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Original Research Article

Study of lipoproteins in type 1 diabetes mellitus

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Abstract

Aim and Objectives: Type I Diabetes mellitus previously classified as juvenile diabetes is supposed to cause derangements in lipid metabolism, consequent on impaired glucose metabolism just like type II diabetes mellitus. If these patients are early diagnosed and properly treated, with good control of diabetes, degenerative changes may be postponed or stopped (or) onset may not occur. Aim is to Study lipoprotein patterns and disturbances in lipid metabolism in cases of type I diabetes mellitus, who are on regular treatment with Insulin.

Materials and Methods: Glucose tolerance test and lipid profile in IDDM patients is done and compared with same biochemical parameters with the healthy non diabetic controls. Cases are being selected from the medical wards of Govt., General Hospital, and Guntur. Cases of about 35 diabetics (IDDM) of both sexes, of various age groups from 6 to 40 years, without clinically manifested complications were investigated. At the same time about 35 controls of nondiabetic healthy persons without hyperglycemia and glycosuria were investigated for comparison with the cases.

Results: The mean HDL cholesterol level for IDDM patients is 37.514 mg % (S.D = + 6.213). In case of normals, the HDL-C is 43.57 mg% (S.D = +6.31) P value is 0.01. So there is significant decrease in HDLC in IDDM patients compared with normals. The mean VLDL-C level for IDDM patients is 46.25 mg% (S.D= + 9.419) and the mean VLDLC concentration in case of normals is 29.71mg% (S.D± 10.53) P value is 0.01. So VLDL-C is increased in IDDM patients compared with normals. The mean LDL-C concentration for IDDM patients is 141.971ng% (S.D+51.64) and the mean LDL-C concentration in case of normal 94.51 mg% (S.D± 21.88) P value is .01. So there is increased concentration of LDL-C in IDDM patients compared with normals. The LDL-C and HDL-C ratio is more in case of IDDM patents compared with normals.

Discussion: The history of the patients is studied. None of them are smokers (or) Alcholics (or) with abnormal food habits leading to obesity. So the basis of the study of lipoproteins is purely is in relation to type I Diabetes mellitus. None of the patients showed any signs and symptoms of cardiac insufficiency (or) cardiomyopathy symptoms. The lipoprotein pattern studied in these patients have shown significant rise of LDL-C in almost all the patients. Mild rise of Triglycerides is seen in all the patients with the mean of 242.628 mg %. The patients studied are on treatment with insulin for more than one year and are with adequate control. Inspite of their treatment of diabetes with insulin therapy, the observation is that, there is increase in cholesterol and triglyceride levels. This indicates that Acetyl COA and FFA are shunted towards fat

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synthesis. HDL fraction is seen in all the patients studied by lipoprotein pattern. The mean value of HDL obtained is 37.5 mg% for normal controls LDL, HDL and VLDL are lower range than Type I diabetes patients.

Conclusion: This study shows that if the patients with diabetes are on regular treatment with insulin and maintaining the normal blood sugar levels, the complications are postponed and less likely to appear. Those whose GTT is increased showing increased or abnormal blood sugar levels have altered or increased lipoprotein levels. This increased lipoproteins may lead to cardiovascular complications in future which life are threatening.

Keywords: Lipoproteins, Type I DM, Triglycerides, oral Glucose tolerance test, HDL, LDL

Introduction

Diabetes mellitus is a generalized chronic metabolic disorder manifesting itself, in it's fully developed form, by hyperglycemia, glycosuria, increased protein breakdown, ketosis and acidosis. If the disease is prolonged, it is usually complicated by degenerative changes of the blood vessels, the Retina, the kidneys and the nervous system. Diabetes mellitus is a group of metabolic disorders of carbohydrate metabolism in which glucose is underutilized, producing hyperglycemia. Some patients may experience acute life-threatening hyperglycemic episodes, such as ketoacidosis or hyperosmolar coma. As the disease progresses, patients are at increased risk for the development of specific complications, including retinopathy leading to blindness, renal failure, neuropathy (nerve damage), and atherosclerosis. The last may result in stroke, gangrene or coronary artery disease.

