

Reference

C. Eisenegger et al, Prejudice and truth about the effect of testosterone on human bargaining behaviour, *Nature* **463**, 356 (2010).

Abstract

Testosterone is a steroid hormone known to have a central role in sexual behaviour and brain development. There are currently two reigning theories on the effects of testosterone on human behaviour – social status theory; which hypothesises testosterone increases ‘social status seeking’ and folk wisdom theory; which proposes testosterone induces antisocial and aggressive behaviours. Much of the experimentation performed on these theories provides only correlative evidence. To discriminate between the two, 121 female subjects (mean age of 25.16 ± 6.40 years), partook in the ‘bargaining ultimatum game’ in which a proposer, party A, could delegate up to 10 real money units (MUs) to a responder, party B. Party B could not make a counter offer to Party A, but if party B vetoed A’s offer, neither party received MUs. The results of the experiment show that a higher frequency of ‘fair offers’ (1:1 MUs) were made via subjects who had received a sublingual administration of testosterone (0.5 mg) 4 hours prior to experimentation. Subjects who believed they had received testosterone, regardless of whether they had, showed a higher frequency of unfair offers. The results are in congruence with social status theory, though highlight that belief in folk wisdom theory may predetermine the subject’s behaviour.

199 words.

Summary

The primary objective of this experiment was to discriminate between and determine which of the two hypotheses, social status theory, and folk wisdom theory, best describe the affects of the steroid hormone, testosterone, on human behaviour. Evidence from rodent studies and salivary testosterone levels in male and female prisoners supports folk wisdom theory; indicating a positive correlation between endogenous testosterone levels and the exhibition of aggressive, egoistic and anti-social behaviour.

The social status theory proposes that testosterone induces status seeking, particularly in social situations that constitute a potential challenge to a person’s status. A social affront can be averted through an adaptation of behaviour – from which testosterone is thought to influence. The experimental evidence supporting and discriminating between these theories is sparse and mainly correlative. The folk wisdom theory has been used as a legitimate legal defence in the United States, so it is therefore important to investigate the credibility that testosterone is such a large inductor of aggressive behaviour.

The prosocial aspect of status seeking was examined via the ultimatum bargaining game in which 121 female participants, (mean age of 25.16 ± 6.40 years) partook, 60 of whom were randomly and anonymously delegated role of the proposer, party A. The proposer’s role was to divide 10 real money units (MUs) between parties A and B. The possible divisions of MUs, A:B, consisted of 1:1, 7:3, 8:2, 10:0 with 1:1 representing the most fair, and 10:0 the least. If B accepted A’s offer then the proposed allocation was implemented. Party B could not make a counteroffer to A, but if B vetoed A’s

proposal, then neither party would receive MUs. Each subject was asked which substance they thought they were administered.

If social status theory is correct then we would expect an increased frequency of fair offers from subjects who had sublingually received a single dose (0.5mg) of testosterone 4 hours prior to the experiment. However, folk wisdom theory suggests that administration of testosterone should cause an increase in unfair offers.

The results of the experiment show that subjects who had received exogenous testosterone made significantly higher offers, with 3.90 MUs on average, while placebo subjects offered 3.40 MU. Notably, strong support for a 'belief effect' was found whereby subjects who believed they received testosterone made much lower offers; i.e. 2.38 MUs – received placebo but believed testosterone, and 3.47 MUs – received testosterone and believed testosterone.

Taken together, the positive impact of testosterone on the fairness of bargaining offers casts strong doubt on the folk hypothesis and is consistent with the social status hypothesis. Alternative explanations for the higher proposal offers observed could be that testosterone has a positive influence on altruistic motivation. If this were the case we would also observe lower rejection rates from testosterone administered responders. It was found however that there was a null effect on the rate of rejection rates implemented by party B. Personality measures were also taken and it was found that neither subjects under the placebo or testosterone belief had more Machiavellian nor more dominant personalities than each other.

Social status theory is therefore the only compatible hypothesis with the outcomes of the experiment. The administration of testosterone increased the number of fair offers and had no effect on the rejection rates of party B. The indirect effects of testosterone on emotional state such as anxiety, anger and arousal cannot explain the results obtained. The findings highlight that both biological and psychological factors influence human behaviour and that in future experiments it is important to control for subject's beliefs so that the pure substance effect is not over or under-estimated.

594 words.