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Journal of Parathyroid Disease

Journal of Parathyroid Disease 2015,3(1),20–24

Original

Correlation of serum adiponectin level with some biochemical and metabolic factors in stable hemodialysis patients

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Abstract

Introduction: Serum adiponectin is a hormone secreted by the adipose tissue and its level usually increases in patients with renal insufficiency. In uremic condition, it not only loses its protective role against atherosclerosis, but also becomes a risk factor. This hormone is a direct predictor of cardiovascular complications in patients with renal failure.

Objectives: This study was designed to assess the association between serum adiponectin with various parameters in in a group of non-diabetic hemodialysis patients.

Patients and Methods: In this study, 73 hemodialysis non-diabetic patients were selected and fasting blood samples were taken to measure adiponectin and some other biochemical parameters. Waist circumference, abdominal circumference, weight and body mass index (BMI) were measured. Pearson statistical test was used to find the association between adiponectin and mentioned parameters.

Results: Adiponectin level was negatively and significantly associated with weight ($P<0.001$), BMI ($P<0.001$), waist circumference ($P<0.05$), abdominal circumference ($P<0.01$), and triglycerides ($P<0.01$).

Conclusion: According to the results of our study, serum adiponectin level in hemodialysis patients was negatively associated with weight and BMI which indicates the likely effect of the hormone. As a result, finding of exact connections between this cytokines and the risk factors of atherosclerosis and hypercatabolism may help to introduce serum adiponectin as a measurable and important marker for atherosclerosis and may be used as an index for prognosis of mortality in this type of patients.

Keywords: Adiponectin, Kidney failure, Hemodialysis

Please cite this paper as: Tamadon MR, Heidari M, Dris F, Mardani S. Correlation of serum adiponectin level with some biochemical and metabolic factors in stable hemodialysis patients. J Parathyr Dis 2015;3(1):20-24.

Introduction

Adiponectin is a material made of white adipose tissue which is itself made of collagen-like proteins with 244 amino acids (1,2). It has a gene-protein character and its plasma level in a healthy individual is 2–20 µg/mL (1,2). This cytokine, in fact, forms 1% of the total serum protein (1-3). In normal health conditions without a renal disease, the synthesis and secretion of the cytokine is negatively proportional to body weight which is due to negative feedback effects of serum levels on the expression of genes that make fat tissue (2-4). Adiponectin is excreted via glomerular filtration (3-5). Adiponectin plays a protective role against atherosclerosis, thus it prevents the attachment of monocytes to endothelial (1-4). Moreover, in normal body condition, adiponectin has a significant effect on insulin function and its level of secretion. It also affects the optimized use and storage of energy in the body and can regulate the energy metabolism and catabolism in mitochondria (2-5).

Specifically, adiponectin increases in patients with chronic renal failure undergoing hemodialysis and peritoneal dialysis (2-5). Research has shown that adiponectin levels in hemodialysis patients is 2.5-3 times more than that in healthy people. Such an increase is associated with decreased renal function, disorder in the regulation of the type and rate of serum levels, and disorder in adiponectin receptors (3-7). In such a condition, increased adiponectin is considered as one of the new risk factors for atherosclerosis, and it changes into one of the most important causes of mortality in these patients (6-8). It has also been stated that, there is an association between serum adiponectin level and other risk factors for atherosclerosis,

Received: 2 November 2014, Accepted: 4 December 2014, ePublished: 21 February 2015

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Implication for health policy/practice/research/ medical education

Adiponectin is a hormone secreted by adipose tissue. In uremic condition, it not only loses its protective role against atherosclerosis, but also becomes a risk factor. It can influence other risk factors for atherosclerosis and can also cause and exacerbate the hypercatabolic condition. Consequently it can result in indiscriminate use of body energy – protein and can be a predictor of morbidity and mortality in these patients. As a result, finding of exact connections between this cytokines and the risk factors of atherosclerosis and hypercatabolism may help to introduce serum adiponectin as a measurable and important marker for atherosclerosis and may be used as an index for prognosis of mortality in this type of patients.

including traditional and new factors (1-4). Studies suggest that in patients with chronic renal failure adiponectin is a predictor of mortality and progression of renal failure (1-6). This suggests that the biological protective effect of adiponectin against cardiovascular diseases is decreased in uremic patients (2-5).

In chronic inflammatory conditions such as chronic heart failure or kidney insufficiency, the consumption of body sources of energy including fat and protein will increase. This process reduces the weight and makes the body lean, thus speeds up mortality in patients .In this situation, adiponectin causes and aggravates the hypercatabolic syndrome (2-8).

