

Differences in Finger Length Ratios Between Self-Identified “Butch” and “Femme” Lesbians

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There is indirect evidence that heightened exposure to early androgen may increase the probability that a girl will develop a homosexual orientation in adulthood. One such putative marker of early androgen exposure is the ratio of the length of the index finger (2D) to the ring finger (4D), which is smaller in male humans than in females, and is smaller in lesbians than in heterosexual women. Yet there is also evidence that women may have different sexual orientations at different times in their lives, which suggests that other influences on female sexual orientation, presumably social, are at work as well. We surveyed individuals from a gay pride street fair and found that lesbians who identified themselves as “butch” had a significantly smaller 2D:4D than did those who identified themselves as “femme.” We conclude that increased early androgen exposure plays a role in only some cases of female homosexuality, and that the sexual orientation of “femme” lesbians is unlikely to have been influenced by early androgens.

KEY WORDS: androgen; sexual orientation; finger length ratios; lesbians.

In nonhuman mammals, sexual differentiation of behavior seems largely driven by exposure to steroid hormones during the perinatal period (Breedlove, Cooke, & Jordan, 1998). The Y chromosome in males causes the undifferentiated gonads to develop as testes, and the testes to secrete androgen, which masculinizes the structure of the brain, permanently molding the animal's behavior to a male-like form (Phoenix, Goy, Gerall, & Young, 1959). Whether early androgen exposure also directly alters the structure of the developing human brain, and thereby adult behavior, remains undetermined.

In the study of sexual orientation, there is little direct evidence that individual differences in early androgen exposure affect the sexual preferences of men. In women, however, there have been several reports of a dif-

ference between heterosexual and homosexual women in purported markers of prenatal or neonatal androgen exposure. McFadden and Champlin (2000) found that auditory evoked potentials (AEP) are more masculine in lesbians than in heterosexual women. Because the sex difference in AEP is present in newborn humans, and because other somatic sex differences in newborns appear to be due to the masculinizing influence of androgen in males, presumably AEP are influenced by, and can therefore serve as markers for, fetal androgen exposure. Thus the AEP results suggest that homosexual women were exposed to more fetal androgen than were heterosexual women. McFadden and Champlin also found that the AEP of homosexual men suggested that they, if anything, had experienced significantly higher levels of perinatal androgen than did heterosexual men. McFadden and Pasanen (1998) also found that otoacoustic emissions, which are also sexually dimorphic at birth (and therefore may also serve as markers for fetal androgen), are significantly more male-like in homosexual women than in heterosexual women. This result is a further indication that lesbians may have been exposed to higher fetal androgen levels than heterosexual women (for an overview, see McFadden, 2002).

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Another purported somatic marker of fetal androgen is the ratio of the length of the index finger (2D) to the ring finger (4D). This ratio, 2D:4D, is smaller in men than in women (Ecker, 1875), a sex difference that is stable from 2 years of age to adulthood (Manning, Scott, Wilson, & Lewis-Jones, 1998). As most somatic differences between young boys and girls have been attributed to differences in exposure to androgen before and just after birth (George & Wilson, 1994), the sex difference in 2D:4D was presumed to reflect sex differences in early androgen.

We have tested this hypothesis by examining the 2D:4D of people with congenital adrenal hyperplasia (CAH). CAH is a disorder that causes the adrenals to produce excessive androgens beginning prenatally and extending to treatment, which usually begins shortly after birth following an accurate diagnosis. We found that the ratios were indeed smaller in CAH females than in control females, and were also smaller in CAH males than in control males (Brown, Hines, Fane, & Breedlove, 2001). The difference between CAH males and control males was especially prominent when comparing first-degree relatives, suggesting that genetic background can affect the finger length ratios but that, within a particular genetic background, greater early androgen exposure reduces the finger ratios. We have also found a similar sex difference in the digit length ratios of mice: rear paw 2D:4D is smaller in males than in females at weaning and in adulthood (Brown, Finn, & Breedlove, 2001), which suggests that adult digit length ratios may provide a retrospective indication of perinatal androgens in many mammalian species.

Accordingly, the report of Williams et al. (2000) that the 2D:4D of homosexual women was more masculine (smaller) than that of heterosexual women indicates again that lesbians are, on average, exposed to more prenatal androgen than are heterosexual women. If so, then increased exposure to fetal androgen may increase the probability of homosexuality in human females. This study found no differences in the 2D:4D of heterosexual versus homosexual men.

