TABLE 2. Parameters of Reproductive Function in Female Rats (M ± m)

Parameter	A	B	C
Number of corpora lutea	13,0±0,65	11,0±0,7	11,8±0,8
Number of fetuses	11,9±0,95	8,8±1,2*	10,6±1,1**
Total embryonic mortality, %	8,5±1,2	20,0±1,4*	10,2±1,3**

The results may serve as the basis for the use of AO preparations as agents normalizing reproductive function in males during a period of low intake and increased utilization of alimentary AO (winter and spring, a stress situation, limitation of physical mobility, a high background level of radioactivity, etc.).

LITERATURE CITED

1. Yu. A. Vladimirov and A. I. Archakov, Lipid Peroxidation in Biological Membranes [in Russian], Moscow (1972).
2. O. N. Voskresenskii, A. P. Levitskii, V. V. Vitt, and V. I. Matsenko, Proceedings of the 3rd International Biophysical Congress [in Russian], Vol. 4, Moscow (1972), pp. 203-204.
3. O. N. Voskresenskii, V. N. Bobyrev, V. F. Pavlenko, and I. A. Zhutaev, Dokl. Akad. Nauk SSSR, 268, 470 (1983).
4. L. V. Serova, L. A. Denisova, Z. I. Apanasenko, et al., Kosmich. Biol., 16, No. 5, 62 (1982).
5. V. V. Sokolovskii, L. V. Lebedeva, and T. B. Lielup, Lab. Delo, No. 3, 160 (1974).
6. N. M. Émanuél', Izv. Akad. Nauk SSSR, Ser. Biol., No. 4, 503 (1975).
7. N. M. Emanuel', Fiziol. Zh. (Kiev), 30, No. 1, 1 (1984).
8. D. Harman, J. Geront., 15, No. 1, 38 (1960).
9. D. Harman, Proc. Natl. Acad. Sci. USA, 78, No. 11, 7124 (1981).
10. F. C. Jager, Nutr. Dieta (Basel), 10, No. 3, 215 (1968).

EFFECT OF IMMOBILIZATION STRESS ON PITUITARY GONADOTROPHIC FUNCTION IN MALE *Papio hamadryas*

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KEY WORDS: immobilization stress; luteinizing hormone; testosterone; monkeys; castration.

Exposure to stress causes a fall of the tesosterone level in peripheral blood of man and various species of animals [1-5, 10, 15]. Changes in the testosterone concentration are associated with depression of the secretory activity of the testes, and both with changes in peripheral metabolism, for the rate of metabolic clearance of testosterone is unchanged during stress [8].

A key role in the maintenance of the endocrine activity of the testes is played by pituitary luteinizing hormone (LH). Information on its time course during exposure to

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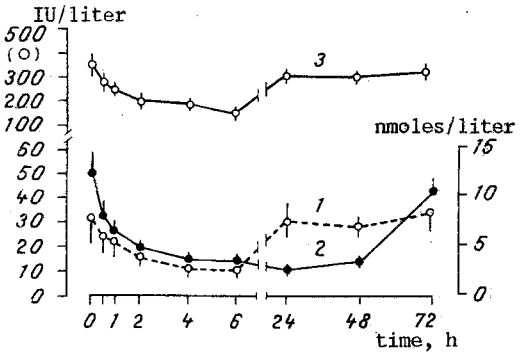

Fig. 1

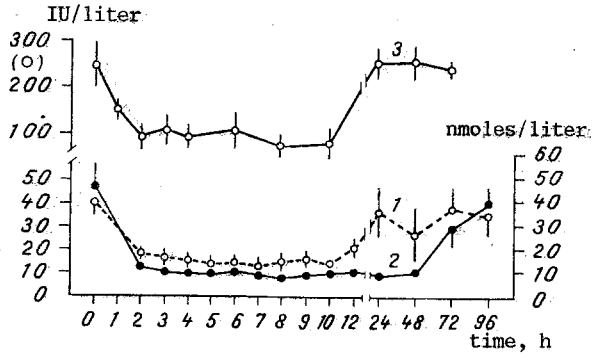

Fig. 2

Fig. 1. Effect of immobilization for 2 h on LH (1) and testosterone (2) concentration in peripheral blood of intact baboons and LH (3) in blood of castrated male baboons. Here and in Fig. 2: abscissa, time (in h); ordinate: on left, LH (in mU/liter); on right, testosterone (in nmoles/liter).

Fig. 2. Time course of LH (1) and testosterone (2) levels in peripheral blood of intact, and of LH (3) level in peripheral blood of castrated, male baboons exposed for 10 days to immobilization stress.

immobilization stress, as to other forms of stress, is contradictory. There are data showing lowering of the hormone level [6, 12], a biphasic reaction with an initial rise and subsequent fall [9], or even no change in the LH concentration [4, 5].

