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BALANCE AND PITCH ACCURACY IN DIVISION I BASEBALL PITCHERS

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CHAPTER 1

INTRODUCTION

Postural control or balance can be defined statically as the ability to maintain the body's center of mass over a base of support with the least amount of movement and dynamically as the ability to execute a task while maintaining a stable position (Bressel, Yonker, Kras, Heath, 2007; Hrysomallis, 2011). Factors that influence balance include sensory information obtained from the somatosensory, visual, and vestibular systems and motor responses that affect coordination, joint range of motion, and strength (Bressel et al., 2007).

The baseball pitch is a complex action that has been studied extensively and utilizes every portion of the kinetic chain (Wilk, Meister, and Andrews, 2002). The wind up phase is the longest phase during this action. During this phase, the pitcher lifts their stride leg and must be able to maintain postural control on their push-off leg through the dynamic movement. If the pitcher loses control of their balance they are likely to lose control of the pitch (Shouchen et al., 2008).

Having poor balance has been shown to predispose athletes to various types of injuries (Michell, Ross, Blackburn, Hirth, and Guskiewicz, 2006). Some evidence in the literature suggests that superior balance among experienced athletes is largely the result of repetitive training experiences that influence motor

responses and not greater sensitivity of the vestibular system (Bressel et al., 2007). Others argue that superior balance is the result of training experiences that influence a person's ability to attend to relevant proprioceptive and visual cues (Oliver & Brezzo, 2009). Although experts may not agree on the mechanism, research suggests that changes in both sensory and motor systems influence balance performance and thus, injury risk (Hrysomallis, 2011).

A few studies have looked at the relationship between balance and sport performance in rifle shooting. These studies have shown that the better balance the participant had the more accurate they were (static performances). Ball et al. (2003) examined six elite rifle shooters. Each participant performed twenty shots under competition conditions. A force plate was used to measure body sway. The results of this study revealed that body sway has a direct influence on aim point fluctuation for all shooters. This shows that the better balance one has the less body sway they will have and thus the better accuracy while shooting a rifle.

Balance may also be associated with skating speed (dynamic performance) in younger hockey players (Behm, Wahl, Button, Power, & Anderson, 2005). Behm et al. (2005) found that hockey players under 19 years old were able to skate faster when they had better balance. This association may be related to the motor

development of the younger skaters. The difficult skills associated with skating would require a more developed balance that would improve with maturity and perhaps training (Behm et al., 2005). Since skating is performed on a very small surface area, the blade, in contact with a low friction surface, younger individuals with greater stability may have an advantage in executing the specific skating skills (Behm et al., 2005).

Very little research has been conducted on balance and dynamic performance in baseball, including variables such as pitch accuracy. In a study by Marsh et al. (2004), the researchers used the SMART Equitest System to measure unilateral balance of the participant's dominate leg. They measured pitch accuracy by using slow motion cameras and took the distance in centimeters from the middle of the catcher's glove at the start of the movement to the position the ball was caught. The data did not reveal a relationship between static balance and pitch accuracy. This is currently the only study that has examined this relationship. If a relationship is elucidated, it could shed light on the development of balance training exercise that could potentially improve pitch accuracy.

The purpose of this study was to determine if balance is related to pitch accuracy in NCAA Division I pitchers. Our Hypotheses were: 1. Participants who score poorly on the Balance Error Scoring System (BESS) test will be less accurate on the

pitch accuracy test. 2. Participants who score well on the BESS test will score well on the pitch accuracy test. It was assumed that all participants will conduct each test to the best of their abilities. It was assumed that the test for pitch accuracy will be an appropriate measure of the accuracy of each pitch. It was also assumed that the participants are in good physical condition.

Chapter 2

METHODS

Participants

The participants for this study consisted of 10 male, Division I baseball pitchers between the ages of 18 and 22 years old who were recruited from the Southern Illinois University-Carbondale men's team. The participant's positions were starting pitcher, long reliever, short reliever, and closer. All participants were considered to be fit and healthy individuals. Testing took place during the fall practice season. All participants signed an informed consent form approved by the Southern Illinois University Human Subjects Committee.

