



Cross-Cultural Variation in women's Preferences for men's Body Hair

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Abstract

Objectives According to the ectoparasite avoidance hypothesis, natural selection has shaped human hairlessness to reduce the potential for the body to host disease carrying ectoparasites. However, men retain sexually dimorphic and conspicuous patches of facial and body hair. The ectoparasite avoidance hypothesis also proposes that sexual selection via women's mate preferences for reduced hirsutism has further elaborated upon the reduction in body hair and could explain variation in women's preferences for body hair in men. The current study tests this hypothesis using cross-cultural data from 30 countries on women's preferences for chest hair.

Methods We test whether heterosexual women's ($N = 3436$) preferences for reduced hirsutism are most pronounced in countries with higher disease and parasite levels or whether other social and economic factors previously shown to influence preferences for facial masculinity and beardedness predict women's preferences for chest hair.

Results We found that preferences were unrelated to past or current disease rates. Instead, preferences for body hair were stronger among women who were older, had strong preferences for facial hair, and were from countries that had male-biased sex ratios, higher human development indices, and lower education indices. Women's body hair preferences were also associated with facial masculinity preferences and gender empowerment. However, neither these terms, nor human development indices or education indices were individually significant in their contributions to the family of best-fit models and we suggest caution when interpreting their significance.

Conclusions Women's preferences for body hair may be strongest among women from countries where male-male competition is higher and preferences for beardedness are stronger rather than where prevailing ecological conditions may impact on maternal and offspring survival.

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Introduction

Natural selection for thermal homeostasis during bipedal locomotion has likely shaped the marked reduced hirsutism in humans (Ruxton and Wilkinson 2011), setting them apart from other anthropoid primates where pelage retains functional properties (Chaplin et al. 2014). Sexual selection by mate choice may have further elaborated on reduced hirsutism during the early phases of human ancestry to avoid diseases transmitted via ectoparasites (Rantala 2007). However, conspicuous patches of facial, chest and abdominal hair are markedly more profuse in men than women owing to the effects of androgens and growth hormones during late childhood (Trotter 1922), adolescence (Hamilton 1958) and adulthood (Randall 2008). Beards and body hair provide little survival advantage, suggesting sexual selection has acted on the retention of conspicuous patches of facial and body hair as sexually attractive ornaments or intra-sexual cues of dominance and status (Dixson et al. 2005; Grueter et al. 2015).

While masculine hirsutism is associated with men's mating success (Barber 2001; Dixson et al. 2017c), women's attractiveness judgments of beards and body hair are highly variable between samples (Dixson and Rantala 2016; Dixson et al. 2013; Valentova et al. 2017). Facial and body hair more consistently enhance judgments of men's age, masculinity, social dominance (Dixson and Brooks 2013; Dixson and Vasey 2012; Dixson et al. 2017a; Neave and Shields 2008; Sherlock et al. 2017; Saxton et al. 2016) and aggressiveness (Craig et al. In Press), suggesting they play a role in intra-sexual selection communication. These patterns are similar to those for masculine craniofacial shape, which is comprised of large brow ridges, a defined jaw and pronounced midface, and is positively associated with men's physical strength (Fink et al. 2007; Holzleitner and Perrett 2016; Windhager et al. 2011; Butovskaya et al. 2018), social dominance (Geniole et al. 2015), long-term health (Rhodes et al. 2003; Thornhill and Gangestad 2006). Facial masculinity is also associated with some aspects of men's immune response (Rantala et al. 2012), and mating success (Hill et al. 2013; Kordsmeyer et al. 2018). However, women's preferences for facial masculinity vary considerably between samples (Dixson et al. 2017b; Little et al. 2011) possibly due to the costs associated with physically masculine partners, which includes lower romantic commitment (Boothroyd et al. 2008), more interest in short-term relationships (Rhodes et al. 2005) and higher infidelity (Arnocky et al. 2018; Rhodes et al. 2013). If female mate preferences have been shaped sexual selection to identify characteristics associated with long-term, prosocial and paternally investing partners (Buss 1989), then less facially masculine partners may be preferred over more facially masculine men (Perrett et al. 1998; Kruger 2006).

