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Author for correspondence:
Carmen E. Lefevre
e-mail: carmenlefevre@me.com

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Animal behaviour

Facial width-to-height ratio predicts self-reported dominance and aggression in males and females, but a measure of masculinity does not

Carmen E. Lefevre[1], Peter J. Etchells[2], Emma C. Howell[3], Andrew P. Clark[4] and Ian S. Penton-Voak[3]

[1]Centre for Decision Research, Leeds University Business School, Leeds LS2 9JT, UK
[2]School of Society, Enterprise and Environment, Bath Spa University, Bath BA2 9BN, UK
[3]Department of Experimental Psychology, University of Bristol, Bristol BS8 1TU, UK
[4]Department of Psychology, Brunel University, Uxbridge UB8 3PH, UK

Recently, associations between facial structure and aggressive behaviour have been reported. Specifically, the facial width-to-height ratio (fWHR) is thought to link to aggression, although it is unclear whether this association is related to a specific dimension of aggression, or to a more generalized concept of dominance behaviour. Similarly, an association has been proposed between facial masculinity and dominant and aggressive behaviour, but, to date, this has not been formally tested. Because masculinity and fWHR are negatively correlated, it is unlikely that both signal similar behaviours. Here, we thus tested these associations and show that: (i) fWHR is related to both self-reported dominance and aggression; (ii) physical aggression, verbal aggression and anger, but not hostility are associated with fWHR; (iii) there is no evidence for a sex difference in associations between fWHR and aggression; and (iv) the facial masculinity index does not predict dominance or aggression. Taken together, these results indicate that fWHR, but not a measure of facial masculinity, cues dominance and specific types of aggression in both sexes.

1. Introduction

Observers readily attribute a variety of behaviours and personality traits on the basis of facial appearance [1,2], but relatively little research has addressed the validity of such inferences. The facial width-to-height ratio (fWHR) has been proposed as a metric that cues aggression; faces with higher fWHR are perceived as more aggressive [3,4]. Whether fWHR also associates with actual aggression is less clear. While several studies report these links [5–7], others fail to do so [8–10]. These equivocal behavioural results may indicate that fWHR is not associated specifically with aggression, but rather with a more general trait, such as dominance, that can manifest behaviourally as aggression [11]. Dominance may underlie a wider suite of status-enhancing behaviours, some of which have also been associated with high fWHR, including willingness to cheat and deceive in competitive settings [12,13], untrustworthy behaviour in economic games [14] and increased cooperation with the ingroup during intergroup competition [15]. Finally, achievement striving, a trait closely related to dominance, was positively linked to fWHR in US presidents [16]. In line with these results, testosterone is now commonly thought to relate to social dominance rather than aggression [17] and is associated with fWHR [18]. Additionally, almost no work to date has assessed whether there are links between facial appearance and aggression or dominance in

Table 1. Means and standard deviations for dominance and aggression measures, as well as for fWHR and the masculinity index for the whole sample and split by sex. Note that *t*-tests were performed to test for sex differences on each scale. Statistical significance in probability tests is indicated by asterisks.

	mean (s.d.)	males' mean (s.d.)	females' mean (s.d.)
dominance	32.09 (6.71)	34.44 (6.15)***	29.49 (6.38)
aggression	85.53 (24.36)	91.69 (23.62)**	78.76 (23.57)
physical aggression	23.77 (9.75)	26.89 (10.19)***	20.32 (8.03)
verbal aggression	19.44 (6.23)	21.28 (5.82)***	17.41 (6.08)
anger	19.30 (7.09)	19.59 (6.73)	18.98 (7.52)
hostility	23.03 (9.48)	23.93 (8.55)	22.04 (10.40)
fWHR	2.04 (0.15)	2.08 (0.17)*	2.01 (0.13)
masculinity index	0 (3.00)	1.18 (2.70)***	−1.30 (2.69)

***$p < 0.001$, **$p < 0.01$, *$p < 0.05$.

Table 2. Zero-order correlations between dominance and aggression measures. Statistical significance in probability tests is indicated by asterisks.

	1	2	3	4	5	6
dominance (1)						
aggression (2)	0.66***					
physical aggression (3)	0.45***	0.76***				
verbal aggression (4)	0.69***	0.66***	0.38***			
anger (5)	0.51***	0.80***	0.46***	0.48***		
hostility (6)	0.40***	0.75***	0.34***	0.30***	0.52***	

***$p < 0.001$.

women. Such links are conceivable, because increased aggression is perceived from both male and female high fWHR faces [3,4].

Facial masculinity has also been linked to perceived dominance [19,20] as well as testosterone [21,22], although evidence for the latter is equivocal, with several studies failing to find associations [23,24]. While some studies show links between perceived facial masculinity and physical strength [25,26], to the best of our knowledge, no work to date formally assesses whether dominant or aggressive behaviour is associated with measured facial masculinity. Additionally, although fWHR is argued not to be sexually dimorphic [9,27], it is inversely correlated with a general facial masculinity index [18], leading to conflicting predictions regarding associations with aggressive behaviour. Accordingly, here we investigated the association of fWHR and a facial masculinity index with self-report measures of dominance and aggression, using standardized photography to maximize signal-to-noise ratio in fWHR in a sample of men and women.

2. Material and methods

(a) Participants

One hundred and three participants (49 female, mean age = 21.59 years, range 18–30 years) took part. Ninety-eight participants self-identified as white, three as Chinese and two as Black-African. All were students at the University of Bristol and participated for course credit or payment.

