

Plasma Androgens in Violent and Nonviolent Sex Offenders

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Plasma testosterone has long been recognized as the hormone of libido in both males and females. Several recent studies, however, have failed to find a relationship between plasma testosterone levels and sexual interest or activity in adults humans.^{1,2} Furthermore, data on the relationship between plasma testosterone and the form or object of sexual expression are conflicting. For example, differences in testosterone levels between heterosexual and homosexual men in different studies have been inconsistent.³

There is some evidence that in animals, testosterone may have an organizing effect on the fetal brain and may affect the development of neuromechanisms that govern aggressive behavior.⁴ In humans the data on the effect of testosterone on the form and expression of aggressive and hostile behavior are conflicting. Studies have found correlations between plasma testosterone level and a history of violent behavior⁵ or scores on self-report scales of aggression and hostility,⁶ whereas another study failed to replicate some of these findings.⁷

Only a few studies have reported testosterone levels in sex offenders, whether violent or nonviolent.^{8,9} In a previous report, we measured plasma testosterone level in 52 rapists and 12 child molesters randomly selected from a group of incarcerated sex offenders who had volunteered for the study.¹⁰ The ranges and means of the plasma testosterone level for the rapist and child molesters were within normal limits. However, the group of rapists judged to have been the most violent at the time of the offense had a significantly higher mean plasma testosterone level than normals, child molesters, or other rapists in the study.

To investigate this relationship further, a second study was conducted. Plasma testosterone, dihydrotestosterone, and luteinizing hormone levels were measured in rapists and child molesters. The purposes of the study were (1) to examine the range and means of the plasma androgens in rapists and child molesters; (2) to compare the plasma androgen levels between those sex offenders who were violent during the offense and those who were not; and (3) to examine the relationships of the plasma androgen levels and

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other characteristics of the rapists and child molesters such as age, alcoholism, length of incarceration, and hostility levels based on a self-report measure. The main hypotheses were that plasma androgens would be (a) higher in rapists than in child molesters; (b) higher in sex offenders who were violent than in others; and (c) that self-report hostility scores would be higher in rapists and in violent sex offenders than in others.

Population and Method

Subjects The study was carried out at Atascadero State Hospital, a part of the California state program for the treatment of mentally disordered offenders. The study was reviewed and approved by the Psychiatry Department Research Committee, the Human Research Review Committee of the University of New Mexico School of Medicine, and the equivalent committee at Atascadero State Hospital. Each subject gave written informed consent.

At any one time approximately 200 to 225 child molesters and 100 to 150 rapists are incarcerated at the institution. Treatment staff were asked to submit a list of rapists and child molesters who, in their judgment, had been either brutally violent or entirely nonviolent (using verbal threats at most) at the time of the offense. Subjects with a known history of substantial physical disease or serious psychiatric illness were to be excluded.

This initial canvass revealed approximately 150 subjects, divided about equally between rapists and child molesters. The charts of these offenders were reviewed, and of the approximately 100 offenders considered potential subjects based on the research criteria described below, 90 subjects agreed to the screening interview. This interview focused on prior sex offenses as well as on the commission of the index offense.

Police reports of the index offense were reviewed, and in each instance the information verified the level of violence used by the offenders and other details of the offense. The history of each subject's offense was subsequently reviewed by two of the investigators and a consensus was reached as to the violence or nonviolence of each incident.

Criteria for inclusion in the study were (1) the offender acted alone, (2) the offense was either brutally violent or entirely nonviolent, and (3) the victim was over eighteen years of age (for rapists) or under thirteen years of age (for child molesters). The 44 offenders who met these criteria were asked whether they were willing to participate in the study, and each subject agreed to do so.

All offenders were considered in good physical health based on previous prison medical examination and self-report, none had a history of major mental illness, and none were considered psychotic at the time of the interview. None of the offenders were on psychotropic drugs or on medication for chronic physical disease. All subjects received the same diet and general daily routine. There were some differences between the subjects in the amount and kind of psychotherapy they had. Although all subjects indicated a primary or exclusive heterosexual orientation, subjects who had

homosexual encounters during incarceration could not be excluded. Possibility for heterosexual relationships did not exist. None of the subjects had major disciplinary infractions, and none had a history of fighting or violence during their incarceration, based on personal interview or police records. All subjects were known to have committed multiple sex offenses, but the exact number of offenses could not be determined with certainty.

