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Association of Adiponectin with Components of Metabolic Syndrome in Western U.P

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Abstract

Introduction: Obesity is common and unequivocally associated with several serious complications as Metabolic Syndrome (MetS). Despite considering obesity as a defaulter in reducing life expectancy, an exponential weight gain from one generation to the next is not inevitable. According to International Diabetes Federation (IDF), central obesity is a must criterion to define MetS. A number of obesity related peptide hormones have been recognised to play a role in the pathogenesis of MetS. Adiponectin is a recently identified most abundant adipose-tissue derived protein that is potentially anti-atherogenic & anti-inflammatory in nature. Out of all adipokines secreted from adipose tissue, only adiponectin founds to be reduced with increasing obesity.

Material Method: Adiponectin (ADI) level varies depending on gender, age & ethnic background therefore we aim to circulate and explore the relation of serum adiponectin with escalating components of MetS in study population of Meerut (U.P) India. It is necessary to find accountability of adiponectin in MetS prior to its implementation in clinical practice. The study was conducted on MetS patients attending OPD of Chhatrapati Shivaji Subharti Hospital, Meerut from December 2016-December 2017. Total of 175 subjects (122 with MetS and 53 non-MetS) were included. Their anthropometric parameters, sugar, Lipid & Adiponectin level were measured.

Result: On comparison between controls & the subject of MetS, level of serum adiponectin was significantly lower ($p<0.05$) in the subjects with MetS. Adiponectin is positively correlated with age, diastolic B.P, cholesterol, HDL & LDL while negatively correlated with BMI, systolic B.P, Fasting glucose, TG & VLDL. Serum adiponectin is decreasing with the increasing number of MetS components being insignificantly higher among females than males ($p\geq0.05$).

Keywords: Obesity, Adipokines, Adiponectin, Metabolic Syndrome, BMI, Diabetes Mellitus.

Introduction

The metabolic alterations in lipid and carbohydrates frequently cluster together in a disorder known as Metabolic Syndrome (Mets). Due to life-style variations and ethnic diversity there is an elevated prevalence of MetS worldwide [1] which become a health challenge in India [2]. India having population about 1.2 billion of

which more than 108 million peoples are suffering from multiple endocrine & metabolic disorders [3]. In recent years a continuous upward trend of obesity have been reported among Indians. Although we have enough clinical data of biological drivers of obesity, which include low quality diet, excessive sedentary lifestyle, less physical activity, stress, sleep deprivation and environmental pollutants put an effective strategy to address these drivers with sufficient intensity, consistency, and persistence is still lacking. Today obesity and diet-dependent development of MetS are considered as a global health problem [4]. People diagnosed with MetS are supposed to be more susceptible for developing Type 2 diabetes mellitus (T2DM), cardiovascular diseases (CVD) and cancer etc [5]. It has been documented that MetS develops in obese subjects. Extensive research efforts put forwarded, the pathogenesis of MetS is still neither clear nor completely understood and even their treatment is often unsatisfactory [6]. The genetic, physical inactivity, ageing, a proinflammatory state & hormonal changes may have a casual effect, but the role of these may vary depending on ethnic groups [7].

It has been documented that adipose tissue regulates energy storage. Impairment of adipose tissue leads to the secretion of many adipokines that have been entangled as risk factors for promotion of MetS. Recent studies revealed that being the body's largest endocrine organ, it secretes variety of bioactive adipocytokines which include free fatty acids (FFAs), Leptin, Adipsin, Resistin, Visfatin & Adiponectin etc [8]. Adiponectin-an adipocyte derived protein considered to play an important role in obesity through its anti inflammatory, anti-diabetic and anti-atherogenic properties [9]. Many studies have focused on the presence and absence of Adiponectin in relation with MetS, but the role & relation with degree of severity of MetS is not documented at all [10]. The mechanism by which MetS develops in certain obese individuals and not in others is not understood. There is paucity of literature & knowledge on circulatory adiponectin levels & its relationship with Mets in Indian population. The study explores the relation of circulatory adiponectin with components & its association with the degree of severity of MetS.

Material & Method

The present case-control study was carried out on consecutive MetS patients who refered to Chhatrapati Shivaji Subharti Hospital, Meerut with dyslipidemia and underwent fasting blood test of sugar & lipid profile from December 2016 to November 2017. A total of 122 adult subjects (50 male and 72 female) of age ≥ 25years and ≤ 60 years were included in the study. Age, sex matched 53 subject (32 males and 21 females) healthy control were enrolled in the study.

