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## Social status, masculinity, and testosterone in young men

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### ABSTRACT

Among other things, sexual selection theory posits that in species with limited male parental investment, males should evolve biological mechanisms to competitively dominate or otherwise compete with one another. It is unclear whether such proposed mechanisms would influence status hierarchies in small human groups. We report the results of a study investigating possible effects of prenatal (index-to-ring finger length ratio or 2D:4D) and salivary testosterone, and masculine identification, on status among 71 male college students living in nine residential groups. The results indicate no role of either prenatal or salivary testosterone in maintaining status hierarchies in these groups. A possible explanation is that peer-assessed status in these groups was arrived at cooperatively rather than through dominance contests.

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### 1. Introduction

Any biological processes underlying sex differences in dominant or competitive behaviors in men are likely to develop at least partly under the influences of androgens, especially testosterone (*T*). Wingfield Hegner, Dufty, and Ball's (1990) challenge hypothesis provides a theoretical foundation for studying effects of *T* on social dominance, and has been applied to humans by Archer (2006). According to the challenge hypothesis *T* levels will rise during periods of more intense mating effort, such as during a breeding season or male–male confrontation, thereby presumably supporting physiology and behavior promoting success in mating. There is substantial evidence that testosterone is modulated in this way in many animal species, including both non-human primates (Cavigelli & Pereira, 2000; Czoty, Gould, & Nader, 2009; Girard-Buttoz, Heistermann, Krummel, & Engelhardt, 2009; Gould & Ziegler, 2007) and humans (Archer, 2006; Gray et al., 2004). While there is less evidence that these fluctuations contribute to social dominance, associations with both challenge-elevated and baseline testosterone have been reported for non-human primates (Beehner, Bergman, Cheney, Seyfarth, & Whitten, 2006), including chimpanzees (Anestis, 2006; Muehlenbein, Watts, & Whitten, 2004; Muller & Wrangham, 2004). Pioneering work by Sapolsky further linked endocrine responses to “personality” (Sapolsky, 1991), and this work has been extended (Anestis, 2006).

The modulation of *T* production has been demonstrated in humans, but is only the first part of the challenge hypothesis, whereas

the second part is that elevated *T* should promote social dominance. The specific physiological pathways linking *T*, first with behaviors or personality traits, and then with performance in dominance contests have not been explicated or are only beginning to be understood in humans (Schultheiss, 2007; van Honk, Schutter, Hermans, & Putman, 2004). Recent research into human male behavior and psychology conducted from a biological or evolutionary perspective has focused on the establishment of dominance in dyadic or small group interactions (Archer, 2006; Booth, Granger, Mazur, & Kivlighan, 2006; Mazur, 2005; Mazur & Booth, 1998). The concept of dominance is explained as a special case of social status, but one based on series of competitive one-on-one interactions (Mazur, 2005). Unfortunately, whether status hierarchies in particular groups fit this description may not be obvious because human dominance contests can be “gentle, even subliminal” (Mazur, 2005, p. 6). Proposed competitive behaviors include “assertive eye contact or posturing” (Booth et al., 2006, p. 173). Even “antisocial” behavior has been suggested as a reflection of dominance-striving which manifests in inappropriate contexts (Archer, 2006; Mazur & Booth, 1998). Dabbs broadened this paradigm by arguing that even dimensions of social status among men that are not established through competition may be influenced by *T*, and encouraged researchers to first discover the behavioral and psychological correlates of *T*, then use this information to inductively develop a better understanding of hierarchy formation (Dabbs, 1998; Dabbs & Dabbs, 2000).

Most previous research cited as supporting an association between adult *T* levels and dominance has been based on very small samples, and focused on ratings of dominant, assertive, or aggressive behavior, rather than assessments of attained status in

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real social groups (Mazur & Booth, 1998; Sellers, Mehl, & Josephs, 2007). One exception was the finding by Dabbs and Morris (1990) that *T* predicted occupational status, but low rather than high status. Another was a study of status in co-resident female college students (Cashdan, 1995). However, this study found that women with higher *T* were rated as having lower status by their peers, and over-rated their own status. The phenomenon of over-ranking oneself has also been identified as a potential component of sex-differentiated dominance-striving behavior (Archer, 2006; Johnson, 2004; Johnson et al., 2006).

*T* can be measured in saliva (Granger, Schwartz, Booth, & Arentz, 1999), but some researchers have argued that prenatal *T* is more important in the development of any important biological sex differences in personality or behavior (Collaer, 1998; McIntyre

& Edwards, 2009; McIntyre & Hooven, 2009). As prenatal *T* cannot be studied directly, indirect approaches have been developed (Cohen-Bendahan, van de Beek, & Berenbaum, 2005), including the ratio of the lengths of the index and ring fingers, or 2D:4D (Manning, Scutt, Wilson, & Lewis-Jones, 1998; McIntyre, 2006). Lower 2D:4D is hypothesized to be associated with greater prenatal androgenization, and therefore dominance-striving. A previous study with questionnaire self-assessment of dominance detected a very small negative association with 2D:4D in a large sample of women ( $r < 0.03$ ) and an even smaller significant association in men (Manning & Fink, 2008).

