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Attenuation of Saccharin Neophobia by Melatonin

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GOLUS, P., R. McGEE AND M. G. KING. Attenuation of saccharin neophobia by melatonin. PHARMAC. BIOCHEM. BEHAV. 11(3) 367–369, 1979.—Administration of Melatonin has been reported to decrease emotionality in the rat as indexed by the defecation response. The present experiment was designed to examine whether Melatonin would attenuate the neophobic response to a novel solution. It was found that Melatonin significantly increased the rat's consumption of a novel saccharin solution suggesting that the emotionality/arousal produced by the intake of this solution was attenuated.

Melatonin Neophobia Emotionality

IF a rat is presented with a novel taste it will consume less of that particular substance when compared with the intake of a familar substance. Such a reluctance to ingest a novel food or fluid has been termed neophobia [3,4]. Accompanying this decrease in consumption, rats also display indications of arousal or emotionality such as rattling and biting the drinking tube which delivers the novel fluid [6]. As Nachman, Rauschenberger and Ashe [10] have proposed, a novel taste is an attention getting substance which elicits an emotional or phobic reaction. With repeated exposures to the taste, the arousing properties of novelty become habituated and there is a concomitant loss of neophobia [6].

A number of investigators have suggested that the pineal gland through the secretion of Melatonin may play a role in certain behavioral processes (e.g. [2, 7, 8, 9]). Treatment with Melatonin has been reported to affect learning tasks such as active avoidance [9] and passive avoidance [8]. The effect of Melatonin administration may be due to an increased inhibition of memory [8,9] and/or a decreased level of emotionality [2]. Recently, Datta and King [5] have found that Melatonin facilitated extinction of a passive avoidance response and decreased defecation during the task. It was argued that Melatonin had an inhibitory effect on both emotionality and memory. The present experiment was designed to specifically examine whether Melatonin would similarly decrease the rat's emotionality/arousal as indexed by the neophobic response to a novel taste.

METHOD

Animals

Thirty male Wistar rats aged from 90 to 100 days at the beginning of the experiment were used. After arrival in the laboratory animals were individually housed in wire mesh cages with free access to food and water. They were maintained on a 12:12 hour light:dark cycle with light off at 10.00. Each animal was provided with two drinking bottles positioned on either side of the front of the cage. This two bottle procedure was used throughout the experiment. The thirty animals were randomly allocated to two groups of fifteen, one receiving Melatonin treatment, the other receiving control injections.

Procedure

After seven days of ad lib food and water, the animals were deprived of water for 24 hr and maintained on a 23 hr 50 min deprivation schedule for the duration of the experiment. Fluid consumption was measured by weighing each bottle before and after the 10 min drinking period. Following three days of adaptation to the deprivation procedure, administration of Melatonin and control injections began. For eight consecutive days each animal received an intraperitoneal injection of Melatonin (250 μg/rat) in a vehicle (0.9% NaCl, 0.01 M acetic acid and 2% ethanol in 0.25 ml) or a control injection of the vehicle. The injection occurred one hour prior to the drinking period on each day in keeping with the practice of previous studies [5,8]. Both the injection and fluid presentation were performed between the 5th and 7th hours of darkness in a dimly lit room.

On the first four days of injections, both bottles on each cage contained water. However, on Days 5 to 8, the animals were presented with a 0.1% sodium saccharin solution in one bottle, while the other contained water. Because a two bottle drinking procedure was employed, there was the possibility that consumption of saccharin on initial exposure (Day 5) and on subsequent days could be confounded by an animal's preference for drinking on a particular side of the cage. In order to attenuate this possibility, each animal's preferences were monitored on Days 1 to 4 prior to initial saccharin presentation. For five animals showing strong bottle preferences in the Melatonin group, the bottle containing the saccharin solution was placed on the non-preferred side on Day

5. This was also carried out for four animals in the Melatonin control condition. For the remaining animals, the saccharin bottle was randomly placed on the left or right of the cage on Day 5 and its position was alternated on each successive day. The Day 5 drinking period served as a measure of the animal's response to a novel taste (neophobia), while Days 6 to 8 were used to study recovery from neophobia.

