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Short Communication

Facial width-to-height ratio predicts psychopathic traits in males

Christine Anderl [a,*], Tim Hahn [a], Ann-Kathrin Schmidt [a], Heike Moldenhauer [a], Karolien Notebaert [a,b], Celina Chantal Clément [a], Sabine Windmann [a]

[a] Johann Wolfgang Goethe University Frankfurt/Main, Department of Cognitive Psychology, Germany
[b] Katholieke Universiteit Leuven, Research Center of Marketing and Consumer Science, Belgium

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ABSTRACT

Facial width-to-height ratio (*fWHR*), a putative marker of pubertal testosterone action, has been reliably linked with various facets of unsociable behavior in men. In order to elucidate the underlying mechanisms, a recent study by Geniole and colleagues (2014) has provided evidence for an association between male fWHR and the psychopathic personality trait fearless dominance in an undergraduate student sample, although the reported effect size was small ($\beta_{stand} = .17$). We aimed to replicate and extend this finding by recruiting young adult prison inmates in addition to a sample of undergraduate students, thereby increasing the variance of the psychopathy scores at the high-end of the continuum. We found significant positive associations between fWHR not only with fearless dominance, as reported before, but also with the factor self-centered impulsivity, and with overall psychopathy scores. Results point to a role of testosterone in the development of psychopathic personality traits.

1. Introduction

A growing body of research has reliably linked a structural facial feature, the bizygomatic width divided by upper face height (facial width-to-height ratio; *fWHR*), with various facets of unsociable behavior in males. For instance, wider faced men have been demonstrated to display higher propensity towards aggression and retaliation (Carré & McCormick, 2008; for a recent meta-analysis, see Haselhuhn, Ormiston, & Wong, 2015), more self-centered and deceptive behavior (Geniole, Keyes, Carré, & McCormick, 2014; Haselhuhn & Wong, 2012; Stirrat & Perrett, 2010), less cooperative negotiation (Haselhuhn, Wong, Ormiston, Inesi, & Galinsky, 2014), and stronger explicit support for prejudicial beliefs (Hehman, Leitner, Deegan, & Gaertner, 2013).

Facial shape in men has been shown to be affected by testosterone exposure during puberty (Marečková et al., 2011; Verdonck, Gaethofs, Carels, & de Zegher, 1999), with wider faces reflecting higher levels of testosterone (Lefevre, Lewis, Perrett, & Penke, 2013; Verdonck et al., 1999). Thus, enhanced testosterone action during puberty may have contributed to shaping the unsociable behavioral dispositions of wider faced men (e.g., Carré & McCormick, 2008; Lefevre et al., 2013). In exploring these implications, one may be informed by personality psychology. This field describes self-centered and antisocial behavioral tendencies in terms of psychopathy (e.g., Anderson & Kiehl, 2012), and this correlates indeed with baseline testosterone levels in both forensic and community samples (Stålenheim, Eriksson, von Knorring, & Wide, 1998; Welker, Lozoya, Campbell, Neumann, & Carré, 2014; for a review, see Yildirim & Derksen, 2012). Moreover, one recent study by Geniole et al. (2014) has directly confirmed a significant (yet relatively weak, $\beta_{stand} = .17$) association between male fWHR and the psychopathic personality trait *fearless dominance* in male undergraduate students (correlation for the total psychopathy score was not reported).

We set out to replicate and extend the Geniole et al. (2014) finding. Specifically, in addition to a sample of undergraduate students, we recruited young male offenders, whose psychopathy scores we expected to be significantly higher than for the general population, and correlated participants' fWHR with their psychopathy scores both within and across samples. We expected the latter correlation to be stronger than the one reported by Geniole et al. (2014) because inclusion of the young offenders would increase the variance in the PPI-R scores.

2. Methods

2.1. Participants

2.1.1. Undergraduate student sample

For the undergraduate student sample, $N = 105$ adult male undergraduate students from various disciplines were recruited at *Goethe University Frankfurt* (Germany) in return for partial course credit or an expense allowance of 8 Euro. Exclusion criteria were (1) suffering from a psychiatric disorder and/or taking psychoactive medication according to self-report ($n = 7$) or (2) – since bizygomatic width has been demonstrated to differ depending on ethnicity (e.g., Bedoya, Osorio, & Tamayo, 2015) – not being Caucasian ($n = 2$). The remaining ninety-six participants had a mean age of 23.68 years ($SD = 4.70$).

* Corresponding author at: Department of Cognitive Psychology, Johann Wolfgang Goethe University Frankfurt/Main, Grüneburgplatz 1, 60323 Frankfurt/Main, Germany.
E-mail address: anderl@psych.uni-frankfurt.de (C. Anderl).

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Informed consent was provided by all participants and study protocols were approved by the faculty review board.

2.1.2. Inmate sample

For the inmate sample, we tested $N = 44$ adult male prisoners of a German young offenders institution (*Justizvollzugsanstalt Ebrach*) in exchange for a small allowance in kind (e.g., chocolate bars, coffee). Exclusion criteria were identical to the undergraduate student sample. Accordingly, one non-Caucasian participant was removed from analysis. Additionally, two participants had to be excluded as they failed to complete parts of the procedures of the study. This resulted in a final sample of $N = 41$ with a mean age of 21 years ($SD = 1.32$). Informed consent was provided by all participants and study protocols were approved by the review board of the German Psychological Society (*DGPs*).