Analysis of publications on the effect of immobilization stress on pituitary gonadotrophic function suggests that the heterogeneity of the data can be attributed either to differences in reactivity of the system depending on its initial functional state or to technical variations (the duration of exposure to stress, the time of recording the hormonal response, the method of determination of LH, and so on).

In order to study the role of the duration of exposure to stress and the initial level of functional activity of the system, we have studied the effect of immobilization for 2 and 10 h on the dynamics of blood levels of LH and testosterone in intact and castrated male baboons (Papio hamadryas).

EXPERIMENTAL METHOD

Experiments were carried out on sexually mature male baboons at Sukhumi Primatological Center. The monkeys weighed 26-24 kg and were 6-10 years old. The animals were immobilized by fixing the outstretched limbs securely while the animals were recumbent in the supine position, on special stretchers. Blood was taken from the cubital vein. Plasma was obtained by centrifugation at 1000g and kept at −20°C until required for hormone estimation.

Experiment 1. Five male baboons were immobilized for 2 h. Blood was taken before (0) and 30 min and 1, 2, 4, 6, 24, 48, and 72 h after the beginning of immobilization.

Experiment 2. Five baboons were immobilized for 10 h. Blood was taken before (0) and 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 24, 48, 72, and 96 h after the beginning of immobilization.

Experiment 3. Five castrated baboons were immobilized for 2 h. Blood was taken before (0) and 30 min and 1, 2, 4, 6, 24, 48, and 72 h after the beginning of immobilization. Bilateral gonadectomy was performed 3 months before the beginning of the experiments.

Experiment 4. Five castrated male baboons were exposed to immobilization for 10 h (the same animal were used in this experiment as in Experiment 3, after an interval of 3 weeks). Blood was taken before (0) and 1, 2, 3, 4, 6, 8, 10, 24, 48, and 72 h after the beginning of immobilization.

Luteinizing hormone was determined by a biological micromethod in vitro [13], adapted for plasma of P. hamadryas [7], in the modification of Wickings et al. [14]. The sensitivity of the method was 15 μU per sample, using the first international standard of WHO for human pituitary gonadotrophin (69/104).

Testosterone was determined by radioimmunoassay using antiserum obtained in the Laboratory of Experimental Endocrinology, Research Institute of Experimental Pathology and Therapy,

TABLE 1. Cortisol Concentration (moles/liter: M ± m) after 2 h and 10 h of Immobilization Stress

Experiment	Time of investigation	
	before stress	end of stress
1	770±87	1742±104
2	1243±140	2600±206
3	1359±245	2277±675
4	1172±28	2087±222

Academy of Medical Sciences of the USSR (technical specification No. 44.14 336-82). The criteria of reliability of the method were described previously [2].

Cortisol was determined by the competitive binding method [11]. Concentrations of the hormones were calculated from the results of radioimmunoassay, by statistial analysis using Student's test, on the D-3-28 computer, using the appropriate program.

EXPERIMENTAL RESULTS

It will be clear from the results given in Table 1 that immobilization for 1 or 2 h caused an increase in the cortisol concentration on average by 126 ± 14 and 66 ± 8% in the intact and castrated animals, respectively.

An increase in the duration of exposure to stress did not lead to any further activation of cortisol secretion by the adrenals. The percentage rise of the hormone concentration by the end of the 10th hour of immobilization was 120 ± 28 and 72 ± 16% in intact and castrated animals, respectively.

The time course of LH and testosterone levels in intact and castrated male baboons immobilized for 2 h is shown in Fig. 1. Blood LH and testosterone levels 30 min after the beginning of immobilization were appreciably lower, on average by 24 ± 6 and 35 ± 3%, respectively. Toward the end of immobilization, blood levels of LH and testosterone had fallen by 43 ± 9 and 74 ± 12%, respectively, and they remained at this low level for 4 h after the end of exposure to stress. During the next 3 days the time course of these hormones showed dissociation: the LH level reverted to its initial values whereas the testosterone level remained low, only 20-30% of its initial concentration. The testosterone concentration in the peripheral blood returned to normal 72 h after the beginning of immobilization.

The blood LH concentration in the castrated male baboons was 355 ± 55 IU/liter. Under the influence of immobilization stress, the concentration of the hormone fell, just as in intact animals, by 20 ± 2 and 46 ± 3%, 30 min and 2 h after the beginning of immobilization, respectively. The hormone level 24 h after immobilization returned to its initial values characteristic of the castrated animals.