It is reported that such an increase is associated with loss of energy and protein and increased fluid volume in this group of patients (4-9). A study on nephrotic syndrome showed that the increase in serum adiponectin level has a strong positive association with risk of metabolic syndrome and proteinuria (10-14).

In a study on patients with chronic renal failure who were affected by type 1 diabetes, the association between serum adiponectin and albuminuria and creatinine levels was assessed. The results showed a positive relationship between increased level of serum adiponectin with albuminuria and increased serum creatinine (10-15).

Objectives

Considering the importance of adiponectin in inflammatory conditions and due to the lack of information about its relationship with the parameters influencing inflammatory conditions in hemodialysis non-diabetic patients, this study was designed to assess the association between serum adiponectin with various parameters in in a group of non-diabetic hemodialysis patients.

Patients and Methods

Type of study and sampling method

To carry out this study, we recruited 73 non-diabetic hemodialysis patients who referred to hemodialysis ward in Hajar hospital in Shahrekord in 2012. Of all, 33 patients were female and 40 patients were male. Their age range was between 13 to 91 years. Following a standard protocol, before hemodialysis, systolic and diastolic blood pressures of all patients (per mm Hg) were measured two times with a time interval of 15 minutes. Weights of patients with the minimum clothes and without shoes were measured by a calibrated scale and were recorded in kilograms. Heights of patients without shoes, in a vertical position, while their heels were completely close to the wall, were measured using a cotton meter that was attached to the wall and the measured heights were recorded in meters. Body Mass Index (BMI) was calculated through dividing weight (kg) by the square of height (m^2). Waist size was measured by a meter three centimeter (cm) above the belly button in cm. Waist circumference in cm was measured using a cotton meter.

To collect adiponectin blood samples and other samples, a needle 18 was used and the blood was taken from the dialysis site. Accordingly, if dialysis was performed by permcath, first, a few milliliters of blood was aspirated to remove the heparin and then the samples were taken from the arterial line. Otherwise, if the dialysis had been performed by fistula or graft, the blood samples were taken from the area where it was determined for dialysis. To test serum glucose, cholesterol, triglycerides (via enzymatic method per mg/dl), and total cholesterol (by immunoturbidimetry method per mg/dl) samples were sent to hospital laboratory. To determine serum adiponectin level, serums were immediately isolated after blood sampling and stored at -80°C to -70°C until testing. In our laboratory, serum adiponectin level was measured per µg/ml by ELISA method and using a kit supplied by Orgenium Company, UK.

Ethical considerations

The primary research plan was approved by the Research Committee of Hajar hospital and school of medicine. Moreover, ethics committee of Shahrekord University of Medical Sciences also approved the plan. Before beginning the study, written informed consent was obtained from all patients who participated in the study. All information about patient was coded and kept confidential.

Data analysis

Data obtained from patients that had been recorded in checklists and the data which was collected from the laboratory tests were analyzed using SPSS version 16. Chi-square test was used for descriptive parameters. The association between adiponectin levels in patients with other parameters was assessed by calculating Pearson's correlation coefficient and related graphs were plotted using Excel software. The correlation coefficient below 5% was considered as a statistically significant value.

Results

Table 1 presents the details about the patients who were enrolled in the study. Of all 73 non-diabetic hemodialysis patients who were studied, 54.80% were male and 45.20%

Table 1. Patients' characteristics

Characteristic	Mean	Standard Deviation (SD)	Minimum	Maximum
Age (year)	57.07	19.96	13.00	91.00
Male (%)	54.80	50.11	0	100
Adiponectin (µg/ml)	10.56	3.88	0.32	17.41
Weight (kg)	58.38	14.33	31.00	103.00
Body mass index (kg/m^2)	21.92	3.79	14.74	33.33
Waist circumference (cm)	87.73	10.77	65.00	140.00
Abdominal circumference (cm)	92.19	10.43	59.00	115.00
Systolic blood pressure (mm Hg)	124.38	21.98	90.00	190.00
Diastolic blood pressure (mm Hg)	70.27	9.86	60.00	90.00
Sodium (mg/dl)	140.93	2.75	134.00	146
Potassium (mg/dl)	4.98	0.69	3.00	7.50
Blood Urea Nitrogen (mg/dl)	64.94	18.52	26.00	112.00
Creatinine (mg/dl)	8.62	2.88	2.80	10.00
Calcium (mg/dl)	9.00	0.54	7.50	11.00
Phosphorus (mg/dl)	5.11	1.13	2.80	10.00
Fasting glucose (mg/dl)	82.29	10.09	65.00	110.00
Triglycerides (mg/dl)	150.91	95.92	45.00	581.00
Cholesterol (mg/dl)	171.93	41.24	71.00	283.00

were female. The mean age of patients was 57.07; the youngest and oldest patients were 13 and 91 years old, respectively.

