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Original Article

Female Facial Appearance and Health

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Abstract: The current study addressed whether rated femininity, attractiveness, and health in female faces are associated with numerous indices of self-reported health history (number of colds/stomach bugs/frequency of antibiotic use) in a sample of 105 females. It was predicted that all three rating variables would correlate negatively with bouts of illness (with the exception of rates of stomach infections), on the assumption that aspects of facial appearance signal mate quality. The results showed partial support for this prediction, in that there was a general trend for both facial femininity and attractiveness to correlate negatively with the reported number of colds in the preceding twelve months and with the frequency of antibiotic use in the last three years and the last twelve months. Rated facial femininity (as documented in September) was also associated with days of flu experienced in the period spanning the November-December months. However, rated health did not correlate with any of the health indices (albeit one marginal result with antibiotic use in the last twelve months). The results lend support to previous findings linking facial femininity to health and suggest that facial femininity may be linked to some aspects of disease resistance but not others.

Keywords: femininity, health, facial attractiveness, immunity, immunocompetence

Introduction

The universal nature of human facial preferences (Langlois et al., 2000) suggests the possibility that such preferences are adaptations to the problem of mate choice (Penton-Voak and Perrett, 2000). Sexual selection will have favored preferences for facial traits which are associated with reproductive success (Rhodes, 2006). Facial preferences may therefore exhibit the characteristics of a system designed for the identification of high quality mates (Thornhill and Gangestad, 1999). One way facial traits may signal mate quality is by indicating the health of the individual displaying them. Healthy individuals confer a reduced risk of infection as well as the possibility of heritable immunity for their suitors' offspring (Hamilton and Zuk, 1982). Preferences for facial traits that are linked with health are therefore expected to be present.

One facial cue used in the judgment of a woman's attractiveness is facial femininity. While facial proportions diverge between the sexes in particular ways, within each sex, the extent to which an individual typifies the prototypical face structure of his or her sex varies. Given that women have smaller jaws, lighter brow-ridges, higher cheekbones and larger foreheads than men (Enlow and Hans 1996; Penton-Voak et al, 2001), facial femininity represents the degree to which such traits are exaggerated in a woman's face.

Folstad and Karter (1992) suggest that sexually dimorphic traits in males signal immunocompetence because the sex hormones responsible for their manifestation are immunosuppressive (e.g., testosterone) (Alexander and Stimson, 1988; Møller, Christe, and Lux, 1999, but see Roberts, Buchanan, and Evans, 2004; Boonekamp, Ros, and Verhulst, 2008). As a consequence, male facial masculinity may honestly signal immune system quality since only the healthiest males can afford the costs to immune functionality of high levels of testosterone (for discussion of the immunocompetence handicap hypothesis, see Rhodes, Chan, Zebrowitz, and Simmons, 2003), although some have recently urged caution on this (Boothroyd et al., 2005; Boothroyd, Lawson, and Burt, 2009; Scott et al., 2010) and suggested alternative mechanisms (Alonso-Alvarez et al., 2007).

The handicap hypothesis may not be applicable to female facial femininity, since estrogen, which gives rise to feminine facial features in women (Law-Smith et al., 2006), is not clearly immunosuppressive. While estrogen is positively associated with endometrial, breast, and ovarian cancers (Service, 1998), it is also linked with the production and action of antibodies (Alexander and Stimson, 1988). Thus estrogen may prove detrimental to cell-mediated immunity, but beneficial to humoral immunity (Da Silva, 1999). In light of this, it may be appropriate to consider female facial femininity as a direct signal of health, with estrogen partially augmenting immune function. Indeed facial femininity in women has been shown to be positively correlated with other putative cues to health, such as facial symmetry (Little et al., 2008) and skin condition (Fink, Grammer, and Matts, 2006).

