Blood Groups and the Dependence of the Glycoproteid Values (Bound Hexoses) on the Values of Total Blood Serum Proteins in Man

Introduction. During the course of a study of the glycoproteid levels (bound hexoses) in patients with nervous[1] and psychic diseases[2], we also undertook an investigation of a group of normal subjects — 400 blood donors before the first blood letting. A statistical analysis of the results obtained from this control group revealed a significant dependence of the values of bound hexoses on the values of total proteins. The low percentage of that dependence indicated, however, that factors or circumstances might exist which obscure this dependence. On analysing these factors, it was felt desirable to find out whether this dependence observed in the whole group can also be demonstrated when the group is further subdivided according to blood groups.

Material and methods. The levels of total proteins and bound hexoses were investigated in blood samples obtained from 400 blood donors before the first blood letting (173 females and 227 males); age ranging from 18 to 59 years. The total proteins were determined by the method of Kjeldahl. The value of protein-free nitrogen was subtracted from the value of total nitrogen. In computing protein-containing nitrogen, the factor 6.25 was used. Bound hexoses were determined by adopting the orcinol method according to STARY et al.[2,3]. For statistical purposes allowance was made for the fact that the values of bound hexoses might be dependent on the age of the subjects under investigation[4]. Therefore, for each subgroup, the partial correlation coefficient of the dependence of the values of bound hexoses on the values of total proteins was computed without making allowance for the dependence of these values on the age of the subjects. The calculation was carried out by the method according to WEBER[5].

Results. No significant difference was observed in the *mean values* of total proteins and of bound hexoses obtained from groups of blood donors after a subdivision of the subjects according to sex and blood groups was carried out (Table I).

The dependence of bound hexoses on the values of total proteins (Table II) could be demonstrated both in the whole group and in the subgroups consisting either of

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Table I

Blood groups	N	Total proteins		Bound hexoses		Regressive coefficients		% rate of correlations	
		x	s_x	y	s_y	b_x	b_y	B_{xy}	$B_{xy.z}$
'A'	143	7.52	0.29	120.9	14.8	0.009328	9.88439	0.06	0.07
'B'	82	7.55	0.40	118.8	13.1	0.004754	12.3863	0.09	0.12
'AB'	39	7.54	0.38	122.7	17.5	0.008487	18.2754	0.16	0.13
'0'	111	7.47	0.40	120.7	15.0	0.003972	5.5482	0.02	0.03
The whole group	400[a]	7.51	0.37	120.5	14.9	0.005974	9.8931	0.06	0.06

N = Number of investigated persons. [a] = In 25 blood donors the blood groups were not determined. B_{xy} = % rate of correlation between the values of bound hexoses (y) and the values of total proteins (x) of the serum. $B_{xy.z}$ = % rate of partial correlation between the values of bound hexoses (y) and the values of total proteins (x) of the serum, making no allowance for the dependence on the age of the subjects under investigation (z).

Table II

	Blood groups 'A'			'B'			'AB'			'0'			Total		
	N	r_{xy}	$r_{xy.z}$	N	r_{xy}	$r_{xy.z}$	N	r_{xy}	$r_{xy.z}$	N	r_{xy}	$r_{xy.z}$	N	r_{xy}	$r_{xy.z}$
Females	61	0.3441[d]	0.3155[e]	27	0.3550	0.3543	19	0.4003	0.4003	53	0.1424	0.1625	173[a]	0.2810[b]	0.2741[b]
Males	82	0.2296[e]	0.2992[d]	55	0.2807[e]	0.3267[e]	20	0.4305[e]	0.3358	58	0.1761	0.1982	227[a]	0.2536[b]	0.2952[b]
The whole group	143	0.2427[c]	0.2665[c]	82	0.3037[d]	0.3426[c]	39	0.3938[e]	0.3635[e]	111	0.1484	0.1709	400[a]	0.2431[b]	0.2535[b]

N = Number of investigated persons. [a] = In 25 blood donors (12 males and 13 females) the blood groups were not determined. r_{xy} = Correlation coefficient of the dependence of the values of bound hexoses (y) on the values of total proteins (x) of the serum. $r_{xy.z}$ = Partial correlation coefficient of the dependence of the values of bound hexoses (y) on the values of total proteins (x) of the serum, making no allowance for the dependence on the age of the subjects under investigation (z). Statistical significance for r_{xy} and $r_{xy.z}$: [b] $P < 0.001$; [c] $P \gtrless 0.001 - 0.0027$; [d] $P \gtrless 0.0027 - 0.01$; [e] $P \gtrless 0.01 - 0.05$.
Unmarked = $P > 0.05$.