The costs of selecting masculine partners may be reduced under conditions where short-term mating strategies would be advantageous to offspring fitness via heritable indirect genetic benefits (Gangestad and Simpson 2000). Thus, women's preferences for facial masculinity are stronger among reproductively capable than post-menopausal women (Little et al. 2010b; Marcinkowska et al. 2018c), when judging for short-term than long-term relationships (Little et al. 2011) and are lower during early motherhood than during pregnancy (Cobey et al. 2015; Escasa-Dorne et al. 2017). Initial research also provided evidence that women's preferences for masculine characters are stronger

at the peri-ovulatory phase of the menstrual cycle when conception is most likely and any genetic benefits to offspring fitness would be gained (Gildersleeve et al. 2014). However, the majority of this early research on ovulatory shifts in mate preferences employed indirect counting methods to characterise women's fertility, which lack the accuracy of direct endocrine measures (Blake et al. 2016). While some research employing endocrine measures to determine fertility have shown women's preferences for masculine facial characters are higher at the peri-ovulatory phase of the menstrual cycle (Ditzen et al. 2017), several recent studies have not reported ovulatory shifts in women's preferences for facial masculinity (Jones et al. 2018b; Marcinkowska et al. 2018a, b, c; Dixson et al. 2018a), muscularity (Marcinkowska et al. 2018a; Jünger et al. 2018a) or vocal masculinity (Jones et al. 2018a; Jünger et al. 2018b). Moreover, women's fertility is associated with general patterns of sexual desire rather than short-term mating attitudes and preferences (Jones et al. 2018c). Thus, individual differences in women's mating strategies over the menstrual may not explain women's motivation to select masculine characters in short-term partners (Jones et al. 2019).

The strength of female choice on attractive traits also varies with environmental, ecological and social factors (Jennions and Petrie 1997), including human mate preferences for facial sexual dimorphism (Marcinkowska et al. 2014; DeBruine et al. 2010a). Women's preferences for facial masculinity were stronger in societies with high pathogens and lower life expectancy (Moore et al. 2013; DeBruine et al. 2010a, b, 2012). These cross-cultural findings have been interpreted as evidence of women's facultative trade-offs for partners higher in genetic quality but lower in paternal investment under conditions where infant survivability is compromised and indirect genetic benefits would be beneficial (DeBruine et al. 2010a). This hypothesis received further support from studies reporting women's preferences for facial masculinity, masculine vocal pitch and bodily masculinity were positively associated with their self-reported pathogen disgust (DeBruine et al. 2010b; Jones et al. 2012), although studies in identical twins and non-identical did not support this pattern (Zietsch et al. 2015). Experimentally inducing pathogen disgust by exposing female participants to stimuli depicting high pathogens and disease augmented preferences for facial masculinity and symmetry compared to when exposed to non-pathogenic stimuli (Little et al. 2011). However, one study did not report positive associations between women's preferences for facial masculinity and self-reported disgust or after exposure to pathogenic cues (McIntosh et al. 2017). Taken together, there is some evidence that women's preferences for masculine characters are stronger under actual and perceived pathogen threat.

Sexual selection also involves male-male competition, which favours the evolution of weaponry and ornaments that communicate age, social rank and dominance (Rico-Guevara and Hurme 2018). Female choice for male characters reflecting male resource holding potential may benefit maternal and offspring survival directly via resources and protection (Puts 2016). Thus, masculine social and physical formidability may be preferred among women living in countries with high levels of violent crime as a cue of protection (Snyder et al. 2011). Reanalyses of the data presented by DeBruine et al. (2010a) revealed that women's facial masculinity preferences were better explained by variation in economic equality, suggesting preferences for intra-sexually competitive partners under conditions of stronger male-male competition (Brooks et al. 2011). Most recently, cross-cultural research has shown that women from industrialized societies have stronger preferences for facial masculinity than women from small-scale societies,

possibly as a consequence of visual exposure to anonymous conspecifics arising through urbanization and population density (Scott et al. 2014).