Overnight fasting 5ml venous blood sample in plain vials were collected from study patients referred for evaluation of MetS. The serum was separated & stored in duplicate aliquots. One out of two aliquots was used for the immediate assays for fasting glucose & lipid profile. The other aliquots were stored at -80^{o}C for the subsequent assay of adiponectin.

A written consent from all the patients and control subject was obtained and followed by collection of personal data from patients and healthy control in well designed pretested questionnaire. The questionnaire included socio-demographic characteristics such as age, gender, occupation, socio-economic status, literacy, nationality, physical examination including pulse, blood pressure, height, weight, lifestyle habits like smoking, alcohol consumption and diet, drug history, etc. The clinical and biochemistry laboratory investigations such as fasting & post prandial blood glucose, total cholesterol, HDL, Non-HDL, LDL cholesterol levels and TGs.

Patients fulfilling IDF criteria were followed. The serum Adiponectin levels were assayed by readymade kits procured form M/S Assaypro Pvt. Ltd., USA for Human Adiponectin ELISA Kits. Lipid & Diabetic profile parameters were quantified on samples collected in the fasting state by using enzymatic assays. LDL-C was calculated using the Friedewal's formula for patients with TG ≤ 400 mg/dl, whereas levels of non-HDL-C were calculated by subtracting HDL-C from total cholesterol. Height and weight were measured using standard method. The body mass index (BMI) was calculated as the weight in kilograms divided by height in meters square. Blood pressure was recorded using standard mercury sphygmomanometer pre-calibrated instrument and the mean of two readings were reported five minutes apart.

Statistical Analysis

The data analysed using SPSS statistical package software version 17. The variables expressed as Mean ± SD, Student's *t*-test was used to ascertain the significance of differences between mean values of two groups. Pearson's Correlation was used to determine the correlation MetS with risk factors. Correlation regression analysed using same software. P-value ≤ 0.05 is considered statistically significant.

Result

The comparison between study & control groups revealed significant differences in demographic & biochemical parameters. The subject having MetS had significantly lower adiponectin levels with the mean ± SD value 25.26 ± 2.34 while control subjects had 26.36 ± 3.15 ng/ml level of adiponectin (p≤0.05). Similarly Blood sugar, HDL-cholesterol, LDL-cholesterol in respect to both group are also found significant i.e. (p≤0.05). Furthermore BMI, B.P Triglycerides & VLDL-Cholesterol were highly significant i.e. (p < 0.001).

While there were no significant differences in age, Total Cholesterol & Non-HDL-C levels between control and MetS groups (p≥0.05). The comparison between anthropometric and metabolic parameters of the study subjects are shown in Table-1

Correlation analysis between biochemical variables of the control and MetS group are shown in Table 2, adiponectin levels were insignificant and positively correlated with Age, Diastolic B.P, post prandial Sugar, Total Cholesterol, HDL, Non-HDL-C, LDL respectively. Furthermore there was insignificant and negative correlation of adiponectin with BMI, Systolic B.P, Fasting blood sugar, Triglycerides & VLDL.

TABLE 1: Clinical characteristics of subjects with and without MetS

Sr. No.	Variables	Metabolic Syndrome (MetS)		P-value
		Control (n=53)	Case (n=122)	
1	AGE (Years)	41.18 ± 10.57	42.92 ± 10.28	NS
2	BMI (Kg/m^2)	30.72 ± 1.61	33.30 ± 2.28	< 0.001*
3	SBP (mmHg)	130 ± 7.96	145.59 ±16.39	< 0.001*
4	DBP (mmHg)	82.2 ± 5.39	88.31 ± 10.60	< 0.001*
5	FBG (mg/dl)	92.74 ± 7.03	109.73 ± 37.82	.002*
6	PP-BG (mg/dl)	126.86 ± 8.01	152.36 ± 64.86	.006*
7	TC (mg/dl)	197.54 ± 24.28	200.13 ± 39.77	NS
8	TG (mg/dl)	116.96 ± 28.30	210.53 ± 75.25	< 0.001*
9	HDL-C (mg/dl)	49.22 ± 7.92	44.03 ± 11.17	.003*
10	N.HDL-C (mg/dl)	148.32 ± 24.65	155.32 ± 39.22	NS
11	VLDL-C (mg/dl)	23.39 ± 5.66	42.09 ± 15.07	< 0.001 *
12	LDL-C (mg/dl)	125.15 ± 23.86	114.51 ± 35.61	.047 *
13	ADI (ng/ml)	26.36 ± 3.15	25.26 ± 2.34	.013*

* P≤0.05 is statistically significant. NS- Non Significant

TABLE 2:
Pearson's correlation of Adiponectin with parameters of MetS.

