Indian J Physiol Pharmacol 1999; 43 (1) : 104–108

EFFECT OF NIKETHAMIDE AND DIAZEPAM ON THE LEVELS OF BIOGENIC AMINES IN THE DIFFERENT PARTS OF THE POULTRY BRAIN AT THREE AGE GROUPS

V. K. GURU, H. S. SINGH*, I. J. SHARMA AND M. A. QUADRI

Department of Physiology,
College of Veterinary Sciences,
Jabalpur – 482 001

(Received on January 24, 1998)

Abstract : Fifty four female poultry birds of 3, 4 and 5 months age were given nikethamide and diazepam intramuscularly as stimulant and depresent, respectively. The effects of above two drugs on the levels of biogenic amines were measured Fluorometrically in the rostral, middle and caudal portions of poultry brain. Diazepam increased the levels of 5–HT and dopamine in the caudal and middle portion of the brain respectively. The levels of dopamine and non-epinephrine increased with the nikethamide administration and also with increasing age of the birds, but the effect of diazepam was inconsistant. Unlike the levels of dopamine and nor-epinephrine which were maximum in middle protion, the epinephrine concentration was highest in the caudal portion of brain. It was concluded that 5–HT acted as inhibitory particularly in the caudal portion, whereas, catecholamines as excitatory neurotransmitter of the poultry brain. The increased levels of catecholamines in the poultry brain with increasing age speaks of their positive role in sexual maturity and subsequently in reproduction of the birds.

Key words : poultry brain, nikethamide, diazepam, serotonin, nor-epinephrine

INTRODUCTION

Looking into the development of poultry industry the scientists interest has been diverted towards the factors which are involved in the process of reproduction. Involvement of biogenic amines in controlling the release of gonadotropin and ovulatory events at central and gonadal levels in poultry has been reported (1, 8, 9).

The effects of Nikethamide and diazepam on brian levels of biogenic amines viz; 5 HT, DA, NE and E is not available and hence this project.

METHODS

Fifty-four female poultry brids of 3, 4 and 5 months age were taken. The birds of each age group were equally divided and

*Corresponding Author

given Nikethamide (800 mg/kg) and Diazepam (10 mg/kg) intramuscularly as stimulent and depressant, respectively. The whole brain of birds was tentatively divided into rostral, middle and caudal portions (Fig. 1). Each of the three portions of brain were weighed on a monopan balance. The extraction and estimation of serotonin and catecholamines was done as per the method of Sadavongvivad (11). The data were tested for group significance by using Duncan's Multiple Range Test (10).

RESULTS

The values of 5-hydroxytryptamine, dopamine, nor-epinephrine and epinephrine (η moles/g of wet tissue) concentrations in different parts of the brain as affected by stimulant and sedative have been presented in Table I. The values for the same parameters at different age groups are given in Table II.

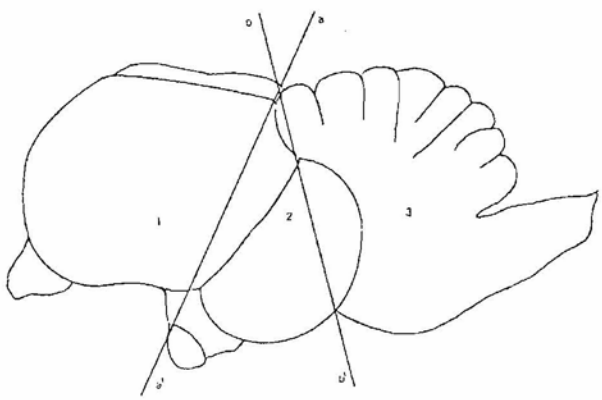

Fig. 1: The Lines a–a' and b–b' indicate the incision lines dividing the brain into 1, 2 and 3 portions. Portion 1– Rostral portion 2– Middle portion and portion 3– Caudal portion.

5-Hydroxytryptamine (5-HT):

The highest concentration of 5-HT was recorded in the rostral portion of the brain. However, Diazepam treated birds had significantly (P<0.05) higher levels of 5-HT

TABLE I : Showing the effect of nikethamide and diazepam on the biogenic amines (η moles/g of wet tissue) in different portions of the poultry brain.

