

maintain a normal level of arterial pressure than is necessary to maintain a normal serum electrolyte pattern. Aldosterone appears to possess certain physiological properties which distinguish it from desoxycorticosterone compounds.

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Received April 5, 1954. P.S.E.B.M., 1954, v86.

Relationship between Plasma Mucoproteins and Protein Sugar in Patients with Rheumatoid Arthritis Receiving Cortisone.* (21035)

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It has been shown by Winzler *et al.* (1) that serum mucoprotein concentrations are significantly increased in patients with rheumatoid arthritis. Shetlar and associates (2), and Kelley (3) have demonstrated that in the same disease there is a considerable rise in the carbohydrate content of the total serum protein. Serum mucoproteins are comparatively rich in polysaccharides since they contain approximately 14.5 mg % of carbohydrate (3), whereas in normal sera the total globulin

fraction contains only 1.5 to 3.9 mg % of carbohydrate and the albumin fraction, about 1.2 mg % (4). Thus, although mucoproteins represent approximately 0.7% of the total serum protein, they contain about 10% of the total protein sugar.

The relationship between the concentrations of serum mucoprotein and total protein sugar has been studied in the present report in order to test the hypothesis that variations of mucoproteins and total protein sugar in inflammatory diseases may depend upon a common regulating factor.

Methods. Mucoproteins were estimated by the Winzler method and are expressed as mg of tyrosine per 100 ml of original serum (Tyrosine Index). Total protein sugar was determined by the tryptophan method of Shetlar as modified by Badin, Jackson, and Schubert (5). Error in duplicate analyses averaged ± 0.3 mg for the Tyrosine Index.

* Supported by grants from the Masonic Foundation for Medical Research and Human Welfare, the National Institute of Arthritis and Metabolic Diseases, National Institutes of Health, and the Arthritis and Rheumatism Foundation (N. Y. Chapter).

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TABLE I.
Variation of Mucoprotein Concentration of Serum with Total Protein Sugar Concentration.

No. of analyses	Total protein sugar mg % serum		Mucoprotein		Mucoprotein sugar × 100	Tyrosine index of mucoprotein (% of cases)		
	Range	Avg	Tyrosine	Sugar	Total protein sugar	<3.5	3.5-4.5	>4.5
			(mg % serum)					
30	90-120	109.0	3.74	13.2	12.1	66.6	13.3	20.1
34	121-140	132.7	4.56	15.9	11.9	29.4	17.7	52.9
20	141-160	148.9	4.59	16.2	10.8	20.0	20.0	60.0
27	161-180	170.7	5.63	19.7	11.6	3.7	14.9	81.4
14	181-200	193.0	6.07	21.2	10.9	0	7.5	92.5
13	>200	235.0	6.60	23.3	10.0			

This is an absolute error which holds over the entire range of 2.5 to 9 mg of tyrosine. The error in carbohydrate determination was found to be $\pm 10\%$ in a range of 90 to 330 mg carbohydrate per 100 ml of serum. One hundred thirty-eight samples were analyzed. They were obtained before, during and after administration of therapeutic doses of cortisone. The sugar bound to mucoproteins was calculated according to the data of Winzler and Smythe(6), and of Levy and Jackson(7). The ratio, sugar/tyrosine, given by these authors varies between 3.85 and 3.26. An average value of 3.5 was chosen as a factor for the calculation of the carbohydrate content from the Tyrosine Index.

Results. The correlation coefficient between the concentrations of serum mucoprotein and the total protein sugar was calculated for the entire group of 138 analyses, and found to be 0.62. Mucoprotein concentration and total protein sugar were compared, the analyses having been grouped according to total protein sugar concentration. No attempt has been made to differentiate those values obtained during cortisone treatment from those prior to or after cortisone administration.

Table I shows that mucoprotein sugar concentration rises with increase in the concentration of the total protein sugar. Mucoprotein sugar varied between 10.0 and 12.1% of the total protein sugar.

