

Sensation Seeking and Hormones in Men and Women: Exploring the Link

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Risky behaviors (e.g., binge drinking, drunk driving, risky sex) are increasing among U.S. college students, and the personality trait of *sensation seeking* provides a potential link between such norm-breaking behaviors and biological processes. We examined the relationship between sensation-seeking behaviors and two hormones, testosterone and cortisol, in male and female college students. Hormone levels were hypothesized to contribute to the variability of individual scores on Zuckerman's Sensation-Seeking Scale. As expected, males scored higher on the scale than females, but the data failed to support the generally accepted positive relationship between testosterone and sensation seeking for either sex. Instead, our results support the existence of a significant inverse relationship between cortisol and sensation seeking in men, but not in women, even after adjustment for testosterone levels and age. Our study contributes to the current literature by (a) supporting the association between risky behavior and a hormone other than testosterone, (b) being the first to examine the association between cortisol and sensation seeking in women, and (c) identifying a possible effect of gender on the association between hormones and sensation-seeking behaviors. Gendered social norms and expectations are likely to be partly responsible for this effect. Theory-guided interdisciplinary research is needed to improve understanding of the biological influences on human behavior, and special attention must be paid to social context, women's perceptions of their expected behavior, and gendered socialization regarding norm-breaking or risky behaviors, which may obscure biological links to female behavior. © 2001 Academic Press

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Recent data confirm the rising incidence of norm-breaking behavior among U.S. college students. The rates of binge drinking, multiple sexual partners, incidence of sexually transmitted diseases, drug use, and drunk driving have increased in recent years (Bell, Wechsler, and Johnston, 1997; Wechsler, Dowdall, Maenner, Gledhill-Hoyt, and Lee, 1998; Duncan, Donnelly, Nicholson, and White, 1999; Centers for Disease Control and Prevention, 2000; Wechsler, Lee, Kuo, and Lee, 2000). This phenomenon has been studied from social, psychological, and economic perspectives (Oetting, Deffenbacher, and Donnermeyer, 1998; Deery and Fildes, 1999; Fromme, D'Amico, and Katz, 1999), but biosocial explanations are scarce. The personality trait of sensation seeking, defined as pursuing and taking risks in order to experience a variety of new sensations (Zuckerman, 1979; McCourt, Gurrera, and Cutter, 1993), provides a link between deviant or norm-breaking behavior and biological processes. Deviant behavior can be considered a reflection of sensation-seeking tendencies (Newcomb and McGee, 1991; Oetting *et al.*, 1998; Deery and Fildes, 1999), which, in turn, have been associated with men's testosterone levels (e.g., by Daitzman, Zuckerman, Sammelwitz, and Ganjam, 1978; Daitzman and Zuckerman, 1980; Bogaert and Fisher, 1995; Gerra, Avanzini, Zaimovic, Sartori, Bocchi, Timpano, Zambelli, Delsignore, Gardini, Talarico, and Brambilla, 1999; see Wang, Mason, Charney, Yehuda, Sherry, and Southwick, 1997 for an exception) and cortisol levels (Netter, Henning, and Roed, 1996; Wang *et al.*, 1997). For example, studies on a large sample of male veterans ($n = 4179$) have found positive associations between testosterone and risk behaviors such as gambling, alcohol use, and multiple sexual partners (Dabbs and Morris, 1990; Mazur, 1995).

Another biological link to sensation seeking, not explored here, is the role of the neurotransmitters dopamine (Zuckerman, 1994; Netter *et al.*, 1996; Ruegg, Gilmore, Ekstrom, Corrigan, Knight, Tancer, Leatherman, Carson, and Golden, 1997; Gerra, Zaimovic, Timpano, Zambelli, Delsignore, and Brambilla, 2000) and serotonin (Zuckerman, 1994; Netter *et al.*, 1996).