Currently only two studies have addressed a link between female facial femininity and direct indices of health (Rhodes et al., 2003; Thornhill and Gangestad, 2006). Whereas Rhodes et al. (2003) found that a woman's rated facial femininity was unrelated to her health as assessed by medical records, Thornhill and Gangestad (2006) found a significant positive correlation between measured female facial femininity and number of self-reported respiratory infections in the last three years. However Thornhill and Gangestad (2006) found no association between measured female facial femininity and reported frequency of stomach illness or antibiotic use across this time period. This suggests that facial femininity, if linked with immune function, may be best conceived as related to particular components of the immune system rather than a global immune response.

However, both of the aforementioned studies possess methodological flaws that hinder the reliability of their findings. While Thornhill and Gangestad (2006) could be said to have employed a superior methodology to Rhodes et al. (2003) with respect to the quality of the images used, their study employed a health measure susceptible to memory failure and bias (e.g., one assessment requesting recall of illness within the last three years).

It is possible, for example, that the less feminine faced may have had a bias to recall more negative events than their more feminine counterparts, perhaps mediated by self-esteem and mood (Rhodes, 2006). Furthermore, both studies looked at how health patterns temporally predict facial appearance and did not consider whether facial appearance can predict later health. This distinction is important as it may be that illness affects growth without the factors which drive growth having an impact on immune functioning. For example, meta-analyses of experimental work in nonhuman males suggests that while increasing testosterone may not affect immune parameters, exposure to pathogens may down-regulate testosterone production (Boonekamp, Ros, and Verhulst, 2008).

Accordingly, the present study sought to address the relationship between female facial femininity, attractiveness and perceived/actual health. It was assumed that for femininity to signal health, it must be perceived as healthy and consequently be rated as attractive. Actual health was assessed by multiple self-reports detailing the number of colds, stomach illnesses and frequency of antibiotic use across a number of time periods, including some more recent and therefore less susceptible to error than previous studies employing such a measure (i.e., Thornhill and Gangestad, 2006). Based on previous results, we would predict that the rated femininity, healthiness and attractiveness of the faces would negatively correlate with self-reported ill-health (especially upper-respiratory infections although not necessarily stomach bugs) in shorter-term time periods, as well as over the preceding three years.

Materials and Methods

Participants and Photograph Collection

One hundred and five female undergraduates aged 18-20 years (mean age=18.5) were recruited from the University's Psychology and Biology departments in partial exchange for course credit. Of these, 54 were from the 2009 student cohort and 51 were from the 2010 student cohort.

All students had been photographed on entry to their degree program and gave permission for their departmental portrait to be used in the research project. Each participant was photographed in a "portrait" pose, under diffuse flash in a windowless room. All images were black-masked to conceal clothing, hair, neck, and ears, and were aligned to match on interpupillary distance.

Questionnaire Data

Time 1 questions. Within two weeks of commencing their courses and being photographed, the 2009 cohorts were recruited and asked to report the number of bouts of "colds or flu", the number of "stomach bugs" they had suffered, and the number of occasions on which they had taken antibiotics in both the preceding three years, and 12 months. Due to poor participant retention to Time 2 in the first cohort, the 2010 cohort were recruited at Time 2 and asked to report the same information for the one and three years prior to arriving at university. All participants were also asked to report whether they had any immune system disorders (none were reported) and whether they had suffered any illness at the time of being photographed (63 participants reported illness here, but this did not relate to any facial ratings so was not examined further). The 2010 cohort were also asked to indicate whether they were "probably wearing make-up" when the departmental photograph was taken.

Time 2 questions. All participants completed a second questionnaire during the final week of the autumn term in mid-December (as noted above, the 2010 cohort completed both questionnaires at this time). They were asked to report the number of days in the preceding eight weeks in which they had suffered a cold, the flu, a stomach bug, taken antibiotics, or had a day off due to illness (specifically excluding precautionary measures due to the 2009 Swine flu epidemic when the UK health authorities urged people not to go in even if symptoms were mild).

