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Lacrosse Player's Sprint Ability: The Relationship Between 30M Cradle Sprint and Medicine Ball Throw

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Abstract

Background: Few studies have examined the sprinting capacity of female lacrosse players compared to other field-based sports. Sprinting ability in lacrosse, particularly when players are cradling the ball, may differ from traditional sprinting, as handling the ball can affect acceleration and overall speed.
Aims: This study aimed to investigate the relationship between sprinting ability and medicine ball throws in female collegiate lacrosse players. Specifically, it sought to compare sprint performance with and without cradling and examine how medicine ball throw performance correlates with sprinting ability.
Methods: Twenty-two participants (19.9 ± 1.2 years) were recruited from a collegiate lacrosse team. They performed 30m and cradle sprint trials from a standing start. Additionally, participants conducted medicine ball throws with 1kg, 2kg, and 3kg weights. Sprint times were recorded for 0-10m and a total of 30m distances.
Results: The time for the total 30m distance was significantly shorter in the regular 30m sprint trial than in the 30m cradle trial. The 0-10m segment was slower in the cradle sprint trial than the regular sprint trial. Faster individuals in the 30m sprint trial were associated with longer distances in the 1kg and 2kg medicine ball throws. In comparison, faster individuals in the 30m cradle sprint trial were correlated with longer distances in the 1kg, 2kg, and 3kg medicine ball throws.
Conclusion: The cradle affects acceleration from a stopped position. Additionally, sprinting ability while cradling the ball is correlated with performance in the 3kg medicine ball throw, suggesting a relationship between upper-body strength and sprint performance in lacrosse.

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INTRODUCTION

Lacrosse will be incorporated as an additional sport for the 2028 Los Angeles Olympics, a field sport played on a 110-yard × 60-yard-shaped field. During games, it necessitates various abilities: high-speed movement, rapid changes in direction, and both aerobic and anaerobic capacities (Akiyama et al., 2019; Enemark-Miller et al., 2010; Hauer et al., 2021; Hoffman et al., 2009; Polley et al., 2015; Steinhagen et al., 1998; Talpey et al., 2019). Previous studies have emphasized the importance of sprinting ability (Gagnon-Dolbec et al., 2019; Hamlet et al., 2021; Lockie et al., 2018; Rosenberg et al., 2021; Thomas et al., 2014; Vescovi et al., 2007). However, limited research explores the sprinting capacity of female lacrosse players compared to other field-based sports like soccer and hockey.

Previous studies on sprinting ability in track and field athletics have proposed that explosive power utilizing the lower limbs' stretch-shortening cycle (SSC) significantly influences sprinting performance (Dintiman et al., 1998; Maćkała et al., 2015). For example, throwing medicine balls with a weight of 1-2% and 5-6% of body weight can enhance explosive power capability in the lower limbs (Dintiman et al., 1998; Sakai et al., 2013). Explosive power is essential for accelerating from the start. The movement of medicine ball throwing, characterized by hip flexion, forward lean, and subsequent hip extension, closely mirrors the acceleration phase of running. Both actions rely heavily on hamstring muscle activation (Watanabe, 2006; Izawa et al., 2004). Some studies have examined a positive correlation between medicine ball throws and

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sprinting ability among athletes in various disciplines, such as handball (Fathloun et al., 2011; Ignjatovic et al., 2012), basketball (Szymanski et al., 2007), and tennis (Kramer et al., 2017). Given these findings, it is anticipated that lacrosse players who can throw the medicine ball a greater distance will likely have higher sprinting capabilities.

To enhance short sprinting capabilities in lacrosse, athletes must sprint while carrying a stick to prevent dropping the ball—a technique known as cradling, which is fundamental in lacrosse (Barrett et al., 1997; Rose et al., 2024). Cradling differs from sprinting in track and field as it restricts upper limb movement. To achieve faster running speeds, mastering the cradling technique, involving maintaining ball possession without dropping it, becomes essential. A few studies have investigated the disparity between a normal sprint and a sprint with a cradle (Lockie et al., 2018; Rose et al., 2024). By comparing the movements of these two running styles, understanding the characteristics of cradle running is possible.

