



Original Article

Correlation of Serum Adiponectin, Fasting Serum Glucose and Serum Insulin in Samples Received in a Tertiary Care Hospital in Central India

Authors

Swati Agarwal¹, Rohit Manyal^{2*}

¹Assistant Professor, RKDF Medical College Bhopal.

²Postgraduate Resident, MGM Medical College Indore

*Corresponding Author

Rohit Manyal

Department of Biochemistry, MGM Medical College Indore, MP India

Mob: 07000786450, Email: drrohitmanyal@gmail.com

Abstract

Aim & Objective: Adipose cells release various adipocytokinins in response to insulin resistance. The purpose of this study was to investigate any significant difference in the level of total serum adiponectin and its association with fasting insulin, and fasting serum glucose levels, which are predictors of diabetes.

Material and Methods: An analytical cross sectional study with 120 subjects (60 normal healthy off-springs of diabetic parents and 60 normal healthy off-springs of non-diabetic parents) between age group of 18 to 30 years. Subjects were enrolled after applying all inclusion and exclusion criteria and written informed consent were taken. All socio-demographic data of the participants were entered in a self-designed questionnaire. Serum adiponectin was done by ELISA and fasting glucose by glucose peroxidase method.

Results: The mean value of Fasting Blood Sugar in offspring of non-diabetic, single diabetic parent and both diabetic parents were 85.23(SD 5.939), 86.84(SD 6.258) and 94.95(SD 6.586). The mean value of serum adiponectin found significantly lower in offspring of both diabetic parents than offspring of single diabetic parent (0.039*) and offspring of non-diabetic parents (0.000**).

Conclusion: Adiponectin has been reported as a new risk factor for the development of diabetes. When both parents are diabetic their offsprings should always be kept in follow up as they have high chances of developing hyperglycemia.

Keywords: Adiponectin, Diabetes, Insulin.

Introduction

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. Several pathogenic processes are involved in the development of diabetes, like autoimmune destruction of the beta-cells of the pancreas with

consequent insulin deficiency to abnormalities that result in resistance to insulin action. The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of various organs, especially the eyes, kidneys, nerves, heart, and blood vessels¹.

The prevalence of diabetes is rising all over the world due to population growth, aging, urbanisation and an increase of obesity and physical inactivity. According to recent estimates, approximately 285 million people worldwide (6.6%) in the 20–79 year age group are having diabetes and by 2030, 438 million people (7.8%) of the adult population, is expected to have diabetes².

India is home to over 61 million diabetic patients. The International Diabetes Federation (IDF) estimated the total number of people in India with diabetes rising to 87.0 million by 2030[2]. The country is also largest contributor to regional mortality with 983,000 deaths caused due to diabetes this year. Unlike in the West, where older persons are most affected, diabetes in Asian countries is disproportionately high in young to middle-aged adults^{3,4}. This could have long-lasting adverse effects on a nation's health and economy, especially for developing countries.

Adiponectin-The adipose tissue secretes several adipocytokines (adipose tissue derived protein) into the bloodstream known to influence insulin resistance, including leptin and tumor necrosis factor- α . Adiponectin, is a novel peptide expressed specifically and abundantly in adipose tissue^{5,6}. It seems to be the most interesting and promising biologically active molecule released from fat cells which has profound protective actions in the pathogenesis of diabetes mellitus and cardiovascular disease. Adiponectin [also known as Acrp30 (adipocyte complement related protein of 30 kDa) or AdipoQ] is a 244-amino acid, 30 kDa protein secreted mainly by the adipose tissue. It was discovered in 1995. Adiponectin contains an N-terminal collagen-like hyper variable region at the NH2 terminal and a C-terminal globular domain⁷.

Adiponectin circulates in multimers, i.e. as full-length or high molecular-weight (HMW), medium-molecular-weight (or hexamer), and low-molecular-weight (or trimer) adiponectin complexes. Full-length adiponectin may be cleaved to form a smaller, globular fragment,

which has been proposed to have greater potency than full-length adiponectin⁸. Adiponectin primarily circulates in human plasma as a homomultimer or full-length structure. Its actions in tissues are mediated by its receptors, AdipoR1 and AdipoR2. AdipoR1 is abundantly expressed in heart and skeletal muscle while AdipoR2 expression is more restricted to skeletal muscle and liver. Adiponectin binding to its receptors activates several intracellular signaling pathways, mainly AMP-activated protein kinase (AMPK), nuclear transcription factor- κ B, STAT3, and JNK. AMPK phosphorylation promotes glucose utilization that results in increased fatty acid oxidation, increased glucose uptake in the muscle, and reduced gluconeogenesis in the liver⁸. Therefore, the purpose of this study was to investigate any significant difference in the level of total serum adiponectin and its association with fasting insulin, and fasting serum glucose levels, which are predictors of diabetes.

