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Original Research Article

Correlation of Adipokines Level with Anthropometric and Blood Sugar Profile (Insulin Level, Fasting Plasma Glucose and Hba1c) in T2DM Patients.

Onkar Nath Tiwari[1], Shreya Nigoskar[2]

[1]Ph.D Scholar, Department of Biochemistry, Index Medical College Hospital & Research Center (IMCHRC), Malwanchal University, Nemawar Road, NH-59A, District Indore, Madhya Pradesh, (India)
[2]Professor & Head, Department of Biochemistry, Index Medical College Hospital & Research Center (IMCHRC), Malwanchal University, Nemawar Road, NH-59A, District Indore, Madhya Pradesh, (India)

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Corresponding Author: Dr. Shreya Nigoskar
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Abstract

Background: obesity is recognized as one of the primary elements in the pathogenesis of cardiovascular disease (CVD) and type 2 diabetes mellitus (T2DM). Visceral fat is reported to be far more dangerous than any other form of obesity. Visceral adipose tissue (VAT) is known to be an independent risk factor of myocardial infarction (MI) in elderly patients.

Aim: To correlate the adipokines level with anthropometric and blood sugar profile (Insulin level, fasting plasma glucose and HbA1c) in T2DM patients.

Methodology: The present case-control study was conducted at Index Medical College Hospital & Research Center (IMCHRC) on 160 diabetes, males and females between 35-65 years of age group patients and 160 healthy similar age and sex in control group were enrolled in this study. The screening and management of patients was as per American Diabetes Association guidelines. Serum level of Visfatin and adiponectin was estimated by Enzyme linked immuno sorbent assay (ELISA) as per manufacturer's protocol.

Result: The serum levels of adipokines (Visfatin) level were significantly higher in the case group (45.35±4.64) in comparison to control group (21.44±4.51) (P<0.05). But adiponectin level was significantly lower in the case group (5.86±0.94) in comparison to control group (10.68±1.54) (P<0.05). The Visfatin positively significant associated with weight, BMI, Waist circumference and Waist Hip Ratio; while it was negative significant correlated with HIP Circumference. It was positive insignificant correlated with age and negative insignificant correlated with height. But in case of Adiponectin negative significant associated with weight, BMI, Waist circumference and Waist Hip Ratio; while it was positive significant correlated with HIP Circumference.

Conclusion: The association of visfatin and adiponectin with weight, BMI, waist circumference and waist/hip ratio may partly explain the lower levels of adiponectin found in individuals with diabetes.

Keyword: Adipokine, Blood sugar level, Insulin, HbA1c, Body mass index, Waist circumference, Hip circumference.

Introduction

Type 2 diabetes mellitus (T2DM) accounts for more than 90% of those with diabetes. [1] According to World Health Organization (WHO), estimate that about 366 million people will have diabetes by year 2030 worldwide. [2] Risk cardiovascular disorders is 2-4 times more among T2DM than non-diabetic subjects [3] where about 80% of T2DM patients have cardiovascular complications as peripheral arterial disease, stroke and heart disease. [4]

Obesity is an epidemic and worldwide complication that represents a major health issue of the 21st century. Many studies have shown that obesity, especially visceral obesity is linked to chronic low-grade inflammation in hypertrophied adipose tissue that leads to initiation and progression of metabolic disorders such as dyslipidemia, hypertension, atherosclerosis, insulin resistance (IR), and type 2 diabetic mellitus (T2DM)]. [5] Adipose tissue is not only a major source of energy for the human body but also inert storage reservoir for lipids. [6] The term adipokines can be defined as a biologically active substance released by adipose tissue. [7] It is now considered as a largest endocrine organ of the body that helps in the regulation of glucose and lipid metabolism, insulin sensitivity and secretion, inflammatory process, appetite, satiety, energy expenditure, endothelial function, blood pressure, and neuroendocrine regulation. [8] Most of the

adipokines are proinflammatory and less the number of anti-inflammatory adipokines. [9]

Adiponectin is an anti-inflammatory 30 kDa plasma protein and abundantly expressed in white adipose tissue. [10] A large number of experimental studies on rodent and cell culture model have demonstrated that adiponectin has a protective role in cardiovascular diseases. [11] In human studies decreased circulating levels of adiponectin in patients with cardiovascular disease give support to these findings. [12] A decrease in the level of adiponectin has been associated with IR, dyslipidemia, and atherosclerosis in human and rodents. [12] It has a protective role against metabolic diseases and promotes insulin sensitivity. [13] It also maintains and widespread healthy adipose tissue by preventing ectopic lipid accumulation in an animal model and enhances insulin sensitivity. [12]