All variables collected via health questionnaires were analyzed individually. While data reduction techniques may have reduced Type I error rate, it is important to note that certain variables were not expected to show significant correlations (i.e. the stomach bugs) as they are more susceptible to various lifestyle factors such as food hygiene and period pain and may not be reliable indicators of immune functioning, as per Thornhill and Gangestad's (2006) argument. Likewise, we explicitly wanted to look at the different time periods separately. As such, data reduction was inappropriate and similarly these correlations were not all viewed as part of the same "family" for multiple comparison purposes (e.g., see Benjamini and Hochberg, 1995).

Ratings

Ratings of femininity were used in the present study. Such ratings are affected in the predicted way by systematic and objective manipulation of sexually dimorphic cues in face images (Welling et al., 2007) and have been shown to be positively correlated with measured estrogen level (Law Smith et al., 2006).

Observers were recruited via an opportunity sample of those within Durham University campus. Eleven females and four males with a mean age of 23.7 years (age range 18-37) rated the faces. While observer knowledge of the experimental participants was not considered, it is unlikely that any observers knew any of the experimental participants personally.

Stimuli were presented individually on a laptop display (screen size = 1020 x 780, stimulus resolution= 400 x 500 pixels). Observers were asked to rate each face on femininity, health, mood or attractiveness, from 1 (very masculine/unhealthy/sad/unattractive) to 7 (very feminine/healthy/happy/attractive). They were also asked to rate each face for the degree of makeup they suspected had been applied from 1 (none) to 3 (a lot).

Responses were made by pressing the chosen number on the keyboard and then confirming this response with the enter key. Raters were given as long as needed to complete each trial and subsequent trials would only be presented on completion of previous ones. For each of the five dimensions, raters were required to judge all of the faces. The order in which raters assessed each dimension was randomized, as was the order in which the trials appeared within that block.

Inter-rater agreement for each trial was acceptable to excellent for all five dimensions (Cronbach's alphas: attractiveness 0.77; health 0.83; femininity 0.66; make-up 0.94; mood 0.95). As rated makeup and report of wearing makeup in the images showed a significant positive correlation (r = .489, p = <0.001), rated makeup was considered an appropriate control for the presence of makeup in the analysis. It was not possible to use make-up itself as a control measure as only a subset of participants provided data on it.

Results

Due to the swine flu epidemic of 2009 potentially creating cohort effects, all reported illness was standardised within cohort before data were merged for analysis. As ratings were acquired from different observers in 2009 versus 2010, in order to rule out any differences in ratings (although as above Cronbach's scores were good for both sets), all scores were standardised within cohort.

Table 1. Intercorrelations between the facial rating measures

	Rated health	Rated facial attractiveness	Rated facial femininity	Rated mood
Rated health		.678 p =< .001 n = 105	.680 p =< .001 n = 102	.168 p =< .093 n = 101
Rated facial attractiveness			.897 p = < .001 n = 102	.151 p = .131 n = 101
Rated facial femininity				.126 p = .217 n = 98
Rated makeup	.465 p =< .001 n = 101	.630 p =< .001 n = 101	.659 p =< .001 n = 98	-.004 p = .968 n = 101

Initial correlation analyses (see Table 1) showed that rated health, femininity, attractiveness, and makeup were significantly positively related across faces (p =< .001). In addition, rated mood correlated positively with rated health, although this relationship was only marginally significant (p = .093). Furthermore, health, femininity, and attractiveness ratings remained significantly positively related when controlling for rated makeup and mood (all r > 0.49, all ps < .001; see Table 2).

Table 2. Intercorrelations between rated health, attractiveness and femininity with rated makeup and mood statistically controlled

	Rated health	Rated facial attractiveness
Rated facial femininity	.547 *p* < .001 *df* = 94	.818 *p* < .001 *df* = 94
Rated health		.543 *p* < .001 *df* = 97

Rated attractiveness, health, and femininity, were then entered into a bivariate collation analysis with all health variables separately. To remove the possibility that a participant's degree of makeup and happiness of expression in the photographs were confounding the relationships between rated health, attractiveness, and femininity with reported health, rated mood and makeup were controlled for within the analysis.