Adiponectin levels can be routinely done in young and healthy individuals with risk factors or family history of diabetes and preventive measures such as lifestyle modification can be suggested to 'at risk- individuals' and total incidence and burden of such a debilitating illness could be reduced.

Material and Methods

Present study was carried out in the Department of Biochemistry at the People's College of Medical Sciences and Research Centre Bhopal during period of October 2013 to September 2014. The study protocol was approved by the Institutional Ethics Committee of our institute. Before enrollment in the study informed written consent was obtained from each subject.

Study Design: Analytical cross sectional study was carried out. Total 120 subjects (60 normal healthy off-springs of diabetic parents and 60 normal healthy off-springs of non-diabetic parents) between age group of 18 to 30 years were enrolled after applying all inclusion and exclusion criteria and written informed consent were taken.

All socio-demographic data of the participants were entered in a self-designed questionnaire.

Participants were divided into three groups-

Group 1: control group consists (n=60) both male and female of age group between 18 to 30 years, whose parents are non-diabetic, non-hypertensive and do not have any family history of coronary heart diseases.

Group 2: (n=38) both male and female of age group between 18 to 30 years, with one of their parents with history of type 2 diabetes.

Group 3: (n=22) both male and female of age group between 18 to 30 years with both parents having history of diabetes.

Selection of study subjects

Inclusion criteria: Healthy off-springs of diabetic parents in age group 18 to 30 years and healthy off-springs of non-diabetic parents in age group 18 to 30 years as controls.

Exclusion criteria: Subjects not fulfilling the age criteria mentioned in inclusion criteria, those with uncontrolled liver or thyroid diseases or any acute illnesses, such as infection, surgery, and hospital admission, recent bone fracture (<6 months) or on

medications known to affect bone or glucose metabolism, such as glucocorticoids or bisphosphonates.

After overnight fast (8-12 hrs) blood sample for serum glucose was collected in fluoride vial and that for insulin, adiponectin were collected in plain vial between 8 am and 10 am. Sample was centrifuged at 3000 rpm for 10 minutes; serum was separated and immediately stored in deep freezer at -20°C until further analysis.

Estimation of Blood Glucose: Glucose oxidase peroxidase method was used.

Estimation of Serum Adiponectin was done by Enzyme Linked Immunosorbent Assay.

Results

We calculated the mean value and standard deviation of all the parameters and with the help of ANOVA we saw if any significant difference is present between the groups in all the parameters included in our study and this was followed by post hoc test to see where the actual difference was present.

To find correlation of serum adiponectin with other parameters we applied multiple regression.

Table No.1 Mean Value of Serum Adiponectin

Variable	Group	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Serum Adiponectin	Group 1	60	10.8633	1.23453	0.15938	10.5444	11.1822	8.30	13.00
	Group 2	38	10.2500	1.68439	0.27324	9.6964	10.8036	6.20	13.20
	Group 3	22	9.2545	1.81284	0.38650	8.4508	10.0583	6.50	12.00
	Total	120	10.3742	1.60469	0.14649	10.0841	10.6642	6.20	13.20

Table No.1 showing mean value of Serum Adiponectin in 3 different groups with standard deviation. The mean value of Serum Adiponectin in offspring of non-diabetic parents was 10.8633(SD 1.23453), in offspring of single diabetic parent was 10.2500(SD 1.68439) and in

offspring of both diabetic parents was 9.2545(SD 1.81284).

(Group 1- offspring of non-diabetic parents, Group 2- offspring of single diabetic parent, Group 3 - offspring of both diabetic parents)

Table No.2 Mean Value of Serum FBS

Variable	Group	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
FBS	Group 1	60	85.23	5.939	0.767	83.70	86.77	70	99
	Group 2	38	86.84	6.258	1.015	84.79	88.90	74	102
	Group 3	22	94.95	6.586	1.404	92.03	97.87	83	108
	Total	120	87.53	7.094	0.648	86.24	88.81	70	108

Table No.2 showing mean value of Fasting Blood Sugar in 3 different groups with standard deviation. The mean value of Fasting Blood Sugar in offspring of non-diabetic parents was 85.23(SD 5.939), in offspring of single diabetic parent was

86.84(SD 6.258) and in offspring of both diabetic parents was 94.95(SD 6.586).

