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Short Communication

Age at menarche predicts individual differences in women's preferences for masculinized male voices in adulthood

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ABSTRACT

Although researchers have suggested that adult women who experienced early puberty may demonstrate particularly strong preferences for masculine men, evidence for such an association is equivocal. Here we show that adult women's preferences for masculinized male voices (i.e., male voices with lowered pitch) are negatively associated with the age at which they experienced first menses (i.e., age at menarche). Moreover, this relationship was independent of women's stated preference for long- versus short-term relationships, suggesting that the relationship does not necessarily reflect individual differences in women's preferred type of relationship. We discuss alternative mechanisms for the relationship between early puberty and women's masculinity preferences, focusing on the possibility that girls who experience early puberty might learn to associate masculinity with desirable mates because of exposure to particularly masculine males during adolescence.

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1. Introduction

Psychosocial stress in early life is thought to accelerate physical maturation during childhood and adolescence and cause individuals to seek short-term, rather than long-term, relationships in adulthood (Belsky, Steinberg, & Draper, 1991). Women typically demonstrate stronger preferences for masculine men as short-term partners than as long-term partners (e.g., Little, Jones, Penton-Voak, Burt, & Perrett, 2002; Smith et al., 2009) and women who report relatively strong preferences for short-term relationships demonstrate stronger preferences for masculine men than do women who report strong preferences for long-term relationships (e.g., Smith et al., 2009; Waynforth, Delwadia, & Camm, 2005). These effects of the temporal context of the relationship for which men's attractiveness was judged and reported preferences for engaging in short- versus long-term relationships may occur because masculine men are more interested in pursuing short-term relationships (e.g., Rhodes, Simmons, & Peters, 2005) and less willing to invest resources in their partners and offspring (e.g., Gray, Kahlenberg, Barrett, Lipson, & Ellison, 2002) than their relatively feminine peers (e.g., Little et al., 2002; Smith et al., 2009). In light of these findings and proposals, several researchers have suggested that early puberty may be associated with stronger preferences for masculine men among adult women (e.g., Cornwell et al., 2006; Koehler & Chisholm, 2009).

Evidence that indices of early puberty in women (e.g., age at menarche or first coitus) predict adult women's mate preferences is somewhat equivocal, however. Cornwell et al. (2006) found that reported age at first coitus, but not age at menarche, was negatively correlated with the strength of adult women's preferences for masculine characteristics in men's faces. Hoier (2003), however, found that women who reported early menarche generally gave higher attractiveness ratings to male faces than did women who reported relatively late menarche and suggested that women who experience earlier menarche may have lower standards when judging men's attractiveness.

Previous tests for associations between early puberty and women's mate preferences focused on women's face preferences (Cornwell et al., 2006; Hoier, 2003). Masculine characteristics in *voices* (e.g., low pitch) are positively associated with men's voice attractiveness (Feinberg, Jones, Little, Burt, & Perrett, 2005; Vukovic et al., 2008) and with indices of men's reproductive success and potential (Apicella, Feinberg, & Marlowe, 2007; Puts, 2005), suggesting that men's vocal masculinity is also important for women's mate preferences (Apicella et al., 2007; Feinberg et al., 2005; Puts, 2005; Vukovic et al., 2008). Indeed, adolescent girls at a later stage of pubertal development demonstrate stronger

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preferences for masculinized male voices than do girls at an earlier stage of development (Saxton, DeBruine, Jones, Little, & Roberts, 2009a). Thus, we tested for an inverse relationship between women's preferences for masculine male voices and age at menarche in a sample of adult women. Additionally, we tested whether the predicted relationship between women's masculinity preferences and age at menarche is independent of women's stated preference for long- versus short-term relationships. We controlled for possible effects of other factors that modulated women's masculinity preferences in previous studies and that may covary with age at puberty (i.e., self-rated attractiveness and partnership status, Little et al., 2002; Vukovic et al., 2008).

2. Methods

2.1. Stimuli

First, recordings were made of six men speaking the vowel sounds 'eh' as in bet, 'ee' as in see, 'ah' as in father, 'oh' as in note, and 'oo' as in boot. These men were young adult, white undergraduate students at the University of St. Andrews. Recordings were made in a quiet room using Soundforge recording software, in mono, and at a sampling rate of 44.1 kHz with 16-bit amplitude quantization. The number of voices used in our study is similar to those used in previous studies that assessed preferences for masculinized and feminized voices (e.g., Feinberg, DeBruine, Jones, & Little, 2008; Vukovic et al., 2008). Next, we manufactured two versions of each voice recording: a feminized version with raised voice pitch and a masculinized version with lowered voice pitch.

