Male Testosterone Linked to High Social Dominance but Low Physical Aggression in Early Adolescence

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ABSTRACT

Background: The association of male pubertal testosterone with social dominance and physical aggression was studied in a population sample of boys followed from age 6 to 13 years to understand the origin of the links between violent behavior and gonadal hormones. **Method:** Physical aggression was assessed from the end of kindergarten to the end of elementary school by teachers and peers (aged 6 to 12 years). Social dominance and testosterone levels were assessed at 13 years of age during a 1-day visit to a laboratory with four unfamiliar peers. **Results:** Boys perceived as socially dominant by unfamiliar peers were found to have concurrently higher levels of testosterone than boys perceived as less socially dominant. In contrast, boys who had a history of high physical aggression, from age 6 to 12, were found to have lower testosterone levels at age 13 compared with boys with no history of high physical aggression. The former were also failing in school and were unpopular with their peers. **Conclusions:** Both concurrent and longitudinal analyses indicated that testosterone levels were positively associated with social success rather than with physical aggression. High testosterone levels in adolescent boys may thus be regarded as a marker of social success in a given context, rather than of social maladjustment as suggested in previous studies. *J. Am. Acad. Child Adolesc. Psychiatry,* 1996, 35(10):1322–1330. **Key Words:** testosterone, puberty, social dominance, physical aggression.

Testosterone (T) is the most potent hormonal determinant of physical and behavioral masculinization. It has been implicated for decades in the stimulation of sexual behavior, as well as in the activation of dominance and aggressive behaviors in male primates, including humans (Archer, 1988, 1991; Brain, 1979; Reiss and Roth, 1993). The currently available data on the link of T to overt aggression and, in humans, to aggression-related traits or attitudes, conform with a general model according to which behavior and gonadal androgen production interact in a regulation loop, being alternately causal and consequential (Archer, 1991; Mazur, 1983). Up to now, in humans, the behavior-to-hormone causative influences are far better understood than the reverse. This is best exemplified by T changes following nonaggressive social challenges, positive and negative outcomes inducing, respectively, short-term increments and decrements in the hormone level (Booth et al., 1989; Elias, 1981; Mazur et al., 1992; Mazur and Lamb, 1980; McCaul et al., 1992). The neuroendocrine mechanisms by which sociopsychological events impinge on circulating T levels involve both direct modulation of the testicular axis and indirect modulation through the adrenal axis. Evidence linking both hormonal systems and their reactivity to environmental stress is at hand in primates (Higley et al., 1992; Keverne, 1992; Sapolsky, 1991) and adult humans (Bambino and Hsueh, 1981; Collu et al., 1984; Gladue et al., 1989). Both neuroendocrine pathways, but primarily the adrenal system, are sensitive to physical and

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psychological stress. For example, adrenal activation has suppressive consequences at each level of the gonadal axis (hypothalamic, pituitary, and testicular) (Cumming et al., 1983; Plant, 1986; Sakakura et al., 1975). Thus, the circulating T level is the result of the complex interrelations between behavioral expression in a given social environment and the way the consequences of behavior are integrated at the neuroendocrine level, both concurrently and ontogenetically.

Empirical support for this multiple hormone–behavior regulation model stems essentially from correlational and experimental studies conducted on postadolescent males (Booth et al., 1989; Elias, 1981; Mazur et al., 1992; Mazur and Lamb, 1980; McCaul et al., 1992; Virkkunen et al., 1994). How hormonal systems and behavior interact during ontogeny remains little explored, especially within the unique period of puberty when gonadal androgens rise progressively from undetectable to mature levels. The adult precedent referred to above would suggest that androgens will be increasingly strong regulators of adolescent psychological and behavioral functioning. Studies of late pubertal and young adult males indeed tend to confirm a positive relationship between T and behavior dimensions related to aggression (Olweus et al., 1980, 1988). However, pre- and early adolescents provide less clear-cut evidences of T–aggressive behavior association. In recent studies, for example, no relationship was found between plasma T level and synchronous self-reported negative affect, maternal reports of delinquency and opposition, or direct observation of irritability and assertiveness (Inoff-Germain et al., 1988; Susman et al., 1987). Likewise, two other studies did not find any consistent association between high T concentration in saliva or serum and high level of concurrent irritability and aggression (Constantino et al., 1993; Eccles et al., 1988). Finally, although all males evince increased T in early adolescence, they do not all display increased aggression. In contrast, in some clinical syndromes inducing very low T levels at puberty, adolescents can behave in a highly aggressive way to compensate for physical stigma (Johnson et al., 1970). Thus the evidence for proximal T–aggression links at adolescence remains at best controversial (Eichelman, 1992; Reiss and Roth, 1993). A panel of the National Research Council on the understanding and control of violent behavior (Reiss and Roth, 1993) has recently called for more systematic investigation of the relationship between violent behavior and sex hormones. They specifically suggest that longitudinal data, from population-based samples, linking childhood social behavior with peers and gonadal hormones, would help predict violent behavior (pp. 160 and 339). The present report addresses two questions relating to the applicability, at the pubertal period, of the hormone–behavior interaction model outlined above.

