

NUCLEUS ACCUMBENS LESION DOES NOT AFFECT SCHEDULE INDUCED POLYDIPSIA

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Abstract : Rats with lesion of nucleus accumbens were hypodipsic under free-feeding conditions. In schedule-induced polydipsia (SIP) tests conducted by reducing the rats to 70% of free-feeding body weight and delivering 60 mg bengal gram pellets on a fixed time 1-min schedule, nucleus accumbens lesions did not delay the acquisition or show a decrease in the maintenance of S.I.P.

Key words: nucleus accumbens schedule-induced polydipsia (S.I.P.)

INTRODUCTION

Under certain control conditions rats exhibit excess drinking-behaviour, i.e. - polydipsia. One of the vital conditions that need to be controlled to elicit this polydipsia is to schedule the food-intake. Hence the term schedule-induced polydipsia-SIP (1).

Lesions of certain areas of the C.N.S. attenuate drinking-behaviour. Such lesions also attenuate SIP. These structures include lateral hypothalamus (2) and zona incerta (3). The limbic structure-nucleus accumbens, the lesion of which causes decrease in 24-hour water intake (4), has so far not been implicated in its role on influencing SIP. The aim of this study is to find out the influence of nucleus accumbens lesion on SIP.

Earlier, peripheral factors like dry mouth and oropharyngeal stimulation were solely implicated in the phenomenon of SIP (5). But now a central-neural mechanism is clearly evolving. SIP is considered to be a form of behaviour, i.e. an adjunctive behaviour, adjunct to a scheduled feeding under high drive conditions. There are indications that addictive behaviour is a form of adjunctive behaviour (6).

Hence the study of SIP may lead to the elucidation of the erstwhile unknown mechanisms causing addiction.

METHODS

Twentyfour adult albino wistar male rats (220-320 gms) were included for the study. Each rat was housed in a single plastic cage under light-dark cycle of about 14-10 hrs. The cages were placed in the animal room with ambient temperature which ranged from 25°C to 35°C. Food was available to the animal in the form of soaked Bengal grams and tap water was provided through a tube attached to a measuring cylinder.

Measurement of ad-lib water and food intake: Measured quantity of water and food was provided at 9 a.m. daily and the food and water intake was measured for 24 hours every day for a period of 10 days. This was utilised to estimate the mean water and food intake of each animal (n=8).

Development of schedule induced polydipsia (S.I.P.): For induction of S.I.P. each rat was exposed to restricted *ad-lib* feeding so that the body weight of the animal was brought down to 70% of the free-feeding body weight (1, 9).

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For development of S.I.P an operant chamber (Skinner box) was utilised. The operant chamber consists of a slot for delivery of the food pellets and the animal is able to drink water from the water container fixed to the side wall. The opening of the water tube being 2 mm in diameter and the tip of the tube being 3 cm from the floor.

After an overnight fast the animal was placed in the operant chamber at the same time of the day in the forenoon. Dry split Bengal-gram seeds were used as pellets. Each pellet weighing 60 mgs.

The session for induction of polydipsia lasted 30 mins, in which a pellet was delivered through the slot at a fixed time interval of 1 min. The delivery of pellets was done manually to avoid electromechanical noise when food magazine was used. The animal was exposed to this thirty min session every day to record the water intake during this scheduled feeding. The procedure was continued every day till the animal attained a significantly high level of polydipsia for seven consecutive days atmost.

After the session the animal was replaced in its home-cage and food was given so as to maintain its body-weight at 70% free-feeding level and water was available *ad-lib*.

The following co-ordinates were used (Konig and Klippel-A Stereotaxic Atlas) in the stereotaxic equipment and bilateral ablation of nucleus accumbens was performed :

Frontal plane +9.8 mm.

Lateral plane +1.2 mm.

Horizontal plane -0.4 mm.

Historical confirmation of the lesion were done retrospectively.

Acquisition of S.I.P and nucleus accumbens lesion: After 8 days of post-stereotaxy recovery the rats (n=5) were subjected to induction of S.I.P.

Maintenance of S.I.P. and nucleus accumbens lesion: Rats (n=10) were subjected to development of S.I.P. till they developed a significant polydipsia. A few of these rats (n=6) were subjected to stereotaxy and nucleus accumbens was ablated bilaterally. After 8 days of post-stereotaxy recovery the rats (n=6) along with the control rats (n=4) were again tested for S.I.P. maintenance.