(Group 1- offspring of non-diabetic parents, Group 2- offspring of single diabetic parent, Group 3 - offspring of both diabetic parents)

Table No.3 Mean Value of Serum Insulin

Variable	Group	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Insulin	Group 1	60	8.6967	2.55124	.32936	8.0376	9.3557	5.10	16.00
	Group 2	38	10.8184	1.73281	.28110	10.2489	11.3880	8.00	15.00
	Group 3	22	12.6909	1.55499	.33153	12.0015	13.3804	9.20	15.20
	Total	120	10.1008	2.64313	.24128	9.6231	10.5786	5.10	16.00

Table No. 3 showing mean value of serum Insulin in 3 different groups with standard deviation. The mean value of Serum Insulin in offspring of non-diabetic parents was 8.6967(SD 2.55124), in offspring of single diabetic parent was 10.8184 (SD 1.73281) and in offspring of both diabetic parents was 12.6909(SD 1.55499).

(Group 1- offspring of non-diabetic parents, Group 2- offspring of single diabetic parent, Group 3 - offspring of both diabetic parents)

Discussion

We found that the mean value of serum Adiponectin was significantly lower in offspring of both diabetic parents than offspring of single diabetic parent (0.039*) and offspring of non-diabetic parents (0.000**).

Pellme F et al⁹ also found significantly lower level of adiponectin (p<0.03) in male subjects in Sweden, first degree relatives of type 2 diabetic patients. Sull et al¹⁰ also concluded his study that family history of diabetes is associated with hypoadiponectinemia. Recently, K. Bose et al¹¹ also found in his study the significant difference in

serum adiponectin between offsprings of both diabetic parents and offspring of single diabetic parent. (P=0.000**). Lindsay et al.¹² recently showed in a nested case-control study with Pima Indians that higher plasma levels of adiponectin protected against later development of type 2 Diabetes Mellitus. Lihn et al¹³ in his study found that adiponectin expression in adipose tissue is reduced in first degree relatives. He found substantially reduced levels of adiponectin mRNA in subcutaneous adipose tissue from FDR compared with control subjects.

Adiponectin has been reported as a new risk factor for the development of diabetes which is exclusively secreted by adipose tissue and regulates the metabolism of lipids and glucose, and circulates quite abundantly in plasma^{14,18}.

Adiponectin decreases insulin resistance and body weight by increasing lipid oxidation in muscle and other organs such as the pancreas and liver¹⁵. Plasma Adiponectin concentrations are also reduced in individuals with obesity, diabetes mellitus, or coronary heart disease^{19,20}.

In Our study we found that serum adiponectin was inversely correlated with BMI and it was statistically significant but correlation with WHR was not significant. Our findings are consistent with studies by Indian researchers Vikram et al²¹ who found that adiponectin levels correlate (inversely) strongly with anthropometric parameters in Asian-Indians though unlike their study, our study does not show a significant correlation with WHR. Possible explanation for such (negative but non-significant) findings in our study could be that the majority subjects included in this study were non-obese.

In our study serum adiponectin concentrations were also inversely correlated with fasting blood glucose and insulin which is consistent with other studies done by Bacha et al²², and recently Bose et al¹¹ who also showed negative correlation of serum adiponectin with insulin.

Plasma adiponectin levels were inversely correlated with fasting glucose and insulin in a study done by Hotta k et al²³, Weyer C²⁴. Previous studies in Pima Indian, Hispanic, and Asian-American children demonstrated that plasma adiponectin levels correlate inversely with fasting insulin levels^{25,26}. We also found non-significant negative correlation between adiponectin and insulin resistance. In a study done by Amita et al²⁷, she also showed a non-significant negative relation of insulin resistance with adiponectin. Our findings are consistent to the findings of Matsubara²⁸ and Funahashi²⁴ who demonstrated that hypo-adiponectinemia was more intensively related to the degree of insulin resistance. Although the value of insulin resistance in our study were consistent with that of other studies but it was not statistically significant. It may be due to small sample size of our study. Comuzzie AG et al²⁹ in his study said that Adiponectin levels have a reported genetic heritability of 46%. Genetic polymorphisms in the adiponectin gene have been identified^{30,31} and shown to be associated with obesity and insulin resistance³². Yet, the mechanism by which adiponectin influences insulin sensitivity in humans is unclear.

Conclusion

Adiponectin has been reported as a new risk factor for the development of diabetes. When both parents are diabetic their offsprings should always be kept in followup as they have high chances of developing hyperglycemia.

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