

The Moderating Role of Parent–Child Relationships in Testosterone and Child and Adolescent Adjustment

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Introduction

In a sample of established middle- and working-class families with normally developing children and adolescents ranging in age from 6 to 18 years, sons' and daughters' testosterone levels showed no direct relationship to risk behavior or symptoms of depression. In contrast, testosterone's positive relationship with risk behavior and negative relationship with depression were conditional on the quality of parent–child relationships. As the quality of the parent–child relationship improved, testosterone-related adjustment problems became less noticeable. When relationship quality declined, testosterone-linked risk-taking behavior and depression symptoms became more prevalent. There were few correlations found between parental testosterone and child behavior. In some cases, the ages and stages of pubertal development of boys and girls were important in understanding the expression of hormone-related problem behavior, but not in others.

Contemporary theories of behavior problems assume reciprocal causal relationships between biological processes, behavior, and social forces. This biosocial perspective has become central in research attempting to explain patterns of risk and resilience in individual development. Recent advances in basic research have laid the groundwork for the widespread application of this paradigm in the development of externalising and internalising behavior problems in children and adolescents. Advances in behavioral endocrinology have enabled the noninvasive measurement of key hormones (e.g., in saliva). Hormones translate different experiences into variability in gene expression, which affects protein synthesis and, ultimately, changes in physiology and behavior. According to a recent review by Researchers (1997), while many researchers emphasise the potential importance of incorporating biosocial interactions into theoretical models of antisocial behavior, few studies actually test for them. This scarcity of data is particularly noticeable in studies of adjustment problems in children and adolescents.

Testosterone and Adjustment

Because there have been so few studies linking children's testosterone to adjustment issues, we relied on adult studies to help guide this investigation. Numerous adult studies have linked testosterone to antisocial behavior, health-risk behavior, and negative mental and physical health outcomes. Individual differences in testosterone levels in men are associated with dominance, aggression, violent crime, and antisocial personality disorder, as well as negative emotionality and depression. Given the breadth of the literature, it is surprising that so few studies have investigated the nature, direction, and magnitude of such effects in youth. A small number of studies on normally developing adolescent boys show that higher levels of testosterone are associated with a readiness to respond

vigorously to provocations and threats, a tendency to dominate peer relationships, aggressive-destructive behavior, and a higher frequency of sexual activity. Similarly, compared to girls with low testosterone levels, girls with high testosterone levels report higher levels of depression, more involvement in male modes of play (e.g., rough-and-tumble activities, preference for traditionally masculine toys), greater interest in sexual behavior during adolescence, and a tendency to be more resistant to parental socialisation efforts to encourage femininity.

Depressive symptomatology is rarely studied in relation to testosterone, but there are several lines of research that support including it in the current study. First, medical studies show that giving testosterone to men who have very low testosterone levels improves their mood. Second, a study of men found a U-shaped relationship between depressive symptoms and testosterone levels: men with low levels and men with high levels reported more symptoms of depression. Third, the fact that girls appear to be more prone to puberty-related depression than boys is another compelling reason to investigate the relationship. Studies on hypogonadal (low-testosterone) adolescent boys revealed that those given testosterone behaved more aggressively than those given placebo. It is also worth noting that a number of studies on children and adolescents have found no link between testosterone and typical testosterone-related behaviors. Taken together, the existing literature linking testosterone to behavior in children emphasises the importance of using a biosocial model to decipher the nature of testosterone–behavior relationships. In a large, nonclinical sample of nearly 400 families with children and adolescents, the current study investigated relationships between testosterone and behavior as moderated by family context features.

Is the Hormone–Behavior Relationship Linear?

When considering the link between testosterone and adjustment problems in children and adolescents, it is important to note that most studies have assumed testosterone–behavior relationships in youth to be linear. In doing so, they may have overlooked important, albeit complex, associations. Two recent studies of a large sample of 4,393 men call into question the assumption of linear relationships. The relationships between men's testosterone and depressive symptoms, aggression, health, and drug use in these studies were not linear. Rather, they were more appropriately described as U-shaped, with men with high and low testosterone levels having a higher risk of depressive symptoms. The link between high testosterone levels and depressive affect was entirely explained by unemployment, being single, drinking, and being in trouble with the law. However, none of these social factors explained the link between low testosterone and depression symptoms. Rat studies, on the other hand, point to a possible biological mechanism for this relationship: Serotonin receptors are increased by oestrogen (low levels of which are associated with depression). Because oestrogen is synthesised from testosterone, low testosterone levels may result in insufficient oestrogen, which may then result in low serotonin levels. We used an analytic strategy that looked at both linear and curvilinear relationships between testosterone levels and multiple domains of individual adjustment and interpersonal relationships in this study.

