EFFECT OF LIMITATION OF MUSCULAR ACTIVITY (HYPODYNAMIA) ON THE BLOOD SERUM PROTEIN CONCENTRATION

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A decrease in the albumin concentration and an increase in the globulin concentration were found in the blood serum of rabbits kept for 7 and 14 days in a state of hypodynamia. There was a particularly marked increase in the β-globulin concentration. The total protein concentration was unchanged. These indices remained practically unchanged in control rabbits throughout the period of observation.

The concentrations of the serum proteins were investigated in rabbits whose movements were severely restricted, thereby producing changes similar to those observed in atherosclerosis in the animals even without administration of exogenous cholesterol [6, 7].

EXPERIMENTAL METHOD

The total protein concentration in the blood serum was determined refractometrically. The serum protein fractions were investigated by electrophoresis on paper in the ÉFA-1 apparatus using veronal buffer (pH 8.6). Strips of paper (Leningrad Chromatographic Paper No. 2, fast), 2.5 cm wide and 26 cm long were used, and 0.01 ml serum was applied to the starting line. Electrophoresis was carried out for 6 h with a current of 0.5 mA for a strip 1 cm wide, with a voltage of 200 V. The protein fractions were stained with bromphenol blue. The protein fractions thus obtained were determined quantitatively by means of the FÉKN-57 photoelectric colorimeter.

Tests were carried out on 17 experimental and 10 control male chinchilla rabbits. The mobility of the experimental animals was sharply restricted while that of the control animals was unrestricted, i.e., they were kept in ordinary cages. The tests were carried out 7 and 14 days after the beginning of the period of hypodynamia.

EXPERIMENTAL RESULTS

The total protein concentration in the blood serum of the experimental rabbits showed no significant change and fluctuated during the experiments from 6.1 ± 0.14 to 6.3 ± 0.05 g%. The albumin concentration

TABLE 1. Serum Globulin Concentrations in Rabbits in a State of Hypodynamia

Globulin fraction	Before restriction of movement	After restriction of movement	
		7 days	14 days
α_1	4,41±0,26	4,51±0,12	5,03±0,31 ($P<0,001$)
α_2	7,00±0,26	11,36±1,44 ($P<0,003$)	11,31±1,58 ($P<0,007$)
β	11,14±0,38	15,44±0,92 ($P<0,001$)	17,28±0,99 ($P<0,001$)
γ	10,67±0,58	11,33±0,47 ($P>0,25$)	11,11±0,98 ($P>0,3$)

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TABLE 2. Concentration of Proteins and Their Fractions in Blood Serum of Control Rabbits

Indices studied	At beginning of experiment	7 days after	14 days after
Total protein (in g%)	6,0±0,16	5,9±0,19	6,0±0,12
Albumins	67,28±0,91	67,14±0,47 ($P>0,46$)	66,73±0,17 ($P>0,27$)
Globulins:			
α_1	4,06±0,15	4,09±0,14 ($P>0,46$)	4,11±0,15 ($P>0,42$)
α_2	7,04±0,26	7,04±0,22	7,12±0,25 ($P>0,42$)
β	11,31±0,31	11,40±0,37 ($P>0,42$)	11,39±0,35 ($P>0,46$)
γ	10,32±0,71	10,29±0,54 ($P>0,46$)	10,64±0,40 ($P>0,34$)
Albumin-globulin ratio	2,07±0,09	2,05±0,13 ($P>0,46$)	2,01±0,14 ($P>0,38$)

before and 7 and 14 days after the beginning of hypodynamia averaged 66.77 ±5.86, 57.34 ±2.12 ($P > 0.08$), and 54.26 ± 1.83% ($P < 0.03$) respectively. Restriction of movement thus caused a gradual decrease in the serum albumin concentration. The change in the serum concentrations of the various globulin fractions are given in Table 1.

The results in Table 1 show a particularly marked increase in the β-globulin concentration. The albumin–globulin ratio in the experimental animals was 2.06 ±0.58 before hypodynamia, while after 7 and 14 days of hypodynamia it fell to 1.38 ±0.32 and 1.25 ±0.12 respectively ($P < 0.001$).

No statistically significant changes in the indices studied could be observed in the control rabbits throughout the period of observation (Table 2).

The changes in the concentrations of the blood protein fractions discovered in the experimental animals are similar to those which occur in man during atherosclerosis [1-5, 8].

LITERATURE CITED

1. V. E. Anisimov, Biochemical Disturbances in Coronary Atherosclerosis and Their Clinical Importance, Author's Abstract of Doctoral Dissertation, Kazan' (1964).
2. N. S. Bazarnaya, Electrophoretic Investigations of Blood Serum Protein Fractions and Capillary Permeability in Atherosclerosis, Author's Abstract of Candidate's Dissertation, Frunze (1965).
3. Wang He-pin, Dynamics of Changes in Blood Protein Fractions and Lipids in Atherosclerosis of the Coronary Arteries. Candidate's Dissertation, Leningrad (1957).
4. G. A. Gel'fer, Ter. Arkh., No. 12, 42 (1960).
5. V. M. Zaitsev, The Blood Serum Proteins in Various Forms of Atherosclerosis from Data on Electrophoresis on Paper, Author's Abstract of Candidate's Dissertation, Kazan' (1959).
6. V. V. Tyavokin, Pat. Fiziol., No. 1, 77 (1966).
7. V. V. Tyavokin, Byull. Éksperim. Biol. i Med., No. 2, 19 (1967).
8. J. Loeper, J. Loeper, and F. de Mersseman, Presse Méd., 68, 953 (1960).