Comparison of agility and countermovement jump performance among middle school, high school, and college aged female soccer players

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Abstract

Introduction

Only a small number of published reports describe agility and countermovement (CMJ) performance characteristics for female soccer players [1,4]. The purpose of our study was to compare CMJ height and performance on two agility tests among different age groups of female soccer players. We hypothesized that older players would demonstrate greater CMJ height and faster agility times compared to younger players.

Methods

Data from 415 female soccer players aged 12-21 yrs who participated in several previously conducted studies from our group were gathered retrospectively and evaluated in a cross-sectional design. Participants were divided based on age into the following groups: middle school (12-13 yr, n=79); high school (14-17 yr, n=223); and college (18-21 yr, n=113). Agility was assessed using modified versions of the Illinois and pro-agility tests with infrared timing gates (Brower Timing, Utah). The Illinois test was abbreviated by omitting two of the four 9.1m linear sprints; thus athletes sprinted 9.1m from the start position to the second corner cone, turned to weave down and back through the center column of cones, changed direction at the third corner cone and finished with another 9.1m sprint across the finish line. The pro-agility was modified by using a flying start to incorporate the use of the timing gates, which were placed at the center cone. Athletes sprinted 9.1m from the start line to the opposite end line, changed direction, sprinted back to the start line, and made a final change of direction to sprint through the finish at the center cone (4.6m). CMJ height was determined using an electronic timing mat (Just Jump System, Probotics Inc.). Participants stood with their hands on the hips, performed a crouching action followed immediately by a jump for maximal height. Flight time was converted to jump height with the equation: $1/8\ (g \cdot t^2)$ (g=acceleration due to gravity and t=air time). Each test was performed in duplicate; the fastest time or greatest jump height was used for statistical analysis. Comparisons were made using a one-way ANOVA with LSD post-hoc analysis.

Results

Pro-agility times were greater in middle school soccer players compared to high school and college athletes (5.18±0.36 vs. 4.92±0.24 and 4.87±0.21s, p<0.000), however the difference between high school and college players did not reach statistical significance (p=0.106). Illinois agility times were different between each of the three age groups (10.84±0.71 vs. 10.36±0.50 vs. 10.20±0.36s, p≤0.007). Differences between each age group were also observed for countermovement jump height (37.3±4.8 vs. 38.7±5.1 vs. 42.0±5.0cm, p≤0.026).

Discussion

Pro-agility times were greater for middle school compared to high school and college players, however no difference was observed between the two older age groups. In contrast, times for the Illinois test were different between each of the age groups, becoming progressively greater with decreasing age. Data from the pro-agility test provide supportive evidence for the observation that peak power during a short cycle test (5-8s) increases until age 15-16 and then plateaus in young women 2, whereas results from the Illinois test are suggestive that the continued improvements in performance with increasing age during longer tests (~10s) may be related to other factors associated with maturation (e.g., neuromuscular, motor control, or metabolic factors) [3].

Purpose

No single study has presented linear sprint times for a group of female soccer players spanning a wide age range1-3, thus it is unclear if we can distinguish between different age groups based on linear sprint times of

Methods

Participants

Data from 415 female soccer players aged 12-21 years who participated in several previously conducted studies from our group were gathered retrospectively and evaluated in a cross-sectional design. Participants were divided based on age into the following groups: middle school (12-13 yr, n=79); high school (14-17 yr, n=223); and college (18-21 yr, n=113).

Countermovement Jump

Countermovement jump height was determined using an electronic timing mat (Just Jump System, Probotics Inc.). Participants began from a standing position, performed a crouching action followed immediately by a jump for maximal height. Hands remained on the hips for the entire movement. Participants were instructed and carefully observed to maintain straight legs while airborne. If the knees were bent or raised the trial was discarded and the athlete was given another attempt following a rest period.

Illinois Agility Test

The Illinois test timing gates were placed at the start and finish lines at a height of 0.30 m. The original version of the Illinois may be heavily influenced by the ability to sprint quickly over short distances instead of measuring the ability to change directions. In addition, the duration of the original test is approximately 16-18 seconds, thus performance may have metabolic limitations. Therefore two of the four 9.1 metre linear sprints were omitted from the original protocol. Thus to complete the modified Illinois test athletes sprinted 9.1 metres from the start position to the second corner cone, turned to weave down and back through the center line of cones, made one final change of direction at the third corner cone and finished with another sprint (9.1 metres) across the finish line.

Pro-Agility Test

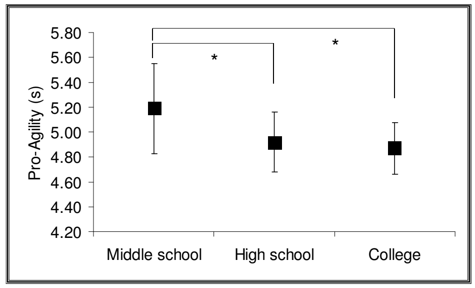
The pro-agility was modified by using a flying start to incorporate the use of the timing gates, which were placed at the center cone at a height of approximately 1.0 m. Athletes sprinted maximally from the starting line to the other end cone (9.1 metres), touched the ground with one hand, changed direction, sprinted back to the start line, again touched the ground with one hand, made a final change of direction to sprint through the finish line at the center cone (4.6 metres).