The Importance of Parental Testosterone Levels

According to one study, parents' testosterone may play a role in explaining the relationship between children's testosterone and adjustment, as well as the moderating effect of parent–child relationships. Researcher (1990) discovered that fathers with high testosterone had poorer relationships with adolescent sons. The tendency for many high testosterone men to be inept at initiating and maintaining high-quality marital relationships may indicate similar difficulties in initiating and maintaining high-quality relationships with offspring.

Women with high testosterone levels have been found to have low prematernal interest in children, fewer children, lower levels of traditionally feminine characteristics, and an attraction to male-dominated occupations. Although lower investment in children may be another predictor of high testosterone in mothers, none of these findings provide a compelling reason why women with high testosterone would have poor parent-child relationships. In fact, the competitive tendencies suggested by an interest in male-dominated occupations may indicate a desire to succeed in any endeavour, including parenthood. In this article, we will first look at the direct effect of parental testosterone on the quality of parent-child relationships.

The Social Environment's Role

Men's studies show a positive relationship between basal testosterone and risky behavior, but some of these studies also show that the social environment moderates hormonal influences. Marriage and stable employment, for example, reduce the likelihood of high-testosterone men engaging in deviant behavior or developing depression symptoms. These patterns are consistent with our conceptual framework and lead us to expect that a child's social environment will moderate the relationship between testosterone and behavior, a process that previous studies have not investigated. In our analyses, we look at whether the strength of the relationship between children's and adolescents' testosterone and risk behavior or depression symptoms is exacerbated or muted by the quality of parent-child relationships.

Gender's Function

Hormone-adjustment relationships may differ between boys and girls for at least two reasons. First, with the possible exception of early childhood, boys' testosterone production far outnumbers that of girls. If the strength of the testosterone-behavior link differs between boys and girls, analyzing their data together may obscure important relationships. Second, there are gender differences in the nature of children's and adolescents' adjustment problems, with girls being more likely to exhibit internalizing symptoms and boys being more likely to exhibit externalizing problems. For these reasons, hormone-adjustment associations were examined separately for girls and boys.

Testosterone and Growth

Do testosterone-behavior relationships differ by level of development as measured by age and pubertal stage? The majority of testosterone and devel-

opment research is focused on the hormone's relationship to reproductive maturity. It is rarely used, however, when studying cognitive, behavioral, and social change in children and adolescents. One exception is the study of testosterone's relationship to the expression of sexual behavior, where increases in testosterone are associated with an interest in sexual activity and a lower age of first coitus. As a result, in addition to reporting testosterone-behavior relationships for the entire sample, we also report findings for developmental subgroups defined by age and pubertal phase. Adolescence has been identified as a developmental turning point as well as a time of rapid change. According to research on parent-offspring interaction, the most conflict occurs between the ages of 10 and 14 years, which corresponds to the most rapid increase in testosterone and the most dramatic morphological changes. Sons and mothers interrupt each other more and explain themselves less during the puberty transition. Sons also show less deference to their mothers, and family interactions become more rigid. Paternal assertiveness and adolescent deference, on the other hand, characterize father-son relationships during this time period. Girls' early adolescent relationship changes have also been observed. In one cross-sectional study, declines in the quality of parent-daughter relationships were observed from just before menarche to more than 12 months after its onset. Mothers were viewed as less accepting, more controlling, and less influential at the onset of menarche, and mothers reported less daughter participation in family activities. During this time, fathers were also seen as less influential and accepting. The current study investigated the extent to which the moderating effect of parent-child relationships on the relationship between testosterone and child adjustment is more or less evident during middle adolescence compared to early and later adolescence. Development was tracked using both chronological age and pubertal phase. In summary, the overall goal of this study was to use a biosocial approach to investigate testosterone-behavior relationships in normally developing children and adolescents. The first question addressed in this study was whether above or below average levels of testosterone in boys and girls (relative to age and pubertal phase) were associated with risk behaviour and depression symptoms. Based on previous research, we expected to find high levels of testosterone associated with risky behavior, as well as high and low levels of the hormone associated with depressive symptoms. The second question we addressed was whether testosterone's ability to set specific adjustment problems in motion would be exacerbated or muted by the nature of the family context, specifically the quality of the parent-child relationship. The final question was whether testosterone-behavior links would differ depending on developmental stage.