

## C-PEPTIDE IS THE BETTER MARKER TO RULE OUT PREDIABETES IN CHRONIC PANCREATIC DISORDER PATIENTS

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Received: 31 May 2014, Revised and Accepted: 03 July 2014

### ABSTRACT

**Objective:** C-peptide is considered as a better marker for beta cell function in newly detected diabetes patients.

**Methods:** We are studying Serum C-Peptide levels of 30 chronic pancreatic patients and 20 healthy volunteers to rule out the prediabetes in chronic pancreatic disorder patients.

**Results:** From this study by analyzing the result we found that the mean of fasting serum C-peptide levels in cases as 1.03 ng/ml with a standard deviation of 0.38 is lower when compared with controls with mean value observed in the control group is 3.55 with a standard deviation of 1.12. The P value of fasting serum levels of C-peptide in cases and controls is 0.00. The mean of 2nd hour serum C-peptide levels in cases as 2.91 ng/ml with a standard deviation of 0.86, the mean value observed in the control group is 5.43 with a standard deviation of 1.05 is higher in controls. The P value of 2nd hour serum levels of C-peptide in cases and controls is 0.00, hence there is a significant difference showing low levels in cases. Serum C-peptide levels are higher in controls compared to cases.

**Conclusion:** This indicates that there is significant beta cell dysfunction in cases compared to controls. This leads to the diabetic condition in chronic pancreatic disorder patients.

**Keywords:** C-peptide, Beta cell, Prediabetes, Serum, Chronic pancreatic disorder.

### INTRODUCTION

C-peptide is the abbreviation for connecting peptide; it is a 31 amino acid peptide. C-peptide of insulin is the C-terminal cleavage product produced during processing of the insulin prohormone to the mature insulin molecule. Proinsulin is cleaved when it is released from the pancreas into the blood. One C-peptide for each insulin molecule C-peptide is devoid of any biological activity but appears to be necessary to maintain structural integrity of insulin. Newly diagnosed diabetes patients offer to get their C-peptide levels measured to find if they have Type 1 diabetes or Type 2 diabetes [1,2]. The pancreas of patients with Type 1 diabetes is unable to produce insulin, and they will therefore usually have a decreased level of C-peptide, while C-peptide levels in Type 2 patients is normal or higher than normal. Measuring C-peptide in patients injecting insulin can help to determine how much of their own natural insulin these patients still produce. Any insulin that the body does not make will be reflected in the C-peptide level; therefore, the C-peptide measurement can be used to monitor beta cell activity [3-6]. C-peptide levels are better indicators of beta cell function and capacity than peripheral insulin level. C-peptide levels increase in insulinomas and beta cell tumors. C-peptide not metabolized through liver.

### Aim and objectives

The objective of this study is to prove that C-peptide is a better marker and diagnostic test to detect pre-diabetes in chronic pancreatic disorder patients.

For this study, 30 male and female patients of different age group of chronic pancreatic disorder patients are taken, and 20 health subjects are taken as controls.

### MATERIALS AND METHODS

#### Oral glucose tolerance test (OGTT)

In cases and controls fasting and after the 2<sup>nd</sup> hr samples were collected. Fasting sample was collected after 8 hrs overnight fasting. 2<sup>nd</sup> hr sample was collected after providing the glucose diet to cases and controls.

Fasting OGTT range: <110 mg/dl.

Post-glucose load ranges: At 120 minutes: <140 mg/dl.

#### Serum insulin [7]

In cases and controls fasting and after the 2<sup>nd</sup> hr samples were collected. Fasting sample was collected after 8 hrs overnight fasting. 2<sup>nd</sup> hr sample was collected after providing the glucose diet to cases and controls.

Fasting insulin range: 3.0-25.0 mU/L.

Post-glucose load ranges [8]:

At 60 minutes: 29-88 mU/L

At 120 minutes: 22-79 mU/L.

#### C-peptide

In cases and controls fasting and after the 2<sup>nd</sup> hr samples were collected. Fasting sample was collected after 8 hrs overnight fasting. 2<sup>nd</sup> hr sample was collected after providing the glucose diet to cases and controls.

C-peptide range: 0.81-3.85 ng/mL.

### RESULTS

In cases and controls, OGTT, serum insulin and C-peptide levels of both groups I and II are shown in Tables 1-3.

#### Statistical analysis

In Table 4, the mean of fasting OGTT levels in case is 83 mg/dl with standard deviation (SD) of 8.785 and the mean value observed in control group is 86.70 with SD of 9.068 (Fig 1).

The p values of fasting OGTT levels in case and controls 0.163, hence there is no significant difference and showing levels in cases and controls.

The mean of 2<sup>nd</sup> hr OGTT levels in cases is 144.20 mg/dl with a SD of 28.33; the mean value observed in control group is 105.90 mg/dl with SD of 6.569.