Table 1 presents patients' data. The results suggest that mean serum adiponectin level was 10.56±3.88 µg/ml. In addition, the minimum and maximum levels of serum adiponectin level in patients were 32.0 and 17.41 µg/ml (Table 1). The mean weight of patients was 58.38 kg, the mean BMI was 21.92 kg/m^2, and the mean waist and abdominal circumference were 87.73 and 92.19 cm, respectively (Table 1).

As shown in Table 1, adiponectin level was negatively and insignificantly associated with age of patients. Additionally, there was a significant negative association between serum adiponectin and body weight and BMI ($P<0.05$, and R was -0.48 and -0.55, respectively) (Figures 1 and 2).

The correlation coefficients between adiponectin and waist and abdominal circumference, respectively, were -0.25 and -0.40, which was significant at the 5% level (Figures 3 and 4).

Mean systolic and diastolic blood pressures were 124.38 mm Hg and 70.28 mm Hg, respectively (Table 1). There was no significant association between blood pressure and adiponectin at the 5% statistical level (Table 2).

As shown in Table 2, there was no significant correction between serum adiponectin with levels of serum parameters including sodium, potassium, calcium phosphorus and also blood urea nitrogen (BUN) and creatinine ($P>0.05$).

Mean fasting glucose level was 82.29 mg/dl (Table 1) and it had no significant association with serum adiponectin

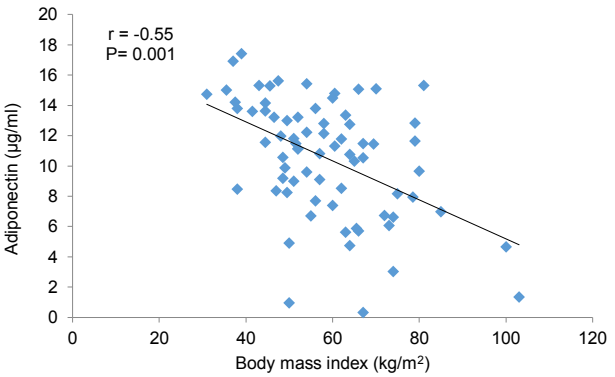

Figure 2. Association between serum adiponectin level and body mass index in non-diabetic hemodialysis patients

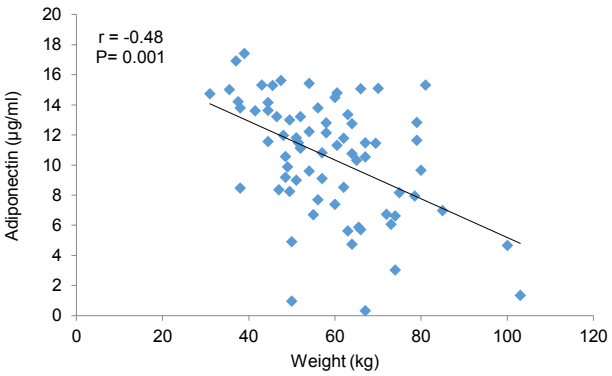

Figure 1. Association between serum adiponectin level and weight of non-diabetic hemodialysis patients

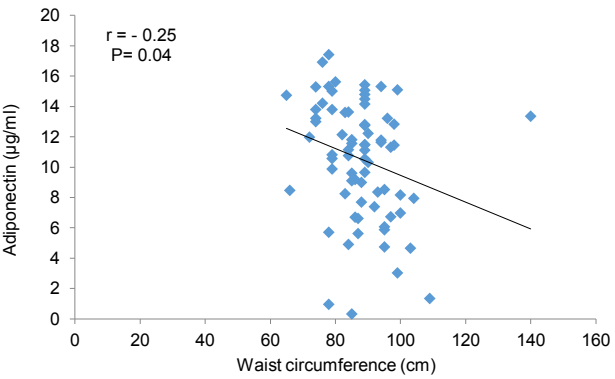

Figure 3. Association between serum adiponectin level and waist circumference in non-diabetic hemodialysis patients

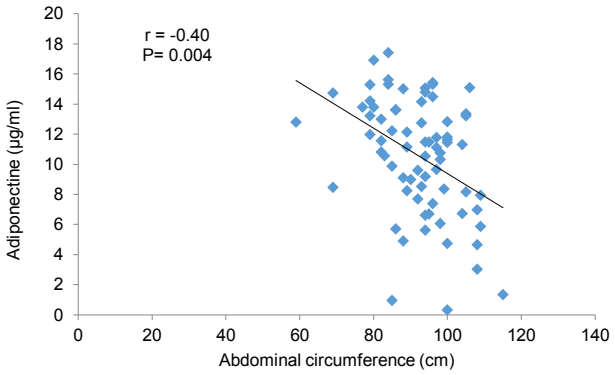

Figure 4. Association between serum adiponectin level and abdominal circumference in non-diabetic hemodialysis patients

