The Effects of Shisheh on Adrenal Gland Function in Male Rats

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Abstract—Adrenal gland function is influenced by various factors including opioids. The purpose of this study was to determine the effects of Shisheh (Methamphetamine) on serum levels of ACTH and cortisol in rats. In this study male Wistar rats were randomly divided to control, low-dose (2mg/kg), medium-dose (4mg/kg), and high dose (6mg/kg) of Shisheh receiving groups 5 rats in each. Shisheh or saline was injected intraperitoneally once a week for 6 weeks. Blood samples were obtained by cardiac puncture method and serum level of ACTH and cortisol was measured by ELIZA method. Data were analyzed and compared between groups using ANOVA. Serum levels of ACTH were significantly increased in 2, 4 and 6mg/kg of Shisheh receiving groups compared with control group (P<0.01, P<0.01 and P<0.001, respectively). Serum level of cortisol was also significantly increased in Shisheh receiving rats compared with control animals (P<0.001). The results of this study show that the injection of Shisheh can increase the activity of the adrenal gland.

Index Terms—Shisheh, ACTH, Cortisol, Rat.

I. INTRODUCTION

Adrenocorticotropic hormone (ACTH) is a polypeptide tropic hormone produced and secreted by the anterior pituitary gland. It is an important component of the hypothalamic-pituitary-adrenal axis and is often produced in response to biological stress. ACTH stimulates secretion of glucocorticoid steroid hormones from adrenal cortex cells [1]. Cortisol, also known more formally as hydrocortisone, is a glucocorticoid, produced by adrenal gland [2] and stimulates gluconeogenesis, lipogenesis and proteolysis and activates anti-stress and anti-inflammatory pathways [3], [4].

Methamphetamine is a psychomotor stimulant which can adversely affect on nervous system [5]. It has also been suspected that amphetamine influences adrenal gland [6].

Considering different findings of previous studies concerning with the effects of amphetamines on thyroid gland this study was exerted to investigate the effects of Shisheh (a type of methamphetamine which is used in Iran) on serum level of ACTH and cortisol, as an usual index of adrenal gland function, in male rats.

II. MATERIAL AND METHODS

A. Animals

Adult Wistar rats weighting 200±30g were purchased and raised in our colony from an original stock of Pasteur institute (Tehran, Iran). The temperature was at 23±2 °C and animals kept under a schedule of 12h light:12h darkness (light on at: 08: 00 a.m.) with free access to water and standard laboratory chow. Care was taken to examine the animals for general pathological symptoms. Food was withheld for 12-14h before death. This study was performed according to ethical guidelines relating to working with laboratory animals [7].

B. Protocol of Study

Male Wistar rats were randomly divided into control, normal saline receiving, low-dose (2mg/kg/day) [8,9], medium-dose (4mg/kg/day) [10,11], and high-dose (6mg/kg/day) [10] of Shisheh receiving groups of 5 rats in each. Shisheh was intraperitoneally injected. After six weeks, blood samples were collected in appropriate tubes by cardiac puncture technique 24h after the last treatment. After collection, the blood samples left to clot at room temperature for 15 minutes and then centrifuged at 2500 r.p.m for 10 minutes [12]. The serum layer was then separated and aliquoted into small test tubes and stored at -20 °C until ACTH and cortisol measurement.

C. Statistical Analysis

All values are presented as mean ± S.E.M. Statistical significance was evaluated by one-way analysis of variance (ANOVA) using SPSS 19. Significance was measured using Fisher’s least significant for the exact P values and significant differences are noted in the results. Differences with P<0.05 were considered significant.

III. RESULTS

Table 1 indicates the serum levels of ACTH and cortisol in male rats.

Serum level of ACTH and cortisol was not significantly changed in saline receiving animals compared to control animals. Serum levels of ACTH were significantly increased in 2, 4 and 6mg/kg body weight of Shisheh receiving groups compared with control group (P<0.01, P<0.01 and P<0.001, respectively). Serum level of cortisol was also significantly increased in Shisheh receiving rats compared with control animals (P<0.001).
IV. DISCUSSION

According to our finding the injection of Shisheh resulted in increased serum levels of ACTH and cortisol. This finding is in accordance with the results of previous studies indicating the stimulatory effects of amphetamine derivatives on adrenal gland [6]. Increased serum level of cortisol may come from the direct impact of methamphetamine on pituitary - adrenal axis leading to increased ACTH level [6], [13]. Studies also show that enhancement of serum level of prolactin which is followed by increased testosterone level can influence adrenal gland function [14], [15]. Findings report that increased serum testosterone can influence secretion of ACTH [13], by which may bring about enhanced serum cortisol level [16].

V. CONCLUSION

Shisheh injection results in increased serum level of ACTH and cortisol. This finding indicates that adrenal hyperactivity is a major adverse effect of amphetamine injection which can bring about other pathophysiological changes in normal body functions.

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REFERENCES