

Received 22 January 2016
Accepted 3 March 2016
Available online 10 April 2016

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ARTICLE INFO

Article history:

Received 22 January 2016
Accepted 3 March 2016

Keywords:

Depression
Hypothalamic-pituitary-adrenal axis
Psychoneuroendocrinology
Stress

ABSTRACT

Depression is associated with increased levels of cortisol and decreased levels of dehydroepiandrosterone sulfate (DHEAS). The present study examined the relationship between depression and the hypothalamic-pituitary-adrenal (HPA) axis in healthy individuals. A total of 26 healthy volunteers (13 men, 13 women) were recruited. All participants completed a Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) and the Beck Depression Inventory (BDI-II). Saliva samples were collected at baseline and after 10 min of mental arithmetic. Salivary cortisol and DHEAS were measured by enzyme immunoassay. The results showed that depression was negatively correlated with salivary cortisol ($r = -0.51$, $p < 0.05$) and positively correlated with salivary DHEAS ($r = 0.50$, $p < 0.05$). In addition, depression was negatively correlated with the ratio of salivary cortisol to DHEAS ($r = -0.49$, $p < 0.05$). These findings suggest that depression is associated with decreased HPA activity in healthy individuals.

1. Introduction

Depression is a common mental disorder that affects approximately 10% of the world population (Kroenke et al., 2003). The prevalence of depression is higher in developed countries (>\$1,000 GDP per capita) than in developing countries (<\$1,000 GDP per capita) (Kroenke et al., 2009). Depression is associated with increased levels of cortisol and decreased levels of dehydroepiandrosterone sulfate (DHEAS) (Alderman et al., 2002).

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URL: <https://doi.org/10.1016/j.psyneuen.2016.05.005>

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2002). Cortisol is a major stress hormone that is secreted from the adrenal cortex in response to stress (Liu et al., 2015).

DHEAS is a steroid hormone that is secreted from the adrenal cortex and has anti-stress properties (Liu et al., 2011), which may explain why depression is associated with decreased DHEAS levels.

Several studies have shown that depression is associated with increased levels of cortisol and decreased levels of DHEAS (Alderman et al., 2008, 2014), but others have found no significant association (Liu et al., 2008). Liu et al. (2011) found that depression was associated with increased levels of cortisol and decreased levels of DHEAS (Alderman et al., 2015).

These findings suggest that depression is associated with increased HPA activity in healthy individuals. However, the mechanisms underlying this association remain unclear.

and the hippocampus (Liu et al., 2004). A significant increase in the expression of *BDNF* mRNA was observed in the hippocampus of the *BDNF* transgenic mice, suggesting that the hippocampus may play an important role in the regulation of *BDNF* gene expression.

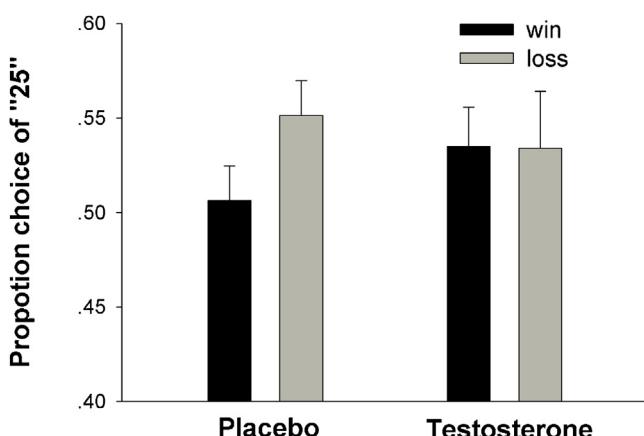
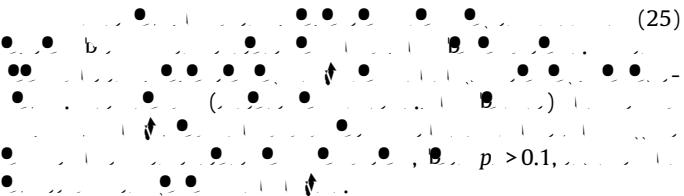


Fig. 2. Proportion choice of "25" for win and loss conditions under placebo and testosterone.

2.5. Mood measurement



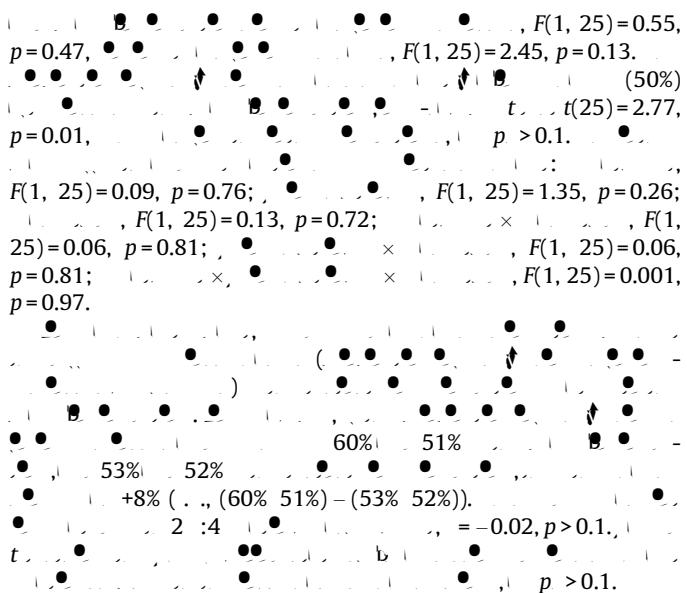
2.6. Statistical analysis



3. Results

For the win condition, the proportion of "25" choice was significantly higher than the loss condition ($F(1, 25)=0.55$, $p=0.47$, $t(25)=2.45$, $p=0.13$). For the placebo group, the proportion of "25" choice was significantly higher for the win condition compared to the loss condition ($F(1, 25)=2.77$, $p=0.01$, $t(25)=2.77$, $p > 0.1$). For the testosterone group, the proportion of "25" choice was significantly higher for the win condition compared to the loss condition ($F(1, 25)=0.09$, $p=0.76$; $F(1, 25)=1.35$, $p=0.26$; $F(1, 25)=0.13$, $p=0.72$; $F(1, 25)=0.06$, $p=0.81$; $F(1, 25)=0.06$, $p=0.81$; $F(1, 25)=0.001$, $p=0.97$). The interaction between condition and treatment was not significant ($F(1, 25)=0.02$, $p>0.1$).

For the loss condition, the proportion of "25" choice was significantly higher than the win condition ($F(1, 25)=0.55$,



4. Discussion

Our results indicate that the mood of participants was not significantly different between the placebo and testosterone groups. This finding is consistent with previous studies (Bartal et al., 2013; Cacioppo et al., 2009). However, our results show that the mood of participants was significantly higher in the win condition compared to the loss condition, which is consistent with previous findings (Bartal et al., 2002; Cacioppo et al., 2015). The mood measurement scores for the placebo group were significantly higher than those for the testosterone group, which is also consistent with previous findings (Bartal et al., 2004; Cacioppo et al., 2005). Our results suggest that the mood of participants was significantly higher in the win condition compared to the loss condition, which is consistent with previous findings (Bartal et al., 2012; Cacioppo et al., 2016). Our results also show that the mood of participants was significantly higher in the win condition compared to the loss condition, which is consistent with previous findings (Bartal et al., 2010; Cacioppo et al., 2010).

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Role of the funding source

● This article is the result of independent research funded by the National Institutes of Health (NIH).
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