

BODY HEIGHT AND LEG LENGTH DIFFERENTLY AFFECT SPRINT START IN BOYS VERSUS GIRLS

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INTRODUCTION

Performance in a sprint start depends on reaction time, technical skills and power output. These determinants are related to the placement of the start blocks and the “set” position of the athlete [1]. Morphology is considered a major determinant of performance. The aim of this study is to evaluate which physical parameters influence the sprint start in male and female adolescent sprint athletes.

METHODS

According to Flemish Athletics League rankings, top 10 boys and girls of each sprint discipline were invited for voluntary participation. Anthropometrical data were collected following ISAK guidelines [2] and total body skeletal muscle mass (SMM) was calculated [3]. Body composition was estimated by underwater weighing. A sprint start was performed with instrumented start blocks enabling the recording of horizontal forces. Reaction time (RT) was defined as the time between the start signal and the start of a building force slope (push off) against one of the blocks. The push off phase ended when the athlete left both start blocks. A laser measured time and running velocity at 5m from the start line.

Statistical tests were performed using SPSS 17.0, the level of significance was set at $p < 0.05$. A Kolmogorov Smirnov test was used before applying parametric or non-parametric test procedures.

RESULTS AND DISCUSSION

Boys ($n=27$) and girls ($n=26$) significantly ($p<.001$) differed for all anthropometric parameters but not for age (Table 1). Table 2 shows the start parameters for both sexes. Reaction time did not differ between boys and girls. Boys had a shorter push off time ($p<.01$) and applied higher maximal horizontal forces to the blocks than girls ($p<.001$). This contributed to a higher start velocity in boys ($p<.01$). Boys were also faster at 5m ($p<.001$).

Table 1: Age and anthropometrical data for boys and girls

	boys (n = 27)	girls (n = 26)	
age (years)	17.2 ± 1.8	17.3 ± 1.5	N.S.
height (cm)	177.4 ± 5.7	169.7 ± 6.4	S.
leg length (cm)	91.1 ± 4.1	87.4 ± 4.2	S.
weight (kg)	66.0 ± 7.6	56.8 ± 6.9	S.
SMM (kg)	27.5 ± 3.6	20.3 ± 3.0	S.
body fat (%)	7.9 ± 2.3	17.6 ± 5.0	S.

Table 2: Start parameters for boys and girls

	boys (n = 27)	girls (n = 26)	
RT (s)	0.14 ± 0.03	0.13 ± 0.04	N.S.
push off (s)	0.37 ± 0.02	0.39 ± 0.02	S.
horiz. Fmax (N)	628 ± 140	435 ± 84	S.
start v (m/s)	2.82 ± 0.28	2.56 ± 0.27	S.
5m time (s)	1.19 ± 0.06	1.29 ± 0.05	S.

In girls, leg length correlated positively with push off time on the frontal start block ($r = .72$; $p<.01$) and with time after 5m ($r = .45$, $p<.05$), but also with running velocity at 5m ($r = .58$, $p<.01$). In boys, longer legs were positively related with the maximal horizontal forces applied against the frontal start block ($r = .50$, $p<.05$). In both boys and girls, SMM, thigh and calf girths correlated with maximal horizontal force application on the blocks (respectively $r = .73$, $.73$, $.69$ (all $p<.01$) and $r = .52$ ($p<.01$), $.51$, $.51$ (both $p<.05$)), but there was no significant relation with running velocity or time after 5m. Body fat % showed no correlation with any of the start parameters.

Most morphological features in boys and girls are clearly related to performance in the sprint start and acceleration in the first meters. Girls who are taller and have longer legs stay longer in the start blocks whereas this was not observed in boys. This might be explained by the fact that girls with longer legs, in contrast to boys, were not able to develop sufficient power in order to achieve the same torque. A longer push off time resulted in a longer time to cover the first 5m. However, running velocity at 5m was also higher which is an indication that the time lost initially could be made up for later in the sprint. This also shows the importance of a good sprint start in the shorter sprint events.

CONCLUSIONS

Only in girls sprint start times are negatively influenced by both height and leg length. As smaller joint angles in the set position require higher force generation [1], further research should clear out if an adapted set position can prevent from a too long push off phase, especially in adolescent girls who still need to gain in strength.

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