Materials and Methods

The present problem includes the study of the levels of Glucose tolerance test, lipid profile in IDDM patients and comparison of the same biochemical parameters with the healthy non diabetic controls, cases being selected from the medical wards of Govt., General Hospital, Guntur. Cases of about 35 diabetics (IDDM) of both sexes, of various age groups from 6 to 40 years, without clinically manifested complications were investigated. At the same time about 35 controls of nondiabetic healthy persons without hyperglycemia and glycosuria were investigated for comparison with the cases.

Biochemical aspects of lipoproteins

Composition of the lipoproteins in plasma of humans

Fraction	Source	Diameter (nm)	Density	Composition						
						Percentages of Total Lipid				
				Protein (%)	Total Lipid (%)	Triacyl-Glycerol	Phospho Lipid	Choles-teryl Ester	Choles-terol (Free)	Free Fatty Acids
Chylomicrons	Intestine	90-1000	<0.95	1-2	98-99	88	9	3	1	—
Chylomicron Remnants	Chylo-microns	45-100	<0.019	6-8	92-94	80	11	—	4	1
Very low density lipo-proproteins (VLDL)	Liver (Intestine)	30-90	0.95-1.006	7-10	90-93	56	20	15	8	1
Intermediate density lipoproteins (IDL)	VLDL	25-30	1.006-1.019	11	89	29	26	34	9	1
Low-density lipoproteins (LDK)	VLDL	20-25	1.019-1.063	21	79	13	28	48	10	1
High density lipoproteins (HDL)		20-25	1.019-1.063	32	68	2	53	34	11	—
HDL_1	Liver and Intestine, VLDL, chylomi-crons	10-20	1.063-1.125	33	67	16	43	31	10	...
HDL_2		5-10	1.125-1.210	57	43	13	46	29	6	6
HDL_3		<5	>1.21	70	30	—	83	—	17	—
Preβ-HDL^1										
Albumin-free fatty acids	Adipose tissue	—	> 1.281	99	1	0	0	0	0	100

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Interpretation and Results

In the present study results are reported for 35 IDDM patients and 35 normals. The mean total cholesterol for IDDM patients is 225.77 mg %. For normals is 170 mg %, p-value is .01. So there is significant increase in total cholesterol value of IDDM patients compared with normals. The mean fasting triglyceride level for IDDM patients is 242.628 mg % (S.D. = 49.626). The mean fasting triglyceride level for normals is 145mg % (S.D = +49) p value is .001. So there is increase in triglyceride concentration in IDDM patients compared with normals. The mean HDL cholesterol level for IDDM patients is 37.514 mg % (S.D = + 6.213). In case of normals, the HDL-C is 43.57 mg % (S.D = +6.31) P value is 0.01. So there is significant decrease in HDLC in IDDM patients compared with normals. The mean VLDL-C level for IDDM patients is 46.25 mg % (S.D= + 9.419) and the mean VLDLC concentration in case of normals is 29.71 mg % (S.D ± 10.53) P value is 0.01. So VLDL-C is increased in IDDM patients compared with normals. The mean LDL-C concentration for IDDM patients is 141.971 ng % (S.D+51.64) and the mean LDL-C concentration in case of normal 94.51 mg % (S.D ± 21.88) P value is .01. So there is increased concentration of LDL-C in IDDM patients compared with normal. The LDL-CHDL-C ratio is more in case of IDDM patents compared with normals.