First, it was asked to what extent are perceptions of toughness and leadership by unfamiliar peers after brief encounters linked with concurrent T level? The model summarized above would predict that T concentration is positively related with peer perception of toughness and leadership.

Second, it was asked whether antecedent, long-term, stable behavioral style might influence T level in early adolescence. Childhood experiences, specifically those deriving from social interaction strategies and coping styles integrated in a stable behavioral repertoire, may indeed influence the endocrine processes controlling pubertal biological change and make a significant contribution to individual differences in adolescent psychobiological functioning (Belsky et al., 1991). According to previous work (Olweus et al., 1980, 1988), the expected direction of influence would be that dispositions to physical aggressivity will be linked to higher T levels. Alternatively, physically aggressive subjects may also have been rejected by their social environment and would thus have been exposed to negative, highly stressful social encounters. The adrenal axis of these subjects might then have been much more solicited than in less physically aggressive boys, with the consequence of lowering T production (Nottelman et al., 1990; Susman et al., 1991).

METHOD

Subjects

The subjects involved in the present study (n = 178) were drawn from a large sample (n = 1,161) of boys followed up from kindergarten in a longitudinal-experimental study of social development (Tremblay et al., 1994, 1995). To preclude cultural and socioeconomic biases, the boys were recruited according to the following criteria: (1) attending school in low socioeconomic areas of Montréal; (2) born from Caucasian, French-speaking parents themselves born in Canada; and (3) living with parents having medium to low educational status. As the focus of the present analyses was on individual, rather than on developmental differences in both hormone levels and behavioral dispositions, we used a limited age range to attenuate pubertal stage variability. The T data were collected when the subjects were on average age 13.1 years (SD = 0.32 year).

Procedure and Instruments

Behavioral assessments were collected at school (at ages 6, 10, 11, and 12 years) from teacher and peer ratings and during the subject's visit to the laboratory with four unfamiliar peers (at age 13 years).

During the laboratory visit, T and physical development (height, weight, wrist robustness, and skin-fold measurements at triceps, shoulder, and abdomen) data were also collected. Pubertal status was self-assessed using the Pubertal Development Scale. This scale of pubertal status assessment integrates self-report of growth spurt, body and facial hair development, and skin and voice changes on 4-point scales. Classification into one of the five pubertal status categories (pre-, early, mid-, late, and postpubertal) is based on the level of development of the three most salient indices of pubertal change (i.e., body hair, facial hair, and voice alterations) (Petersen et al., 1988).