Lockie et al. (2018) have investigated the field test characteristics of female lacrosse players. These results suggest that for the 30m sprint test, 0-10m in sprint times were faster than 0-10m in cradle times; however, there was no significant difference between the overall 30m times between the two conditions. In addition, Kulakowski et al. (2020) have investigated the relationship between 30m sprint time and lower-body power. They found a positive correlation between the overall 30m times and the height in the countermovement jump. Given the abovementioned findings, explosive lower body power appears essential for female lacrosse players' sprint performance. However, more research is needed to understand this relationship fully.

This study investigated whether 30m sprint time differs between without stick and cradle. We also investigated the relationship between sprinting ability and medicine ball throws for female lacrosse players. The focus is on short sprints because lacrosse players operate on a 110-yard × 60-yard-shaped field. We hypothesized a positive correlation between medicine ball throw distance and cradle running times in lacrosse athletes. It would be important for coaches and athletes to comprehend their sprint ability as it is fundamental for lacrosse players (Lockie et al., 2018; Rosenberg et al., 2021; Vescovi et al., 2007). Lacrosse players can enhance their game performance by acquiring knowledge and skills about sprinting and cradling (Bunn et al., 2022; Ferrenburg, 2024).

METHOD

Participants

This study employed a within-subjects experimental design. Twenty-two female participants (mean age ± SD = 19.9 ± 1.2 years) were recruited from the Tokyo Women's College of Physical Education lacrosse team. The length of time playing lacrosse was 1.4 years ± 1.2 SD. Participants had normal or corrected-to-normal vision. Written informed consent was obtained from all participants. This study was approved by the Tokyo Women's College of Physical Education ethics committee (2023-15). For this ethics review, I was required to submit documents covering study safety, privacy, protocol, consent, and publication.

Procedure

The experiment was conducted at an athletics track. Considering the participants' schedules, I formed groups of 4-5 participants and conducted the measurements. Following a sprint test, participants performed medicine ball throws. Participants performed 30m and cradle sprint trials from a standing start. 30 m sprint time was recorded by a SprintTimer (Sten Kaiser, USA) and video camera (CASIO, EXILIM PRO EX-F1). The sampling rate was 300 Hz. Each participant completed two trials. The 30m sprint trial was completed without a lacrosse stick, while the cradle sprint trial was completed with a stick and a ball carried in the dominant hand. Participants were instructed to run at maximal effort during a 30-meter sprint trial. During the cradle sprint trial, participants were instructed to run at maximal effort while maintaining a secure ball cradle. The total time was measured by a SprintTimer (Sten Kaiser, USA). Lap time and the numbers of steps for 0-10m, 10m-20m, and 20m-30m were measured using Kinovea (version 0.9.3).

The standing forward medicine ball throw started with the feet shoulder-width apart and toes on the zero-measurement line. The medicine ball throws were performed using 1kg, 2kg, and

3kg. Participants threw a medicine ball three times with each of two different weights. The order of the medicine ball weight (1kg, 2kg, and 3kg) was counterbalanced across participants. The throws were marked at first contact with the ground and were measured in meters. The maximum throwing distance for each weight was used as the measured value.

Statistical Analysis

Lap time and number of steps were subjected to two-way ANOVAs with repeated factors of Lap (0-10m/10-20m/20-30m) and condition (sprint/cradle). Medicine ball throws were subjected to one-way ANOVA with repeated factors of ball weight (1kg/2kg/3kg). Bonferroni correction was applied to post-hoc comparisons. Pearson's product-moment correlation coefficient was calculated between lap time and medicine ball throws. All statistical analyses were conducted using JAPS (0.15.0.0).

RESULTS AND DISCUSSION

Results

30m Sprint Trial (Sprint Vs. Cradle Sprint)

A paired t-test revealed that time for a total of 30m was significantly shorter in the 30m sprint trial than in the 30m cradle trial (30m sprint trial: 5.91 sec, SD = 0.33; 30m cradle trial: 6.09 sec, SD = 0.32; *t* (21) = 4.58, *p* = .001, *d* = 0.98).

