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Original Research Article

VARIATION OF ADIPONECTIN LEVELS IN NORMAL AND OBESE MALE: POSSIBLE CORRELATION WITH ANTHROPOMETRIC PARAMETERS AND LIPID PROFILES

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ABSTRACT

Background: Adiponectin, a protein from adipose tissue, regulates glucose levels and metabolic processes. It's higher in lean individuals and lower in obesity-prone ones. Understanding adiponectin levels and their correlations with anthropometric parameters could predict obesity-related metabolic dysfunction and disease risk. **Aim and Objectives:** The aim of this study was to evaluate the association between serum adiponectin concentrations and anthropometric indices and lipid profiles among normal and obese male.
Material and Methods: In this cross sectional observational study of 60 male patients (30 normal weight, BMI 18.5- 22.9 kg/m² and 30 obese, BMI≥ 25kg/m²), participants were included which presented in medicine department. Anthropometric measurements like age, height, weight, BMI, Waist circumference, hip circumference, waist to hip ratio, were taken from each participant and serum adiponectin were measured using an enzyme-linked immunoassay. Fasting glucose and lipid profile levels determined by the glucose oxidize and enzymatic methods, were measured from overnight fasting samples respectively.
Results: Mean serum adiponectin concentration significantly decreased with obesity ($p<0.05$). Although adiponectin showed a significant negative correlation with BMI (r=-0.622), WC (r=-0.486), WHR (r=-0.420), SBP (r=-0.314), DBP (r=-0.266), VLDL (r=-0.328) levels, LDL (r=-0.264), and positively correlation with serum HDL, FBS, HC in all subjects and has no statistical significance.
Conclusion: Our results suggested that adiponectin had an inverse correlation with adiposity indices and unfavourable lipid profiles.
Key Words: Adiponectin, BMI, Obese, Lipid profile, Anthropometric indices.

INTRODUCTION

Obesity, defined as increase in the size of fat mass, is a major health problem in developing countries with many complications and is associated with the development of many diseases such as type 2 diabetes mellitus, hypertension and cardiovascular diseases.[1,2] Adipose tissue products many bioactive peptides 'adipocytokines' such as leptin and adiponectin. Adiponectin also called ARCP30, AdipoQ, and apM1, is a 247–amino acid peptide hormone, discovered in 1995 and is predominately expressed by differentiated adipocytes and other cell types that may express low levels of adiponectin.[3-5] Adiponectin is an anti-hyperglycemic, anti-atherogenic and anti-inflammatory peptide, abundant in human plasma with concentrations ranging from 5 to 30mg/mL, accounting for about 0.01% of total plasma protein, three times higher than concentrations of most other adipose tissue-derived hormones.[6-8] In a study of normal and

obese subjects, plasma adiponectin was negatively correlated with body mass index (BMI).[9] Plasma adiponectin levels are lower in individuals with central obesity than those with peripheral or general obesity. Evidence suggests that high serum adiponectin concentrations are associated with high HDL-C concentration. In contrast, data on the relationship of adiponectin and unfavorable lipid levels has been inconsistent.[10-13] Most previous studies focused on comparing serum adiponectin levels of normal individuals and patients, e.g. as in diabetic and non-diabetic subjects. In addition, there are few studies which assess these relationships in obesity. The inverse relationship of adiponectin serum level has been shown in diseases such as type 2 diabetes and cardiovascular diseases. Thus, its reduction could be considered as a contributing risk factor for development of the diseases mentioned.[14] The study explores the variation of adiponectin levels in normal and obese males, revealing its role in metabolic regulation. It suggests that understanding its levels can help identify obesity-related disorders and establish adiponectin as a biomarker for metabolic health and risk stratification. Correlations with anthropometric measures and lipid profiles could also aid in early intervention strategies for cardiovascular and metabolic disease. Considering the aforementioned, this current study aimed at evaluating correlations between serum levels of adiponectin and the anthropometric indices and lipid profiles in normal weight and obese male.

