

Physical attractiveness influences reproductive success of modern men

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Abstract Theory suggests that reproductive success is positively associated with an individual's genetic quality. However, the association between physical attractiveness and reproductive success (i.e., number of offspring) in modern humans remains less clear. Here we examined associations between men's reproductive success and physical attractiveness from retrospective data obtained from married, divorced, and single samples of Slovakian men. As predicted, facially more attractive and taller men were more likely to engage in marriage. In turn, married men had higher reproductive success than single men. Even when men's marital status was considered, facially more attractive men had higher reproductive success than their less attractive counterparts. This supports the importance of physical attractiveness in sexual selection in modern humans.

Keywords Attractiveness · *Homo sapiens sapiens* · Reproductive success · Sexual selection

Introduction

Sexual selection results in nonrandom reproduction of reproductively active individuals in population (Darwin

1871). Female mate choice is associated with preferences for males' ornaments, courtship or coloration (indirect benefits) or material resources (direct benefits) (Andersson 1994). Male ornaments are cues of male fitness that might be passed to offspring (Zahavi 1975; Hamilton and Zuk 1982; Jennions and Petrie 2000).

From an adaptationist point of view, human attractiveness indicates direct (genetic) and/or indirect (material) benefit to a potential mate (Symons 1979; Thornhill and Gangestad 1999; Grammer et al. 2005; Rhodes 2006; Oberzaucher and Grammer 2010). With respect to the former, attractive or masculine male faces are associated with better health (Shackelford and Larsen 1999; Rhodes et al. 2003; Thornhill and Gangestad 2006, but see Kalick et al. 1998; Hume and Montgomerie 2001), longevity (Henderson and Anglin 2003), and genetic diversity of major histocompatibility complex (MHC) which determines immune diversity (Roberts et al. 2005; Lie et al. 2008, 2010). Consequently, facial cues associated with pathogen resistance are preferred by females (Gangestad and Buss 1993; Penton-Voak et al. 2004; DeBruine et al. 2010), suggesting that male facial attractiveness is an honest indicator of mate quality (Lie et al. 2008). With respect to the latter, male facial attractiveness positively correlates with socioeconomic status of their rearing environment (Hume and Montgomerie 2001).

Some indicators suggest that male height is also considered as an indicator of genetic quality. Tall men are more likely to marry (Manfredini et al. 2010) and are more attractive to females (Hensley 1994; Pierce 1996; Mueller and Mazur 2001; Manfredini et al. 2010), which is supported by high response rates of females to male advertisements published in newspapers (Pawlowski and Koziel 2002; Koziel and Pawlowski 2003). In addition, some data indicate that more attractive women have on average taller

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husbands (Pawlowski et al. 2008). Several epidemiologic studies revealed that height was negatively related with the risk of respiratory and cardiovascular system, with hemorrhagic stroke, skeletomuscular or psychiatric diseases (Tuvemo et al. 1999; Silventoinen et al. 2006; Inwood and Roberts 2010). Height is also negatively associated with mortality (Song et al. 2003; Inwood and Roberts 2010), but, in contrast, prostate cancer seems to be more prevalent in taller men (Sequoia et al. 2006).

The fact that both facial attractiveness (Cornwell and Perrett 2008) and body height (Chambers et al. 2001; Silventoinen et al. 2001) are heritable reinforces their potential importance in human sexual selection. The majority of works examining associations between physical attractiveness and mating success (i.e., number of sexual partners) showed that more attractive males reported to have more sexual partners and/or more extrapair partners (e.g., Thornhill and Gangestad 1994; Gangestad and Thornhill 1997; Rhodes et al. 2005; Weeden and Sabini 2007). Women are generally more interested in physically attractive men at high fertility (for a review see Gangestad et al. 2007; Gangestad and Thornhill 2008; Jones et al. 2008), supporting the notion that male physical attractiveness is an honest advertisement for male quality. However, associations between physical attractiveness and reproductive success (i.e., number of offspring) have been less known. Although it may initially appear that mating success and reproductive success would correlate, modern humans have access to a variety of contraceptive methods that were unavailable to our ancestors. Furthermore, the overall per-incident pregnancy rate for reproductive-age women engaged in consensual, unprotected penile–vaginal intercourse is low (about 3.1%, see Wilcox et al. 2001). If physical attractiveness still plays a role in sexual selection of modern humans, physical attractiveness should correlate with reproductive success.