The p values of 2<sup>nd</sup> hr OGTT levels in cases and control in 0.00 hence there is significant difference, showing raised levels in cases.

In Table 5, the mean of fasting serum insulin levels in case is 18.00 mU/L with SD of 6.07 and the mean value observed in control group is 7.00 with SD of 2.97.

The p values of fasting serum levels of insulin in case and controls 0.00, hence there is a significant difference and showing raised levels in cases.

Table 1: OGTT levels in mg/dl in both the groups

Serial number	Group I		Group II	
	Fasting	2 <sup>nd</sup> hr	Fasting	2 <sup>nd</sup> hr
1	82	136	96	110
2	92	128	88	108
3	74	140	84	112
4	74	126	78	112
5	88	134	70	110
6	96	160	94	112
7	88	220	80	100
8	80	124	96	110
9	84	144	102	110
10	96	130	84	112
11	80	134	90	110
12	92	126	88	100
13	84	124	88	110
14	70	128	70	100
15	78	164	88	108
16	82	138	104	96
17	74	130	78	106
18	70	128	84	104
19	84	208	88	88
20	70	134	84	100
21	84	124		
22	72	118		
23	100	126		
24	76	132		
25	80	130		
26	88	172		
27	84	138		
28	96	228		
29	74	148		
30	88	154		

OGTT: Oral glucose tolerance test

Table 2: Serum insulin levels in mU/L in both the groups

Serial number	Group I		Group II	
	Fasting	2 <sup>nd</sup> hr	Fasting	2 <sup>nd</sup> hr
1	13.66	24.79	3.87	24.36
2	23.46	12.12	3.84	11.98
3	16.35	12.47	8.86	12.40
4	14.52	25.38	7.46	24.62
5	21.79	22.14	9.50	22.80
6	26.60	7.50	8.86	8.12
7	41.38	14.70	9.24	13.70
8	12.70	18.66	4.76	19.48
9	16.38	7.59	4.64	8.24
10	14.73	17.62	13.24	6.98
11	21.68	26.94	10.00	25.88
12	13.00	7.78	4.58	8.42
13	21.55	22.88	9.69	22.00
14	13.00	4.18	2.76	5.24
15	21.74	22.51	9.58	21.84
16	13.13	23.92	8.23	22.86
17	13.29	21.46	2.76	20.92
18	20.65	12.46	8.74	12.62
19	15.62	16.46	5.25	15.82
20	12.78	22.46	4.24	23.82
21	14.96	16.62		
22	25.15	14.82		
23	15.38	24.48		
24	12.93	18.46		
25	18.42	8.42		
26	22.68	18.22		
27	18.24	8.42		
28	16.80	24.44		
29	14.26	14.68		
30	13.28	22.82		

The mean of 2<sup>nd</sup> hr serum insulin levels in cases is 17.31 mU/L with a SD of 6.35. The mean value observed in control group is 16.60 with SD of 6.95 (Fig 2).

Table 3: Serum C-peptide levels in ng/mL in both groups

Serial number	Group I		Group II	
	Fasting	2 <sup>nd</sup> hr	Fasting	2 <sup>nd</sup> hr
1	1.72	3.84	4.20	5.40
2	1.20	4.24	3.21	6.20
3	1.52	2.92	2.31	5.00
4	1.88	2.82	4.86	4.92
5	0.42	4.00	2.92	7.28
6	0.92	3.92	2.48	6.82
7	0.81	2.24	3.26	5.12
8	0.72	1.94	2.22	4.94
9	0.54	2.20	1.88	5.40
10	1.00	2.12	3.84	4.16
11	0.64	1.84	2.68	5.64
12	1.23	3.24	3.18	7.00
13	1.48	2.98	4.87	5.30
14	1.22	2.64	5.97	4.94
15	0.86	4.62	3.84	7.10
16	0.62	2.14	2.52	4.62
17	1.32	3.18	5.08	5.11
18	0.74	2.78	3.94	4.00
19	1.32	1.88	4.84	3.42
20	0.54	3.72	2.96	6.44
21	0.50	4.84		
22	1.42	3.14		
23	0.94	2.04		
24	0.78	2.41		
25	0.88	3.22		
26	1.42	1.66		
27	1.22	3.08		
28	1.44	1.92		
29	0.92	2.80		
30	0.84	3.12		