Figure 1 shows the average time for each lap in both the 30 m sprint and the 30m cradle sprint. Two-way ANOVA revealed a significant interaction between sprint type and lap ($F(2, 42)$ = 18.39, p = .001, $p\eta^2$ = .46). Post-hoc tests revealed that 0-10m in cradle trial was slower for 0-10m in sprint trial ($t(21)$ = -5.55, p = .001). Post-hoc tests revealed that 0-10m in cradle trial was slower for 10-20m in cradle trial ($t(21)$ = 54.25, p = .001), and 20-30m in cradle trial ($t(21)$ = 56.31, p = .001). Post-hoc tests revealed that 0-10m in sprint trial was slower for 10-20m in sprint trial ($t(21)$ = 51.89, p = .001), and 20-30m in sprint trial ($t(21)$ = 53.77, p = .001).

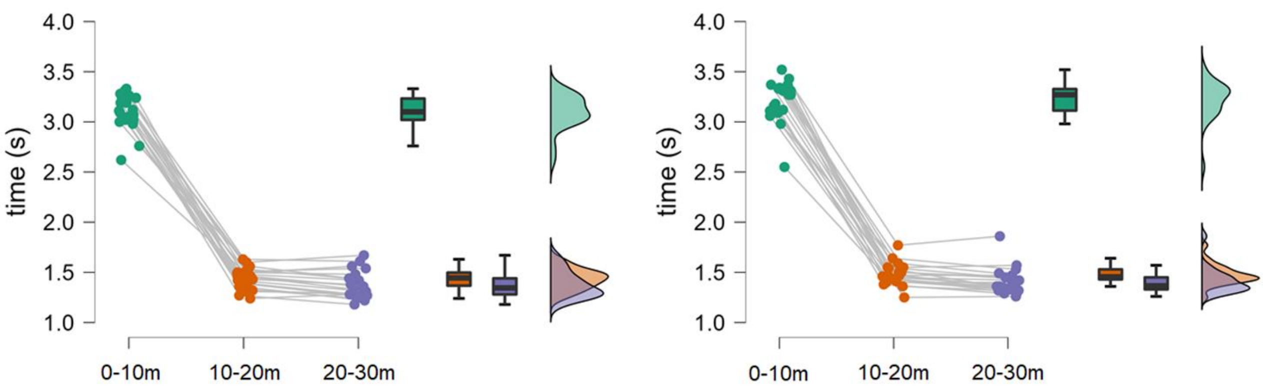

Figure 1. Average Time (and SD) for Each Lap in Both 30m Sprint (LEFT panel) and 30m Cradle Sprint (Right Panel)

Figure 2 shows the number of steps for each lap in both the 30 m sprint and the 30m cradle sprint. For the number of steps, two-way ANOVA revealed a main effect for a lap ($F(2, 42)$ = 347.323, p = .001, $p\eta^2$ = .94). Number of steps was more for 0-10m than for 10-20m ($t(21)$ = 20.19, p = .001) and 20-30m ($t(21)$ = 24.77, p = .001). Number of step was more for 10-20m than for 20-30m ($t(21)$ = 4.57, p = .001). Two-way ANOVA revealed no main effect for condition ($F(1, 21)$ = .11, p = .74, $p\eta^2$ = .01). There was no interaction ($F(2, 42)$ = .82, p = .45, $p\eta^2$ = .01).