Jokela (2009) found that the least facially attractive men had fewer children than more attractive men. However, Prokop et al. (2010) found no association between facial attractiveness and reproductive success in a cohort of married men. Taller men are less likely to be childless than shorter ones (Pawlowski et al. 2000; Mueller and Mazur 2001; Nettle 2002) and/or have several different long-term partners (Mueller and Mazur 2001; Nettle 2002). None of these studies, however, examined male facial attractiveness and tallness simultaneously. Thus, the relative importance of these two variables in sexual selection in modern humans is less understood. We predict that male facial attractiveness and tallness would be positively associated with (1) mate choice and (2) reproductive success. This means that facially more attractive and taller men would more likely engage in marriage and that they would have more children than their less attractive and shorter counterparts.

Methods

First-year university students ($N = 480$) were asked at the beginning of the winter semester 2007 to voluntarily provide facial photographs of more than 40-year-old men (single or married) at their age of 20 years. A similar method was used by Pawlowski et al. (2008), investigating attractiveness of postreproductive women at their younger age. It is widely accepted that semen quality decreases rapidly after the age of 35 years and so does the probability of successful reproduction (Rolf and Nieschlag 1997, 2001; Piñón 2002). Students were explicitly instructed that the men in photographs could not be celebrities or other publicly known people and that the photographs could not be downloaded from any websites. All concerned persons agreed to the use of photographs as well as of additional data for our research purposes. Our informal discussion with students showed that they had used mainly photographs of their friends and family members. Additional requested data on photographed males were: current age of each man, age of man on the photograph, total number of his biological children, marital status (single, married or divorced), current body height (in cm), birth order, education level (categorized to three levels: 1 = completed elementary school studies, 2 = completed high school studies, 3 = completed university studies), and total number of full siblings. There was no difference in current age and age when photographed between unmarried (mean \pm SD, 46 ± 7.11 and 20 ± 2.12 years, respectively), married (46 ± 5.74 and 20 ± 1.95 years, respectively), and divorced men (48 ± 5.27 and 21 ± 2.94 years, respectively) [analysis of variance (ANOVA), $F_{2,496} = 1.49$ and 0.47 , $P = 0.23$ and 0.62 , respectively].

Although height was not measured directly, studies evaluating measured and self-reported height consistently showed that this information was strongly correlated (Oliveira et al. 2009 and references therein). We acknowledge that human height decreases with age, which would be another confounding factor influencing the body height data. However, cumulative height loss from the age of 30 to 70 years is about 3 cm for men (Sorkin et al. 1999), suggesting a low impact of age.

Education level was asked because higher education would be associated with reproductive success (Kaplan and Lancaster 2000; Weeden et al. 2006; Goodman and Koupil 2010) and birth order/number of siblings is associated with mating strategies and/or fertility (Draper and Hames 2000; Michalski and Shackelford 2002; Milne and Judge 2009). Descriptive statistics of measured variables are presented in Table 1. Students who participated in this study got an extra credit in human biology course.

In total, 719 black-and-white photographs were received, of which 220 were excluded from further consideration due

Table 1 Descriptive statistics for selected variables measured for single ($N = 176$), married ($N = 284$), and divorced men ($N = 39$)

	Facial attractiveness	Height (cm)	Education	Birth order	Number of siblings	Reproductive success
Single	2.73 (0.73) ^a	176.70 (6.94) ^c	2.01 (0.57)	2.29 (1.29)	2.23 (1.59)	0.02 (0.23) ^e
Married	2.95 (0.74) ^b	178.22 (6.52) ^d	2.10 (0.48)	2.21 (1.54)	2.39 (1.78)	2.04 (1.18) ^f
Divorced	2.77 (0.67) ^{ab}	180.36 (7.36) ^d	2.08 (0.48)	2.31 (1.22)	2.51 (1.39)	1.23 (1.63) ^g
<i>P</i>	0.005 ^A	0.004 ^A	0.070 ^B	0.83 ^A	0.50 ^A	<0.001 ^A

Numbers are means with SD in parentheses. Numbers below parentheses denote differences based on Tukey post hoc test (a versus b, $P = 0.005$; a versus ab and b versus ab, no significant difference; c versus d, $P < 0.05$; e versus f and g, all $P < 0.001$)

