Age, Testosterone, and Behavior Among Female Prison Inmates

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Objective: The objective of the study was to determine how testosterone levels, both alone and interacting with age, were associated with criminal behavior and institutional behavior among female prison inmates. **Method:** Subjects were 87 female inmates in a maximum security state prison. Criminal behavior was scored from court records. Institutional behavior was scored from prison records and interviews with staff members. Testosterone levels were scored from radioimmunoassay of saliva samples. **Results:** Product-moment correlations revealed first-order relationships among age, testosterone, criminal behavior, and institutional behavior. Structural equation analysis suggested a causal model in which age leads to lower testosterone, which in turn leads to less violent crime and less aggressive dominance in prison. **Conclusion:** Testosterone is related to criminal violence and aggressive dominance in prison among women, as has been reported among men. Changes in these behaviors with age are in part explained by a decline in testosterone levels.

Key words: women, testosterone, prison, crime, violence, dominance, aggression.

INTRODUCTION

Testosterone is produced by the testes of men and the ovaries of women and by the adrenal glands of both sexes. Before birth it masculinizes the fetus, and in adults it builds muscle and increases libido. It has similar effects in both sexes, although its absolute levels are much lower in women than in men. Testosterone levels decline with age in men (1) and in women (2). Correlational studies have found women with higher testosterone levels engage in more sexual activity (3, 4), drink more alcohol (3, 5), enter more competitive occupations (6), and behave in a more masculine and rambunctious manner (5, 7) than low testosterone women. Experimental studies have found administration of testosterone to women increases libido (8) and spatial ability (9).

It is commonly believed that testosterone is linked to aggression. However, few studies have found that testosterone causes aggression in human beings or other primates (10) (11). It is probably more accurate to say that testosterone is associated with dominance in one-on-one encounters among both men (12) and women (3). Sometimes dominance is accomplished through aggression, but often it is accomplished through more subtle behaviors that convey confidence, power, or threat.

There is no direct link between testosterone and criminality, but behavior associated with testosterone can lead to trouble with the law. The trouble centers around interpersonal encounters, as revealed in differences in behavior between low and high testosterone criminals. Prison studies have found high testosterone men commit more crimes against persons (ie, violent crimes) than property crimes and misbehave more in prison, in comparison with low testosterone men (13).

Little is known about the relationship between testosterone and criminal behavior among women. Lore has it that life among prison inmates centers more around dominant individuals in male prisons and around groups of friends in female prisons. Because criminal violence and physical dominance are less characteristic of women than men, the role of testosterone may be less important. Dabbs et al. (14) found women convicted of crimes of unprovoked violence had high levels of testosterone, but the overall relationship between testosterone and violence among women is unclear.

The present study further examined the role of testosterone among female prison inmates. It dealt with how age and testosterone together might relate to the violence of the crime an inmate had committed and to the inmate's aggressive dominant behavior in prison.

METHODS

Subjects were 87 women inmates in a maximum security state prison. They ranged in age from 17 to 60 years (mean = 33) and were incarcerated for crimes ranging from forgery to murder. Data were obtained from institutional records, staff reports, and saliva samples assayed for testosterone. Subjects were volunteers who were not paid for their participation. They were recruited from among inmates available when the investigator (M.H.) visited the prison. They were approached in groups and individually. Of

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those approached in groups, 10% to 20% declined to participate; of those approached individually, none declined. The study was approved by the Institutional Review Board at Georgia State University and complied with regulations of the Alabama Department of Corrections.

Criminal violence was scored from court records of crimes for which subjects were incarcerated. Each crime was scored on a 3-point scale as a) nonviolent (theft, embezzlement, forgery, receiving stolen property, or drug trafficking), b) defensive-violent (homicide or assault of a victim who had earlier abused the perpetrator, where abuse was indicated by hospitalizations or visible scars), or c) violent (homicide, assault, or robbery with no history of having been abused by the victim). The violent-nonviolent distinction follows a Federal Bureau of Investigation distinction between personal crimes and property crimes (15).

Aggressive dominant institutional behavior was scored from prison records and staff reports. It was scored on a 3-point scale as a) passive (staff identifying the subject as "very passive" or "very compliant" and records showing few or no rule infractions), b) neutral (staff identifying the subject as "ordinary, nothing remarkable," and records confirming this assessment), or c) aggressive dominant (staff identifying the subject as "always in trouble," physically aggressive or threatening others, dominating informal prison social groups, or acting as if "they think they run the place," and records showing repeated rule infractions). A double scoring procedure was used. Aggressive dominance was first scored by the investigator, based on written prison reports of misbehavior. These scores were then reviewed by three staff members, one of whom was the sergeant in charge of security. When staff members disagreed with the investigator's scoring, her scoring was changed. Both investigator and staff members were blind as to subjects' testosterone levels when they scored the subjects' behavior.

