

# RESPONSE OF THE PITUITARY-ADRENAL SYSTEM TO THE ACTION OF A VARIABLE MAGNETIC FIELD

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A significant increase in the content of 11-hydroxycorticosteroids was found in the adrenals of albino rats kept in a variable magnetic field (200 Oe, 50 Hz) for 24 h and 7 days, respectively. The plasma levels of total, transcortin-bound and, in particular, of the free hormones rise under these conditions. Changes in the steroid-binding capacity of the plasma proteins could not be detected under these conditions but the degree of their saturation with steroids is increased.

Experiments have shown the high sensitivity of the hypothalamic neurosecretory mechanisms to the effect of magnetic fields [2, 8, 9]. However, the functional state of the adrenal cortex during exposure to a variable magnetic field (VMF) has been insufficiently studied.

The concentration of 11-hydroxycorticosteroids (11-HC) in the adrenals and the ratio between the free and transcortin-bound forms were determined in the blood plasma of rats kept in a VMF.

## EXPERIMENTAL METHOD

Experiments were carried out on male albino rats weighing 150-200 g. The animals were placed in the gap between the poles of a magnet, the ends of which measured 200-300 mm; the height of the gap was 80 mm. The intensity of the magnetic field was 200 Oe with variation of not more than 5% over the area, and its frequency was 50 Hz. The animals were kept in the field for 24 h and 7 days.

The 11-HC concentration was determined in adrenal homogenate and in blood plasma [5, 10]; the binding capacity of transcortin [1, 3] and the ratio between the free and transcortin-bound forms of 11-HC also were estimated.

## EXPERIMENTAL RESULTS

Exposure to the VMF led to significant activation of glucocorticoid function, as shown by a marked increase in the 11-HC level in the adrenal tissue and blood plasma (Table 1), observed not only on the first but also on the 7th day of the animals' stay in the VMF.

Since it is important, when assessing the biological action of hormones, to take into account not only their total blood level but, more especially, their concentration in the free state [1, 6], the level of transcortin-bound and free steroids was determined. Under the influence of the VMF the total 11-HC concentration increased, chiefly on account of an increase in the concentration of free forms, the proportion of which was 26% after exposure for 24 h and 19% of the total plasma steroids after exposure for 1 week (compared with 10% in the control). These figures indicate marked activation of the secretory function of the adrenals.

There is evidence that the binding capacity of transcortin plays an important role in regulating the level of active hormones in the blood [6, 7, 11]; the degree of saturation of transcortin is consequently a parameter reflecting the size of the reserve of this system [3].

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TABLE 1. Effect of Variable Magnetic Field on Some Parameters of Adrenocortical Function ( $M \pm m$ )

	11-HC in adrenal (in $\mu\text{g/g}$ wet wt. of tissue)	Total 11-HC in plasma (in $\mu\text{g}\%$ )	Transcortin-bound 11-HC (in $\mu\text{g}\%$ )	Free 11-HC (in $\mu\text{g}\%$ )	Binding capacity of transcortin (in $\mu\text{g}\%$ )
Action of magnetic fields for 24 h					
Control	$19,5 \pm 1,44$	$22,2 \pm 1,6$	$19,6 \pm 1,4$	$2,43 \pm 0,22$	$26,6 \pm 1,5$
Experiment	$23,8 \pm 1,35$	$33,4 \pm 3,0$	$24,6 \pm 2,1$	$8,8 \pm 1,48$	$28,2 \pm 2,6$
P	$<0,05$	$<0,05$	$<0,05$	$<0,001$	$0,6$
Action for magnetic field for 7 days					
Control	$18,2 \pm 2,3$	$21,2 \pm 2,9$	$18,5 \pm 2,9$	$2,12 \pm 0,15$	$30,8 \pm 3,4$
Experiment	$24,2 \pm 3,9$	$32,8 \pm 2,5$	$27,6 \pm 2,3$	$6,1 \pm 0,66$	$32,8 \pm 4,06$
P	$<0,1$	$<0,02$	$<0,001$	$<0,001$	$0,7$

The statistics given in Table 1 show that the absolute value of the binding capacity of the transcortin under the influence of the VMF was not significantly changed from the control but the degree of saturation of transcortin increased, especially after exposure to the VMF for 1 week. This can be regarded as an adaptive reaction of the animal aimed at restoring the normal level of biologically active forms of the hormones.

The results suggest that an important factor in the mechanism of action of the VMF on metabolism is its stressor effect on the pituitary-adrenal system.

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