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A comparison of the manifestation of psychopathic traits between women with and without
Polycystic Ovary Syndrome (PCOS)

RUNNING TITLE

Polycystic Ovary Syndrome and psychopathy

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ABSTRACT

One popular school of thought posits that the development of both psychopathic personality and polycystic ovary syndrome (PCOS) may be underpinned, at least in part, by in utero elevations of testosterone. Although there is a large body of literature delineating the relationship between increased testosterone and the presence of psychopathic traits, psychopathic traits in women with PCOS has not been previously explored. In the current study, we compared self-reported psychopathic traits between 82 women with PCOS and 85 women without PCOS. Results showed that women with and without PCOS did not differ on measures of interpersonal manipulation, callous affect, erratic lifestyle, or anti-social behaviour. Our findings offer opposing evidence to the proposed relationship between testosterone and psychopathy, and are interpreted in the context of measurement limitations in PCOS as well as the absence of accurate indices of hormone levels. Results of this study will likely inform research into psychopathy in the general population and convey meaningful knowledge and impact for patients living with, and practitioners working with PCOS. The data file and pre-print of this paper is available here:

https://osf.io/54g9n/?view_only=be718f9a551d4a2fbb75a554e4108268

KEY WORDS

Testosterone; Interpersonal Manipulation; Anti-social behaviour; Androgens; Callousness

49 **1. Introduction**

50 Psychopathic personality, or psychopathy, is typically conceptualised by a constellation of
51 interpersonal, affective, and behavioural features such as superficial charm, callousness,
52 poor impulse control, and deficits in emotional empathy (Hare, 2003). As such, it is
53 unsurprising that a large body of research into psychopathy has been conducted in clinical
54 and forensic settings. Nevertheless, the presence of psychopathic traits in the general
55 population, and indeed their adaptive value and potential benefit, has been acknowledged
56 and well-documented (e.g., Skeem et al., 2011; Smith & Lillienfeld, 2013).

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58 Alongside other social and development dynamics, one potential risk factor for the
59 emergence of psychopathic behaviour is increased in utero exposure to testosterone (see
60 Yildirim & Derksen, 2012); a hormone released by the hypothalamic-pituitary-gonadal axis.
61 Testosterone is considered a biological marker of traits and behaviours associated with
62 psychopathy, such as deficits in empathy and emotional arousal (Helleday et al., 1993;
63 Josephs et al., 2006), as well as dominant, cold, and antisocial behaviour (Archer et al.,
64 2005; Eisenegger et al., 2011; Turan et al., 2014). Testosterone has also been associated
65 with psychopathic traits, specifically, with participants evidencing positive correlations
66 between testosterone and psychopathy after being asked to lie on film (Dane et al., 2018);
67 possibly indicative of enjoyment derived through deception. Moreover, a proxy measure of
68 foetal testosterone, the second-to-fourth digit ratio, was found to positively relate to scores
69 of psychopathy in females and callous affect in males (Blanchard & Lyons, 2010). In forensic
70 samples, increased levels of testosterone have been found in offenders characterised by
71 extreme violence and sexual deviancy (Aromäki et al., 1999; 2002; Räsänen et al., 1999), and
72 has further been associated with the presence of anti-social personality disorder and

psychopathy-related traits (Stålenheim et al., 1998). Further, and in the general population, increased testosterone predicted psychopathic traits in Glenn et al. (2011). However, this association was only evident as a function of low cortisol, and so potentially lends support to a proposed dual-hormone model of social behaviour whereby testosterone and cortisol are mutually inhibitive of each other (see Mehta & Prasad, 2015 for a review). Taken together, although this evidence presents a compelling argument for the relationship between testosterone and psychopathy, this association has yet to be explored in a sample characterised by a pre-disposition for increased testosterone.

Women with polycystic ovary syndrome (PCOS) are thought to be exposed to elevated levels of testosterone in utero (Ibáñez et al., 2000; Tehrani et al., 2014; Wu et al., 2010), and compared to women without the condition, are considered to have elevated levels of testosterone throughout adulthood (Sirmans & Pate, 2014). PCOS is thought to affect up to 20 per cent of women during their reproductive ages, dependant on the criteria used to diagnose the condition (Sirmans & Pate, 2014). PCOS is characterised by obesity, polycystic ovaries, hirsutism (male patterned hair growth), and male-patterned hair loss (Barry et al., 2011; Norman et al., 2007). As such, this population offers a unique opportunity to explore direct, testosterone-related differences in psychopathic traits.