Testing Protocol

The participants completed three sessions, all two weeks apart. During each session, they were evaluated on balance and pitch accuracy. First, the participants warmed-up and were allowed to familiarize themselves with the testing conditions. They completed the balance portion, warm-up throwing, and then completed the pitch accuracy portion.

Instruments

Balance of all participants was measured using the Balance Error Scoring System (BESS). The BESS test is a test of static

balance and involved participants standing unsupported with their eyes closed under six conditions. They stood in single leg, double leg, and tandem stances on both a firm and a foam surface (Susco, McLoed, Gansneder, and Shultz, 2004). The firm surface test was the floor of the athletic training room. The foam surface was an Airex pad, a 50 x 41 x 6 cm medium-density foam pad.

The participants stood in each test condition for twenty seconds with their hands on their iliac crest. An error was scored if the subject did any of the following: (1) lifting either the hand off the iliac crest; (2) opening the eyes; (3) stepping, stumbling, or falling; (4) moving the hip into more than 30 degrees of flexion or abduction (measured by the naked eye of the researcher); or (5) lifting the forefoot or heel. All participants and errors were scored by the same researcher. The errors from each condition were added to get the total BESS score. The stances included; the double leg stance (participants stood with both feet together), the single leg stance (participants stood on their push off leg), and the tandem stance (participants stood heel to toe with their push off leg in the rear). If the participant's movement created measurable errors, they were instructed to return promptly to the testing position.

To measure pitch accuracy each participant was instructed to throw twenty fastballs in a section of the strike zone that was be randomly selected. The target consisted of an area 45.72cm across by 72.6cm high. This area represented the “strike zone.” This strike zone was divided into four equal 22.86cm by 38.1cm sections (Figure 1). The sections will be made of nylon string suspended over the plate. There was a catcher to help simulate a game experience. Each participant was scored on how many targets he hit out of the twenty pitches. The participants warmed-up their how they normally would before pitching off the mound. They were allowed five practice throws off the mound prior to each session.

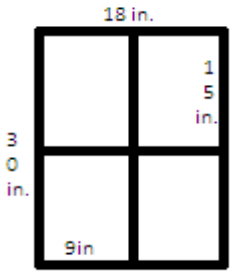

Figure 1. Strike zone

Data Analysis

Scores from each of the three trials of the BESS test and the pitch accuracy test were analyzed using interclass correlation (Pearson r). A simple analysis of variance was used

to determine differences in the Bess test and pitching accuracy scores between the three trials (PASW 18).

Chapter 3

RESULTS

The results of this study showed no correlation between static balance and pitch accuracy in division I baseball pitcher for any of the three trials (r^2=.03). Figure 2 illustrates the mean score of all 10 participants in the three rounds of the pitch accuracy test. Figure 3 shows the mean score of the 10 participants in the three rounds of the BESS test.