Similar changes in secretory activity of the pituitary-gonads complex were observed in animals exposed for 10 h to immobilization stress (Fig. 2). The LH and testosterone levels 2 h after the beginning of immobilization were reduced by 51 ± 7 and 57 ± 13%, respectively. During the subsequent hours of immobilization the concentrations of the hormones remained at the same low level. Just as after 2 h of immobilization, in the poststress period dissociation of the time course of the hormones was observed, with definite restoration of the LH level. Normalization of the testosterone level was observed only 3-4 days after the end of immobilization.

The LH concentration in the castrated males repeated the time course of the hormone in the intact animals for 10 days of immobilization. After 2 h the hormone level had fallen by 44 ± 4%, and remained at low values until the end of the experiment. On the days after immobilization the LH concentration returned to normal.

As a result of these experiments, a stable and unidirectional character of the response of LH to acute immobilization stress of varied duration and different levels of functional activity of the pituitary-gonads complex was thus discovered. The fall of the LH concentration during stress occurred simultaneously and correlated positively with the time course of testosterone. However, restoration of the pituitary gonadotrophic function on the 2nd-3rd days preceded normalization of the secretory activity of the testes.

The results are evidence that the inhibitory action of stress factors extends both to the endocrine activity of the testes and to the gonadotrophic function of the pituitary. As our previous studies showed [2], preliminary stimulation of pituitary gonadotrophic function by exogenous LH RH does not prevent depression of the endocrine activity of the testes during stress. These data, and also the dissociation observed in this investigation in the course of LH and testosterone in the poststress period, suggest that LH deficiency does not play a pathogenetic role in the disturbance of secretory activity of the testes during stress. The inhibitory effect of stress factors is aimed simultaneously at the pituitary and gonads, with the maximal disturbance at the level of the testes.

LITERATURE CITED

1. N. P. Goncharov, A. V. Antonichev, G. V. Katsiya, et al., Byull. Éksp. Biol. Med., No. 3, 270 (1978).
2. G. V. Katsiya, A. M. Chirkov, and N. P. Goncharov, Probl. Éndokrinol., No. 1, 73 (1984).
3. G. V. Katsiya, A. M. Chirkov, and N. P. Goncharov, Byull. Éksp. Biol. Med., No. 3, 285 (1984).
4. G. Charpenet, Y. Tache, M. Bernier, et al., Biol. Reprod., 27, 616 (1982).
5. R. Collu, Y. Tache, and J.-R. Ducharme, J. Steroid Biochem., 11, 989 (1979).
6. R. Collu, W. Gubb, and J.-R. Ducharme, Biol. Reprod., 30, 416 (1984).
7. M. P. Goncharov, A. V. Antonichev, V. M. Gorlushkin, et al., Acta Endocrinol. (Copenhagen), 91, 49 (1979).
8. G. D. Gray, E. R. Smith, D. A. Damassa, et al., Neuroendocrinology, 25, 247 (1978).
9. L. Krulich, E. Hefco, P. Felner, and C. B. Read, Neuroendocrinology, 16, 293 (1974).
10. A. Nakashima, K. Koshijama, T. Uozumi, et al., Acta Endocrinol. (Copenhagen), 78, 250 (1975).
11. C. A. Nugent and D. M. Mays, J. Clin. Endocrinol., 26, 1116 (1966).
12. Y. Tache, J.-R. Ducharme, G. Charpenet, et al., Acta Endocrinol. (Copenhagen), 93, 168 (1980).
13. M. R. Van Damme, D. M. Robertson, and E. Diczfalusy, Acta Endocrinol. (Copenhagen), 77, 655 (1974).
14. E. J. Wickings, M. H. Qazi, and E. Nieschlag, J. Reprod. Fertil., 57, 497 (1979).
15. P. D. Woolf, R. F. Hamill, J. V. McDonald, et al., J. Clin. Endocrinol., 60, 444 (1985).

EFFECT OF THE THYMUS ON IMMUNOREACTIVE PEPTIDE ACTIVITY

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KEY WORDS: thymus, thymectomy; thymalin; cytomedins; peptides.

A new class of mediators of intercellular interaction, known as cytomedins, in the biocontrol system of multicellular organisms has recently been isolated and described. These substances are polypeptides of basic nature and they are responsible for intergenic interactions in populations of specialized cells [6]. We know that the cytomedins from different organs contain peptides capable of influencing differentiation of immunocompetent cells and of interacting with the system for hemostasis and fibrinolysis [2]. However, the role of these compounds in the mechanism of protective reactions of the whole organism is not yet clear. Meanwhile thymectomy, when carried out in particular in the early stages, inhibits immunity and causes hypercoagulation and depression of fibrinolysis [1]. The impression is created that regulatory factors of peripheral organs cannot interact in the absence of the thymus. Experiments described below were undertaken to test this hypothesis.

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