University's athletic department. The strength and conditioning coaches within the athletic department have conducted FMS tests to the Division I men's and women's basketball, soccer, and cross-country teams at the University prior to their primary season. This includes seven subtests; Deep Squat, Hurdle Step, In-Line Lunge, Shoulder Mobility, Active Straight Leg Raise, Trunk Stability Push Up, and Rotary Stability. Participants were scored on each subtest on a scale of 0-3 based on their completion of each subtest. Scores of 3 were given to student athletes who completed a subtest with no asymmetrical compensation or pain. Scores of 2 were given to participants who completed a subtest with one or more compensatory movements with no pain. Scores of 1 were given when athletes were unable to complete a subtest. Scores of 0 were given when the participant experienced pain during the subtest. For subtests requiring the evaluation of both left and right sides of the body (Hurdle Step, In-Line Lunge, Shoulder Mobility, Active Straight Leg Raise, and Rotary Stability) the lower score for both sides were recorded. After all seven subtests were conducted, the participants received a score with the lowest possible score of 0 and the highest possible score of 21.

Butler University's athletic department and the Institutional Review Board approved the release of de-identified data for 122 student athlete participants including their FMS score, injury prior to FMS testing, injury following FMS testing, sports team, and gender. The data from 65 males and 57 females was then compiled and analyzed using IBM SPSS Statistics Software. The number of musculoskeletal injuries for each of

the 122 student athletes was counted with the inclusion criteria of musculoskeletal tears, sprains, strains, hyper extensions, cramps, fractures, tightness, weakness, and inflammation. Total FMS scores, on a scale of 0-21, and gender, encoded 1 = male and 2 = female, were also recorded. We used Pearson's correlation coefficient to determine the relationship strength between Total FMS scores and Number of Athletic Related Musculoskeletal Injuries. In addition, T-Tests for independent samples were conducted to assess Gender differences in relation to Total FMS mean scores, and the mean number of Athletic Related Musculoskeletal Injuries. We set a confidence level of 0.05 level (2-tailed). The Gender T-Tests with the variables of Number of Athletic Related Musculoskeletal Injuries and Total FMS scores also calculated the means and standard deviations, with a 95% Confidence Intervals. Lastly, the results of all three statistical tests were analyzed for significance and visually represented through a scatter plot and histograms. Conclusions were drawn on whether the FMS scores of Butler University student athletes were impacted by previous musculoskeletal injury and gender, and if scores lower than or equal to 14 out of 21 can be used to predict future injury.

RESULTS

In this study, we primarily assessed Total FMS Scores in relation to athletic related injury and secondarily assessed gender in relation to Total FMS Scores and athletic related injury amongst Butler University student athletes. This was accomplished by collecting de-identified data, assessing the number of musculoskeletal injuries for each athlete, and recording and analyzing the data through IBM SPSS Statistics Software. A Pearson correlation was performed on Total FMS Scores and the Number of Musculoskeletal Athletic Related Injuries, which resulted in a significant correlation ($r = 0.24$, p-value $=0.019$). This indicates a small relationship between the number of injuries and FMS score, which is athletes who scored higher Total FMS scores also had more musculoskeletal injuries. It was found throughout both genders of the studied collegiate teams on average student athletes had 2.32 injuries and on average scored 14.63 on FMS testing (Figure 1).