IDDM PATIENTS

Name	Age	Sex	GTT			Lipid Profile				
			Fasting B. Sugar	Ihr Blood sugar	IIhr Blood sugar	Triglycerides	Total Cholesterol	HDL-C	VLDL-C	LDL-C
P. Sridevi	10	F	190	252	300	300	320	36	60	224
Adam	32	M	210	285	305	180	00	36	36	128
Ramya	6	F	240	290	320	135	230	40	37	153
Geetha	30	F	200	380	310	200	350	38	40	272
Alabiksha	35	M	210	246	250	175	220	38	35	147
Lakshmi	24	F	180	280	240	300	220	50	60	110
Ashok	8	M	330	370	370	300	226	34	60	132
Kiriti	22	M	300	350	380	250	240	36	50	154
Srinivas	20	M	190	260	240	200	220	44	40	136
Tulasi	12	F	280	380	350	250	250	38	50	162
Srikararao	38	M	190	283	290	229	191	26	46	119
Santhaiah	39	M	194	274	317	300	220	17	60	143
Prakashbabu	40	M	127	245	298	220	240	36	44	160
Kirthi	27	F	228	320	360	240	170	42	48	80
P.Anil	32	M	260	320	340	180	230	34	36	110
Valli	32	F	200	356	380	220	250	42	44	156
Sultana	25	F	250	275	290	300	320	42	60	218
Subbarao	20	M	200	235	290	220	240	40	44	156
Nageswara Rao	28	M	290	380	400	250	200	34	50	116
Nagendran	40	M	230	385	396	230	200	36	46	140
Edwal	30	M	200	240	285	197	220	40	40	140
Lalitha	30	F	200	275	290	185	290	48	37	205
Ramakrishna	39	M	190	242	290	295	150	34	59	57
Jamunabai	36	F	196	313	348	250	150	30	50	70
Vijayalakshmi	24	F	190	240	226	290	220	40	38	142
Srinivasa Rao	30	M	180	325	395	175	200	40	35	125
S. Tagore	30	M	190	236	291	206	160	34	41	85

Name	Age	Sex	GTT			Lipid Profile				
			Fasting B. Sugar	Ihr Blood sugar	IIhr Blood sugar	Triglycerides	Total Cholesterol	HDL-C	VLDL-C	LDL-C
Venkatasubbamma	40	F	210	230	260	250	270	42	50	178
Venkateswarlu	30	M	191	250	240	180	170	42	36	92
Kalyan	24	M	218	278	250	250	360	40	50	270
Krishnaveni	12	F	210	260	280	160	150	40	32	78
Kiranmai	20	F	190	280	340	300	210	26	60	124
Pavankumar	25	M	190	240	260	325	225	36	65	101
Seetharamaiah	29	M	170	300	280	220	230	38	44	148
Gopalan	20	M	176	240	280	180	160	44	36	80

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IDDM Patients	Arithmetic Mean	$\bar{X}$	209.828	290.142	307.457	242.628	225.77	37.514	46.25764	141.971
	Standard Deviation	σ	40.0326	51.0675	50.322	49.626	53.0083	6.21370	9.41945	51.6478
Normals	Arithmetic Mean	$\bar{X}$	88.17	131.74	103.05	145	170	43.57	29.71	94.51
	Standard Deviation	σ	15.84	27.88	21.11	49	24.92	6.31	10.53	21.88
	t value	=	16.62	16.107	22.142	8.275	5.629	4.055	6.968	5.0093
	p value	=	0.001	0.001	0.001	0.001	0.01	0.01	0.01	0.01

NORMALS

Name	Age	Sex	GTT			Lipid Profile				
			Fasting B. Sugar	Ihr Blood Sugar	IIhr Blood Sugar	Triglycerides	Total cholesterol	VLDL-C	HDL-C	LDL-C
Lakshman	30	M	100	164	122	60	145	12	50	73
Sujatha	20	F	105	155	120	100	150	20	44	86
Prasad	35	M	88	124	125	125	170	25	48	97
Sharif	40	M	67	78	90	148	165	30	40	95
Ramanjaneyulu	35	M	66	130	110	250	220	50	44	126
B. Subba Rao	30	M	99	164	129	125	170	25	42	103
M.B. Subba Rao	32	M	77	137	91	150	160	30	38	82
M.S.C Rao	35	M	68	128	75	149	155	30	44	81
Deva Raj	39	M	95	153	143	159	147	32	40	75
Vedavathi	30	F	80	95	76	93	150	19	48	83
A.S.Sanbrajyam	30	F	76	85	70	115	160	23	44	73
V. Lakshmi	30	F	73	98	88	50	158	10	43	105
Kranthi	29	F	83	100	70	200	190	40	45	105
Anjaneyulu	32	M	84	123	99	150	240	30	30	90
Karthik	19	M	90	115	96	150	180	30	50	100
Tulasi	18	F	90	120	86	110	160	22	48	90
Radhakrishna Murthy	25	M	75	127	111	125	187	25	40	122
Y.Krishna Reddy	32	M	65	124	112	209	168	42	42	84
Mastan Rao	16	M	89	147	80	111	156	22	48	86
Bapanaiah	20	M	110	179	109	200	260	40	36	184
A.Suvarchala	23	F	61	89	73	165	150	33	40	77
Rama Rao	15	M	107	140	120	175	170	25	50	95
Narsimhamurthy	27	M	96	130	140	160	170	40	36	94
Harika	32	F	125	172	118	78	160	16	50	94
Subhani	15	M	87	126	86	160	160	32	40	98
Chandravathi	16	M	88	180	83	132	170	26	26	118