To date, the authors are aware of only one study that has attempted to outline associations between PCOS and deviant personality traits (Gotby et al., 2015). Derived from a series of national registers, a large ($n = 12,730$) sample of Swedish women with PCOS were found to be at an increased risk for both violent and non-violent crime, relative to non-PCOS controls. Although this finding suggests a potential association between increased testosterone and

psychopathic-related traits in PCOS (i.e., anti-social behaviour), this research did not explicitly measure psychopathy and so did not contrast psychopathic traits in women with and without PCOS. As such, the aim of this study was to investigate differences in psychopathic-related traits (i.e., interpersonal manipulation, callous affect, erratic lifestyle, and anti-social behaviour) between women in the general population with (PCOS+) and without (PCOS-) a diagnosis of PCOS. Based on the existing, but limited research in this area, we hypothesised that women with PCOS would report higher levels of psychopathic traits (and subscales thereof) than women without PCOS.

2. Method

2.1. Subjects

To determine our target sample size, we conducted an a priori power analysis using G*Power (version 3.1.9.3). Assuming an anticipated medium effect size ($f^2 = .15$) and a standard alpha level of .05, the algorithm suggested that a minimum of 130 participants would be required to have 95% power in our planned analyses. We aimed to recruit a minimum of 200 participants (100 PCOS+, and 100 PCOS-). This oversampling accounted for potential missing data and participant withdrawals.

A total of 288 participants ($M_{age} = 31.32$, $SD = 8.34$) responded to an online advertisement distributed via social media. All participants were women aged 18 years or older. Inclusion criteria required participants to not currently be taking medication to change their gender, or as a means of treatment or contraception (e.g., the combined oral contraceptive pill). Participants were excluded if they reported a diagnosis of any current mental health condition (other than depression or anxiety) or any mental health condition requiring

hospitalisation over the previous 12 months. Participants provided written informed consent online in accordance with approved [REMOVED FOR REVIEW] research protocols (Ref: [REMOVED FOR REVIEW]) and British Psychological Society ethical guidelines (2017) both pre and post data collection. Participants were not reimbursed for their time.

2.2. Materials

2.2.1. Demographics and Health-based Questions

Participants were asked to self-report key demographic details as well as confirmation of any previous diagnosis of PCOS.

2.2.2. Self-Report Psychopathy III (SRP-III; Paulhus, Neumann, & Hare, 2009)

The SRP-III comprises 64 items that measure psychopathy-related personality traits, including interpersonal manipulation (16 items; e.g., “I purposely flatter people to get them on my side”; $\alpha = .81$), callous affect (16 items; e.g., “Most people are wimps”; $\alpha = .79$), erratic lifestyle (16 items; e.g., “I have taken illegal drugs (e.g., marijuana, ecstasy)”; $\alpha = .74$), and anti-social behaviour (16 items; e.g., “I have threatened people into giving me money, clothes, or makeup”; $\alpha = .82$). Each item is rated on a 5-point scale anchored from “Disagree Strongly” to “Agree Strongly”. Item responses are also summed to create a composite score ($\alpha = .81$). High scores indicated greater levels of psychopathy-related traits. Alpha coefficients derived from Paulhus et al. (2009) and coefficients for the current sample can be viewed in Table 2.

2.3. Procedures

Qualtrics survey software (www.qualtrics.com) was used to present participants with an online questionnaire. After consenting to take part in the research, participants entered their demographic information and stated whether or not they had a diagnosis of PCOS. Participants then completed the SRP-III, before being debriefed and asked to re-confirm their consent. On average, the study took less than 15 minutes to complete.

2.4. Statistical Analysis

Means and standard deviations were calculated for all demographic questions as well as sub-scale and total measures of psychopathy. Demographics were compared between PCOS+ and PCOS- groups using independent sample *t*-tests. In order to test differences in interpersonal manipulation, callous affect, erratic lifestyle, and anti-social behaviour, as well as total scores of psychopathy, between PCOS+ and PCOS- groups, a multivariate analysis of variance (MANOVA) was conducted.

3. Results

3.1. Data Cleaning

Of the 288 participants, 98 did not re-consent to allow their data to be used upon debrief (the majority of which, withdrew upon opening the demographic portion of the questionnaire). Of the remaining 190 participants, 11 did not complete key demographic information (preventing classification into PCOS+ or PCOS- groups) and a further 12 did not complete (i.e., > 5% missing data) the psychopathy measures. As such, these individuals were removed, leaving a final sample of 167 ($M_{\text{age}} = 30.95$, $SD = 8.82$ years, 84.4% UK (10.2% USA)). This final figure remains above the required sample of 130 participants.

