

Original Research Article

A study of serum C peptide levels in newly detected diabetic patients in tertiary care hospital

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ABSTRACT

Background: Diabetes mellitus (DM) refers to a group of common metabolic disorders that share the phenotype of hyperglycemia. The deficiency of C-peptide in type 1 DM or its excess in type 2 DM leads to the development of disorders which includes the cardiovascular, nervous, excretory and other systems. The present study is done to assess the serum C-peptide levels in newly detected diabetic patients and its significance in classification of diabetes and deciding about management.

Methods: This cross sectional study was conducted within the hospitals attached to Bangalore medical college and research institute. 65 newly detected diabetes patients who gave consent for study and satisfy the inclusion criteria were included in the study. Data was collected using semi structured questionnaire, clinical examination and relevant investigations. Statistical analysis was performed using SPSS software. A p value of <0.05 was considered significant.

Results: C-peptide levels showed that 34 (52.3%) subjects had C-peptide levels >2 followed by 10 (15.4%) subjects having 0.1 to 0.6, 9 (13.8%) subjects having 1 to 2, 6 (9.2%) subjects each having 0.6 to 1 and <0.1.

Conclusions: Serum C-peptide levels are useful as an index of endogenous insulin production. Low C-peptide levels need insulin treatment due to poor insulin reserve. Majority of the subjects, who had low serum C-peptide levels also had low BMI suggesting a positive correlation between C-peptide levels and BMI.

Keywords: Diabetes mellitus, C-peptide, BMI

INTRODUCTION

DM refers to a group of metabolic disorders that share the phenotype of hyperglycemia.¹ Currently 347 million people worldwide have diabetes. More than 80% of diabetic deaths occur in low and middle income countries.² WHO projects that diabetes is going to be the 7th leading cause of death in 2030.³

The international diabetes federation (IDF) predicts the total number of people in India with diabetes to be around 50.8 million in 2010, rising to 87.0 million by 2030.⁴ In

India, more than half of patients have poor glycemic control and have vascular complications. Therefore, there is an urgent need to develop novel therapeutic agents of diabetes without the development and progression of complications or compromising on safety.⁵

Measurement of C-peptide, which is co secreted with insulin from beta cells of pancreas (pro insulin, insulin, C-peptide) provides an index of endogenous insulin production and pancreatic beta cell function.⁶ Once diabetes is diagnosed, assay for C-peptide can be used to differentiate type 1 and type 2 diabetes mellitus and to distinguish those who require insulin treatment from

others who can be managed by diet, exercise and OHA's.⁷ The incidence of type 1 DM (insulin dependent) among adults initially classified as type 2 DM (non-insulin dependent) was found to be around 10%.⁸

The deficit of C-peptide in type 1 DM or its excess in type 2 DM leads to the development of disorders in the cardiovascular, nervous, excretory and other systems.⁹ It is shown that C-peptide within the physiological concentrations has anti-inflammatory, immunomodulatory and neuroprotective effects, so that it and its synthetic analogues can be widely used to treat diabetic patients and to prevent DM complications.¹⁰

The present study is done to study the serum C-peptide levels in newly detected diabetic patients and its significance in classification of diabetes and deciding about management.

Aim

The aim of this study was to study the serum C-peptide levels in newly detected diabetic patients.

METHODS

It is a cross-sectional study conducted within hospitals attached to Bangalore medical college and research institute between November 2017 to May 2019. Newly detected diabetic patients, both inpatient and outpatients were taken for the study. Sample size was 65. Simple random sampling method was used for the study. After obtaining ethical clearance and approval from the institutional ethics committee of BMCRI, written informed consent was taken from the patients.

Inclusion criteria

Patients who are willing to give informed consent, patients who are newly diagnosed with diabetes mellitus according to ADA criteria, patients whose age was more than 18 years were included in this study.

Exclusion criteria

Patients who are on treatment for type 1 and 2 diabetes, patients who present with serious infections, DKA at the time of diagnosis and patients not willing to participate were excluded from this study.

Data was collected by semi structured questionnaire, clinical examination and investigations. Detailed clinical history was taken which was included, age and gender, symptomatic/asymptomatic, any past history of hypertension and other endocrinological illness, any family history of diabetes, hypertension, dyslipidemia, liver disease, history of smoking, history of alcohol consumption.

Clinical examination included, anthropometric measurement including height, weight, BMI, waist circumference, hip circumference, waist to hip ratio. The waist circumference was measured at the mid-point between the lower border of the rib cage and the iliac crest, whereas the hip circumference was obtained at the widest point between the hip and buttock.

