



Short Communication

Handgrip strength and the Big Five personality factors in men and women

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ABSTRACT

Physical strength correlates with facial and body morphology, body movement, and sexual behavior, especially in men. Thus, physical strength may signal male quality in the context of intersexual and intrasexual selection. We investigated relationships of handgrip strength (a measure of upper body muscularity) and personality (as assessed via the “Big Five” factors) in a sample of British men ($n = 75$) and women ($n = 86$), aged 18 to 42 years. Handgrip strength correlated negatively with neuroticism and positively with extraversion in men, and negatively with agreeableness in women. The relationship of handgrip strength and neuroticism in men remained after controlling for the influence of age and body mass index. We conclude that handgrip strength provides information about male neuroticism. We discuss our findings with reference to recent reports on male quality correlates of strength.

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1. Introduction

Handgrip strength (HGS)—a reliable index of physical strength (Vaara et al., 2012; Wind, Takken, Helders, & Engelbert, 2010)—is sexually dimorphic (Hoffman, Stauffer, & Jackson, 1979) and heritable in men. In a study of men aged 59 to 69 years, Reed, Fabsitz, Selby, and Carmelli (1991) estimated heritability of 0.65 for HGS, even after controlling statistically for weight, height, and age. The variability of HGS among men increases with age (Chandrasekaran, Ghosh, Prasad, Krishnan, & Chandrashaarma, 2010), and Isen, McGue, and Iacono (2014) reported that 80% of this variance is attributable to genetic variance. Fink, Thanzami, Seydel, and Manning (2006) found that the ratio of the second to fourth finger—a proxy of prenatal exposure to testosterone—is negatively correlated with HGS in men, but not women. These findings suggest that physical strength in men is attributable in part to sex-influenced genetic expression (see also Frederiksen et al., 2002).

Men with greater HGS experience lower risk of disability (Giampaoli et al., 1999), have greater bone mineral density (Chan et al., 2008; Kritz-Silverstein & Barrett-Connor, 1994), and live longer (Laukkanen, Heikkinen, & Kauppinen, 1995; Rantanen et al., 2000). Thus, male physical strength is associated with positive health outcomes. Physically stronger men have more sexual partners (Gallup, White & Gallup, 2007) and women rate the faces of physically stronger men to be

more attractive (Fink, Neave, & Seydel, 2007) and more formidable (Sell, Tooby, & Cosmides, 2009). Physical strength is related to male facial features that women perceive as masculine and dominant (Windhager, Schaefer, & Fink, 2011). Moreover, Sell, Cosmides, et al. (2009) showed that both men and women accurately assess male physical strength from body morphology and vocal cues (Sell et al., 2010). Men's HGS predicts women's ratings of their dance attractiveness (Hugill, Fink, & Neave, 2009; McCarty, Hönekopp, Neave, Caplan, & Fink, 2013), a relationship not replicated for men rating women (Weege, Pham, Shackelford, & Fink, 2015). Together these findings suggest that HGS is an honest indicator of male fitness.

Research investigating men's HGS and sensation-seeking suggests that these strength–quality relationships may extend to men's personality. Fink, Hamdaoui, Wenig, and Neave (2010) examined the association of HGS with sensation seeking (assessed via the Sensation Seeking Scale Form V; SSS-V) among 117 men aged 18 to 30 years. HGS showed positive relationships with the SSS-V total score and the thrill and adventure seeking (TAS) subscale, corroborating the suggestion that physically stronger men not only exhibit masculine physical but also social characteristics desired by women (Gallup, White & Gallup, 2007; Frederick & Haselton, 2007). However, Sell, Tooby, et al. (2009) argue that because physically stronger men experience anger more easily and quickly, feel entitled to better treatment, and are more aggressive, they may use their physical strength to secure benefits by inflicting violence on others. Thus, men's personality may reflect their propensity to participate in activities that honestly advertise that strength (e.g., combat, dance) and, therefore, their quality.

The current research explored the relationships between HGS and broad domains of personality (i.e., the Big Five factors; Costa

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& McCrae, 1985, 1992) in men and women. Given that most HGS correlates in samples from post-industrial societies have been reported for men, including relationships with pro-social traits (Lukaszewski & Roney, 2011), we expected to detect larger associations for men than for women.

