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Original Article

Physiology Section

The Serum C Peptide Levels Among the Offsprings of the People with Type 2 Diabetes

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ABSTRACT

Background: Insulin Resistance (IR) is a condition in which the cells of the body become resistant to the effect of insulin , that is, the normal response to a given amount of insulin is reduced. As a result, levels of insulin are needed in order for insulin to produce its effect. The incidence of diabetes in the offsprings of diabetic couples was more than the incidence of diabetes in the offsprings, of whom only a single parent was diabetic.

Aims and Objectives: This study was done to assess the prevalence of insulin resistance in the offsprings of diabetic patients.

Material and Methods: The present, cross sectional study conducted in the Teerthanker Mahaveer Medical College and Research Centre, Moradabad, U.P., india. The offsprings of diabetic subjects attended the General Medicine OPD and the Diabetic Clinic and they were also admitted in the indoor wards of the Department of Medicine. The study material consisted of 53 (35 males and 18 females) live offsprings of diabetics from 28 families.

Results: The mean c-peptide level in the offsprings of biparental diabetics was significantly higher than that in the offsprings of monoparental diabetics ($p<0.01$) and in the offsprings of non-diabetics ($p<0.01$). The frequency of the high c-peptide level was 38.1% in the offsprings of biparental diabetics, it was 21.1% in the offsprings of monoparental diabetics and it was 7.7% in the offsprings of non-diabetics.

Conclusion: This study revealed that during the young ages of the offsprings of biparental diabetics, insulin resistance was common and that insulin resistance was more common in the obese, female offsprings of biparental diabetics.

Key Words: Insulin resistance, Obesity, Diabetes mellitus, C-peptide

INTRODUCTION

Insulin Resistance (IR) is a condition in which the cells of the body become resistant to the effect of insulin, that is, the normal response to a given amount of insulin is reduced. As a result, levels of insulin are needed in order for insulin to produce its effect [1].

At the molecular level, insulin resistance correlates with an impaired insulin signaling. The brown adipocytes are the target cells for the insulin action. The tumour necrosis factor (TNF-a) causes insulin resistance on glucose uptake, by impairing the insulin signaling at the level of the IRS-2. Activation of the stress kinases and the phosphates by this cytokine contributes to insulin resistance [2]. Obesity, particularly a higher body fat percentage, is mostly predictive of a high risk of hyper insulin, even in childhood and adolescence [3 -6].

A simple test for identifying insulin resistant individuals is important, both for a population based research and the clinical practice. Though glycaemic insulin clamps and the intravenous glucose tolerance test (NGTT) are standard methods for the measurements of the insulin resistance in research, they are impractical in the clinical practice and are difficult to perform in population based research studies [7]. Most of the studies have assessed the prediction of insulin resistance in the individuals who were selected randomly with an Impaired Glucose Tolerance (IGT) and diabetes. Only few studies have specially evaluated the prediction of insulin resistance in individuals with a normal glucose tolerance [8].

The incidence of diabetes in the offsprings of diabetic couples was more than the incidence of diabetes in the offsprings, of whom only a single parent was diabetic. It was also observed that the children of juvenile onset diabetics were far more likely to develop diabetes than those of maturity onset diabetics [9].

In the present study we specially evaluated the prevalence of insulin resistance in the group which was at the most risk i.e. a group of offsprings of diabetic parents, by the measurement of the serum C- peptide levels. Although insulin resistance can also be diagnosed by evaluating the serum insulin levels, the serum c- peptides levels is a better biochemical marker of the insulin resistance, because the C -peptide is less susceptible than insulin to a hepatic degradation. The C-peptide has a longer half life (about 35 min) than insulin.

A 5-10 times higher concentration of the c-peptide persists in the peripheral circulation and it allows a discrimination between the endogenous and the exogenous sources of insulin [10 -12].

MATERIALS AND METHODS

The present, cross sectional study was conducted in the Teerthanker Mahaveer Medical College and Research Center, Moradabad, U.P., India. The offsprings of diabetic subjects, who attended the General Medicine OPD and the Diabetic Clinic and who were also admitted in the indoor wards of the Department of Medicine, constituted the case material for this study.