Unlike facial masculinity, men can groom or remove their facial and body hair, enhancing or reducing masculine signals at almost no cost biologically. While temporal variation in grooming patterns occur due to cultural factors (Oldstone-Moore 2015), there is evidence that men's decisions to wear facial hair are influenced by prevailing social and economic conditions. For example, among men announcing marriages in the *Illustrated London News* magazine from 1871 to 1972 beards were more frequent in years during which there were more men than women of marriageable age (Barber 2001). This pattern in mating success may reflect that preferences for novel facial hair styles underpins men's grooming patterns or that the attractiveness of facial hair is higher under conditions where communicating masculinity, maturity and social aspects of dominance would be advantageous. Experimental evidence supports that beards were more attractive to women when they were rare than when they were common, so that within-population variation in facial hair fashions may be negative frequency-dependent (Janif et al. 2014). Cross-culturally, women's preferences for men's facial hair were stronger in larger cities, where beards were more common and where average income levels were lower, suggesting that between-population variation in the attractiveness of beardedness is maintained by demographic factors associated with male-male competition (Dixson et al. 2017c). Sexual attractiveness judgments of men's beards may not vary with women's fertility as measured indirectly via questionnaires (Dixson and Brooks 2013; Dixson and Rantala 2016, 2017) or in lab studies where the peri-ovulatory phase was ascertained via hormone measures (Dixson et al. 2018a, b). Instead, women's preferences for facial hair are positively associated with their age, possibly because beards enhance masculine facial structure (Dixson et al. 2016, 2017a), age (Neave and Shields 2008) and social status (Dixson and Vasey 2012).

The extent to which body hair enhances male physical attractiveness also varies cross-culturally. Pronounced chest hair was preferred among women from the UK (Dixson et al. 2003), Bakossi women of Cameroon judged moderate amounts of chest hair as most attractive (Dixson et al. 2007a), while women from Brazil and Czech Republic stated preferences for hairless and very light body hair (Valentova et al. 2017). Women judged hairless chests as most attractive in Finland, China, Turkey, New Zealand, Slovakia and the U.S (Dixson et al. 2007b, 2010; Prokop et al. 2012, 2013; Rantala et al. 2010). Like men's facial hair, there is little evidence that women's preferences for men's chest hair are stronger at the peri-ovulatory phase of the menstrual cycle (Dixson and Rantala 2016, 2017; Rantala et al. 2010; Prokop et al. 2013). During the early phases of human evolution, the transfer of diseases via ectoparasites potentially imposed fitness costs (Kupfer and Fessler 2018) and natural selection may have shaped reduced body hair in response to ectoparasite loads (Pagel and Bodmer 2003; Rantala 1999). Natural selection may have also favoured behavioural responses for detecting and avoiding pathogenic stimuli (Schaller 2011), so that sensory responses on the skin, itch responses and grooming may facilitate ectoparasite avoidance (Kupfer and Fessler 2018). Ectoparasite avoidance could also have shaped mate preferences for reduced hirsutism as beards and body hair may provide appropriate habitat for disease carrying ectoparasites to breed (Pagel and Bodmer 2003; Rantala 1999). However, women's preferences beards and body hair were not lower following exposure to stimuli depicting pathogens and ectoparasites (McIntosh et al. 2017;

Prokop et al. 2012). Whether or not cross-cultural variation in women's preferences for men's chest and abdominal hair conform to those reported for facial hair and facial masculinity or patterns associated with parasite avoidance strategies remains to be determined.

If women's preferences for body hair follow the same patterns as other masculine traits, chest hair should be preferred under conditions of high pathogens where indirect genetic benefits (e.g. health or immunity) may enhance offspring fitness or conditions of high income inequity or violence where direct benefits (e.g. resources or protection) would be beneficial to maternal and child survival (Little et al. 2011). Thus, if preferences for body hair follow the same pattern as those for facial masculinity, we would expect preferences to be strongest in countries with high levels of pathogens (DeBruine et al. 2010a, b, 2012) or high income inequality and homicides (Brooks et al. 2011). If women's preferences for body hair follow the same pattern as those for beardedness, we would expect preferences to be strongest under conditions of high income inequality or high population density (Dixson et al. 2017c), and to be preferences for beards are higher and are positively associated with women's age (Dixson and Rantala 2016). Alternatively, if the advantage to hairlessness in reducing parasite loads in ancestral humans has been further elaborated on by sexual selection, women's preferences male body hair should be lower when pathogen loads are higher (Rantala 2007). To test these hypotheses, we present findings from a cross-cultural study comparing preferences for men's chest hair among 3436 heterosexual women from 30 countries with their corresponding national socioeconomic, demographic and developmental metrics. To test whether women's preferences for body hair converge or diverge from preferences for other masculine traits, we fitted preferences for facial masculinity and beardedness from previous studies (DeBruine et al. 2010a, b; Dixson et al. 2017c).