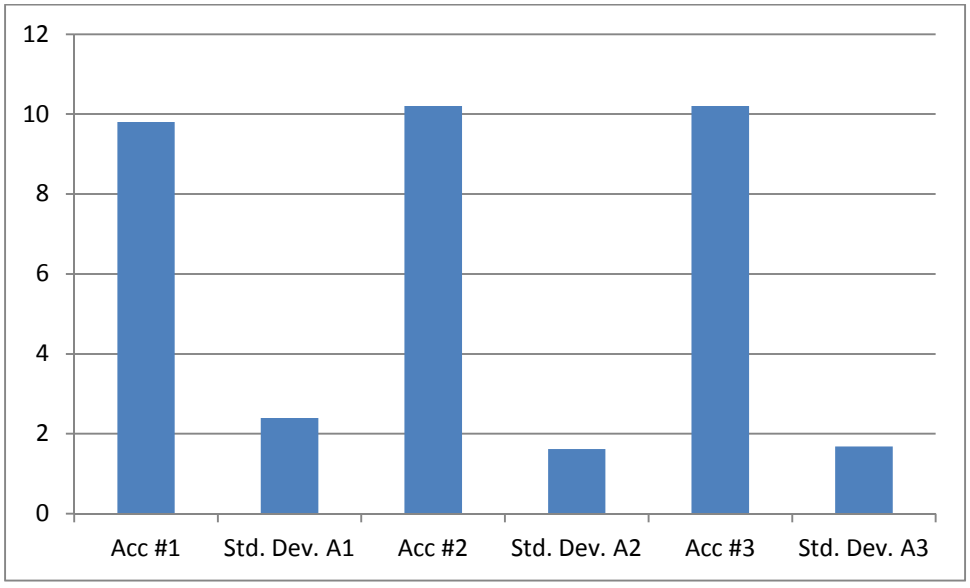

Figure 2. Mean scores and standard deviations for Pitch Accuracy Test.

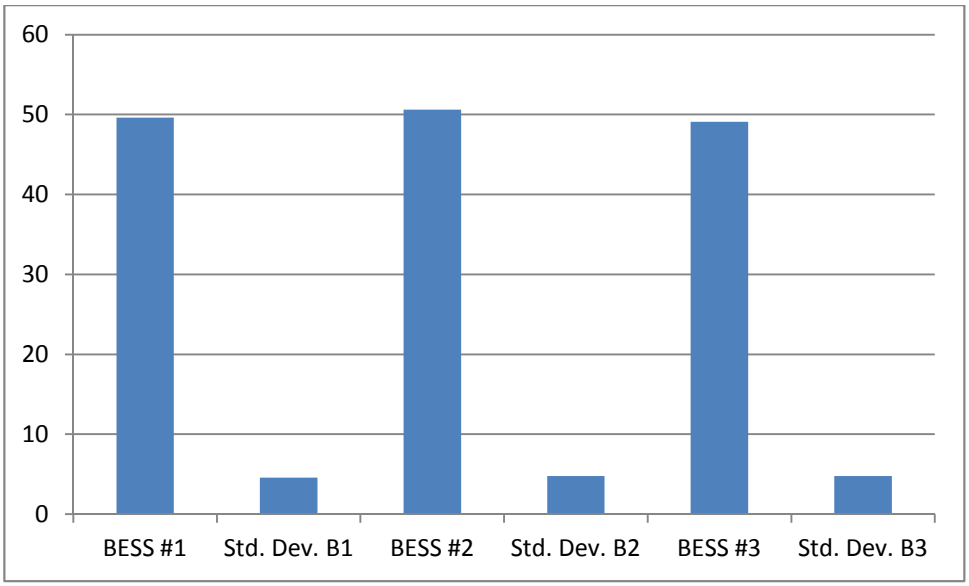

Figure 3. Mean scores and standard deviation for the BESS Test.

