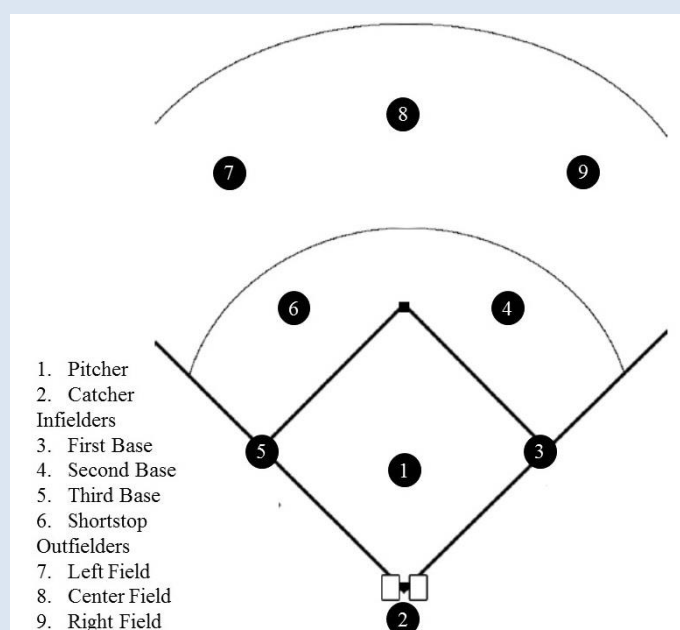


## ABSTRACT

Different fitness capacities (e.g., speed, strength, power) could influence a high school athlete's ability to be successful in their sport. Moreover, different measures of fitness could contribute to an athlete's ability to play certain positions within a sport. Limited analysis of this in high school girls softball players is currently available. Greater understanding of the relationships between speed, strength, and power within this population could assist with program design by the strength and conditioning coach. **PURPOSE:** To determine differences in linear speed, lower-body strength and power, and softball-specific skills (throwing, hitting) in high school softball players by their primary position. **METHODS:** Analysis was conducted on data collected from 32 high school softball players prior to participation in a strength and conditioning training program. The data recorded for each player included: age, height, and body mass; 9.14-m (10-yard) and 18.29-m (20-yard) sprint times; standing broad jump (SBJ) distance (lower-body power); throwing and hitting exit velocity measured using a portable tracker (softball-specific skills); and absolute and relative 3-repetition maximum (3RM) front squat and trap bar deadlift (lower-body strength). Players self-reported the primary positions they played, and the sample was split into fielders ( $n=18$ ), catchers ( $n=8$ ), and pitchers ( $n=6$ ). A one-way analysis of variance, with Bonferroni post-hoc for multiple comparisons, was used to compare the position groups ( $p<0.05$ ). **RESULTS:** Significant interactions were found for the SBJ ( $p=0.005$ ), throwing velocity ( $p=0.019$ ), and absolute ( $p=0.019$ ) and relative ( $p=0.005$ ) 3RM front squat. Pairwise comparisons showed that catchers had a greater SBJ ( $p=0.005$ ), absolute ( $p=0.017$ ) and relative ( $p=0.007$ ) 3RM front squat compared to pitchers, and faster throwing velocity ( $p=0.017$ ) compared to field players. Field players also had a greater relative 3RM front squat compared to the pitchers ( $p=0.012$ ). **CONCLUSIONS:** Certain fitness tests were distinctive between position groups in this sample of high school softball players. Catchers had a greater SBJ (lower-body power) and absolute and relative 3RM front squat (lower-body strength) compared to pitchers. The nature of the catching position (i.e., constantly squatting and rising from the ground) may place a greater emphasis on lower-body power and strength. However, the pitchers also had a lower relative front squat when compared with field players. Given that the pitching action is initiated from the legs, the pitchers from this sample may need targeted lower-body strength development (although limb length could influence the front squat load for pitchers). Catchers also had a faster throwing velocity compared to field players; catchers need a 'good arm' as they must complete forceful throws from home plate to infielders. **PRACTICAL APPLICATIONS:** It should be noted that high school softball athletes may play numerous positions during a season. Nonetheless, the current data could show how certain athletes may have the physical capacity that could predispose and benefit their ability to play certain positions. In this sample, lower-body strength and power, and throwing velocity, were qualities indicated as important for high school softball catchers. Further, data such as that analyzed in this study may show limitations by position groups. In this sample, the pitchers may benefit from specific lower-body strength training.

## INTRODUCTION

Softball is played with 9 players on the field when the team is fielding, with each player falling into one of 4 categories: pitcher, catcher, infielders, and outfielders. Some players may be a utility capable of manning multiple positions. However, for an at-bat, each player is responsible for a fielding position (Figure 1).



**Figure 1.** Fielding positions in softball.

Different fitness capacities (e.g., speed, strength, power) could influence a high school athlete's ability to play certain positions within a sport. Some information that could be inferred regarding positional differences is that smaller-sized athletes (i.e., infielders, outfielders) may excel in sprint tests (8) and relative strength (2).

Collegiate softball pitchers and catchers tend to have greater body mass than fielders (6), and this could manifest in absolute strength and power tests (5,7) and softball-specific skills such as hitting (4). Limited analysis of this in high school girl's softball players is currently available. Greater understanding of the relationships between speed, strength, and power in high school girl's softball players could assist with program design by the strength and conditioning coach.

The purpose of this study was to determine differences in linear speed, lower-body strength and power, and softball-specific skills (throwing, hitting) in high school softball players by their primary position.