(b) Facial measurements

Participants were photographed with neutral expression and standardized camera distance and angle, to minimize photographic artefacts. Following Stirrat & Perrett [14], fWHR was measured as the distance between the left and right boundary of the face (width) divided by the distance between the upper lip and the highest point of the eye-lid (height). The masculinity index was calculated following Pound *et al*. [21]: we measured five sexually dimorphic facial ratios: (i) lower face/whole-face-height, (ii) cheek-bone prominence, (iii) face-width/lower face-height, (iv) mean eyebrow height and (v) eye size. These ratios were then *z*-transformed, aligned such that positive values indicated more masculinity, and summed to create the masculinity index.

(c) Dominance and aggression measures

Dominance and aggression were measured using established self-report scales, the 11-item dominance subscale of the IPIP (http://ipip.ori.org/ipip/; [28]) and the Buss–Perry Aggression Questionnaire (BPAQ [29]).

3. Results

Descriptive statistics for the dominance and aggression scales are presented in table 1. The correlations between the scales can be found in table 2.

Table 3. Zero-order and partial correlations between fWHR, the facial masculinity index and dominance and aggression measures for the whole sample and split by sex. Statistical significance in probability tests is indicated by asterisks.

	fWHR all	fWHR males	fWHR females	masculinity index all (contr. sex)	masculinity index males	masculinity index females
dominance	0.29**	0.29*	0.12	0.05	−0.04	0.16
aggression	0.28**	0.27*	0.17	−0.04	−0.18	0.12
physical aggression	0.20*	0.10	0.19	0.08	−0.00	0.20
verbal aggression	0.31**	0.22	0.31*	−0.08	−0.15	−0.02
anger	0.28**	0.37**	0.17	−0.03	−0.15	0.10
hostility	0.09	0.19	−0.06	−0.09	−0.26	0.06
fWHR all	—	—	—	−0.34***	—	—
fWHR males	—	—	—	—	−0.53***	—
fWHR females	—	—	—	—	—	−0.46***

***$p < 0.001$, **$p < 0.01$, *$p < 0.05$.

fWHR was positively correlated with both self-reported dominance and aggression (table 3). Assessing the subscales of BPAQ indicated that physical aggression, verbal aggression and anger were all positively correlated with fWHR but hostility was not. Subsequent sex splits show that for males, dominance, aggression and the anger subscale of the BPAQ were significantly correlated with fWHR. For females, only the verbal aggression subscale significantly correlated with fWHR, although it is noteworthy that in the female sub-sample all correlations were in the same (positive) direction as in the overall sample. Subsequent linear regression analyses testing for fWHR × sex interactions showed no significant interactions for any of the dominance or aggression variables (all $p \geq 0.27$), indicating no sex-specific effects of fWHR.

BMI has been shown to correlate with fWHR [11,30] and may implicate behavioural associations. Here, we find no association between BMI and fWHR ($r = 0.09$, $p = 0.35$) but BMI was significantly positively correlated with dominance ($r = 0.22$, $p = 0.03$). We therefore re-ran correlation between fWHR and dominance controlling for BMI. Results remained virtually unchanged (all: $r = 0.27$, $p = 0.005$; males: $r = 0.27$, $p = 0.04$; females: $r = 0.15$, $p = 0.32$).

The masculinity index was negatively correlated with fWHR ($r = -0.34$, $p < 0.001$) but showed no correlations with either dominance or aggression after controlling for sex in the whole sample or when splitting by sex (table 3).

4. Discussion

fWHR has been proposed as a cue to aggression. Here, we show clear links between fWHR and self-reported aggression in both men and women as well as associations with dominance in men. Although previous work has demonstrated perceptual links between aggression and fWHR in women [3,4], this is the first study to show behavioural associations in females. The facial masculinity index was not related to either dominance or aggression, indicating that fWHR specifically, but not facial masculinity, is an indicator of dominant/aggressive behaviour. These results are in line with recent findings showing a link between circulating testosterone levels and fWHR but not masculinity in men [18] and other work that has demonstrated associations between testosterone and status-striving behaviour in both men and women [17]. It is, however, unclear what function increased fWHR has in more aggressive individuals. One explanation might be that larger, stronger zygoma are better able to withstand fracture from blows to the head, which may, in turn, be more likely to occur in more aggressive individuals. Indeed, zygomatic fractures are the second most common facial fractures, are predominantly observed in young men and are almost always caused by assault [31].

Some previous studies have not found associations between the BPAQ and fWHR [8,10]. The reason for these discrepancies is unclear. Özener's [8] study was conducted in Turkey and it is thus possible that cultural differences may have affected responses to the BPAQ. In the case of Carré *et al.*'s study [10], it is possible that the small sample size was masking effects that would have otherwise emerged. The current paper is also limited by its modest sample size, which may specifically hide relatively smaller effect sizes in the female dataset. Post-hoc power analyses indicated that we were powered above 80% to detect effect sizes of 0.25 in the whole sample and at 59% and 55%, respectively, for the male and the female sub-sample. It is noteworthy that the apparent sexual dimorphism of fWHR in the current sample runs contrary to some previous work ([8,27], but see [3]). The mean difference observed here is small (mean difference = 0.07) and similar to those seen in the opposite direction (i.e. females having higher fWHR) in other samples [27]. Additionally, the standard deviations are comparable to those in other samples [27], indicating that the current sample is similar to others and adequately represents the population.

In sum, we demonstrate that fWHR but not facial masculinity is linked to self-reported aggression in both men and women, as well as dominance in men. These results indicate that fWHR is a valid cue to dominance behaviours, including aggression, while masculinity (at least as measured here) is not.

Ethics statement. This study was approved by the Faculty of Science Human Research Ethics Committee at the University of Bristol.

Data accessibility. Data files in the electronic supplementary material.

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