

SEASONAL VARIATION IN THE CHOLESTEROL CONTENT OF THE ADRENALS IN RATS

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Data on the fluctuations in the cholesterol content of the blood in animals and man are found in the literature [1, 4, 7]. There are also other works devoted to a study of the seasonal variations in the sudanophilic lipoids in the adrenal cortex [3] and also in the weight of the adrenal glands [5]. Nevertheless, these questions cannot be considered as entirely solved.

The problem in the present work was to examine the cholesterol content of the adrenals in the rat at monthly intervals throughout the year.

EXPERIMENTAL METHODS

The cholesterol content was determined in the adrenals of male rats weighing 120-160 g and fed on a mixed diet of cereal, bread, mil, etc. Food was withheld from the animals for 24 h before they were killed, unlimited water was provided. Every month throughout the year ten animals were killed by decapitation. The adrenals were immediately excised, weighed and immersed in a mixture of ethyl alcohol and caustic potash. The mixture was heated on a water bath until the adrenals were completely dissolved. The cholesterol content was determined by a method which was briefly described in our preceding work [2], but in the execution of that work only two adrenals were taken in each sample.

The weights of the adrenals and hypophysis were also determined. The organs were weighed in a moist state on a torsion balance having a precision of 0.5 mg.

EXPERIMENTAL RESULTS

The data obtained are given in Table 1 which shows the absolute content of total cholesterol in both adrenals in milligrams and the corresponding relative content in grams percent. It will be seen that the level of total cholesterol, expressed in grams percent, undergoes substantial changes which are related to the time of the year. At the beginning of spring (March) low values for the cholesterol content are noted. In April the level rises and reaches its maximum value in May. Some reduction in the cholesterol content was observed during summer and in the autumn (October—November) the level dropped to an extremely low value. The winter level of cholesterol exceeds the summer level and, in particular, that of the spring period.

The variations in the absolute content of cholesterol were not so great but the sequence of changes was preserved. A statistical treatment of the data obtained showed that, in comparison with the average annual increase, the rise in the level of cholesterol in May and the fall in March, October and November were significant. The increase in the level of cholesterol in June and December, calculated on 100 g adrenal tissue, was also significant, but if the absolute content of cholesterol is taken into account, then the increase appears to be insignificant (see Table 1). This may be due to the low weight of the adrenals during those months.

In Table 2 are given the data summarized according to seasons. They show that the general decline in the cholesterol level proceeds in the following sequence:—winter, spring, summer, autumn.

TABLE 1. Monthly Variations in the Content of Total Cholesterol in the Adrenals and in the Relative Weight of the Adrenals and Hypophysis in Rats

Month	No. of animals	Absolute cholesterol content in both adrenals, mg		Cholesterol content, g%		Relative weight of adrenals, mg%		Relative weight of hypophysis, mg%	
		$M \pm m$	P	$M \pm m$	P	$M \pm m$	P	$M \pm m$	P
January	14	$0,85 \pm 0,06$	0,2	$3,48 \pm 0,14$	0,2	$20,6 \pm 1,1$	0,5	$3,1 \pm 0,1$	0,01
February	10	$1,06 \pm 0,10$	0,2	$3,56 \pm 0,06$	0,2	$24,8 \pm 0,4$	0,001	$3,2 \pm 0,2$	0,1
March	10	$0,65 \pm 0,09$	0,05	$2,40 \pm 0,23$	0,05	$24,2 \pm 0,8$	0,05	$3,5 \pm 0,1$	0,5
April	10	$1,14 \pm 0,11$	0,1	$3,33 \pm 0,42$	0,5	$23,5 \pm 1,2$	0,2	$3,4 \pm 0,1$	0,2
May	10	$1,21 \pm 0,11$	0,05	$4,42 \pm 0,34$	0,001	$20,4 \pm 1,1$	0,5	$4,4 \pm 0,1$	0,001
June	10	$1,06 \pm 0,12$	0,2	$3,96 \pm 0,22$	0,05	$16,6 \pm 0,5$	0,001	$3,8 \pm 0,1$	0,2
July	10	$0,96 \pm 0,11$	0,5	$2,93 \pm 0,30$	0,5	$20,5 \pm 0,8$	0,5	$4,4 \pm 0,2$	0,01
August	10	$0,94 \pm 0,24$	0,5	$2,71 \pm 0,36$	0,2	$22,0 \pm 0,6$	0,5	$3,8 \pm 0,1$	0,2
September	10	$0,99 \pm 0,06$	0,5	$3,43 \pm 0,20$	0,5	$24,9 \pm 0,6$	0,01	$3,8 \pm 0,2$	0,5
October	10	$0,54 \pm 0,03$	0,001	$1,61 \pm 0,09$	0,001	$22,6 \pm 0,5$	0,2	$3,3 \pm 0,1$	0,05
November	10	$0,50 \pm 0,04$	0,001	$2,08 \pm 0,25$	0,01	$20,5 \pm 0,7$	0,5	$3,2 \pm 0,1$	0,02
December	10	$1,13 \pm 0,10$	0,1	$4,23 \pm 0,03$	0,001	$17,3 \pm 0,1$	0,001	$3,2 \pm 0,1$	0,02
Average		$0,92 \pm 0,07$		$3,18 \pm 0,25$		$21,5 \pm 0,7$		$3,6 \pm 0,1$	

TABLE 2. Seasonal Variations in the Content of Total Cholesterol in the Adrenals of the Rat

Season	No. of animals	Total cholesterol content, g%, $M \pm m$	P
Winter	34	$3,74 \pm 0,16$	—
Spring	30	$3,34 \pm 0,25$	0,2
Summer	30	$3,22 \pm 0,26$	0,05
Autumn	30	$2,27 \pm 0,19$	0,001

In comparison with the very high winter level, it is seen that the reduction in the cholesterol content during summer and autumn are statistically significant.

We also noted fluctuations in the relative weight of the adrenals and hypophysis. It is seen from Table 1 that there are two peaks among the variations in weight of the adrenals: one in January, February and March and the other in August, September and October. In June and December the relative weight of the adrenals was low. The highest relative weight of the hypophysis was observed from May to September.

Our data show that, over the course of the year, definite variations arose in the total cholesterol content of the adrenals of the experimental animals. The relative weights of the adrenals and hypophysis also changed. In each group there was quite a large variability, the degree of which was not always identical.

The cholesterol in the adrenals of the rat has a two-fold origin; the greater part comes from the blood plasma, only an insignificant amount being synthesized in the tissue of the adrenal itself [6]. In the rabbit and guinea pig the adrenals participate in the synthesis of cholesterol to a considerably greater degree.

To a certain extent, other data [3] corroborate our results which show that the maximum cholesterol content of the adrenals was found in May. It is an interesting fact that the absolute cholesterol content of the adrenals does not fall below 0.5 mg. Obviously, this fact is of a definite biological significance. It is, evidently, the amount of cholesterol necessary for covering the organism's requirements in corticosteroids. The low contents of cholesterol in the early spring and late autumn are possibly connected with adaptive reactions of the organism to new conditions in the environment.

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