Original Article

A comparison of base running start techniques in collegiate fastpitch softball athletes

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ABSTRACT

This study examined the time difference between three different base running start techniques. Thirteen Division II collegiate softball players performed maximal sprints off a softball bag at two different distances. Sprint times at 4.57 and 18.29 meters for each technique were measured using Fusion Sport's Smartspeed System. At both 4.57 and 18.29 meters, the rocking start (0.84 ± 0.10; 3.04 ± 0.16 s) was found to be significantly faster (in seconds) than both the split technique (1.01 ± 0.04; 3.27 ± 0.12 s) and the crouch technique (1.05 ± 0.12; 3.35 ± 0.16 s) ($p < 0.05$). Results recommend that the rocking start technique be implemented as the starting position off the bag in fastpitch softball. Implementing the rocking technique may enhance performance and success in stealing and base running. **Key words:** FEMALES, ATHLETES, RUNNING TECHNIQUES, SPEED.

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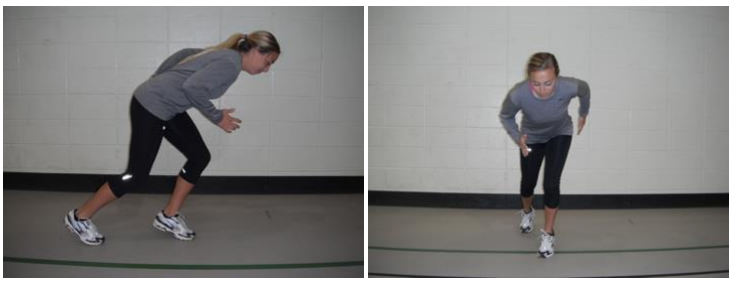
INTRODUCTION

Overtime, softball has grown via technological and strategic advances from its initial inception of slowpitch to a competitive fastpitch and fast paced game. Differing from baseball's 27.43 meter base to base length, fastpitch softball is a mere 18.29 meters. Because of this difference, aspects of the game are regulated differently. For example, one must stay in contact with the base until the pitcher releases the ball, making start techniques increasingly important. A tenth of a second is the difference between successfully stealing a base or getting thrown out. Therefore, in order to enhance overall sprint performance, one must effectively and efficiently get the best initial start off a base.

There are multiple starting techniques utilized in fastpitch softball: the split start technique, the rocking split start technique, and the crouch/track start (Figure 1). Both the split start and rocking split start technique are frequently used in fastpitch softball, whereas the crouch/track start has been used by few. Many studies have been conducted to compare multiple starting techniques for sprint starting in track (Cronin, Green, Levin, Brughelli, and Frost, 2007; Frost, Cronin, and Levin, 2008; Salo and Bezodis, 2004; Schot and Knutzen, 1992). Studies have shown differing views; finding that there was no significant time difference between the crouch and split start techniques (Salo and Bezodis, 2004), nor split and false step (when initial movement time was removed) (Frost et al., 2008) and that the parallel start is significantly slower than the split and false start (Cronin et al., 2007). One similar finding between studies was the significant change from one distance to another, with all showing significant results at shorter compared to longer distances (Cronin et al., 2007; Frost et al., 2008; Schot and Knutzen, 1992).

STANDING SPLIT START TECHNIQUE



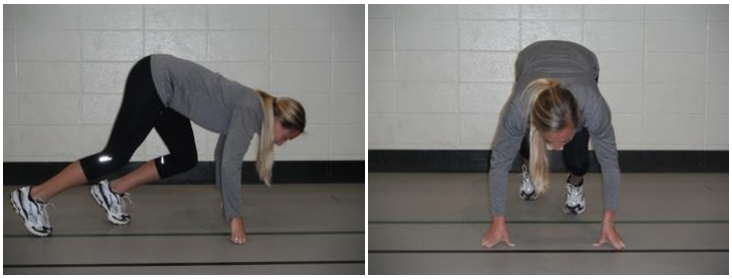
Side Front

ROCKING START TECHNIQUE

Side

Front

CROUCH START TECHIQUE



Side Front

Note. Permission secured for likeness to be used.

Figure 1. Start techniques.

With the lack of substantial data available, theory and preference are the two deciding factors for implementing a specific starting technique for base running. By creating uniform techniques as well as studying the time differences at 4.57 and 18.29 meter distances, fastpitch softball coaches and athletes can utilize data to support a specific starting technique. Distances of 4.57 and 18.29 meters have been chosen specifically for the base to base difference (18.29 meters) and lead off distance (approximately 4.57 meters). The purpose of this study is to examine the time difference between three different starting techniques (standing split start with back foot on base, rocking start with front foot on base, and the crouch start with back foot on base) at 4.57 and 18.29 meter measurements.