In contrast, leptin is proinflammatory, a product of obese (ob) gene is a 16-kDa circulating protein hormone produced by adipocytes. It is an adipokines and a key molecule that regulates food intake and body weight. [14] The level of plasma leptin is directly proportional to the mass of body fat. [15] It also plays an important role in the regulation of body metabolism, energy homeostasis, and neuroendocrine function. [16] It acts by binding to circulating receptors, triggers Janus kinase, and induces signal transducer and activator of transcription pathway. [17] Increased leptin directly modulates pancreatic beta cells functions and indirectly through central neural pathways leading to progression of IR and T2DM. [8]

From extensive literature study, we found that there is a lack of data to clearly explain the relationship between blood sugar profile and anthropometric parameters in center India population specifically from Indore and its surroundings. This study evaluates the comparative and relative relationship between adipokines level (Visfatin and Adiponectin) with fasting plasma glucose, insulin, HbA1c level and anthropometric parameters (weight, hight, BMI, Waist circumference, hip circumference and Waist / hip circumference ratio) in diabetes patients.

Material & Method

The present case-control study was conducted at In-dex Medical College Hospital & Research Center (IMCHRC) on 160 diabetes, males and females between 35-65 years of age group patients and 160 healthy males and females between 35-65 years of age group enrolled in this study. Individuals who have less than 35 years or greater than 65 years of age, suffering from disease like psychiatric disorders, hypertension, Alcoholics, Smokers, Pregnant and lactating women were excluded from the study. The screening and management of patients was as per American Diabetes Association guidelines.

As per WHO criteria; T2DM is characterized by elevated fasting blood sugar (FBS) (≥126mg/dl) or post-prandial blood sugar (PPBS) (≥200mg/dl) concentrations. [18] The American Diabetes Association (ADA) Standards of Medical Care in Diabetes added that glycated haemoglobin (HbA1c) as an important standard for the diagnosis of pre-diabetes and diabetes (5.7-6.4% and ≥6.5%, respectively). [19]

Assay of Visfatin and Adiponectin: Serum level of Visfatin and adiponectin was estimated by Enzyme linked immuno sorbent assay (ELISA) as per manufacturer's protocol.

It was analysed with SPSS (Statistical Package for the Social Sciences) software version 20.0 (IBM, New York, USA). Broadly, descriptive analysis of quantitative data was expressed as means and standard deviation. Categorical/Ordinal data was expressed as percentage, median and range. Cross tables were generated and Chi Square/Fishier extract test was used for comparisons & associations. Independent Sample t test or Mann-Whitney U test was used to test difference between quantitative data among groups. Bivariate analysis (Pearson correlation) was used to find the association of Visfatin and Adiponectin level with anthropometric and sugar profile. A p-value less than 0.05 ($P<0.05$) was considered as statistically significant.

Results

Proportion of male patients was comparably higher in number in both groups and it was insignificantly distributed in both groups ($P>0.05$). There was statistically insignificant higher older age population in case group (51.46±8.69) in compare to control group (49.94±7.90) ($P>0.05$). The anthropometric distribution was statistically significant higher in case of weight, BMI, Waist Circumference and Waist Hip Ratio in case group ($P>0.05$). while in case of Hip circumference was significant lower in case group. But age and height were insignificant deference in both groups. Blood Sugar level (Fasting Plasma Glucose, Insulin level and HbA1c) were significantly higher in the case group in comparison to control group ($P<0.001$) [Table no. 1].