RESULTS

Figure 1 shows the mean saccharin consumption for the Melatonin and Melatonin control groups over Days 5 to 8. Saccharin consumption for the initial presentation on Day 5 was analysed by a t-test; consumption on the subsequent recovery days was analysed with analysis of variance. On Day 5, animals treated with Melatonin consumed significantly more saccharin than did the controls, with $t(28)=2.14$, $p<0.025$ for a one-tailed test. There was no difference between the groups in overall saccharin consumption over recovery Days 6 to 8. There was a significant linear trend across these same days, $F(1,28)=5.10$, $p<0.05$, indicating increased saccharin consumption from Day 6 to Day 8, but the linear trend did not significantly interact with the effect of hormone treatment.

The mean total fluid consumption over Days 1 to 8 is also shown in Fig. 1. An analysis of variance indicated no overall difference in total fluid consumption between the Melatonin and Melatonin control groups. Once again, there was a significant linear trend for increased consumption by both groups across days, $F(1,28)=52.49$, $p<0.05$, but this trend did not interact with the effect of hormone treatment.

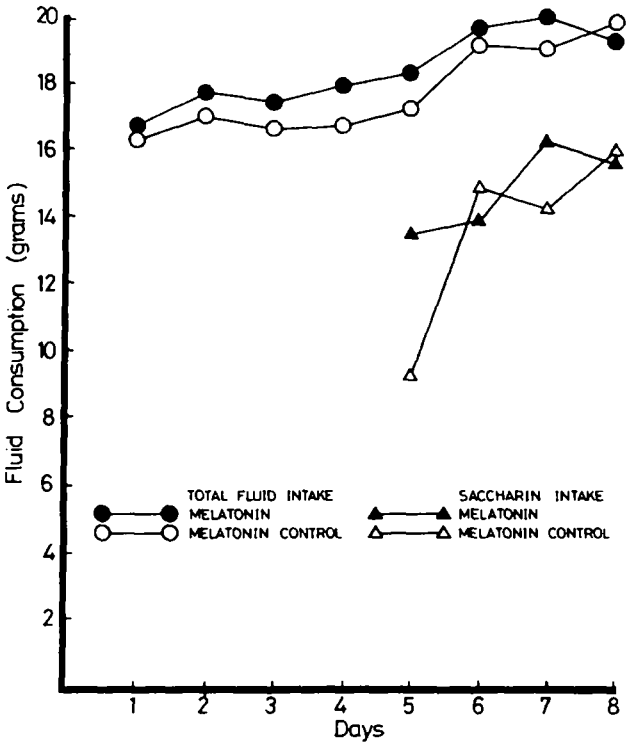

FIG. 1. Effect of Melatonin on saccharin consumption (Days 5 to 8) and total fluid consumption (Days 1 to 8). Values are means in g.

DISCUSSION

In agreement with previous studies [7,8], Melatonin was found not to affect water intake. However, the administration of Melatonin prior to the first exposure of an animal to a novel saccharin solution resulted in a significantly higher consumption of that solution when compared with controls. It would appear, then, that the neophobic response to the novel taste was attenuated by Melatonin. Other researchers have reported an inhibitory effect of Melatonin on the defecation response, an indicator of emotionality [5]. The study presented here substantiates this inhibitory effect employing the neophobic response to a novel taste as an index of emotionality or arousal.

A possible alternative explanation for the obtained results would be that Melatonin enhances an animal's preference for sweet tastes. However, it should be noted that the effect of Melatonin occurred only on initial exposure to the novel taste and not on subsequent recovery days. This contradicts an explanation based on enhanced preference for sweet flavors.

The suggestion has been made that Melatonin may inhibit the emotional-arousal system of the organism [2, 8, 9, 11]. The results of the present experiment confirm such an hypothesis. It has been found that intraventricular [12] and intraperitoneal [1] administration of Melatonin produces an increase in serotonin (5-HT) levels in the brain. Brain 5-HT has been reported to inhibit the stress response of the hypothalamic-pituitary-adrenal system [11, 12, 13]. Whether the attenuation of the neophobic response found in the present study can be attributed to increased levels of 5-HT acting upon this system remains to be investigated.

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