Material and Methods

Body Hair Stimuli Photographs of 20 men of European descent from Finland (Mean age, 25.7 years, $SD = 3.7$) with dark brown body hair were taken in front-pose under standardized lighting from a distance of 200 cm with their natural distribution of chest and abdominal hair and again when clean-shaven (Fig. 1). Participants were recruited from the University of Turku and Abo Academy. To produce standardized poses, participants stood with their arms in relaxed positions by the side of their torso. Participants were first photographed with their natural distribution of chest and abdominal hair. Immediately following this first photo session, participants were asked to shave their abdomen with an electric shaver, finishing up with a wet shave using a razorblade and shaving cream. After shaving, a new set of pictures was taken under the identical setup as was used for the photographs prior to shaving (Rantala et al. 2010).

Body Hair Categories The 20 available images of hairy male torsos were then placed by the authors into one of four categories of body hair distribution: Heavy, medium, light, and very light using established protocols (Setty 1961, 1966). Thus, five individuals were placed into each category of body hair distribution. Heavy body hair refers to hair around the pectoral and areolar region, extending down the infra-clavicular region (Fig. 2, images 4, 6, 10 combined), and connecting with abdominal hair (Fig. 2, images G, H, or J). Medium body hair also included well-developed pectoral hair surrounding



Fig. 1 An example of the body hair stimuli used in this study. Images show the same individual with their natural distribution of body hair and again immediately following removal of their body hair

the areolae and the infra-clavicular region (Fig. 2, images 4 and 6, combined). However, chest hair was not connected to abdominal hair, which was also less developed or absent in some cases (Fig. 2, images B and C). Light body hair was more sparsely distributed in the mid pectoral region, connecting to the sternum but not extending to the infra-clavicular region (Fig. 2, images 3 and 4 but more sparse distribution) or abdominal regions (Fig. 2, image D). Finally, very light body hair was defined as small clusters of hairs surrounding the areolae and pectoral region but a virtual absence of hair on the central sternum and no connection with the infra-clavicular region (Fig. 2, images 2 and 8, but very scanty) or the abdomen (Fig. 2, images B, but very scanty) and D (with scanty hair around belly button). Examples of the images in each of the categories of body hair distribution are shown in Fig. 3.

Participants and Procedure Studies were undertaken on-line (www.socialsci.com). Mate preferences vary with sexual orientation when judging cues of facial and bodily sexual dimorphism (Glassenberg et al. 2010; Petterson et al. 2015, 2016, 2018), including beards and body hair (Valentova et al. 2017). From the total sample of 4535 participants (3814 women and 719 men), women indicating heterosexual preferences from the 30 countries for which we had data on all covariates of interest were retained ($n = 3436$, Mean age = 27.43, SD = 8.30). To measure body hair preferences, participants selected the image they judged most sexually attractive in each pair from 20 pairs of male torsos showing the same male with their natural distribution of chest and trunk hair and when chest hair had been removed. The position of the clean-shaven and hairy image in each pair (left or right) was randomised. In this study, women also selected their preferences for men's facial hair in a forced choice design asking which image was most attractive from 20 pairs of images (Dixson et al. 2017c). Participants also stated their sexual orientation, age, height, and country of residence.

Preferences for Body Hair, Facial Hair and Facial Masculinity We estimated each individual's preference for body hair as a slope by assigning clean shaven bodies a value of 0 and very light, light, medium and heavy body hair scores of 1 to 4 respectively. We estimated the least squares regression slope of these five values on the number of times each level of facial hair was preferred (corrected for number of times presented). This method turns the levels of body hair distributions into ordinal

