SHORT REPORT

Serum adiponectin levels in diabetes, obesity and gender in Punjabi subjects from Faisalabad, Pakistan

Syeda Sadia Najam, Fazli Rabbi Awan, Shahid Mahmood Baig

Abstract

Adiponectin has been associated with common metabolic disorders. The current study was conducted to measure and compare levels of adiponectin with obesity, type 2 diabetes mellitus (T2DM) and gender in Punjabi subjects from Faisalabad, Pakistan. Serum adiponectin was measured by enzyme-linked immunosorbent assay (ELISA) along with measurements of some clinically important analytes (fasting blood glucose, cholesterol, triglycerides) as well as body mass index (BMI) in 80 subjects. The main results were significantly ($p<0.003$) decreased serum adiponectin level in T2DM patients (n=40) compared to non-diabetic controls (n=40). In obese subjects, (n=40) also, there was a decrease, but it was not significant. Adiponectin levels in the subgroups of diabetic and obese patients were also observed, but no significant gender-based differences were found.

Keywords: Adiponectin, Type 2 Diabetes Mellitus, Obesity.

Introduction

Adiponectin is an important hormone implicated in obesity and type 2 diabetes mellitus (T2DM) which is secreted by the adipocytes and released into blood.[1] Its levels in the blood show an inverse relationship with body fat composition and it is thought to be the only adipose-derived hormone which is decreased in obesity and T2DM.[2] Range of serum adiponectin concentration in normal subjects is between 0.5 to 30µg/ml.[1] Adiponectin levels are variable with respect to gender as males usually have low adiponectin.[3] It is a multifunctional hormone, and it has been implicated to act in the brain to decrease the body weight. However, the molecular mechanism is yet unclear. Its direct actions are in the liver, skeletal muscles and vasculature. In previous studies, the diabetics showed decreased plasma adiponectin levels.[4] The anti-diabetic actions of thiazolidinediones involve insulin sensitisation which is partially caused by up-regulation of adiponectin levels.[5]

As there is scarce data on adiponectin levels in Pakistani population, the present study was planned to measure serum concentration of adiponectin in type 2 diabetics and obese subjects, and to correlate it with gender in a representative Punjabi population from Faisalabad, Pakistan.

Methods and Result

As part of our ongoing research on metabolic disorders (T2DM, obesity, diabetic nephropathy), we have collected biofluid samples and clinically relevant information from more than 500 participants at public places and hospitals in the Faisalabad region of Pakistan. Out of these, 80 subjects who met the study criterion were included in this small case-control study for adiponectin levels from April to December 2012. It was approved by the institutional ethics committee, and all participants gave written informed consent.

The subjects were included and their subsets were made on the basis of obesity and diabetes status. Number of males and females taken in each group were also similar. The study design for grouping was made to reduce the confounding factors as much as possible. The non-diabetic group had 40(50%) subjects; 20(50%) obese (Ob) (body mass index [BMI] 30) and 20(50%) non-obese (NOb) (BMI 24.9). In both the categories, the gender distribution was equal, with 10(50%) men and 10(50%) women each forming the Ob and NOb segments. The same pattern of distribution was adopted for the T2DM group.

The age of participants was 40 years and the samples were collected from all the subjects according to the World Health Organisation (WHO) criteria.[6] Subjects with any other disease (cancer, hepatic, cardiovascular or renal) or those who were over-weight were excluded.

A detailed questionnaire was used for the collection of information. The participants were in fasting state (10 hours overnight fast) at the time of sampling. Venous blood samples were collected in gel-coated vacutainers for serum separation and stored at -20ºC till analysis. Biochemical parameters like fasting blood glucose, total

Diabetes and Cardio-Metabolic Disorders Lab, Human Molecular Genetics and Metabolic Disorders Group, Health Biotechnology Division, National Institute for Biotechnology and Genetic Engineering (NIBGE), Jhang Road, Faisalabad, Pakistan.

Correspondence: Fazli Rabbi Awan. Email: awan.fr@gmail.com

cholesterol, and total triglycerides were measured through a semi-automated clinical chemistry analyser (Micro Lab300, Merck, Germany). Adiponectin hormone was analysed with sandwich based enzyme-linked immunosorbent assay (ELISA) kit (Adipogen, Korea).

For comparisons of groups, data was analysed with GraphPad InStat (v3.05) and SAS 9.3 software. Unpaired t test with Welch correction was used and p value was two-tailed.

