Personality and Individual Differences 70 (2014) 136–139

Contents lists available at ScienceDirect

Personality and Individual Differences

journal homepage: www.elsevier.com/locate/paid

2D:4D digit ratio predicts depression severity for females but not for males

Kerrie D. Smedley *, Kayla J. McKain, Devon N. McKain

Lebanon Valley College, United States

ARTICLE INFO

Article history:
Received 26 March 2014
Received in revised form 23 June 2014
Accepted 24 June 2014
Available online 20 July 2014

Keywords:
Digit ratio
Depression
Sex differences
2D:4D

ABSTRACT

Depression affects at least twice the number of women than men. This difference appears to be relatively consistent across a wide range of cultures, with an average female to male ratio of 2:1 (Immerman & Mackey, 2003). Explanations of this sex difference have focused on hormones, the role that early traumas such as sexual abuse play in predisposing females to depression, and socialization influences (Nolen-Hoeksema, 1998). Digit ratio (2D:4D index to ring finger) is a well-established sexually dimorphic trait in humans, with females having a higher ratio than males (Martin, Manning, & Dowrick, 1999). This trait, stable across the lifetime, has been correlated with many other sexually dimorphic traits (Austin, Manning, McInroy, & Matthews, 2001). Previous research has shown contradictory results regarding whether depression is associated with a more masculine digit ratio or a more feminine digit ratio. The purpose of this study was to further investigate whether digit ratio is predictive of severity of depression. Results indicated that higher digit ratio is correlated with higher depression scores in females, but not males. Study limitations and further directions are considered.

1. Introduction

The experiences of depression and depression-related disability fall disproportionately on women. According to a large epidemiological study, depression is approximately twice as common among women compared to men (Robins & Regier, 1991). The National Comorbidity Survey (NCS; Kessler, McGonagle, Swartz, Blazer, & Nelson, 1993) further indicated that the lifetime prevalence rate for major depressive disorders is approximately twice as high among women compared to men (21.3% vs. 12.7%, respectively). A replication of the NCS produced similar findings that depression rates are twice as high in women than men (Kessler et al., 2003).

The striking sex difference in depression exists across most of the lifespan and across cultures. In childhood, depression rates are similar for girls and boys; the twofold increase in depression risk for women begins at puberty and continues across the rest of the lifespan (e.g. Kovacs, Obrowksy, & Sherrill, 2003). The higher rate of depression for women appears to be relatively consistent across a wide variety of cultures. For example, citing evidence from 43 nations, Immerman and Mackey (2003) reported that in all but one country, there was a greater frequency of depression among women than men. Similar to other studies, the results of that study also revealed a 2:1 female to male ratio of depression. Depression is the leading cause of disability among women worldwide; understanding why is a critical public health issue (Murray & Lopez, 1996).

Explaining the sex difference in depression has been a major effort among researchers over the past several decades. Attention has been focused on a variety of factors, and a full review is beyond the scope of this paper. However, the current evidence points to a complex interplay of biological vulnerability and environmental factors. For example, depressed individuals often display an exaggerated hypothalamic pituitary adrenal (HPA) axis response to stress, including the presence of elevated cortisol levels. The etiology of dysregulated HPA axis response is debated but likely due in part to genetic factors (e.g. Jokinen & Nordström, 2009). Furthermore, it is increasingly clear that early experiences with stress, such as domestic violence and sexual abuse, may prime emotional reactions and generate a greater sensitivity toward future stress and subsequent depression. Those early stressful events, more common for women, also make them more vulnerable to depression (Nolen-Hoeksema, 1998).

Evidence for direct effects of hormones on depression is limited and contradictory. For example, depression in women often occurs in response to hormonal changes associated with the postpartum

* Corresponding author. Address: Lebanon Valley College, Department of Psychology, 287C Lynch Memorial Hall, Annville, PA 17003, United States. Tel.: +1 (717) 867 6194.
E-mail address: smedley@lvc.edu (K.D. Smedley).

http://dx.doi.org/10.1016/j.paid.2014.06.039
0191-8869/

period or during the premenopausal period, and estrogen treatment is generally associated with improvements on depression scores for premenopausal and postmenopausal women (Walf & Frye, 2006). However, the role of testosterone is less clear. In one study, women who were being treated for depression showed higher blood concentrations of testosterone than non-depressed controls (Baischer, Koinig, Hartmann, & Langer, 1995). In another study, women with premenstrual dysphoric disorder (PMDD) had higher levels of testosterone during the luteal phase of their cycles – when depression symptoms are highest – compared to controls (Dunn, Macdougall, Coote, & Steiner, 2001). Some research has found low levels of testosterone to be associated with higher risk for depression symptoms in women. For example, Giltay et al. (2012) examined salivary testosterone levels in men and women, and reported that levels were lower among female participants who had a depressive disorder. That pattern was not found for the male participants. Furthermore, testosterone treatment has been found in some studies to improve depression symptoms for women (e.g. Miller et al., 2009; Shifren et al., 2000).