MATERIALS AND METHODS

A cross-sectional observational study, conducted at Department of Medicine, Santosh medical college and Hospital, Ghaziabad over a period of one year. total 60 subjects which presented Medicine OPD and IPD, aged 30-60 years, were selected on the basis of inclusion and exclusion criteria and divided into two groups. Were 30 obese and 30 normal weight males. Informed consent was obtained from all subjects and the protocol was reviewed and approved by the institutional ethics committee of Santosh deemed to be university, Ghaziabad, Uttar Pradesh. Individuals were asked to complete questionnaires on anthropometric characteristics, smoking, alcohol consumption, personal history of disease and use of medications. Biochemical Profile were measured from overnight fasting samples respectively.

Anthropometric measurements were taken before breakfast, with subjects wearing light clothing without shoes. All subjects were classified into 2 groups based on BMI (WHO), which was calculated as weight (kg) divided by square of height (m2).[15] Subjects included 30 men as normal weight (BMI: 18.9-22.9 kg/m2) and 30 men with obesity; (BMI >25 kg/m2). Height was measured with a wall-mounted stadiometer with an accuracy of 0.5 cm, and weight, on a digital glass scale, with an accuracy of 0.1 kg. Waist and hip circumferences were taken with a soft tape in the standing position following normal expiration, waist being defined as the narrowest circumference between the costal margin and the iliac crest and hip as the widest circumference between the waist and the thigh. Waist to hip ratio (WHR) was calculated as waist circumference divided by hip circumference.

Blood for venous blood samples (10mL), collected from all individuals, after an overnight 12 hour fast, was drawn from the antecubital vein. Sera, separated immediately after centrifugation with 3000 x g for 10 min, were stored at -70 C until biochemical analyses were performed.

Fasting blood glucose concentration was measured by glucose oxidize method (glucose kit). The intra- and inter-assay coefficients of variation were 1.74 and 1.19%, respectively. Serum lipid profiles including total cholesterol, triglycerides, and high density lipoprotein cholesterol, using commercially available kits were measured by the Automatic analyzer (Abbott Alyson). Low-density lipoprotein-cholesterol (LDL-C) was estimated indirectly using Friedewald's formula for subjects with a serum TG concentration<400mg/dL; LDL-C= total cholesterol (TC) – (HDL-C) - [triglycerides (TG) ÷ 5]. Serum adiponectin concentration was measured by the immunoassay method using a commercially human adiponectin ELISA kit (Elabscience human ADP/Acrp30 (Adiponectin) ELISA kit, Cat no. E-EL-H6122). The lowest detectable level of serum adiponectin was ng/mL and coefficients of variation were <10%, respectively. The detectable range of serum adiponectin 0.16-10 ng/mL and sensitivity was 0.1 ng/ml.

The study analyzed data using SPSS 24.0, ANOVA, Pearson correlation coefficient test, and multiple linear regression analysis. The results showed significant differences between anthropometric and biochemical measures among groups, with adiponectin's correlation with other parameters being evaluated. $P<0.05$ was considered statistically significant.

RESULTS

The study analyzed anthropometric indices in normal weight and obese male groups, revealing significant differences in height, weight, BMI, WC, and WHR. However, no significant differences were found in age. Biochemical parameters showed lower serum adiponectin levels in obese males, while lipid profiles showed higher values in obese males. Normal weight subjects had significantly higher mean serum adiponectin levels than obese individuals. However, higher mean serum lipid concentrations of LDL, TC, TGs, and VLDL were observed in obese subjects, except for HDL levels. Fasting blood sugar levels showed no significant

difference between obese and normal weight male groups. [Table 1]

Body mass index (BMI); Waist circumference (WC); Hip circumference (HC); Waist-to-hip ratio (W/H Ratio); Fasting blood sugar(FBS); Triglycerides (TGs); Total cholesterol (TC); High density lipoprotein (HDL); Low-density lipoprotein (LDL); Very low density lipoprotein (VLDL); Data are presented as mean ± SD **.Correlation is significant at the 0.01 level (2-tailed); *Correlation is significant at the 0.05 level (2-tailed).