MATERIAL AND METHODS

Participants

Thirteen Division II collegiate softball players (20.3 ± 1.5 yrs) were recruited for participation. Pre-experimental data was collected 2 weeks prior to the study (Table 1). Participants filled out an informed consent form, health status questionnaire, and Physical Activity Readiness Questionnaire (PAR-Q) (Thomas, Reading, and Shepard, 1992). Participants underwent instruction in regard to each sprint start technique. After instruction, participants practiced each technique to demonstrate proper understanding and implementation to the researchers. This study was approved by the university Institutional Review Board and an informed consent was signed and collected by each participant prior to testing.

Measures

Testing was performed over a 2-week period. All participants underwent a 30-second Wingate Test on a Lode Excalibur Sport (Groningen, Netherlands) to determine peak power and rate of fatigue. One week

following Wingate testing, participants completed a vertical jump test and a 1-RM for leg press. Body composition was determined using a three-site skinfold assessment (Jackson and Pollock, 1985). Time measurements at the 4.57 and 18.29 meter splits were collected via Fusion Sport's Smartspeed System (Coopers Plains, Australia), a wireless reactive light timing system.

Table 1: Subject Characteristics.

	M	SD
Age (yrs)	20.3	1.5
Height (cm)	164.8	6.3
Mass (kg)	66.9	13.8
Body Composition (% Body Fat)	21.0	3.0
Vertical Jump (cm)	36.8	5.1
1-RM Leg Press (kg)	155.4	41.2
WT Mean Anaerobic Power (W)	569.2	152.6
WT Peak Anaerobic Power (W)	1173.7	211.9
WT Minimum Anaerobic Power (W)	221.8	84.5
WT Time to Peak Anaerobic Power (s)	3.4	0.4
WT Rate to Fatigue (W/s)	35.7	9.2

Data are mean ± standard deviation.
yrs, years; cm, centimeters; kg, kilograms; W, Watts; s, seconds.

Procedures

Participants reported to the softball field on the day of testing. Thirty minutes prior to testing, participants consumed twenty ounces of a sports drink. Participants then performed a standardized dynamic warm-up: two lap jog, walking hip flexor stretch (18.29 meters), high knees (18.29 meters), walking quad stretch (18.29 meters), butt kicks (18.29 meters), high kicks (18.29 meters), karaoke (18.29 meters), 50% sprint (18.29 meters), 75% sprint (18.29 meters), 100% sprint (18.29 meters), and 5-10-15-20 meter shuttle. Following the dynamic warm-up, athletes were directed to sit in a chair for a resting period of five minutes. Following the rest period, participants were given one of three randomly assigned starting techniques; split start technique, rocking split start technique, or crouch/track start. Twelve maximal 18.29 meter sprints were then performed. Time measurements at the 4.57 and 18.29 meter splits were collected via Fusion Sport's Smartspeed System (Coopers Plains, Australia), a wireless reactive light timing system. An electronic sensing system was also placed on the front of the base to begin time at push off. Following each sprint, the athlete was again directed to sit in a chair for a resting period of five minutes. After completion of the second sprint of the first technique, participants were given a five minute rest before beginning the second randomly assigned start. The second and third start techniques were then performed with exact specifications as technique one. After completion of two trials with each of the three starting techniques, participants were randomly assigned a starting technique order again and the testing protocol was repeated for each of the starting techniques. Following completion of the testing, each participant had completed four trials with each starting technique. The best (fastest) time for each split (4.57 and 18.29 meters) for each technique was chosen for further analysis. Testing concluded with a two lap recovery jog.

Analysis

All data were analyzed using IBM SPSS Statistics for Windows, (Armonk, NY: IBM Corp.). One-way repeated measures analysis of variance (ANOVA) with Bonferroni post-hoc tests were used to determine whether significant differences existed between the best times of the three different starts at the 4.57 and 18.29 meter

distances. Pearson correlation coefficients were calculated to examine relationships between selected variables. Statistical significance was accepted at $p < 0.05$.

RESULTS

Results show that there was a significant difference between start techniques at both 4.57 and 18.29 meter measurements within subjects (Table 2). The rocking start technique was found to be significantly faster than the crouch start technique by 20.0% and the split start technique by 16.8% at 4.57 meters. It was also found that at the 18.29 meter measurement, all techniques were significantly different from each other; with the split technique significantly faster than the crouch technique by 2.39%, rocking significantly faster than the split by 7.03%, and rocking significantly faster than the crouch by 9.25% ($p < 0.05$).

