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THE ANTHROPOMETRIC AND BIOCHEMICAL PROFILE OF PATIENTS WITH DIABETES MELLITUS IN THE AGE GROUP OF 12-35 YEARS

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ABSTRACT: OBJECTIVES: Objective of this study was to look for different anthropometric measurements and laboratory abnormalities in diabetic patients whose age of onset is <35 years and >12 years getting treatment from Sri Manakula Vinayagar Medical College & Hospital. **RESEARCH DESIGNS AND METHODS:** A total of 130 patients who developed diabetes before the age of 35 were included in this descriptive study. The aim of the study was to look for different anthropometric measurements and derived estimates of body composition, in particular BMI, Waist-to-Height ratio, Waist-to-Hip ratio (WHR), and also to find out laboratory abnormalities like HbA1c, lipid abnormalities in diabetic patients whose age of onset <35 years and >12 Years getting treatment from our institution. **RESULTS:** Majority of them (78.4%) had BMI >23 and (92.7%) had central obesity. All female patients including type 1 diabetes had high Waist Hip Ratio. Hypertension was present in (20.8%) patients (systolic BP >140 & diastolic > 90). Lipid abnormalities were found in more than half of the patients. Hypertriglyceridemia and Hypercholesterolemia were found more in type 2 diabetes patients. High LDL and low HDL were found in both type 1 and type 2 diabetes. Majority of the patients had poor glycemic control as indicated by high HbA1C. DKA was present in 9 patients; seven of these belonged to type 1 diabetes. **CONCLUSION:** Majority of patients had high BMI (>23). Among them majority of them had central obesity irrespective of the type of diabetes and also had poor glycemic control with high HbA1c. Lipid abnormalities were present in more than half of the patients with high numbers of Hypertriglyceridemia and Hypercholesterolemia in type 2 diabetes and high LDL and low HDL in both type 1 & 2 Diabetes.

KEYWORDS: Diabetes Mellitus, Ada Criteria, Types, BMI, Waist to Hip Ratio, Obesity, Hba1c, Dyslipidemia.

INTRODUCTION: Prevalence of diabetes is increasing throughout the world. This is also reflected in the younger population especially for the type 2 DM.¹ It is more so in India probably due to changing lifestyle and food habits in a population where already ethnically predisposed to type 2 Diabetes mellitus (T2DM). Until recently, type 1 diabetes mellitus (T1DM) was not only the most common form of diabetes seen in youth, but also perhaps the only form of diabetes seen in children and adolescents. However, this trend has started changing slowly.²

Type 2 diabetes mellitus (T2DM), earlier considered a disorder of middle age or elderly is increasingly being reported among young adults and now also in adolescence and childhood, probably due to the emerging epidemic of childhood obesity³. Obesity has been on the rise in the adolescent age, which might have a causative role for the rising prevalence of diabetes in the young⁴. A recent survey in southern India has shown that obesity among adolescent school children was related to decreased physical activity.⁵

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Obesity is a well-established risk factor for type 2 diabetes. However several studies suggest that anthropometric measurements that describe central fat distribution are superior in predicting type 2 diabetes compared with measurements of general adiposity, this issue remains controversial.⁶ Although obesity is a major contributing factor to diabetes, and Asian Indians are known to have lower BMIs than Europeans.⁷ However, for any given BMI, Asian Indians have greater waist-to-hip ratios and abdominal fat than Europeans.⁸

Dyslipidemia is a frequent comorbidity of obesity and T2DM, starting in childhood, and poses a major public health risk. Dyslipidemia in pediatric subjects with Uncontrolled T2DM is significantly worse than in obese subjects but is similar to obese subjects when diabetes was better controlled.

Earlier use of lipid-lowering drugs should be considered in pediatric T2DM patients who achieve tight glycemic control, yet their dyslipidemia persists.⁹ Since there are very few studies on fat distribution in Indians, the first objective of this study was to measure body fat distribution by anthropometric measurements and derived estimates of body composition, in particular BMI, waist - to-hip ratio (WHR) in our patients in relation to different type of diabetes.

With the increase in diabetes in children and the accompanying increased use of HbA1C concentration as a glycemic indicator, it is important to develop reference levels and standards for HbA1c for this population.¹⁰ So second object of this study to find out the laboratory abnormalities present in the diabetic patients whose age of onset is <35 years and >12 years.

AIM:

- 1) To study the anthropometric profile of patients with diabetes whose age of onset <35 years and >12 years
- 2) To study the biochemical profile of patients with diabetes whose age of onset <35 years and >12 years

MATERIALS AND METHODS: This study was a descriptive study over a period of 1 year consisting of Retrospective study from June 1st 2011-May 31st 2012.