Body mass index (BMI); Waist circumference (WC); Hip circumference (HC); Waist-to-hip ratio (W/H Ratio); Fasting blood sugar(FBS); Triglycerides (TGs); Total cholesterol (TC); High density lipoprotein (HDL); Low-density lipoprotein (LDL); Very low density lipoprotein (VLDL); systolic blood pressure (SBP); Diastolic blood pressure (DBP)

The Pearson correlation coefficient test was used to determine correlations between serum adiponectin levels and anthropometric characteristics and biochemical variables among groups (Table 2). Results indicated significant inverse correlation between adiponectin and BMI (r = -0.622, P = 0.0001); WC(r = -0.486 P = 0.0001), W/H ratio(r =-0.420, P = 0.001), SBP(r = -0.314, P = 0.015), DBP (r = -0.266, P = 0.040) levels. In our study Correlation of Adiponectin level with lipid profile shown inverse correlation except HDL level. Significant inverse correlation was found between serum adiponectin and LDL and VLDL levels (r = -0.264,P = 0.041)(r = -0.328,P = 0.011) .In contrast FBS shown positive correlation with adiponectin level which was non significant (r = 0.093,P = 0.479). [Table 2]

Table 1: Anthropometric and biochemical parameters in normal weight and obese male

Parameters	Normal weight (N=30)	Obese male (N=30)	P-value
Age	45.23 ± 9.66	43.96 ± 9.60	.613
Height	164.66 ±14.91	154.90 ± 5.91	.001**
Weight	56.41 ± 11.04	66.26 ± 5.17	.0001**
BMI	20.64 ± 1.26	27.63 ± 1.86	.0001**
WC	77.46±4.94	87.36±6.27	.0001**
HC	92.72 ± 4.84	94.73 ± 8.50	.266
W/H Ratio	0.83 ± 0.047	0.93 ± 0.135	.0001**
FBS	102.36 ± 23.86	96.43 ± 11.87	.228
TG	131.00 ± 64.58	147.40 ± 33.62	.222
VLDL	26.70 ± 4.97	29.50 ± 6.70	.072
HDL	47.50 ± 9.79	45.70 ± 7.35	.424
TC	186.46 ± 38.87	201.73 ± 22.87	.069
LDL	111.70 ± 35.14	126.53 ± 23.02	.058
Adiponectin	9.72 ± 2.12	5.88 ± 2.03	.0001**

Table 2: Bivariate Pearson correlation of serum adiponectin with lipid parameters and anthropometric indices in subjects

	Adiponectin		
	Pearson Correlation	p-value	N
BMI	-.622**	.0001**	60
WC	-.486**	.0001**	60
HC	.026	.846	60
W/H Ratio	-.420**	.001**	60
SBP	-.314*	.015*	60
DBP	-.266*	.040*	60
FBS	.093	.479	60
TG	-.203	.119	60
VLDL	-.328*	.011*	60
HDL	.085	.520	60
TC	-.245	.060	60
LDL	-.264*	.041*	60
**. Correlation is significant at the 0.01 level (2-tailed).			
*. Correlation is significant at the 0.05 level (2-tailed).			

DISCUSSION

The research examined the relationship between serum adiponectin levels and anthropometric indices and lipid profiles in obese and normal weight males. Unlike studies on healthy and unhealthy individuals, there are few on obese and non-obese males. Reduction in adiponectin levels in obese individuals may lead to common diseases like diabetes type 2, cardiovascular diseases, and obesity-related complications.[14] Our results demonstrate that serum adiponectin levels, decreased with increase in obesity and adiposity indices. A cross-sectional study in Italy of non-diabetic subjects, indicated plasma adiponectin was significantly higher in non-obese than in obese individuals. However, adiponectin, had a negative correlation with BMI, waist circumference; waist-to-hip ratio (WHR).[16] A