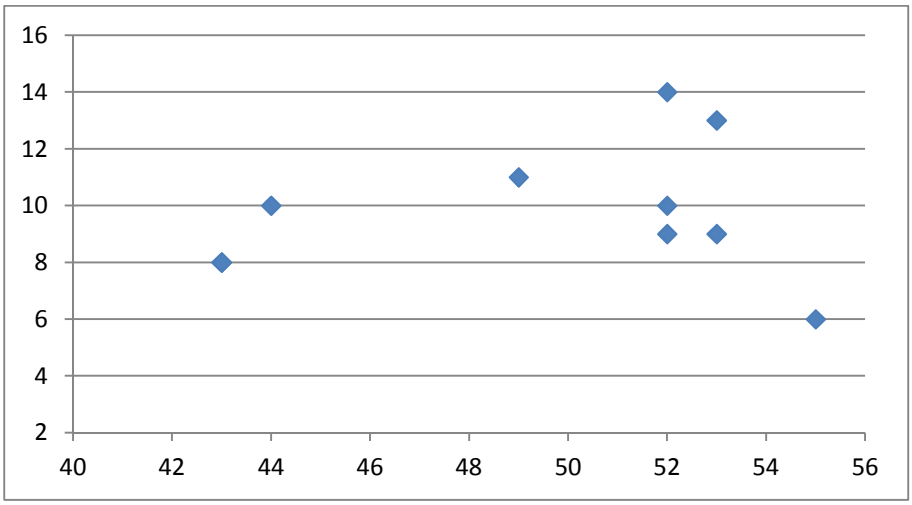

Figure 4. Scatter plot of the BESS test scores on the x-axis and the pitch accuracy score on the y-axis for trial 1.

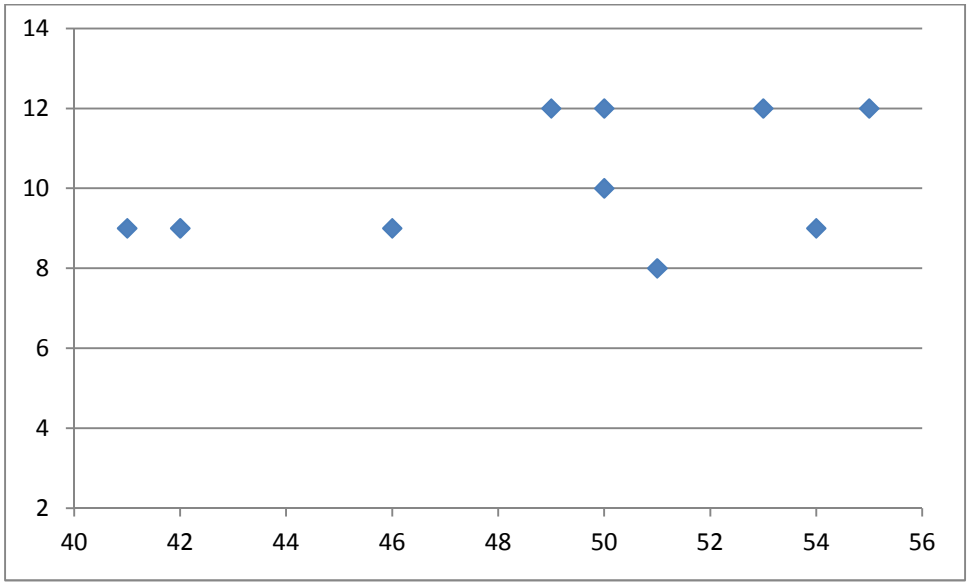

Figure 5. Scatter plot of the BESS test scores on the x-axis and the pitch accuracy score on the y-axis for trial 2.