## METHODS

- Retrospective analysis was conducted on data collected as part of standard practice from 32 high school softball players (age:  $14.88 \pm 1.01$  years; height:  $1.66 \pm 0.07$  m; body mass:  $62.58 \pm 9.30$  kg) by staff working at a private strength and conditioning facility. The players were about to begin an 8-week strength and conditioning program.
- The data included: age, height, and body mass; 0-9.14 m (10-yard) and 0-18.29 m (20-yard) sprint interval times; standing broad jump (SBJ) distance; throwing and hitting (batted ball) velocity measured using a portable tracker; and absolute and relative 3-repetition maximum (3RM) front squat and hexagonal bar deadlift (HBD).
- Players self-reported the primary positions they played, and the sample was split into fielders ( $n = 18$ ), catchers ( $n = 8$ ), and pitchers ( $n = 6$ ). In this pilot analysis infielders and outfielders were combined in the one group. A one-way analysis of variance, with Bonferroni post-hoc for multiple comparisons, was used to compare the position groups ( $p < 0.05$ ).

## RESULTS

- Descriptive data is shown in Table 1. Significant interactions were found for the SBJ ( $p = 0.005$ ), throwing velocity ( $p = 0.019$ ), and absolute ( $p = 0.019$ ) and relative ( $p = 0.005$ ) 3RM front squat.
- Pairwise comparisons showed that catchers had a greater SBJ ( $p = 0.005$ ), absolute ( $p = 0.017$ ) and relative ( $p = 0.007$ ) 3RM front squat compared to pitchers, and faster throwing velocity ( $p = 0.017$ ) compared to field players. Field players also had a greater relative 3RM front squat compared to the pitchers ( $p = 0.012$ ).

**Table 1.** Descriptive data (mean  $\pm$  SD) age, height, body mass, 0-9.14 m sprint interval, 0-18.29 m sprint interval, SBJ, throwing velocity, hitting velocity, and absolute and relative 3RM front squat and HBD for high school softball players defined by their primary position.

	Field Players (n = 18)	Catchers (n = 8)	Pitchers (n = 6)
Age (years)	14.83 $\pm$ 1.15	14.75 $\pm$ 0.71	15.17 $\pm$ 0.98
Height (m)	1.65 $\pm$ 0.07	1.69 $\pm$ 0.07	1.67 $\pm$ 0.09
Body Mass (kg)	61.23 $\pm$ 11.12	62.63 $\pm$ 3.88	66.60 $\pm$ 8.26
0-9.14 m Sprint (s)	1.82 $\pm$ 0.09	1.82 $\pm$ 0.07	1.88 $\pm$ 0.06
0-18.29 m Sprint (s)	3.11 $\pm$ 0.14	3.13 $\pm$ 0.14	3.21 $\pm$ 0.13
SBJ (m)	1.91 $\pm$ 0.15	2.06 $\pm$ 0.12	1.80 $\pm$ 0.11*
Throwing Velocity (km/hr)	91.55 $\pm$ 6.14*	98.39 $\pm$ 4.20	94.47 $\pm$ 3.76
Hitting Velocity (km/hr)	104.82 $\pm$ 9.11	112.45 $\pm$ 10.19	104.85 $\pm$ 6.85
3RM Front Squat (kg)	66.15 $\pm$ 10.87	72.01 $\pm$ 10.27	55.19 $\pm$ 8.92*
Relative 3RM Front Squat (body mass/kg)	1.10 $\pm$ 0.19	1.15 $\pm$ 0.15	0.84 $\pm$ 0.15**
3RM HBD(kg)	99.29 $\pm$ 23.54	100.92 $\pm$ 17.61	97.52 $\pm$ 14.91
Relative 3RM HBD (body mass/kg)	1.62 $\pm$ 0.25	1.61 $\pm$ 0.21	1.48 $\pm$ 0.23

\* Significantly ( $p < 0.05$ ) different from catchers.

# Significantly ( $p < 0.05$ ) different from field players.

## CONCLUSIONS

- Certain fitness tests were distinctive between position groups in this sample of high school softball players. Catchers had a greater SBJ (lower-body power) and absolute and relative 3RM front squat (lower-body strength) compared to pitchers. The nature of catching (i.e., constantly squatting and rising from the ground) may place a greater emphasis on lower-body power and strength. These data indicate the importance of lower-body power and strength for catchers, which could be a specific focus in high school strength and conditioning programs.
- The pitchers had a lower relative front squat when compared with field players. Anthropometry could be a limiting factor. Greater arm length can be beneficial for generating throwing velocity (3), and although not measured, pitchers could have had a longer arm length. Greater arm length could negatively influence the front squat, due to the requirements of the movement (1). Nevertheless, as the pitching action is initiated from the legs (9), pitchers from this sample may need targeted lower-body strength development.
- The catchers also had a faster throwing velocity compared to field players. Catchers need a 'good arm' as they must complete forceful throws from home plate to infielders.

## PRACTICAL APPLICATIONS

- It should be noted that high school softball athletes may play numerous positions during a season. Nonetheless, the current data could show how certain athletes may have the physical capacity that could predispose and benefit their ability to play certain positions. These results have practical application for the high school girl's softball strength and conditioning coach.
- In this sample, lower-body strength and power, and throwing velocity, were qualities indicated as important for high school softball catchers. Further, data such as that analyzed in this study may show limitations by position groups. In this sample, the pitchers may benefit from specific lower-body strength training, even though the front squat movement could have been a factor.

## ACKNOWLEDGEMENTS

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