Testosterone was assayed from saliva samples. Each subject chewed a stick of sugar-free gum to stimulate the flow of saliva and deposited 3 ml saliva into a 20-ml polyethylene vial. Samples were assayed using an in-house radioimmunoassay procedure with ether extraction, ^{125}I-testosterone tracer, and charcoal separation (16). Each sample was assayed in duplicate, and each subject was assigned a score based on the mean of the two duplicates. Samples were assayed in two batches; control pool values for the two batches were virtually identical, and the two batches were combined and treated as a single batch in subsequent analyses. Samples had been collected in the morning from 8:00 to 11:00 AM. Testosterone levels decline across the day (16), and individual scores were adjusted to correct for regression onto mean change across the morning hours. Mean salivary testosterone level was 1.98 ng/dl (SD = 0.61), which is within the normal range for women (16, 17). The coefficient of variation between sample duplicates was less than 10%.

After the study had begun, we realized that our interest in high levels of testosterone might cause us to neglect characteristics uniquely associated with low levels. To ensure a more complete understanding of low testosterone individuals, the investigator gave a list of the five subjects who were lowest in testosterone to the staff members who had helped with the earlier scoring. The staff members were still blind as to subjects' testosterone scores. They were asked, "How are these five inmates similar? Please describe what they have in common."

RESULTS

Table 1 shows mean testosterone scores of subjects with different levels of criminal violence and different levels of aggressive dominance in prison. Analyses of variance showed testosterone significantly related to behavior in prison, $F(2, 84) = 5.53$, $p<.01$, but not to criminal violence, $F(2, 84) = 1.37$, NS.

TABLE 1. Salivary Testosterone Concentrations Among Groups Differing in Criminal Violence and Prison Behavior

	Number of Subjects	Testosterone Concentration[a] (ng/dl)
Level of criminal violence		
Violent	28	2.14 (.51)
Defensive violent	6	1.97 (.54)
Nonviolent	53	1.89 (.70)
Behavior in prison		
Aggressive dominant	23	2.22 (.63)
Neutral	45	1.97 (.66)
Passive	15	1.57 (.34)

[a] Values are mean (SD).

Table 2 shows first-order product-moment correlations among age, testosterone, criminal violence, and aggressive dominance. As expected, testosterone decreased significantly with age. Aggressive dominance decreased significantly with age and increased significantly with testosterone, and there was a nonsignificant trend for criminal violence to increase with testosterone. Aggressive dominance and criminal violence were unrelated to each other.

Because of the relationships among variables and the likelihood that age causes a decrease in testosterone, we examined all variables together in a LISREL structural equation model (18). The model is shown in Figure 1. It is a causal model in which age is proposed to affect criminal violence and aggressive dominance, both directly and indirectly through lower levels of testosterone that come with age.

The LISREL analysis produced the path coefficients shown in Figure 1. Each path coefficient indicates the proportion of the SD of the variable following its arrow that can be accounted for by the variable preceding its arrow. In this model the effect of testosterone on both criminal violence and aggressive dominance was significant. Age alone did not account for reduced dominance, as might have been

TABLE 2. Intercorrelations Among Age, Testosterone, Criminal Violence, and Aggressive Dominance

	Age (yr)	Testosterone	Criminal Violence	Aggressive Dominance
Age (yr)	–	−.43*	.05	−.25*
Testosterone	−.43*	–	.18	.34*
Criminal violence	.05	.18	–	.03
Aggressive dominance	−.25*	.34*	.03	–

* $p < .05$.

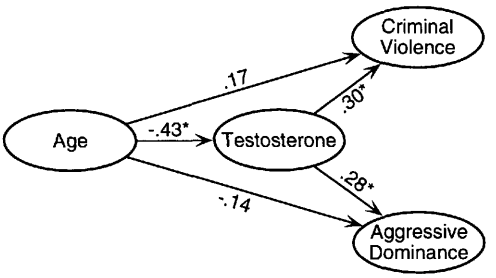

Fig. 1. Path diagram showing effects of age on criminal violence and aggressive dominance mediated by declining testosterone levels. *Statistically significant path coefficients.

inferred from the product-moment correlations; instead, aggressive dominance was reduced by the lower testosterone that comes with age.

When the investigator asked the group of three staff members (still blind as to subjects' testosterone levels) about the five individuals who were lowest in testosterone, they gave her a number of descriptors. They noted that all five were drug users and repeat offenders and that some had been in abusive relationships. They used the phrases "very manipulative," "denies her part in problems," "sneaky," "a snake in the grass," and "makes nice to your face but is a back stabber" in describing them. When the investigator asked for a single adjective that best described the five, one staff member offered the word "treacherous," and the others agreed. We have no information on possible in-prison drug use of these women.

DISCUSSION

Although the first-order correlations showed age negatively related to aggressive dominance, the relationship was mediated by changes in testosterone. The initial correlation of aggressive dominance with age ceased to be significant when testosterone was taken into account. It seems to be the lower testosterone that comes with age, rather than age alone, that makes older inmates less aggressive and dominant. Although correlations cannot prove causation, the pattern of correlations is consistent with the causal model proposed in Figure 1.