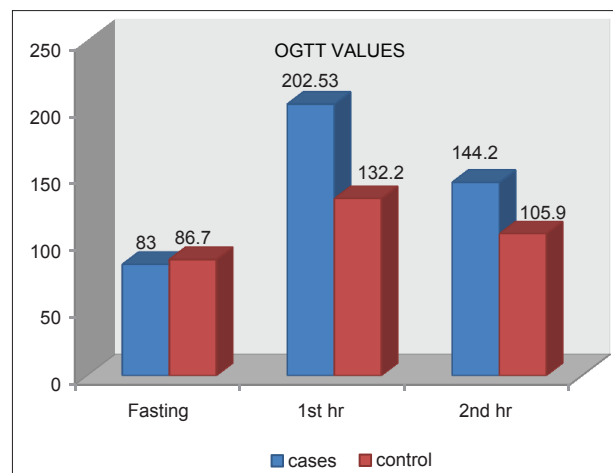


Fig. 1: Comparison of mean glucose levels in cases and controls

The p values of 2<sup>nd</sup> hr serum levels of insulin in cases and control in 0.68 hence there is no significant difference, showing equal levels in cases and controls.

In Table 6, it shows the mean of fasting serum C-peptide levels in cases as 1.03 ng/mL with SD of 0.38, the mean value observed in control group is 3.55 with SD of 1.12 (Fig 3).

The p value of fasting serum levels of C-peptide in cases and controls is 0.00, hence there is significant difference, showing low levels in cases.

The mean of 2<sup>nd</sup> hr serum C-peptide levels in cases as 2.91 ng/mL with SD of 0.86, the mean value observed in control group is 5.43 with SD of 1.05.

The p value of 2<sup>nd</sup> hr serum levels of C-peptide in cases and controls is 0.00, hence there is a significant difference showing low levels in cases.

**Table 4: Statistical analysis of OGTT levels in both groups**

	Fasting	2 <sup>nd</sup> hr
Case		
Mean+SD	83+8.785	144.20+28.335
SE	1.604	5.173
Control		
Mean+SD	86.70+9.068	105.90+6.569
SE	2.028	1.469
p value	0.163	0.000

SD: Standard deviation, SE: Standard error, OGTT: Oral glucose tolerance test

**Table 5: Statistical analysis of serum insulin levels in both groups**

	Fasting	2 <sup>nd</sup> hr
Case		
Mean+SD	18.0037+6.07022	17.3140+6.35450
SE	1.10827	1.16017
Control		
Mean+SD	7.0050+2.97029	16.6050+6.95147
SE	0.66418	1.55440
p value	0.000	0.685

SD: Standard deviation, SE: Standard error

## DISCUSSION

Blood glucose levels are strongly controlled by regulation of insulin release from pancreatic beta cells. This homeostatic function depends on glucose uptake in beta cells and subsequent signaling pathways that influence the rate of exocytosis.

In present study the OGTT levels in fasting conditions with  $p > 0.05$  have no significant value. At the same time, 2<sup>nd</sup> hr levels with  $p < 0.05$  have significant value with raised levels in cases [9,10].

Serum Insulin levels in fasting condition with  $p < 0.05$  have significant value with raised levels in cases. At the same time, 2<sup>nd</sup> hr levels with  $p > 0.05$  have no significant value [9].

Serum C-peptide levels in fasting condition with  $p < 0.00$  have significant value with low levels in cases. And 2<sup>nd</sup> hr serum peptide levels with  $p < 0.00$  have significant value with low levels in cases [9].

From the above analysis with raised 2<sup>nd</sup> hr levels of glucose indicates the low level of insulin secretion and raised levels of fasting insulin levels indicate the decreased metabolism of serum insulin and insulin resistance. From the above analysis it is assumed that the low levels of serum C-peptide in cases shows the pancreatic beta cell dysfunction.

## CONCLUSION AND SUMMARY

In the present study, the OGTT, serum insulin, serum C-peptide levels variation in patients with pancreatic disorders compared to controls are:

- OGTT levels significantly higher at after oral glucose administration but not in fasting condition.
- Serum insulin levels significantly higher at fasting but not after oral glucose administration.
- Serum C-peptide levels significantly lower in fasting and after oral glucose administration.

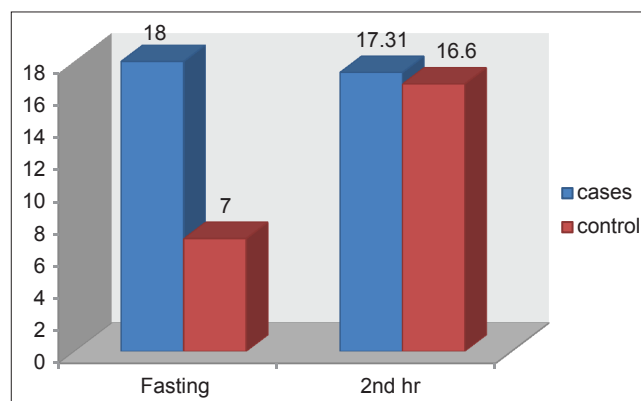
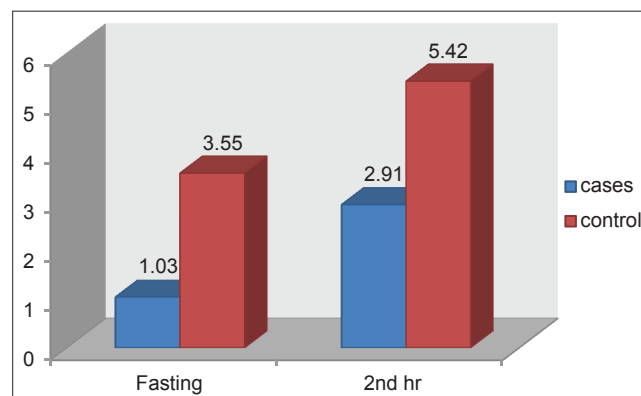
From this it clearly indicates that there is significant insulin resistance and decreased production of serum insulin in pancreatic disorder patients.