We employed the approach of Cashdan (1995) to test for an association of salivary *T*, 2D:4D, and self-assessed masculinity with peer rankings of dominance and status in groups of young men.

**Table 1**

Associations among 2D:4D, salivary testosterone, masculinity, and peer rankings and over-ranking of self. Significant associations in bold type (uncorrected for multiple comparisons).

<i>N</i> = 71 Pearson <i>r</i> <i>p</i> -value	Right-hand 2D:4D	Salivary testosterone (adjusted)	Salivary testosterone (late day)	Masculinity (Bem)	Masculinity (Adjective Checklist)
Right-hand 2D:4D		−0.021 <i>0.860</i>	0.015 <i>0.900</i>	0.026 <i>0.829</i>	0.112 <i>0.351</i>
Salivary testosterone (adjusted)			0.921 <b>&lt;0.001</b>	−0.042 <i>0.725</i>	−0.083 <i>0.491</i>
Salivary testosterone (late day)				−0.040 <i>0.741</i>	−0.080 <i>0.509</i>
<i>Average peer ranking of participant</i>					
Athleticism ICC = 0.93	0.178 <i>0.139</i>	−0.222 <i>0.062</i>	−0.207 <i>0.084</i>	0.131 <i>0.275</i>	<b>0.326</b> <b>0.005</b>
Confidence ICC = 0.81	0.088 <i>0.464</i>	−0.124 <i>0.304</i>	−0.080 <i>0.508</i>	<b>0.480</b> <b>&lt;0.001</b>	<b>0.426</b> <b>&lt;0.001</b>
Aggressiveness ICC = 0.89	0.004 <i>0.975</i>	−0.088 <i>0.465</i>	−0.103 <i>0.391</i>	<b>0.557</b> <b>&lt;0.001</b>	<b>0.328</b> <b>0.005</b>
Toughness ICC = 0.88	0.108 <i>0.372</i>	<b>−0.248</b> <b>0.037</b>	<b>−0.248</b> <b>0.037</b>	<b>0.294</b> <b>0.013</b>	<b>0.351</b> <b>0.003</b>
Leadership ICC = 0.70	0.212 <i>0.076</i>	−0.002 <i>0.987</i>	−0.022 <i>0.856</i>	<b>0.280</b> <b>0.018</b>	<b>0.279</b> <b>0.019</b>
Sensitivity ICC = 0.79	0.056 <i>0.644</i>	−0.022 <i>0.857</i>	−0.042 <i>0.728</i>	<b>−0.391</b> <b>0.001</b>	−0.225 <i>0.059</i>
Success with Romantic Partners ICC = 0.79	0.160 <i>0.182</i>	−0.200 <i>0.095</i>	−0.179 <i>0.136</i>	<b>0.270</b> <b>0.023</b>	<b>0.267</b> <b>0.025</b>
Overall status ICC = 0.89	<b>0.261</b> <b>0.028</b>	−0.007 <i>0.955</i>	−0.015 <i>0.900</i>	0.177 <i>0.139</i>	0.229 <i>0.054</i>
Mean of all ranks	0.200 <i>0.095</i>	−0.174 <i>0.147</i>	−0.171 <i>0.155</i>	<b>0.345</b> <b>0.003</b>	<b>0.379</b> <b>0.001</b>
<i>Over-ranking by self-relative to peers</i>					
Athleticism	−0.187 <i>0.118</i>	0.104 <i>0.389</i>	0.147 <i>0.221</i>	0.046 <i>0.705</i>	0.124 <i>0.305</i>
Confidence	−0.045 <i>0.708</i>	0.028 <i>0.814</i>	0.023 <i>0.849</i>	0.105 <i>0.385</i>	0.158 <i>0.189</i>
Aggressiveness	0.060 <i>0.622</i>	0.030 <i>0.804</i>	−0.003 <i>0.981</i>	0.131 <i>0.274</i>	0.138 <i>0.249</i>
Toughness	−0.029 <i>0.807</i>	0.159 <i>0.184</i>	0.149 <i>0.216</i>	0.006 <i>0.962</i>	−0.021 <i>0.860</i>
Leadership	−0.153 <i>0.201</i>	−0.163 <i>0.175</i>	−0.074 <i>0.540</i>	0.023 <i>0.852</i>	0.002 <i>0.985</i>
Sensitivity	−0.165 <i>0.169</i>	0.086 <i>0.476</i>	0.078 <i>0.516</i>	−0.202 <i>0.091</i>	−0.122 <i>0.312</i>
Success with Romantic Partners	−0.149 <i>0.216</i>	0.020 <i>0.868</i>	0.030 <i>0.806</i>	0.224 <i>0.061</i>	0.092 <i>0.448</i>
Overall status	−0.060 <i>0.619</i>	−0.137 <i>0.256</i>	−0.151 <i>0.208</i>	0.097 <i>0.421</i>	0.076 <i>0.527</i>
Mean over-ranking	−0.124 <i>0.302</i>	0.019 <i>0.877</i>	0.061 <i>0.615</i>	0.090 <i>0.458</i>	0.117 <i>0.331</i>

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