^A ANOVA

^B Chi-square test

to small size, low quality, facial expression (only faces with neutral expression were involved), or profile exposition. Photos picturing more people were also removed. Background of the remaining pictures was not distinguishable, because men’s faces covered most space. Attractiveness of the remaining 499 similarly sized photographs was rated on a seven-point scale (1 = not attractive, 7 = very attractive) by twenty-seven female students aged 19–23 years ($M = 21.19$ years, $SD = 1.08$ years). Students were explicitly asked how facially attractive they judged the faces of these males. These students were volunteers from grades 2 and 3. They did not know the men in the photographs and were not aware of the research questions. Each female rated all photographs in random order. The session lasted for 4 h, including 4 short (5–7 min) breaks. Female ratings of facial attractiveness were internally highly consistent (Cronbach’s $\alpha = 0.91$), meaning that ratings were highly reliable (Nunnally 1978). An attractiveness score for each male face was calculated by averaging across all raters. Some data were $\log_{10}(x + 1)$ transformed to achieve normality. For analysis, all statistical tests were two-tailed and calculated with Statistica (version 6; StatSoft 2001, Tulsa, OK, USA, <http://www.statsoft.com>). Means are presented with standard deviations (SD) if not stated otherwise.

Results

Factors influencing marriage

Multiple logistic regression (forward stepwise method) with marital status [married (+divorced) versus unmarried men] as a dependent variable, educational level as a categorical predictor, and current age, number of siblings, birth order, height, and facial attractiveness defined as continuous predictors showed that married men were facially more attractive and taller. Especially men with the lowest educational level were more likely to be unmarried (Table 2). Other variables were removed from the model. These results support prediction 1.

Table 2 Multiple logistic regression (forward stepwise method) results on the effect of measured variables on probability of marriage of 499 men

	Level of effect	Estimate	SE	Wald’s χ	<i>P</i>
Intercept		7.32	2.58	8.05	<0.001
Facial attractiveness		−0.38	0.14	7.88	<0.01
Body height		−0.04	0.01	6.76	<0.01
Education	1	0.55	0.21	6.84	<0.01
Education	2	−0.32	0.14	4.91	0.03

Variables excluded from the model were: current age of men, birth order, and number of siblings

Factors influencing probability of parenthood

Multiple logistic regression (forward stepwise method) with having at least one child ($N = 257$ men) or no children ($N = 242$ men) as a dependent variable, educational level as a categorical predictor, and current age, number of siblings, birth order, height, and facial attractiveness defined as continuous predictors showed that the probability of parenthood was significantly higher in facially more attractive and better educated men (Wald’s $\chi = 12.97$ and 8.76 , $df = 1$ and 2 , $P = 0.0003$ and 0.012 , respectively). Other predictors were removed from the model. These results support prediction 2.

To avoid effects of confounding variables, only still-married men were used to test associations between facial attractiveness, educational level, and male fertility. This restriction was applied because only still-married men are expect to have regular sexual access to a female partner. Multiple logistic regression with having at least one child as dependent variable, facial attractiveness as continuous predictor, and education level as categorical predictor showed that men having at least one child tended to be facially more attractive than their childless counterparts (mean \pm SD score, 2.99 ± 0.73 versus 2.76 ± 0.74 , $n_1 = 239$, $n_2 = 45$, Wald’s $\chi = 3.76$, $df = 1$, $P = 0.053$). These results were only marginally influenced by education level (Wald’s $\chi = 5.0$, $df = 2$, $P = 0.08$). Inclusion of

current age of men into the model did not change these results.

Factors influencing men's reproductive success

In total, 242 men (48%) were childless, 3.61% had one child, 28.1% had two children, 15% had 3 children, and 4.81% had more than 3 children with a maximum of 7 children. Multiple linear regression (forward stepwise method) with number of children as a dependent variable and marital status, educational level, current age, number of siblings, birth order, height, and facial attractiveness defined as predictors showed that the association between predictors and men's reproductive success was significant ($R^2 = 0.34$, $F_{4,494} = 62.84$, $P < 0.0001$). Only marital status and facial attractiveness were significantly associated with men's reproductive success ($\beta = 0.55$ and 0.10 , $t(494) = 14.95$ and 2.71 , $P < 0.001$ and 0.007 , respectively). Unmarried men had lowest reproductive success, followed by divorced and married men (Table 1). Birth order and number of siblings showed no significant association with men's reproductive success (both $P > 0.05$). The other variables were excluded from the model. This provides further support for prediction 2.

When the analyses were restricted to the sample of married men, or to married men with at least one child, backward stepwise multiple linear regression models were not significant.

Discussion

This study contributes to a renaissance of interest in measuring actual reproductive success in contemporary human populations (for reviews see Nettle and Pollet 2008; Stearns et al. 2010).