The ratings of toughness/leadership were obtained from individual interviews during which every subject from a peer group was asked to nominate the leader ("Who would you choose as leader?") and identify the toughest boy ("Who was the toughest?"). The interviews were made at approximately 10:30 A.M. after a 3-hour period during which the subjects were picked up at home and driven together to the laboratory in a van, were seen individually to assess personality and cognitive functioning, and took part in a competitive group task to provide an opportunity to measure social interactions. This task consisted of a 15-minute competition in which they were given a limited set of sandbags and were asked to throw the bags at targets to win points in exchange for money. No rules were set except that bags had to be thrown from a fixed distance. When the task was completed, the winner received $2, but all the other boys were told they had done well and were given $1 each. Each subject received a toughness and a leadership score ranging from 0 to 5 depending on the number of nomination he received (including self-nominations). The crossing of both toughness and leadership scores, using the median, yielded four groups defined as follows: (1) tough-leader (n = 52); (2) tough-not leader (n = 27); (3) not tough-leader (n = 44); and (4) not tough-not leader (n = 48). These four groups were not different on a number of demographic and socioeconomic variables (family status, both parents' age at birth of first child and at birth of subject, both parents' educational status, both parents' job socioeconomic level, and total family adversity). However, as expected, they were different on peer ratings of behaviors in school during the preceding year (Fig. 1). The boys rated tough by unfamiliar peers in the laboratory (especially the tough-not leaders) had also been rated by familiar peers as more aggressive than those rated not tough (fights with other children; kicks, bites, hits other children; bullies or intimidates other children) ($F[1,158] = 8.54$; $p < .01$). The boys rated leaders had been rated by peers as more popular (Pekarik et al., 1976) than those rated not leaders ($F[1,158] = 6.08$; $p < .01$). These results indicate that the sociometric status obtained after having met for only 3 hours corresponded to behavior perceptions by familiar peers at school during the preceding 15 months.

Childhood aggression and anxiety were assessed by teacher ratings on the Social Behavior Questionnaire (Tremblay et al., 1991). For this study, a *fighting score* was derived by using three items ("fights"; "kicks, bites, hits"; and "bullies or intimidates other children"). The range of possible values of the fighting score was 0 through 6. Cronbach's α varied between .78 and .87 from ages 6 to 12 years. The *anxiety score* was obtained through the aggregation of five items ("worried"; "tends to do things on his own, solitary"; "unhappy or distressed"; "tends to be fearful"; "easily cries"). The possible scores range from 0 to 10. Cronbach's α varied between .76 and .85 from age 6 to 12 years. From the total sample of subjects with complete behavioral data (n = 948), four extreme groups of subjects were identified on the basis of the intensity and stability of their physical aggressivity and anxiety scores as assessed by teachers during the kindergarten year (age 5 to 6) and during the three last primary school years (ages 9 to 12). Boys were entered into the following categories according to their behavior rating scores on at least three of four assessments: (1) stable high fighter/stable high anxious (SHF-SHA; n = 20): fighting and anxiety scores at the 70th percentile or greater; (2) stable high fighter/stable low anxious (SHF-SLA; n = 11): fighting score equaled or exceeded the 70th percentile and anxiety score was equal to or below the 50th percentile; (3) stable low fighter/stable high anxious (SLF-SHA; n = 10): equal to or less than the 50th percentile on the fighting scale and greater than the 70th percentile on the anxiety scale; and (4) stable low fighter/stable low anxious (SLF-SLA; n = 25): equal to or lower than the 50th percentile on both fighting and anxiety scores. Classroom peer ratings at age 12 years were used to verify to what extent the classification of subjects based on teacher ratings of behavior from age 6 to 12 corresponded to familiar peer perception. From Figure 2 it can be seen that the teacher-rated physically aggressive boys (SHF-SLA and SHF-SHA), compared with the not physically aggressive boys (SLF-SLA and SLF-SHA), were rated higher on proactive aggression ($F[1,62] = 56.13$; $p < .001$) by their classroom peers. They were also rated less popular ($F[1,62] = 4.53$; $p < .04$).

Testosterone levels were assayed from multiple saliva samples collected (at approximately 8:30 A.M., 10:00 A.M., 11:30 A.M., and 3:30 P.M.) during the 1-day visit to the laboratory. The first two saliva samples were collected before the competitive interaction at 10:00 A.M. Subjects were requested to donate saliva into sterile vials which were immediately frozen (−20°C) until radioimmunoassay. The assays were performed blindly. The procedure was a variant of that established by Vittek et al. (1984) with T-assay kits purchased from ICN Biomedicals Inc. (Montreal). Once centrifugated, 500 μL of saliva was pipetted and extracted with 2 mL of ether. One milliliter of the organic phase was taken and evaporated to dryness. The residue was incubated at 37°C for 120 minutes with 50 μL of steroid diluent. After incubation, 100 μL of sex-hormone–binding-globulin inhibitor, 400 μL of ^{125}I-testosterone, and 400 μL of anti-T were added and incubated overnight. A separation antibody was then added and allowed to incubate for 90 minutes at 37°C. After 15 minutes of centrifugation, the supernatant was discarded and the tube was counted in a gamma counter. Precision of the analytical procedure was improved by extraction of the standard curve. Intraassay and interassay coefficients of variation were 6.3% and 12.3%, respectively. Regarding the specificity of the assay, no significant cross-reactions of the antibody were measured, except for 5-α-dihydrotestosterone (3.4%). The titration of T from saliva was preferred to any other way of obtaining similar data for practical and theoretical reasons. Its application being unobtrusive, it does not interfere with stress-elicited alterations of T. In addition, the handling of saliva is uncomplicated in comparison with the handling of blood or urine. Salivary T level, being highly correlated with the unbound fraction of circulating T, is assumed to be a precise indicant of the behaviorally active fraction of T (Riad-Fahmy et al., 1982; Wang et al., 1981).

