Ejaculations Induced by \( p \)-Chloroamphetamine (PCA) in Rats, Hamsters and Mice

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The ejaculatory response induced by \( p \)-chloroamphetamine (PCA) in male rats, hamsters and mice was observed during 2 hours after the injection. The animals were treated intraperitoneally with PCA at doses ranging from 0.78125 to 160 mg/kg. The ED\(_{50}\) (effective dose in 50% of animals) values of PCA for the initiation of ejaculation in rats and hamsters were 1.3397 (1.0732-1.6725) and 0.1105 (0.0802-0.1522) mg/kg, respectively. On the other hand, no ejaculation was observed in any mice at any doses examined. So we concluded that there are species differences in the ejaculatory response, induced by PCA, among rats, hamsters and mice.

--- KEY WORDS : ejaculation, 5-HT, PCA

Pharmacological evidence suggests that \( p \)-chloroamphetamine (PCA) releases 5-hydroxytryptamine (5-HT) [2, 9] and catecholamines [3]. Some of the behavioral effects of PCA, e. g. increased locomotor activity [1, 7], stereotypic behavior [12], and salivation [4, 5], may be mediated by these transmitters. Humphries et al. [4, 5] observed that PCA induced ejaculation in rats. The male rat ejaculated without the presence of a receptive female within 30 min after the injection of PCA. These results suggest that 5-HT plays some role in this effect.

It is well known that the copulatory behavior of male rats, hamsters and mice is characterized by the male repeatedly approaching and mounting the female. The mounting behavior leads to intromission, and after several intromissions, an ejaculation occurs. Following ejaculation, there is a post-ejaculatory period before the male again attempts copulation with the female. However, detailed observation has shown differences in the copulatory pattern among the three rodents. Generally speaking, male rats [8, 10, 11] and hamsters [15, 16] ejaculate several times an hour, while male mice [6, 13] ejaculate only once a night. In addition, ejaculation latency and post-ejaculatory intervals in rats and hamsters are shorter than in mice [6, 8, 10, 11, 13, 15, 16].

The purpose of the present study was to determine whether male hamsters and mice injected with PCA would ejaculate similarly to rats.

Sexually experienced male Wistar-Imamichi rats aged 9-12 weeks, Syrian hamsters aged 9-11 weeks and IVCS mice aged 8-11 weeks were used in this experiment. The animals were kept under controlled light (14 hr light, 10 hr dark; lights off at 19:00) and temperature (22-27°C) conditions. They received a standard laboratory diet (MF, Oriental Yeast Co., Ltd.) and
Table 1. Effects of p-chloroamphetamine (PCA) on ejaculatory response in rats, hamsters and mice

<table>
<thead>
<tr>
<th>PCA (mg/kg)</th>
<th>Rat</th>
<th>Hamster</th>
<th>Mouse</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.078125</td>
<td>1/6</td>
<td>0/6</td>
<td>nc</td>
</tr>
<tr>
<td>0.15625</td>
<td>5/6</td>
<td>0/6</td>
<td>nc</td>
</tr>
<tr>
<td>0.3125</td>
<td>0/6</td>
<td>8/8</td>
<td>0/6</td>
</tr>
<tr>
<td>0.625</td>
<td>0/8</td>
<td>6/6</td>
<td>0/6</td>
</tr>
<tr>
<td>1.25</td>
<td>4/10</td>
<td>0/6</td>
<td>nc</td>
</tr>
<tr>
<td>2.5</td>
<td>8/8</td>
<td>0/6</td>
<td>nc</td>
</tr>
<tr>
<td>5.0</td>
<td>6/6</td>
<td>0/6</td>
<td>nc</td>
</tr>
<tr>
<td>10.0</td>
<td>0/6</td>
<td>nc</td>
<td></td>
</tr>
<tr>
<td>20.0</td>
<td>0/9</td>
<td>nc</td>
<td></td>
</tr>
<tr>
<td>40.0</td>
<td>0/8</td>
<td>nc</td>
<td></td>
</tr>
<tr>
<td>80.0</td>
<td>0/8</td>
<td>(8)</td>
<td></td>
</tr>
<tr>
<td>160.0</td>
<td>0/7</td>
<td>(7)</td>
<td></td>
</tr>
</tbody>
</table>

ED_{50} \(^{b}\) = 1.3397 \(1.0732-1.6725\) mg/kg
(95% confidence limits) = 0.1105 \(0.0802-0.1522\) mg/kg

\(^{a}\): Number of animals ejaculating / Number of animals injected with PCA
\(^{b}\): Calculated by the Van der Waerden method
nc: not calculated
( ): No. of dead animals

tap water ad libitum. On the day of testing, PCA HCl (Sigma Chemical Co., Ltd.) was dissolved in saline and administered intraperitoneally (i. p.) in a volume of 0.1ml/100g body weight. Single doses ranging from 0.078125 to 160mg/kg PCA were given to the animals. Each dosage group consisted of 6-10 males. In the ejaculating test, each male was placed in a testing chamber(30 × 40 × 20cm) with a mesh floor, 5 min preceding the injection of PCA. A mirror was placed beneath the testing chamber, so that the experimenter had a ventral as well as a lateral view of the genital region of the subjects during a testing session. When tests were initiated at 19:00, dim red light was provided. Ejaculation was recorded by counting seminal material collected during each 30 min period. Observations were conducted for 2 hrs.

Table 1 presents the results of the ejaculatory response during a period of 2 hrs in rats, hamsters and mice treated with PCA. PCA caused a dose-dependent ejaculatory response in rats and hamsters. These animals, except a few rats, showed one ejaculation within 30 min after the injection of PCA. In the rat study, incidences of ejaculation were 0, 40 and 100% at a dose of 0.625, 1.25 and 2.5mg/kg, respectively. The dose level expected to cause an effect in 50% of the animals (ED_{50}) was calculated using the Van der Waerden Method [14]. The ED_{50} (95% confidence limits) of PCA for induction of ejaculation was 1.3397 (1.0732-1.6725) mg/kg. In the hamster, the ejaculation rates were 16.7, 83.3 and 100% at a dose of 0.078125, 0.15625 and 0.3125mg/kg, respectively. The ED_{50} value was 0.1105 (0.0802-0.1522) mg/kg. No ejaculation occurred in any mice at doses ranging from 0.0785 to 160 mg/kg. In 80 and 160 mg/kg doses, all mice died within 20 min after the injection of PCA. Furthermore, the surviving mice did not ejaculate until next morning.

These results show that there were species differences among rats, hamsters and mice in the ejaculatory response induced by PCA. In summary, hamsters were more sensitive to the response than rats, but mice were insensitive. The question arises, why do mice not ejaculate even when treated with large dosages of PCA? It may be that the secretion of 5-HT from serotonergic systems caused by PCA is not sufficient to elicit the ejaculatory performance. It appears that the threshold for the arousal of central nervous systems mediating ejaculatory performance may be very high in mice, compared with the other two rodents. In fact, IVCS mice ejaculate only once per night even when mated with receptive females [13]. The
significant differences of the dosage on ejaculatory response between rats and hamsters may also be related to the secretion of 5-HT and the threshold of sexual arousal. Further study is needed to clarify these points. Thus far, the mechanism of catecholamines effects on ejaculatory performance is unknown.

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References