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Digit ratio (2D:4D) and facial fluctuating asymmetry as predictors of the dark triad of personality

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ABSTRACT

Digit ratio (2D:4D) – a reliable marker of prenatal sex hormone exposure – and low facial fluctuating asymmetry – a marker of developmental stability – are associated with specific personality traits in both sexes. Recently, the interest in the dark triad of personality (Machiavellianism, narcissism, and psychopathy) has increased. However, whether 2D:4D and facial fluctuating asymmetry are related to and predictive to the dark triad remain unknown. The aim of this study was to fill this gap by assessing the relationship between these variables. A group of 119 healthy college students (71 females) answered the short dark triad questionnaire. Photographs were used to determine their degree of facial fluctuating asymmetry and the digit ratios (2D:4D) on both hands were directly measured. The data revealed that narcissism was predicted by lower left-hand 2D:4D and lower facial fluctuating asymmetry. We suggested that a trait related to variations in sex hormone levels (measured by lower 2D:4D) and to developmental stability (measured by lower facial fluctuating asymmetry) contributes to higher narcissistic tendencies in both sexes, which might serve as a reinforcement strategy that increases their attractiveness and is rewarded by increased social status and mating partners.

1. Introduction

Digit ratio – the relative length of the index finger (2D) to the ring finger (4D) – is a sexually dimorphic trait in humans. Men typically have lower 2D:4D than women (i.e., a shorter 2D relative to 4D) (Hönekopp & Watson, 2010). Manning, Fink, and Trivers (2014) suggested that this sex-based difference is determined during ontogeny and is associated with variations in fetal exposure to testosterone and estrogen. Higher testosterone levels result in lower 2D:4D in males whereas higher estrogen levels result in higher 2D:4D in females (Manning, Scutt, Wilson, & Lewis-Jones, 1998; Manning, 2002, 2008; McIntyre, Chapman, Lipson, & Ellisson, 2007).

This sex difference remains stable throughout childhood and puberty (Trivers, Manning, & Jacobson, 2006). Since testosterone-dependent traits are reliable indicators of fitness (Folstad & Karter, 1992; Rantala et al., 2012), it has been suggested that variations in 2D:4D may be related to other-rated attractiveness in males (Roney & Maestripieri, 2004; Bogaert, Fawcett, & Jamieson, 2009) and self-reported attractiveness both in males and females (Manning & Quinton, 2007; reviewed in Hönekopp, 2013).

One of the main components of physical attractiveness in humans and non-human animals is the level of fluctuating asymmetry (FA). In other animals, lower levels of FA in physical traits signals the ability of organisms to cope with genetic and environmental stress such as homozygosity, mutation, low food quality, extreme temperatures, toxins, or parasitism (Møller, 1997; Møller & Swaddle, 1997). Therefore, it has been suggested that symmetrical traits (lower FA) could be related to sexual selection and mate choice processes. In fact, by using a meta-analysis, Møller and Thornhill (1998) found that organisms possessing lower FA in physical traits have higher success in sexual selection among a wider number of animal taxa.

Evidence in human beings shows that lower facial FA is positively related to apparent health (Jones et al., 2001) and physical and facial attractiveness in both sexes (e.g., Grammer & Thornhill, 1994; Perrett et al., 1999; Fink, Neave, Manning, & Grammer, 2006; Abend, Pflüger, Koppensteiner, Coquerelle, & Grammer, 2015). Both digit ratio and facial FA have been related independently to the expression of personality traits associated with obtaining social and sexual benefits (2D:4D studies: Fink, Manning, & Neave, 2004; Luxen & Buunk, 2005; Millet & Dewitte, 2007; Hampson, Ellis, & Tenk, 2008; Facial FA

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studies: Fink, Neave, Manning, & Grammer, 2005; Pound, Penton-Voak, & Brown, 2007; Borráz-León & Cerda-Molina, 2015). Because personality is also an important component of attractiveness in humans (Botwin, Buss, & Shackelford, 1997), hence, it is not surprising that digit ratio 2D:4D and facial FA could be biological markers of personality that facilitate access to valuable resources.

In recent years, the interest in the study of the evolutionary advantages conferred by the dark triad of personality has increased. The dark triad includes features of non-pathological Machiavellianism, narcissism, and psychopathy related to antisocial tendencies, other-derogation, self-promotion, emotional coldness, and aggressiveness (Paulhus & Williams, 2002). Machiavellianism, also known as the manipulative personality, focuses on what will be beneficial for one's well-being regardless of the well-being of others; narcissism is focused on self-ascribed grandiosity, inflated ego, exhibitionism, vanity, and self-sufficiency; whereas psychopathy is related to impulsivity and lacking empathy (Jones & Paulhus, 2011). However, it is unknown whether variations in 2D:4D (an indicator of prenatal testosterone/estrogen exposure) and lower facial FA (a signal of developmental stability) are predictive of the dark triad of personality traits.

