



Effects of Starting Stance on Base Running Sprint Speed in Softball Players

AMY MARQUARDT[†], MEGAN A. WONG[†], CASEY M. WATKINS[†], SALDIAM R. BARILLAS[‡], ANDREW J. GALPIN[‡], JARED W. COBURN[‡], and LEE E. BROWN[‡]

Human Performance Laboratory, Department of Kinesiology, California State University, Fullerton, Fullerton, CA, USA

[†]Denotes graduate student author, [‡]Denotes professional author

ABSTRACT

International Journal of Exercise Science 11(6): 179-186, 2018. Speed is a crucial aspect in softball, and can be the difference between winning and losing. Base stealing is a method used to produce runs. There has been debate over which starting position is the most advantageous to maximize acceleration and speed to reach the next base the fastest. The purpose of this study was to examine the effect of different starting stances on acceleration and speed phases in collegiate softball players. Seventeen healthy NCAA Division I women's softball players (age = 19.9 ± 1.3 yrs, height = 167.0 ± 5.4 cm, mass = 74.8 ± 14.1 kg) volunteered to participate. Three maximum 45 ft sprints, with one minute rest, were performed (with splits at 15, 30 and 45ft) for each of three starting stances (front foot on the base, back foot on the base, and cross over stance). A 1x3 repeated measures ANOVA for total time demonstrated that front foot on the base was significantly faster (2.51 ± 0.18 s) than back foot on the base (2.70 ± 0.19 s) and the cross over step (2.66 ± 0.23 s). For all three splits, front foot on the base was also significantly faster (0.96 ± 0.07 s, 0.81 ± 0.06 s, and 0.73 ± 0.06 s) than back foot on the base (1.10 ± 0.13 s, 0.84 ± 0.05 s, and 0.75 ± 0.43 s) and cross over step (1.04 ± 0.09 s, 0.84 ± 0.06 s, and 0.75 ± 0.07 s). The decrease in time for front foot on the base was probably the result of using the base to push against, like a sprinter's block, to produce greater horizontal force to accelerate faster and reach a greater top speed. Coaches should teach their softball athletes to stand with their front foot on the base when base running.

KEY WORDS: Base stealing, sprint, stretch shortening cycle

INTRODUCTION

Stealing a base in the sport of softball is one way for the team to produce runs. However, players are not allowed to lead off the base until the pitcher has released the ball. Therefore, the starting position while attempting to steal has been debated regarding which is the most advantageous start stance off the bag to maximize speed and beat the catcher's throw. Since the distance between bases is only 60 feet, the acceleration phase is the most important factor for success (9). Kraan, van Veen, Snijders, and Storm found that maximal forward acceleration is achieved when sprinters start with sprinters blocks (17). Sprinters blocks help produce greater acceleration rates by creating higher ground reaction forces in the horizontal plane (8,

11). This may be beneficial for softball athletes, as the bag can mimic the starting blocks of a sprinter (3).

Although sprinters blocks appear to be the most effective starting position, many studies have shown the false step to also be effective when compared to a parallel stance (9, 15). A false step is when the front foot moves backwards before moving forward. Frost, Cronin and Levin (2008) found the a false step reduced 3m sprint times by 6% when compared to a parallel starting stance (10). Kraan et al. concluded that the false step produced more horizontal power due to the stretch-shortening cycle (15, 17). Similarly, Johnson et al. found the staggered split start to be faster than the parallel sprint start in collegiate volleyball players, especially when using the false step in conjunction with a staggered stance (15).

Previous research has focused on other sports, making it difficult for softball coaches to instruct players on the most effective starting stance for base stealing. Therefore, the purpose of this study was to examine the effect of different starting stances on acceleration and speed phases in collegiate softball players. We hypothesize that using the base as a starting block will result in the shortest acceleration and top speed phase times.

METHODS

Participants

Assuming an effect size f of 0.25, a power of 95%, and a correlation of $r=0.85$ between repeated measures, a power analysis estimated a sample size of 14 subjects. Seventeen NCAA Division I women's softball players (age range 18-25yrs; age= 19.9 ± 1.3 yrs, height= 167.0 ± 5.4 cm, mass= 74.8 ± 14.1 kg) volunteered to participate and were free from lower body injuries for the past 6 months. The study was approved by the University Institutional Review Board and all participants read and signed an informed consent prior to participation.