Table 2. Association between adiponectin with various characteristics of hemodialysis patients (N= 73)

Characteristic	*P* value	r
Age (year)	0.130	-0.180
Weight (kg)	0.001***	-0.480
Body mass index (kg/m^2)	0.001***	-0.550
Waist circumference (cm)	0.037*	-0.250
Abdominal circumference (cm)	0.004**	-0.400
Systolic blood pressure (mmHg)	0.710	0.040
Diastolic blood pressure (mmHg)	0.960	0.007
Sodium (mg/dl)	0.170	0.160
Potassium (mg/dl)	0.990	0.001
Blood Urea Nitrogen (mg/dl)	0.240	0.140
Creatinine (mg/dl)	0.490	0.080
Calcium (mg/dl)	0.920	-0.010
Phosphorus (mg/dl)	0.170	0.160
Fasting glucose (mg/dl)	0.230	0.140

*, ** and *** indicate significance at levels of 5, 1 and 0.1%, respectively.

level too ($P > 0.05$; Table 2).

Discussion

Based on the results of this study, serum adiponectin level in hemodialysis patients had a negative significant association with weight and BMI. Moreover, waist and abdominal circumference had a significant negative association with serum adiponectin level. Adiponectin is a cytokine protein - collagen which is secreted only from adipose tissue (1-5). Recent studies have shown that adipose tissue is not only an energy storage tissue, but also it is like an endocrine tissue which generates hormones and uses them to connect with other tissues (3-9). Adiponectin is produced by a set of adipose tissue genes (10-18). Adiponectin makes its effects on other organs via adiponectin receptors type I and II (5-10).

Adiponectin creation is regulated by a negative feedback relationship between serum adiponectin levels and adipose tissue (11-17). Adiponectin exists in plasma in three forms: with low, medium, and high molecular weights (8-14). However, high molecular weight adiponectin is more effective in terms of function (3-8). Adiponectin is excreted via kidney glomerular filtration (12-18). In healthy people, adiponectin has a protective role against atherosclerosis; however after the development of atherosclerotic plaques, it not only loses its protective role (especially in basic inflammatory conditions such as uremia), but also together with other inflammatory cytokines becomes a cause of development and progress of atherosclerotic plaques (16-18). Studies suggest that serum adiponectin level in hemodialysis patients is 4 to 5 times higher than that in healthy people (12-19). Due to higher expression of adiponectin mRNA, adiponectin is more increased in yellow adipose tissues of end-stage renal failure patients than in healthy subjects (12-18). Such an increase can lead to increased risk of death due to cardiovascular problems (18-22). In basic inflammatory conditions such as uremia, hyper catabolic conditions emerge which consume the energy of the body and subcutaneous white fat (source of energy storage in body). In contrast, the yellow adipose tissue, in which inflammatory cells are accumulated and inflammatory cytokines are generated, are formed around body organs with low weights and sizes (22-25) Therefore, chronic inflammatory condition such as uremia can lead to weight loss, decrease BMI and reduce waist and abdominal circumference. On the other hand, the production of adiponectin, as an inflammatory cytokine, increases and causes an inverse relationship between serum adiponectin level and weight, body mass index, and waist and abdominal circumference. Recent studies suggest a positive significant association between plasma adiponectin level and severe systemic weight loss, which is a predictor of early mortality (20-27). Other investigations also state that serum adiponectin level in patients with heart failure is associated with severe weight loss (24-27).

Conclusion

Adiponectin is a hormone secreted by adipose tissue. In uremic conditions, it not only loses its protective role against atherosclerosis, but also becomes a risk factor. Hence it can influence other risk factors for atherosclerosis and can also cause and exacerbate the hypercatabolic condition, consequently it can result in indiscriminate use of body energy – protein and can be a predictor of morbidity and mortality in these patients. As a result, finding exact connections between this cytokines and the risk factors of atherosclerosis and hypercatabolism may help introducing serum adiponectin as a measurable and important marker for atherosclerosis and may be used as an index for prognosis of mortality in this type of patients.

Authors' contributions

All authors wrote the manuscript equally.

Conflict of interests

The authors declared no competing interests.

Ethical considerations

Ethical issues (including plagiarism, misconduct, data fabrication, falsification, double publication or submission, redundancy) have been completely observed by the authors.

Funding/Support

This paper has been derived from the residential thesis. This study was granted by Shahrekord University of Medical Sciences (Grant No. 1302).

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