By the above results, by analyzing the C-peptide in chronic pancreatic disorders will help to rule out diabetic state. By testing OGTT only we can know the high glucose level after oral glucose administration. By testing the serum insulin level we will know the fasting condition of the patient only and we cannot rule out the beta cell dysfunction. Serum insulin easily metabolizes through liver and hence the testing of serum insulin levels may sometimes be not accurate.

**Table 6: Statistical analysis of serum C-peptide levels in both groups**

	Fasting	2 <sup>nd</sup> hr
Case		
Mean+SD	1.0353+0.38449	2.9163+0.86165
SE	0.7020	0.15732
Control		
Mean+SD	3.5530+1.12863	5.4325+1.05619
SE	0.25237	0.23617
p value	0.000	0.000

SD: Standard deviation, SE: Standard error

**Fig. 2: Comparison of mean insulin levels in cases and controls****Fig. 3: Comparison of mean C-peptide levels in cases and controls**

By testing C-peptide levels we can easily come to know that the low level of C-peptide directly indicates the low level of insulin and it will rule out beta cell dysfunction. By this study we came to know that by testing serum peptide levels in chronic pancreatic disorder we analyze the beta cell function and by this we can know prediabetes in pancreatic disorder patients. From this we can say that serum C-peptide is better marker than OGTT, serum insulin to rule out prediabetes in chronic pancreatic disorder patients.

## REFERENCES

1. Ido Y, Vindigni A, Chang K, Stramm L, Chance R, Heath WF, *et al.* Prevention of vascular and neural dysfunction in diabetic rats by C-peptide. *Science* 1997;277(5325):563-6.
2. Hoogwerf BJ, Goetz FC. Urinary C-peptide: A simple measure of integrated insulin production with emphasis on the effects of body size, diet, and corticosteroids. *J Clin Endocrinol Metab* 1983;56(1):60-7.
3. Sacks DB. Carbohydrates. In: Burtis CA, Ashwood ER, editor. *Tietz Text Book of Clinical Chemistry*. 2<sup>nd</sup> ed. Philadelphia: WB Saunders; 1994. p. 935-49.
4. Dods RF. Diabetes mellitus. In: Kaplan LA, Pesce AJ, editors. *Clinical*

- Chemistry: Theory, Analysis, and Correlation. 3<sup>rd</sup> ed. St. Louis: CV Mosby; 1996. p. 620-6.
5. Wahren J, Ekberg K, Johansson J, Henriksson M, Pramanik A, Johansson BL, *et al.* Role of C-peptide in human physiology. *Am J Physiol Endocrinol Metab* 2000;278(5):E759-68.
  6. Törn C, Landin-Olsson M, Lernmark A, Palmer JP, Arnqvist HJ, Blohmé G, *et al.* Prognostic factors for the course of beta cell function in autoimmune diabetes. *J Clin Endocrinol Metab* 2000;85(12):4619-23.
  7. Chevenne D, Trivin F, Porquet D. Insulin assays and reference values. *Diabetes Metab* 1999;25(6):459-76.
  8. Clinical and Laboratory Standards Institute (formerly NCCLS). How to Define and Determine Reference Intervals in the Clinical Laboratory; Approved Guidelines. 2<sup>nd</sup> ed. Wayne PA: Clinical and Laboratory Standards Institute; 2000. NCCLS Document C28-A2.
  9. Bonora E, Rizzi C, Lesi C, Berra P, Coscelli C, Butturini U. Insulin and C-peptide plasma levels in patients with severe chronic pancreatitis and fasting normoglycemia. *Dig Dis Sci* 1988;33(6):732-6.
  10. Utzschneider KM, Prigeon RL, Tong J, Gerchman F, Carr DB, Zraika S, *et al.* Within-subject variability of measures of beta cell function derived from a 2 hr OGTT: Implications for research studies. *Diabetologia* 2007;50(12):2516-25.