Protocol

Prior to testing, height was measured using an electronic stadiometer (Seca, Ontario, CA, USA) and mass with an electronic scale (DHRWM; MFG. CO., Webb City, MO 64870). All sprint tests were performed on the dirt infield of a regulation softball field utilizing a regulation first base. Testing was completed in one day lasting approximately 15 minutes per participant. All participants were instructed to wear their normal softball metal cleats as they would during a game. They completed a five minute dynamic warm up consisting of 20 feet of knee hugs, quad pulls, walking lunges and three 60 foot sprints at intensities of 50%, 75% and 100%. After the warm up, they were instructed on the three different starting stances. Stance 1 was with the left (front) foot on the base while the right (back) foot was behind and slightly to the right of the base (Figure 1). In stance 1, the athlete rocks back, shifting their weight to the back foot before starting their sprint. Stance 2 was with the back foot (preferred foot of the individual) on the base with the front foot in front of the base (Figure 2). Stance 3 was a crossover stance with the participant facing home plate, in a parallel stance, with the left foot on the bag (Figure 3).



Figure 1. Front foot on the base.



Figure 2. Back foot on the base.



Figure 3. Cross over stance.



Figure 4. A participant sprinting through the timing gates.

The researcher gave a verbal “ready, go” to each participant who then initiated their sprint on “go.” Each participant was instructed to sprint as fast as possible. A total of four timing gates, (Brower Timing Systems, Draper, UT, USA) were used to record sprint times. The first set of timing systems was placed 12in in front of the base as start gates. The second, third, and fourth sets were placed at 15ft, 30ft, and 45ft distances from the starting gates. Breaking the infrared beam provided 0-15ft, 15-30ft, and 30-45ft split times (Figure 4). The distance between bases in softball is 60 feet, but 45 feet was used for the study because the last 15ft is used to decelerate in order to slide into the base. Each stance was performed three times in random order, in which all three trials of one stance were completed before moving to the next stance. One minute rest was given between each sprint of the same stance and two minutes between

different stances. Fourteen of the seventeen participants reported they normally used their front foot on the base when base stealing, while the other three reported using their back foot on the base.

Statistical Analysis

A 1x3 repeated measures ANOVA analyzed total time between conditions. A 3x3 (condition x split) repeated measures ANOVA analyzed split times between conditions. Three 1x3 repeated measures ANOVA analyzed split times between conditions. An alpha level of 0.05 was used to determine statistical significance. The average of the three sprint times were used for all statistical analyses. All statistical analyses were performed using IBM SPSS Statistics software (version 24, IBM, Armonk, NY, USA).

RESULTS

For total time, there was a main effect for condition where front foot on the base stance was significantly less than back foot on the base and cross over step stances (Table 1).

For split times, front foot on the base stance was significantly less than back foot on the base and cross over step stances across all three splits (Table 2). Also, for all stances, split 30-45 was less than splits 0-15 and 15-30 while split 15-30 was less than split 0-15.

Table 1. Total times (mean±SD) between conditions.

	Front Foot on Base	Back Foot on Base	Cross Over Stance
Total Time (s)	2.51 ± 0.18*	2.70 ± 0.19	2.66 ± 0.23

* = Significantly less than both the back foot on the base and the cross over stance (p<0.05)

Table 2. Split times (mean±SD) between conditions.

	Front Foot on Base	Back Foot on Base	Cross Over Stance
0-15 ft Split (s)	0.96 ± 0.07*	1.10 ± 0.13	1.04 ± 0.09
15-30 ft Split (s)	0.81 ± 0.06*^	0.84 ± 0.05^	0.84 ± 0.06^
30-45 ft Split (s)	0.73 ± 0.06*#	0.75 ± 0.04#	0.75 ± 0.07#

* = Significantly less than both the back foot on the base and cross over stances (p<0.05). ^ = Significantly less than 0-15 split (p<0.05). # = Significantly less than both 0-15 and 15-30 splits (p<0.05)

DISCUSSION

The purpose of this study was to examine the effect of three different starting stances on base stealing acceleration and speed phases in collegiate softball players. The major finding was that sprint times with the front foot on the base were less than with the back foot on the base and with the cross over stance. This time decrease occurred in all three splits and the total time and was probably the result of a combination of leg momentum, the stretch shortening cycle (SSC) and using the base like a sprinter’s block to produce greater horizontal force in order to accelerate faster and reach a greater top speed.