Eleven males from the treatment staff volunteered to serve as a control group in the study. It was known that these men differed from the inmates in several important ways including level of education, socioeconomic status, history of alcoholism, and opportunity for heterosexual activity. However, they were living in the same geographic location and were partaking often of similar institutional food and water, factors that might affect hormone levels.

Classification of Offenders Rapists and child molesters were classified as violent or nonviolent. To be classed as violent, the sex offender had to have inflicted severe physical injury to the victim. Classification of offenders into the violent category was simple because these offenders were truly brutally violent. For example, the least violent of the violent rapists had broken the jaw of the victim during the rape offense. The brutally violent child molesters had inflicted serious physical injury to either the body or genitalia of the victim. Of the approximately 50 child molesters screened by personal interview, only 6 were brutally violent and all agreed to participate in the study. None of the violent offenders had murdered the victim. To be classed as nonviolent an offender had to have used verbal threats only and no physical violence during the commission of the index offense. Moreover, there had to be no evidence from personal interview or in institutional or police records of previous brutally violent sex offenses.

Nine rapists were classified as violent and 9 as nonviolent; 6 child molesters were classified as violent and 20, nonviolent.

Psychological Tests and Data Collection Data were collected on each subject as follows: age, marital status, race, highest grade level attained in school, length of incarceration at Atascadero State Hospital, and degree of drinking, if any, at the time of the commission of the offense. The degree of drinking was labeled as heavily (ten or more beers or the equivalent), moderately (five to nine beers), or lightly (under five beers). Each 12 ounce beer contains about 14 grams of ethanol. Each subject completed the Michigan Alcoholism Screening Test (MAST),¹¹ a screening questionnaire for detecting a history of alcoholism (in this study a score of seven or above labeled a subject as alcoholic), and the Buss Durkee Hostility Inventory (BDHI), a self-rating hostility scale.¹²

Procedure of Plasma Assay Four blood samples were drawn from each subject. Two samples were drawn between 8 a.m. and 9 a.m. and two samples were drawn between 4 p.m. and 5 p.m. over a period of three, and in some instances, four days. The samples were immediately centrifuged and the plasma withdrawn and frozen until assayed.

Testosterone and 5 α -dihydrotestosterone were measured by the method of Coyotupa, Parlow, and Abraham.¹³ This method involves the extraction of testosterone and DHT from plasma with ether, separation of the steroids with celite microcolumns, and assay of the eluates with an antiserum specific for testosterone and DHT. For testosterone, the within assay coefficient of variation was 7.97 percent and the between assay coefficient of variation was 9.43 percent. For the DHT assay, the within assay coefficient of variation was 7.6 percent and the between assay coefficient of variation was 12.12 percent.

Luteinizing hormone was measured by the method of O'Dell *et al.*¹⁴ The reference material used for the standard was the second IRH-HMG. The within assay coefficient of variation was 7.8 percent and the between assay coefficient of variation was 10.2 percent at the higher part of the curve and 14.3 percent at the lower end of the assay curve.

Statistical Methods Group mean differences were determined by Student's t-test. For all correlations the Pearson's product-moment correlation coefficients were used. Results at or below the conventional 5 percent level of probability were regarded as statistically significant.

Results

Demographic Data and Length of Incarceration Table 1 lists the demographic data for the rapists, child molesters, and controls. The age of rapists ranged from 19 to 40 years, mean of 24.8 years. The age of child molesters ranged from 19 to 55 years, mean of 32.9 years. The difference in the mean age between the two groups was statistically significant ($p < .01$) and is consistent with that found in previous studies.^{10,15} There were no statistically significant differences between rapists and child molesters in race, marital status, education, or length of incarceration. Staff controls had

Table 1. Demographic Data and Length of Incarceration of Rapists, Child Molesters, and Controls.