2. Materials and methods

We recruited 75 heterosexual men and 86 heterosexual women from the student population at Northumbria University (U.K.) as part of a larger-scale project on body movement and anthropometric and personality characteristics (Fink, Weege, Neave, Ried, & do Lago, 2014; Hufschmidt et al., 2015; Weege, Barges, Pham, Shackelford, & Fink, 2015; Weege, Pham, et al., 2015). Handgrip strength (HGS; kgf) was measured with a hand dynamometer (Takei Kiki Kogyo K.K., Japan), twice for each hand, and the grand mean of the two left and two right HGS measurements was used in the analysis. Body height (cm) and weight (kg) were measured to calculate body mass index (BMI = mass (kg)/height (m)²) – a correlate of HGS (Chandrasekaran et al., 2010) and personality (Vainik, Dagher, Dubé, & Fellows, 2013). Participants reported their age and sexual orientation, and completed the 60-item NEO-FFI personality inventory, widely used to measure the five major dimensions of adult personality (neuroticism, extraversion, openness to experience, conscientiousness and agreeableness; Costa & McCrae, 1985, 1992). Test scores for each dimension range from 0 to 4.

3. Results

Table 1 reports descriptive statistics for age, BMI, HGS and personality measures for the total sample, and men and women separately. There were sex differences for BMI, HGS, neuroticism, and agreeableness. Men had higher BMI and were physically stronger than women. Women scored higher on neuroticism and agreeableness. Zero-order correlations (Pearson *r*, two-tailed) revealed negative relationships of HGS with neuroticism and positive relationships of HGS with extraversion for the total sample and for men. Negative relationships of HGS with agreeableness were detected for the total sample and for women. See Table 2

There were positive correlations of age with openness for the total sample ($r = .18, p = .023$) and for women ($r = .27, p = .011$). BMI correlated positively with HGS ($r = .37, p = .001$) and negatively with agreeableness ($r = -.19, p = .016$) for the total sample. BMI was positively correlated with HGS in both men ($r = .30, p = .010$) and women ($r = .31, p = .003$). We therefore re-calculated the relationships of HGS with personality scores, controlling for the influence of age and BMI. We next report these partial correlations.

HGS correlated negatively with neuroticism ($r_p = -.36, p = .001$) for the total sample and for men ($r_p = -.40, p = .001$) and negatively with agreeableness ($r_p = -.22, p = .045$) for women. The relationships of HGS and neuroticism for men remained after Bonferroni correction (p set to .01), but the correlation of HGS with agreeableness for women failed to reach significance. Additional regression analyses with personality measures as dependent variables and age, BMI, and

Table 2

Correlations of handgrip strength (HGS) with self-reported personality scores in men ($n = 75$) and women ($n = 81$).

	Total	Men	Women
Neuroticism	-.32**	-.29*	-.11
Extraversion	.18*	.23*	.14
Openness	-.01	.09	-.03
Agreeableness	-.26**	-.11	-.21*
Conscientiousness	-.03	.07	.07

** $p < .001$.

* $p < .05$.

HGS as predictors revealed a significant model for neuroticism for men ($F = 6.22, p = .001$; age: $\beta = -.27, p = .015$, BMI: $\beta = .31, p = .015$, HGS: $\beta = -.41, p = .001$). None of the regression models were significant for women.

4. Discussion

The results of the present study suggest that HGS is related to male personality, and to neuroticism, in particular. Physically stronger men are less neurotic and this relationship remains after controlling for BMI. HGS and BMI predict neuroticism. A negative relationship between HGS and agreeableness in women did not remain after Bonferroni correction.