Name	Age	Sex	GTT			Lipid Profile				
			Fasting B. Sugar	Ihr Blood Sugar	IIhr Blood Sugar	Triglycerides	Total cholesterol	VLDL-C	HDL-C	LDL-C
Sukanya	20	F	87	130	96	161	150	32	40	98
Venkat Raman	16	M	105	143	100	295	170	59	45	66
Prasad	20	M	88	124	120	150	150	30	60	60
Premkumar	22	M	80	126	110	80	180	16	50	114
Pradeep	24	M	96	126	136	140	160	28	42	90
Sneha	29	F	62	90	74	160	180	32	44	104
Kalyani	26	F	108	140	120	120	180	24	50	106
Kalpana	20	F	110	179	109	200	156	40	40	76
Pavan	18	M	106	170	120	120	170	24	48	98

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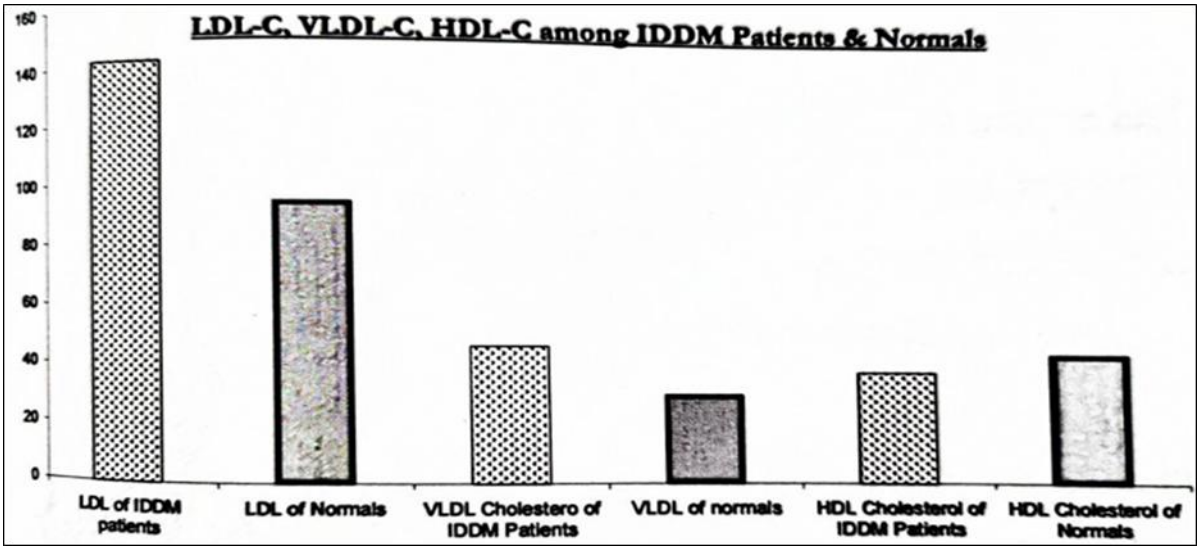