study in Taiwan of overweight and obese subjects reported hypoadiponectinemia in obese subjects; also, adiponectin levels were negatively correlated with BMI and WHR.[17] Another study of healthy nondiabetic adolescents indicated that plasma adiponectin was negatively related to BMI, fat mass, waist circumference and WHR.[18] Additionally, previous studies in Japanese individuals demonstrated plasma adiponectin concentration was negatively correlated with BMI and hence lower in obese, than in lean subjects, our results, in agreement with this finding, demonstrated that plasma adiponectin concentrations are inversely related to fat distribution indices (waist, hip circumferences and WHR) as the measures of adiposity.[19-21] Therefore, our results also confirm that adiponectin is the only adipose-specific protein known to date, that, despite its exclusive production in white adipose tissue, is negatively correlated with obesity, findings similar to those in rodents where the murine homologue of adiponectin-AdipoQ is also down regulated in obesity.[22] The adiponectin gene is predominantly expressed in adipose tissue and its expression decreases in obese diabetic (db/db) murrain models.[23] Results of a cross sectional study on the Indian-Caucasian women and men showed that there was an inverse correlation between adiponectin and BMI and body fat mass.[24] The molecular basis of down-regulation of adiponectin gene expression and its secretion from adipose tissue in non-diabetic obese individuals has not been completely understood. However, some researchers suggest that there is inhibition feedback process in increasing of body fat mass and increasing of other cytokines.[27] Others indicate the decrease in half-time of adiponectin molecules in blood circulation of obese subjects and increase in molecule degradation.[28] In obese subjects, with increase of BMI and body fat mass, adiponectin mRNA expression in adipose tissue is decreased, and low serum adiponectin levels are related to a higher risk of diabetes.[29] Although adiponectin is secreted mainly from adipose tissue, its levels are paradoxically lower in obese than in lean humans which is in contrast to most other adipocytokines, whose levels are increased in obesity in proportion to increasing total body fat mass. It is possible that although adiponectin expression is activated during adipogenesis, a feedback inhibition in its production may occur during development of fat mass due to increase in the production of other adipocytokines. In addition, adipocytokines such as TNF-□ may decrease adipocyte expression and secretion of adiponectin.[30] It has been suggested that with increasing grades of obesity, there may be a decrease in the metabolic functioning of adipocytes, along with hypertrophy and/or aging of these cells.[31] Other our results showed that adiponectin was inversely correlated with blood pressure, and unfavorable lipid profiles. Baratta R et al,[32] indicated that adiponectin, was negatively correlated with fasting plasma glucose, TC and triglycerides, whereas it was positively correlated with HDL-C.[16] Yang WS et al, in a study in Korea, showed that obese subjects had elevated fasting plasma glucose and triglyceride levels, but low levels of high-density lipoprotein-cholesterol.[17] Other studies report that serum adiponectin correlates negatively with serum triglycerides and LDL-C, and positively with HDL-C levels in obese subjects.[33,34] Our results, shows positive correlation with FBS and agreement with other lipid profile findings, showed that low adiponectin concentrations were associated with unfavorable lipid profiles and low concentrations of HDL-C. Regarding the relationship between adiponectin and HDL-C, it has been suggested that the possible mechanisms may partially be explained with the proxisome proliferate–activated receptor-a (PPAR-α), which affects the genes, associated with HDL-C metabolism. Adiponectin stimulated PPR-α ligand activates in liver and skeletal muscles, which results in the increased synthesis of HDL-C.[35] Results of two studies on the nondiabetic men and women by Mohlig M et al,[36] and Brame LA et al,[37] indicated that adiponectin levels were inversely associated with fasting glucose. It is speculated that adiponectin facilitates glucose uptake by increasing glucose transporter-4 expression and its translocation also stimulates glucose utilization and fatty acid oxidation in skeletal muscles and in the liver which suppresses gluconeogenesis tvin the liver.[38,39] Results of multiple regression analyses show that waist size had the most effects on serum adiponectin As previous studies indicate, waist circumference is an indicator of body fat distribution, and with increasing degrees of obesity or fat mass, levels of adiponectin tend to decrease.[18] Therefore, decrease in waist size, and increased adiponectin concentration may help lower the prevalence of obesity and its complications. The study reveals that obesity leads to decreased serum adiponectin levels, accompanied by increased anthropometric indices, blood pressure, and unfavorable lipid parameters. It recommends routine measurement of adiponectin levels in medical laboratories and abnormal levels as risk factors for obesity-related diseases. Further experimental studies are needed to understand the role of adiponectin in obesity parameters and related complications.

CONCLUSION

Adiponectin levels are significantly lower in obese males, indicating an inverse relationship with body fat and adverse anthropometric parameters. This suggests adiponectin's importance in metabolic health, suggesting monitoring its levels alongside anthropometric and lipid measures could provide valuable insights for predicting and managing cardiovascular and metabolic risks in obese individuals, highlighting the importance of metabolic health.

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