



## The relationship of plasma cortisol level with processing speed and working memory in methamphetamine users

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### Letter to Editor

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#### Introduction

Biological, hormonal, and psychological changes are known as the side effects of chronic use of methamphetamine.<sup>1</sup> Studies show that cortisol levels in drug-dependent individuals are significantly higher than the normal population.<sup>2</sup> Prolonged exposure to increased levels of cortisol can be associated with reduce in cognitive functions.<sup>3</sup> However, in other studies, the relationship between the cortisol level and cognitive functioning has been reported insignificant.<sup>4</sup> In this regard, a number of studies have indicated a lack of significant correlation between the cortisol level and psychiatry syndrome such as depression, which can confirm the inability of the effect of cortisol on reducing cognitive functioning.<sup>1</sup>

Since increased levels of cortisol have been observed in chronic methamphetamine users, and in conditions exposed to stressors, this issue increases the speculation among researchers about the possible association of high levels of cortisol and cognitive damages in drug consumers. In the previous study, we

investigated the correlation between the cortisol level and executive functions, which showed a significant inverse relationship.<sup>3</sup> Due to the lack of a study on the relationship between the cortisol level and memory performance with the processing speed in methamphetamine users, this study aimed to evaluate two hypotheses, comparing cognitive functions of consumers with nonconsumer individuals, and evaluating the relationship between cortisol levels with working memory and processing speed.

This study was the third part of a multiphase study with clinical trials registry code of TCTR20180616001 conducted between March 15 and June 9, 2015. From the people who referred for inguinal hernia to three public hospitals in Tehran, Iran, 35 male methamphetamine users and 35 non-consuming subjects ( $n = 70$ ) were selected through respondent-driven sampling (RDS) method. After a structured clinical interview for the fourth version of Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) (SCID), plasma serum levels of cortisol were measured at three time intervals, at 0 (after induction of anesthesia), and 12 and 24 hours later. Then, the samples were centrifuged for 12 minutes at a speed of 3,000 rpm and assessed

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using radioimmunoassay (RIA) method.

After 10 days of operation, the Stroop Color and Word Test (SCWT, 2 cards) and subtest digit span from the Wechsler Adult Intelligence Scale were performed in order to evaluate the cognitive functions in three periods with an interval of 48 hours. The average of measurements was used as evaluation criterion. Data were analyzed using analysis of variance (ANOVA) and repeated measures correlation (rmcorr) methods. All stages of the study were conducted after obtaining informed consent. and based on the latest version of the Declaration of Helsinki.

ANOVA analysis showed that in two indices of processing speed, the working memory scores of the methamphetamine consumer group were significantly lower than the control group ( $P < 0.050$ ). In the index of cortisol level in the control group, an increase in the cortisol level (24 hours after operation) in the methamphetamine group was observed ( $P < 0.010$ ).

The results of correlation test with repeated measures showed that there was a significant negative correlation between the cortisol level with processing speed [ $r_{rm}$  (70, Cortisol-processing speed) =  $-0.71$ ; confidence interval of 95% (CI95%):  $-0.82, -0.60$ ;  $P < 0.001$ ] and working memory [ $r_{rm}$  (70, Cortisol- working memory) =  $-0.58$ , CI95%:  $-0.71, -0.45$ ;  $P < 0.001$ ].

Results showed a weaker performance in the processing speed and working memory among methamphetamine users compared to control group. Moreover, there was a significant inverse relationship between cognitive functions and salivary cortisol. In consist with the results of this study, the results of the study by Pirnia et al.<sup>1</sup> showed that the cortisol index in methamphetamine users was higher than that of non-users group. Besides, in another study by Pirnia et al.,<sup>3</sup> the uplift of cortisol was associated with damage to executive functions. Harris et al.<sup>5</sup> also showed a relationship between high cortisol levels and lower cognitive abilities. Contrary to our results, Korten et al.<sup>4</sup> found that there was no significant relationship between cortisol level and cognitive functioning. The relationship between the duration of methamphetamine use and the uplift of cortisol by considering gender role and hormonal functions can be a good route for future studies.

### Conflict of Interests

Authors have no conflict of interests.

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### References

1. Pirnia B, Givi F, Roshan R, Pirnia K, Soleimani AA. The cortisol level and its relationship with depression, stress and anxiety indices in chronic methamphetamine-dependent patients and normal individuals undergoing inguinal hernia surgery. Med J Islam Repub Iran 2016; 30: 395.
2. Pirnia B, Janbozorg M, Pirnia K. Comparing the depression symptoms and gender differences in individuals dependent and independent to methamphetamine and the relation of these symptoms with plasma cortisol level, a cross-sectional study. Razi J Med Sci 2017; 24(6): 49-56. [In Persian].
3. Pirnia B, Pirnia K, Aghajanpoor M, Mardan F, Zahiroddin A. Relationship between function of hypothalamic-pituitary-adrenal axis and executive functions in chronic methamphetamine users: A cross-sectional study. Asian J Psychiatr 2018; 35: 113-4.
4. Korten NCM, Penninx BWJH, Rhebergen D, Deeg DJH, Comijs HC. Hypothalamus-pituitary-adrenal-axis activity and cognitive functioning in older adults. Psychoneuroendocrinology 2018; 91: 50-4.
5. Harris MA, Cox SR, Brett CE, Deary IJ, MacLullich AMJ. Cognitive ability across the life course and cortisol levels in older age. Neurobiol Aging 2017; 59: 64-71.