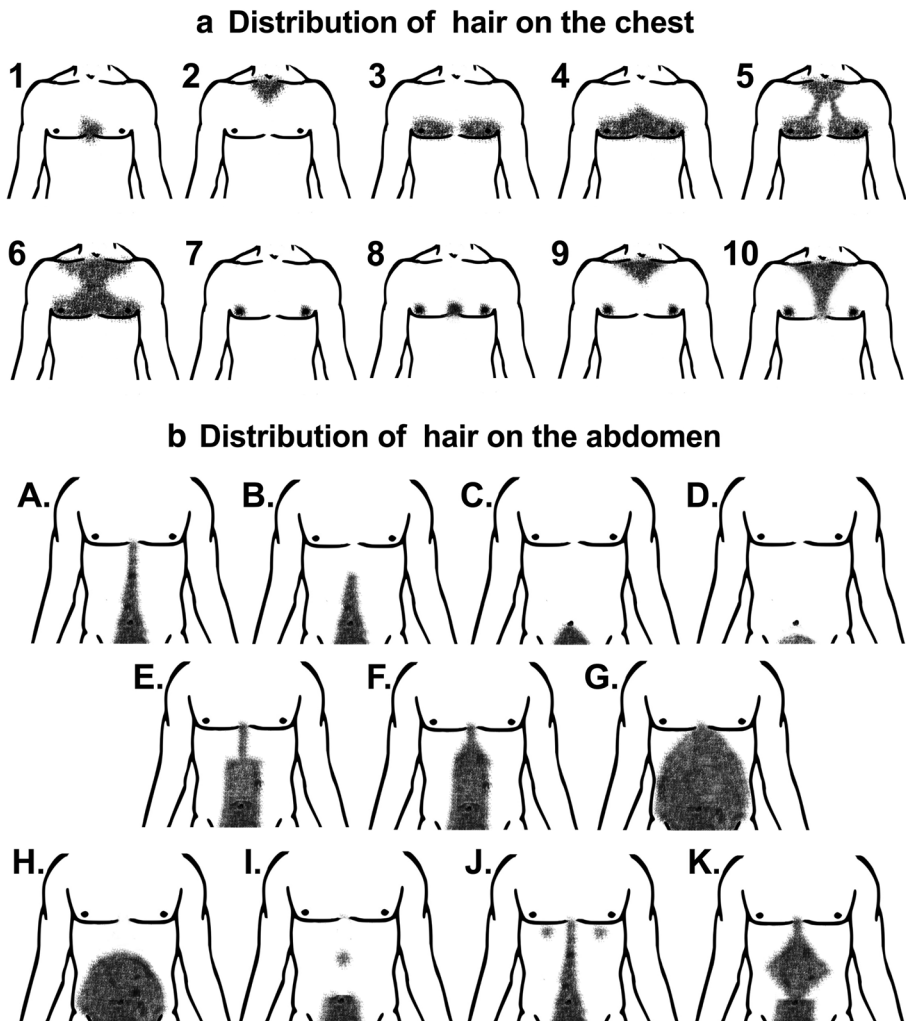


Fig. 2 The images used to categorize the 20 hirsute torsos as either heavy body hair, medium body hair, light body hair or very light body hair (adapted Setty 1961, 1966). **Panel A** shows the possible distributions of hair on chest. **Panel B** shows possible distributions on the abdomen. Heavy body hair: Hair around the pectoral and areolar region, extending down the infra-clavicular region (2A, images 4, 6, 10 combined), and connecting with abdominal hair (2B, images G, H, or J). Medium body hair: well-developed pectoral hair surrounding the areolae and the infra-clavicular region (2A, images 4 and 6, combined), which did not connect to abdominal hair that was also less developed or absent (2B, B and C). Light body hair: Sparsely distributed mid pectoral hair connecting to the sternum but not extending to the infra-clavicular region (2A, images 3 and 4, but more sparse distribution) or abdominal regions (2B, image D). Very light body hair: Small clusters of hairs surrounding the areolae and pectoral region, but a virtual absence of hair on the central sternum and no connection with the infra-clavicular region (Fig. 2A, images 2 and 8, but very scanty) or the abdomen (2B, image B, but very scanty) and D including scanty hair around belly button)

variables and then into a slope. We used this approach to measure women's preference for beards for a previous study (Dixon et al. 2017c) and these data were entered as an individual-level covariate in the current study. Finally, we fitted preferences for facial masculinity from a previous study (DeBruine et al. 2010a, b).