Sr. No.	Variables	Adiponectin(ng/ml)	
		r	p
1	AGE (Years)	0.080	0.380
2	BMI (Kg/m^2)	-0.072	0.432
3	SBP (mmHg)	-0.076	0.406
4	DBP (mmHg)	0.112	0.218
5	FBG (mg/dl)	-0.031	0.738
6	PP-BG (mg/dl)	0.048	0.602
7	TC (mg/dl)	0.059	0.522
8	TG (mg/dl)	-0.172	0.059
9	HDL-C (mg/dl)	0.070	0.441
10	N.HDL-C (mg/dl)	0.065	0.477
11	VLDL-C (mg/dl)	-0.175	0.053
12	LDL-C (mg/dl)	0.102	0.264
13	Adiponectin (ng/ml)	1.000	-

ADI- Adiponectin r = regression correlation

The characteristics of the subjects with different number of MetS components are shown in Table 3. Out of all study subjects 12 subjects had only 1 component, 54 subjects had 2 components, 46 subjects with 3 components and 22 subjects had 4 components of MetS respectively. Subjects were grouped according to the number of Mets component present like-wise 1, 2, 3 & 4. There were total 122 subjects fulfilling the criteria of MetS. There was no significant difference in age among these four groups. All subjects were overweight/obese (BMI ≥ 25 kg/m2), but those with MetS were significantly more obese compared to the non MetS group ($p < 0.001$). Systolic & Diastolic B.P showed an increasing trend with the increasing number of components. Fasting and post prandial sugar scored mixed values with increasing components.

Total Cholesterol, Triglycerides, N.HDL-C, VLDL-C & LDL-C were higher in the group with higher components of MetS. While HDL-C & Adiponectin level were low with the increasing components of MetS. It has been observed that as the number of MetS components increased the mean serum adiponectin levels declined. The diagnostic presentation illustrated in Fig – 1. Total of 41 subjects out of 175 were have 0 components. Here 0 refers presence of no component of Mets.

TABLE 3: - Demographic and biochemical characteristics present in one or more components of MetS

Parameters	PRESENCE OF NUMBER OF MetS COMPONENTS			
	1(n=12)	2(n= 48)	3(n=41)	4(n=21)
Age (Years)	44.33 ± 7.39	42.38 ±11.24	44.17 ± 9.77	41.13 ± 8.70
Body Mass Index (Kg/m^2)	31.66 ± 0.81	33.57 ±1.99	33 ± 2.60	33.18 ±2.30
Systolic B.P (mmHg)	137.33 ± 8.64	142.74 ±17.22	147.17± 17.06	149.54 ±17.19
Diastolic B.P (mmHg)	82.5 ± 2.73	87.35 ± 6.06	88.88 ±13.60	89.45± 10.12
Fasting Glucose (mg/dl)	89.5 ± 7.44	107.61 ± 42.49	110.51 ± 31.59	109.72 ± 41.70
Post-Prandial Glucose (mg/dl)	125.16 ± 3.06	150.96 ± 64.57	155.86 ± 67.39	141.54 ±11.40
Total Cholesterol (mg/dl)	187.83 ± 18.79	193.68 ± 42.74	203.84 ± 39.20	208.54 ±32.77
Triglycerides (mg/dl)	112.16 ± 32.80	188.57 ± 77.71	216.42 ± 77	253.95 ± 85.67
HDL-C (mg/dl)	46.33 ± 8.35	45.79 ± 13.23	43.95 ± 9.46	39.36 ± 7.31
N.HDL-C (mg/dl)	141.5 ±16.37	146.12 ± 41.26	159.88 ± 39.07	169.18 ± 29.96
VLDL-C (mg/dl)	22.43 ± 6.56	37.74 ± 15.57	43.34 ± 11.40	50.77 ± 17.10
LDL-C (mg/dl)	119.06 ± 17.30	110.03 ± 33.39	116.04 ± 36.95	122.72 ± 38.77
Adiponectin (ng/ml)	26.50 ± 3.41	25.53 ± 2.41	25.19 ± 2.38	24.71 ± 2.14

Values expressed as Mean ± SD, N. HDL-C = Non-HDL Cholesterol.