males or of females ($P < 0.001$). A comparison between the values of the correlation coefficients and of the partial correlation coefficients, respectively, showed that, in groups which were subdivided according to the blood groups, the correlation coefficient in the blood group '0' was conspicuously low. Provided that the sex is not taken into consideration, it may be inferred that in the subgroups with the blood groups 'A', 'B', and 'AB' the dependence is statistically assured (in the groups 'A' and 'B' $P < 0.001$, in the group 'AB' $P \gtrsim 0.01 - 0.05$). In groups subdivided according to sex and blood groups, the dependence is not statistically assured if the groups consist of only a small number of subjects (females: groups 'B' and 'AB', males: group 'AB'). There is, however, reason to believe that even in these groups the dependence will prove to be significant if the number of subjects under investigation is increased. This assumption is based on the finding that a statistically significant dependence is observed when males and females of the same blood group are investigated as one group (i.e. when the number of subjects under investigation is increased). In the group of donors with the blood group '0', such a dependence could not be demonstrated, and, even if the number of subjects under investigation were increased, it could not be expected. The highest regressive coefficient of dependence of the values of bound hexoses on the values of total proteins was observed in the group 'AB'.

Discussion. It appears that the synthesis of the majority of plasma proteins, with the exception of glycoproteids, is accomplished in the liver[6-9]. It is assumed that under pathological conditions an increase in the level of glycoproteids in the serum is brought about by the liberation of a certain humoral factor which stimulates their synthesis[10]. It can reasonably be expected that under physiological conditions, the synthesis of the different fractions of plasma proteins and their penetration through the cytological membranes are determined by a certain law. One of the manifestations of this law is perhaps the dependence of the values of bound hexoses on the values of total proteins, which could be demonstrated in our experiments while carrying out in the first place an investigation of a whole group of blood donors, and then of its two subgroups – males and females. With regard to blood groups, such a dependence was observed only in the groups 'A', 'B' and 'AB'. From this it appears that in the group of blood donors with the blood group 'O', where such a dependence was not observed, the cause might have been a change either in the conditions of the formation of some protein fractions of the blood-serum (glycoproteids ?) or in the conditions of the penetration of these fractions through cytological membranes into the blood. A detailed report of these observations will be published elsewhere.

Zusammenfassung. Bei einer Gruppe von 400 Blutspendern wurde die Abhängigkeit gebundener Hexosen von Werten des Gesamteiweisses im Blutserum festgestellt. Einzig bei Blutgruppe «0» wurde keine solche Abhängigkeit beobachtet.

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Hyperemin, a New Vasoactive Substance which Regulates the Metabolic Responses of the Coronaries

In earlier investigations the metabolic adaptive capacity of the coronary vessels measured by reactive hyperemia (RH) was decreased after blocking the coronary vasoconstrictor tone and was interpreted as a consequence of decreased 'constrictor reserve' for the metabolic dilatation. However, in a number of cases the RH not only diminished but disappeared completely[1-3].

The present experiments succeeded in demonstrating that in this later case a substance was depleted from the heart which, when normally present, provides the coronaries with their ability to dilate in response to metabolic stimuli[4]. In the absence of this substance, no RH could be produced and other metabolic stimuli, such as adrenalin administration, also failed to produce a dilatation.

On 81 dogs with open chest under morphine-chloralose narcosis, the coronary blood flow (CBF) was measured by a rotameter, and RH was produced by clamping the inflow tube of the rotameter for 10 to 30 sec. To eliminate the RH, surgical or pharmacological blockade of the coronary vasoconstrictor tone was attempted, i.e. stelletectomy or intra-coronary administration of agents such as hexamethonium (C_6), dibenamine, or other procedures were performed, which had proved to be active in earlier investigations[1-3]. If stelletectomy or C_6 failed to eliminate RH, hypoxic periods were performed by incomplete occlusion of the inflow tube of the rotameter or cyanide (CN) was administered[4]. By this means RH was eliminated in 60% of the experiments. In all these cases CBF was not maximal; sometimes it did not change while in other cases it decreased. Blood pressure was often unchanged, but a drop as well as an elevation could equally often be observed. After stelletectomy, RH disappeared 5 sec to 1 h later. During the experiments RH was tested periodically and test samples were taken from the coronary sinus. The samples were centrifuged, and the plasma, or a portion of the plasma which was heated to 100 °C, was tested on a second dog heart or isolated rat heart (49

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