HORMONAL ACTIVITY OF THE PITUITARY–GONADS SYSTEMS IN MALE BABOONS DEPENDING ON HIERARCHIC STATUS

A. G. Taranov, L. K. Shaik-ogly, and N. P. Goncharov

UDC 612.433.018+612.616.31]-06.612.821-019

KEY WORDS: baboons (*Papio hamadryas*); hormonal activity.

Interrelations between animals in a population have a definite ethologic structure, and this is evidently a universal phenomenon in the animal world. Hierarchic distribution in primates begins from the time of appearance of the group [2, 6]. During the formation of such groups a dominant position as a rule is occupied by males with a higher sex hormone level [3, 5, 7]. In more numerous communities of monkeys with a complex hierarchic structure, correlation between the hormonal status of the individual and its rank is less clearly defined than in small groups [4].

To determine the possible dependence of hormonal activity of the pituitary–gonads system on the hierarchic status of the individual in an isolated group of the same sex, an investigation of the social status of adult male baboons (*Papio hamadryas*) confined in cages, and its correlation with blood testosterone and luteinizing hormone (LH) levels was undertaken.

EXPERIMENTAL METHOD

Experiments were carried out on 16 sexually mature male baboons aged 7-14 years and weighing 17-32 kg. Before the beginning of the experiment the animals were adapted for 5 months in a large cage (capacity 150 m^3). The animals' hierarchic status was assessed visually on the basis of the following ethologic parameters: the order of approach to food and water, grooming, aggressiveness, agonistic interactions. Every two months throughout the year blood was taken from the cubital vein of the animals into tubes containing heparin, and centrifuged for 15 min at 3000 rpm; hormone levels were determined in the plasma obtained from it. The LH concentration was determined by a biological method based on measurement of the quantity of testosterone produced by the Leydig cells of mouse testes in the presence of added gonadotrophin [8]. Testosterone was determined by radioimmunoassay, by a method adapted for monkey plasma [1]. The numerical results were subjected to statistical analysis by Student's t test on the D-3-28 computer, using a specially written program.

EXPERIMENTAL RESULTS

Observations on male hamadryas baboons kept in one cage revealed a relatively stable hierarchy. Dominance of the monkeys in a large group is not linear. The animals unite into subcells, consisting mainly of two individuals. Distinct linear dominance is exhibited in the subcells.

Correlation was established between the hierarchic status of the individual in the group and its blood level of the principal testicular hormone – testosterone (Table 1). The blood testosterone level in monkeys, in our opinion, is genetically determined, and this enables individuals, on reaching puberty, to occupy a definite status in the social group. A low hormone concentration does not allow the animal to occupy a leading position, but a high hormone level itself is not enough to enable the individual to become a leader. For an animal with a high sex hormone level to occupy a position of high rank, it must possess a number of qualities. The most important are muscular mass and age – the individual's "life experience". This kind of dependence in individual subcells can be detected particularly clearly. For example, in subcell 1 the testosterone level was a little higher in male No. 2, but being two years younger than the leader No. 1, and having a smaller muscle mass, it occupied a subord-

Laboratory of Experimental Endocrinology, Institute of Experimental Pathology and Therapy, Academy of Medical Sciences of the USSR, Sukhumi. Translated from Byulleten' Eksperimental'noi Biologii i Meditsiny, Vol. 101, No. 3, pp. 356-358, March, 1986. Original article submitted February 10, 1985.

 0007-4888/86/0003-0374$12.50

TABLE 1. Relationship Between Body Weight, Age, and Mean Annual Blood Testosterone Concentration in Subcells of Male Hamadryas Baboons Kept in Captivity

Serial No. of individual	No. of subcell	Body weight, kg	Age, years	Testosterone concentration, nM
1		31	14	30,5±2,2
2		29	12	31,6±3,9
3	1	32	11	23,7±3,6
4		24	7	25,0±3,6
5		38	12	63,6±3,1
6		33	11	28,8±6,2
7	2	24	8	20,3±2,0
8	3	32	11	31,0±7,3
9		19	14	23,5±4,1
10	4	31	11	32,6±4,1
11		26	8	19,4±4,0
12	5	28	8	34,7±4,6
13		24	7	31,2±3,7
14	6	25	8	37,0±5,9
15		26	6	27,6±6,9
16	7	26	8	16,3±2,3