The current research demonstrates a relationship between neuroticism and male quality (i.e., HGS). Recent research on associations of personality and fertility in a Norwegian sample reported a negative relationship of fertility with neuroticism in men and a positive relationship of fertility with extraversion in both sexes (Skirbekk & Blekesaune, 2014) – findings in line with results generated from analyses of 15,729 men and women from the Wisconsin Longitudinal Study (Jokela, Alvergne, Pollet, & Lummaa, 2011). Skirbekk and Blekesaune (2014) conclude that personality may be more important for male than for female fertility. Neuroticism may lower male fertility by decreasing the probability of being partnered, perhaps by inhibiting career-advancement goals (Judge, Ilies, Bono, & Gerhardt, 2002).

Von Rueden, Lukaszewski, and Gurven (2015) argue that physical strength relates to pro-social leadership orientation (PLO) – a combination of low neuroticism and high extraversion/openness/agreeableness – such that greater strength calibrates individuals toward higher PLO. The authors argue that strength-PLO relationships should be stronger in men, although no sex difference was found in an indigenous sample (the Tsimane of the Bolivian Amazon). Although there is a discrepancy between this and related research in post-industrial societies (e.g., Lukaszewski & Roney, 2011), the evidence suggests that physical strength also provides information on male quality in Western societies.

Fink et al. (2014) demonstrated that men's HGS is negatively correlated with fluctuating asymmetry, a measure of developmental health. Healthier men may benefit from high testosterone (e.g., developing greater muscularity and HGS) while better resisting its immunosuppressive effects. Isen et al. (2014) suggested a stronger genetic component in the

Table 1

Descriptive statistics for age, body-mass index (BMI), handgrip strength (HGS) and self-reported personality scores in men ($n = 75$) and women ($n = 81$).

	Total	Men	Women	t	p
	Mean (SD)	Mean (SD)	Mean (SD)		
Age	21.19 (4.01)	21.76 (4.09)	20.69 (3.90)	1.70	.090
BMI	23.77 (3.73)	24.68 (3.81)	22.98 (3.50)	2.96	.004
HGS	29.78 (10.05)	37.33 (8.60)	23.21 (5.62)	12.45	.001
Neuroticism	1.69 (0.64)	1.52 (0.61)	1.84 (0.62)	-3.32	.001
Extraversion	2.74 (0.47)	2.77 (0.51)	2.72 (0.44)	0.72	.472
Openness	2.31 (0.56)	2.28 (0.59)	2.34 (0.55)	-0.64	.526
Agreeableness	2.52 (0.46)	2.42 (0.47)	2.61 (0.43)	-2.73	.007
Conscientiousness	2.51 (0.56)	2.45 (0.57)	2.57 (0.55)	-1.41	.161

development of HGS in men, which may explain why we did not detect robust relationships between HGS and personality in women. Isen et al. further suggested that androgen-mediated mechanisms might affect the development of HGS in men, which is consistent with reports identifying negative relationships between HGS and 2D:4D ratio for men, but not women (Fink et al., 2006; Hone & McCullough, 2012).

Male quality is a composite of interrelated components that women find attractive, and HGS may be one such component. Previous research documented that men's HGS is positively associated with sensation seeking, and the present study identified a negative relationship of men's HGS with neuroticism. Women prefer as mates men who display sensation seeking and low neuroticism. Although risk-taking behavior may be positively related to physical condition, the current research suggests that neuroticism is negatively related to physical condition.

Weege, Barges, et al. (2015) found that women rated the dance of more neurotic men to be unattractive, and suggested that women might be sensitive to neuroticism cues when rating attractiveness. A similar suggestion was offered for attractiveness ratings of faces and bodies (Grammer et al., 2001), corroborating the idea that attractiveness assessments of male quality are designed to motivate avoiding prospective partners who display traits that portend cost-infliction. This hypothesis is speculative and awaits empirical testing. Likewise, the present study is correlational, rendering premature strong statements of causality. However, this study may inform experimental research that can identify the causes and consequences of strength-personality relationships.