Treatment	*Parameter*	*Portions of brain*		
		Rostral	*Middle*	*Caudal*
	5–HT			
Control		58.24±8.47	40.33±4.66	31.12±0.82 a
Diazepam		58.77±1.90	53.15±2.20	27.94±4.34 b
Nikethamide		79.44±12.51	42.24±4.25	33.99±4.55 a
	Dopamine			
Control		17.05±2.48	56.13±9.59	32.38±6.16
Diazepam		22.68±1.71	24.66±1.75	28.36±5.80
Nikethamide		26.65±2.27	29.30±3.60	22.58±0.05
	Norepinephrine			
Control		7.60±0.80	14.34±1.76	5.64±1.24 a
Diazepam		12.78±1.03	9.59±0.62	6.25±0.55 a
Nikethamide		12.17±1.48	8.61±1.63	14.50±1.54 b
	Epinephrine			
Control		4.47±0.52	5.43±0.37	10.70±1.64
Diazepam		3.74±0.83	3.92±0.74	3.61±0.56
Nikethamide		6.47±1.18	7.51±1.32	6.12±0.76

Values with the same superscripts do not differ significantly (P<0.05).

TABLE II : Age related changes in the levels of biogenic amines (η moles/g wet tissue) in different portions of the poultry brain.

Age (months)	*Parameter*	*Portions of brain*		
		Rostral	*Middle*	*Caudal*
	5-HT			
3		103.86±9.39[b]	48.90±5.06	43.03±7.13
4		47.75±2.68[a]	41.60±3.60	51.61±5.67
5		43.70±5.08[a]	45.22±3.19	53.84±8.71
	Dopamine			
3		20.89±2.00	33.22±2.69	37.95±4.41
4		24.35±2.94	28.69±2.09	14.08±2.61
5		21.43±1.96	48.29±10.89	32.89±5.59
	Norepinephrine			
4		10.19±1.04	11.94±0.64	9.68±1.81
5		11.51±1.08	9.76±1.68	8.03±0.65
	Epinephrine			
3		2.78±0.54	3.32±0.18[a]	7.39±1.56
4		5.08±0.28	4.36±0.56[a]	3.24±0.67
5		6.82±0.42	9.11±1.10[b]	9.81±0.98

Values showing the same superscripts are not significantly (P<0.05) different.

in the caudal portion of their brain (Fig-2). The levels of 5-HT in the same portion of the brain did not change with the nikethamide treated birds in comparison to the control birds.

Dopamine (DA) :

No significant alterations in the dopamine levels were recorded in three different portions of the poultry brain or in different age groups of birds. However, a non-significant fall was recorded after the injection of stimulant as well as sedative in the middle portion of the brain. Similarly at 5th month of age a slight increase in dopamine was also recorded. However, there was fall in the dopamine levels with age in the middle portion of brain.

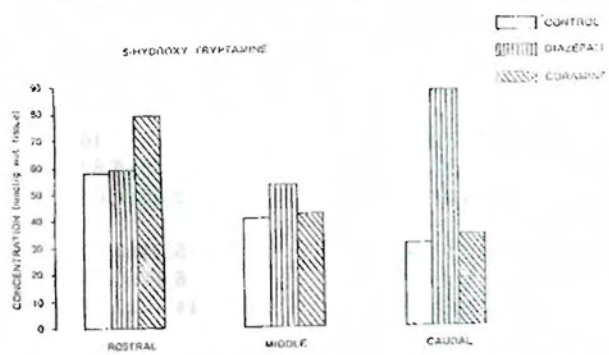

Fig. 2: Effect of diazepam and coramine on the concentration of 5–hydroxy tryptamine in the three portions of the brain.

Nor-epinephrine and Epinephrine (NE and E) :

Nikethamide significantly (P<0.05) increased the concentration of nor-epinephrine in caudal portion of the brain as compared to the control and diazepam treated laying birds (Fig. 3), whereas, the epinephrine content of these birds did not change with the sedative and stimulant (Table I).