If early hormone levels affect human sexual orientation in the same manner as they do other sex dimorphic behaviors in other animals, this influence would be expected to be organizational in nature such that the behavior pattern affected is set from a young age and remains constant throughout the life span. There is some evidence, however, that some women have a heterosexual orientation during certain periods of their lives and a homosexual orientation at other periods (Diamond, 1998). This suggests that other factors, including social influences, can also affect sexual orientation in women. Therefore, presumably some of the lesbians studied in the previously cited reports were exposed to low levels of androgen in development,

i.e., perinatal androgens played no role in the development of their sexual orientation. Because other, nonandrogenic factors influence female sexual orientation, the experimental detection of effects of early androgen, especially via indirect measures, requires large sample sizes. We therefore wondered whether it would be possible to subdivide lesbian participants into groups in which perinatal androgen exposure might be more or less likely to have played a role in the development of a homosexual orientation. Because some lesbians consider themselves to be more masculine ("butch") than other women, we tested whether the finger length ratios of "butch" lesbians would show evidence of greater perinatal androgen exposure than those of "femme" lesbians.

METHODS

A booth was rented for the August 2000 Gay Pride Mardi Gras in Oakland, CA. All adult participants were offered a California Lottery "scratcher" ticket in return for answering an anonymous survey that asked their age, sex at birth, and number of older brothers and sisters.

Participants and Measures. Participants identified themselves as "exclusively heterosexual," "predominantly heterosexual," "bisexual," "predominantly homosexual," or "exclusively homosexual." They were also asked the gender of their sexual partners ("exclusive males," "predominantly males," "males and females equally," "predominantly females," or "exclusively females") and the gender of sexual partners in their fantasies. These latter two questions were asked to confirm self-reports of orientation and, in this study, all participants gave answers that were consistent with their reported sexual orientation. They were also asked to answer the following question: "If I had to describe myself as one of the two types below, I would consider my overall outlook to be (circle one)": with the choices butch and femme on the line beneath. The questionnaire informed them that answering any question was voluntary and would not affect their receipt of a ticket. Participants were not asked to report their ethnicity.

The participants then had their hands copied on a portable photocopier. A clear plexiglass form was placed on the glass platen. This form had two posts, 6 mm in diameter, 147 mm apart. Participants were asked to place their hands flat, palm-down, thumbs near each other, fingers on each hand together, on the form with the posts between the index and middle fingers of each hand, snug against the junction of the two fingers. A millimeter scale was present 12 mm lateral to the posts and the participants' middle fingers were aligned on this scale. A white plastic bag, filled with rice for ballast, was placed over the hands before photocopying. Matching numbered stickers were affixed

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to the back of the questionnaire and photocopy to discern which answers were associated with each photocopy.

Finger lengths were measured by an experimenter, without knowledge of any participant's group membership. If the tip of either finger was obscured in the photocopy, then no ratio was available for that hand for that participant. Measures were taken for each finger to the nearest 0.5 mm, based on their alignment to the photocopied ruler running along the middle finger. This method of measuring finger length differs slightly from other recent reports, but is much more efficient than the method we used previously (Williams et al., 2000). It also more closely matches the measurement method reported by George (1930), confirming Ecker's report (Ecker, 1875). Two mixed-design ANOVAs, with an independent factor of either male/female (to evaluate sex differences) or butch/femme (to evaluate lesbian subgroups), and right and left hand finger ratios as repeated measures, were conducted. Further analysis of differences between groups were evaluated by Student's *t* tests, with all reported *p* values, two-tailed.

RESULTS

The present measurement method detected the previously reported sex difference in 2D:4D between the 267 female and 168 male participants. ANOVA revealed a sex difference in which ratios were greater in males than in females, $F(1, 432) = 28.3, p < .001$, a laterality effect in which the ratios were greater on the right than on the left, $F(1, 432) = 6.0, p < .02$, and a significant interaction of the two factors, $F(1, 432) = 18.6, p < .001$. Student's *t* tests indicated that the interaction was due to a greater sex difference on the right than on the left. For the right hand, the ratio was 0.994 ± 0.003 (*SEM*) for women, 0.958 ± 0.004 for men, $t(431) = 6.6, p < 10^{-10}$; for the left hand, the ratio was 0.967 ± 0.003 for women and 0.938 ± 0.004 for men, $t(431) = 5.9, p < 10^{-8}$. Our previous report (Williams et al., 2000) also found the sex difference in 2D:4D to be greater on the right hand than on the left hand.

Of the 267 women, 29 identified themselves as heterosexual (either "predominantly heterosexual" or "exclusively heterosexual"), 28 as bisexual, 207 as homosexual (either "predominantly homosexual" or "exclusively homosexual"), and one declined to answer the questions about sexual orientation. The data from bisexuals were not examined. Among the homosexual women, 89 identified themselves as femme, 87 as butch, whereas 31 declined to answer the question. Self-identified butch versus femme lesbians were not significantly different in age (femme: mean of $39.41 \pm .98$ years, range, 22–58; butch: $41.12 \pm .90$ years, range, 24–66).