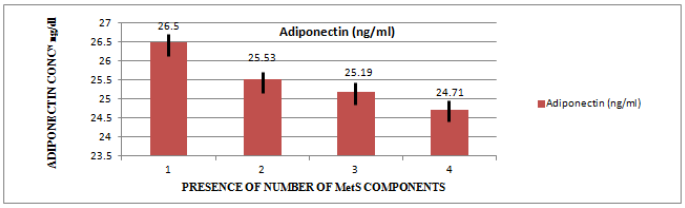

Figure: 1 Distribution of Adiponectin levels in subjects with increasing component of MetS

Discussion

In India due to rapid economic growth, lifestyle obesity is pandemic. Obesity is becoming a burden on health that extends across multiple organ systems & diseases. An obesity and diet dependent development of MetS are considered as a global health problem [4]. According to International Diabetes Federation (IDF) definition for a person to be defined as having the MetS must have central obesity as a core feature with obesity related disorders that includes abnormal Blood pressure, Tg, HDL, Cholesterol, Glucose [8]. Despite extensive research, the factual

underlying cause of the MetS continues to challenge the experts. Factors including Insulin resistance, central obesity, genetics, physical inactivity, ageing, a proinflammatory state & hormonal changes have casual effect, but the role of these may vary depending on presence of ethnicity. To asses community at risk for the development of MetS, several markers have been studied, with majority of them related to the adipose tissue[11].The studies performed during last decade revealed that being the body's largest organ–An Adipose tissue not only stores excess fat for body energy but also secretes variety of adipocytokines. These includes leptin, tumor necrosis factor-alpha (TNF-α), adipsin, resistin , visfatin & adiponectin etc [12]. Adiponectin is a adipokine of interest for researchers these days. Adiponectin inhibits the expression of TNF-α in adipocytes and both TNF- α & IL-6 inhibits the metabolism of adiponectin [13]. Hence our main objective was to identify & quantify the association of adiponectin with the increasing components of MetS.

In present study we have evaluated 122 subject with MetS (IDF criteria) and 53 control. Our study highlights statistical significant difference between the MetS Group compared with control group. Subjects with MetS had significantly higher BMI, B.P, Glucose, Tg & VLDL than controls while adiponectin levels were significantly lower in MetS than control ($p \leq 0.05$). This is in agreement with published data from Imphal, study conducted on Indian Manipuri population which showed significantly decreased adiponectin levels in Mets individuals [2]. Similar to the finding of present study several studies reported that MetS patients had lower circulating adiponectin levels than the control subjects ($p \leq 0.001$) [14, 15]. Some studies documented a conflicting results regarding role of adiponectin as in previous study among Cuban American reported higher adiponectin levels in MetS [16] and another study found low adiponectin levels which were statistically insignificant [17]. One study showed that the raised adiponectin is associated with increased rather than decreased risk of cardiovascular disease (CVD) and mortality at older age [18]. Present study finding reciprocate that the adiponectin levels are higher in women than men [19] but with the difference that our data showed insignificant difference between adiponectin level of both sexes. Whereas study reported that there is no difference in adiponectin levels between sexes. Adiponectin was positively correlated with Age, Diastolic B.P, post prandial Sugar, Total Cholesterol, HDL, N. HDL, LDL, etc Furthermore there was a negative correlation of adiponectin with BMI, Systolic B.P, Fasting blood sugar, Triglyceride & VLDL-C. Almost similar association reported by Ryu et al. in his study [20]. However, few differences were observed between the present study & other studies. In this study adiponectin showed a positive correlation with age & total cholesterol while other has reported negative correlation.

In the present study, the serum adiponectin was significantly correlated with every component of metabolic syndrome. The major finding of present study is that those subjects possessing highest number of MetS components had lower levels of adiponectin. Thus decreasing level of adiponectin with increasing components reflects higher probability of having MetS when compared with those with the fewer components of MetS. Similar results were documented from China in which adiponectin levels were declined with the increase number of Mets component.

Conclusion

Present study concludes that an association between the decreased Adiponectin levels and presence of MetS is higher in female compared with men. We found an inverse relationship between Adiponectin concentration and presence of MetS components. Study conclude that

Adiponectin as marker have significant clinical value of diagnostic marker for MetS. Adiponectin thus explain the risk of MetS. Two identify earliest & initiate adequate treatment to end the worsening epidemic of MetS, we are of opinion that a prompt monitoring of Adiponectin levels as clinical criterion will be a crucial step in the battle against MetS diagnosis at earliest stage which helps to initiate treatment promptly.

