A Longitudinal Study of Digit Ratio (2D:4D) and Its Relationships with Adult Running Speed in Jamaicans

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Letter to the Editor

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Dear Editor,

We write to point out that digit ratio may be a useful childhood biomarker for endurance running in adults. We have considered this question in a cohort of Jamaican children who have been studied from 1996 to the present day (Trivers et al. 1999).

Digit ratio (2D:4D; the relative lengths of the second and fourth digits) is a negative correlate of prenatal testosterone (PT) (Manning et al. 2007). PT has organizing effects on many traits, including performance in sport. Low 2D:4D (high PT) is linked to endurance sports, but it is unclear whether 2D:4D measured in children and teenagers is predictive of their performance when they are adults (Manning et al. 2007).

The purpose of this letter is to consider this question in a long-term study (the Jamaican Symmetry Project, JSP) of participants from a rural Jamaican population (Trivers et al. 1999). The JSP consists of a cohort of 288 children (155 boys) that were first measured in 1996 when participants were 5–11 years. The JSP focuses on developmental stability, but many other traits have been included. 2D:4D was measured in 1996 from hand x-rays and also from hand photocopies in 2002, and in 2010 for the present study. These measurements afforded us the opportunity to consider a longitudinal study of childhood, teenage, and adult 2D:4D as predictors of endurance-related adult performance in sport. We examined the participant performance in two races (90 m and 180 m) and focused on participant time for the 180 m relative to time for the 90 m.

We considered the hypothesis that low 2D:4D is linked to endurance and made the following predictions: (1) participants with low 2D:4D would run faster in the 180 m than expected after consideration of their 90-m times—that is, 2D:4D would be positively correlated to 180-m times after the influence of 90-m times was removed (residuals of 180-m times regressed on 90-m times: res180mon90m); and (2) this pattern of relationships not only would be found for 2D:4D measured in 2010 but also would apply to 2D:4D measured in 2002 and 1996.

As our experimental protocol, we ran the first race for each subject (90 m) followed by second race (180 m) about 30 min after the first race. Therefore, any increase in exhaustion from the first race affected the longer, second race, the critical measure being the relative difference between the two. Subjects were run in pairs. Finger measurements were made from scans of the ventral surface of the hand.

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Table 1. Mean (SD) for Right and Left 2D:4D for Males and Females Measured in 2010 (n = 160; 97 males), 2001 (n = 130; 80 males), and 1996 (n = 146; 88 males)

YEAR	RIGHT 2D:4D				LEFT 2D:4D			
	MALE	FEMALE	T-VALUE	P-VALUE	MALE	FEMALE	T-VALUE	P-VALUE
2010	0.937 (0.035)	0.945 (0.032)	1.45	0.15	0.939 (0.032)	0.942 (0.035)	0.57	0.59
2002	0.944 (0.036)	0.952 (0.034)	1.36	0.15	0.946 (0.036)	0.952 (0.036)	1.17	0.24
1996	0.908 (0.023)	0.904 (0.022)	0.96	0.34	0.906 (0.023)	0.900 (0.021)	1.63	0.11

Results

Means (SD) for 2D:4D are given in Table 1. With regard to sex differences, as expected there was a tendency for males to have lower 2D:4D compared with females, but this was not significant, and the tendency was not found for 1996. There were significant correlations between the means for 2010 and 2002 (right, $r = 0.76$; left, $r = 0.78$) and for 2010 and 1996 (right, $r = 0.46$; left $r = 0.51$), all at $p < 0.0001$. Males ran significantly faster than females for the 90 m (means ± SD: males, 12.97 ± 1.52 s; females, 17.60 ± 2.9 s; $t = 11.75$; $p < 0.0001$) and the 180 m (males, 28.26 ± 4.80 s; females, 38.80 ± 5.80 s; $t = 12.70$; $p < 0.0001$).

We were interested in each participant's relative performance in the 180-m run compared with that in the 90-m run. Therefore, we considered res180mon90m and analyzed male and female data separately. We found that 2D:4D was positively related to res180mon90m for all correlations. That is, participants with low 2D:4D tended to run faster in the 180-m race than was expected after consideration of their 90-m times. The correlations varied in strength from $r = 0.03$ to $r = 0.26$ across data from all three years. However, the strongest correlations were found for female right 2D:4D and res180mon90m for 2010 ($r = 0.26$, $p = 0.02$), 2002 ($r = 0.24$, $p = 0.045$), and 1996 ($r = 0.20$, $p = 0.07$; all one-tailed tests). However, there was a tendency for the effect size (r^2) of the relationships to reduce in the earlier measurements of 2D:4D (2010, $r^2 = 0.07$; 2002, $r^2 = 0.06$; 1996, $r^2 = 0.04$).

To conclude, we found that (1) the variable res180mon90m showed positive correlations with 2D:4D; (2) splitting the correlations by sex and hand, right 2D:4D in females was positively and significantly correlated with res180mon90m; and (3) 2D:4D measured from photocopies in 2002 and x-rays in 1996 showed a similar pattern, with the strongest correlation for right 2D:4D and res180mon90m in females. Therefore, low-2D:4D participants had running times over 180 m that were faster than expected after considering their times over 90 m. We suggest that this supports the hypothesis that low 2D:4D is associated with endurance-linked running. The effect was strongest in females and was particularly associated with right 2D:4D. This general pattern was also found in correlations between 2D:4D and running times when the former was measured 8 years and even 14 years before the latter.

We think that such results can be of interest for the readership of *Human Biology* because sustained studies, such as the JSP, that are carried out over a number of years are not common. Furthermore, 2D:4D represents a relatively simple biomarker for the organizing effects of prenatal sex steroids that may have long-term implications for performance in sport and susceptibility to disease in adults.

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