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Role of Serum Adiponectin in Patients with Metabolic Syndrome

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KEYWORDS

Adiponectin, Cardiovascular Disease, Dyslipidemia and Metabolic Syndrome

ABSTRACT:

Introduction: Adiponectin is a significant adipocytokine that is mostly released by fat-containing adipocytes and is essential for oxidative stress, inflammation, and the metabolism of glucose and lipids. It has been demonstrated that changes in adiponectin levels directly impact glucose and lipid metabolism, which in turn raises the production of lipids, free fatty acids, and inflammatory cytokines.

Objectives: The present study aimed to determine the role of serum adiponectin in patients with metabolic syndrome.

Methods: The observational cross-sectional study department of general medicine, Akash Institute of Medical Sciences and Research Centre, Bangalore, Karnataka, India, hospital-based study between July 2019 and Aug 2020. Total 120 subjects included in the study, among this: newly diagnosed metabolic syndrome (n=40), metabolic syndrome (n=40) and 40 healthy controls age, gender matched healthy controls. For all the subjects anthropometric, demographic, biochemical and serum adiponectin data was noted.

Results: The serum adiponectin significantly and drastically decreased in newly diagnosed metabolic syndrome, and metabolic syndrome when compared to controls (P=0.001**). These levels were significantly and positively correlated with blood pressure, blood sugars, and dyslipidaemia.

Conclusions: Serum adiponectin levels that are significantly lower may be helpful in identifying cardiovascular complications in patients with metabolic syndrome.

1. Introduction

Metabolic syndrome (Met S) might be regarded as an important worldwide health issue. Its pathophysiology is a complex interplay of metabolic, physiological, biochemical, and clinical abnormalities linked to a higher risk of T2DM, atherosclerotic cardiovascular disease (ASCVD), and early death (1-2). The prevalence of metabolic illnesses, such as obesity, type 2 diabetes, hypertension, hyperlipidaemia, and non-alcoholic fatty liver disease (NAFLD), has significantly increased globally during the last 50 years (3-4). Insulin resistance, adipose tissue dysfunction, chronic inflammation, oxidative stress, disruption of the circadian rhythm, microbiome, genetic variables, and maternal programming are among the factors that contribute to Met S (5). It is becoming more well acknowledged that metabolic syndrome is an early clinical sign that helps identify and prevent many disorders.

Adiponectin is a 30 kDa glycoprotein with 244 amino acid residues. It is made up of a collagen-like sequence, a non-homologous or hypervariable area, an N-terminal signal sequence, and a C-terminal globular region (6-7). It is an adipocytokine that alters glucose homeostasis, prevents the activation of the renin-angiotensin system, and has anti-inflammatory and anti-atherogenic properties in controlling insulin sensitivity, glucose, and lipid metabolism (8). Adiponectin affects body weight, metabolic rate, and food intake by increasing peripheral tissues' sensitivity to insulin receptors. Insulin resistance was demonstrated to deteriorate, and in those with elevated insulin levels, a decrease in the bioactive adiponectin was associated with worsening insulin

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resistance (9). Adiponectin levels are lowered by oxidative stress and inflammation, both of which are linked to insulin resistance. Adiponectin's impact and role in lipid metabolism and metabolic diseases have been demonstrated in a number of research (10). Therefore, it can be regarded as a potential target for metabolic syndrome treatment in order to lessen its worldwide burden. To measure the levels of adiponectin in newly diagnosed metabolic syndrome and metabolic syndrome.

2. Objectives

The present study aimed to determine the role of serum adiponectin in patients with metabolic syndrome.

3. Methods

The observational cross-sectional study was carried out at in the Department of Medicine at Akash Institute of Medical Sciences and Research Centre, Bangalore, Karnataka, India between July 2019 and Aug 2020. One hundred twenty patients attended to the general medicine OPD, 40 newly diagnosed with metabolic syndrome and 40 remaining 40 metabolic syndrome according to the International Diabetic Federation (IDF). The 40 age, gender, body mass indexed healthy controls also included for this study. The study approval by institutional ethics committee and the subjects were recruited after taken consent forms from all the study participants.