This study was done to assess the prevalence of insulin resistance in the offsprings of diabetic patients. The study group included 53 subjects who were divided into 3 groups-

Group-I: 21 offsprings of biparental diabetics.
Group II: 19 offsprings of mono-parental diabetics.
Group III: 13 offsprings of non-diabetics as controls.

The study material consisted of 53 (35 males and 18 females) live offsprings of diabetics from 28 families. There was a male responder bias among the offsprings. The oral glucose tolerance test was performed in all the cases and it was interpreted as per the ADA Criteria [13].

SUBJECT SELECTION

Subject selection

Offsprings of diabetic parents, of either sex, who did not have an impaired glucose tolerance.

Exclusion criteria

1) Patients who were unwilling to participate in the study
2) A history of impaired glucose tolerance and diabetes
3) Pregnancy
4) Malignancy
5) Hyperthyroidism
6) Hypothyroidism
7) Other significant endocrine disorders
8) Offsprings of people with gestational diabetes

1) Criteria for the diagnosis of diabetes - The recommendations which were laid down by the American Diabetes Association (2004) were used-

– Symptoms of diabetes plus a random blood glucose concentration of >11.1 mmol/L (200 mg/dl) or

– A fasting plasma glucose level of >7.0 mmol/L (126 mg/dl) or

– A two-hour plasma glucose level of >11.1 mmol/L (200 mg/dl) during an oral glucose tolerance test.

2) The C-peptide examination – The normal fasting c-peptide level is 0.4-2.1 ng/ml in children who are less than 15 years of age, according to Mosby's Manual of Diagnostic and Laboratory Tests 2002 by Kathliendeskapagona.

For assessing the c-peptide levels, fasting blood samples were drawn and they were sent to private pathology. The electrochemiluminescence immunoassay, "ECLIA", was intended to be done for the quantitative determination of the c-peptide in human serum.

Informed consents were taken from the participants before the study started and the study was approved by the Institutional Ethics Committee (IEC).

RESULTS

In the present study, the blood pressures and the fasting and the postprandial blood glucose levels of the offsprings of the Group I, Group II and Group III subjects were found to be within the normal range. Out of the total 53 cases, 39.6% were the offsprings of biparental diabetics, 35.9% were the offsprings of monoparental diabetics and 24.5% were the offsprings of non-diabetics.

The above table depicts that no subject had low levels of the C-peptide. Among those who had normal c-peptide levels, 13 subjects were of Group-I, 15 subjects were of Group-II and 12 subjects were of Group-III.

C-Peptide level (ng/ml)	Number of Subjects					
	Group-I		Group-II		Group-III	
	No.	%	No.	%	No.	%
<0.4 ng/ml (low level)	00	00.0	00	00.0	00	00.0
0.4-2.1 ng/ml (normal)	13	61.9	15	78.9	12	92.3
>2.1 ng/ml (high)	08	38.2	04	21.9	01	07.7
Mean age±S.D.	1.95±0.515		1.23±0.512		1.06±0.453	

[Table/Fig-1]: Distribution of Subjects According to C-Peptide Levels

Study Group	Mean C-Peptide Levels (ng/ml) ± SD	Non-Responders		
			't'	'p'
Group-I	1.95±0.51	I Vs II	4.45	<0.01
Group-II	1.23±0.512	II Vs III	0.965	>0.05
Group-III	1.06±0.45	I Vs III	5.156	<0.01

[Table/Fig-2]: Statistical Analysis of Tabel-5

Age (years)	Mean C-Peptide Level (ng/ml±SD		
	Group-I	Group-II	Group-III
0-5	0.00	0.00	0.00
6-10	0.00	0.00	0.00
11-15	0.99	0.81	0.76
16-20	1.78	1.13	1.02
21-25	2.16	1.39	1.00
26-30	2.28	1.63	2.22
>30	0.00	0.00	0.00

[Table/Fig-3]: Distribution of Serum C-Peptide Level According to Age

Among those who had high c-peptide levels, 8 subjects were of Group-I, 4 subjects were of Group-II and 1 subject was of Group-III [Table/Fig-1].