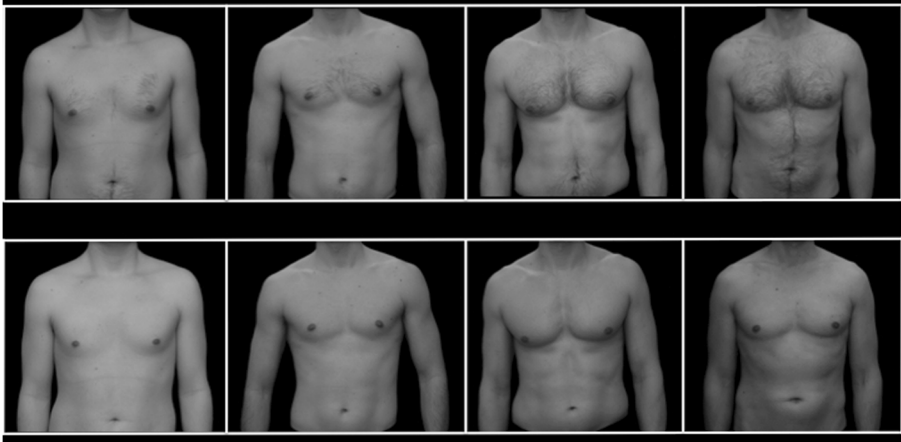


Fig. 3 An example of the body hair stimuli used in this study following classification into degrees of hair distribution. Images show one individual from each of the four categories of body hair distribution (very light, light, medium, and heavy) in front view with natural distribution of body hair and when clean-shaven

Demographic Data We tested for associations between body hair preferences and demographic data previously linked with women’s preferences for masculine traits in men. We used the National Health Index (DeBruine et al., 2010) and life expectancy at birth from the 2007 UN Statistical Division as proxies for pathogens as in previous research on facial masculinity preferences. We further used indices of contemporary and historic pathogen prevalence from Fincher et al. (2008). Following previous research on male-male competition shaping women’s preferences for masculine facial shape in men (Brooks et al. 2011) we used the Gini index of income inequality from the UN Statistics Division (for Iceland we used the CIA World Factbook estimate) and homicide rates from the UN Office on Drugs and Crime for 2001–2005. To test how gender equity shapes preferences for body hair we used education as the mean number of years of female education (CIA World Factbook) and gender empowerment from UN Statistical Division 2006 data. Sex ratio and the Human Development Index data were taken from the UN Human Development Report 2014. Data on Gross National Income (GNI) per capita at purchasing power parity (PPP) were taken from the World Bank.

Results

Body hair preferences was the dependant variable in a Multi-Level Mixed Model in which participant age and height were entered at the first (individual subject) level as individual-level fixed covariates, with random intercepts and slopes fitted for each country, permitting the relationship between each covariate and preference for body hair to vary among countries. We then fitted individual preference for facial hair. At the second (country) level, national-level variables were fitted as fixed covariate effects. We used AIC-based model selection process to arrive at the model that best fit the information content in our data (Symonds and Moussalli 2011). Participant height was never supported as an individual-level covariate, but the inclusion of age was always supported by the model fit.

According to the model that minimised AIC (6250.08), preferences for body hair were stronger in women who were older ($\beta = 0.025 \pm 0.002$ S.E.), had strong preferences for facial hair ($\beta = 0.492 \pm 0.023$), and from countries that had male-biased sex ratios ($\beta = 1.74 \pm 0.924$), higher human development indices ($\beta = 0.680 \pm 0.523$), and lower education indices ($\beta = -0.572 \pm 0.874$). The relationship between women's preferences for men's beards and body hair was positive although the effect was not large ($N = 3436$, $r = 0.306$, $p < 0.001$; Fig. 4). Variation in national preferences for facial hair and body hair in relation to sex ratios, human development indices and education indices are shown in Fig. 5. Models that included preference for facial masculinity ($\beta = 0.302 \pm 0.392$) and/or gender empowerment ($\beta = 0.107 \pm 0.330$) index were within 2 AIC (5250.3–6250.9) of the model that minimised AIC and we thus consider that these variables may be important. However, neither these terms, nor human development indices or education indices were ever individually significant in their contributions to the family of best-fit models, and we prefer to interpret the effects of these terms with caution.

Discussion

Women's preferences for male body hair were positively associated with their age and were strongest in countries where preferences for beardedness were higher and sex ratios were more male-biased. These patterns are consistent with those reported in Barber (2001), wherein marriage announcements posted in the Illustrated London News magazine from 1871 to 1972 more often included men with facial hair in those years where the sex ratio in the marriage market was more male biased. Recent cross-cultural research has also reported beards were more common among men living in larger cities, where average incomes are low and women's preferences for facial hair are higher (Dixson et al. 2017c). Finally, women's preferences for men's chest hair were strongly positively associated with their preferences for beardedness. Given the associations between beardedness and perceptions of age, masculinity, social dominance and aggressiveness (Craig and Gray 2018; Dixson and Brooks 2013; Dixson and

