Available online at www.scholarsresearchlibrary.com

Scholars Research Library

Annals of Biological Research, 2011, 2 (6):349-355
(http://scholarsresearchlibrary.com/archive.html)

Annals of Biological Research
Scholars Research Library
ISSN 0976-1233
CODEN (USA): ABRNBW

Adiponectin in relation cardiovascular risk factors in diabetic

Eizadi Mojtaba, Eghdami Anoosh, Sohaily Shahram and Imanzadeh Reza

Department of Physical Education and Sport Science, Shahre - e - Qods Branch, Islamic Azad University, Iran

---

ABSTRACT

Adiponectin, an adipocyte-specific protein, is associated with cardiovascular risk factors in diabetic patients. The study objective was to determine whether the serum adiponectin concentration was associated with lipid profile and body composition indexes in type 2 diabetic patients. For this purpose, Forty three obese sedentary (BMI≥30) with type 2 diabetic were enrolled to the study. Serum adiponectin, lipid profiles and anthropometrical indexes were measured in all patients after an overnight fasting. Pearson correlations method was used to determine the relations of adiponectin with other variables in obese subjects. Serum adiponectin levels were negatively correlated with triglyceride (TG), total cholesterol (TC), triglyceride to High Density Lipoprotein cholesterol (TG/HDL), visceral fat and abdominal circumference ($p<0.05$). There was no significant relationship between serum adiponectin with HDL and body mass index ($p\geq0.05$). Our finding support this hypothesis that adiponectin is a appreciate predictor of cardiovascular risk factor in type 2 diabetic patients.

Key words: diabetes, cardiovascular risk factors, adiponectin.

INTRODUCTION

Nowadays obesity and increase in fat tissue, especially abdominal obesity are the major problems of public health in the worldwide that will causes chronic cardiovascular abnormalities especially type 2 diabetic in middle-aged people and adults [1].White adipose tissue is an main source of energy storages and have special significance in energy homeostasis. Serum lipids disturbance play an important role in increasing the risk of cardiovascular abnormalities in patients with type 2 diabetes [1]. Type 2 diabetes is a disease related to obesity and a risk factor for cardiovascular disease which is also associated with arthrosclerosis and [2]. Some studies have introduced expansion factors of cardiovascular diseases caused by type 2 diabetes as dyslipidaemia, increase of triglyceride (TG) and low-density lipoprotein (LDL) and decrease of high dense lipoprotein (HDL) [3,4]. Other studies have also reported the increase of total cholesterol (TC) to HDL ratio

(TC/HDL) as more appropriate indices to predict cardiovascular diseases related to type 2 diabetic [5].

On the other hand, adipose tissue is not only an inexhaustible source of fat reserve but also an endocrine organ that secrete some biologically active cytokines named adipokines such as leptin, resistin, Visfatin and also adiponectin which plays an important role in energy homeostasis and fat - carbohydrate metabolism [6, 7]. Adiponectin is an 247 amino acid peptide hormone with molecular weight of 30 Kilo Dalton (30KD) which due to its anti-atherogenic and anti-inflammatory role has an effect on energy homeostasis and body weight [7]. It also plays a crucial role in insulin resistance and type 2 diabetes in obese people (8, 9). Findings suggested that adiponectin is a predictive index for insulin resistance in type 2 diabetes [10]. Other studies have also repeatedly reported the increase of lipid profile indexes in diabetes patients [3, 4].

Since the lipid tissue is considered as the main sources of synthesis both adiponectin and lipid profile indices such as TC, TG and LDL, this question is raised that whether there is a significant relationship among serum adiponectin levels with lipid profile indexes and anthropometrical variables such as body mass index (BMI) and visceral fat type 2 diabetes patients. In contrast to what is the case for most adipose-tissue produced proteins, plasma adiponectin levels are found to be lower in obese subjects than in lean subjects, and negative significant correlation between plasma adiponectin levels and BMI have been shown both in humans and in animals [11,12].