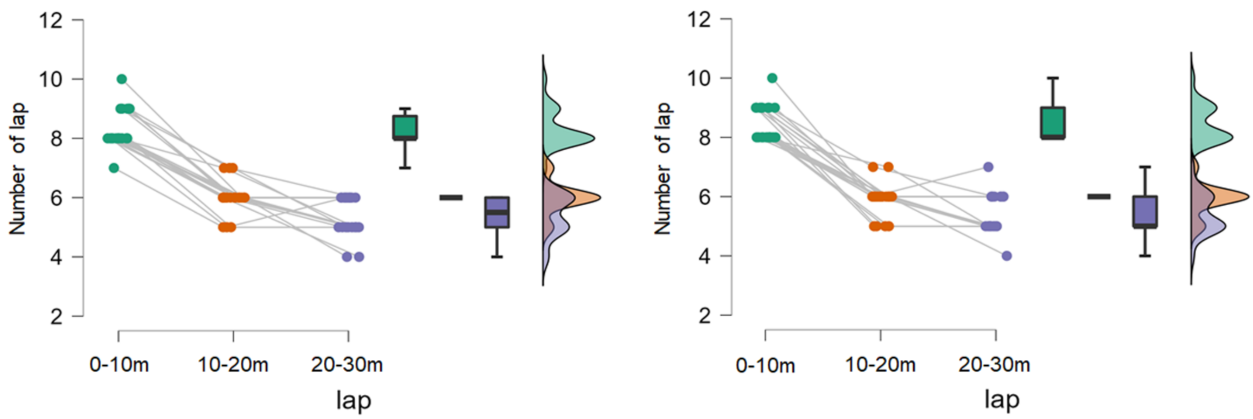

Figure 2. Average Number of steps (and SD) for each lap in both 30 m sprint (left panel) and 30m cradle sprint (right panel).

Distance for Medicine Ball Throws

One-way ANOVA revealed the main effect of weight ($F(2, 42) = 267.58$, $p = .001$, $p\eta^2 = .93$). Post-hoc tests revealed that distance was longer for 1kg (12.52, SD = 1.58) than for 2kg (10.06, SD = 1.23; $t(21) = 12.24$, $p = .001$) and 3kg (7.87, SD = 1.21; $t(21) = 23.12$, $p = .001$). Post-hoc tests revealed that the distance was longer for 2kg than for 3kg ($t(21) = 10.88$, $p = .001$).

Correlations between Sprint Task and Distance for Medicine Ball Throws

We calculated correlations between sprint time and distance for medicine ball throws. We found the faster individuals for 30m sprint trial was associated with the longer distance for 1kg (r = -.51, p = .02) and 2kg (r = -.50, p = .02). There was no significant correlation between 30m sprint trial and 3kg (r = -.37, p = .90). We found the faster individuals for 30m cradle sprint trial was associated with the longer distance for 1kg (r = -.51, p = .02), 2kg (r = -.53, p = .01), and 3kg (r = -.43, p = .05).

We also calculated correlations between lap time and distance for medicine ball throws. For the 30m cradle sprint trial, we found the faster individuals for 0-10m lap time were associated with the longer distance for 1kg (r = -.60, p = .01), 2kg (r = -.66, p = .01), and 3kg (r = -.48, p = .03). For 30m sprint, there was no significant correlation among variables.

Table 1. The Correlations between Sprint Task and Distance for Medicine Ball Throws

	1kg	2kg	3kg
Total time	**-.51****	**-.50****	-.37
0-10m	-.40	-.40	-.42
10-20m	-.40	-.40	-.16
20-30m	-.42	-.40	-.23
Cradle time	**-.51****	**-.53****	**-.43***
0-10m	**-.60****	**-.66****	**-.48***
10-20m	-.25	-.27	-.26
20-30m	-.45*	-.32	-.31

Discussion

We aimed to investigate whether there is a difference in 30m time between a sprint trial and a cradle sprint trial. We also investigated the relationship between sprinting ability and medicine ball throws for female lacrosse players. We found a shorter time in the 30m sprint trial than in the 30m cradle sprint trial. The 0-10m time was slower in the 30m cradle than in the 30m sprint. In the 30m sprint trial, we found that individuals with higher speed for the 30m sprint were associated with longer distances for 1kg and 2kg. Individuals with higher speed for the 30m cradle sprint were associated with longer distances for 1kg, 2kg, and 3kg in the cradle sprint. In the 30m cradle sprint, individuals with higher speed for the 0-10m lap time were associated with longer distances for 1kg, 2kg, and 3kg.