Table 3. The relationship between rated facial femininity, health, and attractiveness and reported past health, controlling for makeup and mood

	Rated health	Rated facial attractiveness	Rated facial femininity
Number of colds or flu within the specified time period			
last three years *df*=92	.020 *p* = .851	.007 *p* = .944	-.033 *p* = .751
last 12 months *df*=94	-.133 *p* = .197	-.191 *p* = .062	-.215 *p* = .035
Days of stomach bug within the specified time period			
last three years *df*=94	-.054 *p* = .600	-.028 *p* = .783	.030 *p* = .469
last 12 months *df*=94	-.061 *p* = .557	.052 *p* = .613	.051 *p* = .620
Days of antibiotic use within the specified time period			
last three years *df*=94	-.166 *p* = .106	-.226 *p* = .027	.-.272 *p* = .007
last 12 months *df*=94	-.170 *p* = .097	-.172 *p* = .095	-.211 *p* = .039

Number of colds within the last twelve months correlated significantly negatively with rated facial femininity (r = -2.15, p < .05) and negatively, yet marginally, with rated facial attractiveness (r = -.191, p = .062). Similarly, there were significant negative relationships between antibiotic use, rated facial attractiveness, and femininity, such that more attractive and feminine women reported significantly or marginally less antibiotic use (all rs > 0.17, all ps < 0.1, see Table 3 for figures). There was also a marginal negative correlation between rated health and reported antibiotic use in the last twelve months (r = -.172, p =.095). There were no other significant relationships (see Table 3).

Table 4. The relationship between rated facial femininity, health, and attractiveness and prospective reported health, controlling for makeup and mood

	Rated health	Rated facial attractiveness	Rated facial femininity
Number of colds within the last eight weeks	-.067 p =.589 df = 66	-.066 p =.595 df = 66	-.060 p =.628 df = 66
Days of flu within the last eight weeks	.115 p =.350 df = 66	-.180 p =.142 df = 66	-.265 p =.029 df = 66
Days of antibiotic use within the last eight weeks	.072 p =.558 df = 66	.048 p =.700 df = 66	-.025 p =.838 df = 66
Days off for illness in the last eight weeks	.184 p =.133 df = 66	.027 p =.826 df = 66	-.047 p =.703 df = 66
Days of stomach bug within the last eight weeks	-.193 p =.114 df = 66	-.122 p =.323 df = 66	-.121 p =.324 df = 66

Looking at the prospective validity of facial ratings, controlling for rated makeup and mood, there was a significant relationship between rated facial femininity and days of flu across the last eight weeks of the Autumn term (r = -.265, p =< .05, see table 4). That is, women whose faces appeared more feminine in early October reported experiencing fewer days of flu in November and December. Importantly, although the N for the prospective data was smaller, results for colds and antibiotic use did not approach coefficient magnitudes which would be significant with about 100 participants as in our previous analyses, suggesting that these null correlations are not due to reduced sample size.

Discussion

The present study addressed the relationship between rated female facial femininity, attractiveness, health, and susceptibility to infectious disease. It was predicted that all three rating variables would correlate negatively with bouts of illness, particularly with colds and flu suffered, although not necessarily with rates of stomach infections. The results showed partial support for this prediction, in that there was a general trend for both facial femininity and attractiveness to correlate negatively with reported number of colds in the preceding twelve months and with frequency of antibiotic use in the last three years and the last twelve months. Rated facial femininity (as documented in October) was also associated with days of flu experienced in the period spanning the November-December months. No other significant results were obtained.

The current findings that only some illness indices are associated with facial ratings supports the results of Thornhill and Gangestad (2006) who found no association between female facial femininity and frequency of antibiotic use, or number of reported stomach bugs. However they did find a negative relationship between facial femininity and respiratory infection. These findings suggest that it may be inaccurate to conceive of a “unitary” or “global” immune system, as doing so may obscure potential relationships between facial rating variables and individual illness categories. The non-significant relationship between facial femininity and health in Rhodes et al (2003) may perhaps be due to the unitary annual health score they employed as their health measure. Femininity may not therefore signal an augmentation of global immunity, but rather increased resistance to some infectious diseases over others (non-human evidence suggests that disease resistance can be pathogen specific and that immune function is more multi-faceted than behavioral research tends to assume; see Muehlenbein and Bribiescas, 2005, for a review).