Comparison between non-diabetics (ND) and diabetics (T2DM) for biochemical changes was made on the basis of disease status. The mean age of ND and T2DM subjects was 48±7 and 53±6 years respectively. BMI value for ND was 27.5±5.0kg/m2 and for T2DM patients it was 27.9±5.1kg/m2 (p<0.71). From group comparisons, it was evident that the two groups were significantly different for fasting blood glucose (FG), triglyceride (TG) and adiponectin levels. Following changes were found in the T2DM group compared to the ND group with measurements represented as per cent change in diabetics [T2DM: median (Interquartile range) vs ND:

Table-1: Comparison of Biochemical and Clinical Parameters in Type 2 Diabetes and Obesity Status.

Biochemical/Clinical Parameters	Non-Diabetics (ND)			Diabetics (T2D)		
	Non-obese (NOb) (n=20)	Obese (Ob) (n=20)	P-value	Non-obese (NOb) (n=20)	Obese (Ob) (n=20)	P-value
BMI (kg/m^2)	23.7 ± 2.7	31.2 ± 3.8	<0.0001	24.1 ± 2.9	31.6 ± 3.9	<0.0001
FG (mg/dl)	86 (81-92)	88 (83-106)	0.08	202 (159-267)	150 (135-232)	0.32
TC (mg/dl)	76 (65-86)	88 (76-99)	0.01	86 (76-99)	85 (74-101)	0.41
TG (mg/dl)	22 (14-32)	22 (20-41)	0.24	31 (29-45)	31 (22-47)	0.51
Adiponectin (g/mL)	7.5 (4.7-12.8)	5.5 (4.3-10.0)	0.38	4.5 (1.5-8.8)	1.5 (0.3-5.9)	0.04
Biochemical/Clinical Parameters	**Non-Obese (NOb)**			**Obese (Ob)**		
	Non-Diabetics (ND) (n=20)	Diabetics (T2D) (n=20)	P-value	Non-Diabetics (ND) (n=20)	Diabetics (T2D) (n=20)	P-value
BMI (kg/m^2)	23.7 ± 2.7	24.1 ± 2.9	0.60	31.2 ± 3.8	31.6 ± 3.9	0.75
FG (mg/dl)	86 (81-92)	267 (202-342)	<0.0001	88 (81-106)	150 (135-232)	<0.0001
TC (mg/dl)	76 (65-86)	86 (76-92)	0.02	88 (76-117)	85 (74-101)	0.29
TG (mg/dl)	18 (14-32)	31 (29-45)	0.008	22 (20-41)	31 (22-47)	0.23
Adiponectin (g/mL)	7.5 (4.7-12.8)	4.5 (1.5-8.8)	0.10	5.5 (4.3-10.0)	1.5 (0.3-5.9)	0.003

Data are given as the mean ± SD or as the median (interquartile range). The P-values were calculated using unpaired t test. BMI, body mass index; FG, fasting glucose; TC, total cholesterol; TG, triglycerides.

Table-2: Comparison of Biochemical and Clinical Parameters in Type 2 Diabetes and Obesity with Gender status.

	OBESITY WITHOUT TYPE 2 DIABETES					
Biochemical/Clinical Parameters	**Non-Obese (NOb)**			**Obese (Ob)**		
	Males (n=10)	Females (n=10)	P-value	Males (n=10)	Females (n=10)	P-value
BMI (kg/m^2)	23.43 ± 2.39	23.93 ± 2.99	0.68	29.04 ± 2.13	33.41 ± 3.89	0.006
FG (mg/dl)	88 (81-103)	86 (83-90)	0.12	85 (81-99)	101 (88-108)	0.19
TC (mg/dl)	74 (61-85)	83 (70-86)	0.93	76 (72-119)	101 (79-117)	0.29
TG (mg/dl)	29 (18-43)	14 (9-18)	0.009	22 (20-43)	22 (20-36)	0.84
Adiponectin (g/mL)	5.4 (1.6-8.8)	10.3 (5.6-13.3)	0.37	4.7 (4.1-9.6)	5.7 (4.4-10.5)	0.62
	OBESITY WITH TYPE 2 DIABETES					
Biochemical/Clinical Parameters	**Non-obese (NOb)**			**Obese (Ob)**		
	Males (n=10)	Females (n=10)	P-value	Males (n=10)	Females (n=10)	P-value
BMI (kg/m^2)	23.53 ± 3.64	24.74 ± 1.86	0.36	30.22 ± 2.48	33.0 ± 4.66	0.11
FG (mg/dl)	180 (157-204)	238 (202-290)	0.30	146 (135-195)	182 (135-258)	0.25
TC (mg/dl)	94 (76-123)	85 (78-94)	0.57	85 (65-105)	83 (74-97)	0.74
TG (mg/dl)	31 (27-41)	31 (18-79)	0.39	29 (22-54)	31 (23-41)	0.55
Adiponectin (g/mL)	7.1 (1.4-11.9)	3.5 (1.9-8.3)	0.23	1.0 (0.4-2.2)	3.0 (0.2-6.8)	0.39