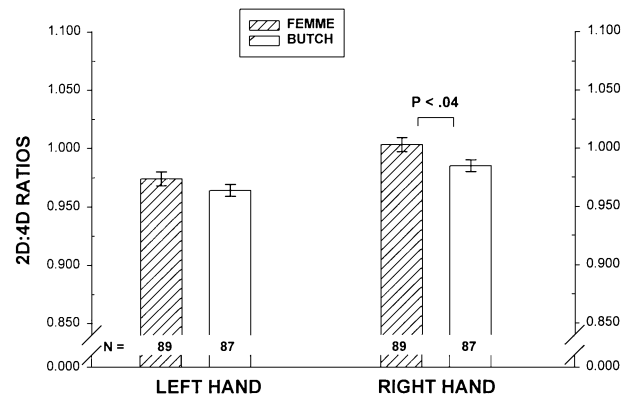


Fig. 1. Finger length ratios in self-identified femme and butch lesbians. Means and standard errors of the means are depicted. A smaller 2D:4D is thought to reflect greater exposure to androgen during the perinatal period. Because the sex difference in 2D:4D is greater on the right hand than on the left (see text), the right hand may provide a more sensitive measure of early androgen than does the left.

ANOVA revealed that the 2D:4D of lesbians were lateralized, as the ratio was greater on the right than on the left, $F(1, 173) = 55.5, p < .001$. The ratios of butch lesbians was smaller than that of femme lesbians, although the difference was only marginally significant, $F(1, 173) = 3.75, p = .056$. The interaction between lesbian subtype and laterality was not significant, $F(1, 173) = 1.02, p > .30$, but *t*-tests indicated that the difference between butch and femme lesbians was greater on the right hand than on the left (Fig. 1). The right hand 2D:4D of butch lesbians (0.985 ± 0.005) was smaller than that of femme lesbians (1.00 ± 0.006), $t(174) = 2.15, p = .033$. The difference between the two groups of lesbians on the right hand ratio seemed to be due entirely to differences in the length of the ring finger (femme: 666.3 ± 5.12 mm; butch: 683.3 ± 5.24), $t(174) = 2.33, p = .02$. The length of the index finger did not differ between the two groups on either hand (femme: left 673.4 ± 5.03 , right 667.5 ± 5.77 ; butch: left 678.2 ± 4.98 , right 672.5 ± 5.31 ; *ps* > .50), which suggests that the two groups did not differ in overall body size. Differences between butch and femme lesbians in the length of the ring finger on the left hand did not reach significance (femme: 692.1 ± 4.87 ; butch: 704.4 ± 4.97), $t(174) = 1.76, p = .08$ (two-tailed). Therefore the 2D:4D ratio did not differ significantly between the two groups on the left hand (butch: 0.964 ± 0.004 ; femme: 0.974 ± 0.005).

DISCUSSION

We found that it was possible to classify homosexual women into two self-reported categories: those who regard

themselves as having a “butch” outlook and those who regard themselves as having a “femme” outlook. Although there is debate over the validity of segregating homosexual women into these categories (Laner & Laner, 1980), most participants in this study appeared to intuitively understand what we were referring to by these classifications and most of them, when asked, appeared to readily identify more with one than the other. These two groups differed significantly in the 2D:4D ratio of the right hand, suggesting that the femme group had been exposed to less prenatal androgen than had the butch group. Nevertheless, the overlap between the two groups for this measure was considerable. The data thus indicate that there are more factors influencing sexual orientation than simply early androgen exposure.

The finding that women who identify themselves as either butch or femme lesbians differ in this biological marker for androgen suggests that it may be worthwhile to try to more rigorously define subgroups of individuals regarded as either heterosexual or homosexual. The present classification was simple (an answer to a single, rather amorphous question) and therefore surely crude. It should be possible, with more extensive probing of personality traits, to more accurately classify homosexual women. Such refined classifications might reveal a greater difference in 2D:4D, or might reveal personality traits that covary with finger ratios, which might shed light on the butch–femme distinction. For example, after conducting the study we learned of the report by Wilson (1983) regarding women who answered a newspaper survey. Those who reported that their index finger was shorter than their ring finger were more likely to describe themselves as “assertive and competitive” than those whose index finger was longer than the ring finger. Again, the sample size was large (985 women), so it is not a question of whether early androgens determine this personality style, only whether they increase the probability of such a personality developing. It is possible that the present differences in 2D:4D reflect a difference in assertiveness between butch and femme lesbians.

The 2D:4D difference between butch and femme lesbians is consistent with the idea that early androgens have some influence on later orientation, at least in females. The present findings also conform to the report from Singh, Vidaurri, Zambarano, and Dabbs (1999) that butch lesbians had a higher waist-to-hip ratio, higher salivary testosterone levels, and more reports of childhood gender-atypical behavior than did femme lesbians. These results and the previously discussed auditory system measures suggest that early exposure to androgen can increase the probability of a homosexual orientation in human females.