In addition, some recent evidence also reported that Plasma adiponectin concentrations were negatively correlated with TG, LDL and intracellular fat storages [13,14] and its positive correlation with HDL [11, 15]. Recent evidence also support some of the actions of adiponectin in the liver and muscle, which result in improved insulin sensitivity, decreased plasma FFA, decreased secretion of VLDL and decreased hepatic TG synthesis [16].

However, despite the above-mentioned findings, some studies have also reported that there are no relationship among systemic adiponectin levels with lipid profile indices, anthropometric variables and visceral adipose tissue [17, 18]. Another study showed that systemic adiponectin levels are not related to the body fat level [19]. It is also expressed in other studies that adiponectin levels are not related to waist circumference, BMI, HDL and its relation with insulin resistance is independent of adiposity [20, 21].

Review of research evidence shows that there is a contradiction among the findings concerning the relationship among adiponectin levels and lipid profile and anthropometric indexes in type 2 diabetes patients and there is not a general consensus among the results. Therefore, the aim of present study is determining the relationship between serum adiponectin and the variables in middle-aged obese men with type 2 diabetes.

MATERIALS AND METHODS

Subject: This study conducted on 43 middle-aged obese men with type 2 diabetic, between 35 and 50 years old who voluntarily participated in this study. This study approved by Islamic Azad University and Community support for diabetics patients. Informed consent was obtained from all patients. In this study, a medical history to retrieve information about health status, current medications, alcohol consumption and a physical examination including height, weight, body mass index and blood pressure, a fasting blood sampling for the determination of adiponectin, lipid profile were performed of all participant.

Inclusion or Exclusion criteria: Inclusion criteria for study group were determined as existing type 2 diabetic for at least five months, being between the ages of 30-50 years, having a BMI of 30 or above. All subjects were non-smokers. All participants had not participated in regular exercise/diet programs for the preceding 6 months. Exclusion criteria for the study group were: history of alcohol use, having symptoms that may be indicative of ischemia in electrocardiography, cerebrovascular disease.

Anthropometric measurements: Body weight and height were measured with a standard physician's scale and a stadiometer, respectively when subjects were in a fasting state when the participant had thin clothes on and was wearing no shoes. Visceral fat and body fat percentage was determined using body composition monitor (OMRON, Finland). Systolic and diastolic blood pressure was measured using the left arm after the subject had been sitting comfortably for 5 min, using an oscillometric device (Alpikado, Japan). Two measurements were made every 1 minute and the average of two measurements was used for analysis. Body mass index (kg/m^2) was calculated as weight (kg) divided by squared height (m^2).

Blood sampling: All participants were asked to attend Hematology Lab for blood sampling. Those patients unable to avoid taking hypoglycemic drugs or other therapeutic drugs within 12 hours before blood sampling were barred from participating in the study. Patients were also told that avoid using the medicine or hormone preparations that affect the carbohydrate and lipid metabolism. Subjects were asked to avoid doing any heavy physical activity for 48 hours before blood sampling. A venous blood sample was collected from all the subjects who came after a 12-h overnight fast between the hours of 8 to 9 am. Blood samplings were performed in order to measuring of fasting serum adiponectin, total cholesterol, triglyceride, high Density Lipoprotein cholesterol and low density Lipoprotein cholesterol. Total cholesterol, HDL cholesterol and triglycerides were measured using the colorimetric enzymatic method (Pars Azmoon kit, Tehran). Serum adiponectin was determined by ELISA method, using a Biovendor- Laboratorial kit made by Biovendor Company, Czech. The Intra- assay coefficient of variation and sensitivity of the method were 3.9% and 5-50 ng/mL, respectively.

Statistical analysis: All values are represented as mean ± SD. Data were analyzed by computer using SPSS software version 15.0. Pearson correlations were used to establish the relationship between adiponectin concentration with lipid profiles and anthropometrical indexes on obese subjects.