Masculinized and feminized versions were manufactured by raising and lowering voice pitch using the pitch-synchronous overlap add (PSOLA) algorithm in Praat audio software to +/−0.5 ERBs (equivalent rectangular bandwidths) of the original frequency. This PSOLA method has been used successfully in other human voice attractiveness studies (e.g., Jones, Feinberg, DeBruine, Little, & Vukovic, 2010; Vukovic et al., 2008). While the PSOLA method alters voice pitch, other aspects of the voice are perceptually unaffected (Feinberg et al., 2005). After manipulation, amplitudes were scaled to a consistent presentation volume using the RMS (root-mean-squared) method. The raised pitch versions of the voices had a mean pitch of 4.21 ERBs (SD = 0.6 ERBs; M = 149.6 Hz, SD = 23.9 Hz). The lowered pitch versions of the voices had a mean pitch of 3.33 ERBs (SD = 0.5 ERBs; M = 114.6 Hz, SD = 25.3 Hz).

2.2. Procedure

Women (N = 104, mean age = 23.3 years, SD = 4.9) were played the six pairs of voices, each pair consisting of a masculinized and feminized version of the same voice, and were asked to indicate which voice in each pair was more attractive. The orders in which pairs of voices were played and in which the masculinized and feminized versions in each pair were played were fully randomized. This method for assessing masculinity preferences has been used in many previous studies (e.g., Jones, Feinberg, DeBruine, Little, & Vukovic, 2008; Jones et al., 2010; Vukovic et al., 2008).

Women also completed a questionnaire in which they reported their age, partnership status (currently in a romantic relationship, N = 56, or not currently in a romantic relationship, N = 48), and the age at which they experienced menarche (reported in years and months. M = 12.3 years, SD = 1.3 years). The average age of menarche and standard deviation in this sample are consistent with those in many other studies (for a review see Cole, 2000). Following Smith et al. (2009), participants indicated their preferred (i.e., ideal) relationship type on a 1 (strong preference for short-term relationships) to 7 (strong preference for long-term relationships) scale (M = 6.0, SD = 1.4). Scores on this 7-point scale predict variation in women's masculinity preferences in the same way as more established measures of relationship attitudes (e.g., the Sociosexual Orientation Inventory) do, with women who are particularly open to short-term relationships demonstrating particularly strong masculinity preferences (see Smith et al., 2009; Waynforth et al., 2005). Participants also rated their own attractiveness on a 1 (very unattractive) to 7 (very attractive) scale (M = 4.4, SD = 1.3).

The study was run online. Previous studies have shown that online tests of voice preferences produce patterns of results that are very similar to laboratory-based tests (e.g., Feinberg et al., 2008; Jones et al., 2010). Data from repeat IP addresses were not recorded, ensuring that no participant was included in the data set more than once.

3. Results

For each participant, we calculated the proportion of trials (out of 6) on which she chose the masculinized voice as the more attractive. A one-sample t-test comparing these scores with the chance value of 0.5 indicated that women were more likely to choose the masculinized voices than the feminized voices ($t(103) = 7.55$, $p < 0.001$, $M = 0.68$, SEM = 0.02). Table 1 shows the correlations among masculinity preference, age at menarche, preferred relationship type, self-rated attractiveness, and participant age.

Independent samples t-tests showed that women with partners were older than unpartnered women ($t(102) = 3.06$, $p < 0.001$) and reported stronger preferences for long-term relationships than did unpartnered women ($t(102) = 2.12$, $p = 0.036$). Women with partners also tended to rate themselves as more attractive than unpartnered women ($t(102) = 1.77$, $p = 0.079$). Partnered and unpartnered women did not differ in their masculinity preferences ($t(102) = -1.07$, $p = 0.289$) or age at menarche ($t(102) = 0.84$, $p = 0.406$).

Next, women's masculinity preferences were analyzed using a regression analysis in which age at menarche, preferred relationship type, partnership status (0 = unpartnered, 1 = partnered), self-rated attractiveness, and participant age were entered as independent variables. Data satisfied the assumptions for linear regression as laid out by Field (2005). The overall model was significant ($F(5,98) = 4.10$, $p = 0.002$). This analysis revealed the predicted inverse relationship between age at menarche and masculinity preference ($t = -3.12$, standardized beta = −0.29, $p = 0.002$). The positive relationship between participant age and masculinity preference was also significant ($t = 2.72$, standardized beta = 0.28, $p = 0.008$). Inverse relationships between preferred relationship type and masculinity preference ($t = -1.84$, standardized beta = −0.18, $p = 0.068$) and between partnership status and masculinity preference ($t = -1.97$, standardized beta = −0.19, $p = 0.052$) approached significance. There was no significant relationship between self-rated attractiveness and masculinity preference ($t = 1.45$, standardized beta = 0.14, $p = 0.149$) and subsequent analyses showed no significant interactions between age at menarche and other variables.

