Sex Differences in Childhood Athletic Performance

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ABSTRACT

INTRODUCTION Growth and motor development literature suggests a two-way (age by sex) interaction for maturational traits and motor performance variables (Beunen & Malina, 1988). Much of the research in this area, however, focuses on sex differences around the adolescent growth spurt with little documentation of performance differences throughout childhood.

PURPOSE The purpose of this study was to test for the presence of an age by sex interaction for a complex motor performance task and to determine whether or not sex differences exist for the performance of this task during childhood.

METHODS The data for this project were provided by USA Swimming (USAS) and consisted of the best 50-yard Freestyle performance for all USAS registered male and female swimmers from 6-19 years of age that competed in the event from 2005-2010 (N = 1,193,362). The distribution location was determined for each combination of age, sex and competition year using methods previously described (Hoaglin, 2006). ANOVA was then utilized to test the significance of the age by sex interaction.

RESULTS ANOVA revealed a significant age by sex interaction effect (F(13, 65) = 136.2, p < .001). Simple effects analysis indicated that the location parameter was significantly lower (i.e., times were faster) for boys than girls for 8-10 and 13-19 year olds (p < .001) while there was no difference in the location parameter between boys and girls 6-7 and 11-12 years old. The mean difference in the location parameter between boys and girls was significantly greater (p < .05) for 13-19 year olds (2.64) than for 6-12 year olds (0.44).

CONCLUSIONS The age by sex interaction for 50-yard Freestyle performance parallels the reported maturational changes. The marked acceleration in height, weight, and strength in boys beginning around 13 years magnifies the relatively small preadolescent sex differences. These traits play a crucial role in the increased performance difference between boys and girls from 12 to 13 years. While maturational traits play a role in adolescent performance differences, their role in childhood performance differences is unclear. Additional research is needed to determine whether or not the superior performance of boys relative to girls relates to physiological parameters and/or sex differences in participation and selection bias.

INTRODUCTION

- Thomas (1985) described a typical pattern for sex differences for motor performance tasks (e.g., long jump, shuttle run, grip strength, sit up test) across childhood and adolescence (Figure 1):

  1. performances slightly favor males during early childhood

  1. performances improve linearly across childhood with boys maintaining a slight but increasing advantage

  2. female performances level off at puberty whereas male performances continue to improve and may even accelerate

INTRODUCTION CONT.

- Most studies on sex differences in motor performance utilize 'non-athletic' cohorts, samples of less than 1,000 observations, and convenient sampling.

- The research focus in this area is on the performance of tasks considered to be "fundamental skills" and "motor fitness items" and not upon competitive athletic events for which children receive regimented training and practice.
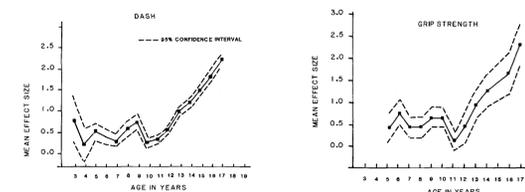

Figure 1. Examples of sex differences across childhood and adolescence for two motor tasks: a running test (left) and a grip strength test (right). From Taylor and French (1985).

PURPOSE

- To determine whether or not sex differences exist for a complex competitive motor performance task (50-yard Freestyle swimming performance) during childhood, adolescence, and early adulthood

- To test for the presence of an age by sex interaction for this complex motor performance task in a trained competitive cohort of boys and girls.

METHODS

- The data for this project were provided by USA Swimming (USAS) and consisted of the best 50-yard Freestyle performance for all USAS registered male and female swimmers from 6-19 years of age that competed in the event from 2005-2010 (N = 1,193,362).

- A total of 168 swimming performance distributions were characterized, one for each combination of age, sex, and competition year (14 ages x 2 sexes x 6 competition years).

- Each distribution consisted of thousands of swimming performances and was characterized by four parameters (location, scale, skewness, and elongation) using methods previously established (Hoaglin, 2006).

METHODS CONT.

- The location parameter, which is computed as the median value from the distribution, was the only distribution parameter used for further analysis in this study.

- Two-way ANOVA was utilized to test the significance of the age by sex interaction on the location parameter and simple effects analysis was used to analyze the interaction using methods previously described (Keppel & Wickens, 2003).

RESULTS

- ANOVA revealed a significant age by sex interaction effect (F(13, 65) = 136.2, p < .001).

- Simple effects analysis indicated that the location parameter was significantly lower (i.e., times were faster) for boys than for girls for 8-10 and 13-19 year olds (p < .001) while there was no difference in the location parameter between boys and girls 6-7 and 11-12 years old (Figures 2 and 3).
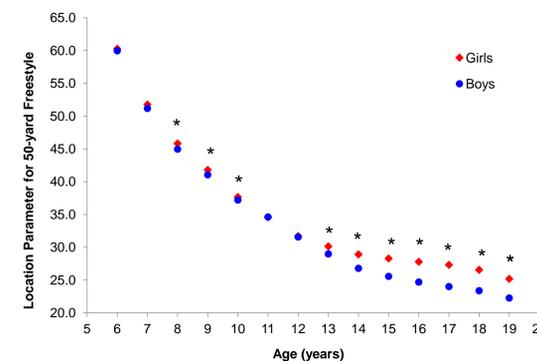

Figure 2. Location parameter (s) for boys (blue circles) and girls (red diamonds) as a function of age. * indicates significant difference (p < .05) between boys and girls.
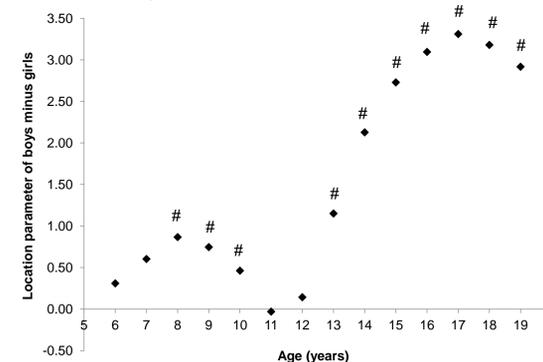

Figure 3. The mean location parameter (s) for boys from 2005-2010 minus the mean location parameter (s) for girls from 2005-2010 as a function of age. # indicates the difference is significantly different (p < .05) from zero.

CONCLUSIONS

- The age by sex interaction for competitive performance parallels reported physical/maturational changes in that the marked acceleration in stature, fat free mass, and functional strength in boys beginning around 13 years magnifies the relatively small preadolescent sex differences.

- The lack of performance differences observed between the girls and boys at age 11 and 12 years is novel. Recently, Kojima, Jamison, and Stager (2012) compared swim performances of boys and girls using the mean of the top 100 recorded yearly performances for both sexes and found the boys to be superior to the girls at these ages. We conclude that the respective findings differ as a result of Kojima analyzing only the "best" performers while the current analysis considered "all" performers. It is likely that Kojima's results are influenced by the maturational timing of the elite athlete to a greater extent than are ours.

- While maturational traits play a role in adolescent performance differences, their role in childhood performance is unclear.

- Additional research is needed to determine whether or not the superior performance of boys relative to girls relates to physiological parameters or sex differences in participation and selection bias.

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USA SWIMMING

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