RESULTS

Water and food intake in control rats: The water and food intake (soaked bengal grams) of control rats (n=8); were found to be 24 ml and 24 gms respectively. This measurement facilitated the quantification of the polydipsia.

Bilateral nucleus accumbens lesion and S.I.P. acquisition: All animals (n=5) utilized for this aspect of the study showed no delay in acquisition of S.I.P., as post-pellet drinking bouts started towards the end of first session like in the control rats. Hence it is demonstrated that nucleus accumbens has no role in acquisition of S.I.P.

Bilateral nucleus accumbens lesions and S.I.P. maintenance: Out of the rats (n=10) in whom S.I.P. had been induced, some of the rats (n=6) were subjected to bilateral nucleus accumbens lesion. After the post-lesion recovery period all the rats i.e. (n=10) were subjected to S.I.P. induction. As shown in Figs. 1 and 2, no

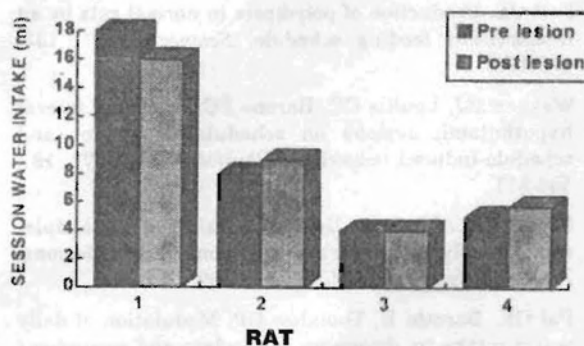


Fig. 1 : Bar diagram showing S.I.P. session water intake of four control rats. The 't' values are 1.063, 1.701, 0.273 and 3.298 in rats 1 to 4 respectively.

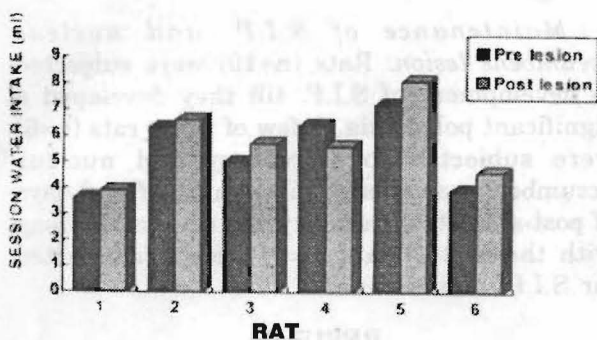


Fig. 2 : Bar diagram showing S.I.P. session water intake of six lesioned rats. The 't' values are 1.015, 0.807, 1.361, 1.446, 2.529 and 3.850 in rats 1 to 6 respectively.

rat showed statistically (Paired Student's t-test) significant decrease in S.I.P. That is S.I.P. maintenance was not decreased.

DISCUSSION

At present the central neural mechanisms rather than the peripheral mechanisms are held responsible for S.I.P. (2, 8, 3). Pal et al in 1991 showed that nucleus accumbens lesion caused decrease in 24-hour water intake (4). Nucleus accumbens is a limbic structure with connections to the LH (9) via the medial forebrain bundle.

Rats which exhibit SIP have to be maintained under high-drive conditions of

reduced body weight. This reduced body weight and the intermittency provided in the feeding schedule drives the LH and the adjunctive behaviour of polydipsia is manifest.

On framing the study it was hypothesized that since nucleus accumbens lesions cause hypodipsia it must also cause attenuation of SIP. Hence the aims and objectives of the study were to first demonstrate SIP and then look for any delay in acquisition of SIP in bilaterally nucleus accumbens lesioned naive rats. In another group, bilateral lesion of nucleus accumbens was performed after inducing SIP and maintenance of SIP was tested for after the lesion.

As in the control rats, acquisition of SIP took place in the lesioned rats in the first session itself. That is, post-pellet drinking developed in the first session itself. Contrary to expectations nucleus accumbens lesion does not produce any significant decrease in post-lesion S.I.P. development.

In addition the intensity of the polydipsia remained unchecked post-lesion when compared to the pre-lesion levels.

Thus it appears that nucleus accumbens has no role to play in the acquisition and the maintenance of SIP.

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