

Total Serum Glycoprotein Levels in Normal New Zealand White Rabbits.*† (22713)

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Interest in the serum glycoproteins has been aroused by reports of abnormally high levels in various physiological and pathological states(1,2). Although the levels of these carbohydrate-containing proteins of the serum have been studied in many conditions and disease states, and work on establishing the chemical composition has been initiated, little is known about the physiological significance of these substances and from whence they arise(3,4).

Inasmuch as it will be necessary for laboratory animals to be used in experimental studies designed to establish the site or sites of the origin of these compounds and to determine the physiological and pathological significance of serum glycoproteins, the present investigation was undertaken to establish the normal level of serum glycoproteins in New Zealand white rabbits. In our experience, the rabbit has proven to be the most satisfactory laboratory animal for this type of study because of the similarity between its electrophoretic serum protein patterns and those of the human in both the normal and infected state.

Methods. In this series, 10 male and 9 female New Zealand white rabbits weighing from 2.3 to 2.8 kg each were used. They were individually housed in wire cages in an air conditioned room and were maintained on a diet of Purina rabbit pellets supplemented daily with carrots and tap water, *ad lib*. All animals were observed for a period of 6 weeks prior to this study in order to rule out any abnormalities. Blood samples were collected weekly on each normal healthy animal for a period varying from one to 11 weeks with the

different animals. Approximately 5 cc of blood was obtained each week by lancing the ear and allowing free-flow collection in acid cleaned test tubes. With the exception of the first 3 weeks all samples were stored in the frozen state between determinations; in our experience serum specimens showed no demonstrable change for as long as 3 months. The total serum glycoproteins were determined according to a modification of Winzler's technic for protein-bound hexose determination in which 90% sulfuric acid was substituted for the 60% acid in mixing the original reagent(1). Each sample was determined in duplicate on at least 2 separate occasions and the values used in the following results were derived from the average of all determinations on each sample. The mean, standard error of the mean, *t*, and probability values were determined by the standard statistical procedures.

Results. In 122 serum samples, the established mean and standard error for total serum glycoproteins was 84.5 ± 1.31 mg% protein-bound hexose ($p < .001$). The normal range was 56.5 to 113.5 mg% protein-bound hexose. Summaries of the results of the chemical analyses for total serum glycoproteins showing variation between individual animals and effects of weekly bleedings are presented in Tables I and II, respectively. All animals continued to gain weight throughout the course of the experiment and there were no apparent after-effects due to bleeding. No statistically significant changes occurred in the concentration of the serum glycoproteins from week to week when compared to the established mean. When compared to the first week's mean, however, there was a significant increase in the total serum glycoprotein at the sixth bleeding. No significant difference was found between sexes.

Discussion. On the whole, the variation between determinations in each animal appeared to be greater than that between the

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TABLE I. Variation between Individual Animals, Grouped According to Sex.

Male No.	No. samples	Mean $\pm$ S.E.*	Female No.	No. samples	Mean $\pm$ S.E.*
1	10	83.3 $\pm$ 3.39	24	8	80.5 $\pm$ 6.53
2	10	71.9 $\pm$ 2.81	4	10	76.0 $\pm$ 2.94
7	10	89.1 $\pm$ 5.59	6	10	84.8 $\pm$ 3.22
8	11	91.6 $\pm$ 4.68	25	9	85.6 $\pm$ 4.86
10	11	86.2 $\pm$ 2.77	12	11	90.6 $\pm$ 4.69
Avg		84.4 $\pm$ 3.42	Avg		83.5 $\pm$ 2.45

* All serum glycoprotein levels are expressed as mg % protein-bound hexose.

individual animals. The normal range varies considerably, much like blood sugar levels, but in Table I less variation is seen between the individual animals. Little change is noticed in the levels of glycoproteins in the group from week to week when compared with the average mean so that it is assumed there was no significant effect on the blood levels of glycoproteins due to the bleeding. However, when the concentrations of glycoproteins were compared to the mean of the first week a significant P value was obtained for the sixth week. We are unable to explain this observation on the basis of dehydration as total protein determinations were not done. Since the rabbits were housed in air conditioned quarters and always had ample water supply, it was not felt that dehydration was a contributing factor. On the basis of work by Weimer

et al.(5) it appears doubtful that significant variations in total protein occur normally. They showed no significant increases, and only transient decreases in the serum proteins of guinea pigs and rats following weekly bleedings of approximately 20% of the total blood volume. Variation between animals was greatest at the third bleeding but this is unexplained and cannot be attributed to environmental changes, in that the date of the third bleeding was not the same among all rabbits. There was no significant statistical difference between the male and female groups ($P = <.001$).

Summary. The normal serum levels of glycoproteins in 19 New Zealand white rabbits are reported. It was shown that there was no significant difference between the sexes and essentially little effect on total serum glycoprotein concentration when the rabbits were bled weekly in the quantity reported over an 11 week period.

TABLE II. Effects of Weekly Bleedings on Serum Glycoprotein Concentrations.

Wk No.	No. samples	Mean $\pm$ S.E.*	P†
1	9	82.9 $\pm$ 3.59	—
2	10	86.0 $\pm$ 3.06	> .2
3	10	83.7 $\pm$ 9.14	> .5
4	10	81.9 $\pm$ 4.77	> .5
5	9	85.3 $\pm$ 3.44	> .3
6	10	89.3 $\pm$ 5.00	< .05
7	8	88.6 $\pm$ 5.27	> .05
8	10	82.8 $\pm$ 3.17	> .5
9	9	82.4 $\pm$ 3.83	> .5
10	8	82.9 $\pm$ 2.03	> 0
11	7	80.1 $\pm$ 3.05	> .2

* All serum glycoprotein levels are expressed as mg % protein-bound hexose.

† P values derived by comparing means of each succeeding week with mean of first week.

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