RESULTS AND DISCUSSION

Mean and standard deviation of biochemical and anthropometric indexes of studied patients are shown in Table 1. A total 43 middle-aged obese men with type 2 diabetic participated in the present study. Findings obtained from spearman analysis showed a negative significant relationship between fasting serum adiponectin with abdominal obesity indices and visceral fat ($p = 0.000$). In the other hand, increasing in visceral fat levels in studied subjects was accompanied to decreasing serum adiponectin. An inverse significant relationship was observed between fasting triglyceride levels and serum adiponectin levels (figure 1). Adiponectin also correlated negatively with total cholesterol (figure 2). Although the relationship between adiponectin levels with LDL and HDL in patients was linear, or on the other hand decreasing adiponectin was accompanied with decreasing HDL and increasing LDL, but these relationship was not statistically significant. Another important finding of present study is negative significant correlation between fasting serum adiponectin with TC/HDL ratio that is as precise predictive index for cardiovascular diseases (figure 3).

Table 1: Anthropometrical and laboratory characteristics, and their relation with serum adiponectin in middle-aged obese males with type 2 diabetic.

Variable	Mean	Standard Deviation	Range	p-value	R
Age (year)	44	7	35 - 50	0.104	0.48
Weight (kg)	91	7	83 – 99	0.003	0.42
Height (cm)	173	6	165 - 184	0.000	0.52
Systolic blood pressure (mmHg)	130	19	10 – 16	0.004	0.41
Diastolic blood pressure (mmHg)	84	8	7 – 10	0.053	0.28
Total cholesterol (mg / dl)	219	28	145 - 283	0.001	0.45
Triglyceride (mg / dl)	187	62	112 - 325	0.000	0.59
Low density lipoprotein (mg / dl)	135	35	99 – 171	0.341	0.18
high density lipoprotein (mg / dl)	47	4.43	40 - 54	0.567	0.08
TC / HDL ratio	4.66	0.35	3.60 – 5.20	0.000	0.57
Body mass index (kg/m^2)	31	2.61	30 - 34	0.843	0.03
Visceral fat	13.45	1.93	9 - 17	0.007	0.38
Adiponectin (µg / ml)	4.55	1.25	2.4 – 6.5	-----	-----

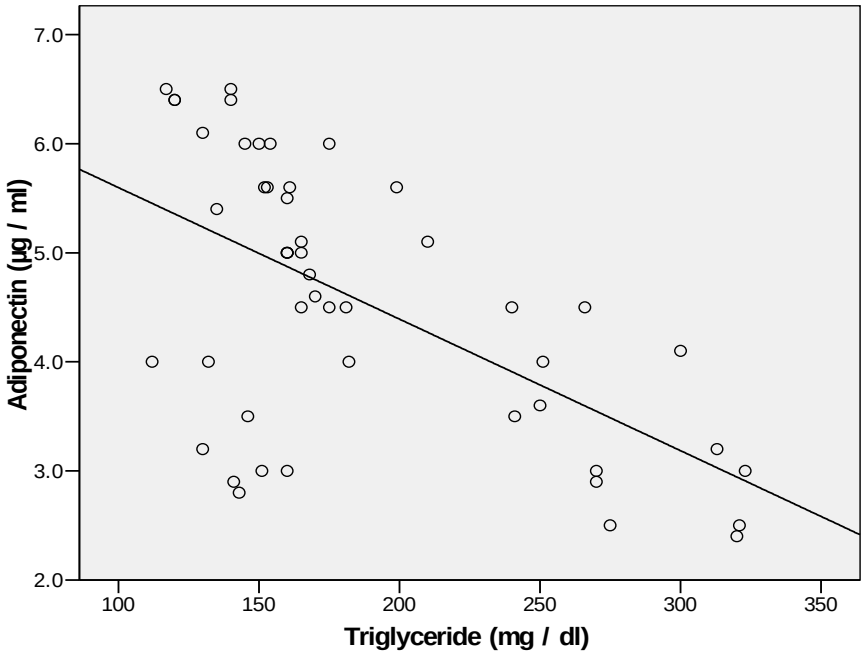

Figure 1: The correlation pattern between serum adiponectin and triglyceride concentration in diabetic patients