Variable	Rapists (n = 18)	Child Molesters (n = 26)	Controls (n = 11)
Age			
Mean age			
Age range			
Race			
Caucasian	14	19	11
Black	2	0	0
Hispanic	2	1	0
Marital status			
Single	10	14	3
Married	4	4	8
Divorced	1	6	0
Separated	3	2	0
Mean school grade level	10.9	11.5	17.4**
Mean length of incarceration (in months)	17	19	—

* Rapists vs. child molesters and controls ($p < .01$)

** Staff controls vs. rapists and child molesters ($p < .05$)

significantly more years of schooling than offenders ($p < .05$) and were more likely to be married.

Alcohol History Fifty percent of rapists and of child molesters were rated alcoholic on the MAST. Fifty-five percent of rapists and 46 percent of child molesters were drinking at the time of the commission of the offense (DATCO). Violent rapists and violent child molesters were more likely to be drinking at the time of the offense than the nonviolent offenders. Of those rapists DATCO, 60 percent were drinking heavily, 10 percent moderately, and 30 percent lightly. Of those child molesters DATCO, 75 percent were drinking heavily, 17 percent moderately, and 8 percent lightly. The proportion of alcoholics and of those DATCO are consistent with previous reports for both types of offenses.¹⁵⁻¹⁸

Table 2. Hostility Rating Scores of Rapists, Child Molesters, and Controls.

Group	Buss Durkee Hostility Inventory Total Scores
Total rapists (n = 18)	40.4*
Violent rapists (n = 9)	46.0*
Nonviolent rapists (n = 9)	34.9
Total child molesters (n = 26)	32.9
Violent child molesters (n = 6)	33.8
Nonviolent child molesters (n = 20)	32.7*
Controls (n = 11)	24.5**

* Total rapists and violent rapists vs. nonviolent child molesters ($p < .05$)

** Controls vs. total rapists and violent rapists ($p < .01$). Controls vs. nonviolent rapists and total child molesters ($p < .05$)

Hostility Rating Scores Table 2 lists the total scores on the BDHI for the various groups. The mean BDHI score for rapists was higher than for child molesters, but this difference did not reach statistical significance. Violent rapists and total rapists had a significantly higher BDHI score than did nonviolent child molesters ($p < .05$).

The controls in this study had a mean score of 24.5, which was statistically significantly lower than the scores for total rapists and violent rapists ($p < .01$) and than nonviolent rapists and total child molesters ($p < .05$).

The BDHI can be broken down into Factor I and Factor II.¹² Factor I is reported as an attitudinal component of hostility and Factor II as a motor component. These two factors were tabulated and a comparison made between the groups. There were no statistically significant differences between rapists and child molesters on Factor I. However, rapists were significantly higher on Factor II than child molesters ($p < .05$) and than nonviolent child molesters ($p < .01$).

Plasma Testosterone, DHT, and LH Table 3 lists the means and range of means of the four samples of plasma testosterone, DHT, and LH for rapists,

Table 3. Plasma Testosterone, DHT, and LH Levels of Rapists, Child Molesters, and Controls.

Group	Testosterone ng/100 ml	Assay DHT ng/100 ml	LH mIU/ml
Total rapists (n = 18)	^a 9.16 ± 0.59 ^b 6.06 – 15.11	1.11 ± 0.06 .60 – 1.71	16.65 ± 1.09 12.05 – 31.10
Violent rapists (n = 9)	^a 8.94 ± 0.67 ^b 6.74 – 12.61	1.20 ± 0.10 .60 – 1.71	18.65 ± 1.86 12.29 – 31.10
Nonviolent rapists (n = 9)	^a 9.37 ± 1.00 ^b 6.06 – 15.11	1.01 ± 0.06 .66 – 1.37	14.65 ± 0.78 12.05 – 17.50
Total child molesters (n = 26)	^a 8.22 ± 0.57 ^b 5.07 – 16.38	1.13 ± 0.06 .62 – 1.74	18.35 ± 0.69 12.46 – 25.83
Violent child molesters (n = 6)	^a 9.53 ± 1.47 ^b 6.08 – 16.38	1.27 ± 0.13 .88 – 1.52	19.39 ± 1.18 15.85 – 21.90
Nonviolent child molesters (n = 20)	^a 7.83 ± 0.59 ^b 5.07 – 14.38	1.08 ± 0.07 .62 – 1.74	18.04 ± 0.82 12.46 – 25.83
Controls (n = 11)	^a 7.85 ± 0.96 ^b 3.88 – 13.51	1.02 ± 0.11 .66 – 1.64	15.40 ± 1.01 10.23 – 21.90