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3.2. Demographic and Health Data

171 As shown in Table 1, women with PCOS were significantly older ($t(165) = 3.78, p = .001, d =$
 172 $.51$), weighed more ($t(165) = 6.99, p < .001, d = .22$), and in line with previous literature (Al-
 173 Azemi et al., 2004), had greater BMI scores ($t(165) = 7.01, p < .001, d = 1.08$) than women
 174 without PCOS. On average, height did not differ significantly between the two groups
 175 ($t(165) = 1.40, p = .162, d = 1.08$).

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Table 1. Means and standard deviations for demographic questionnaire data across PCOS+ and PCOS- groups.

	Total ($n = 167$)	PCOS+ ($n = 82$)	PCOS- ($n = 85$)	p
Age	30.95 ± 8.82	33.16 ± 7.29	28.81 ± 9.66	.001
Height (m)	$1.65 \pm .07$	$1.66 \pm .08$	$1.64 \pm .07$	.162
Weight (kg)	82.60 ± 26.14	95.28 ± 27.72	70.37 ± 17.36	< .001
BMI	30.33 ± 9.07	34.74 ± 9.82	26.08 ± 5.69	< .001

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3.3. Psychopathy Data

180 Cronbach's alpha coefficients, as well as means and standard deviations of psychopathic
 181 trait scores are shown in Table 2. Using a MANOVA, we found no statistically significant
 182 differences in psychopathy scores between PCOS+ and PCOS- groups ($F(4, 162) = .716, p =$
 183 $.582$; Wilk's $\Lambda = .983$, partial $\eta^2 = .017$). This finding remained after controlling for age ($F(4,$
 184 $161) = .615, p = .652$; Wilk's $\Lambda = .985$, partial $\eta^2 = .015$).

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Table 2. Means and standard deviations for psychopathic trait scores across PCOS+ and PCOS- groups.

	α	Total ($n = 167$)	PCOS+ ($n = 82$)	PCOS- ($n = 85$)
Interpersonal Manipulation	.85	36.55 $\pm$ 9.55	36.34 $\pm$ 9.71	36.75 $\pm$ 9.46
Callous Affect	.84	35.38 $\pm$ 9.32	35.61 $\pm$ 9.18	35.16 $\pm$ 9.50
Erratic Lifestyle	.83	40.04 $\pm$ 10.21	40.06 $\pm$ 10.39	40.01 $\pm$ 10.10
Anti-social Behaviour	.68	23.18 $\pm$ 6.51	23.87 $\pm$ 6.93	22.52 $\pm$ 6.05
Total SRP-III	.92	135.15 $\pm$ 29.10	135.88 $\pm$ 30.08	134.45 $\pm$ 28.04

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189 **4. Discussion**

190 This is the first study to investigate differences in psychopathic traits between women with
 191 and without a diagnosis of PCOS. With psychopathy and PCOS both thought to be
 192 underpinned, at least in part by in utero elevations of exposure to testosterone, the
 193 hypothesis that women with PCOS, relative to those women without PCOS would report
 194 higher rates of psychopathic traits was tested. Unexpectedly, results of this investigation
 195 suggested no differences between women who were and who were not diagnosed with
 196 PCOS in regards to psychopathy in general, or the distinct subscales thereof, more
 197 specifically.

198

199 One potential explanation for these observed results might be the use of a non-forensic
 200 sample, who are naturally expected to report lower levels of psychopathy, relative to
 201 offender populations. However, psychopathic traits are broadly distributed within the
 202 general population (Skeem et al., 2003), and relationships between testosterone and

psychopathy, or psychopathic-related traits, have been extensively delineated. Previously, increased levels of testosterone have been associated with low emotional arousal (Josephs et al., 2006) and antisocial behaviour as a function of increased sub-clinical manifestations of psychopathy (Blanchard & Centifanti, 2017). Moreover, increased levels of testosterone have been associated with psychopathic traits more specifically, in the context of a social stressor (Dane et al., 2018), when a proxy measure of testosterone was used (Blanchard & Lyons, 2010), and when testosterone was calculated as a ratio of testosterone to cortisol (Glenn et al., 2011).