Investigations included fasting and postprandial blood sugar, fasting serum C-peptide levels, HbA1C levels, lipid profile including total cholesterol, LDL, HDL, TG and VLDL, urine microalbuminuria, blood urea and serum creatinine routine blood counts, serum electrolytes, ECG 2D echo and ocular fundus examination.

Data was analysed using descriptive statistics, students t-test will be used for significant difference between two variables. Chi-square test will be used for association of qualitative variable.

Diabetes diagnosed as per ADA guidelines with symptoms of diabetes with random blood sugar >200 mg/dl or fasting blood sugar >126 mg/dl or HbA1c >6.5% or 2-hour plasma glucose >200 mg/dl during an oral glucose tolerance test.

RESULTS

In our study maximum subjects belonged to 18-30 years, 29 patients (44.6%) followed by 31-40 years, 16 patients (24.6%) and the least subjects were above 60 years, 4 patients (6.2%).

Gender-wise distribution of subjects in the study include males 35 patients (53.8%) and females 30 patients (46.2%). Out of 65 (100%) patients, 41 (63.1%) patients had family history of diabetes and 24 (36.9%) patients had no family history of diabetes.

Out of 65 (100%) subjects, 28 (43.1%) were normal, 19 (29.2%) subjects were underweight and 18 (27.7%) were overweight.

Table 1 shows cross-tabulation of age and BMI. Out of subjects aged 18 to 30 years; 29 (44.6%), maximum subjects; 12 (18.5%) were underweight, in subjects of age group 31 to 40 years maximum were of normal weight; 10 (15.4%), in 41 to 50 years; 4 (6.2%) subjects each were of normal weight and underweight, in 51-60 years, 5 (7.7%) were overweight and above 60 years; 2 (3.1%) each were of normal weight and overweight. Chi-square test showed significant association between age and BMI ($\chi^2=16.61$; $p=0.034$).

Cross tabulation of gender and BMI showed highest distribution of the subjects (both male and female) having normal weight; 28 (43.1%) with 16 (24.6%) females and 12 (18.5%) males.

Table 1: Cross-tabulation of age and BMI.

Age-classified (in years)		BMI-classified			Total
		Normal	Overweight	Underweight	
18 to 30	Count	11	6	12	29
	% of total	16.9	9.2	18.5	44.6
31 to 40	Count	10	3	3	16
	% of total	15.4	4.6	4.6	24.6
41 to 50	Count	4	2	4	10
	% of total	6.2	3.1	6.2	15.4
51 to 60	Count	1	5	0	6
	% of total	1.5	7.7	0.0	9.2
Above 60	Count	2	2	0	4
	% of total	3.1	3.1	0.0	6.2
Total	Count	28	18	19	65
	% of total	43.1	27.7	29.2	100.0
Chi-square value=16.61					
P=0.034*					

*significant

Table 2: Cross-tabulation of gender and BMI.

Gender		BMI-classified			Total
		Normal	Overweight	Underweight	
Female	Count	16	7	7	30
	% of total	24.6	10.8	10.8	46.2
Male	Count	12	11	12	35
	% of total	18.5	16.9	18.5	53.8
Total	Count	28	18	19	65
	% of total	43.1	27.7	29.2	100.0
Chi-square value=2.40					
P=0.3					

Table 3: Mean distribution of the subjects based on FBS and PPBS.

	N	Minimum	Maximum	Mean	Standard deviation
FBS (mg/dl)	65	126.0	486.0	216.026	64.5754
PPBS (mg/dl)	65	200	514	319.35	67.574

Table 4: Cross-tabulation of family history of diabetes and C-peptide levels.

Family history of diabetes		C-peptide low and high		Total
		<0.6	>0.6	
No	Count	8	16	24
	% of total	12.3	24.6	36.9
Yes	Count	8	33	41
	% of total	12.3	50.8	63.1
Total	Count	16	49	65
	% of total	24.6	75.4	100.0
Chi-square value=1.55				
P=0.21				

Table 5: Mean distribution of the subjects based on WC.

	N	Minimum	Maximum	Mean	Standard deviation
Normal	28	71	96	80.32	6.296
Overweight	18	74	106	95.61	8.269
Underweight	19	72	91	81.58	5.419

Table 6: Mean distribution of the subjects based on Hb%.

HbA1C	N	Minimum	Maximum	Mean	Standard deviation
7 to 9	5	10.10	17.00	13.32	3.19
More than 9	60	7.60	16.80	12.12	2.18

Table 7: Cross-tabulation of BMI and C-peptide levels.