Therefore, the aim of this study was to investigate the relationships among 2D:4D, facial FA, and the dark triad. Pfattheicher (2016) observed that basal testosterone level was positively associated with narcissism but not with Machiavellianism or psychopathy. Hence, we predicted a negative relationship between 2D:4D and narcissism scores but non-significant relationships for Machiavellianism or psychopathy, regardless of sex. Likewise, we expected that males and females with lower facial FA will score higher in all three personality traits because characteristics related to the latter are more often exhibited by people with lower facial FA, such as anger (Muñoz-Reyes, Gil-Burmann, Fink, & Turiegano, 2012) and neuroticism (Holtzman, Augustine, & Senne, 2011). Finally, we anticipated that both lower 2D:4D and lower facial FA could predict the expression of the dark triad of personality traits regardless of the sex of the participants.

2. Methods

2.1. Participants

A sample of 119 healthy college students (48 males and 71 females) was recruited by personal invitations at the University of Turku in Finland. The sample size was calculated with a confidence level of 95% according to Daniel (1982). The mean age was 26.92 years (SD = 7.60) for males and 24.41 years (SD = 5.94) for females. Participants received detailed information about the aims of the research and answered a general data questionnaire. The participants did not receive any compensation for taking part in the research.

2.2. The dark triad questionnaire

The short dark triad questionnaire (SD3; Jones & Paulhus, 2014) was employed to measure Machiavellianism (e.g., “You should wait for the right time to get back at people”), narcissism (e.g., “People see me as a natural leader”), and psychopathy (e.g., “Payback needs to be quick and nasty”). The SD3 includes 27 items, nine for each trait. Participants indicated their level of agreement with each item using a five-point Likert-type scale (1 = strongly disagree; 5 = strongly agree). The accuracy and reliability of the SD3 are well established in the literature, including construct and external validation based on informant ratings (e.g., Jones & Paulhus, 2014). Participant responses to each item on the scale were averaged to create indexes of Machiavellianism (M = 27.36, SD = 5.181, $\alpha = 0.73$), narcissism (M = 26.12, SD = 4.933, $\alpha = 0.72$), and psychopathy (M = 18.94, SD = 5.089, $\alpha = 0.74$).

2.3. Facial fluctuating asymmetry measurements

A picture of the face of each participant was taken using a Sony DSC-W800, 20.1 MPx digital camera at a constant distance of 1 m, in the same natural light conditions, and without a flash. The participants were instructed to assume neutral and relaxed facial expressions with mouths closed. All pictures were horizontally aligned and scaled according to inter-pupillary distance.

Facial FA was calculated according to the procedure described by Grammer and Thornhill (1994). Six horizontal lines were drawn, corresponding to the inner and outer corners of the eyes, cheekbones, outer edges of the lower nose region, corners of the mouth, and jawbones. These were used to define the outer part of the face along the horizontal axis of the mouth. The lines were drawn and measured using the open-source ImageJ software version 1.42 (NIH, Bethesda, MD, USA). The midpoints of each line were calculated using the following formula [(left point − right point / 2) + right point].

In a completely symmetrical face, all of the midpoints are positioned on the same vertical line and the sum of all of the differences among the midpoints is zero. Increasing values are reflective and proportional to decreasing facial symmetry. Facial FA values were also calculated using the ImageJ. 1.42. To ensure the reliability of facial FA measurements the intraclass correlation coefficients were computed using the calculated facial FA values from two different pictures of the same participant ($n = 50$, $r = 0.95$, $p < 0.001$). The average between the facial FA values from two pictures of each individual was used for all future calculations.

2.4. Digit ratio (2D:4D) measurements

Finger length was measured twice by the same researcher using a digital caliper that measured down to 0.01 mm (#7236, Horse Power, Hamburg Germany) directly on the ventral surface of both hands from basal crease to the fingertip, according to standard protocol (Manning et al., 1998; Klimek, Galbarczyk, Nenko, Calistro Alcarado, & Jasienska, 2014). This method was chosen based on suggestions that direct measurements are more reliable than indirect methods (e.g., using hand scans or photocopies) that are more prone to distortions (Manning, Fink, Neave, & Caswell, 2005; Ribeiro et al., 2016). To ensure that the measurements were reliable intraclass correlation coefficients were calculated for both hands (right hand: $r = 0.89$, $p < 0.001$; left hand: $r = 0.90$, $p < 0.001$). The average finger length measurements were used to calculate left and right-hand digit ratios (L2D:4D and R2D:4D respectively).

2.5. Statistical analyses

We used the Kolmogorov-Smirnov (K-S) test to ensure normality. A *t*-test for independent samples was used to identify potential sex-based differences. Pearson correlation coefficients were used to reflect the relationships between the variables. Then, to test the predictive power of the independent variables (L2D:4D, R2D:4D, facial FA, and the sex), we used a series of hierarchical regression analyses that consecutively introduce one personality trait associated with the dark triad as a dependent variable. The data were analyzed using SPSS version 23 (SPSS Inc., Chicago, IL, USA). All tests were two-tailed, and the significance was set at $p \leq 0.05$.

3. Results

3.1. Sex differences

We found sex-based differences in L2D:4D, R2D:4D, Machiavellianism, and narcissism scores but not in facial FA or psychopathy scores (Table 1). Males had lower L2D:4D and R2D:4D and scored significantly higher in Machiavellianism and narcissism