LIPID METABOLISM IN DIABETICS WITH AND WITHOUT BLOOD PRESSURE INCREASE

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It is generally known that in certain aspects, uncontrolled diabetes resembles the state of fasting: the oxidation of fatty acids in the tissues is intensified while that of carbohydrates is lowered, the mobilization of free fatty acids by the adipose tissue is intensified and, not infrequently, a rise of the triglycerides' blood content occurs (3).

Substantial changes in the lipid metabolism are likewise observed in atherosclerosis (1, 2).

Diabetes mellitus is characterized by speeded up development of atherosclerosis and often, it runs a course associated with increased blood pressure and furthermore, it is a well known fact that a definite interdependence exists between atherosclerosis and hypertonic disease.

We set out to find out whether or not increased blood pressure exerts influence on the lipid metabolism and on the lipoprotein-lipase activity in diabetes mellitus.

Material and Methods

Investigation was performed on a total of 38 patients with diabetes mellitus, of which 16 with increase, and 22 — without increase of the blood pressure, as well as on 45 patients with hypertonic disease of which 12 (males only) in the first, and 33 in the third stage of disease, according to Lang, and on 17 practically healthy, normotonic subjects. The age of the diabetics without increase of the blood pressure ranged from 23 to 67 years, or 49 y. average, in diabetics with blood pressure increase — from 22 to 70 y., or 50 y. average, in hypertonic patients, stage I according to Lang — 19 to 22 y., or 19.5 y. average, in hypertonic patients, stage III according to Lang — 28 to 61 y., or 49 y. average and the subjects considered as practically healthy were 20 to 56 y. old, or 36 y. in the average. All patients were fed on the respective for their particular affection diet.

The heparin test was performed in the following manner: in the morning, before meal, 150 mg heparin were administered over a four-hour period by drop infusion of 500 ml physiological serum. Just prior to and after the infusion, blood sugar, serum lipids and endogenous heparin were examined. Blood-sugar determination was made after the method of Haggedorn—Jensen, cholesterol — after Ilko, total lipids — after Bragdon-Bloor, phospholipids — after Svanberg-Swanerholm, beta-lipoproteins — after Burstein, non-esterified fatty acids — after Dancomb, heparin — after Pipta and lipoprotein-lipase activity — after Lukasik.

Results and Discussions

The results of our studies show that in diabetics with increased blood pressure, besides blood sugar level, also the concentrations of cholesterol, total lipids, phospholipids, tri-glycerides, beta-lipoproteins and non-esterified fatty acids are considerably elevated, whilst the content of endogenous heparin is much lower than in healthy persons. No significant difference is established in terms of lipoprotein lipase activity (Table 1). Identica

Table 1

The Ratio between Blood Sugar and Serum Lipids in Healthy Persons and Diabetics with and without Hypertension

	Healthy persons n=17 M±σ	Diabetics without hypertension n=22 M±σ	P	Diabetics with hypertension n=16 M±σ	P
1. Blood sugar mg %	105±14	231±82	<0.001	203±55	<0.001
2. Cholesterol mg %	223±37	271±54	<0.001	287±60	<0.001
3. Total lipids mg %	568±73	707±146	<0.001	736±121	<0.001
4. Phospholipides mg %	196±26	227±37	<0.001	228±27	≈0.001
5. Triglycerides mg %	153±44	204±109	<0.01	215±79	<0.001
6. Beta-lipoproteins PU	40±11	60±19	<0.001	64±16	<0.001
7. Non-esterified fatty acids μ M/ml	0.52±0.1	0.72±0.1	<0.001	0.72±0.2	<0.01
8. Lipoprotein lipase μ M/ml	2.40±0.42	1.94±0.28	<0.1	1.88±0.34	<0.01
9. Endogenous heparin U/ml	9±0.61	7±2.4	<0.001	7±2.2	<0.001

dependence is discovered also among diabetics with increased blood pressure (Table 1). The content of serum lipid fractions, endogenous heparin and lipoprotein-lipase disclosed no differences whatsoever between the two groups of diabetic patients studied (Table 1).

The comparative study of the content of lipid fractions, endogenous heparin and lipoprotein-lipase activity in diabetics without increased blood pressure with that in patients with hypertonic disease, first and third stage according to Lang, shows that the concentrations of the single lipid fractions and lipoprotein-lipase activity are significantly higher, whilst the endogenous heparin content in diabetic patients is substantially reduced (Table 2). The same dependence is established in comparison with patients suffering from hypertonia (third stage), except for endogenous heparin which reveals a substantial decrease in the latter group. Identical dependence is established also between the group of diabetics with increased blood pressure and those with hypertension, stage I and III (Table 3). The lipolytic effect of heparin is approximately equally manifested in both groups of diabetics (Table 4).