Table 2. Fastest sprint times at 4.57 and 18.29 meters.

	M	SD
Crouch/Track Start		
4.57 m	1.05†	0.12
18.29 m	3.35*	0.16
Split Start		
4.57 m	1.01‡	0.04
18.29 m	3.27*	0.12
Rocking Split Start		
4.57 m	0.84†‡	0.10
18.29 m	3.04*	0.16

Data are mean ± standard deviation. m, meters.
**Denotes that the techniques were significantly different at same distance, p < 0.05.*
†Denotes that crouch and rocking techniques were significantly different, p < 0.05.
‡Denotes that split and rocking techniques were significantly different, p < 0.05.

Correlations between demographic variables, vertical jump, 1-RM leg press, and Wingate results were also analyzed. Significant correlations ($p < 0.01$) between variables were found; mass and height, mass and body composition, Wingate mean power and peak power, mean power and rate to fatigue, peak power and rate to fatigue, minimum power and peak power/body mass, mean power and mean power/body mass, peak power/body mass and mean power/body mass, mass and leg press, crouch time at 4.57 and 18.29 meters, crouch time at 18.29 meters and split time at 18.29 meters, split time at 18.29 meters and rocking start at 18.29 meters, and rocking start time at 4.57 and 18.29 meters. Significant correlations ($p < 0.05$) between variables were also found between; mass and Wingate mean power, height and Wingate peak power, mass and Wingate peak power, Wingate minimum power and Wingate rate to fatigue, Wingate peak power/body mass and Wingate rate to fatigue, Wingate mean power/body mass and Wingate rate to fatigue, body composition and vertical jump, body composition and leg press, body composition and split time and 18.29 meters, vertical jump and split time at 18.29 meters, and split time at 4.57 and 18.29 meters.

DISCUSSION

Results of this study show that there was a noticeable difference between start techniques at both 4.57 and 18.29 meter measurements. The crouch start was observed to be significantly slower than the rocking start

by 0.21 seconds at the 4.57 meter measurement and by 0.31 seconds at the 18.29 meter measurement. The crouch start was also found to be significantly slower than the split start at 18.29 meters by 0.08 seconds. A possible contributor to the slow crouch start performance could be the overall experience of the participant. Although participants practiced each technique for understanding and implementation, experience with the technique was limited to the pre-experiment practice session. Participants did have prior experience with both the split and rocking techniques prior to the study.

When analyzing the difference between split and rocking start techniques, a significant difference was found at both 4.57 and 18.29 meter measurements. The rocking start again was the fastest over the split technique by 0.17 seconds at 4.57 meters and 0.23 seconds at 18.29 meters. There are many reasons that could contribute to the performance of the rocking start. Newton's second law of motion states that "the change of motion of an object is proportional to the force impressed; and is made in the direction of the straight line in which the object will accelerate in the direction of the next external force (Franklin, 1996)." Therefore, if a net external force is exerted on an object, the object will accelerate in the direction of the next force. This force then changes the momentum of an object over time. When it comes to the rocking start, momentum has already been created prior to the actual push off, whereas for both the split and crouch start, force and momentum are not created until actual push off. Therefore, this added momentum could impact the overall force generated at push off.

The Stretch Shortening Cycle (SSC) involves a combination of eccentric and concentric actions within the muscle. When an eccentric action precedes a concentric action, the resulting force output of the concentric action is increased (Chu and Potach, 2000). In the rocking start, participants rock back (load/eccentric movement) which is then followed by the push off (concentric movement). Therefore, since the concentric movement is preceded by an eccentric movement the force output is increased. In both the split and crouch start techniques, there is no eccentric movement which could limit the amount of force produced at push off.

Another area of interest for this study were the correlations between all variables found in Table 2. Significant correlations were found regarding body composition with vertical jump (negative correlation), split technique at 18.29 meters, and rocking technique at 18.29 meters. These results show that the lower the body composition, the higher the vertical jump and the shorter the times for the split and rocking techniques at 18.29 meters. Therefore, it is possible that smaller participants could create more force in comparison to body composition which correlated to vertical jumps and 18.29 meter sprint performance. However, it is interesting to note that body composition is not correlated to crouch technique time at 18.29 meters, which again questions the experience and performance of this technique.

CONCLUSION

By taking into consideration the body mass and lower body strength of an athlete, an appropriate base running start technique can be determined for each athlete. By choosing the most effective start technique for each athlete, coaches can hone in on specific issues that directly affect the athlete's performance. Once identified, the technique can be practiced and perfected for use in base stealing during fastpitch softball.

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