IDF Criteria (11) for Met S, Visceral obesity, which is defined as a waist circumference of 102 cm for men and 88 cm for women, fasting plasma glucose of 100 mg/dL, systolic blood pressure (SBP) of 130 mmHg and/or diastolic blood pressure of 85 mmHg, or a patient receiving antihypertensive medication, serum triglycerides of 150 mg/dL or a patient receiving lipid-lowering medication, and HDL-cholesterol (HDL-C) of less than 40 mg/dL in men and less than 50 mg/dL for women. Pregnant and feeding women, people with acute or chronic infectious disorders, liver or renal diseases, heart conditions, hyperthyroidism, urinary tract infections, and those who were reluctant to participate were all excluded from the study.

Each participant contributed a five-millilitre (mL) fasting blood sample, which was given out as follows: One millilitre ought to be put into a fluoride tube, two millilitres ought to be put into an EDTA tube, and three millilitres ought to be put into a plain tube. Centrifugation was used to separate the serum and plasma, and aliquots were appropriately labelled and kept at -50°C until analysis.

Standard laboratory techniques were used to measure high density lipoprotein (HDL), total cholesterol (TC), triglycerides (TGL), and fasting blood sugar (FBS). The immunoturbidometric approach was used to detect glycated haemoglobin (HbA1c), and the Chem Ultra-Euro Fully automatic analyser, Mindray CL-1200i, and Immuno Assay Automatic Analyzer were used to quantify adiponectin levels using the Enzyme-Linked Immunosorbent Assay (ELISA).

The data distribution was analyzed using the Kolmogorov-Smirnov test and then reported as mean ± standard deviation (SD). While Pearson's correlation was employed to examine the relationship between serum adiponectin and other characteristics among the research participants, analysis of variance (ANOVA) was utilized for group comparisons. A statistically significant p value was defined as one that was less than 0.05. All statistical analyses were performed using Microsoft Office Excel and the Statistical Package for the Social Sciences (SPSS).

4. Results

The patients' clinical, biochemical, and demographic characteristics are shown in Table 1. Subjects with Met S had significantly higher weight, height, age, diastolic blood pressure (DBP), systolic blood pressure (SBP), and body mass index (BMI) than controls (P = 0.001**). FBS, PPBS, and lipid profile mean ± SD were substantially higher in Met S than in controls (P = 0.001**). In comparison to controls, the thyroid profile demonstrated statistical significance (P = 0.001**). Furthermore, we discovered that Met S patients had substantially reduced serum adiponectin levels than controls (P = 0.001**).

When compared to healthy controls, newly diagnosed with metabolic syndrome and metabolic syndrome had significantly higher levels of age, height, weight, BMI, SBP, and DBP (P = 0.001**). There were significantly higher levels of FBS, PPBS, TGL, TC, HDL, VLDL, and LDL (P=0.001**). Additionally, the newly diagnosed with metabolic syndrome, metabolic syndrome patients

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significantly decreased serum adiponectin (P= 0.001**) when compared to controls (Table 2).

Table 3 displays the results of the pearson's correlation analysis between the serum adiponectin and other study variables. The BMI, FBS, PPBS, TGL, TC, VLDL, and LDL all showed a significant negative connection with serum adiponectin (P = 0.001**), while HDL showed a substantial positive correlation (0.001**) with serum adiponectin.

5. Discussion

The metabolic syndrome increases the risk of type II diabetes mellitus and atherosclerotic cardiovascular diseases. It is characterized by a number of metabolic problems, including insulin resistance, dyslipidaemia, hypertension, and central obesity. The diagnosis of metabolic syndrome requires three or more of these metabolic abnormalities, highlighting the vital need for early detection and intervention strategies (20). The prevalence of metabolic syndrome has significantly increased during the past 20 years. Met S levels are significantly elevated in 20–25% of the global population (21). The thyroid and adipocytes in Met S individuals produce numerous difficulties, including hypothyroidism, type 2 diabetes, and cardiovascular disorders [19]. Thyroid dysfunctions and metabolic syndrome are the two most common endocrine disorders, and they significantly overlap. Both have a significant worldwide impact on health care because of their high correlations with morbidity and mortality (22). The previously mentioned central anomalies in autonomic regulation are closely related to the peripheral changes that directly impact body weight management, the altered metabolism of lipids and glucose, and the control of blood pressure that are observed in metabolic syndrome (23-24).