We examined the relative importance of male phenotype, especially facial attractiveness and body height, in human sexual selection. Taller and facially more attractive men got married more frequently than shorter and facially less attractive ones. In turn, married men (especially those who were facially more attractive) raised more children than single men. Men's educational level, which would reflect their socioeconomic status, was a weak predictor of male reproductive success.

Facially more attractive and taller men more frequently engaged in marriage, and in turn, married men had higher reproductive success than unmarried men, corroborating and extending previous research (Pawlowski et al. 2000; Nettle 2002; Jokela 2009; Manfredini et al. 2010). Although Prokop et al. (2010) did not find any associations between reproductive success and facial attractiveness, we suggest that this could be due to either their using

photographs of older men for rating attractiveness (mean age of their participants was 47.7 years) as well as investigating only married men having at least one child. Given that both male facial attractiveness and body height are attractive for females, similar effects of these variables on men's reproductive success are not surprising. However, facial attractiveness and height are distinct cues that do not correlate with each other ($r = 0.04$, $P = 0.43$, $N = 499$, data not shown), and our data suggest that male facial attractiveness, but not tallness, is a significant predictor of men's reproductive success. It may be that male tallness is under stronger natural selection (relative to sexual selection) (see Kanazawa 2007) than facial attractiveness, thus the relationship between facial attractiveness and reproductive success was found to be stronger.

A marginally significant association between childlessness and low facial attractiveness found within the sample of married men indicates that a link between facial attractiveness and semen quality could exist (Soler et al. 2003). However, there are several alternative explanations for this association; for example, women may be more interested in having sex with their more physically attractive partners. Consequently, couples with attractive men may have sex more frequently, resulting in higher likelihood of conception. Research shows that women report more frequent coital orgasms when mated with attractive males (Thornhill et al. 1995; Shackelford et al. 2000) and that orgasm is associated with sperm retention and possibly with high conception rates (Baker and Bellis 1995), providing indirect support for this possibility. Also, a growing body of work showing effects of menstrual cycle on women's mate preferences (e.g., Gangestad et al. 2007; Gangestad and Thornhill 2008; Jones et al. 2008) suggests that women become particularly interested in having sex with physically attractive men and men with masculine and symmetrical faces and bodies near ovulation, when they are most likely to conceive. Thus, couples in which a male partner is more physically attractive may have sex more frequently at high fertility than couples in which a male partner is less attractive. Another possibility is that less attractive men marry less attractive women (Buston and Emlen 2004; Pawlowski et al. 2008), who are less fertile (e.g., Zaadstra et al. 1993; Manning et al. 1997; De Pergola et al. 2006). Alternatively, perhaps less attractive men in this sample were not as financially successful as the more attractive men and, therefore, decided to have fewer children. Furthermore, it is possible that more attractive men simply got married earlier and have more children. We cannot rule out this possibility, as no data were collected on number of years married. Clearly, further research including investigation of reasons of infertility of some married couples is necessary to test these ideas.

Male height was distributed nonrandomly between the three cohorts: single men were smallest, still-married men were taller, and divorced men tended to be the tallest. These patterns indirectly fit with the idea that tallness is attractive to women and favors men in attracting new mates (Mueller and Mazur 2001 see also Pawlowski and Koziel 2002; Koziel and Pawlowski 2003). However, in contrast to Mueller and Mazur's (2001) study, the reproductive success of divorced men was generally lower than those of married ones. At present, our data support the current findings of Borgerhoff Mulder (2009), who found that remarriage did not provide reproductive benefit to man. Ideally, additional data on full marital history and socio-economic status of the currently married and currently divorced men would be required to test this idea.

This study supports the idea that human female mate choice is based on morphological traits of a potential partner (e.g., Thornhill and Gangestad 1994; Rhodes et al. 2005; Weeden and Sabini 2007; Manfredini et al. 2010). Our data either show that taller and facially more attractive men more likely engage in marriage and that facially more attractive men have greater reproductive success than their less attractive counterparts. Considering that male facial attractiveness was a stronger predictor of reproductive success than tallness, we propose that facial attractiveness is under stronger sexual selection than tallness. In summary, the importance of physical attractiveness (especially facial attractiveness) in sexual selection in modern men exists, which provides further evidence on evolution of body attractiveness via sexual selection. Further research including data from more diverse samples and additional facial (e.g., averageness, masculinity, and symmetry), health, and wealth measures is required.

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