In disagreement with previous research (Roberts et al., 2005, Kalick, Zebrowitz, Langlois, and Johnson, 1998., Little et al., 2011) the current study found no significant relationship between perceived health and actual health indices (albeit one marginal result with antibiotic use in the last twelve months). This is a striking finding given that the absence of such a relationship in the present sample cannot be accounted for by the confounding effects of mood and makeup or by the possibility that apparent health represents current condition and not long term disease resistance (i.e., reported illness on day of photograph was not associated with rated health). It may be that, as above, apparent health relates to some aspects of actual health and not others. Alternatively, wider factors may have influenced our results. For instance, recent research has suggested that diet (Stephen, Coetzee, and Perrett, 2011) and facial adiposity (Coetzee et al., 2011) are related to rated health. As diet and facial adiposity where not controlled for it is possible that they confounded the relationship between perceived and actual health. Furthermore given the subtle coloration changes linked with a healthy appearance (i.e., increased redness and yellowness; Stephen, Smith, Stirrat, and Perrett, 2009), the lack of standardized lighting and screen calibration at the rating stage of the experiment may have presented an additional confound.

It is also possible that rated and actual health failed to be associated due to a weakness in the study’s assessment of health. While the present study employed self-report of both remote and recent illness, the potential for memory failure, although reduced relative to previous studies (Thornhill and Gangestad, 2006), remains. It would therefore be interesting to see if the present results are replicated using more objective measures of health. One avenue would be to examine the relationship between rated facial femininity, health, and attractiveness and oxidative damage (a cause of a host of diseases; Velando, Torres, and Alonso-Alvarez, 2008) to women's proteins, lipids, and DNA (see Gangestad, Merriman and Thompson, 2010, for such a study using male participants).

The second aim of this study was to compare the ability of facial features to indicate past versus predicting future health. While there is a broad pattern of facial femininity and attractiveness indicating elements of past health (7 out of 12 predicted correlations were significant or borderline in the correct direction), there was less evidence when considering the two month period after the photographs were taken. Indeed, there was only one out of 12 anticipated correlations (given the expectation that stomach bugs would not be significant) raising the very real possibility of a Type I error. It may be that 8 weeks was insufficient time for participants' immune systems to sufficiently differentiate; however the first term of university was selected specifically because the exposure to novel pathogens from a wide range of areas of the country/globe represented a time in which susceptibility ought to be important. Thus it may be that female facial femininity is a valid index of past health experiences (perhaps due to illness and pathogen exposure modulating sex hormones during late adolescence when our sample would still have been developing) without being a valid predictor of current or future health functioning. Future research, however, should look at future health over a longer time period to ensure that the time span difference here did not give insufficient future-health data.

Finally, it is important to acknowledge that the association between facial femininity and health may not be due to disease resistance. It is possible that feminine women are more likely to avoid infection by moderating their exposure to pathogens rather than possessing superior immune systems. It may be the case that the hormones associated with facial masculinity (i.e., testosterone in men; Pound, Penton-Voak, and Surridge, 2009) and lower estrogen in women (Law Smith et al., 2006) are precisely those which predispose an individual to engage in behavior linked with the acquisition of disease/infection (e.g., increased risk taking/impulsivity). Indeed, men are more likely to engage in unhygienic behavior than women, as studies of restroom hygiene have demonstrated (Johnson et al., 2003; White, Kolble, Carlson, and Lipson, 2005). Further study should therefore seek to assess the health attitudes of women and men with feminine and masculine faces before any strong claims can be made regarding the inherent immunity associated with feminine faced females and masculine faced males.

In summary, this study supports the finding that facial femininity and attractiveness may indicate women's health history, which partially supports (although without confirmation of such relationships in future health, does not confirm) the hypothesis that female facial structure is a direct indicator of health functioning.

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