Inclusion criteria: All diabetic patients whose age of onset was more than 12 years and less than 35 years coming to medicine OPD of Sri Manakula Vinayagar Medical College & hospital were included in the study.

In the study a detail clinical history followed by physical examination was done in all patients. In all patients FBS, PPBS, Blood urea, Sr. creatinine, fasting lipid profile, urine routine examination and HbA1C were done.

Exclusion criteria: Patients with diagnosis of gestational diabetes mellitus were not included in the study.

As like other retrospective study the data was collected from the patient records available in the medical record department of our institution. All the data was collected according to the protocol attached. 2011 ADA¹¹ criteria were used for diagnosis and categorization into various types of diabetes. The data obtained was tabulated and was analyzed.

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RESULTS:

Systolic BP	VALUES	Type 1	TYPE 2	OTHERS	TOTAL
Normal	<120	13	52	4+2	71
Prehypertension	120-139	2	17	1	20
Stage 1	140-159	2	7	Nil	9
Stage 2	> 160	Nil	5	+1	6
TOTAL		17	81	8	106
Diastolic BP	VALUES	Type 1	TYPE 2	OTHERS	TOTAL
Normal	<80	10	41	3+2	56
Prehypertension	80-89	5	22	2	29
Stage 1	90-99	1	9	Nil	10
Stage 2	> 100	1	9	+1	11
Total		17	81	8	106

TABLE - 1: Blood Pressure

Table 1 shows the details of the blood pressure at the time of examination in the patients. In 25 retrospective cases BP recording was not available. Among 106 patients in whom BP was recorded, 71 patients were found to have normal systolic BP. Twenty out of 106 patients had systolic prehypertension. Twenty nine out of 106 patients had diastolic prehypertension. Stage I systolic hypertension was found in 9 patients and stage II systolic hypertension was found in 5 patients. Stage I diastolic hypertension was found in 10 patients and stage II diastolic hypertension was found in 11 patients. Majority of the patients with high BP readings belonged to type 2 diabetes.

BMI	Grade	Type 1	Type 2	Total
<18.5	Under nutrition	3	3	6
18.5 – 22.9	Normal	4	12	16
23-24.99	Pre-obese	3	10	13
25-29.99	Obese I	3	31	34
>30	Obese II	2	31	33
Total		15	87	102

TABLE – 2: Body Mass Index (BMI)

Table 2 shows the body mass index of the patients. Among 102 patients in whom details were available, 6 patients were found to have low BMI. Sixteen patients had normal BMI. Pre-obesity was detected in 13 patients and grade I obesity was found in 34. Thirty three patients were found to have grade II obesity.

WHR	Type 1	Type 2	Total
Male <0.9	5 (6.3%)	2 (7.1%)	7
> 0.9	4 (43.7%)	36 (40.5%)	40
Female < 0.81	-	0	0
>0.81	6 (50%)	43 (52.4%)	49
Total	15 (100%)	81(100%)	96

TABLE – 3: Waist Hip Ratio (WHR)

Normal: 0.88 in Male 0.80 in Female

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Table 3 shows the waist hip ratio. Among 96 patients in whom details were available 89 patients were found to have high waist hip ratio. Even among type 1 diabetes mellitus four males and six females were found to have high waist hip ratio. Among type 2 diabetes patients only two males and none of the females had normal waist hip ratio and all the rest were found to have central obesity according to the new criteria for Asian Indians.

Waist	Type 1	Type 2	Total
Male <85	3	7	10
> 85	7	46	53
Female < 80	5	6	11
> 80	-	22	22
Total	15	81	96

Table – 4: Waist Circumference

Normal, M- 85; F-80

Table 4 shows distribution of waist circumference in the patients. Among 96 patients in whom details were available 75 patients had high waist circumference. Most of the patients of type 2 diabetes had high waist circumference indicating presence of obesity in both sexes. In female, almost all patient with type 2 diabetes were obese.

HbA1C:	Type - I	Type - II	No. of Cases
5-5.9	1	2	3
6-6.9	1	1	2
7-7.9	5	19	24
8-8.9	1	11	12
9-9.9	1	7	8
10-10.9	1	7	8
>11	0	1	1

TABLE – 5: Level of HbA1C

Table 5 shows the distribution in the HbA1C values in our patients. HbA1C was done in only 58 patients. Majority of the patients 53/58 had HbA1C more than 7 % showing poor diabetic control. 17 patients had HbA1C more than 9 % showing extremely poor glycemic control.

