The role of mating context and fecundability in women's preferences for men's facial masculinity and beardedness

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ABSTRACT

The ovulatory shift hypothesis proposes that women's preferences for masculine physical and behavioral traits are greater at the peri-ovulatory period than at other points of the menstrual cycle. However, many previous studies used self-reported menstrual cycle data to estimate fecundability rather than confirming the peri-ovulatory phase hormonally. Here we report two studies and three analyses revisiting the ovulatory shift hypothesis with respect to both facial masculinity and beardedness. In Study 1, a large sample of female participants (N = 2,161) self-reported their cycle phase and provided ratings for faces varying in beardedness (clean-shaven, light stubble, heavy stubble, full beards) and masculinity (-50%, -25%, natural, $+25\%$ and $+50\%$) in a between-subjects design. In Study 2, 68 women provided the same ratings data, in a within-subjects design in which fertility was confirmed via luteinising hormone (LH) tests and analysed categorically. In Study 2, we also measured salivary estradiol (E) and progesterone (P) at the low and high fertility phases of the menstrual cycle among 36 of these women and tested whether shifts in E, P or E:P ratios predicted face preferences. Preferences for facial masculinity and beardedness did not vary as predicted with fecundability in Study 1, or with respect to fertility as confirmed via LH in Study 2. However, consistent with the ovulatory shift hypothesis, increasing E (associated with cyclical increases in fecundability) predicted increases in preferences for relatively more masculine faces; while high P (associated with cyclical decreases in fecundability) predicted increases in preferences for relatively more feminine faces. We also found an interaction between E and preferences for facial masculinity and beardedness, such that stubble was more attractive on un-manipulated than more masculine faces among women with high E. We consider discrepancies between our findings and those of other recent studies and suggest that closer scrutiny of the stimuli used to measure masculinity preferences across studies may help account for the many conflicting findings that have recently appeared regarding cycle phase preference shifts for facial masculinity.

1. Introduction

The ovulatory shift hypothesis proposes that peri-ovulatory increases in women's sexual desire occur in response to male phenotypic and behavioral traits (Gangestad and Haselton, 2015). For example, at the peri-ovulatory phase women prefer men with more masculine facial features, including defined brows, deeply set and narrow eyes, thin lips, robust midface, and a square jaw (Penton-Voak et al., 1999; Penton-Voak and Perrett, 2000; Little and Jones, 2012, Little et al., 2008).

Facial masculinity is androgen dependent (Whitehouse et al., 2015), and is positively associated with men's current health (Rhodes et al., 2003), past disease resistance (Thornhill and Gangestad, 2006), immune response (Rantala et al., 2012), physical strength (Windhager et al., 2011), social rank (Geniole et al., 2015), and mating success (Hill et al., 2013). However, investment in androgen dependent traits that are associated with mating effort may compromise paternal investment (Muller, 2017), so that masculine men may be costly as long-term partners. Facially masculine men report having more short-term than

long-term sexual partners (Rhodes et al., 2005) and women accurately assigned higher sexual infidelity to facially masculine men (Rhodes et al., 2013), which may explain some of the variation in women's facial masculinity preferences (Kruger, 2006; Perrett et al., 1998). However, women's preferences for facial masculinity were highest at the peri-ovulatory phase of the menstrual cycle (Penton-Voak et al., 1999; Penton-Voak and Perrett, 2000; Little and Jones, 2012; Little et al., 2008), suggesting that the costs of masculinity are sometimes bypassed when heritable benefits to offspring may be gained.

Like facial masculinity, beardedness is sexually dimorphic (Trotter, 1922), androgen dependent (Randall, 2008) and enhances ratings of men's masculinity, age, social dominance, and aggressiveness (Dixson and Vasey, 2012; Dixson and Brooks, 2013; Geniole and McCormick, 2015; Muscarella and Cunningham, 1996; Neave and Shields, 2008). Bearded men also report feeling more masculine (Wood, 1986), endorse masculine gender roles (Oldmeadow and Dixson, 2016), and have higher serum testosterone (Knussman and Christiansen, 1988). Although craniofacial masculinity and beardedness are both androgen dependent, they develop under different androgenic processes. Facial masculinity emerges as testosterone binds to androgen receptors that promote skeletal growth, beginning during fetal development (Whitehouse et al., 2015), becoming elaborated upon under the actions of testosterone during adolescence (Marečková et al., 2011), and is fully developed at adulthood (Penton-Voak and Chen, 2004). Beardedness requires the conversion of testosterone to dihydrotestosterone via 5 alpha reductase activity within hair follicles to stimulate the growth of facial hair (Farthing et al., 1982; Randall, 2008), which suggest facial masculinity varies, to some extent, independently of the capacity to grow a full beard and could signal different or convergent components of quality (Dixson et al., 2016).

Facial hair enhances the appearance of testosterone dependent facial traits, such as overall facial length and jaw size which, in turn, augments judgments of masculinity and dominance (Dixson et al., 2017a; Sherlock et al., 2017). Facial masculinity and beardedness also interact to determine women's attractiveness judgments of men's faces, so that slightly less masculine faces are judged as more attractive when bearded than highly masculine faces, possibly because beards mask the less masculine facial cues that may not enhance male facial attractiveness (Dixson et al., 2016). While highly masculine faces and full beards in combination may not enhance attractiveness due to appearing overly masculine, dominant and aggressive, they may be more attractive when considering short-term rather relationships and when fertility is highest. However, whether this interaction between facial masculinity and beardedness on attractiveness judgments varies over the menstrual cycle is unknown.