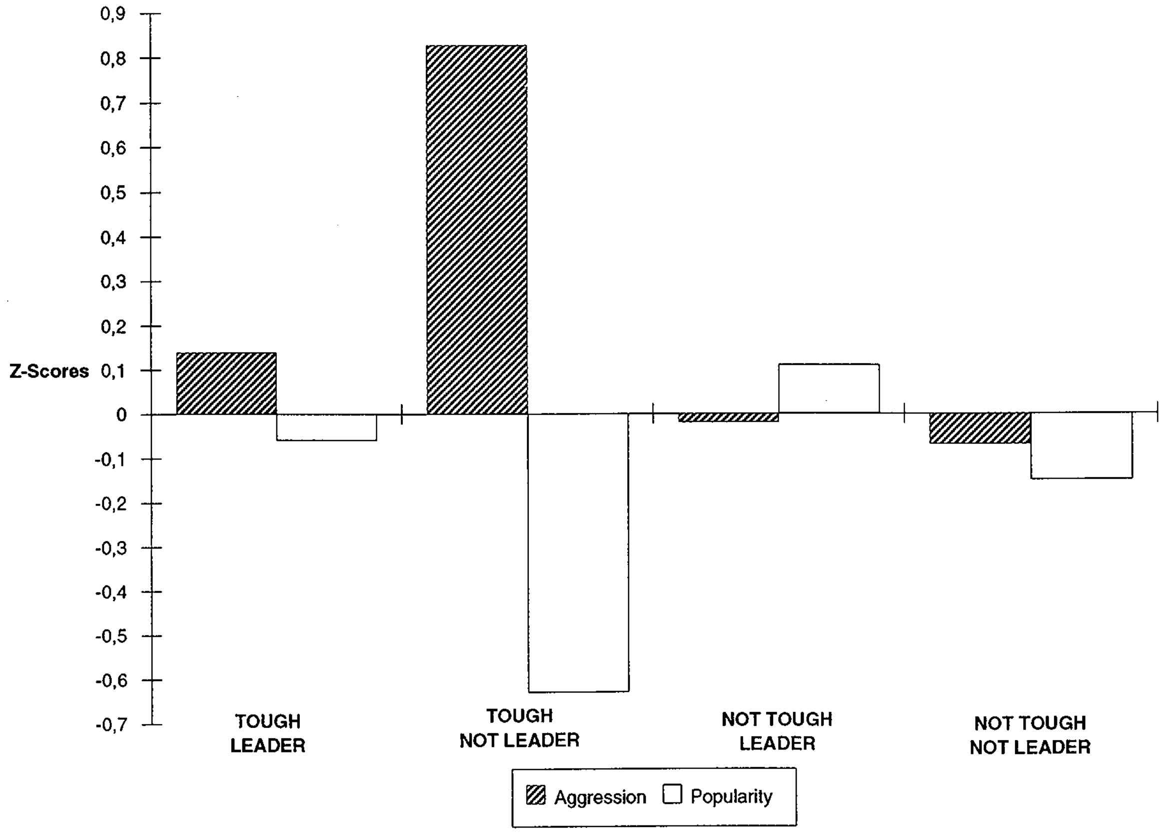

Fig. 1 Classroom peer evaluations of proactive aggression (*Z* scores) and popularity (*Z* scores) at age 12 for groups based on unfamiliar peer ratings of leadership and toughness at age 13.