Lipid	Type I	Type II	Total No. of Cases
Hypercholesterolemia (>200)	2/7 (28.6%)	25/55 (45.5%)	27
Hypertriglyceridemia >150	2/7 (28.6%)	32/51 (62.7%)	34
↑ LDL (>100)	4/6 (66.7%)	33/48 (68.7%)	37
↓ HDL (<40)	3/ 6 (50%)	31/49 (63.3%)	34

TABLE – 6: Pattern of Lipid Profile in Young Diabetes

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Table 6 shows Lipid profile in young diabetes. Among 56 patients whom details were available, only six patients had normal lipid profile. Majority of the patients had high LDL, hypertriglyceridemia, and low HDL. 37 patients had high LDL, 34 patients had Hypertriglyceridemia, 34 patients had low HDL and 27 patients had Hypercholesterolemia. Patients with typical diabetic dyslipidemia were 14, out of this 13 were of type 2 diabetes. One belonged to type 1 diabetes.

S.N	Sex	Age of onset	R/U*	TYPE	FH†	BMI	WHR
1	F	25	R	1	Nil	16.7	0.91
2	M	22	U	1	Nil	14.9	0.88
3	M	25	U	2	Nil	27.8	0.92
4	M	22	U	1	Both	19.1	0.95
5	M	25	U	1	Both	21.3	0.86
6	F	23	U	1	N	19.5	0.88
7	F	13	U	2	MGM	18.2	0.97
8	M	23	U	1	N	30.3	1.11
9	F	17	U	1	Nil	18.6	0.95
10	F	25	U	2	Both	36.9	1.08
11	F	20	R	FCPD	F	15.8	0.98
12	F	25	U	S	Nil	22.8	0.88
13	M	24	U	2	Both	24.1	1.01
14	F	20	U	2	Both	28.1	0.96
15	M	25	U	1	F	-	-
16	M	25	R	2	Nil	-	-
17	F	21	U	1	Nil	-	-
18	F	14	U	1	Nil	-	-
19	F	21	R	2		-	-
20	M	24	R	2	NIL	21.7	-
21	F	24	R	2	Nil	34.9	-
22	F	21	U	S	Nil	-	-

Table – 7: Characteristics of Indian Diabetic Patients with Onset of diabetes < 25

* Rural/Urban † Family History

The following table 20 shows characteristic of 22 patients who had onset of disease < 25 years in our study. Out of this 10 were of type 1 diabetes, 9 were of type 2 diabetes and 2 patients were of steroid induced diabetes and one patient of FCPD. In the case of type 1 diabetes out of 19 patients 10 had onset of diabetes below 25 years (52.6%). Only 9 out of 103 patients of type 2 diabetes had onset of disease < 25 (8.6%). Majority of the patients of type 2 diabetes had high Body Mass Index.

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DISCUSSION:

Blood Pressure: Only 2/17 (11.8%) patients with type 1 Diabetes Mellitus and 12/81 (14.8%) of type 2 diabetes had systolic BP > 140. 2/17 of type 1 and 18/81 of type 2 Diabetes Mellitus had diastolic hypertension > 90. Twenty two patients were found to have hypertension (systolic < 140 and Diastolic <90). Hypertension contributes to the development and progression of chronic complications both microvascular and macrovascular.

In type 2 diabetes hypertension is often a part of the metabolic syndrome that includes insulin resistance, obesity and dyslipidemia. In type 1 diabetes persistent hypertension is often a manifestation of diabetic nephropathy. The data from the National Institute of Health in US shows that incidence of hypertension is 2.8 times higher among diabetes below 45 years of age compared to non- diabetic.¹²

Body Mass Index: The relationship between obesity and type 2 diabetes is complex and is confounded by many heterogeneous factors. In all the studies in south Indians, body mass index (BMI) has been strongly associated with glucose intolerance, although the mean BMI has been much below the obesity level, both in rural and urban populations. This suggested that increase in body weight, although within the ideal levels of body mass, could still confer risk of diabetes. The cut off values for ideal body weight applicable to western populations might not hold good in generally lean Asian Indians. Despite their lean body mass they could be adversely affected by even small increments in the body mass. Asians with BMI > 23 has been found to have the same risk for developing diabetes as patients of western countries with BMI > 25. Accordingly 80/102 were found to have values above normal BMI. Out of these as expected 72 belonged to Type 2 Diabetes.

