

## Adrenal Ascorbic Acid Response to Noise

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In previous papers<sup>1,2)</sup> it was shown that the adrenal ascorbic acid (AAA) concentrations in rats were decreased by short periods of exposure to noise. The lowered levels of AAA returned to normal approximately six hours after the end of exposure to noise.

From our previous studies<sup>4)</sup> it appears that 60 db can be considered as the threshold limit value for noise.

Our previous studies were carried out on rats who were exposed to noise for less than 30 minutes. This, of course, did not provide us with information concerning adrenal response to repeated exposure to noise stimuli. Therefore, a series of studies were designed in an attempt to determine the AAA response of rats to extended periods of noise stimuli.

### MATERIALS AND METHODS

Male rats of the Wistar strain weighing approximately 100 gr apiece were used. 88 rats were divided into 9 groups with 9 or 10 rats in each group. Of these 9 groups, 5 groups were experimental and 4 were control groups.

The five experimental groups were exposed to noise of 1,000 cps,  $120 \pm 5$  db for 2.5 hours per day for periods of 1 day, 10 days, 20 days and 30 days. The rats exposed for 30 days were divided into 2 sub-groups, Group A and Group B. All rats in the experimental groups with the exception of those in Group B of the rats exposed for 30 days were sacrificed 30 minutes after the final noise exposure. Those in Group B were sacrificed 12 hours after the final noise exposure.

The rats were sacrificed by decapitation without anesthesia. Blood from the trunks was collected in heparinized beakers and the concentrations of AAA were determined by a modification of the method of Roe and Kuether as described by Roe et al.<sup>5)</sup>

### RESULTS

Mean concentrations of AAA in Control groups:

1 day                    382.31 mg %

10 days	331.47 mg %
20 days	389.60 mg %
30 days	391.83 mg %

Mean concentrations of AAA in Experimental groups:

1 day	287.61 mg %
10 days	331.47 mg %
20 days	389.60 mg %
30 days	
Gp. A	410.43 mg %
Gp. B	515.91 mg % (sacrificed 12 hours after final noise exposure)

In the case of 1 day exposure to noise a significant decrease of AAA concentrations (Pr. <0.05) was found, but for the groups exposed for 10 days, 20 days and Group A of those exposed for 30 days no significant decrease was found in their AAA concentrations. For Group B of the rats exposed for 30 days (sacrificed 12 hours after final noise exposure) a significant elevation of AAA concentrations was found (Pr. <0.01). No changes in adrenal weights were detected (see Table 1).

Table 1. Adrenal ascorbic acid concentrations and adrenal weights of rats after the noise exposures of 1, 10, 20 and 30 days (2.5 hours per day).

DAYS	1		10		20		30			
	CONT.	EXP.	CONT.	EXP.	CONT.	EXP.	CONT.	Gp.A	Gp.B	
ADRENAL ASCORBIC ACID (AAA) mg %	N	10	10	10	10	10	9	10	9	
	M	382.31	287.61*	362.45	331.47	396.99	389.60	391.83	410.43	515.91**
	S.D.	102.08	81.42	57.15	35.56	78.48	60.94	47.71	89.10	43.81
	S.E.	32.28	25.75	18.07	11.24	24.82	19.27	15.90	28.18	14.60
ADRENAL WEIGHT per BODY WEIGHT mg/g	M	0.224	0.235	0.205	0.189	0.200	0.177	0.157	0.156	0.139
	S.D.	0.042	0.040	0.033	0.032	0.033	0.057	0.037	0.030	0.027
	S.E.	0.013	0.013	0.010	0.010	0.011	0.019	0.012	0.009	0.009

CONT.: Control, EXP.: Experimental group, N: Number of rats, M: Mean, S.D.: Standard error, \*: Significant decrease (Pr.<0.05), \*\*: Significant increase (Pr.<0.01).

Using body weight as an index of body growth, it was found that for the rats exposed for 10 days and 20 days there was delayed body growth, but for the groups exposed for 30 days, Group A Showed only a slight delay and for Group B there was practically no difference.

## DISCUSSION

It is well established that AAA concentrations of rats are decreased by exposure to noise for short periods of time. Eosinophil counts of the peripheral blood are also decreased by noise.<sup>3)</sup>

From the above observations in our laboratories and from the reports of other investigators (Sayers et al.,<sup>6)</sup> Thorn et al.,<sup>7)</sup> Rerups et al.,<sup>8)</sup> Brodish<sup>9)</sup>) it may be interpreted that the decrease in AAA concentrations is brought about by an increase in blood ACTH released from the anterior pituitary lobe.

The physiological role of AAA is not yet sufficiently understood but it may be associated with corticosteroid synthesis and the release of corticosteroids from the adrenal gland.

As noted in our previous studies, the AAA concentrations returned to normal levels approximately six hours after the end of exposure to noise. In the present studies, while there was a significant decrease in the case of the rats exposed only once, in the case of those exposed for 10 days, 20 days and Group A of those exposed for 30 days there was not any significant decrease in AAA concentrations. In the case of Group B of the rats exposed to noise for 30 days there was a significant, and unexpected, increase in the level of AAA concentrations.

At present there is limited knowledge of the processes of adaptation. However, if the results of our experiments are interpreted according to Selye's Stress Theory,<sup>10)</sup> then the AAA depletion in response to noise for those exposed only once may accord with the stage of alarm reaction and the relatively unchanged AAA levels for the groups exposed for 10 days, 20 days and Group A of those exposed 30 days may indicate that adaptation to the noise occurred and it may correspond to the stage of resistance of Selye's Stress Theory. However, the unexpected and significant increase in AAA concentrations in Group B raised a series of unanswered questions which indicated the need for further study and experimentation. Because of this a second series of experiments was undertaken and will be described in a subsequent paper.

## SUMMARY

In an attempt to observe the response of the hypothalamo-hypophyseal-adrenal system to noise, a series of experiments were carried out on rats. As an index of ACTH release from the anterior pituitary gland into the blood, the AAA concentrations following exposure to noise were determined. A decrease of AAA concentrations was found following a single exposure to noise. For rats exposed to noise for 10 days, 20 days and 30 days and sacrificed 30 minutes after the final exposure to noise no significant change in AAA concentrations was found. For rats exposed for 30 days and sacrificed 12 hours after the final noise exposure

a significant increase in AAA concentrations was found. Because this significant increase was unexpected and no satisfactory reason for it could be found further studies and experiments have been undertaken and will be reported subsequently.

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