Although initial research provided compelling evidence for ovulatory shifts in women's mate preferences (Gangestad and Thornhill, 2008), recent studies did not find ovulatory shifts in preferences for facial masculinity (Harris, 2011, 2013; Zietsch et al., 2015) or beardedness (Dixson and Brooks, 2013; Dixson et al., 2013; Dixson and Rantala, 2016, 2017). Evidence from two meta-analyses were also mixed. Wood et al. (2014) concluded that there were no ovulatory shifts in women's mate preferences for masculinity. However, their meta-analyses estimated that the effect size (g) for masculinity preference shifts was 0.08, with a 95% CI spanning −0.01–0.16, which only just includes 0 and does not constitute strong evidence in favor of the null hypothesis. Additionally, the studies included in the estimate of cycle shift effects on masculinity preferences (k = 38) combined attractiveness judgements for faces, bodies, trait descriptions, and voices. If only studies assessing preference shifts for masculine facial shape are considered (k = 28), the estimated mean effect size more than doubles to 0.19. Gildersleeve et al. (2014) did assess cyclical preference shifts for facial masculinity, specifically, and found the significant predicted shift with an estimated effect size (g) of 0.13 overall, increasing to 0.19 for short-term contexts. Both meta-analyses reported significant cycle phase shifts across other traits relevant to the ovulatory shift hypothesis

(including facial symmetry), which are not examined in the current study.

However, many of these studies were criticized for employing self-reported menstrual cycle data and variable computations of the peri-ovulatory phase in their analyses (Harris et al., 2014; Wood and Carden, 2014). Using self-reported recollected dates of menstrual bleeding may not generate accurate estimations of current fecundability (Small et al., 2007), owing to natural variation within healthy and regularly cycling women in menstrual cycle lengths (Jukic et al., 2008) and hormone levels (Jasienska and Jasienski, 2008). These natural differences reflect development in utero (Jasienska et al., 2006b), genetic differences (Jasienska et al., 2006a), body fat distribution (Ziomkiewicz et al., 2008), lifestyle factors (Jasienska, 2003) and age related changes in hormones (Lipson and Ellison, 1992). Statistical simulations suggest that between-subject designs, indirect counting methods, and low statistical power have contributed to mixed findings in past ovulatory shift research (Gangestad et al., 2016). Indirect counting methods do not predict hormonally verified peri-ovulatory periods with greater than 60% accuracy (i.e. these methods typically result in fertile window estimates where no more than 60% of the days are actually in the period of increased fecundability, Blake et al., 2016).

Peri-ovulatory increases in women's sexual desire coincide with rises in estradiol (E) and lower progesterone (P) levels (Roney and Simmons, 2013; Jones et al., 2018a). These hormonal changes may also underpin aspects of women's physical attractiveness (Puts et al., 2013), assertiveness (Blake et al., 2017a,b) and mate preferences (Gangestad and Haselton, 2015). Mid-cycle levels of E were positively associated with between-subject and within-subject preferences for facial masculinity (Roney and Simmons, 2008; Roney et al., 2011; Ditzen et al., 2017). However, two studies employing within-subject designs did not report effects of E or P and instead found that testosterone levels were associated with preferences for facial masculinity (Bobst et al., 2014; Welling et al., 2007). Three recent studies employing between-subject designs also found no association between E and preferences for facial masculinity for either short-term or long-term relationships (Marcinkowska et al., 2016; Escasa-Dorne et al., 2017; Jones et al., 2018b). Additional studies testing associations between women's hormone levels over the menstrual cycle and their mate preferences would therefore be valuable.

Here, following recent methodological recommendations targeted at reducing inconsistent findings across tests of the ovulatory-shift hypothesis (Gangestad et al., 2016), we tested whether women's preferences for facial masculinity and beardedness vary with fecundability using three methods varying in expected reliability: with the fertile window estimated via self-report of recent menstruation commencement dates; via detection of luteinising hormone peaks to define the fertile window; and via measures of salivary estradiol and progesterone representing continuous variations in fecundability across the cycle. In Study 1, we used a large between-subjects design among 2161 women who provided sexual attractiveness ratings when considering a short-term relationship for stimuli varying in facial hair (clean-shaven, light stubble, heavy stubble, full beards) and facial masculinity (−50%, −25%, natural, +25% and +50%). This sample size is almost twice the 1213 participants recommended by Gangestad and colleagues (2016, for 80% power to detect a medium effect size of $d = 0.5$). In Study 2a, we used a within-subject design in which the peri-ovulatory period was confirmed via LH tests among 68 women. This sample size is again larger than the 48 participants recommended for 80% power to detect a medium effect size of $d = 0.5$ (Gangestad et al., 2016). We also collected salivary E and P at the low and high fertility phases of the menstrual cycle among 36 of these women to test whether shifts in E, P or the E:P ratio predicts preferences (Study 2b). This sample size is larger than some past within-subject studies reporting significant associations between estradiol and women's facial masculinity preferences (e.g. Roney et al., 2011).