

SHORT COMMUNICATION

ROLE OF ACETYLCHOLINE AND DOPAMINE IN DORSAL HIPPOCAMPUS ON HOARDING BEHAVIOR IN RATS

ABHAYA S. BORKER AND JOLLY F. MASCARENHAS*

*Department of Physiology,
Goa Medical College,
Bambolim - 403 005, Goa*

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Abstract : The probable roles of Acetylcholine (Ach) and Dopamine (DA) in the modulation of instinctual behaviors of feeding and hoarding (HS), as also the body weight and vaginal cyclicity (EI), were studied by instillation of Atropine (Ach antagonist), Haloperidol (DA antagonist) and Apomorphine (DA agonist) in the dorsal hippocampus of nonpregnant female rats. It was observed that the HS was significantly decreased with both Atropine and haloperidol and increased with Apomorphine, although the food intake was decreased with the three chemicals. It appears that action of both Ach and DA on the dorsal hippocampus has a positive influence on hoarding behavior.

Key words : hoarding score

estrus index

haloperidol

INTRODUCTION

Despite a large number of studies on various functional aspects of the hippocampus, the exact functions of this structure remain an enigma. The hippocampus is ideally placed to integrate signals from entorhinal areas (sensory associative areas) and brain stem areas related to sleep/arousal and sensory/motor processes however how this interaction takes place is far from clear (1). Earlier we have reported the differential role of the hippocampus in the instinctual behaviors of feeding and hoarding in female rats. Discrete electrolytic lesions of ventral hippocampus resulted in hoarding deficit and the reverse was noted with dorsal hippocampal lesions (2,3). Several neurotransmitters are implicated in the functioning of the hippocampus (4). To further decipher the possible mechanism of transmitter involvement in the hoarding behaviour, the present study attempted to observe the effects of two of these transmitters, viz acetylcholine and dopamine in the dorsal hippocampus.

METHODS

Thirty five adult female albino rats were subjected to the same protocol as in our earlier work (2,5). Data of body weight, food intake, hoarding score (HS) and vaginal cyclicity in terms of Estrus Index (EI) (6) was collected for 2 weeks prior to and 2 weeks during the experimental procedures. All animals acted as their self controls. These were subjected to surgery under ether anaesthesia. Bilateral implantation of cannulae (made from 22 gauge hypodermic needles cut to size) to reach the predetermined sites in the dorsal hippocampus, was carried out using the co-ordinates of A 4.2: L 1.5: H+2.7. The cannulae were fixed in place with dental cement. Allowing 2 days for recovery, the animals were then sorted into five series. Series I (12 in number) were subjected daily for 2 weeks to intracerebral instillation of atropine sulphate (1.5 μ g) using Hamilton's microsyringe. Series II of 5 rats were similarly treated with Apomorphine (2 μ g) and series III of 8 rats with

Haloperidol (2 μ g). Series IV and V (5 rats each) were treated with saline (0.9%) and absolute alcohol respectively, as these were the solvents used for diluting the chemicals.

At the end of the study, the animals were sacrificed and localization of the tips of cannulae confirmed histologically by cresyl violet staining technique.

The data collected was statistically analysed using the "student's test" for determining the level of significance.

RESULTS AND DISCUSSION

As observed from the Table, a significant decrease in HS was recorded with the instillation of both atropine (anticholinergic) and haloperidol (dopamine antagonist) in the dorsal hippocampus, whilst apomorphine (dopamine agonist) in the same area increased the HS markedly. On the other hand the food intake decreased with the application of all the three chemicals without affecting body weight. Instillation of same volume of normal saline and absolute alcohol did not show any change thus

eliminating the effect of the procedure itself and/or that of the solvent used for dilution of the chemicals.

It appears from the results that both acetylcholine and dopamine in the hippocampus have a positive influence on hoarding and feeding behaviours. Earlier we reported that lesions of substantia nigra decreased the HS (2). Similar to the present study where instillation in the dorsal hippocampus of haloperidol decreased and apomorphine increased the HS, thus suggesting that one of the neurochemical mechanisms involved in the modulation of this behavior may be dopaminergic. The linkages between these structures are documented (8,9) and their influence may be mediated via the hypothalamus which plays a pivotal role in hoarding behaviour (10).

Acetylcholine and dopamine may have an opposite role to play in certain structures as in the basal ganglia and normally a cholinergic-dopaminergic balance may be disrupted when anticholinergic or antidopaminergic drugs are instilled (10). However, in the present study on the hippocampus both Acetylcholine and Dopamine appear to be synergistic rather than antagonistic. Our earlier observations of increased HS and food

TABLE I: Showing Mean \pm SE of body weights, food intakes, hoarding scores and vaginal cyclicity in the experimental and Sham series.

Series	Substances centrally instilled	Body weight (g)		Food intake (g)		Hoarding score (HS) (No. of pellets)		Vaginal Cyclicity Estrus Index (EI)	
		Before	After	Before	After	Before	After	Before	After
I	Atropine	175.58	170.2	9.86	6.41***	34.63	11.27***		
n=12		± 3.96	± 3.26	± 0.35	± 0.33	± 5.37	± 0.89	1	1
II	Apomorphine	176.60	175.7	10.70	9.50*	27.20	46.50***		
n=5		± 5.21	± 5.14	± 0.25	± 0.24	± 2.58	± 6.40	1	1
III	Haloperidol	156.55	145.09	9.09	7.15**	27.62	6.63***		
n=8		± 4.79	± 5.55	± 0.30	± 0.48	± 2.07	± 0.55	1	1
IV	Normal Saline	169.16	170.16	7.40	7.16	24.52	26.16		
n=s	(Vehicle for Atropine and Apomorphine)	± 3.95	± 4.68	± 0.44	± 0.17	± 2.34	± 3.41	1	1
V	Absolute alcohol	154.66	149.54	8.78	8.58	26.14	16.45		
n=5	(Vehicle for Haloperidol)	± 7.09	± 7.76	± 0.12	± 0.12	± 2.82	± 1.62	1	1

n = No. of animals; level of significance*, $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$

intake following discrete electrolytic lesions of dorsal hippocampus (3) conflict with the present findings. However, it is well documented that the two types of manipulations viz lesion mg and chemical blockage may produce opposite results, since the chemical blockers/stimulants may selectively interrupt specific pathways, whereas lesion destroys the neurons as well as all functional connections located within the lesioned area. There

is also a chance of the spread of the instilled drug to the neighbouring areas which then can produce widespread effects as against the effects of discrete and limited lesioned areas (11).

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