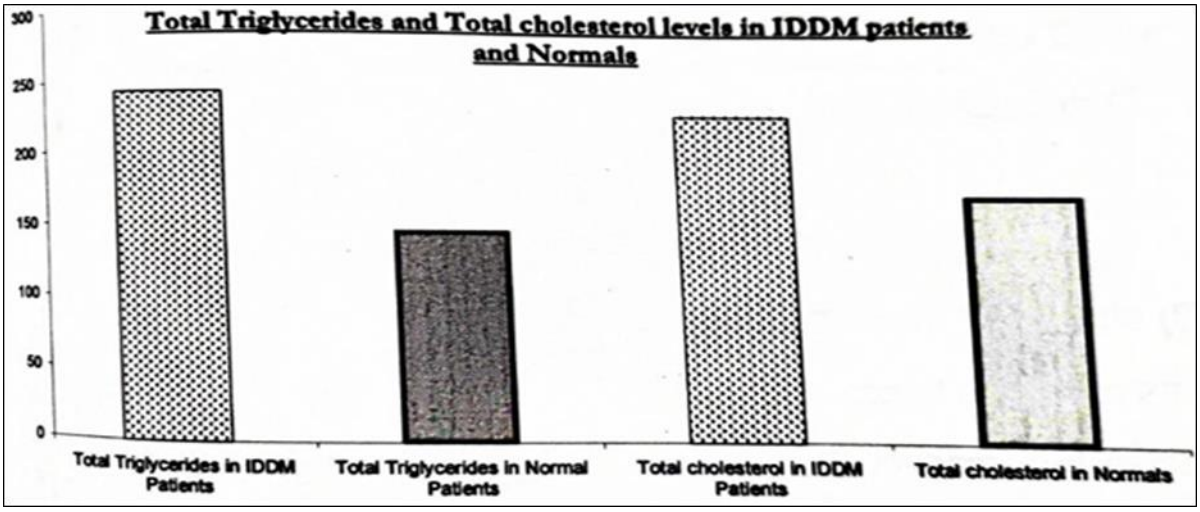

Discussion

For the present study of oral glucose tolerance and Hyperlipoproteinemias in type I Diabetes mellitus, patients are selected from I.P and O.P departments of GGH, Guntur. The patients are in the age group of 6-40 years. 35 patients are of type I Diabetes mellitus, clinically diagnosed by the physicians. Another 35 patients are normals who are screened for Diabetes mellitus. The history of the patients is studied. None of them are smokers (or) Alcoholics (or) with abnormal food habits leading to obesity. So the basis of the study of lipoproteins is purely is in relation to type I Diabetes mellitus. None of the patients showed any signs and symptoms of cardiac insufficiency (or) cardiomyopathy symptoms. All of them appeared almost in good health. About 10 of the patients studied in 35 patients are found to be emaciated and undernourished. Their weight is correspondingly less for their norms of age and height. None of them are found to be obese (or) overweight In the patients of type I Diabetes mellitus family history is asked and about 60% of the parents presented no history of Diabetes and a few people (40%) gave information as having recent development of Diabetes mellitus. Parents having diabetes are above the age group of 40 years. All the patients are on treatment with insulin. Parents of some patients who are diabetic are found to have good control with oral hypoglycemic agents. Oral GTT patterns of these patients are almost of the same type. The Ihr test of plasma glucose, has shown significant rise and II hr test has shown high values without any decrease in the Glucose values inferring that no insulin is available after Glucose stimulus. The lipoprotein pattern studied in these patients have shown significant rise of LDL-C in almost all the patients. Mild rise of Triglycerides is

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seen in all the patients with the mean of 242.628 mg %. The patients studied are on treatment with insulin at least for more than one year and are with adequate control. Inspite of their treatment of diabetes with insulin therapy, the observation that increase in cholesterol and triglycerides though not to a marked extent indicates that Acetyl COA and FFA are shunted towards fat synthesis.

Conclusion

Quantitative lipid abnormalities are observed in patients with poorly controlled type 1 diabetes mellitus. Patient with optimally controlled type 1 diabetes show normal or slightly decreased triglycerides and LDL-cholesterol levels and sometimes increased HDL-cholesterol levels. Controls who have normal GTT and good glycemic control are less prone to complications of Type I diabetes mellitus as their lipoprotein levels are not increased. The exact consequences of these qualitative lipid changes on the development of cardiovascular disease in type 1 diabetes are still unknown.

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