Alternatively, as a large amount of existing literature into associations between testosterone and psychopathy has been conducted in male, rather than female cohorts, the purely female sample reported in this investigation may have contributed somewhat to the observed findings. Indeed, it is acknowledged that there is both a smaller prevalence of psychopathic traits in females compared to males (Verona & Vitale, 2006) and the manner by which said psychopathic traits and behaviours manifest might differ as a function of sex (Cale & Lillienfeld, 2002). However, not only have associations between testosterone and psychopathy been documented in women (Glenn et al., 2011, Roy et al., 2019), but there was no variation between PCOS+ or PCOS- groups across *any* of the facets of psychopathy, either affective (i.e., interpersonal manipulation, callous affect) or behavioural (i.e., erratic lifestyle, anti-social behaviour) in nature.

With psychopathy-related traits such as dominance, aggression, and risk-taking behaviour being consistently found to associate with increased testosterone when measures of cortisol were low (*see Mehta & Prasad, 2015 for a review*) the role of cortisol cannot be ruled out.

227 Interestingly however, when measuring psychopathic traits explicitly, the positive
228 relationships between testosterone and psychopathy documented in Welker et al. (2014)
229 and Roy et al. (2019) were only present in the context of high, not low, cortisol. Specifically,
230 the associations reported in Roy et al. held for the interpersonal manipulation, erratic
231 lifestyle, and antisocial, but not affective facets of psychopathy explored in the current
232 research. Although this reversal of the dual-hormone hypothesis might be explained by
233 social context (Mehta & Prasad, 2015) and the presence of high psychopathic traits (Welker
234 et al., 2014), there appears a lack of comprehensive understanding and reasoning for this
235 disparity. In the current study, although women with PCOS are considered to have higher
236 levels of baseline cortisol, relative to those without PCOS (Kondoh et al., 1999;
237 Tsilchoroziduo et al., 2005), no measure of cortisol was taken; a factor which needs to be
238 addressed in future investigations. Taken together, it is surprising that levels of psychopathy
239 in women with PCOS, a condition characterised by increased testosterone, did not differ
240 from those without PCOS.

241
242 This study is not without limitations. First, it did not measure direct levels of testosterone in
243 either PCOS+ or PCOS- groups. Instead, disparity in testosterone levels is inferred as a
244 function of having a clinical disorder associated with elevated levels of testosterone. Second,
245 although participation was restricted to individuals who were not actively taking combined
246 oral contraceptives (COCs), previously shown to reduce androgen levels (Costello et al.,
247 2007; Vrbíková & Cibula, 2005), we were not able to control for life course factors that may
248 have impacted testosterone. It is, however, considered that a diagnosis of PCOS represents a
249 more stable indication of testosterone than a single saliva- or blood-measurement, in line
250 with the sampling method used in Gotby et al. (2015). Further, although the exclusion of

women taking COCs was intended as a control measure, it cannot be ignored that such women may include those who experience symptoms reflective of higher levels of testosterone. As such, assessment of these individuals post-diagnosis, but pre-treatment, may benefit this body of research. Third, psychopathic traits were measured using only a single, self-report measure, which because of the potential negative connotations surrounding psychopathy, may be open to reporting-bias as a function of social desirability. Moreover, some items of the SRP-III (e.g., “I always plan out my weekly activities” and “I never miss appointments”) may neither be appropriate for PCOS individuals specifically, nor individuals with long-term conditions more generally. Such individuals learn to modify their lifestyle around diet, exercise, and treatment, and structure their weekly activities accordingly (Bates & Legro, 2015). Finally, this investigation sampled entirely from the general population. Assuming feasibility for future investigations to recruit large enough cohorts of PCOS+ and PCOS- women from forensic settings, it would be of interest to test the lack of difference observed here using more formal assessments of psychopathy (e.g., the Psychopathy Checklist – Revised; Hare, 2003).

In conclusion, our results indicate that levels of self-reported psychopathic traits do not differ between women with and without a diagnosis of PCOS in the general population. As such, these findings contradict existing research which suggests that psychopathy is associated with increases in testosterone. We propose that further studies should control for blood levels of both testosterone and cortisol in order to test the dual-hormone hypothesis in PCOS, and attempt to replicate findings reported here in forensic samples in order to fully understand the manifestation of psychopathy in PCOS.

275 **Contributors**

276 DF performed the analyses and wrote the first version of the manuscript. SW and IH
277 contributed knowledge and expertise to the design of the study. SW and DF assisted in data
278 collection. All authors contributed to the final manuscript and have approved its submission.

279

280 **Conflict of interest**

281 None.

282

283 **Ethical Standards**

284 The study was approved by a central university ethics committee. Data was collated and
285 anonymised, with all personally identifiable information destroyed thereafter. Informed
286 consent was obtained from all participants.

287

288 **Acknowledgement**

289 The researchers would like to acknowledge the time and commitment provided by the
290 participants in this study.

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