Our study show that adiponectin as anti-inflammatory cytokine that secreted by adipose tissue has a high relationship with cardiovascular risk factors in type 2 diabetic patients, although the molecular mechanisms for this are less understood. It is generally accepted that cardiovascular diseases are the most important factors of mortality in the present world [22]. Lipid abnormalities in metabolic syndrome and type 2 diabetes are the origins of cardiovascular diseases. White adipose tissue is a major site of energy storage and as it stores body energy in the form of triglyceride and it is released into the bloodstream when needed [23]. The increased concentration of circulatory cytokines as a result of inflammation are main factor the incidence of cardiovascular patients, metabolic syndrome, and specially type 2 diabetic [24]. Cytokine term includes a group of polypeptide hormones mostly synthesized or produced by adipose tissue [25]. In fact, deregulated adiponectin secretion from the fat tissue of obese individuals contributes to the development of systemic low-grade inflammation, insulin resistance and metabolic syndrome or type 2 diabetic [26].

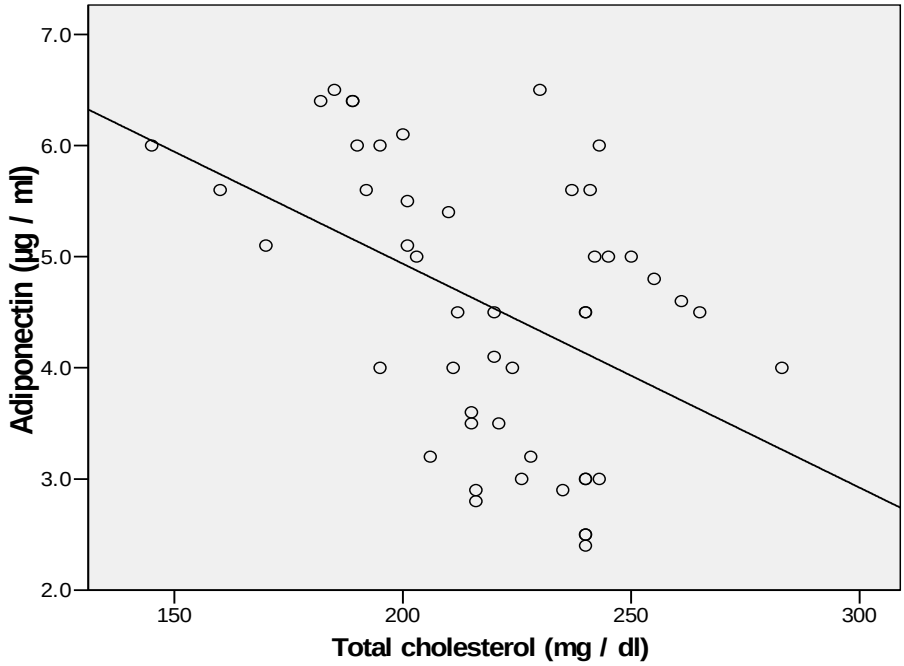

Figure 2: The correlation pattern between serum adiponectin and total cholesterol concentration in diabetic patients