RESULTS

T Levels, Toughness, and Leadership

We first assessed to what extent perceptions of toughness and leadership by unfamiliar peers after a brief encounter were associated with concurrent T level. Average T levels at each of the four sampling times during the visit to the laboratory are depicted in Figure 3 for each of the four groups. An analysis of variance (ANOVA) with repeated measures for sampling times was conducted, in which toughness and leadership scores were the factors and T was the dependent variable. A highly significant main effect for sampling time ($F[3,165] = 61.34$; $p < .0001$) accounted for the diurnal decrease of T concentration in saliva, as was anticipated from previous research (Dabbs, 1991; Lejeune-Lenain et al., 1987; Nieschlag, 1974). A (between-subjects) main effect for toughness ($F[1,167] = 6.08$; $p < .02$) revealed that boys who were rated tough (regardless of concurrent leadership ratings) produced a higher average level of salivary T than did subjects rated not tough. No such main effect on T level was reached for leadership, but a toughness by leadership by time interaction ($F[3,165] = 3.65$; $p < .02$) indicated that tough-leaders produced higher levels of T than any other category, at sampling times 1, 2, and 3, but not 4.

Because T has been found to correlate with pubertal stage and somatic growth (Forest, 1989; Mowszowicz, 1989), they were controlled by entering them as covariates in a multivariate analysis of covariance (MANCOVA) with T level as the dependent variable (Table 1). The following variables were correlated with T level beyond the .05 threshold: pubertal stage, $r = .44$; body surface, $r = .50$; head circumference, $r = .30$; triceps skin-fold, $r = -.19$; wrist measurement, $r = .50$. A significant toughness by leadership by time interaction ($F[3,165] = 3.65$; $p < .01$) confirmed that the tough-leader group had higher levels of T at the first three sampling times after we controlled for all the variables described above. It is interesting that the main effect for toughness was not significant after having included