We have so far detected no difference between heterosexual and homosexual men in 2D:4D, suggesting that early androgens do not differ between the two groups and may not play a role in the development of male sexual orientation. But the present findings suggest that it might be possible to classify homosexual men into categories that might reveal a difference in early androgen exposure. For example, some homosexual men report a history of gender nonconformity as children, whereas others do not. It is possible that a relative lack of early androgen exposure might contribute to the development of homosexuality in the former, and/or that a relative surplus of early androgen might contribute to homosexuality in the latter. Robinson and Manning (2000) in fact report that the finger ratios of gay men differ according their score on the Kinsey sexual orientation scale.

We have several times found the sex difference in 2D:4D to be greater on the right hand than on the left (Williams et al., 2000, the present study, and unpublished observations), as have other groups (Manning et al., 1998). We also found that the difference between CAH and control women was greater on the right hand than on the left (Brown, Hines, et al., 2001). These data suggest that the right hand finger ratios are more sensitive to prenatal androgen than are those on the left. We can offer no explanation for why androgen would affect the developing right hand more than the left.

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REFERENCES

- Bailey, J. M., Pillard, R. C., Neale, M. C., & Agyei, Y. (1993). Heritable factors influence sexual orientation in women. *Archives of General Psychiatry*, *50*, 217–223.
- Breedlove, S. M., Cooke, B., & Jordan, C. L. (1998). The orthodox view of sexual differentiation of the brain. *Brain, Behavior and Evolution*, *54*, 8–14.
- Brown, W. M., Finn, C., & Breedlove, S. M. (2001). A sex difference in the digit length ratio in mice (Abstract). *Hormones and Behavior*, *39*, 325.
- Brown, W. M., Hines, M., Fane, B., & Breedlove, S. M. (2001). Masculinized finger length ratios in humans with congenital adrenal hyperplasia (CAH) (Abstract). *Hormones and Behavior*, *39*, 325–326.
- Diamond, L. M. (1998). Development of sexual orientation among adolescent and young adult women. *Developmental Psychology*, *34*, 1085–1095.
- Ecker, A. (1875). Some remarks about a varying character in the hand of humans. *Archiv für Anthropologie*, *8*, 68–74.
- George, F. W., & Wilson, J. D. (1994). Sex determination and differentiation. In E. Knobil & J. D. Neil (Eds.), *The physiology of reproduction* (pp. XXX–XXX). New York: Raven Press.

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- George, R. (1930). Human finger types. *Anatomical Record*, *46*, 199–204.
- Laner, M. R., & Laner, R. H. (1980). Sexual preference or personal style? Why lesbians are disliked. *Journal of Homosexuality*, *5*, 339–356.
- Manning, J. T., Scott, D., Wilson, J., & Lewis-Jones, D. I. (1998). The ratio of 2nd to 4th digit length: A predictor of sperm numbers and concentrations of testosterone, luteinizing hormone and oestrogen. *Human Reproduction*, *13*, 3000–3004.
- McFadden, D. (2002). Masculinization effects in the auditory system. *Archives of Sexual Behavior*, *31*, 93–105.
- McFadden, D., & Champlin, C. A. (2000). Comparison of auditory evoked potentials in heterosexual, homosexual, and bisexual males and females. *Journal of the Association of Research in Otolaryngology*, *1*, 89–99.
- McFadden, D., & Pasanen, E. G. (1998). Comparison of the auditory systems of heterosexuals and homosexuals: Click-evoked otoacoustic emissions. *Proceedings of the National Academy of Sciences of the United States of America*, *95*, 2709–2713.
- Phoenix, C. H., Goy, R. W., Gerall A. A., & Young, W. C. (1959). Organizing action of prenatally administered testosterone propionate on the tissues mediating mating behavior in the female guinea pig. *Endocrinology*, *65*, 369–382.
- Robinson, S. J., & Manning, J. T. (2000). The ratio of 2nd to 4th digit length and male homosexuality. *Evolution and Human Behavior*, *21*, 333–345.
- Singh, D., Vidaurri, M., Zambarano, R. J., & Dabbs, J. M. (1999). Lesbian erotic role identification: Behavioral, morphological, and hormonal correlates. *Journal of Personality and Social Psychology*, *76*, 1035–1049.
- Williams, T. J., Pepitone, M. E., Christensen, B. M., Huberman, A. D., Breedlove, T. J., Jordan, C. L., et al. (2000). Finger length patterns indicate an influence of fetal androgens on human sexual orientation. *Nature*, *404*, 455–456.
- Wilson, G. D. (1983). Finger-length as an index of assertiveness in women. *Personality and Individual Differences*, *4*, 111–112.