Previous studies (1, 15, 17, 19) have examined different starting stances for sprinting, such as the false step, parallel and staggered stances, in multiple sports. However, few studies have examined softball players. Coleman and Amonette examined sprinting in major league baseball players, however, they examined sprinting from home to first base rather than stealing between bases (5).

Acceleration is a crucial component for the success of softball athletes (9, 21) as the distance between bases on a softball field is only 60 ft. Therefore, softball athletes need to accelerate as fast as possible to reach the next base quickly. Since softball rules do not allow players to leave contact with the base (i.e. lead off) until the pitcher has released the ball, starting with the front foot on the base and back foot behind the base allows a player to push off the base and take a full step with the back foot while the front foot is still in contact with the base. In the other two stances, while athletes still push against the base with their foot to generate horizontal force, (3) they do not have forward momentum with the other foot. However, both front foot in contact and back foot in contact are similar to track and field sprinting, where athletes use blocks to maximize horizontal force generation to increase forward momentum (8, 11, 17).

Kraan, van Veen, Snijders, and Storm examined the advantage of a false start by having subjects perform three types of starting stances: (a) starting on the subject's own initiative, (b) starting with both feet together parallel with no backwards step, and (c) a split start (17). They found that forward force production was significantly greater in the false step stance than the other two, while the parallel stance was significantly slower than both the other two stances. Thus, the stance initiated by a step backwards resulted in the highest force production and power during the contact phase when compared to those that did not. Slawinski et al. suggested that increased power, force and velocity might contribute to faster sprint times using a false start when compared to a parallel start (24). They also suggested that using a false start might be associated with greater kinetic energy (24). Weyand, Sternlight, Bellizzi and Wright concluded that the ability to generate greater force into the ground was the primary mechanism for achieving faster speeds (25). The results of the present study suggest that faster sprint times resulted due to increased force production were generated from using the base to push off, similar to a starting block, and forward momentum of the swing leg.

The front foot on the base utilizes the SSC which is a mechanism whereby an eccentric muscle action occurs immediately prior to a concentric muscle action and results in greater force production than the concentric action alone (12). Previous studies have shown sprint performance is positively correlated with exercises that utilize the SSC (12). A study by Johnson et al. (15) examined four different starting positions in collegiate volleyball players: parallel stance with a forward first step, parallel stance with a false step before stepping forward with the front foot, a staggered stance with the first step coming from the back foot, and a staggered stance with a false step by switching feet before stepping forward. Their results showed a staggered stance, with or without the false step, was faster than the parallel stance and concluded it was due to use of the SSC and the ability to shift the center of mass forward (15). This is similar to the present study in that both stances, the staggered false step stance and front foot on the base, resulted in the fastest sprint times and both utilized the SSC

prior to the push-off phase (15). When using the front foot on the base stance, athletes rock back toward the back leg, then swing their front leg towards the next base (i.e. increasing momentum) as they simultaneously push off the base with their front foot to begin the sprint (3).

The cross over parallel stance does allow use of the base to push off against as the foot is next to the base rather than on top. It also requires a turn towards the next base rather than pushing straight off the base in the direction of the sprint, thereby generating minimal momentum by a forward lean towards the next base. Previous studies, that have examined the parallel start (9, 10, 15-17) found it to result in slower sprint times. The cross over stance used in the present study may be similar to that of the parallel stance because the feet are in a straight line rather than being staggered, which forces a change in center of mass before sprinting (1).

The findings of the present study demonstrate that using the front foot on the base stance decreases sprint times for 45ft and each 15ft split in Division I female softball athletes, when compared to the back foot on the base and the cross over stances. Therefore, softball coaches should instruct their athletes to use this stance to maximize acceleration and top speed sprint time phases.

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