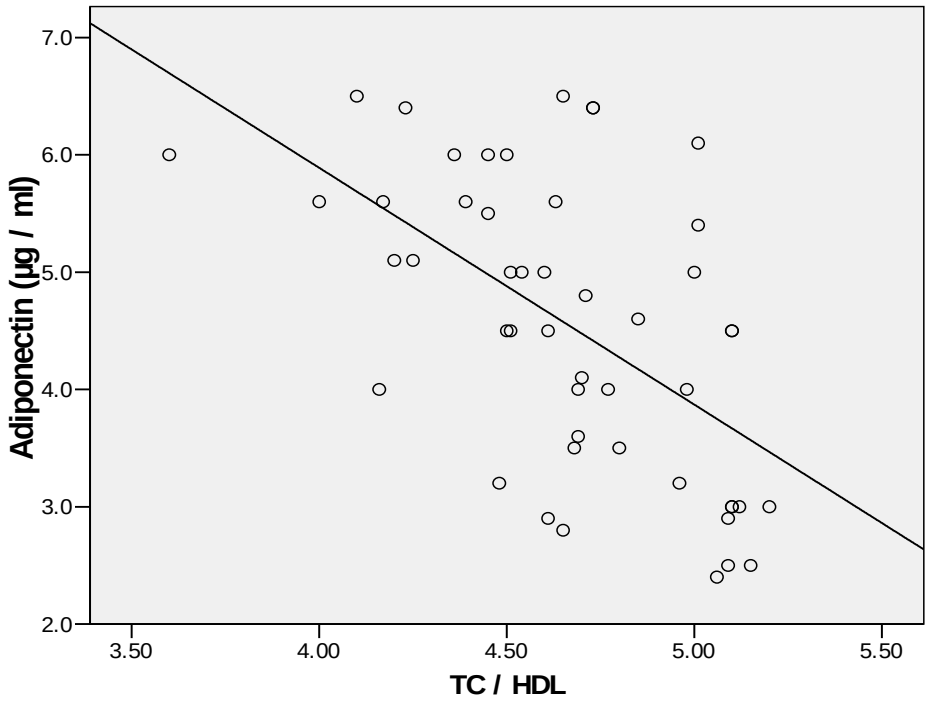

Figure 3: The correlation pattern between serum adiponectin and TC/HDL ratio in diabetic patients

Circulating adiponectin levels in normal subjects has been reported as 5–20 µg/ml [25]. The most effective factor to reduce adiponectin in humans is obesity [27]. The findings of present study support inverse significant relation of serum adiponectin with fasting triglyceride and cholesterol. These findings suggest that in proportion to increase of serum triglyceride and cholesterol levels in type 2 diabetes patients, serum adiponectin concentration as an anti-inflammatory cytokine with anti-atherogenic and anti-diabetic characteristics is reduced. In fact, according to high

significant correlation of adiponectin with triglyceride, it can be concluded that serum triglyceride is an appropriate predictor of adiponectin levels in type 2 diabetes patients.

To support these findings, some recent evidence also support significant linear relationship of serum triglyceride and cholesterol levels with systemic adiponectin levels in obese patients with diabetes [13, 14, 16]. Appropriate levels of adiponectin has been shown to improve insulin sensitivity, increase rates of fat oxidation, decrease muscle lipid content, and reduce muscle inflammation and vascular injury [28].

Several studies have suggested that that the adiponectin levels are inversely correlated with BMI [29] whereas in our study, a non-significant relationship was observed between adiponectin and BMI. Since BMI is the ratio of weight to height and increases as the weight of people increases, and it is likely that weight increase in some people is due to the increase of muscle levels and not due to lipid levels. In such cases, it is also likely that BMI is not an appropriate index for determining obesity. On the other hand, findings of our study showed that visceral fat index that is another characteristic of body tissue especially abdominal fat were high correlated negatively with serum adiponectin levels. Research findings indicate that there is a direct relationship between adiponectin and HDL levels of blood [29]. In the present study, the relationship between adiponectin and HDL was linear but none-significant. But despite the lack a significant relationship between adiponectin and HDL, findings show that TC/HDL ratio that is an appropriate index in diagnosis of cardiovascular diseases and type 2 diabetic, were negatively correlated with fasting serum adiponectin. This finding shows that as the levels of serum adiponectin decreases, TC/HDL ratio as a risk factor of cardiovascular diseases, increases. These findings support the hypothesis that low adiponectin is associated with prevalent cardiovascular disease. It should also be noted that low number of participants is a one of the limitations of this study. On the other hand, it is probably that lack a significant relation between adiponectin with HDL or BMI in this study to be due to low number of participants who have participated in this study.

