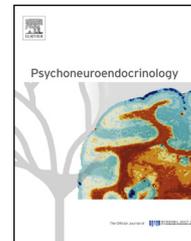




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Early follicular testosterone level predicts preference for masculinity in male faces – But not for women taking hormonal contraception



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Summary It has been shown that women's preference for masculinity in male faces changes across the menstrual cycle. Preference for masculinity is stronger when conception probability is high than when it is low. These findings have been linked to cyclic fluctuations of hormone levels. The purpose of the present study is to further investigate the link between gonadal steroids (i.e. testosterone, estradiol, and progesterone) and masculinity preference in women, while holding the cycle phase constant. Sixty-two female participants were tested in their early follicular cycle phase, when conception probability is low. Participants were shown face pairs and were asked to choose the more attractive face. Face pairs consisted of a masculinized and feminized version of the same face. For naturally cycling women we found a positive relationship between saliva testosterone levels and masculinity preference, but there was no link between any hormones and masculinity preference for women taking hormonal contraception. We conclude that in naturally cycling women early follicular testosterone levels are associated with masculinity preference. However, these hormonal links were not found for women with artificially modified hormonal levels, that is, for women taking hormonal contraception.

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1. Introduction

Facial attractiveness has been positively related to mating success (Jokela, 2009). Recent research has identified various facial cues that are responsible for attractiveness: symmetry, averageness, skin healthiness, facial adiposity and sexual dimorphism (e.g. Coetzee et al., 2009; Little et al., 2011; Koscinski, 2012). In terms of sexual dimorphism, there is

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rather clear agreement that femininity is positively related to female attractiveness (e.g. Perrett et al., 1998; Rhodes, 2006; Koscinski, 2013). However, there is no such agreement whether masculine facial traits make a male face more attractive (e.g. Rhodes, 2006; DeBruine et al., 2010; Koscinski, 2012, 2013). A reason for inconsistent findings could be that women's preferences for male stimuli change across the menstrual cycle: in the late follicular phase women prefer more masculine men than in other phases. This shift in preferences has been shown for men's body odour (Grammer, 1993), body shape (Little et al., 2007) and voice (Puts, 2005; Feinberg et al., 2006; Puts, 2006). Likewise women's preferences for male faces change. Penton-Voak et al. (1999) found that, in general, females preferred male faces with a slightly more feminine shape – however this preference was weaker if the woman was tested near ovulation. This implies that women's face preferences are modulated by hormonal changes which occur across the menstrual cycle in accordance with conception probability. Other studies found an overall preference for more masculine male faces (Johnston et al., 2001) or no overall preference (Penton-Voak and Perrett, 2000); however they all found the same cycle effect: women showed a stronger preference for more masculine face shapes if they were tested near ovulation than when tested in other cycle phases (Penton-Voak and Perrett, 2000; Johnston et al., 2001). Females' preference for faces of men with higher testosterone levels was also highest around ovulation (Roney and Simmons, 2008). Since facial masculinity has been linked to testosterone levels in men (Penton-Voak and Chen, 2004; Roney et al., 2006), this result is in line with the studies reviewed above. However, the link between facial masculinity and testosterone level is debatable: some studies did not find an association between facial masculinity and current testosterone level (Peters et al., 2008) or only an association with testosterone increase after winning a competitive task but not with the baseline testosterone level (Pound et al., 2009). Furthermore, also the shift of women's preferences across the cycle is not undisputed (e.g. Harris, 2012).

Shifts in preferences are commonly explained in the context of conception probability: demands on a potential partner are likely to change over the cycle. According to the *ovulatory shift hypothesis* (Gangestad et al., 2005) the optimal mate should, on the one hand, have genes that are beneficial for potential offspring, on the other hand an ideal partner should engage in high paternal investment. Since females particularly benefit from good genes when conception actually occurs, a preference for phenotypic markers of good genes should be especially strong during ovulation (Gangestad and Thornhill, 1998; Gangestad et al., 2005). Masculine features have been argued to be a sign of a good immune system (Folstad and Karter, 1992) and have been found to be linked to good health (Rhodes et al., 2003; Thornhill and Gangestad, 2006). However, masculinity is also associated with negative qualities. Raised testosterone levels in men are associated with more troubles in romantic relationships (Booth and Dabbs, 1993), more self-reported aggressive behaviour (Harris et al., 1996), more anti-social behaviour (Dabbs and Morris, 1990), and more dominant demeanour (Mazur and Booth, 1998). Thus, a stronger preference for more masculine men when conception probability is high might be profitable in terms of offspring's health

but at expenses of paternal investment (Penton-Voak and Perrett, 2001). Consequently, a female would benefit most from choosing a man with feminine traits as a long-term partner but pursuing extra-pair mating during ovulation (cf. Gangestad et al., 2005). However, Dixson (2012) for example challenges this view by stating that extra-pair mating during ovulation would just be too risky: it would endanger long-term relationships and could impact the welfare of already existing children negatively.

Fluctuating hormone levels are likely to be the proximate cause for the cyclic shifts, since the menstrual cycle is characterized by changing hormonal levels (e.g. Sherman and Korenman, 1975). At the beginning of the cycle, the follicle stimulating hormone (FSH) stimulates the follicle which results in an increased production of estradiol. Estradiol level is highest when the follicle reaches maturity and decreases again after ovulation. Progesterone level increases after ovulation. Shortly before onset of menstruation, estradiol and progesterone levels decline (Butt, 1979). Testosterone is highest around ovulation (Dabbs and Delarue, 1991; Bloch et al., 1998). Yet, Dabbs and Delarue (1991) found that for testosterone, changes across the menstrual cycle are smaller than circadian changes: testosterone levels were 12% higher around ovulation than in other cycle phases but 80% higher in the morning compared to the evening. Koscinski (2011) found that face preferences change across a women's life span. Younger women for example prefer more sexy-looking men than older women do, and pregnant women's preferences were more similar to those of middle-aged women than to non-pregnant women of the same age. Again, changes in hormonal levels could account for the different face preference at different age and in different life situations. Also men's face preferences can be linked to hormones: the preference for femininity in female face was stronger for men with higher cortisol levels (Jones et al., 2013). Furthermore this preference was also stronger at times when testosterone levels were high, however there was no link between average testosterone level and face preference (Welling et al., 2008). Hormones are not only linked to face preferences but are known to be associated with various other behaviours. Women with higher estradiol levels were more likely to flirt with men other than their primary partner than were women with lower estradiol levels. Furthermore, women with higher estradiol levels had higher self-perceived attractiveness and reported to have had more long-term relationships in their life (Durante and Li, 2009). Moreover progesterone level was linked to the affiliation motive; for men it was a negative and for women a positive relationship. Schultheiss et al. (2003) found for both men and women that averaged testosterone levels were positively associated with power motivation. Testosterone level is further associated with mating behaviour in men: Men with higher testosterone levels have more sex partners (e.g. Pollet et al., 2011), are less often married (e.g. Booth and Dabbs, 1993) and if married, they spend less time with their wife (Gray et al., 2002). For adolescent males, testosterone level was predictive for sexual activities. This was found between adolescents as well as within adolescents. Adolescents with higher testosterone levels were more sexually active than adolescents with lower testosterone levels. Furthermore, adolescents became more sexually active when their testosterone levels increased and less sexually active

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