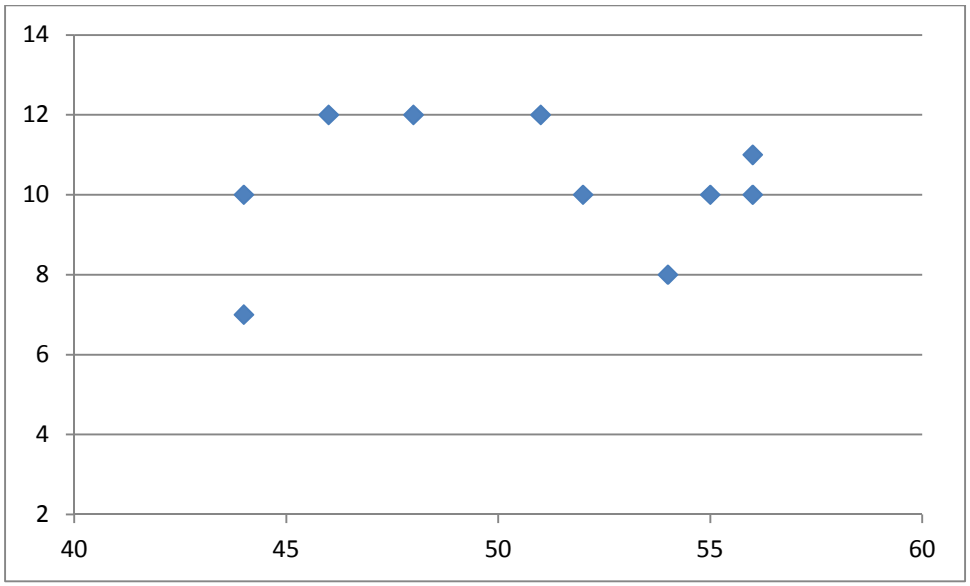

Figure 6. Scatter plot of the BESS test scores on the x-axis and the pitch accuracy score on the y-axis for trial 3.

Chapter 4

DISCUSSION

The results of this study indicated there was no correlation between the participants BESS test scores and the participants pitch accuracy score, and thus did not support our hypothesis. Our results are consistent with those of the previous study by Marsh et al. (2004). Marsh et al. (2004) found balance in collegiate pitchers did not correlate with their pitching error. When comparing the results in this study, the participants had the lowest balance score (49.1) but the highest pitch accuracy (10.2) score during the third trial. In the first trial, the participant's balance score was higher than the balance score for the third trial but the pitch accuracy was much lower. You could expect this given the time of season. Since this study was conducted during the fall season, the participants were coming off a longer rest. Therefore, they would not be as consistent as they might be in the middle of the season. The third trial may have been more accurate because the pitchers were further along in their fall throwing programs. Although balance did not show a correlation with pitch accuracy in experienced pitchers, it could play a role in the development of novice pitchers. This is because experienced pitchers have

established their throwing mechanics while novice pitchers have not. Future studies should examine this relationship.

Previous studies have shown balance has an association with accuracy during the sports of archery as well as rifle shooting. This could be because these sports require more of a static balance, where the participants are standing on both feet without moving their feet. The baseball pitch is a much more complicated movement that requires more dynamic balance. The baseball pitch is an action that has several movements that requires the use of the entire kinetic chain. Future research should be conducted measuring dynamic balance by having participants go through the throwing motion while on a force platform, as opposed to static balance, to find if it correlates with pitch accuracy.

Due to a limited availability of pitchers, sample size could have been a significant limitation to this study. The low numbers dictated that all types of pitchers, starters, relievers, and closers, be included and the issue that could have arisen with this situation is stamina. Starters are used to throwing 70 plus pitches in game, whereas closers may only throw 10-15 pitches. Starters should have a higher stamina than closers and this could have impacted the results.

Although the hypothesis was incorrect, the topic of baseball pitch accuracy still remains a fairly un-studied topic. Future research should be conducted to find what aspects of a pitcher affect their pitch accuracy. Previous studies show glenohumeral internal rotation deficit (GIRD) can be a cause to shoulder and elbow injuries (Wilk et al., 2002). This deficit could also result in performance issues, such as pitch accuracy.

Another topic for future research concerning pitch accuracy is hip range of motion, in particular, hip flexion. A deficit in hip flexion could cause the pitcher's stride to be shortened. This would cause timing issues with the mechanics of the pitch which could result in decreased pitch accuracy.

CHAPTER 5

SUMMARY

In conclusion, the results of this study found that balance does not acutely affect pith accuracy in Division I pitchers. Although previous studies have shown balance can influence performance outcomes, static balance does not have an influence on pitch accuracy in baseball (Hrysomallis, 2011). Future research needs to be conducted to determine what aspects of a pitcher affect their pitch accuracy. Future research topics could include the affect glenohumeral internal rotation deficit and hip range of motion have on pitch accuracy on baseball. Also, this study was conducted with experienced pitchers. Research needs to look into balance and pitch accuracy in the adolescent, less experienced population. This population is still developing and it would be interesting to see if balance has an effect on a less experienced population’s pitch accuracy.

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