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References

1. Clarisse Noel A, Francky Teddy A, Samuel Honore M, Jean Jacques N, et al. "Association of the leptin-to- adiponectin ratio with metabolic syndrome in a sub-Saharan African population". Diabetology & Metabolic Syndrome, 2017;9(66):1- 6.
2. Premchandra Singh Y, Tilakeswari Devi L, Joshita L, Romola Devi TH. et al. "Plasma adiponectin is an Independent Predictor of Metabolic Syndrome". Journal of Dental and Medical Sciences, 2012; 2(4):34-43.
3. Ahmed N, Nagtilak S, Kumar A, Parashar . et al. "Role of Circulating protein in Thyroid Disorders". Journal of Medical Science and Clinical Research. 2018; 6(2):485-489.
4. Reaven GM: "The Insulin resistance syndrome: Definition and dietary approach to treatment". Annu Rev Nutr, 2005; 25: 17.1-17.6.
5. Le L, Li K, Li L, Fang X, Zhou T, Zhang C, et al. "Circulating zinc-α2-glycoprotein levels are low in newly diagnosed patients with metabolic syndrome and correlate with adiponectin". Nutrition & Metabolism, 2017;14(1):1-7.
6. Gharipour M, Sadeghi M, Mansourian M, Andalib E, Talaie M, Mohamadifard N, et al. "Correlation of circulating inflammatory markers, ghrelin, adiponectin with obesity indices in subjects with metabolic syndrome". Pak J Med Sci, 2013; 29(1)Suppl:264-268.
7. Kassi E, Pervanidou P, Kaltsas G, Chrousos G. "Metabolic Syndrome: definitions and controversies". BMC Med, 2011;9(48): 1-13.
8. Hirose H, Yamamoto Y, Seino-Yoshihara Y, Saito I. "Serum high- molecular –weight adiponectin as a marker for the evaluation and care of subjects with metabolic syndrome and related disorders". Journal of Atherosclerosis and Thrombosis, 2017; 17:1201-1211.
9. Chen M.C., Lee C.J., Yang CF, Chen Y.C, et al."Low serum adiponectin level is associated with Metabolic syndrome and is an independent marker of peripheral arterial stiffness in hypertensive patients". Diabetology and Metabolic syndrome, 2017;9(49):1-10.
10. Ayina C.N, Endomba F.T, Mandengue S.H, et al. "Association of the leptin-to-adiponectin ratio with metabolic syndrome in a sub-Saharan African population." Diabetology & Metabolic Syndrome, 2017;9(66):1-6.
11. Lara-Castr, C.; Fu, Y.; Chung, B.H.; Garvey, W.T. "Adiponectin and the metabolic syndrome: mechanisms mediating risk for metabolic and cardiovascular disease". Curr. Opin. Lipidol. 2007;18: 263-270.
12. K, Prins J, Venkatesh B. Clinical Review: Aprahamian T.R., Sam F. "Adiponectin in

cardiovascular Inflammation and Obesity". International Journal of Inflammation. 2011; 1-8.

13. Tabak O, Simsek G, Erdenen F, et al. "The relationship between circulating irisin, retinol binding protein-4, adiponectin and inflammatory mediators in patients with metabolic syndrome". Arch Endocrinol Metab. 2017;61(6):1-9.
14. Abu-Farha M, Behbehani K, Elkum N. "Comprehensive analysis of circulating adipokines and hsCRP association with cardiovascular disease risk factors and metabolic syndrome in Arabs".Cardiovascular Diabetology. 2014; 13(76):1-10.
15. Simao A.N.C, Lozovoy M.A.B, Simao T.N.C, et al. "Adiponectinemia is associated with uricemia but not with proinflammatory status in women with Metabolic Syndrome".Journal of Nutrition and Metabolism. 2012;12:1-7.
16. Sepulveda KK, Huffman FG, Mclean M, Zarini GG. "Increased adiponectin among Cuban American type 2 Diabetes with Metabolic syndrome". FASEB J. 2009; 23:547-8.
17. Mori Y, Hoshino K, Yokota , Itoh Y, Tajima N. "Role of hypoadiponectinemia in the metabolic syndrome and its association with post-glucose challenge hyper-free fatty academia. A study in prediabetic Japanese males". Endocrine. 2006;29:357-61.
18. Wannamethee S. G, Welsh P, Whincup P.H.et al. "High adiponectin and increased risk of cardiovascular disease and mortality in asymptomatic older men: does NT-proBNP help to explain this association?" European Journal of preventive cardiology. 2010;18:65-71.
19. Garg M.K, Dutta M.K, Mahalle N. "Adipokines (adiponectin and plasminogen activator inhibitor-1) in metabolic syndrome. Indian". Journal of Endocrinology and Metabolism. 2012;16:116-123.
20. Ryu H.K, Yu S.Y, Park J.S, Chori Y.J, et al. "Hypoadiponectinemia is strongly associated with metabolic syndrome in Korean type 2 diabetes patients". J Am Coll Nutr. 2010; 29:171-8.