^a = mean ± SE^b = range of means

child molesters, violence subgroups, and controls. None of these differences are significant.

The mean testosterone level of rapists was higher than child molesters or control subjects. The mean testosterone levels of violent and nonviolent rapists were similar. Violent child molesters had the highest mean testosterone level of any group. The testosterone values of rapists and violent child molesters were combined (mean testosterone ± S.E. = 9.25 ± 0.56) and compared with the testosterone mean of nonviolent child molesters. This difference showed a trend but failed to reach the level of significance ($p = 0.087$).

In addition to total mean scores, the mean values of plasma testosterone, DHT, and LH for the 8 a.m. and 4 p.m. samples were compared between and within groups. There were no statistically significant differences between the groups on either the 8 a.m. or 4 p.m. means. It is known that testosterone has a diurnal variation, with greater values occurring in the morning.^{19,20} Within each group the 8 a.m. testosterone mean was higher than the 4 p.m. mean, but none of the differences were statistically significant.

The mean plasma testosterone, DHT, and LH levels in alcoholic rapists and nonalcoholic rapists and in alcoholic child molesters and nonalcoholic child molesters were compared. None of the differences were significant.

Correlation coefficients were computed for rapists and child molesters on each of the following variables: plasma testosterone, BDHI total scores, Factor I, Factor II, age, length of incarceration. None of the correlations for rapists were significant. In child molesters, age was significantly negatively

Table 4. Correlation Coefficients of Child Molesters' Age and Testosterone with Factor I and Factor II of the Buss Durkee Hostility Inventory.

	Factor I	Factor II
Age	-.45*	-.30
Testosterone	+.08	+.34*

*Significant at $p < .05$

correlated with both plasma testosterone and BDHI total scores ($p < .05$). Table 4 shows the correlation between age and plasma testosterone and Factor I and Factor II of the BDHI for child molesters. Age was significantly negatively correlated with Factor I of the BDHI ($p < .05$). Plasma testosterone was significantly positively correlated with Factor II ($p < .05$).

Discussion

Based on our previous study, we hypothesized that rapists would have higher testosterone levels than child molesters and that the violent offenders would have higher testosterone levels than the nonviolent offenders in each group. This was not confirmed; however, the trends are consistent with several previous reports. The violent child molesters' mean testosterone level was similar to those of the violent and nonviolent rapists, a group of men generally considered to be more aggressive and violent than nonviolent child molesters: these differences in testosterone levels among violence groups did not reach a significant level, but the trend is similar to that of some other studies that indicate a relationship between plasma testosterone and aggressive behavior in criminal and non-criminal populations.^{5,6,21}

A confounding variable in this study is that all the offenders had been arrested and incarcerated, and the findings cannot be generalized to all rapists or pedophiliacs. Swanson,²² for example, has emphasized the importance of distinguishing between pedophiliacs in general and those men incarcerated for child molestation because the two groups are likely to differ on certain important demographic and social variables. There are not, to our knowledge, any studies of large numbers of outpatient pedophiliacs. Thus, comparisons of plasma testosterone levels among pedophiliacs and child molesters cannot presently be made. At this time there is no convincing evidence that plasma testosterone significantly influences the form and object of sexual expression.

The hypothesis of the relationship of violent offenses and BDHI scores was only partly supported. Several previous studies report conflicting data on the relationship between testosterone levels and scores of self-report hostility scales. Previously, we found no correlation between BDHI score, Factor I, Factor II, and plasma testosterone in rapists or child molesters.¹⁰ In this study there were no correlations between these hostility measures and plasma testosterone level in rapists. There was, however, an interaction between age, BDHI scores, and plasma testosterone in child molesters.