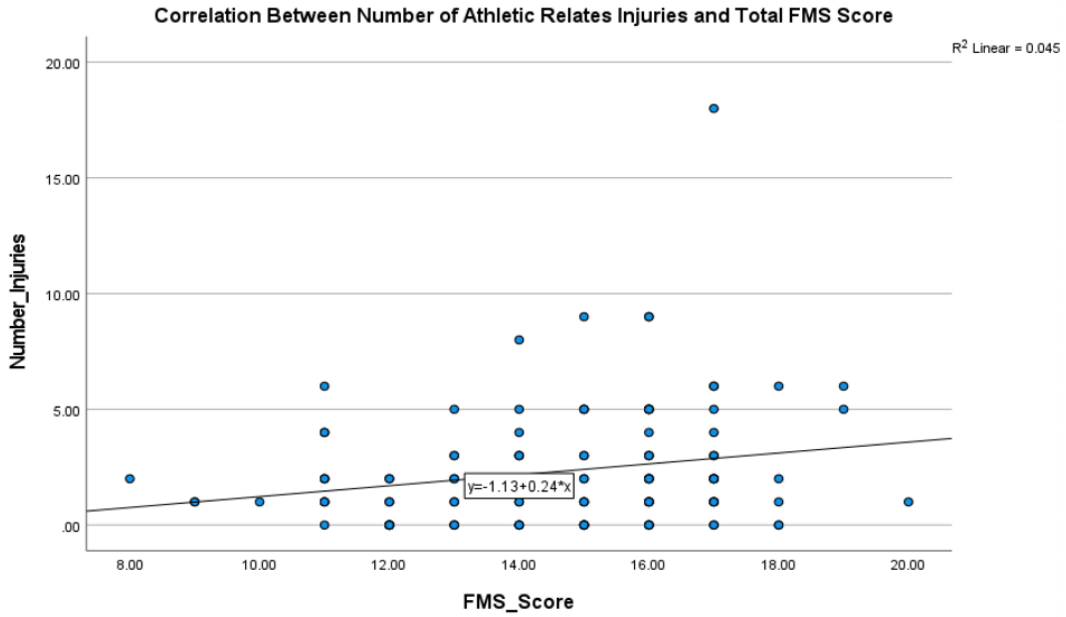

Figure 1. Scatter plot of the correlation between the number of musculoskeletal athletic related injuries and the total FMS scores for 122 Butler University Division I student athletes from the men's and women's basketball, soccer, and cross-country teams. Number of injuries and total FMS score for each athlete was recorded in IBM SPSS Statistics Software, where statistical analysis was run, and visual representation is plotted above. A linear regression represents the correlation between number of injuries and FMS score for each athlete, and the slope of the line ($r=0.24$) represents Pearson's r. The correlation between number of injuries for each athlete and FMS scores was significant and confirmed with a Pearson correlation ($p=0.019$).

A T-Test was performed on Total FMS Scores and Gender, which resulted in a significant difference in the means scores (p=0.017). This result is interpreted as the difference in the FMS means scores by gender, where on average gender 1=male had higher FMS scores than gender 2=female (15.09 vs. 14.10) (Figure 2). This T-Test was held to a 0.05 2-tailed significance level, with a 95% confidence interval of the difference (0.178, 1.796) lower limit CI, upper limit CI), and 120 degrees of freedom.

