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Testosterone is associated with mating success but not attractiveness or masculinity in human males

MARIANNE PETERS*†, LEIGH W. SIMMONS* & GILLIAN RHODES†
*Centre for Evolutionary Biology, School of Animal Biology
†School of Psychology, University of Western Australia

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Testosterone is thought to mediate a trade-off between paternal effort and mating effort, such that males investing monogamously have lower testosterone than those with multiple partners. This suggests that high-testosterone males may have a reproductive advantage over their low-testosterone counterparts via increased mating success. We tested 119 adult males to assess whether testosterone is associated with mating success, and rated masculinity and attractiveness. We found a significant positive correlation between testosterone and cumulative mating success. There was, however, no correlation between testosterone and rated masculinity or attractiveness. This study indicates that, although current levels of testosterone covary with male mating success, this effect may not be mediated by women's preferences for visual cues to testosterone levels conveyed in static face or body features. If the testosterone–mating success link is driven by female choice, this effect may be behaviourally modulated, for example, through the augmentation of male mate seeking or courtship effort.

Keywords: attractiveness; masculinity; mating success; men; testosterone

Work with nonhuman animals suggests that testosterone mediates a trade-off between paternal effort and mating effort, such that males investing monogamously have reduced testosterone (e.g. McGlothlin et al. 2007). A testosterone-mediated trade-off between mating effort and parental effort may also characterize humans (reviewed in Archer 2006). Archer (2006) proposed that differences in testosterone are associated with differing life history strategies: one that favours mating effort and another that favours parenting effort. Those individuals who favour mating effort over parenting effort will show higher levels of testosterone (Archer 2006). In males, increased mating effort, at the expense of parenting effort, has significant potential benefits as total reproductive success tends to increase with mating effort (Trivers 1972; Wade & Shuster 2002). One measure of mating effort in young adult males is their mating success as measured by the number of sexual partners they have acquired. We therefore hypothesized that there may be a link between adult testosterone levels and number of sexual partners, and directly investigated whether current (adult) levels of testosterone are associated with cumulative male mating success.

Recent research does suggest that testosterone may be associated with mating strategy and relationship status in humans (Gray et al. 2002; McIntyre et al. 2006; van Anders & Watson 2007; van Anders et al. 2007). Specifically, men in monogamous relationships have lower testosterone than single men (McIntyre et al. 2006; van Anders & Watson 2007) and men with multiple partners (van Anders et al. 2007). Furthermore, men who are fathers have lower testosterone than single men, and trade-off mating effort for parenting effort (Gray et al. 2002). Thus, it appears that high-testosterone men may favour a multiple-mate or short-term mating strategy. These men, who are not committed to a single relationship, therefore have the opportunity to acquire more sexual partners than monogamous men.

Correspondence: M. Peters, Centre for Evolutionary Biology, School of Animal Biology (M092), University of Western Australia, 35 Stirling Hwy, Crawley, WA 6009, Australia (email: mpeters@cyllene.uwa.edu.au).

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Adult testosterone levels may be associated with behaviour and mating success, either by motivating, or fluctuating in response to, certain behaviours. Testosterone has been shown to affect sexual motivation in males. High testosterone motivates sexual activity in adolescent boys (Udry et al. 1985; Udry 1988; Halpern et al. 1993), increases extrapair interest and decreases commitment to monogamous relationships in men (McIntyre et al. 2006). Testosterone replacement studies of hypogonadal men have also shown that testosterone is important for sexual desire and interest (reviewed in Sherwin 1988). These same studies, however, suggest that there may be an upper threshold beyond which increases in testosterone cease to have behavioural effects (Sherwin 1988; see also Wingfield et al. 1990). Fluctuations in testosterone levels have nevertheless been shown to account for variations in sexual activity within individuals (Hirschenhauser et al. 2002), although variation between individuals is not associated with variation in sexual activity over a short period of time (Brown et al. 1978). The association between testosterone and behaviour can manifest equally in the opposite direction, whereby certain behaviours, particularly in the context of reproduction, can cause an increase in testosterone, for example in response to 'challenges' (Archer 2006) and interactions with women (Roney et al. 2003).

