

The effect of mental rotation on changes in plasma testosterone and cortisol levels

Research Article

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Abstract: Testosterone level has an influence on cognitive functions, especially spatial abilities. The relationship is, however, bidirectional and brain activity also affects testosterone levels. The aim of this study was to analyze the effects of an intensive 3D mental rotation task on testosterone levels in young healthy men and women. In the mental rotation task, men reached a higher top score ($P=0.027$) and total score ($P=0.004$) compared to women. In 8 out of 9 women ($P=0.008$) but not in men ($P=0.129$) testosterone levels decreased after one hour of mental rotation testing. A significant gender difference was shown ($P<0.0001$). In all women, plasma cortisol levels were significantly lower after testing ($P=0.004$). In men cortisol levels decreased in 7 out of 9 subjects ($P=0.039$). A significant gender difference was not found ($P=0.19$). No association was found in women between baseline testosterone levels and mental rotation total score ($P=0.810$). In men there was a positive correlation between baseline testosterone and mental rotation total score ($P=0.015$). A significant gender difference was seen in the association between testosterone and mental rotation score ($P<0.05$). Mental rotation stimuli caused significant changes in hormonal levels of testosterone and cortisol. A gender-specific response was detected in testosterone fluctuation.

Keywords: Mental rotation • Testosterone • Cortisol • Hormonal changes • Plasma

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1. Introduction

Recent observations indicate that sex and level of steroid hormones may influence cortical networks associated with specific cognitive functions, in particular visuo-spatial abilities [1-7]. On the other hand, a variety of factors, including stress, emotions and other brain activities, can themselves influence hormone levels. For example, sexy thoughts increase testosterone levels in women [8]. Watching and participating in sexual activities induce elevation of male testosterone levels [9]. Hormonal changes also occur when falling in love. Testosterone levels are lower in men in love, while women of the same group present higher testosterone levels [10]. Human competitive interactions highly

influence hormonal fluctuation [11]. The victory in a sport competition provokes strong emotions associated with an increase of testosterone [11]. Conversely, stress can lower the level of testosterone in human body. To explore these interactions, laboratory studies have the advantage of standardization of the stressor and better control for known confounding factors. Commonly used stressors in the laboratory setting include mental arithmetic exercises, speech tasks, the Stroop test, videogame playing, films or videotapes and interviews [12]. The results of previous studies suggest that an acute psychosocial laboratory stressor has no strong rapid effects on salivary gonadal steroid hormones. The findings might suggest that stress-induced changes in gonadal steroids occur only in response to more extreme stimuli such as physical

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