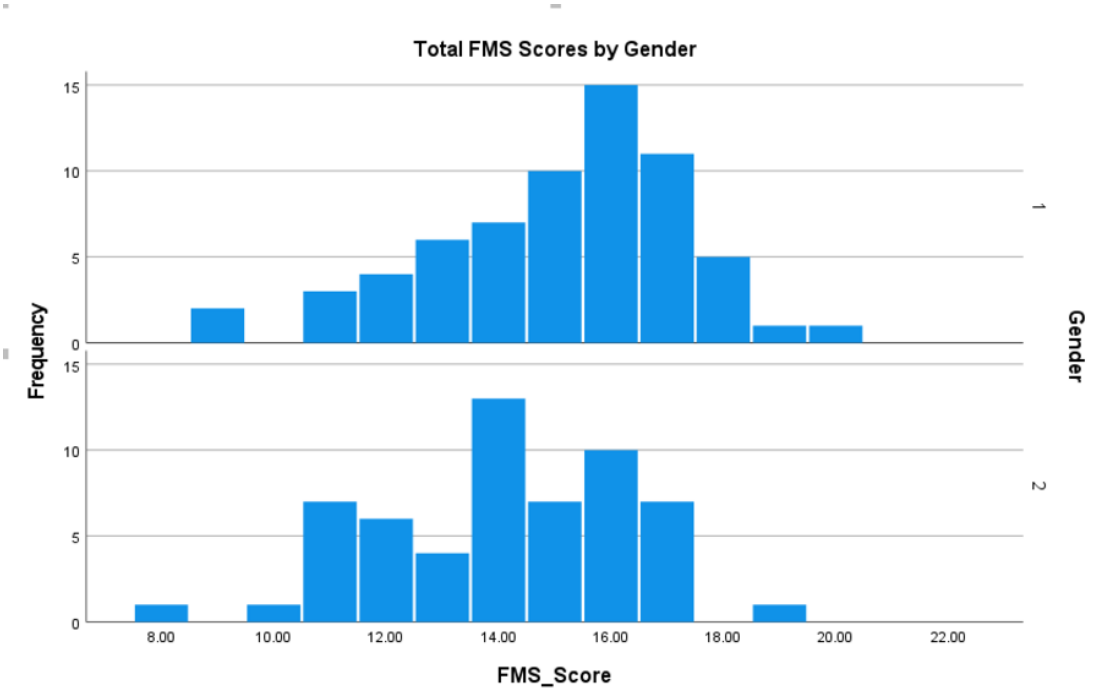

Figure 2. Histogram representing total FMS scores for 65 male and 57 female Butler University Division I student athletes from the men's and women's basketball, soccer, and cross-country teams. Gender (1=male and 2=female) and total FMS scores for each athlete was recorded in IBM SPSS Statistics Software. Statistical analysis via T-Test was run, and visual representation is plotted above. The difference in the FMS means scores by gender was significant and confirmed with a T-Test (p= 0.017).

Lastly, a T-Test was performed on Number of Athletic Related Injuries and Gender, which did not result in a significant difference in the mean number of injuries between genders (p=0.931). This result is interpreted as there is no difference in the number of injuries by gender, where on average gender 1=male had statistically the same number of injuries as gender 2=female (2.34 vs. 2.30) (Figure 3). This T-Test was held to

a 0.05 2-tailed significance level, with a 95% confidence interval of the difference (-0.878, 0.959), and 120 degrees of freedom.