In general outline, our studies of the lipid metabolism in diabetes fail to show any differences in the metabolism of lipids, dependent upon the blood sugar level, or, in other words, the increased blood pressure in dia-

Table 2

The Ratio between Blood and Serum Lipids in Diabetics without Hypertension and Hypertonic Disease I and III Stage

	Diabetics without hypertension n=22 M±σ	Hypertonic disease I stage n=12 M±σ	P	Hypertonic disease III stage n=33 M±33	P
1. Blood sugar mg %	231±82	66±18	<0.001	99±37	<0.001
2. Cholesterol mg. %	271±54	1[illegible]3±32	<0.001	244±46	<0.01
3. Total lipids mg %	707±146	474±89	<0.001	579±119	<0.001
4. Phospholipids mg	227±37	163±29	<0.001	210±35	≈0.05
5. Triglycerides mg %	204±109	158±56	<0.02	124±73	<0.001
6. Beta-lipoproteins PU	60±19	39±13	<0.001	43±16	<0.001
7. Non-esterified fatty acids μ M/ml	0.72±0.2	0.44±0.16	<0.001	0.43±0.25	<0.001
8. Lipoprotein lipase μ M/ml	1.94±0.28	0.62±0.5	<0.001	0.51±0.04	<0.001
9. Endogenous heparin U/ml	7±2.4	10±6.6	<0.001	5±1	<0.001

Table 3

The Ratio between Blood Sugar and Serum Lipids in Diabetics with Hypertension and Hypertonic Disease I and III Stage

	Diabetic with hypertension n=16 M±σ	Hypertonic disease I stage n=12 M±σ	P	Hypertonic disease III stage n=33 M±σ	P
1. Blood sugar mg %	203±55	66±18	<0.001	99±37	<0.001
2. Cholesterol mg %	287±60	153±32	<0.001	244±46	<0.001
3. Total lipids mg %	736±121	474±89	<0.001	579±119	<0.001
4. Phospholipids mg %	2[illegible]8±27	163±29	<0.001	210±35	<0.05
5. Triglycerides mg %	215±79	158±56	<0.02	124±73	<0.001
6. Beta-lipoproteins PU	64±16	39±13	<0.001	43±16	<0.001
7. Non-esterified fatty acids μ M/ml	0.72±0.2	0.44±0.16	<0.001	0.43±0 25	<0.001
8. Lipoprotein lipase μ M/ml	1.88±0.34	0.62±0.5	<0.001	0.51±0.04	<0 001
9. Endogenous heparin U/ml	7±2.2	10±6.6	<0.001	5±1	<0.001

betes is by no means reflected by the lipid fractions, endogenous heparin and lipoprotein-lipase activity, while variations in the lipid metabolism are conditioned by the basic affection exclusively.

Up to a certain extent, the latter circumstance warrants the assumption that increased blood pressure, observed in some patients with diabetes mellitus, should by no means be considered as essential hypertension or else in this particular case, no combination between diabetes mellitus and hypertonic disease is concerned, but rather diabetes mellitus with concomitant hypertension, which, most likely, has its own, different from the hypertonic condition, genesis.

Table 4

The Influence of Heparin upon the Level of Blood Sugar and Serum Lipids in Diabetics with and without Hypertension

	Diabetis without hypertension n=22			Diabetics with hypertension n=16		
	value before heparin $M\pm\sigma$	value after heparin $M\pm\sigma$	P	value before heparin $M\pm\sigma$	value after heparin $M\pm\sigma$	P
1. Blood sugar mg %	231±82	185±83	<0 001	203±55	159±40	<0.01
2. Cholesterol mg %	271±54	254±58	>0 001	287±60	265±55	<0.02
3. Total lipids mg %	707±146	639±129	<0.001	736±121	678±120	<0.001
4. Phospholipids mg %	227±37	227±37	>0.01	228±27	215±27	<0.05
5. Triglycerides mg %	204±109	159±109	>0.001	215±79	192±94	<0.05
6. Beta-lipoproteins PU	60±19	45±13	<0.001	64±16	54±13	<0.001
7. Non-esterified fatty acids μ M/ml	0.72±0.17	0.95±0.18	<0.001	0.72±0.2	1.02±0.34	<0.001
8 Lipoprotein lipase μ M/ml		1.94±0.38			1.88±0.34	
9. Endogenous heparin U/ml	7±2	8±3	<0.001	7±2.2	9±1.7	<0.001

ЛИПОИДНЫЙ ОБМЕН У ДИАБЕТИКОВ С ПОВЫШЕННЫМ И С НОРМАЛЬНЫМ КРОВЯНЫМ ДАВЛЕНИЕМ

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РЕЗЮМЕ

Липопротеин-липазная активность и влияние гепарина на уровень сахара крови и липиды сыворотки исследовали у 38 больных сахарной болезнью, у 16 из которых кровяное давление было повышено, а у 22 — в норме, 45 больных гипертонической болезнью и 17 практически здоровых нормотонических лиц.

У диабетиков с повышенным и с нормальным кровяным давлением по сравнению с больными гипертонической болезнью и нормотониками обнаружили более высокое содержание не только сахара крови, но и липидных фракций сыворотки, а содержание эндогенного гепарина оказалось пониженным.

В результатах исследования липидного обмена при диабете не отмечалось различий в обмене липидов в зависимости от уровня кровяного давления.