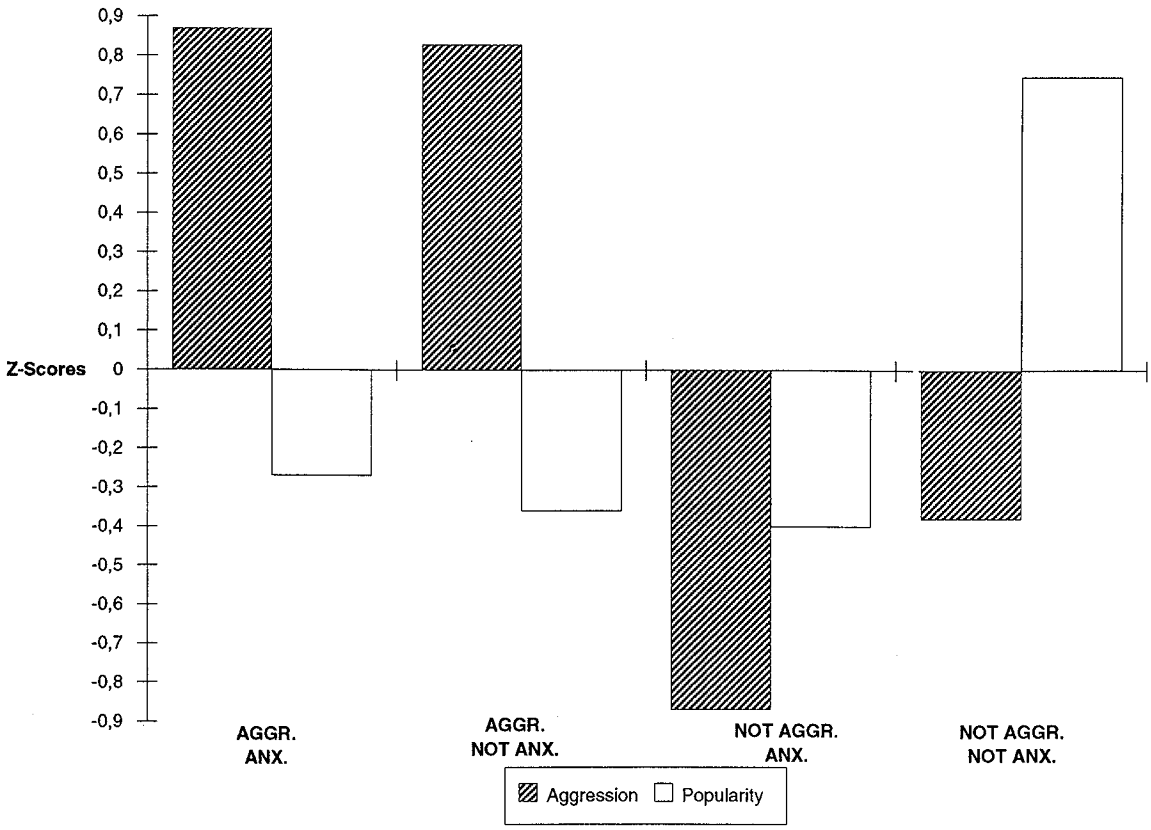

Fig. 2 Classroom peer evaluations of proactive aggression (*Z* scores) and popularity (*Z* scores) at age 12 for groups based on teacher ratings of fighting and anxiety between age 6 and 12.

these covariates, indicating that this main effect was explained by pubertal maturity and somatic growth.

Thus, the link between aggression and T appeared to be modulated by leadership. The subjects who had

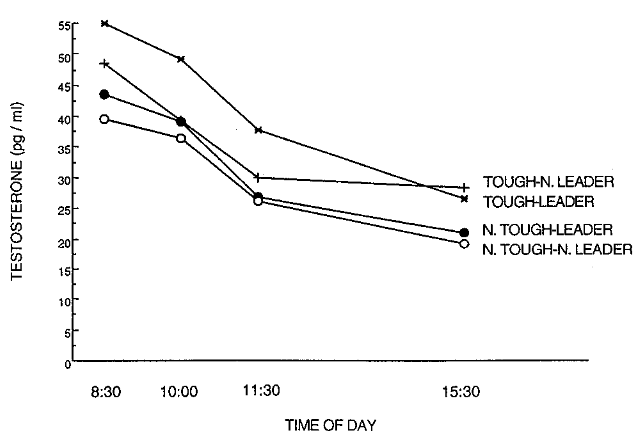

Fig. 3 Salivary testosterone concentration as a function of sampling time in the four categories of 13-year-old boys defined by crossing two dimensions of social dominance (toughness and leadership) rated by unfamiliar peers. N. = not.

the highest T levels were rated tough and leader by their laboratory peers, but they were not rated highest on aggression in everyday life by classmates. It was the tough-not leader boys who were rated highest on aggression by their classmates; their T level was lower than that of the tough-leader boys and similar to that of both not tough groups (not tough-leader and not tough-not leader). From this perspective, boys with a history of aggression who are not socially successful (e.g., designated as leader) do not appear to have high testicular activity before or after a competitive group task in a novel situation. This hypothesis was tested more directly with the following analyses.

T Levels, Aggressivity, and Anxiety

To assess to what extent long-term, stable aggressivity and anxiety before puberty might influence T level in early adolescence, an ANOVA was conducted in which antecedent fighting, anxiety, and T sampling time were the factors and T level was the dependent variable. As expected, the four groups showed an overall steep

TABLE 1
Multivariate Analysis of Covariance Results for the Effects of the "Tough" and "Leader" Classification on Testosterone Levels after Controlling for Covariates

Covariates	ß	*t*	*p*
Body surface	.44	4.67	.001
Pubertal stage	.18	2.90	.004
Wrist circumference	.16	1.93	.055
Head circumference	.06	1.01	.317
Triceps skin-fold	−.42	6.48	.001
Main Effects	*df*	*F*	*p*
Toughness	1	0.73	.394
Leadership	1	0.21	.646
Sampling time	3	61.32	.001
Interactions	*df*	*F*	*p*
Toughness × leadership	1	0.59	.442
Toughness × time	3	0.52	.671
Leadership × time	3	2.75	.045
Toughness × leadership × time	3	3.65	.014

decline of salivary T (Fig. 4) as a function of sampling time ($F[3,60] = 23.61$; $p < .0001$). A statistically significant (between-subjects) main effect was reached for the fighting factor ($F[1,62] = 4.67$; $p = .035$) but not for the anxiety factor. There were no interaction effects.