The analysis of variance showed a significant (P<0.05) effect of age with respect to epinephrine concentration only in the

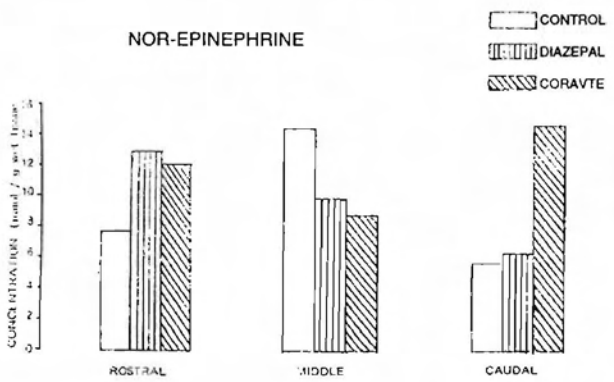

Fig. 3: Effect of diazepam and coramine on the concentration of norepinephrine in the three portions of the brain.

middle portion of the poultry brain (fig .4). However, no significant effect of age was observed in the contents of nor-epinephrine in any portions of the brain. In control birds, the lowest values for epinephrine is recorded in rostral portion and the highest in caudal portion of brain. The diazepam treatment uniformly reduced the nor-epinephrine concentration in all the three portions. It is interesting to note that the nikethamine increased the concentration of epinephrine when compared with the values of Diazepam treated birds.

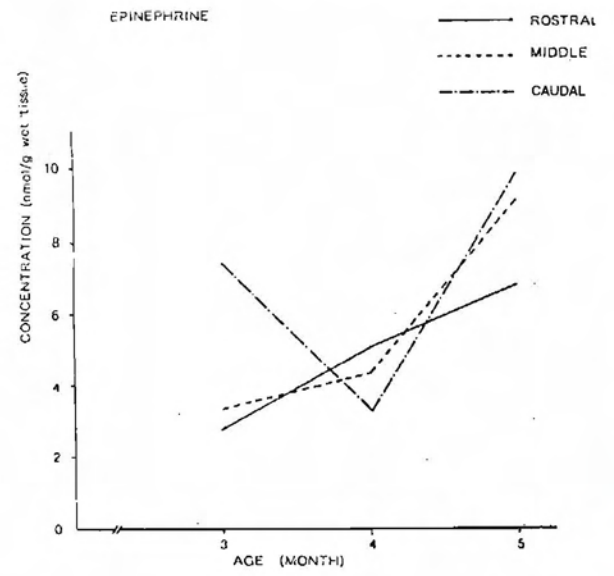

Fig. 4: Effect of age on the concentration of epinephrine in the three portions of the brain.

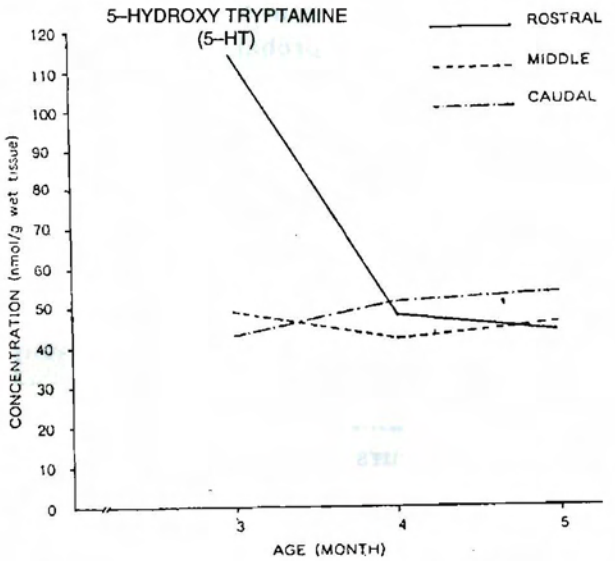

Fig. 5: Effect of age on the concentration of 5-HT in the three portions of the brain.