In a comprehensive review of all aspects of sensation seeking, Zuckerman (1994) pointed out that, as early as 1973, the trait of sensation seeking was linked to both delinquency and creativity in different individuals (Farley, 1973, 1981, as cited by Zuckerman, 1994). In simple terms, Farley postulated that individuals from lower socioeconomic classes do not have access to the same outlets for prosocial and antisocial tendencies, implying that the environment provides the outlet for the sensation seeking, be it prosocial or antisocial (Farley, 1973, 1981, as cited by Zuckerman, 1994). Brook, Whiteman, Cohen, Shapiro, and Balka (1995) found that sensation seeking, among other personality traits, predicted alcohol use among adolescents and young adults.

The purpose of our study is to examine the relationship between two hormones, testosterone and cortisol, and sensation-seeking behaviors in men and women. We build upon previous studies mentioned above that have examined the link between these hormones and sensation-seeking measures. The participants in our study, students at a state university from similar socioeconomic backgrounds, share a common social context and environment. The relative lack of positive outlets for sensation seeking on a college campus located in a medium-sized city is likely to contribute to the high rates of alcohol and drug use, multiple sexual partners, and high incidence of sexually transmitted diseases found on many U.S. college campuses.

The first study to report a link between testosterone and sensation seeking (Daitzman *et al.*, 1978) used an earlier version of Zuckerman's (1979) Sensation-Seeking Scale (SSS-V) that consisted of four subscales: Thrill and Adventure Seeking (TAS), Disinhibition (DIS), Experience Seeking (ES), and Boredom Susceptibility (BS). A review of past research indicates that evidence is inconclusive, however. Wang *et al.*, (1997) reported no relationship between testosterone and sensation seeking as measured by the Cloninger Tridimensional Personality Scale, which contains a novelty-seeking component to explore the trait of sensation seeking (Cloninger, Przybeck, and Svrakic, 1991). Other researchers reported a positive association between testosterone and Zuckerman's SSS-V total score but not with any of the subscales (Bogaert and Fisher, 1995; Gerra *et al.*, 1999). Still others reported an asso-

ciation between testosterone and one of the subscales (DIS) but no association with any of the other three subscales or the total score (Daitzman *et al.*, 1978; Daitzman and Zuckerman, 1980). Evidence regarding women is virtually nonexistent. So far as we know, only one study (Daitzman *et al.*, 1978) has included women, and its small sample size ($n = 7$) precludes any generalizations.

The relationship between cortisol and sensation-seeking behavior has also received some attention. This steroid, produced by the adrenal cortices, is released in times of chronic physical or psychological stress and shows a clear circadian rhythm (Kirschbaum and Hellhammer, 1994; Berne and Levy, 1998). On the basis of findings from the large sample of veterans he studied, Mazur (1995) predicted a negative correlation between cortisol and risk-taking behaviors. He reasoned that "nervous" individuals with high cortisol would be the least likely to engage in sensation-seeking behaviors, whereas those accustomed to deviant and "norm-breaking" behaviors would exhibit low cortisol levels because their risk taking would no longer produce stress. More recent studies have supported this inverse association (Netter *et al.*, 1996; Wang *et al.*, 1997), but Netter *et al.* (1996) reported a negative correlation of men's cortisol levels with the ES subscale of the SSS-V (Zuckerman, 1979) but not with SSS-V as a whole or any of the other subscales. A thorough review of the literature indicated that no studies have examined the role of cortisol in sensation seeking in women, even though the two sexes produce similar levels of this hormone.

Studying both men and women in a college population is a logical step in the identification of important linkages between biological variables and sensation-seeking behavior, which may contribute to the understanding of deviant behavior on college campuses. Specifically, in the present study, we test three hypotheses:

1. Men engage in more sensation-seeking behaviors than women.
2. Testosterone levels are positively associated with sensation seeking in both men and women.
3. Cortisol levels are negatively associated with sensation seeking in both men and women.

METHODS

Sample

The predominantly white non-Hispanic sample consisted of 68 males (mean age 22.01 ± 0.53 SEM)

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