To control for the potential effect of pubertal stage and somatic growth, MANCOVA was again used, introducing the variables described earlier as covariates (Table 2). The main effect for stable fighting was increased ($F[1,57] = 9.03$; $p = .004$). ANCOVAs performed at each T sampling time also indicated significant main effects for the fighting factor at time 1, time 2, and time 3. Thus boys who were stable high fighters from ages 6 through 12 had lower salivary T levels at age 13 compared with boys who were stable low fighters. The stable high fighters who were also stable on anxiety (SHF-SHA) had the lowest T level at age 13. It is important to note that from the standpoint of another social adjustment index, school status (Power et al., 1991; Wadsworth, 1991), the stable fighters (especially the SHF-SHA) also had more problems. Only 41% of the stable high fighters (SHF-SHA = 29%; SHF-SLA = 64%) were in a regular classroom at the level appropriate for their age (age 13) compared with 91% of the stable low fighters (SLF-SHA = 80%; SLF-SLA = 96%) ($\chi^2[3] = 24.42$; $p < .0001$).

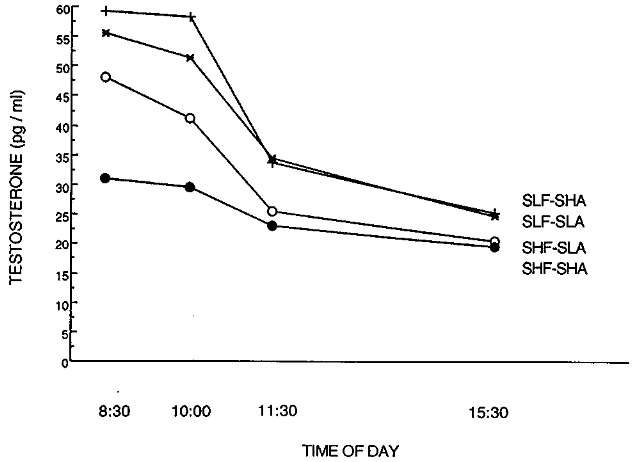

Fig. 4 Salivary testosterone concentration in 13-year-old boys as a function of sampling time and behavior ratings since age 6 in four groups of boys who were defined according to the frequency and stability of their physical aggressiveness and anxiety. SHF-SHA = stable high fighter/stable high anxious; SHF-SLA = stable high fighter/stable low anxious; SLF-SHA = stable low fighter/stable high anxious; SLF-SLA = stable low fighter/stable low anxious.

DISCUSSION

The above analyses approached behavior–T interrelations by measuring different facets of aggressiveness in two very different time periods of child and adolescent development. The first analysis reported high salivary T concentration in boys concurrently nominated by

TABLE 2
Multivariate Analysis of Covariance Results for the Effects of the "Aggressivity" and "Anxiety" Classification on Testosterone Levels after Controlling for Covariates

Covariates	ß	*t*	*p*
Body surface	.43	2.97	.004
Pubertal stage	.11	1.00	.322
Wrist circumference	.31	2.25	.028
Head circumference	.06	0.60	.549
Triceps skin-fold	−.45	−4.19	.000
Main Effects	*df*	*F*	*p*
Aggressivity	1	9.03	.004
Anxiety	1	2.30	.135
Sampling time	3	23.61	.000
Interactions	*df*	*F*	*p*
Aggressivity × anxiety	1	0.35	.556
Aggressivity × time	3	2.17	.101
Anxiety × time	3	0.70	.558
Aggressivity × anxiety × time	3	1.91	.137

unfamiliar peers as tough and leader after having met for only 3 hours. In the second analysis, considering aggression in terms of its extreme manifestation (i.e., frequent physical aggression) and stability throughout childhood, the pattern of results was paradoxically reversed. Boys who were rated consistently high on physical aggressiveness between ages 6 and 12 had lower T levels at age 13, compared with stable nonaggressive boys. Both characterizations of aggressiveness differ. On the one hand, the subjects nominated as tough-leaders, who had the highest morning T levels, were perceived by their unfamiliar peers as socially dominant. They had been perceived by their familiar peers (classmates) 15 months earlier as more popular and less aggressive than the tough-not leader group, but as more aggressive than the not tough groups (not tough-leaders, not tough-not leaders). Thus, these boys with high T at age 13 appear to be individuals who quickly succeed in imposing their will on peers, sometimes by aggressive behavior, but remain socially attractive over time (Savin-Williams, 1979; Strayer and Trudel, 1984). On the other hand, the boys rated by their teachers as physically aggressive from kindergarten to age 12 (especially those also rated anxious), who had the lowest T levels, were not socially dominant. They were perceived by their classroom peers as more aggressive than the not stable fighter group, but they were also rated less popular and were failing in school. These boys who had been physically aggressive since kindergarten appear to have been rejected by their peers and more generally by the school system. Their T levels seem to reflect this status. This interpretation fits well with data indicating that 8- to 13-year-old boys had higher levels of salivary cortisol only when they had concurrent diagnoses of anxiety and conduct disorder (McBurnett et al., 1991). The high chronic activation of the adrenal axis in these children could explain the relative suppression of the testicular axis. It should be recalled that the significant results discussed above were obtained before and after having controlled for pubertal status and physical growth.

