

EFFECTS OF CHRONIC CAFFEINE ON EPISODIC-LIKE MEMORY TASKS IN RATS.

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Objectives:

Caffeine is a mild stimulant of the central nervous system and improves memory, particularly at low doses. Caffeine can improve cognitive function through antagonism of adenosine receptors, which induces the release of acetylcholine, or even the induction of synaptic changes, due to prolonged use (Nature 31-39; 361, 1993; Ann. Rev. Neurosci. 149; 21, 1998). Recently, caffeine administration has also been associated with changes in the rate of neurogenesis in adult rodents hippocampi (Neuropharmacol. 1-7; 30, 2009), what could affect memory and learning (Science 325, 210-213, 2009). In this study, we investigated the effects of treatment with low and high doses of caffeine on two episodic-like memory tasks, which have been shown to be hippocampal-dependent (Behav. Brain Res. 1-8; 300, 2009; Hippocampus 955-964; 18, 2008).

Methods and Results:

Eighteen three-month-old male Wistar rats (200 - 350g) were treated i.p. with saline, 15 or 30 mg/kg caffeine once a day for 45 days, and episodic-like memory behavioral tasks were started on the 29th and 41th days of treatment, respectively. The first one recollects what-when and what-where aspects of memory. The rats were exposed to four copies of an object on the first trial and then to a second sample of four copies of a new object on the second trial (after 1 h interval). The objects were placed on different positions on two trials. In the test, after 24h, the animals were exposed to two objects from each sample trial, located on the same position as before, except for one copy of the first sample (displaced old object). The second task consists of three 5-min-trials with 3-min-intervals between them in which the animal is exposed to the same object located in different positions in each trial. In the test trial, after 30 min, two copies of the object are presented (one of them in the same position as the first sample and the other in the same position as the third sample trial). Test trial is performed upon two conditions: high and low interference, with the two copies of the object distant 42 or 84 cm apart, respectively. Our results showed that in the first task rats treated with saline failed to present increased exploration of old objects (mean \pm SE: 0.43 ± 0.11) compared to recent ones (0.57 ± 0.11), while rats treated with caffeine (15 mg/kg) explored more the old (0.77 ± 0.09) compared to recent objects (0.24 ± 0.09 , paired samples t-test, $p = 0.033$). However there were no differences between exploration rate of displaced and non-displaced objects, in any of the groups. In the second task, under high interference condition, there was no difference in the exploration time of the first object compared to the third object in both control (2.72 ± 1.79 ; 4.72 ± 3.76) and caffeine 15 mg/kg (4.23 ± 1.99 ; 2.63 ± 1.04) groups. However, the caffeine 30 mg/kg group explored more the first (11.08 ± 3.79) object than the third one (4.68 ± 1.95 ; ANOVA and Bonferroni post-hoc, $p = 0.050$).

Conclusions:

Our results suggest that chronic caffeine administration improves temporal aspects of episodic-like memory in object recognition tasks. It should be noted that caffeine, even at high doses could improve memory on conditions of greater difficulty.

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