Sprint time was shorter in the 30m sprint without a stick than in the cradle sprint, and the time for 0-10m was slower in the 30m cradle than in the 30m sprint. These findings suggest that the cradle causes a decrease in speed, and this decrease is particularly noticeable within the first 10 meters. Our results corroborate those of Lockie et al. (2018), demonstrating that 0-10m split times were significantly faster during 30m sprint trials than cradle sprint trials. The movement of both hands is limited with sticks, making accelerating difficult. Therefore, it would be necessary for players to practice accelerating using only the legs.

Importantly, there was a significant interaction between sprint type and lap. This result suggests a difference in acceleration in the first 10 meters, but using the stick does not affect the maintenance of speed in 10m-20m and 20m-30m. The presence or absence of a cradle may have caused a difference in the first 10 meters. In lacrosse, a sprint over short distances, quick dashes from a stopped position, and sharp direction changes are required. The 110-yard by 60-yard lacrosse field necessitates that athletes can accelerate rapidly from the start. In addition, a previous study suggested that cradle sprint may negatively impact direction changes (Rose et al., 2024). Our results suggested that in regular training, focusing on enhancing maximum speed up to 10 meters is necessary.

For the improvement of maximum speed up to 10 meters, previous studies have recommended that performing medicine ball throws with a weight of 1-2% and 5-6% of body weight can enhance the explosive power capability of the lower limbs (Dintiman et al., 1998; Sakai et al., 2013). Previous studies have reported a positive relationship between medicine ball throws and sprint ability for handball (Fathloun et al., 2011; Ignjatovic et al., 2012), basketball (Szymanski et al., 2007), and tennis players (Kramer et al., 2017). In this study, individuals with higher speeds for the 30m cradle sprint were associated with longer distances for 1kg, 2kg, and 3kg. In contrast, individuals with higher speed for the 30m sprint were associated with longer distances for 1kg and 2kg. The dash ability in cradle running is related to a 3kg medicine ball throw, and this relationship is not observed in the 30m run. These results might suggest that cradle sprint requires greater leg muscle strength than sprint without a stick. Restricting arm movements results in a running form that relies more on the legs. The results of this study are useful not only for lacrosse but also for other ball sports because female athletes have slower running speeds than males. Whether 1kg or 2kg, medicine ball throws are important for enhancing basic sprint ability.

Research Contribution

This study contributes to the limited research on sprinting capacity in female lacrosse players, particularly by comparing sprint performance with and without cradling. The findings demonstrate that cradling significantly affects acceleration, especially within the first 10 meters. Additionally, the study highlights the relationship between medicine ball throw distances and sprinting ability, suggesting that increased leg strength and explosive power improve sprint performance, particularly when cradling the ball. These results provide valuable insights for optimizing training programs to improve sprint speed and explosive power in lacrosse players.

Limitations

This study has several limitations. First, we used a simplified set of measurement protocols to reduce participant burden. Further research is warranted to examine the relationship with other physical fitness factors. Second, because the participants were all female sample, we could not assess the physical fitness of male athletes. Given the differences in rules and regulations between male and female lacrosse, further research might need to consider gender differences among lacrosse athletes.

Suggestions

Coaches should focus on enhancing athletes' acceleration within the first 10 meters, especially during cradle sprints. Training programs should incorporate medicine ball throws of varying weights (1kg, 2kg, and 3kg) to develop lower body strength and explosive power, which are crucial for sprint performance. Emphasizing leg-driven acceleration, given the restriction on arm movements during cradling, can help improve overall speed and agility in lacrosse and similar field-based sports.

CONCLUSION

The cradle affects acceleration from a stopped position. The present findings prove that enhancing maximum speed up to 10 meters is crucial in lacrosse. Moreover, the sprint ability in a cradle is correlated with a 3kg medicine ball throw. Our results demonstrate that cradle sprints demand greater leg muscle strength compared to sprints without a stick. These findings contribute valuable scientific insights for enhancing the athletic performance of lacrosse, addressing an area that still lacks sufficient knowledge. Further studies are needed to clarify the relationship between cradle sprint and physical fitness factors (e.g., agility, endurance).

AUTHOR CONTRIBUTION STATEMENT

YM Conceptualization; Data curation; Formal analysis; Project administration; Writing-original draft.

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