Aggressive dominance is a complex variable. Albert et al. (10) note that testosterone has seldom been correlated with aggression among humans and other primates, and Mazur (12) argues that testosterone is related primarily to dominance. Some high testosterone subjects are aggressive, but others achieve dominance through a personal style that makes people around them circumspect and deferential. An example of the latter was observed during data collection, when one very high testosterone inmate secreted chewing gum from the research site and blatantly chewed it in front of guards as she moved about the prison. Chewing gum was a violation of prison rules, but none of the guards asked her to spit it out, as they did when they found other inmates chewing gum.

The issue of why aggressive dominance declines with age may relate to the context of the study. Prison is a tough place, where aggressiveness and assertiveness are important aspects of dominance. These qualities are associated with testosterone, and they decline as testosterone declines. Elsewhere in the world dominance depends on other qualities. People outside of prison may be dominant even though they are old, not because of personal toughness but because of resources, reputations, and patterns of behavior developed over a lifetime.

The staff judgments that low testosterone subjects were "treacherous" are tantalizing. Other studies have found that low testosterone men have a pleasant and friendly manner (19), are generous in judging their peers (20), and maintain positive relationships with their families (21, 22). The present finding again may relate to the context. Confrontation is always close at hand in prison, and inmates often do not have the option of being friendly. Perhaps when dominant high testosterone inmates face confrontation, they can act openly and directly. Low testosterone inmates, because they are less dominant, need to be more "sneaky" in dealing with others.

This study suggests testosterone is important in a female criminal population, but it does not imply testosterone is the only variable or the most important one. Social factors, physical condition, and other hormones contribute to criminal behavior and to behavior in prison. The LISREL analysis indicates age is important and testosterone in women, as in men, is significantly related to violence and dominance. Similar analyses considering age might be applied to other areas in which there are links between testosterone and behavior.

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REFERENCES

1. Dabbs JM Jr: Age and seasonal variation in serum testosterone concentration among men. Chronobiol Int 7:245–249, 1990
2. Vermeulen A: The hormonal activity of the postmenopausal ovary. J Clin Endocrinol Metab 42:247–253, 1976
3. Cashdan E: Hormones, sex, and status in women: Horm Behav 29:354–366, 1995
4. Morris NM, Udry JR, Kahn-Dawood F, et al: Marital sex frequency and midcycle female testosterone. Arch Sex Behav 16:27–37, 1987
5. Banks T, Dabbs JM Jr: Salivary testosterone and cortisol in a deviant and violent urban subculture. J Soc Psychol 136:49–56, 1996
6. Schindler GL: Testosterone concentration, personality patterns, and occupational choice in women [Abstract] (University Microfilms No. 79:19, 403). Dissertation Abstr Internatl 1979:40:1411A
7. Udry JR, Morris NM, Kovenock J: Androgen effects on women's gendered behaviour. J Biosoc Sci 27:359–368, 1995
8. Sherwin BB, Gelfand MM, Brender W: Androgen enhances sexual motivation in females: A prospective, crossover study of sex steroid administration in the surgical menopause. Psychosom Med 47:339–351, 1985
9. van Goozen S: Male and female: Effects of sex hormones on aggression, cognition, and sexual motivation. Amsterdam, University of Amsterdam, 1994
10. Albert DJ, Walsh ML, Jonik RH: Aggression in humans: What is its biological foundation? Neurosci Biobehav Rev 17:405–425, 1993
11. Archer J: The influence of testosterone on human aggression. Br J Psychol 82:1–28, 1991
12. Mazur A: A biosocial model of status in face-to-face primate groups. Social Forces 64:377–402, 1985
13. Dabbs JM Jr, Carr TS, Frady RL, et al: Testosterone, crime, and misbehavior among 692 male prison inmates. Pers Indiv Diff 18:627–633, 1995
14. Dabbs JM Jr, Ruback RB, Frady RL, et al: Saliva testosterone and criminal violence among women. Pers Indiv Diff 9:269–275, 1988
15. Federal Bureau of Investigation: Uniform Crime Reports: Crime in the United States. Washington, DC, US Government Printing Office, 1984
16. Dabbs JM Jr: Salivary testosterone measurements: Reliability across hours, days, and weeks. Physiol Behav 48:83–86, 1990
17. Dabbs JM Jr, Campbell BC, Gladue BA, et al: Reliability of salivary testosterone measurements: A multicenter evaluation. Clin Chem 41:1581–1584, 1995
18. Joreskog KG, Sorbom D: LISREL VI–Estimation of Linear Structural Equations by Maximum Likelihood Methods, Third Edition. Mooresville, IN, Scientific Software,1984
19. Dabbs JM Jr: Testosterone, smiling, and facial appearance. J Nonverbal Behav 21:45–55, 1997
20. Hargrove MF: An investigation of personality correlates of testosterone using peer perceptions. Unpublished Master's Thesis, Georgia State University, Atlanta, 1991
21. Julian T, McKenry PC: Relationship of testosterone to men's family functioning at mid-life: A research note. Aggress Behav 15:281–289, 1989
22. Booth A, Dabbs JM Jr: Testosterone and men's marriages. Social Forces 72:463–477, 1993