4. Discussion

Although women generally preferred masculinized to feminized male voices (see also Feinberg et al., 2005; Vukovic et al., 2008), we found that age at menarche was negatively correlated with adult women's preferences for masculinized male voices. This finding complements Cornwell et al. (2006) who found that women who reported early first coitus demonstrated stronger preferences for

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Table 1
Correlations among studied variables. The table shows Pearson's rs and (in brackets) two-tailed *p*-values.

	Age at menarche	Participant age	Preferred relationship type	Self-rated attractiveness
Masculinity preference	−0.23 (0.02)	0.17 (0.09)	−0.14 (0.16)	0.11 (0.26)
Age at menarche		0.12 (0.22)	−0.03 (0.76)	0.03 (0.79)
Participant age			0.17 (0.09)	0.17 (0.09)
Preferred relationship type				0.17 (0.08)

masculine characteristics in men's faces than did women who reported later first coitus, although Cornwell et al. (2006) observed no significant correlation between masculinity preferences and age at menarche specifically. Since women generally preferred masculinized to feminized male voices (see also, e.g., Feinberg et al., 2008; Vukovic et al., 2008), the negative correlation between age at menarche and women's preferences for masculine men is evidence against Hoier's (2003) proposal that women who report earlier menarche are *less* discriminating when judging men's attractiveness; in our study, women who experienced earlier menarche were *more* discriminating when judging men's vocal attractiveness. Our regression analysis also showed that older women and women who reported stronger preferences for short-term relationships tended to demonstrate stronger attraction to masculine male voices, which is consistent with previous findings (see Feinberg et al., 2008; Smith et al., 2009). Although our analyses revealed no interactions between age at menarche and any of the other variables considered in our study, further research may reveal interactions between age at menarche and other factors that were not considered in our study but are known to modulate masculinity preferences in adult women (e.g., menstrual cycle phase and relationship context, Puts, 2005).

Our regression analysis showed that the relationship between masculinity preference and age at menarche was independent of the effects of women's reported preference for short- versus long-term relationships. This latter finding suggests that the relationship between age at menarche and women's preferences for masculinized male voices is unlikely to reflect differences among women in their preference for short- versus long-term relationships, as other researchers have suggested (Cornwell et al., 2006; see also Koehler & Chisholm, 2009). Nonetheless, we acknowledge here that this conclusion should be treated with caution and that further research into the role of variation in preferred relationship type using other measures of mating strategy is required to clarify this issue. Although some researchers have suggested that individual differences in psychosocial stress early in life may contribute to both rate of physical maturation and variation in adults' mating strategy (e.g., Belsky et al., 1991), it is unlikely that the association between age at menarche and masculinity preferences observed in the current study can be explained by psychosocial stress in early childhood. Previous research has found that childhood stress is associated with *weaker* masculinity preferences among women, even when controlling for possible effects of age at menarche (Boothroyd & Perrett, 2008), or has found no association between childhood stress and masculinity preferences (Koehler & Chisholm, 2009). Collectively, these findings raise the important question of why women who experience early puberty demonstrate particularly strong preferences for masculine men.

One engaging possibility is that women who report early puberty may have learned to associate masculine characteristics with desirable mates, potentially because they received more positive feedback from older (i.e., more masculine-looking) males during adolescence (Cornwell et al., 2006). As adolescents, women who experienced early puberty were more likely to have engaged in sexual and romantic activity with older males who would have possessed more masculine characteristics than their peers (see Cornwell et al., 2006). Indeed, effects of visual experience during critical periods of development are known to have pronounced effects on mate preferences in adulthood (e.g., Perrett et al., 2002; Saxton, Little, DeBruine, Jones, & Roberts, 2009b). Moreover, because age at menarche is highly correlated between mothers and daughters (Kirk et al., 2001), preferences for paternal characteristics may reinforce the association between age at menarche and women's masculinity preferences. If age at menarche is negatively associated with women's preferences for masculine men, girls who experience early puberty may be more likely to have masculine fathers than women who experienced puberty later in life. Since women demonstrate preferences for paternal characteristics (Little, Penton-Voak, Burt, & Perrett, 2003; Perrett et al., 2002), such imprinting-like effects may function to strengthen the correlation between age at menarche and adult women's preferences for masculine men. Further research investigating these possible mechanisms through which the negative association between age at menarche and women's masculinity preferences emerges and is maintained may be a fruitful direction for future research.

5. Uncited references

Chisholm (1993) and Thornhill & Gangestad (2006). Q1

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