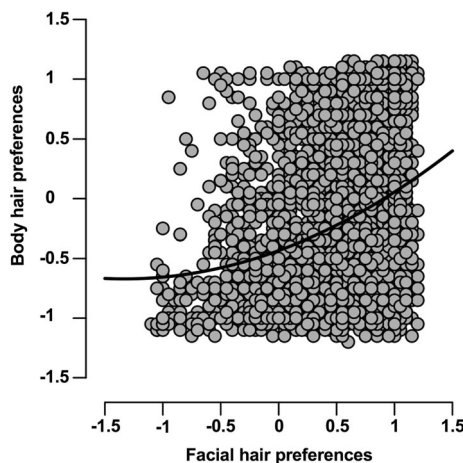


Fig. 4 The positive association between women's preferences for men's body hair and beardedness

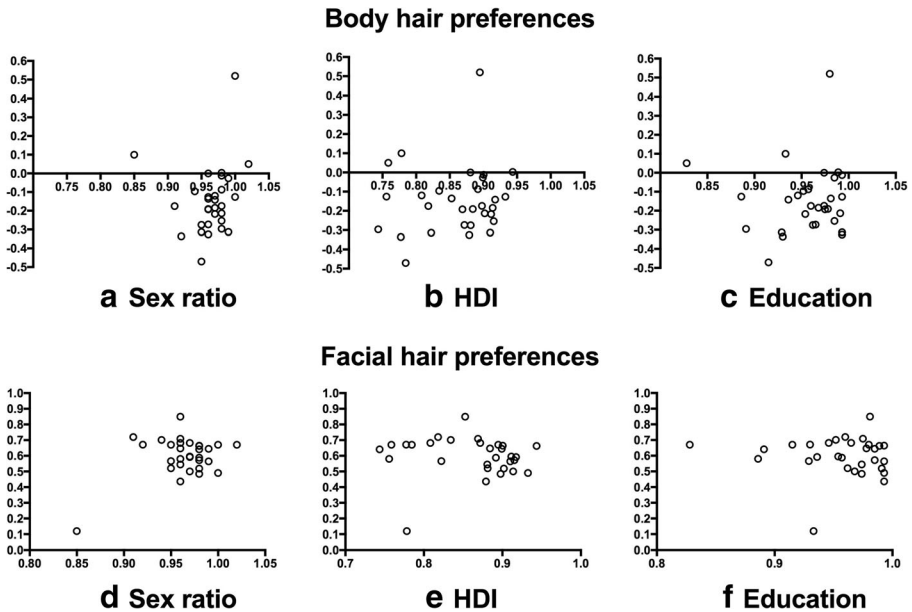


Fig. 5 The three upper panels show the associations between women's preferences for men's body hair and cross-cultural variation in sex ratios (a), the human development index - HDI (b) and education (c). The three lower panels show the association between women's preferences for men's facial hair and cross-cultural variation in sex ratios (d), the HDI (e) and education (f)

Vasey 2012; Neave and Shields 2008), the current results provide further evidence that cues of age, masculinity and social status may be more salient in women's mate preferences under conditions of stronger male-male competition.

In addition to mating market dynamics, the size and complexity of the social environment is also associated with sexual selection on male secondary sexual traits among anthropoid primates (Grueter et al. 2015; Santana et al. 2012, 2013). Comparative research among male anthropoid primates suggest men's visually conspicuous ornaments, including beardedness and body hair, show a similar level of sexual dimorphism to male ornamentation among species with polygynous mating systems (Dixon et al. 2005), large social group sizes and multilevel social organizations (Grueter et al. 2015). Women's preferences for facial masculinity were shown to be strongest in populations with the highest Human Developmental Indices (HDI), which may reflect that under conditions of high anonymity facial masculinity is more salient, distinctive and attractive (Scott et al. 2014). Similarly, cross-cultural research reported higher frequencies of beardedness among men and stronger preferences for beards among women living in larger cities (Dixon et al. 2017c). Our findings suggest that women's preferences for men's body hair are also stronger among countries with higher HDIs and lower levels of education, providing further support that masculine secondary sexual traits are more attractive under conditions of higher social anonymity (Scott et al. 2014). However, we suggest caution when interpreting these associations in our data as while the statistical models were improved when including HDI, the effects were weak. Thus, we suggest further replication is necessary to confirm that men's chest hair is more attractive under conditions of higher urban development and social anonymity.