Several other studies have investigated the relationship between testosterone and depression in men. For example, Seidman et al. (2002) reported that older men with chronic depression (dysthymia) showed higher testosterone levels compared to men without depression symptoms and those with major depressive disorder. The authors note that the dysthymic group in the study had symptoms of depression much longer than the group with major depression (15 years compared to one year), and that this chronicity may have resulted in greater effects on the HPA axis. Other studies have generally pointed to the conclusion that lower testosterone is a risk factor for male depression. For example, men with hypogonadism have decreased testosterone levels, and are significantly more at risk for depression compared to men with normal levels of androgens (Shores et al., 2004); depression also improves with testosterone replacement (Wang et al., 1996).

One of the challenges of understanding the relationship between hormones and depression involves the multilevel influences of hormones. For example, current circulating testosterone can be measured using salivary, urinary, or blood samples. However, levels of testosterone vary across the menstrual cycle and even over the course of a day, making measurement at one time unreliable (e.g. Hall Moran et al., 2001). Furthermore, salivary measures of testosterone are not consistently predictive of blood levels, especially for women (e.g. Granger, Shirtcliff, Booth, Kivlighan, & Schwartz, 2004). In addition, the role of hormones in prenatal development is organizational; the effect is on the structure of the developing nervous system. Thus, it is important to differentiate between hormone effects that are organizational during prenatal development versus those that involve activational effects later in life.

2. Digit ratio as a sexually dimorphic trait

Digit ratio is a phenotypic characteristic trait that is used to represent the relationship between prenatal androgen exposure and sexually dimorphic behaviors (Evardone & Alexander, 2009). According to Manning (2002) research over that past 100 years with primarily Caucasian individuals has shown that men are more likely to have fourth digits longer than their second digits, whereas women tend to have second digits longer than fourth digits. Levels of testosterone and estrogen are associated with 2D:4D finger lengths, with males having lower mean values than females (Fink, Manning, & Neave, 2004). It has been well established that 2D:4D ratios are present in a human embryo in just the seventh week of pregnancy (Manning, 2002). Additionally, evidence suggests that in both males and females, digit ratio acts as an indicator of the level of testosterone the developing fetus was exposed too, making it a useful indirect measure of organizational prenatal hormone exposure (Austin, Manning, McInroy, & Matthews, 2001). Some research indicates that 2D:4D ratio may also be an indicator of perinatal androgen action, whereby lower digit ratios predict greater androgen sensitivity (e.g. McIntyre, 2006).

In general, a smaller digit ratio has been associated with male-dominant disorders, while larger digit ratios have been associated with female-dominant disorders (Putz, Gaulin, Sporter, & McBurney, 2004). Given that depression is a strongly sexually dimorphic trait, it is reasonable to expect 2D:4D ratios to be related to depression. However, results to date have been inconsistent. For example, Martin, Manning, and Dowrick (1999) expected lower 2D:4D to be associated with increased risk of depression in men. They tested a sample of 102 community-dwelling individuals (52 men and 50 women). Results showed a negative but nonsignificant trend, indicating that men with higher organizational testosterone may be more depressed. However, using a larger sample comprised of 298 college students (149 males and 149 females), Bailey and Hurd (2005) found that more feminine ratios were associated with higher depression in men. They found no correlation between 2D:4D and depression in women. This study produced the unusual finding of no sex difference in depression, although digit ratios did differ in the expected direction. As such, it remains unclear to what degree depression and 2D:4D, both characterized by marked sex differences, are related.

The aim of the present study was to further investigate the relationship between digit ratio as a measure of organizational testosterone exposure and depression between males and females. Despite some contradictions in the research, we were guided by consistent findings of sexual dimorphism in both depression and digit ratio, as well as evidence that testosterone appears to play a protective role regarding depression. We hypothesized that lower 2D:4D ratios, which are consistent with higher organizational testosterone, would be predictive of lower depression for both males and females.

3. Method

3.1. Participants

Participants were 128 undergraduate students (51 males and 77 females) from a college in central Pennsylvania. All participants completed the study as part of the requirements for an introductory psychology class. Participants ranged in age from 18 to 24, with a mean age of 20 years. The sample was 87% White, 5% Latino, 4.5% African American, and 1.5% identified as Multiethnic; the remaining 2% did not indicate an ethnic category. Individuals who were taking medication to treat depression were excluded from participating in the study.

3.2. Materials and procedures

3.2.1. 2D:4D digit ratio

The right hand of each participant was photocopied using a Sharp AR-M317 copier. Hands were scanned palm side down, and measured in millimeters from bottom of basal crease to tip of the index finger (2D) and ring finger (4D). Ratios were calculated by first marking the basal crease on the second and fourth digits, measuring from the center of the crease to the fingertip using a digital caliper, and dividing the 2D length by the 4D length. The average measurement of two independent raters was used; the correlation of the two raters was .96.