Three different forms of adiponectin, an adipocytokine of 247 amino acids, can be found in circulation: low, middle, and high molecular weight (25). According to recent research, high molecular weight adiponectin's anti-inflammatory, antioxidative, and anti-atherogenic qualities are linked to Met S, type 2 diabetes, and cardiovascular illnesses (26-27). In the current investigation, we discovered that serum adiponectin levels were considerably lower than those of newly diagnosed metabolic syndrome and metabolic syndrome and controls. The serum adiponectin and fasting blood sugar, lipid profile, and blood pressure were found to be significantly correlated negatively in both groups of metabolic syndrome and controls. In a similar vein, earlier research revealed markedly lower serum adiponectin levels, which were negatively connected with blood pressure, blood sugar, and dyslipidaemia (28-29). The newly diagnosed metabolic syndrome and metabolic syndrome shown lower serum adiponectin levels.

6. Conclusion

Serum adiponectin levels that are significantly lower may be helpful in identifying problems in patients with metabolic syndrome. Therefore, we demonstrate the need for ongoing serum adiponectin monitoring in addition to other helpful metrics for metabolic syndrome patients.

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Table 1: Study variable comparison between the cases and controls.

Parameter	Controls			Metabolic Syndrome			P -Value
	Mean ± SD			Mean ± SD			
Age (Years)	44.08	±	5.14	48.63	±	8.31	0.001**
BMI (kg/m2)	22.00	±	1.85	30.70	±	6.71	0.001**
SBP (mmHg)	130.44	±	4.25	160.34	±	6.66	0.001**
DBP (mmHg)	72.55	±	1.54	90.56	±	4.45	0.001**
FBS (mg/dL)	81.35	±	7.69	165.51	±	26.82	0.001**
HbA1c (%)	4.77	±	0.62	8.73	±	2.61	0.001**
Total Cholesterol (mg/dL)	157.35	±	14.88	265.64	±	75.35	0.001**
Triglycerides (mg/dL)	107.50	±	17.14	194.84	±	60.05	0.001**
HDL (mg/dL)	47.45	±	5.42	31.94	±	5.71	0.001**
VLDL (mg/dL)	21.50	±	3.43	38.64	±	12.29	0.001**
LDL (mg/dL)	88.40	±	11.33	195.06	±	68.30	0.001**
Serum Adiponectin (mg/L)	8.90	±	2.59	42.23	±	25.66	0.001**

Table 2: Study variable comparison between the cases and controls.

Parameter	Newly Diagnosed Metabolic Syndrome			Metabolic Syndrome			P-Value
	Mean ± SD			Mean ± SD			
Age (Years)	40.43	±	3.71	47.88	±	4.79	0.001**
BMI (kg/m2)	22.73	±	1.65	32.19	±	3.24	0.001**
SBP (mmHg)	158.32	±	2.14	165.24	±	1.49	0.001**
DBP (mmHg)	94.76	±	0.43	102.67	±	3.71	0.001**
FBS (mg/dL)	142.38	±	8.13	160.28	±	12.28	0.001**
HbA1c (%)	6.39	±	0.60	8.25	±	1.59	0.001**
Total Cholesterol (mg/dL)	173.50	±	13.65	279.05	±	13.23	0.001**
Triglycerides (mg/dL)	127.63	±	19.44	192.40	±	19.40	0.001**
HDL (mg/dL)	37.05	±	4.42	31.57	±	3.74	0.001**
VLDL (mg/dL)	24.79	±	3.88	38.24	±	3.91	0.001**
LDL (mg/dL)	111.66	±	13.43	209.24	±	13.60	0.001**
Serum Adiponectin (mg/L)	24.15	±	2.10	41.18	±	4.88	0.001**

Tables 3: Peason correlation analysis between serum adiponectin and other study variables.

Parameter	Serum Adiponectin (mg/L)	
	r	P
BMI (kg/m2)	-0.87	0.001**
SBP (mmHg)	-0.54	0.001**
DBP (mmHg)	-0.67	0.001**
FBS (mg/dL)	-0.85	0.001**
HbA1c (%)	-0.81	0.001**
Total Cholesterol (mg/dL)	-0.90	0.001**
Triglycerides (mg/dL)	-0.88	0.001**
HDL (mg/dL)	0.80	0.001**
VLDL (mg/dL)	-0.88	0.001**
LDL (mg/dL)	-0.90	0.001**