DISCUSSION

5-HT

The results of the present study corroborate with the observations on laboratory animals like rats, mice and quinea-pigs (3). From the present study it is tampting to believe that the effect of diazepam on 5-HT levels in the poultry brain is no differnt than that of mammals. Fathi et al (2) observed an increase in 5-HT in whole brain as a result of barbitone sodium and thiopental sodium following i.p. injection in Nilegrass rats.

The effect of age on 5-HT concentration was observed only in rostral portion. The results are indicative of the inhibitory effects of 5-HT on sexual development of the birds as its levels went lower in 4 to 5 months aged birds. However, Moudgal and Razdan (7) reported on change in the concentration of 5-HT in the diencephalan portion of the brain of laying and non-laying birds and concluded that 5-HT probably plays no role in the reproduction of birds. Kamberi et al (5) suggested that 5-HT antagonises the dopamine in release of FSH, LH and Prolactin.

NE and E

The middle portion alongwith other parts of the brain, also incorporates hypothalmus where norepinephrine is more. Juorio and Voget (4) found that although nor-epinephrine occurs in all the regions of fowl brain, the highest concentration is present in the hypothalamus. However, the concentration of epinephrine is reduced in this portion, but increased in the caudal portion. It may be mentioned at this juncture that the dopamine and nor-epinephrine act as precursor for the synthesis of epinephrine. The birds used in the present study were either approaching sexual maturity (4 month age group) or they were sexually mature (5 month age group). Kajal and Moudgal (6) reported that the nor-epinephrine is involved in the maturity of ovarian follicles.

With respect to the effect of age on concentration of dopamine, nor-epinephrine and epinephrine, it was observed that the higher levels of dopamine in the middle portion and low levels of nor-epinephrine at 5 months aged birds suggest the utilization of catecholamine for development of sex organs as earlier hypothesized by Kajal and Moudgal (6). The reverse appears to be true for the role of epinephrine, as the concentration of this amine was more at 5 months aged birds in all the three portions of the brian.

REFERENCES

1. Bunomo FC, Scanes CG. Pharmacological studies on the noradrenergic control of luteinizing hormons secretion in the domestic fowl. *General and Comparative Endocrinology* 1983; 49: 258–363.
2. Fathi MM, Hoda MT, Sayed F. Effect of barbitone sodium and thiopental sodium on brain dopamine, noradrenaline, serotonine and 5-hydroxy indole acetic acid content in arvicanthis niloticus 1987; *Comp. Biochem Physiol* 86 (C); 185–190.
3. Haefely W. Psychotrofic agents, part II, Edt. F. Hoffmeister and G. Stille, Springer Varlong, New York 1981; 137–149.
4. Juorio AV, Voget M. Possible neurotransmitters in Physiology and Biochemistry of the domestic fowl Vol. 2, Ed, Bell and Freeman Acadmic Press London 1972; 689.
5. Kamberi IA, Mical SR, Porter CJ. Effect of melatonin and serotonin on the release of FSH and Prolactin. *Endocrinology* 1971; 88: 1288–1293.
6. Kajal S, Moudgal HP. Dopamine and norepinephrine in the diencephalon of ovariectomized and sham-operated hens around sexual maturity. *J Vet Med* 1987; 34: 113–118.
7. Moudgal HP, Razdan MN, Dopamine, norepinephrine, epinephrine and serotonin in diencephalon of W.L.H. during clutch and pause. *Avian Res* 1983; 67: 88.
8. Moudgal HP, Razdan MN. Catecholamines in different areas of brain during ovulatory cycle in hen and their relationship with egg traits. *Zbl Vet Med A* 1985; 32: 573.
9. Moudgal HP Razdan MN. Effect of oestradiol-17B and progesterone administration during day and night in white leghorn hens on catecholamine levels in different areas of brain. *J Vet A* 1987; 34: 264–270.
10. Snedecor GW, Cochran WG. Statistical methods Sixth Edn. Print. IIIPb. The lowa state University press, Ames, U.S.A. lowa 1989.
11. Sadavongvivad CM. Pharmacological significance of biogenic amines in the lungs. *Brit J Pharmacol* 1970; 372–377.