BMI		C-peptide low and high		Total
		<0.6	>0.6	
Normal	Count	5	23	28
	% of total	7.7	35.4	43.1
Overweight	Count	1	17	18
	% of total	1.5	26.2	27.7
Underweight	Count	10	9	19
	% of total	15.4	13.8	29.2
Total	Count	16	49	65
	% of total	24.6	75.4	100.0

Chi-square value=12.25
P=0.002*

*significant.

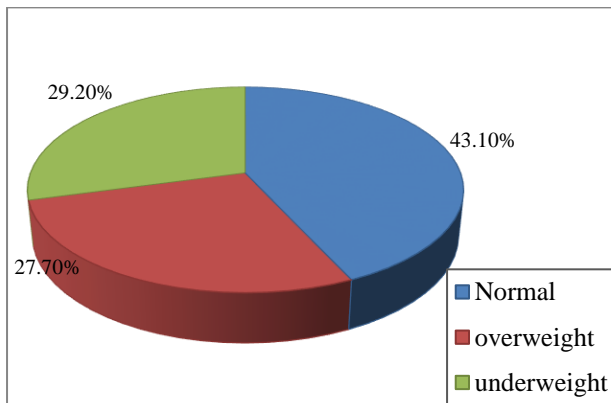


Figure 1: Distribution of subjects based on BMI.

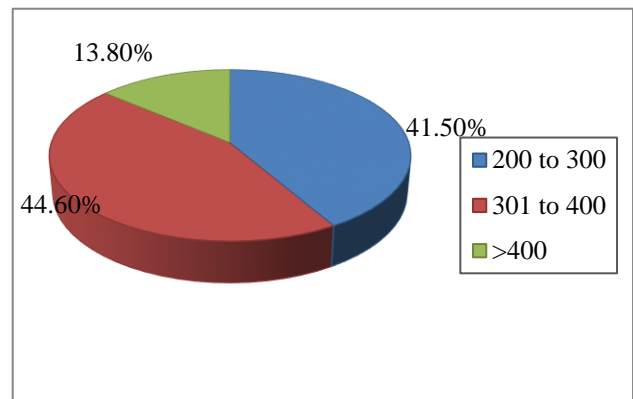


Figure 3: Distribution of the subjects based on PPBS.

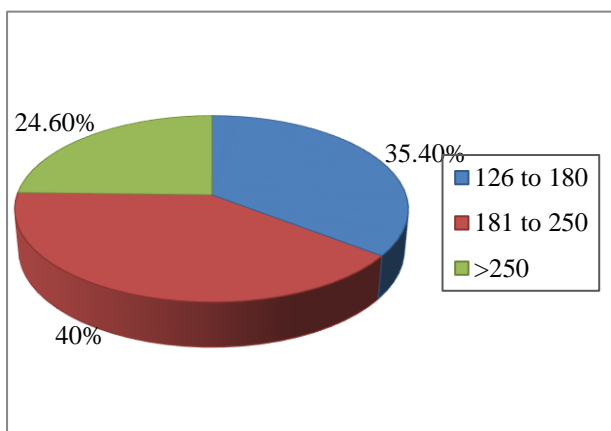


Figure 2: Distribution of the subjects based on FBS.

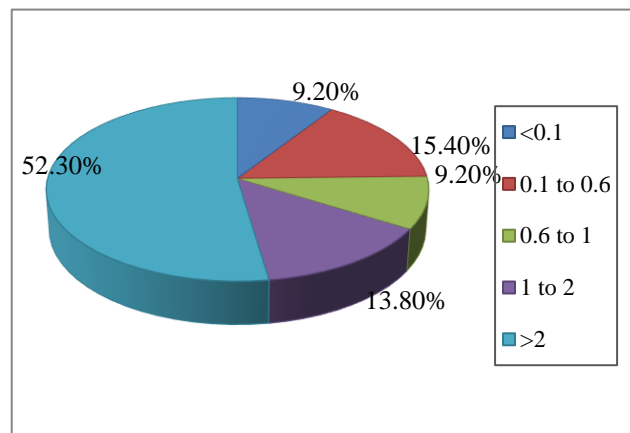


Figure 4: Distribution of the subjects based on C-peptide levels.

Distribution of the subjects based on FBS showed that maximum subjects had 181 to 250 mg/dl 26 (40%), 23 (35.4%) subjects had 126 to 180 mg/dl and 16 (24.6%) subjects had more than 250 mg/dl.