Other studies among young also have highlighted the key association of obesity and diabetes. In the study by C Y Pan et al, 47% patients were found to be overweight (using the European classification of BMI >25 kg/ m² as overweight) However, recent research has shown that obesity – related illness such as hypertension, diabetes and cardiovascular diseases tend to occur at lower BMI values in Asians and this has led to the suggested BMI > 23 kg/m² as being overweight¹³. Accordingly, (67%) of patients in this study were found to be overweight and 47% patients obese. The prevalence of obesity was the highest in Malays were 70% of the patients were found to be having high BMI.

Using the New Asian Criteria for obesity classification, over half of the patients in the CUPS study were found to have high BMI. The total study population was categorized into quartiles based on body mass index and prevalence of diabetes in each quartile was computed. In the first, second, third and fourth quartiles of body mass index, prevalence of diabetes was observed to be 2.9%, 8.1%, 17.6% and 19.5% respectively. Diabetes showed significantly increasing trend with increasing quartiles of BMI. Prevalence of diabetes was computed according to BMI classification according to the Asia pacific guidelines. Diabetes was higher among subjects who were overweight; at risk (16.7%, p=0.007), obese I (18.4%, p<0.001) and obese II (23%, P<0.001) compared to normal patients.

Waist Hip Ratio – Central Obesity: Most of patients both men and women had high WHR of 0.9 and 0.8 respectively. All females in our study even those with type 1 diabetes were having WHR of more than 0.81. These findings are almost similar to study by C Y Pan et al, in which most had WHR > 1.0 in men and > 0.9 in women. The proportion of men with WHR > 1 was similar across Asian countries. But in the case of females more Malays (35%) compared to Chinese (14%) and Indians (15%), had high WHR indicating central obesity.¹³

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Ramachandran et al showed in his studies that more upper body adiposity measured as waist hip ratio found in south Indian population to be a greater risk factor for type 2 diabetes than general obesity. Indians with low BMI have WHR comparable to the Mexican Americans who are obese. The risks conferred by increasing BMI and WHR are high in both populations when compared to the white populations¹⁴. Prevalence of diabetes in subjects with abdominal obesity was significantly higher compared to those without abdominal obesity (27.8% vs. 9.0%, $p < 0.001$).¹⁴

HbA1C: Most of our patients had HbA1c value above 7% indicating poor glycemic control. Those who had normal HbA1c were only few cases. In a Asian study, the glycemic indices were relatively higher in Indians ($11.3 \pm 2.9\%$) compared to Chinese ($10 \pm 2.6\%$) and Malays ($10.2 \pm 2.8\%$). Raheja et al noted a positive relationship between mean HbA1c level and frequency of complications among patients with long diabetes duration. Half of the patients studied by Raheja et al had poor control of diabetes (HbA1c $> 2\%$ above the upper limit of normal). In the DiabCare-Asia 1998 study of 18, 211 patients in twelve Asian nations, India's mean HbA1c was higher ($8.9 \pm 2.1\%$) than the mean of all nations ($8.6 \pm 2.0\%$). While seemingly not a large difference, this takes on special significance given the burden of diabetes in India.¹⁵

Lipid Profile in Diabetes: Dyslipidemia is commonly seen in type 2 diabetes. The changes usually observed are a higher level of TG and VLDL, LDL and low levels of HDL. In type 1 diabetes the lipid patterns are generally similar to age matched controls.

In diabcare Asian study lipid abnormalities in the form of high serum cholesterol and triglyceride values were seen in over half the cases. In our study lipid profile was done only in 7 cases of type 1 diabetes and 55 patients of type 2 diabetes. Majority of the patients with type 2 diabetes (68.7%) had high LDL and hypertriglyceridemia (62.7%). 63.3% patients had low HDL and (45.5%) patients had Hypercholesterolemia.¹³

CONCLUSION: A total of 130 patients who developed diabetes before the age of 35 were included in the study. The aim of the study was to find out the different types of diabetes and to study the clinical and biochemical abnormalities in adolescents and young diabetic patients getting treatment from our institution.

Hypertension was present in nearly 20% of study population with near equal prevalence in both types of diabetes. BMI > 23 and central obesity were seen in majority of patients and as expectedly more common in type 2 diabetes. All female patients including type 1 diabetes had high Waist Hip Ratio.

Lipid abnormalities were found in more than half of the patients. Hypertriglyceridemia and Hypercholesterolemia were found more in type 2 diabetes patients. High LDL and low HDL were found in both type 1 and type 2 diabetes. Majority of the patients had poor glycemic control as indicated by high HbA1C. Diabetic Ketoacidosis was mode of presentation in nearly half of type 1 diabetes patients.

Central obesity, High BMI & Altered lipid profile were found to have high prevalence in our study population of young diabetics aged between 12-35 years. Whether they are contributory or associated finding needs to be studied further in large scale studies.

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