In order to study statistically the discrepancies between the 2 tests, the analyses of total protein sugar have been divided into 5 concentration ranges. In each of these was calculated the percentage of cases where

mucoproteins have been found either normal (Tyrosine Index < 3.5) or moderately high (3.5 to 4.5) or frankly elevated (> 4.5). According to the data given in Table I, it may be expected that (a) when the total protein sugar level is normal (*i.e.* between 90 and 120 mg %) only 66.6% of the cases have normal mucoproteins and moreover 20.1% may even have a high concentration; (b) when total protein sugar is more than 160 mg % mucoproteins are abnormal in 98.2% of cases; (c) when total protein sugar is very high (above 180 mg %) mucoproteins are always abnormal and even frankly high in 92.5% of cases.

In 6 patients, total protein sugar and mucoproteins were determined simultaneously before and during the administration of cortisone. The patients were followed from 105 to 250 days, and determinations were performed every 5 to 15 days. The curves obtained, presented in Fig. 1, are grossly parallel but a number of discrepancies may be noted, especially after the patients have been treated for some weeks.

Discussion. In view of their parallelism, it is possible that a common factor regulates mucoprotein and the total protein carbohydrate concentration. Since it is the α -globulin fraction of serum which is richest in carbohydrate, the regulation of mucoprotein concentration may be dependent on a primary regulation of α -globulin synthesis. It may be assumed that this common factor is at work when the anabolic phase predominates since mucoprotein is always high when the total protein sugar is high. Catabolism of mucoproteins may follow a different course from that of the globulins rich in sugar since

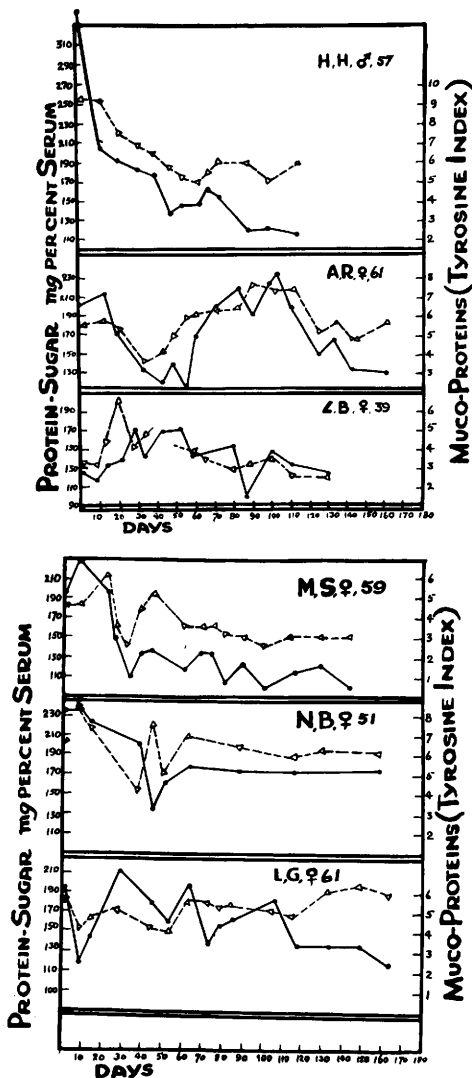


FIG. 1. Variation of mucoproteins and serum protein-sugar levels in 6 patients treated with cortisone.

discrepancies are present mainly when the catabolic phase predominates, *i.e.*, in the falling portions of the curves.

This work confirms the recent findings of

Shetlar and his coworkers who have compared different groups of arthritic patients and demonstrated a close parallelism between the average values of mucoprotein sugar and total serum protein carbohydrates(8).

Summary. In 41 patients with rheumatoid arthritis, who were studied before and during the administration of cortisone, serum mucoprotein and the protein-bound carbohydrate concentrations were studied and compared. 1. The correlation coefficient of the 2 tests was found to be moderately high, $r = 0.62$. 2. It was found that when the total protein sugar concentration was very high, mucoprotein concentration was always above normal values. 3. When the total protein sugar concentration was normal, the serum mucoprotein index was often above normal. 4. From these findings and from the comparative study of the variation of total protein sugar and mucoprotein concentrations during the treatment of 6 patients with cortisone, it is suggested that a common factor regulates the formation of serum mucoproteins and other plasma proteins which are rich in carbohydrate.

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Received April 20, 1954. P.S.E.B.M., 1954, v86.