BLOOD ANDROGEN LEVELS IN MALE BABOONS THROUGHOUT THE YEAR

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Much attention has recently been paid to the study of seasonal fluctuations in sex gland function in animals of different species and, in particular, in primates. The character of changes in the level of the basic sex hormone testosterone depends on the original state of the testes, which in most monkeys is determined by the time of year. Investigations conducted at Sukhumi Primatologic Center on rhesus monkeys have shown that the testosterone concentration is spring is 1-2 ng/ml, whereas in the fall and winter it rises to 10 ng/ml [3]. Other workers have obtained similar results with monkeys of this species [4, 7]. In the course of observations of *Macaca rhesus* for several years seasonal changes were found in the blood testosterone concentration with a maximum in October and a minimum in the summer. Reproduction in this species of monkey is dependent on the time of year. Model experiments on *M. rhesus*, in which seasonal rhythms of function of the sex and adrenal glands were studied most completely have frequently proved unsuitable because of substantial differences from man in the mechanisms of secretion and metabolism of steriod hormones. Of all species of lower monkeys the baboon *Papio hamadryas* is the most acceptable model, because activity of its endocrine system shows the greatest similarity to that of man [1].

This paper describes a study of possible dependence of the androgen level in male baboons on the time of year.

EXPERIMENTAL METHOD

Six sexually mature male baboons aged 12-18 years and weighing 25-35 kg were used. The males were kept permanently in cages with a capacity of 40 m^3 together with 3-5 females and their young. Blood was taken from the animals monthly in the morning throughout the year starting in January. A blood sample of 8 ml was taken from the cubital vein into test tubes with heparin. Plasma was obtained by centrifugation of the blood at 3000 rpm and kept at -20°C. The following androgens were determined by radioimmunoassay, using chromatographic separation of the steriods on columns with celite: testosterone, 5α-dihydrotestosterone, and dehydroepiandrosterone [2]. Plasma steroid concentrations were calculated and the results subjected to statistical analysis by Student's test on the D-3-28 computer using a special program.

EXPERIMENTAL RESULTS

Seasonal change in the concentration of steroids in the animals' blood plasma were discovered. The results of androgen assay throughout the year and determination of their mean annual concentrations are shown in Fig. 1.

The level of the basic testicular hormone testosterone in the period from February through April was 19 nM, but in the hot period of the year (May — November) it was statistcally significantly increased ($p < 0.05$), to reach maximal values in June (27 nM), after which it fell gradually until January. The mean annual testosterone concentration was 22.5 nM (Fig. 1a).

The time course of the concentration of the teststerone metabolite 5α-dihydrotestosterone during the first 6 months correlated strongly with the testosterone level ($r = 0.68$). The high concentration of the steroid was observed in June (3.7 nM), it fell statistically

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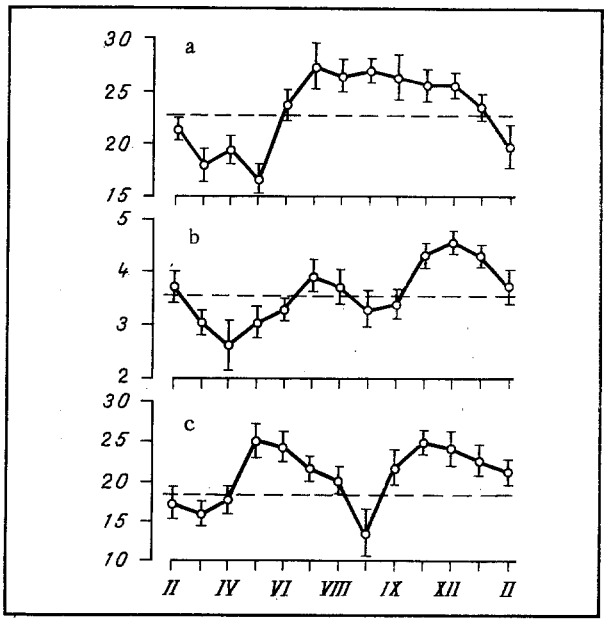

Fig. 1. Changes in concentrations of testosterone (a), 5α-dihydrotestosterone (b), and dehydroepiandrosterone (c) in blood of male baboons throughout the year (M ± m, n = 6). Abscissa, months of the year; ordinate, concentration of androgens (in nM). Broken line shows mean annual concentration of hormone.

significantly in August and September ($p < 0.05$), and rose in November to reach a maximum (4.4 ± 0.3 nM). Like testosterone, the 5α-dihydrotestosterone level in the spring months was statistically significantly lower than in the fall ($p < 0.05$). Its mean annual blood level was 4.5 times less than the testosterone concentration, namely 4.7 ± 0.5 nM (Fig. 1b).

The concentration of dehydroepidandrosterone, the precursor in the system of sex hormone synthesis, was minimal from January through March, it increased statistically significantly in April and May ($p < 0.05$), in August it fell to a minimum (14.8 ± 1.1 nM), and then rose again to a maximum in December (23.5 ± 2.0 nM). The mean annual level of dehydroepiandrosterone in the blood was a little below the testosterone level, namely 19.0 ± 1.5 nM (Fig. 1c).

The study of hormonal activity of the sex glands in experiments on baboons revealed seasonal fluctuations characterized by a fall in the testosterone and 5α-dihydrotestosterone levels in spring and a rise of their concentrations in the fall. Similar data have been obtained from man [5, 6]. Unlike rhesus monkeys, in which reproduction is seasonal, the sex system of *P. hamadryas* is in an active state at all times of the year, and for that reason the annual rhythms of their androgen concentrations are not pronounced.

Changes in the blood androgen levels at different times of the year are evidence that several factors may influence the endocrine function of the steroid-producing glands. The main factor is evidently the change of environment (humidity, temperature, illumination, atmospheric pressure, and so on). The possible effect of an endogenous pacemaker, genetically programmed in phylogeny for animals of a given species, likewise cannot be ruled out. In the experiments described above it was probably impossible to determine which pacemaker plays the decisive role: exogenous or endogenous. However, for the greater part of the year the animals were kept in open cages, i.e., exposed to the strong influence of temperature and light conditions. In addition, during different seasons of the year the character of the monkeys' diet changed substantially: in summer and the fall much of the diet consisted of fresh vegetables and fruit. Nevertheless, the factors mentioned above cannot explain the marked difference in the blood levels of dehydroepiandrosterone found in July and August. In this case the dominant role in the mechanism of formation of seasonal fluctuations is probably by an endogenous pacemaker.

The absence of positive correlation for testosterone and dehydroepiandrosterone confirms the writers' previous conclusion that testosterone is secreated by thetestes but dehydroespiandrosterone by the adrenals [2].

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