Statistics

We compared CMJ height and agility times between the age groups using a one-way ANOVA with LSD post-hoc analysis. Percentiles were also determined for each age group on the three tests. Pearson correlation were used to examine the relationship between the agility and CMJ tests.

Results

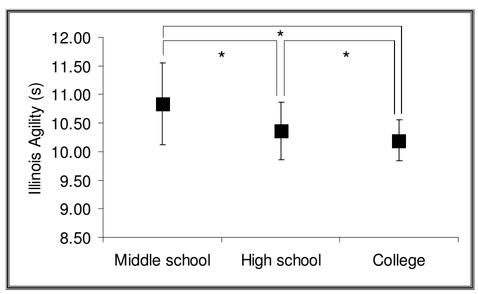
Pro-agility times were greater in middle school soccer players compared to high school and college athletes (5.18±0.36 vs. 4.92±0.24 and 4.87±0.21s, p<0.000); the difference between high school and college players did not reach statistical significance (p=0.106).



Percentiles for Pro-Agility Test (s)

	Min	90	75	50	25	10	Max
Middle School	4.38	4.71	4.93	5.21	5.39	5.69	6.33
High School	4.42	4.63	4.74	4.91	5.05	5.26	5.57
College	4.54	4.62	4.72	4.85	4.99	5.16	5.62

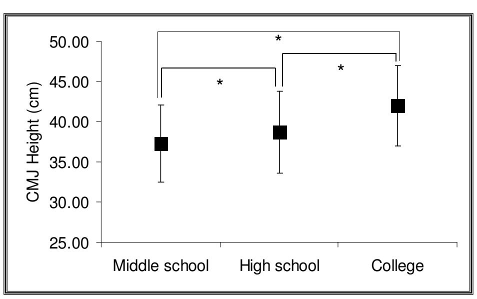
Illinois agility times were different between each of the three age groups (10.84±0.71 vs. 10.36±0.50 vs. 10.20±0.36s, p≤0.007).



Percentiles for Illinois Test (s)

	Min	90	75	50	25	10	Max
Middle School	9.47	10.00	10.36	10.79	11.15	11.71	13.50
High School	9.17	9.77	10.02	10.28	10.66	11.00	12.07
College	9.63	9.78	9.97	10.18	10.34	10.80	11.21

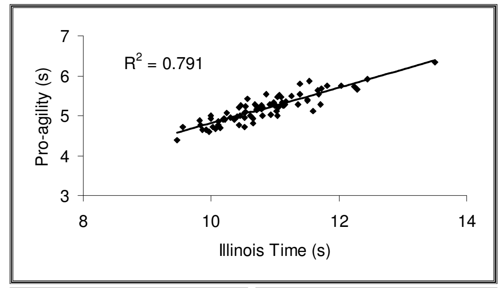
Differences between each age group were observed for countermovement jump height (37.3±4.8 vs. 38.7±5.1 vs. 42.0±5.0cm, p≤0.026).

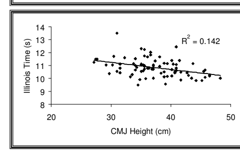


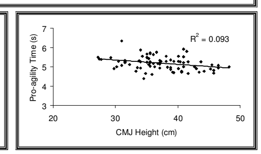
Percentiles for CMJ Height (cm)

	Max	90	75	50	25	10	Min
Middle School	48.3	43.7	40.9	37.1	34.7	31.0	27.2
High School	52.1	45.7	42.1	38.9	35.3	31.9	27.2
College	54.9	48.0	45.0	41.9	37.0	33.5	28.6

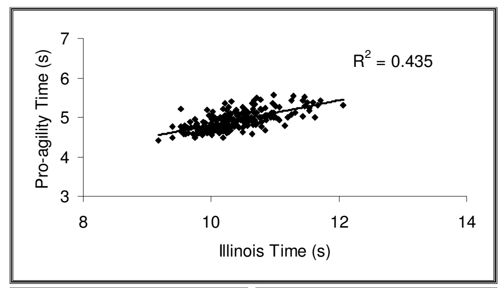
Scatterplots and correlations for Middle School Players

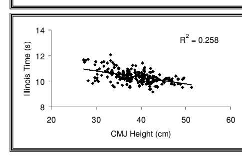


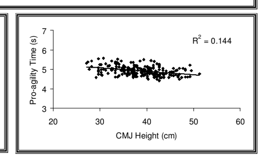




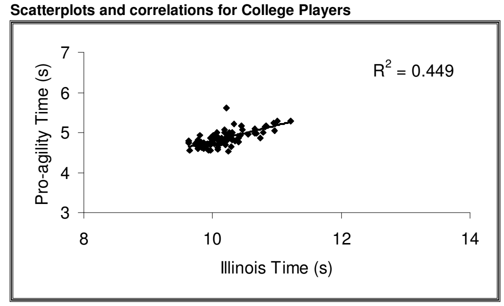
Scatterplots and correlations for High School Players

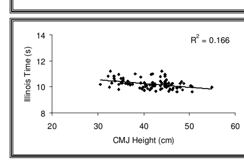


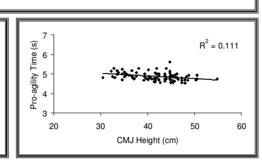




Scatterplots and correlations for College Players







Conclusions

Conclusions here.

References

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Acknowledgement

This project was supported in part by a student grant from the Gatorade Sports Science Institute.