Data are given as the mean ± SD or as the median (interquartile range). The P-values were calculated using unpaired t test. BMI, body mass index; FG, fasting glucose; TC, total cholesterol; TG, triglycerides.

median (Interquartile range)]:

Glucose: [189(144-248) vs 88(83-101) mg/dl; p=<0.0001; (114%↑)], Triglycerides: [31(23-45) vs 22(16-36) mg/dl; p=0.005; (42%↑)], Cholesterol: [86(76-99) vs 79(72-101) mg/dl; p=0.44; (9%↑)], and Adiponectin: [2.5(0.8-8.0) vs 5.8(4.4-12.1) g/mL; p=0.003; (57%↓)] in diabetics.

Comparison between NOb and Ob subjects was done on the basis of obesity status. The mean age of NOb and Ob subjects was 52±6 and 48±7 years respectively. From comparisons of various clinical parameters in these groups, it was evident that the Ob and NOb subjects were significantly (p<0.0001) different only for BMI, as expected. BMI for Ob was 31.5±4.0kg/m2 and for NOb it was 23.9±3.7kg/m2 showing a 32% increase in the obese subjects. Values for other measurements [Ob: median (Interquartile range) vs NOb: median (Interquartile range)] were:

Glucose: [115(88-150) vs 106(86-202) mg/dl; p=0.59], Triglycerides: [25(20-43) vs 29(16-40) mg/dl; p=0.97], Cholesterol: [86(76-106) vs 83(70-95) mg/dl; p=0.31], and Adiponectin: [4.5(1.3-6.9) vs 5.7(1.8-11.6) g/mL; p=0.18] showing a 21% decrease of adiponectin in the obese, but all of these changes were statistically non-significant.

The average age of NOb and Ob non-diabetics was 50±9 and 47±8 years respectively. The groups were significantly different for BMI and total cholesterol (TC) levels (Table-1).

The average age of NOb and Ob diabetics was 54±9 and 51±9 years respectively. The NOb group having diabetes was significantly different from the Ob diabetics for BMI and adiponectin levels.

The mean age of participants having no obesity for the non-diabetic group was 50±9 years and for the diabetic group it was 54±9 years. The NOb non-diabetics and NOb diabetics were significantly different in FG, TC and TG levels. No significant change was seen for adiponectin levels.

The average age of Ob non-diabetics and Ob diabetics was 47±8 and 51±9 years respectively. Ob non-diabetics were significantly different from Ob diabetics in FG and adiponectin levels.

Gender dimorphism was not observed for the main parameter i.e. adiponectin, in any of the study group when all males and females from both non-diabetic and diabetic groups with or without obesity were compared (Table-2).

Conclusions

The results shows significant decrease in serum adiponectin levels i.e. up to 57% in all type 2 diabetes patients, and 67% in obese diabetics compared to diabetics without obesity. Also, overall for obesity there was a decrease of 21% adiponectin in all obese subjects but it was not significant. No significant gender dimorphism for adiponectin levels were observed.

Limitation

In spite of reasonably good study design, there are some limitations of our study. Firstly, the results are based on one-time measurement of adiponectin level for all participants, which could not tell us any difference in adiponectin levels with time or with use of any drugs in case of diabetics. Secondly, this is a representative study of a small group of Punjabi population from Faisalabad. The results cannot be generalised.

References

1. Haluzik M, Parizkova J, Haluzik MM. Adiponectin and its role in the obesity-induced insulin resistance and related complications. Physiol Res 2004; 53: 123-9.
2. Salmenniemi U, Zacharova J, Ruotsalainen E, Vauhkonen I, Pihlajamaki J, Kainulainen S, et al. Association of adiponectin level and variants in the adiponectin gene with glucose metabolism, energy expenditure, and cytokines in offspring of type 2 diabetic patients. J Clin Endocrinol Metab 2005; 90: 4216-23.
3. Haluzik M. Adiponectin and its potential in the treatment of obesity, diabetes and insulin resistance. Curr Opin Investig Drugs 2005; 6: 988-93.
4. Wannamethee SG, Lowe GD, Rumley A, Cherry L, Whincup PH, Sattar N. Adipokines and risk of type 2 diabetes in older men. Diabetes Care 2007; 30: 1200-5.
5. Hulstrom V, Hojlund K, Vinten J, Beck-Nielsen H, Levin K. Adiponectin and its response to thiazolidinediones are associated with insulin-mediated glucose metabolism in type 2 diabetic patients and their first-degree relatives. Diabetes Obes Metab 2008; 10: 1019-28.
6. WHO. Definition and diagnosis of diabetes mellitus and intermediate hyperglycaemia: Report of a WHO/IDF consultation. Geneva: World Health Organization; 2006.