The ectoparasite avoidance hypothesis asserts that the naturally selected reduction in body hair in response to parasite loads has been further elaborated upon by mate choice (Rantala 2007). In the current study, none of the measures of pathogen prevalence (current or historic), health or lifespan were associated with women's preferences for male body hair. This finding is in keeping with past cross-cultural studies involving comparisons between two cultures (Prokop et al. 2013; Valentova et al. 2017) and experimental studies showing that exposure to pathogenic cues, including ectoparasites, does not reduce women's preferences for men's chest hair or beardedness (McIntosh et al. 2017; Prokop et al. 2012). One study comparing variation in women's pathogen disgust and preferences for men's beards reported a positive relationship between women's preferences for facial hair and their self-reported pathogen disgust, which is the opposite relationship to that predicted by the ectoparasite avoidance hypothesis (McIntosh et al. 2017). To our knowledge, the only supporting evidence for ectoparasite avoidance for body hair comes from a study reporting a negative association between men's preferences for women's pubic hair and their self-reported pathogen disgust (Prokop 2016). Analyses of the ethnographic literature revealed that of the 26 societies for which people explicitly stated removing pubic hair, 22 societies stated that women removed pubic hair and 11 stated that men removed public hair (Craig and Gray 2018). Of these 22 societies, 12 stated the most common motivations among women and men for removing pubic hair were for personal hygiene ($n = 7$), to enhance attractiveness ($n = 2$) and social signalling ($n = 3$). At present, no cross-cultural comparative analyses are available for beardedness and body hair grooming practices and future research may consider men's reasons for removing androgen dependent hair in response to potential ectoparasite loads. Based on the findings of the present study and those of past experimental studies, we conclude that there is little evidence that women's preferences for men's body and facial hair support the ectoparasite avoidance hypothesis.

While human mate preferences are argued to have been shaped within ancestral conditions to prioritise cues of underlying health (Little et al. 2011), debate surrounds how the transition from small-scale foraging to large-scale market economies underpins variations in mate preferences (Dixson et al. 2017c; Scott et al. 2014). Cross-cultural studies among women from small-scale and large industrialised societies reported that facial masculinity preferences and judgments of aggressiveness were higher in societies with more urban development (Scott et al. 2014). An important limitation in the current study was that our sample was restricted to societies with primarily market-based economies wherein patterns of grooming are likely to be strongly influenced by contemporary trends in body hair removal (i.e. depilation; Boroughs et al. 2005). Although depilation is most common among women, the prevalence of chest, trunk, and abdominal hair grooming has increased steadily over the past 15 years among young college age men from the US, Australia and New Zealand (Boroughs et al. 2005; Boroughs and Thompson 2014). Heterosexual men reportedly groom and remove their body hair at least partly in response to their perceived lower sexual attractiveness of masculine body hair among women (Boroughs and Thompson 2014; Clarke and Braun 2018) and concerns over personal hygiene (Frank 2014). Extending the current research to include small-scale societies where grooming of body hair may be absent or greatly reduced to that seen in large-scale market economies would be worthwhile. Alternatively, intra-population variation in the expression of male body hair may explain cross-cultural variation in women's mate preferences for masculine hirsutism, implicating

genetic drift (Kupfer and Fessler 2018). A further concern in our study is the lack of control variables in our participants, so that the positive association between women's age and body hair preferences could be due to other correlated variables. Finally, given that facial and body hair may be positively correlated (Winkler and Christiansen 1993), the positive relationship between women's preferences for facial hair and body hair may reflect that beards are primarily under sexual selection while body hair may not be directly under sexual selection. Future research unpacking the extent to which preferences for body hair and beards represent single or separate preference functions would be worthwhile (Dixson et al. 2016). For the present, our study provides the largest cross-cultural analyses of heterosexual women's preferences for men's chest and abdominal hair to date and suggests women's preferences are stronger in places where facial hair preferences are higher and male-male competition may be more pronounced.

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Author Contributions BJWD and RCB designed and conducted the study; MJR provided stimulus materials; RCB analyzed the data and BJWD, RCB and MJR wrote the manuscript.

Compliance with Ethical Standards

Competing Interests We have no competing interests.

Informed Consent All participants provided informed consent prior to participating in this study and were free to withdraw at any point without penalty.

Ethical Approval This study was approved by the Human Ethics Committee at the University of New South Wales (#1876).

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