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References

- Chan, D.C.C., Lee, W.T.K., Lo, D.H.S., Leung, J.C.S., Kwok, A.W.L., & Leung, P.C. (2008). Relationship between grip strength and bone mineral density in healthy Hong Kong adolescents. *Osteoporosis International*, 19, 1485–1495.
- Chandrasekaran, B., Ghosh, A., Prasad, C., Krishnan, K., & Chandrashaarma, B. (2010). Age and anthropometric traits predict handgrip strength in healthy normals. *Journal of Hand and Microsurgery*, 2, 58–61.
- Costa, P.T., & McCrae, R.R. (1985). *The NEO personality inventory manual*. Odessa, FL: Psychological Assessment Resources, Inc.
- Costa, P.T., & McCrae, R.R. (1992). *Revised NEO Personality Inventory (NEO-PI-R) and the NEO Five-Factor Inventory (NEO-FFI): Professional manual*. Odessa, FL: Psychological Assessment Resources, Inc.
- Fink, B., Hamdaoui, A., Wenig, F., & Neave, N. (2010). Hand-grip strength and sensation seeking. *Personality and Individual Differences*, 49, 789–793.
- Fink, B., Neave, N., & Seydel, H. (2007). Male facial appearance signals physical strength to women. *American Journal of Human Biology*, 19, 82–87.
- Fink, B., Thanzami, V., Seydel, H., & Manning, J.T. (2006). Digit ratio (2D:4D) and hand grip strength in German and Mizos men: Cross-cultural evidence for an organizing effect of prenatal testosterone on strength. *American Journal of Human Biology*, 18, 776–782.
- Fink, B., Weege, B., Neave, N., Ried, B., & do Lago, O.C. (2014). Female perception of male body movement. In V.A. Weekes-Shackelford, & T.K. Shackelford (Eds.), *Evolutionary perspectives on human sexual psychology and behavior* (pp. 299–324). Berlin: Springer.
- Frederick, D.A., & Haselton, M.G. (2007). Why is muscularity sexy? Tests of the fitness indicator hypothesis. *Personality and Social Psychology Bulletin*, 33, 1167–1183.
- Frederiksen, H., Gaist, D., Petersen, H.C., Hjelmborg, J., McGue, M., Vaupel, J.W., et al. (2002). Hand grip strength: a phenotype suitable for identifying genetic variants affecting mid- and late-life physical functioning. *Genetic Epidemiology*, 23, 110–122.
- Giampaoli, S., Ferrucci, L., Cecchi, F., Lo Noce, C., Poce, A., Dima, F., ... Menotti, A. (1999). Hand-grip strength predicts incident disability in non-disabled older men. *Age and Ageing*, 28, 283–288.
- Grammer, K., Fink, B., Jütte, A., Ronzal, G., & Thornhill, R. (2001). Female faces and bodies: n-dimensional feature space and attractiveness. In G. Rhodes, & L. Zebrowitz (Eds.), *Advances in Visual Cognition. Facial Attractiveness, Volume I*. (pp. 97–125). Ablex Publishing.
- Hoffman, T., Stauffer, R.W., & Jackson, A.S. (1979). Sex differences in strength. *American Journal of Sports Medicine*, 7, 265–267.
- Hone, L.S.E., & McCullough, M.E. (2012). 2D:4D ratios predict hand grip strength (but not handgrip endurance) in men (but not in women). *Evolution and Human Behavior*, 33, 780–789.
- Hufschmidt, C., Weege, B., Röder, S., Pisanski, K., Neave, N., & Fink, B. (2015). Physical strength and gender identification from dance movements. *Personality and Individual Differences*, 76, 13–17.
- Hugill, N., Fink, B., & Neave, N. (2009). Men's physical strength is associated with women's perceptions of their dancing ability. *Personality and Individual Differences*, 14, 527–530.
- Isen, J., McGue, M., & Iacono, W. (2014). Genetic influence on the development of grip strength in adolescence. *American Journal of Physical Anthropology*, 154, 189–200.
- Jokela, M., Alvergne, A., Pollet, T.V., & Lummaa, V. (2011). Reproductive behavior and personality traits of the Five Factor model. *European Journal of Personality*, 25, 487–500.
- Judge, T., Ilies, R., Bono, J., & Gerhardt, M. (2002). Personality and leadership: A qualitative and quantitative review. *Journal of Applied Psychology*, 87, 765–780.