Table 1: Patients characteristics and sugar profile

		Group		P value
		Case (n=160)	Control (n=160)	
Sex	**Male**	96 (66.2%)	106 (60.0%)	0.247
	Female	64 (33.8%)	54 (40.0%)	
Age (Years)	**≤50**	73 (45.6%)	82 (51.2%)	0.314
	> 50	87 (54.4%)	78 (48.8%)	
	Mean±SD	51.46±8.69	49.94±7.90	0.103
Anthropometric variables	**Weight (kg)**	75.15±10.47	70.61±10.28	**<0.001**
	Height (cm)	163.02±7.47	163.94±6.89	0.257
	Body Mass Index (kg/m^2)	28.36±4.17	26.35±4.11	**<0.001**
	Waist Circumference (cm)	90.01±5.91	85.18±4.92	**<0.001**
	HIP Circumference (cm)	99.35±5.98	100.98±7.06	**0.026**
	Waist Hip Ratio	0.91±0.06	0.85±0.04	**<0.001**
Sugar profile	**Fasting Plasma Glucose**	203.54±43.77	86.44±15.66	**<0.001**
	Insulin level	40.11±10.74	10.24±3.39	**<0.001**
	Glycated Haemoglobin (HbA1c)	10.68±2.23	5.77±0.28	**<0.001**

The serum levels of adipokines (Visfatin) level were significantly higher in the case group in comparison to control group (P<0.05). But adiponectin level was significantly lower in the case group in comparison to control group (P<0.05) **[Table no.2]**.

Table 2: Serum levels of Adipokines

Serum levels of Adipokines	Group		P value
	Case (n=160)	Control (n=160)	
Visfatin	45.35±4.64	21.44±4.51	**<0.001**
Adiponectin	5.86±0.94	10.68±1.54	**<0.001**

In **table no. 3** we noted that the Visfatin positively significant associated with weight, BMI, Waist circumference and Waist Hip Ratio; while it was negative significant correlated with HIP Circumference. It was positive insignificant correlated with age and negative insignificant correlated with height. But in case of Adiponectin negative significant associated with weight, BMI, Waist circumference and Waist Hip Ratio; while it was positive significant correlated with HIP Circumference. It was positive insignificant correlated with height and negative insignificant correlated with age. Negative sign indicates the universally correlation.

Table 3: Correlation of adipokines (Visfatin and Adiponectin) with anthropometric parameters in T2DM patients

	Visfatin		Adiponectin	
	Pearson Correlation Coefficient (r value)	P value	Pearson Correlation Coefficient (r value)	P value
Age	0.076	0.175	-0.068	0.226
Weight	0.200**	**<0.001**	-0.184**	**<0.001**
Height	-0.078	0.167	0.077	0.169
BMI	0.230**	**<0.001**	-0.214**	**<0.001**
Waist circumference	0.402**	**<0.001**	-0.377**	**<0.001**
HIP Circumference	-0.132*	**<0.001**	0.140*	**0.012**
Waist Hip Ratio	0.519**	**<0.001**	-0.502**	**<0.001**
**. Correlation is significant at the 0.01 level (2-tailed).				
*. Correlation is significant at the 0.05 level (2-tailed).				

In **table no. 4** we noted that the Visfatin positively significant associated with fasting plasma glucose, insulin level and HbA1c. But in case of Adiponectin negative significant associated with fasting plasma glucose, insulin level and HbA1c.

Table 4: Correlation of adipokines (Visfatin and Adeponectin) with biochemical parameters in T2DM patients

	Visfatin		Adiponectin	
	Pearson Correlation Coefficient (r value)	**P value**	**Pearson Correlation Coefficient (r value)**	**P value**
FPG	0.972**	**<0.001**	-0.947**	**<0.001**
HbA1c	0.938**	**<0.001**	-0.900**	**<0.001**
Insulin	0.973**	**<0.001**	-0.945**	**<0.001**
**. Correlation is significant at the 0.01 level (2-tailed).				
*. Correlation is significant at the 0.05 level (2-tailed).				

Discussion:

Development of a method for suitable estimate of blood sugar level in regular clinical practice offerings a main challenge for physicians and public health policy makers. The present study provided suggestion of the effectiveness for assessment of serum adiponectin level as an appropriate and sensitive oxidative stress biomarker for the estimation of blood sugar level particularly in our study area.

Our study noted that in case groups, 66.2% male and rest were female and in control groups 60.0% were male and 40.0% were female patients. We found that the statistically insignificant higher older age population in case group distribution in compare to control group (P>0.05). Present study noted the statistically significant higher weight, BMI, Waist Circumference and Waist Hip Ratio in case group in compare to control group (P>0.05). while hip Circumference was significant lower in case group. But height was insignificant deference in both case and control groups. Blood Sugar level (Fasting Plasma Glucose, Insulin level and HbA1c) were significantly higher in the case group in comparison to control group (P<0.001).