2.2. Measures and procedures

After giving written informed consent, participants completed a paper-pencil-version of the Psychopathic Personality Inventory-Revised (*PPI-R*; Lilienfeld & Widows, 2005), a well-validated dimensional self-report measure of psychopathy, in its German version (Alpers & Eisenbarth, 2008). The eight subscales of the PPI-R can be combined to calculate a total psychopathy score (*PPI-R total*) as well as three higher-order factors: *fearless dominance* (consisting of the content scales fearlessness, social potency, and stress immunity), *self-centered impulsivity* (consisting of the content scales Machiavellian egocentricity, rebellious nonconformity, blame externalization, and carefree nonplanfulness), and *coldheartedness* (consisting of a content scale with the same name). Following the questionnaire, participants were seated facing a tripod-mounted digital camera and placed their head on a chin-rest in a straight position with a neutral facial expression, while a frontal photograph of their face was taken. Two trained research assistants, one of them blind to hypotheses and sample type, determined fWHR following the procedures used in other studies (e.g., Stirrat & Perrett, 2010; for an illustration, see Supplementary Figure S1). FWHR measurements were highly consistent across raters within and across samples (all *ICCs* > .98), so the average was used for all statistical analyses. All effects remained intact when only facial measurements provided by the hypotheses-blind research assistant were used to predict psychopathy scores.

3. Results

3.1. Psychopathy scores for the undergraduate student and the inmate sample

One-sample Shapiro–Wilk tests within both samples and across the whole sample revealed no significant deviations from a normal distribution for PPI-R total or any of the PPI-R subfactors (all *ps* > .14; for histograms of the distributions, see also Supplementary Figure S2).

To test whether psychopathy scores were higher for the prison inmates relative to the undergraduate students, we first conducted a t-test to compare mean PPI-R total scores between the two groups. As expected, PPI-R total scores were significantly higher in prison inmates ($M = 323.92$, $SD = 26.23$) than in the undergraduate students ($M = 299.01$, $SD = 25.50$; $t(135) = 5.19$, 95% CI_{diff} [15.41, 34.39], $p < .001$, *Cohen's d* = .97). Separate t-tests for each of the PPI-R factors revealed that self-centered impulsivity ($t(135) = 5.17$, $p < .001$, *Cohen's d* = .97) was significantly increased in the inmate sample, while fearless dominance ($p = .241$, *Cohen's d* = .22) and coldheartedness ($p = .113$, *Cohen's d* = .30) were not significantly different.

3.2. Relationship between fWHR and psychopathy scores

Second, we tested our prediction that psychopathy scores would be associated with fWHR within and across the two samples. As depicted in Fig. 1, fWHR was significantly positively correlated with PPI-R total for both the undergraduate student sample and the inmate sample alone, as well as across the whole sample, using Pearson product–moment correlations. These effects remained significant when the one individual with exceptionally large fWHR (see highest data point in Fig. 1) was removed from the analysis.

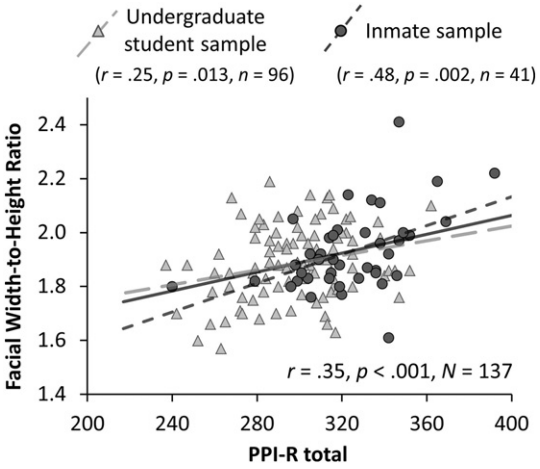

Fig. 1. Scatter plot depicting the bivariate relationship between PPI-R total scores and facial width-to-height ratio across the undergraduate student sample (light gray triangles) and the inmate sample (dark gray dots). The lines display linear trends for the whole sample (solid black line), the undergraduate student sample (light gray dashed line), and the inmate sample (dark gray dashed line).

To explore whether the degree of covariation between fWHR and psychopathy total scores was influenced by Sample Type (undergraduate students vs. inmates), we used multiple linear regression to predict PPI-R total from fWHR, Sample Type (as dummy variable), and the interaction term fWHR x Sample Type. Results showed that fWHR was the only significant predictor ($p = .001$; other *ps* > .232) in this regression model, $F(3133) = 15.78$, $p < .001$, $R^2 = .26$, so no moderating effect of Sample Type was found.

As a last step, to determine whether fWHR was specifically related to any of the psychopathic personality subfactors, we simultaneously predicted fWHR from fearless dominance, self-centered dominance, and coldheartedness, first within, and then across samples. As can be seen in Table 1, both fearless dominance and self-centered impulsivity were significant predictors of fWHR both across the whole sample and within the inmate sample, whereas these positive associations were not large enough to reach significance within the undergraduate student sample alone. To test whether this difference between the two samples was significant, we added Sample Type and the interaction terms Fearless Dominance × Sample Type, Self-centered Dominance × Sample Type, and Coldheartedness × Sample Type as predictors into the regression model. Fearless dominance ($p = .011$) and self-centered impulsivity ($p = .036$) remained the only significant predictors, $F(7129) = 3.26$, $p = .003$, $R^2 = .15$. While fearless dominance

Table 1
Results of the multiple linear regressions predicting facial width-to-height ratio (fWHR) from fearless dominance (PPI-FD), self-centered impulsivity (PPI-SCI), and coldheartedness (PPI-CH), split by sample type (top) and for the whole sample (bottom).

	PPI-FD (β_{stand})	PPI-SCI (β_{stand})	PPI-CH (β_{stand})	*F*	R^2
Undergraduate student sample	.10	.15	.16	2.17†	.07
Inmate sample	.37*	.31*	.19	4.64**	.27
Whole sample	.18*	.22**	.16†	6.24**	.12

* $p < .05$.
** $p < .01$.
† $p < .10$.