Distribution of the subjects based on PPBS showed that maximum subjects had 301 to 400 mg/dl 29 (44.6%), 27 (41.5%) subjects had 200 to 300 mg/dl and 9 (13.8%) subjects had more than 400 mg/dl.

Table 3 shows mean values of FBS and PPBS. Mean FBS was 216.02 ± 64.57 with minimum FBS value of 126 and maximum value of 486. PPBS showed mean value of 319.35 ± 67.57 with minimum PPBS of 200 and maximum of 514.

Table 4 shows cross-tabulation of family history of diabetes and C-peptide levels. Out of 41 (63.1%) subjects who had family history of diabetes, 8 (12.3%) subjects had <0.6 and 33 (50.8%) subjects had >0.6 .

Waist Circumference was 80.32 ± 6.29 in subjects with normal BMI, 95.61 ± 8.26 in overweight subjects and 81.58 ± 5.41 in underweight subjects.

Mean distribution of the subjects based on HB% showed that the mean score HB % was 13.32 ± 3.19 in subjects with HBA1C of 7 to 9 whereas mean score was 12.12 ± 2.18 in subjects having HBA1C more than 9.

Distribution of the subjects based on C-peptide levels showed that 34 (52.3%) had >2 C-peptide levels followed by 10 (15.4%) subjects having 0.1 to 0.6, 9 (13.8%) subjects having 1 to 2, 6 (9.2%) subjects each having 0.6 to 1 and <0.1 .

Cross-tabulation of BMI and C-peptide levels showed 49 (75.4%) had C-peptide levels more than 0.6, out of which 9 (13.8%) were underweight, 17 (26.2%) were overweight and 23 (35.4%) were with normal BMI. Chi-square test showed significant association between BMI and C-peptide levels ($\chi^2=12.25$; $p=0.002$).

DISCUSSION

T2DM is one of most causes of morbidity and mortality globally.¹¹ While all ethnic groups are affected, the prevalence of T2DM in south Asians is high and is increasing in faster rate. Though the south Asians share the basic pathophysiological defects of T2DM seen in other ethnic groups, there is enough evidence to suggest that south Asians are more insulin resistant than Caucasians with the onset of diabetes at younger ages and with comparatively lower BMI.¹² In addition to an increased susceptibility for insulin resistance, south Asians may also experience early declines in β -cell function as compared with other ethnic groups and an early impairment in β -cell function could also be a main pathophysiological mechanism in T2DM development in south Asians.¹³

In our study, out of 65 patients with diabetes, maximum of 29 (44.6%) patients were between the age groups 18-30 years followed by 16 (24.6%) patients in the age group between 31-40 years and the least subjects 4 (6.2%) were above 60 years.

Out of 65 diabetic patients 35 (53.8%) were males and 30 (46.2%) were females and out of 65 (100%) subjects, 41 (63.1%) patients had family history of diabetes and 24 (36.9%) had no family history of diabetes. The mean BMI of the subjects in the study was 23.792 ± 3.439 .

Mean FBS was 216.02 ± 64.57 with minimum FBS value of 126 and maximum value of 486 and PPBS showed mean value of 319.35 ± 67.57 with minimum PPBS of 200 and maximum of 514.

In our study distribution of the subjects based on C-peptide levels showed that 34 (52.3%) had C-peptide levels >2 followed by 10 (15.4%) subjects having 0.1 to 0.6, 9 (13.8%) subjects having 1 to 2, 6 (9.2%) subjects each having 0.6 to 1 and <0.1 .

Similar study conducted by Bilalbin Abdullah et al showed out of 75 patients, 39 (52%) patients had fasting C-peptide levels between 1-2 ng/ml, 19 (25.4%) patients had fasting C-peptide levels between 0.6-0.9 ng/ml and 13 (17.3%) patients had >2 ng/ml. Only 4 (5.3%) patients had <0.6 ng/ml. The mean fasting C-peptide level of the study was $1.315 \pm 0.811.14$.

Another study conducted by Goutham et al showed eight subjects out of 50 subjects had a fasting serum C-peptide value less than 0.3 mg/dl. Thirteen subjects out of 50 subjects had a low stimulated serum C-peptide.¹⁵

CONCLUSION

Measurement of C-peptide levels in a newly detected young diabetic help to distinguish between type 1 and T2DM and it is also of great help in initiation of treatment. Patients (92.3%) with low serum C-peptide levels also had BMI <23 kg/m², suggesting a positive correlation between C-peptide levels and BMI.

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