An association between testosterone and a successful short-term mating strategy may be augmented via a female preference for males with high testosterone. Testosterone is associated with the development of secondary sexual characteristics in males (Enlow 1990), and many studies have shown that females find these traits attractive (Rhodes 2006), arguably because they are honest signals of male health and vigour that reflect an individual's ability to withstand the associated costs of testosterone (Folstad & Karter 1992).

In many vertebrate species, testosterone is related to the expression of characteristics used for signalling to potential mates. For example, birds and fishes are two groups that use bright red and orange colours to attract mates (Brush 1978; Jayasooriya et al. 2002; Blount et al. 2003). In humans, the link between testosterone and masculinity is less clear. The development of masculine traits is stimulated by androgens during adolescence (Tanner 1989; Enlow 1990), although there is little correlation between adolescent and adult testosterone levels (r varies between 0.02 and 0.05; van Bokhoven et al. 2006). Therefore, although masculine traits in adult males are generally attractive to females (Rhodes 2006) and may provide insights as to the condition of the male during puberty (Rhodes et al. 2003), it is unlikely that they convey any information regarding current testosterone levels or immunocompetence to a potential mate. Nevertheless, several studies have investigated whether masculinity and attractiveness are associated with current testosterone levels. Most found no association between attractiveness and testosterone (Swaddle & Reierson 2002; Neave et al. 2003; Penton-Voak & Chen 2004; but see Roney et al. 2006). Furthermore, while Penton-Voak & Chen (2004) found a weak link between masculinity and testosterone, Bogaert & Fisher (1995) and Neave et al. (2003) found no such link using a direct correlational approach.

Bogaert & Fisher (1995) reported a significant correlation of 0.2 between testosterone and current cumulative number of sexual partners, and no significant correlation between testosterone and attractiveness. However, their measures of testosterone were taken in the afternoon, when participant testosterone levels are likely to have been affected by behavioural interactions and activities, such as those discussed above. Furthermore, in Bogaert & Fisher's (1995) study, ratings of attractiveness were made by only one male and one female. These ratings were combined to provide an aggregate attractiveness score that yielded a Cronbach's alpha of just 0.56. Therefore these ratings were arguably unreliable, and additionally did not represent attractiveness judgements that are most relevant to mating success: opposite-sex ratings. We aimed to replicate Bogaert & Fisher's findings, using improved methods for assessing testosterone levels and attractiveness.

Our main aim in this study was to investigate the association between testosterone and mating success in humans. We measured salivary testosterone levels from samples provided upon waking, for a sample of male undergraduate students who completed self-reported surveys of their sexual behaviour. If testosterone is associated with a propensity for increased mating effort, as predicted by Archer (2006) then higher testosterone should be associated with more sexual partners (i.e. increased mating success). We also examined the associations between testosterone and attractiveness and masculinity of both faces and bodies. Both faces and bodies are important for human mate choice (Peters et al. 2007), yet studies have previously focused only on ratings of facial attractiveness and masculinity. We are the first to include female ratings of body, as well as face, appearance in our study of the association between testosterone and appearance. Attractiveness and masculinity were rated by two independent groups of 12 females, and correlated with testosterone measurements to determine whether female perceptions of visual cues to testosterone could account for any association between testosterone and mating success.

METHODS

Participants

We recruited 119 men from the University of Western Australia (mean age $\pm$ SD $= 22.5 \pm 4.9$ years, range 18–35 years), in return for course credit or remuneration for travel expenses. All males were heterosexual, Caucasian and cleanly shaven. The research was approved by the University of Western Australia Human Research Ethics Committee.

Participant Procedure

Each male participant was photographed wearing a white fitted singlet and dark-coloured shorts. Both full-length body and close-up face photos were taken. The participants were asked to adopt a neutral expression and to stand with their feet slightly apart, with their arms relaxed by their sides.