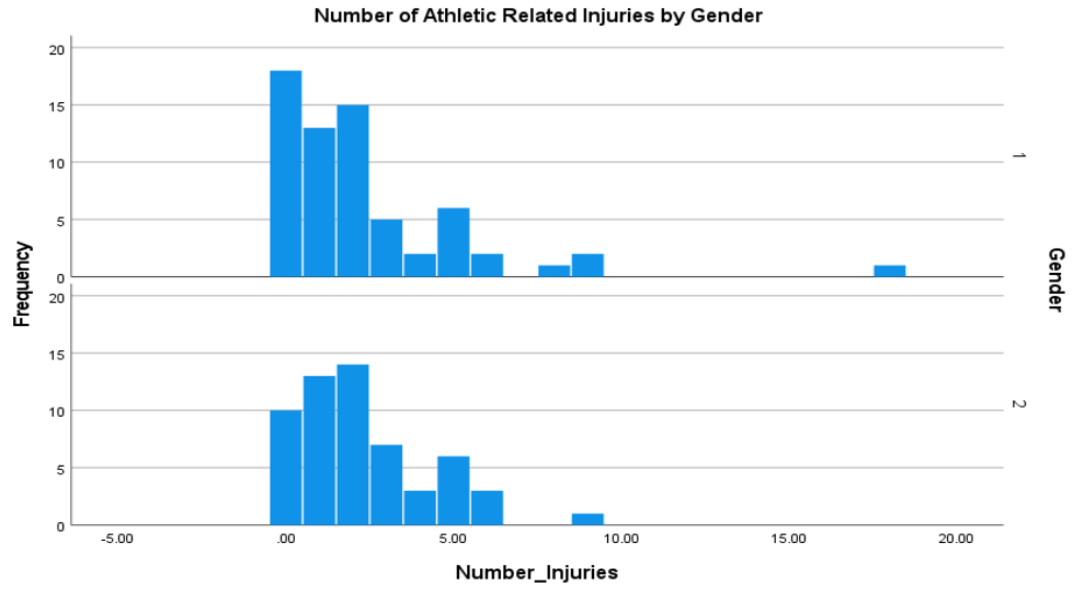

Figure 3. Histogram representing number of athletic related musculoskeletal injuries for 65 male and 57 female Butler University Division I student athletes from the men's and women's basketball, soccer, and cross-country teams. Gender (1=male and 2=female) and number of injuries for each athlete was recorded in IBM SPSS Statistics Software. Statistical analysis via T-Test was run, and visual representation is plotted above. The difference in the number of injuries means scores by gender was not significant and confirmed with a T-Test (p= 0.931).

CONCLUSION

In summary, this study found a positive small correlation between Total FMS Scores for Butler University Division I student athletes (men's and women's basketball, soccer, and cross-country teams), and the number of musculoskeletal injuries reported from athletics. The study consisted of 65 male and 57 female student athletes, where on average male student athletes scored higher on FMS testing than female student athletes. Lastly, it was found that there was no difference between the average number of athletic related musculoskeletal injuries between the two genders.

DISCUSSION

This study consisted of several different techniques to analyze the relationships between total FMS score, athletic related injuries, and gender. First, the Butler University athletic department provided de-identified data for 122 student athletes regarding the participants FMS scores, injury reports, gender, and sports team. Next, the acquired data was recorded in IBM SPSS Statistics Software where only musculoskeletal injuries was included and counted by number along with gender assignments and total FMS scores. Then, a Pearson correlation was performed to determine the relationship between total FMS scores and number of injuries, along with average FMS scores and average number of injuries. Next, T-Tests were performed to analyze the relationships between the 65 male and 57 female participants and total FMS score and number of injuries.

The results of the data gathered in this study show that athletes who scored higher on FMS testing were more likely to have higher numbers of athletic acquired injuries. This is because we rejected the null hypothesis since $p<0.05$, meaning that there was a statistically significant correlation between higher FMS score and higher numbers of injury. This finding goes against the purposed hypothesis of this study, since previous research predicted that there would be fewer injuries with higher FMS scores. This correlation was small, therefore there may be other factors involved with have impacted theses (such as years of playing sports, past injuries vs. injuries after taking the last measure, etc.), but that is out of the scope of this research and are part of the limitations of this study. The results also showed that there was a statistically significant difference between the means of FMS scores by gender, allowing us to reject the null hypothesis since $p<0.05$. This means that on average males had higher FMS scores than females among the student

athlete participants. However, there was no statistically significant difference in means between number of injuries by gender, therefore we failed to reject the null hypothesis since $p>0.05$.

Recent studies have been done on the relationship between athletic injuries and FMS scores, which included variables such as injury prior to testing and BMI. Injuries prior to FMS testing have also been assessed including a study which analyzed NFL football players. Players who were injured prior to FMS testing scored an average of 3.1 points lower than players who were not injured prior to testing (Kiesel et al., 2007). Similarly, previously injured elite junior Australian Football players were 1.5 times more likely to experience pain during at least one of the seven subtests of FMS testing compared to player with no previous injuries, resulting in a lower FMS score (Fuller et al., 2017). The previous data on football players indicates that injuries before FMS testing play a role in the participant's score. Lastly, research has shown that height and weight impacts FMS scores as well. In children, FMS has been negatively associated with BMI due to functional limitations from being overweight (Duncan et al. 2012). In addition, an article published by the Naval Health Research Center studied lower-extremity overuse injuries and found trends for injury in overweight and underweight females (Rauh et al., 2006). It is suggested that BMIs above or below the normal range will have an impact on FMS scores, therefore possibly predicting injury risk among student athlete participants at Butler University.

In the future, there is a need to assess whether FMS scores are influenced by injuries prior to FMS testing, BMI, and other factors such sport, years of playing sports, age, etc. Studies investigating the correlation between FMS testing and injury in athletes

will provide information to sports performance professionals to assess the importance of functional movement. Professionals can use this information to train athletes most efficiently to minimize injury and improve performance.

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