The mean c-peptide level in Group-I was 1.95±0.51 ng/ml, that in Group-II was 1.23±0.51 ng/ml and that in Group-III was 1.06±0.45 ng/ml. The above table shows the statistically significant higher c-peptide levels in Group-I (1,95±0.51 ng/ml) as compared to those in Group-II (1.23±0.512 ng/ml) and Group-III (1.06±0.453 ng/ml). There was no statistically significant difference between the c-peptide levels in Group-II and Group-III [Table/Fig-2].

In the present study, the mean c-peptide level was found to increase in all the three groups, as the age increased. The mean c-peptide level in Group-I was high in all the age groups, as compared to those in Group-II and Group-III.

DISCUSSION

In the present study, the blood pressures and the fasting and the postprandial blood glucose levels of the offsprings of the Group I, Group II and Group III subjects were found to be within the normal range. 38.1% offsprings of biparental diabetics had increased c-peptide levels (n=21) i.e >2.1 ng/ml, while 21.1% offsprings of mono parental diabetics had increased c-peptide levels (n=19). Among the controls, only 7.7% offsprings of non-diabetics had increased c-peptide levels (n=13). The mean fasting serum c-peptide level in Group I was 1.95±0.51 ng/ml, that in Group II was 1.23±0.512 ng/ml and that in the control group was 1.06±0.45 ng/ml [Table/Fig-2 & 3].

Kumar A et al., said that the prevalence of insulin resistance in the 1st degree relatives was 37.8%, while that in the controls was 12.47% with p=0.000. Hazra D K et al., found in a study, that the

mean C-peptide level in the fasting state was 0.9±0.54 ng/ml in uniparental offsprings, that it was 1.74±0.90 ng/ml in biparental offsprings and that it was 1.35±0.61ng/ml in the controls [14-15].

M. Bamentos-Perez et al., showed that 94% of the overweight adolescents with one or two diabetic parents showed insulin resistance and that 58% of the overweight adolescents without any parental history of diabetes showed insulin resistance ($p<0.01$). Therefore, they found an association between insulin resistance and a history of parental diabetes [16].

In our study, the mean C-peptide level in Group-I was 1.8±0.517ng/ml in males and it was 2.25±0.268 ng/ml in females. In Group-II, the mean C-peptide level was 1.15±0.469 ng/ml in males and it was 1.36±0.517 ng/ml in females. In the control group, it was 1.03±0.293 ng/ml in males and it was 1.12±0.464 ng/ml in females. The mean c-peptide levels were also higher in females than in males in Groups -II and III , they but were not significant ($p>0.05$) respectively) [Table/Fig-2]. There were significantly higher mean c-peptide values in Group-I as compared to the Groups-II and III, both among males and females. There was no statistically significant difference between the levels in the Groups-II and III [Table/Fig-3].

CONCLUSIONS

The present, cross sectional analysis on the insulin resistance in the offsprings of Indian diabetics was done on only a very limited number of cases, but it brought forth certain important conclusions, especially, when the data of the earlier cross sections were considered.

Despite its small size, it was useful bringing out the following conclusions as regards the offsprings of Indian diabetics.

1. The mean c-peptide levels in the offsprings of biparental diabetics were significantly higher than those in the offsprings of monoparental diabetics ($p<0.01$) and in the offsprings of non-diabetics ($p<0.01$).

2. The frequency of the high c-peptide level was 38.1% in the offsprings of biparental diabetics, it was 21.1% in the offsprings of monoparental diabetics and it was 7.7% in the offsprings of non-diabetics.

3. The mean c-peptide level was found to be in an increasing order in the offsprings of biparental diabetics, as the age increased.

4. The mean serum c-peptide level was higher in females as compared to that in males, in all the 3 groups.

5. The mean serum c-peptide level was found to be higher in both males and females in Group-I as compared to those in the Groups-II and III.

Thus, this study revealed that during the young ages of the offsprings of biparental diabetics, insulin resistance was common and that the insulin resistance was more common in the obese, female offsprings of biparental diabetics.

This study had some limitations, as the groups were of small sizes. The prevalence of overweight and the abnormal waist to hip ratio can also be measured along with the c-peptide level estimation.

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