TABLE 2. Plasma Luteinizing Hormone Level in Male Hamadryas Baboons in the Course of the Year (in mU/ml)

No. of individual	Month of year							Mean
	February	April	June	August	October	December	February	
1	19,0	23,1	25,2	26,0	32,9	36,8	48,2	30,1±3,8
2	14,1	14,0	43,0	52,3	40,8	29,2	32,3	32,2±4,0
3	16,4	15,3	36,0	48,3	45,0	52,0	20,3	33,2±6,0
4	37,6	25,1	26,3	18,0	30,2	36,8	18,1	27,5±2,9
5	13,1	11,0	53,0	52,3	46,0	25,3	—	33,4±4,5
6	13,2	15,1	10,3	44,0	54,7	65,7	53,3	36,5±4,6
7	36,4	32,2	35,0	59,6	24,8	57,6	45,3	41,5±5,0
8	14,4	22,1	50,3	19,8	17,8	14,6	20,0	22,5±4,7
9	17,0	21,2	25,1	22,3	35,8	29,6	16,1	24,1±2,5
10	25,3	38,1	31,0	33,2	59,4	50,3	22,4	37,0±5,0
11	34,1	26,1	31,6	22,2	35,5	59,4	30,2	34,0±4,6
12	36,6	31,2	21,3	30,6	29,7	11,8	20,4	25,8±3,2
13	28,2	44,0	34,0	36,9	44,8	40,1	33,4	37,3±2,3
14	15,5	18,3	33,2	37,7	48,5	58,0	24,9	33,6±6,0
15	26,6	26,3	26,1	44,5	41,9	51,0	36,4	36,0±3,9
16	32,2	21,3	48,1	27,5	41,9	41,4	25,3	33,9±3,8
$M\pm m$	23,7±2,3	24,0±2,2	31,0±2,8	35,9±5,2	39,3±5,3	41,2±4,0	30,0±2,9	33,9±3,4

inate position. Male No. 3 had a powerful muscle mass and increased agressiveness, but it occupied only the third place in the hierarchy in its subcell because it was three years younger than the dominant male. Its low blood testosterone level was evidently due to the increased aggressiveness, reflecting the strained nervous and emotional state of the individual. Male No. 4 was the youngest in this subcell. With a smaller body weight and a low blood testosterone level, it occupied the lowest rank of the hierarchic ladder. In subcell 2, dependence of testosterone level on body weight and age was demonstrated particularly clearly. The picture in subcell 3 was rather different. The dominant male in it was two years younger than its submissive individual. Having a very small body weight and, consequently, being weak, this male could not occupy a dominant position in its subcell. The lowest testosterone level was observed in a young male which had no social partner.

The maximal testosterone concentration was recorded in the least aggressive individual No. 5, which occupied a dominant position in its subcell. It will benoted that all males which had one or more subordinate individuals in their own subcell exhibited less aggressiveness and had a higher testosterone level than animals occupying a position of low rank. The latter more frequently exhibited aggressiveness not only toward low-ranking males, but also toward the dominant males of other subcells, which was evidently provoked by their own leaders.

The blood LH level of the baboons underwent considerable changes in the course of the year (Table 2). The lowest LH level was observed in spring and the highest in the fall. The LH level was virtually independent of the hierarchic position of the individual in the group.

Whereas the hormone concentration was highly labile in a group of animals, its relative concentration in dominant individuals and in individuals occupying a position of low rank was so similar that it did not permit the individual's hierarchic status to be differentiated with respect to this hormone. The LH and testosterone levels in the course of the year showed weak positive correlation.

Thus the investigations revealed dependence of the hormonal activity of the gonads on the hierarchic position of male hamadryas baboons in an isolated group. A high testosterone level was observed in males occupying the position of leader in their own subcell. Correlation between rank and age of the individual could be distinguished quite clearly. In some subcells an older individual as a rule dominated over a younger baboon.

The absence of correlation between the hierarchic status of hamadryas baboons and their blood LH level may perhaps be linked with the inability of the principal regulator of sex hormone biosynthesis to respond to social stimuli. This role is probably played by other pituitary trophic hormones responsible for social relations between animals.

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