Acknowledgements
The authors of this paper wish to acknowledge the society of diabetic patients for their support and financial support of Azad University and diabetic patients participated in this study.

REFERENCES

[1] Galic S, Oakhill JS, Steinberg GR. **2010**. *Mol Cell Endocrinol*. 316(2):129-39.
[2] Gu K, Cowie CC, Harris MI. **1998**. *Diabetes Care*. 21:1138-1145.
[3] Uusitupa MI, Niskanen LK, Siitonen O, Voutilainen E, Pyorala K. **1993**. *Diabetologia*. 36:1175-1184.
[4] Barrett-Connor E, Grundy SM, Holdbrook MJ. **1982**. *Am J Epidemiol*. 115: 657-663.
[5] Jiang R, Schulze MB, Li T, Rifai N, Stampfer MJ, Rimm EB. **2004**. *Diabetes Care*. 27: 1991-1997.
[6] Kershaw EE, Flier JS. **2004**. *J Clin Endocrinol Metab*. 89: 2548–2556.
[7] Sell H, Dietze-Schroeder D, Eckardt K, Eckel J. **2006**. *Biochem Biophys Res Commun.* 343: 700–706.
[8] Hadaegh F, Harati H, Ghanbarian A, Azizi F. **2006**. *Eur J Cardiovasc Prev Rehabil*. 13: 571-577.
[9] Genuth S, Alberti KG, Bennett P et al. **2003**. *Diabetes Care*. 26: 3160-3167.
[10] Kubota N, Terauchi Y, Yamauchi T et al. **2002**. *J Biol Chem*. 277: 25863–6.
[11] Cnop M, Havel PJ, Utzschneider KM et al. **2003**. *Diabetologia*. 46: 459–469.

[12] Weyer C, Funahashi T, Tanaka S et al. **2001**. *J Clin Endocrinol Metab*. 86: 1930–1935.
[13] Matsubara M, Maruoka S, Katayose S. **2002**. *J Clin Endocrinol Metab*. 87: 2764–9.
[14] Thamer C, Machann J, Tschritter O et al. **2002**. *Horm Metab Res*. 34: 646–9.
[15] Yamamoto Y, Hirose H, Saito I et al. **2002**. *Clin Sci* (Lond). 103: 137–142.
[16] Julius U. **2003**. *Exp Clin Endocrinol Diabetes*. 111: 246–50.
[17] Martin M, Palaniappan LP, Kwan AC, Reaven GM. **2008**. *Diabetes Care*. 31: 798– 801.
[18] Ibáñez J, Izquierdo M, Martínez-Labari C et al. **2010**. *Obesity* (Silver Spring). 18(3): 535-41.
[19] Snehalatha C, Yamuna A, Ramachandran A. **2008**. *Diabetes Care.* 31(12): 2374-9.
[20] Winer JC, Zern TL, Taksali SE et al: **2006**. *J Clin Endocrinol Metab*. 91: 4415–4423.
[21] Bacha F, Saad R, Gungor N, Arslanian SA. **2004**. *Diabetes Care*. 27: 547– 552.
[22] Ford ES, Mokdad AH, Giles WH, Mensah GA. **2003**. *Circulation*. 107: 2185–9.
[23] Spiegelman BM, Flier JS. **2001**. *Cell*. 104: 531–543.
[24] Ross R. **1999**. *N Engl J Med*. 340: 115–26.
[25] Ekmekci H, Ekmekci OB. **2006**. *Clin Appl Thromb Hemost*. 12: 163–8.
[26] Moreno-Aliaga MJ, Lorente-Cebrián S, Martínez JA. **2010**. *Proc Nutr Soc.* 69(3): 324-32.
[27] Arita Y, Kihara S, Ouchi N et al. **1999**. *Biochem Biophys Res Commun*. 257: 79–83.
[28] Sowers JR. **2008**. *Clin Cornerstone.* 9(1): 32-8.
[29] Nayak S, Soon SQ, Kunjal R et al. **2009**. *Arch Physiol Biochem*. 115(1): 28-33.