- Kritz-Silverstein, D., & Barrett-Connor, E. (1994). Grip strength and bone mineral density in older women. *Journal of Bone and Mineral Research*, 9, 45–51.
- Laukkanen, P., Heikkinen, E., & Kauppinen, M. (1995). Muscle strength and mobility as predictors of survival in 75–84-year-old people. *Age and Ageing*, 24, 468–473.
- Lukaszewski, A.W., & Roney, J.R. (2011). The origins of extraversion: Joint effects of facultative calibration and genetic polymorphism. *Personality and Social Psychology Bulletin*, 37, 409–421.
- McCarty, K., Hönekopp, J., Neave, N., Caplan, N., & Fink, B. (2013). Male body movements as a possible cue to physical strength: A biomechanical analysis. *American Journal of Human Biology*, 25, 307–312.
- Rantanen, T., Harris, T., Leveille, S.G., Visser, M., Foley, D., Masaki, K., & Guralnik, J.M. (2000). Muscle strength and body mass index as long-term predictors of mortality in initially healthy men. *Journals of Gerontology. Series A, Biological Sciences and Medical Sciences*, 55, 168–173.
- Reed, T., Fabsitz, R.R., Selby, J.V., & Carmelli, D. (1991). Genetic influences and grip strength norms in the NHLBI twin study males aged 59–69. *Annals of Human Biology*, 18, 425–432.
- Sell, A., Cosmides, L., Tooby, J., Sznycer, D., von Rueden, C., & Gurven, M. (2009b). Human adaptations for the visual assessment of strength and fighting ability from the body and face. *Proceedings B: Biological Sciences*, 276, 575–584.
- Sell, A., Tooby, J., & Cosmides, L. (2009a). Formidability and the logic of human anger. *Proceedings of the National Academy of Sciences*, 106, 15073–15078.
- Sell, A., Bryant, G.A., Cosmides, L., Tooby, J., Sznycer, D., von Rueden, C., ... Gurven, M. (2010). Adaptations in humans for assessing physical strength from the voice. *Proceedings B: Biological Sciences*, 277, 3509–3518.
- Skirbekk, V., & Blekesaune, M. (2014). Personality traits increasingly important for male fertility: Evidence from Norway. *European Journal of Personality*, 28, 521–529.
- Vaara, J.P., Kyröläinen, H., Niemi, J., Ohrankämmen, O., Häkkinen, A., Kocay, S., & Häkkinen, K. (2012). Associations of maximal strength and muscular endurance test scores with cardiorespiratory fitness and body composition. *Journal of Strength and Conditioning Research*, 26, 2078–2086.
- Vainik, U., Dagher, A., Dubé, L., & Fellows, L.K. (2013). Neurobehavioural correlates of body mass index and eating behaviours in adults: A systematic review. *Neuroscience and Biobehavioral Reviews*, 37, 279–299.
- Von Rueden, C.R., Lukaszewski, A.W., & Gurven, M. (2015). Adaptive personality calibration in a human society: Effect of embodied capital on prosocial traits. *Behavioral Ecology*, 26, 1071–1082.
- Weege, B., Barges, L., Pham, M.N., Shackelford, T.K., & Fink, B. (2015a). Women's attractiveness perception of men's dance movements in relation to self-reported and perceived personality. *Evolutionary Psychological Science*, 1, 23–27.
- Weege, B., Pham, M.N., Shackelford, T.K., & Fink, B. (2015b). Physical strength and dance attractiveness: Further evidence for an association in men, but not in women. *American Journal of Human Biology*, 27, 728–730.
- Gallup, A.C., White, D.D., & Gallup, G.G. (2007). Handgrip strength predicts sexual behavior, body morphology, and aggression in male college students. *Evolution and Human Behavior*, 28, 423–429.
- Wind, A.E., Takken, T., Helder, P.J., & Engelbert, R.H. (2010). Is grip strength a predictor for total muscle strength in healthy children, adolescents, and young adults? *European Journal of Paediatrics*, 169, 281–287.
- Windhager, S., Schaefer, K., & Fink, B. (2011). Geometric morphometrics of male facial shape in relation to physical strength and perceived attractiveness, dominance and masculinity. *American Journal of Human Biology*, 23, 805–814.