The Effects of Methmethamphetamine on Hematocrit and Hemoglobin in Rat

Alaee Z*, Ahmadi R, Sattari S

Abstract— Studies have shown that the opioids influence red blood cell indices. The aim of this study was evaluate the effects methamphetamine on hematocrit (HCT) and hemoglobin (Hb). Male and Female Wistar rats were divided to control, low-dose (2mg/kg), medium-dose (4mg/kg) and high dose (6mg/kg) of methamphetamine receiving groups of 5 rats in each. Methamphetamine injected intraperitoneally. After 6 weeks, blood samples were collected using cardiac puncture method. HCT and Hb were measured and compared between groups using Student's t-test and ANOVA. Our findings indicated that Hb and HCT was significantly increased in methamphetamine receiving animals compared with control rats (P<0.05), according to which, it can be concluded that methamphetamine administration results in increased hematopoiesis.

Index Terms— Methamphetamine, HCT, Hb, Rat.

I. INTRODUCTION

Red blood cells contain hemoglobin, which is iron containing oxygen transport metalloprotein [1]. Hemoglobin is also found outside red blood cells and their progenitor lines [2]. Other cells that contain hemoglobin include the dopaminergic neurons in the substantia nigra, macrophages [3], alveolar cells [4], and mesangial cells[5] in the kidney [6]. Hemoglobin is synthesized in a complex series of steps.

The hematocrit (Ht or HCT) or packed cell volume (PCV) is the volume percentage (%) of red blood cells in blood [7]. hematological indices including Hb and HCT are influenced by various factors. The studies show that pulsed electric field [8], magnetic field exposure [9], plant extracts [10], [11], drugs [12], chemicals [13], [14] and opioids [15]-[16] can influence hematological parameters including Hb and HCT.

We exerted the present study to determine the effects of Iranian made methamphetamine (Shisheh) on Hb and HCT in male and female rats.

II. MATERIAL AND METHODS

A. Animals

In this study male and female Wistar rats were used. Rats weighing 200-250 g were purchased from Pasteur Institute of Iran and were transferred to the animals care center of Hamedan Islamic Azad University. The animals were kept at 22 ± 2 °C and 12 hours light and 12 hours dark photoperiod - dark starting at 8 in the morning light, as well as clinical studies done to look for signs of pathology. Food and water were available unlimited for rats.

B. Protocol of Study

Male and female Wistar rats were divided to control, low-dose (2mg/kg), medium-dose (4mg/kg) and high dose (6mg/kg) of metmethamphetamine receiving groups 5 rats in each. Metmethamphetamine was injected intraperitoneally. After 6 weeks, blood samples were collected using cardiac puncture method and HCT and Hb were measured and compared between groups. All animal experiments were carried out in accordance with the guidelines of Institutional Animals Ethics Committee.

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

Tables 1 and 2 represents Hb and HCT in methamphetamine receiving and control male and female rats, respectively.

<table>
<thead>
<tr>
<th>Male Groups</th>
<th>Hb (g/dL)</th>
<th>P</th>
<th>HCT (%)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>4.7</td>
<td>-</td>
<td>14.1</td>
<td>-</td>
</tr>
<tr>
<td>M-Amph(2mg/kg)</td>
<td>8.1</td>
<td>&lt;0.05</td>
<td>24.5</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>M-Amph(4mg/kg)</td>
<td>9.5</td>
<td>&lt;0.05</td>
<td>28.6</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>M-Amph(6mg/kg)</td>
<td>15</td>
<td>&lt;0.05</td>
<td>45</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

The data are indicated as mean. P values are expressed in comparison with control group. Amph indicates methamphetamine and N.S. represents no significant difference.
Our findings indicate that there was significant difference in Hb and HCT between methamphetamine receiving animals and control rats. Hb was significantly increased in male or female methamphetamine receiving animals compared with control group (P<0.05). HCT was also significantly increased in male or female methamphetamine receiving animals compared with control group (P<0.05). Hb or HCT was also more increased in high dose of methamphetamine receiving animals compared with low dose of methamphetamine receiving animals in male or female rats.

IV. DISCUSSION

Our study indicated that Iranian made methamphetamine Shisheh) administration results in increased Hb and HCT in rats. In line with this report, the effects of chemicals and opioids on hematological indices have been previously established [14]–[18]. It has been shown that HCT is enhanced in rats by caffeine administration [18]. In contrast to our finding, there are reports indicating the reducing effects of caffeine on HCT and some other hematological indices [17].

Studies show that chronic amphetamine can increase in a dose-dependent manner serum corticosterone levels [16]. Since corticosteroids have a pivotal role in hematopoiesis [19], it is conceivable that amphetamines can influence Hb and HCT by influencing the hematopoietic pathways. However, further cellular and molecular investigations are required to consolidate this approach.

V. CONCLUSION

We have shown that administration of methamphetamine results in serious enhancement of Hb and HCT in male and female rats. Enhanced Hb and HCT can seriously put at risk the health of organisms. Therefore, this aspect of amphetamines, as opioid or drug derivatives, is important in clinical considerations.

ACKNOWLEDGMENT

This research has been done with the support of Islamic Azad University-Hamedan Branch. We appreciate all who helped us to exert the present study.

### TABLE 2. HB AND HCT IN METHAMPHETAMINE RECEIVING AND CONTROL FEMALE RATS

<table>
<thead>
<tr>
<th>Female Groups</th>
<th>Hb</th>
<th>HCT</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>6</td>
<td>14.4</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>M-Amph(2mg/kg)</td>
<td>8.1</td>
<td>40</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>M-Amph(4mg/kg)</td>
<td>13.3</td>
<td>41.3</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>M-Amph(6mg/kg)</td>
<td>13.7</td>
<td>43.5</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

The data are indicated as mean. P values are expressed in comparison with control group. Amph indicates methamphetamine and N.S. represents no significant difference.

### REFERENCE:


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[10]. NN Obaji, JN Egsungwuwu, BI Uche, A Nwafor, CS Ufearo, RC Uchefuna, DC Nwaorah, OM Adienbo, OJ Olorunfemi