Younger child molesters had higher BDHI scores and higher testosterone levels than other child molesters. The correlations on Factor I and Factor II with age and testosterone differed somewhat. Factor I is considered an attitudinal component and Factor II a motor component. A decrease in the attitudinal component of hostility rating with age is consistent with the observation that offenders, like other people, may tend to mellow with age.^{23,24} The finding that the motor component on the BDHI was positively correlated with plasma testosterone in child molesters is consistent with the hypothesis that aggression might be associated with higher plasma testosterone levels in some offenders.

The staff controls had significantly lower BDHI scores than offenders. However, they scored below the value of 30.0 reported for normals by Buss and Durkee.¹² It is possible that the staff were cautious in answering the BDHI and may have biased their responses.

The history of alcoholism and drinking at the time of the commission of the offense among sex offenders is relevant when offenders' testosterone levels are measured some time after ethanol intake has stopped. The association of alcohol and alcoholism with violent behavior and sex offenses has been frequently reported.^{15-18,25,26} Moreover, a number of recent reports indicate that short term use of alcohol can lead to a fall in circulating plasma testosterone level.^{27,28} It is currently hypothesized that diminished testosterone synthesis is the direct and indirect consequence of metabolic alterations produced by ethanol in the liver and testes, and that these changes are reversible. Thus, it is possible that, due to acute ethanol abuse, the testosterone levels of some drinking offenders may have been lower at the time of the offense than at the time this study was conducted.

Ultimately, chronic alcohol ingestion results in irreversible hepatic and testicular damage that permanently alters the mechanism for the biosynthesis and excretion of steroid hormones.^{29,30} Thus, it is possible that some alcoholic offenders might have lower testosterone levels due to irreversible damage. In this study, however, there were no differences in plasma testosterone levels, DHT, or LH between alcoholic and nonalcoholic rapists or child molesters.

Several methodological aspects of studies of this type deserve comment. Previous studies, including one of our own,¹⁰ have often used a single blood sample for determination of plasma hormone level. It is well known that there are diurnal and possibly cyclic variations in plasma testosterone levels, with higher values occurring in the morning and lower values in the afternoon and evening.^{19,20,31} Multiple samples taken in the morning and afternoon, as in this study, have in part averaged the levels.

Several studies have suggested that plasma testosterone may fall beginning with age 30, 40, or 50,^{6,32,33} but others report no clear decrease in plasma testosterone levels until markedly advanced years, at least in healthy subjects.^{34,35} In our previous report¹⁰ we found no correlation between plasma testosterone and age in rapists or child molesters (the age range for child molesters in that study was between 22 and 48 years). In this study plasma

testosterone was negatively correlated with age in child molesters. The oldest rapist in this study was 40, but there were seven nonviolent child molesters above the age of 40. When the child molesters over 40 are excluded from the sample, the nonviolent child molesters have a slightly higher mean plasma testosterone level (8.39 ng/ml) but still below the values for rapists and violent child molesters. These data suggest that the selection of different groups of patients for comparison of hormone levels might require matching for age.

Studies of the interaction between physiologic variables such as plasma hormones and other variables such as hostility rating scores or aggressive behavior are at present based on relatively coarse measures. Although significant advances in the measurement of plasma hormones have occurred recently, several of the findings are conflicting, and the relevance of the observed differences is not known. The question of whether testosterone diminishes with age and if so, when, is one example. The validity of hostility inventories and the construct they purport to measure is also open to question. For example, self-rating scales of hostility may not accurately discriminate between those who feel they are aggressive and those who actually are.³⁶

Finally we wish to stress several points made by Dixon⁴ after an extensive review of the animal literature on the relationship between plasma androgens and aggression. At the present time, conclusions about the relationship between androgens and aggressive behavior are, at best, tentative. It may be that in some people hormonal factors play a role in increasing the likelihood of aggressive behavior. Nevertheless, psychological, social, and organic pathological factors appear to be much more important than hormone levels in influencing aggressive interactions.

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