Parallel findings have been obtained from primate studies. In unstable, newly composed groups, dominant males synchronously have the highest T levels and aggression rates (Eberhart et al., 1979; Rose et al., 1975). In contrast, in socially stable groups, they no longer show the highest T concentration or aggression rates. While aggression (and associated high T level) is important for attaining high social status (although it is not the only strategy), its sustained manifestation appears not to be decisive for maintaining high status. Rather different behavioral qualities seem to be required in that aim, viz. displaying prosocial activities. Those who behave aggressively but not affiliatively may in the long run be rejected by their social environment, increasing the level of stress they endure, and thus showing low levels of T (Higley et al., 1992). This pattern appears to fit the data observed, especially for the boys categorized as stable aggressive and anxious.

The strength and valence of the T–aggression link at adolescence appears thus dependent on the way aggression is measured and on the social context from which it is derived. It also depends strongly on co-occurring behavioral features. The development of a stable, physically aggressive style of interaction often leads to rejection and increased social stress (Coie et al., 1990; Eaton, 1983; Vitaro et al., 1992). The response of the adrenal axis in these rejected subjects may result in antagonistic effects on T release, since it is known from other studies that stable childhood anxiety may have a suppressive action on T production at early adolescence (Nottelman et al., 1990; Susman et al., 1991). We acknowledge that salivary T was collected over a single day and under conditions that may alter its level. Novel and challenging situations are known to activate the hypothalamic-pituitary-adrenal axis in pubertal age adolescents (Susman et al., in press). Although we found that unfamiliar peer ratings of behavior during that novel and challenging situation corresponded to numerous teacher and peer ratings over the elementary school years (indicating that the behavior of these boys is consistent across settings), T would have to be collected under normal social conditions, preferably over many days, to verify whether chronically aggressive 13-year-old boys have higher or lower T levels under normal social conditions.

To conclude, the present study revealed an apparently contradictory pattern of T–aggression relationships. First, an elevated level of T was associated with social dominance at age 13, when toughness and leadership was assessed by previously unknown age mates, after a short period of interaction. Second, and in sharp contrast, the development of a stable physically aggressive style during prepubertal years (age 6 to 12 years) was paralleled by lowered pubertal activation of the testicular axis at age 13 in a novel and challenging situation. Thus these results suggest that high levels of T are associated with an aggressive style only if the latter confers a dominant status. Higher salivary T level appeared indeed to be a marker of social well-being and success. Low T concentration in adolescents who were antecedently highly aggressive may be explained either by increased social rejection, by stable anxiety throughout childhood, or by the conjunction of both influences.

Olweus et al. (1980) showed a concurrent relationship between plasmatic T level and self-reported aggression in a sample of late pubertal boys. They noted a significant positive correlation between T, responsiveness to aggressive provocation, and lack of frustration tolerance, but no sizable correlation between T and antisocial behavior. From the perspective of the present study, it can be hypothesized that in a sample of normal adolescent males, those who dominate will tend to react to provocation and to show relatively low frustration tolerance. The results from the Olweus and colleagues' study might then be interpreted as showing the relationship between dominance and T, rather than between antisocial behavior and T. We thus suggest that high T level at adolescence is a marker of social success rather than a marker of antisocial behavior as suggested by a number of studies (Buchanan et al., 1992). The output level of T appears to be related to aggression only with respect to the type of aggression and co-occurring behaviors that enable one to become dominant in a given social context.

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