This study noted the serum levels of adipokines (Visfatin) level were significantly higher in the case group in comparison to control group (P<0.05). But adiponectin level was significantly lower in the case group in comparison to control group (P<0.05). The results showed significantly decreased levels of adiponectin in the T2DM patients compared to the control group, which is in agreement with the results of earlier studies. [12, 20,21] The decrease was more pronounced in the obese and severely obese T2DM patients, which corroborates the results of earlier reports, which showed significant decreases in adiponectin levels in overweight and obese diabetics. [22,23,24] Snehalatha C et al [25] also reported the adiponectin level was lower in the diabetic subjects than in the non-diabetic subjects (11.3 ±5.5 vs. 16.7 ±7.6 μg/ml; P = 0.0017). Y. Premchandra singh et al [26] reported the adiponectin level was lower in the diabetic subjects than in the non-diabetic subjects (6.07 ± 1.02 vs. 7.48 ± 1.91 μg/ml; P = 0.003). The present study agrees previous findings that type II diabetes and metabolic syndrome were associated with low serum adiponectin concentrations. Low adiponectin level was a strong predictor of future development of diabetes, also showed a positive predictive association. Nur Firdaus Isa et al [27] reported the no significant difference of the adiponectin level between hyperglycemic and non-hyperglycemic in their studied subjects. Increasing the sample size and expanding their cross-sectional study to a cohort study with longer follow-up may fill in the gaps.

In this study we noted that the Visfatin positively significant associated with weight, BMI, Waist circumference and Waist Hip Ratio; while it was negative significant correlated with HIP Circumference. It was positive insignificant correlated with age and negative insignificant correlated with height. But in case of Adiponectin negative significant associated with weight, BMI, Waist circumference and Waist Hip Ratio; while it was positive significant correlated with HIP Circumference. It was positive insignificant correlated with height and negative insignificant correlated with age. Negative sign indicates the universally correlation. Y. Premchandra singh et al [26] reported the relationship of adiponectin with waist circumfernce appeared to be stronger than other obesity indices or BMI, indicating that central fat distribution (visceral obesity) is a better determinant of circulating adiponectin than total fat mass. Waist circumference in female was (>80 cm-5.98±1.18 μg/ml vs 9.9±2.7 μg/ml; P<0.001) and Waist circumference in male was (> 90 cm 5.81±4.10 μg/ml vs 7.90±0.05 μg/ml; P<0.001). Blaslov K et al [28] reported the patients with higher adiponectin level (n = 39) had significantly lower waist circumference (P< 0.002). Taniguchi A et al [29] reported the serum adiponectin level was negatively correlated to BMI (r = −0.308, P =0 .002).

Similarly, our results of visfatin levels in individuals with and without T2DM are consistent with several previous studies showing that visfatin levels are increased in individuals with overweight and T2DM compared to controls. [30,31] Visfatin serum levels are significantly correlated with the accumulation of white adipose tissue (WAT), and visfatin expression was increased during the differentiation of adipocytes and according to the destruction of β cells. [32,33] The negative correlation between the

levels of visfatin and glucose indicates that visfatin is an important indicator for the development of obesity and related T2DM. [34]

Limitations

This was a cross-sectional study which does not allow for conclusions regarding causality. This study included middle-aged individuals, without prevalent cardiovascular disease. Caution is thus needed in the extrapolation of the findings to other populations, i.e. younger, of other ethnicity or with cardiovascular disease. Moreover, metabolic or hypertension were less prevalent than type 2 diabetes mellitus and impaired fasting glucose in the study population. Finally, the adipokines measured are only a small fraction of the wide array of pro- and anti-inflammatory biochemical indices that are produced by the adipose tissue.

Conclusion:

In conclusion, the present results suggest that circulating levels of visfatin and adiponectin are reduced in the presence of the diabetes and also decrease as the number of diabetes parameters increases. The association of adiponectin with weight, BMI, waist circumference and waist/hip ratio may partly explain the lower levels of adiponectin found in individuals with diabetes. Further prospective studies are needed to confirm the mechanisms underlying this association. The present study provided suggestion of the effectiveness for assessment of serum adiponectin level as an appropriate and sensitive biomarker for the estimation of diabetes and inflammation. Prospective and population-based studies along with interventions to increase adiponectin level are however required to confirm the associations.

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