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Lower Levels of Adiponectin in Japanese than in American Men despite much Less Levels of Obesity in the Japanese

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Abstract

Levels of adiponectin are inversely associated with obesity levels. We examined the levels of adiponectin in American (n = 98) and Japanese (n = 92) men aged 40 to 49 years. Contrary to our expectations, the American men had higher evels of adiponectin than the Japanese men (13.3 ± 5.8 vs 7.3 ± 4.2 (μg/ml) despite higher levels of obesity. Smaller areas of visceral adipose tissue in American than in Japanese men may have resulted in the higher levels of adiponectin.

INTRODUCTION

Adiponectin is a plasma protein secreted by adipose tissue.[1] The levels of adiponectin are known to be reduced in obesity [2].

We previously reported that, comparing American and Japanese men aged 40 to 49 years, American men had a more favorable profile regarding many risk factors, including blood pressure, total and low-density lipoprotein cholesterol, fasting glucose, and cigarette smoking, in spite of their higher prevalence of coronary calcification [3]. A notable exception was much higher levels of obesity in the American men [3]. Because, on average, American men are more obese than Japanese men, we expected that their levels of adiponectin would be lower, which would partly contribute to being more atherosclerotic as demonstrated by the higher prevalence of coronary calcification. We compared the levels of adiponectin across populations using stored blood samples.

METHODS

Study design and methods have been described in detail elsewhere [3]. Briefly, participants were 190 men aged 40 to 49 years without diabetes or coronary heart disease (98 volunteer American men [whites, 99%) from Allegheny County, Pennsylvania, and 92 Japanese men,

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randomly selected from Kusatsu, Japan). The study protocol was approved by the institutional review boards of University of Pittsburgh, PA, and Shiga University of Medical Science, Japan. Venous blood samples were drawn after a 12-hour fast. The blood samples were centrifuged on site and examined at the same laboratory after being shipped on dry ice. We measured adiponectin with a radioimmunoassay procedure (Linco Research, Inc, St Charles, MO), serum lipids with standardized methods according to the Centers for Disease Control and Prevention, and serum glucose with the hexokinase–glucose 6-phosphate dehydrogenase enzymatic assay. Coronary calcification was scanned using a GE-Imatron C150 Electron Beam Tomography scanner (GE Medical System, South San Francisco, CA) at both sites. Coronary calcification was considered to be present when the Agatston score was 10 or more. We used Mann-Whitney tests for triglycerides, Fisher exact tests for coronary calcification, and t tests for other variables, with a significance level of P b .05 in 2-tailed tests.

RESULTS and DISCUSSION

Contrary to what we had expected, the levels of adiponectin were substantially lower in Japanese than American men (7.3 ± 4.2 vs. 13.2 ± 5.8 (μg/ml) in the Japanese vs. Americans, respectively, $p < 0.001$). As a post hoc analysis, we did (1) waist circumference stratification and (2) regression analyses. We first divided the participants into tertile groups of waist circumference. The levels of adiponectin were higher in the American men across all waist circumference tertile groups (Table 1). In the regression analyses, the dependent variable was the level of adiponectin, and site (USA or Japan) and waist circumference were the independent variables (model 1). We then added levels of fasting blood glucose, low density lipoprotein cholesterol, triglycerides, and high density lipoprotein cholesterol to the model as independent variables (model 2). In model 1, both site (P b .001) and waist circumference (P = .013) were significantly associated with adiponectin. In model 2, site still remained significant ($P < 0.001$).

The difference in abdominal fat distributions between the American and Japanese men may, to some extent, account for the higher levels of adiponectin in the American men. It has been reported that visceral adipose tissue (VAT)– dominant subjects showed lower adiponectin levels than subcutaneous adipose tissue–dominant subjects [4]. Japanese men actually had larger VAT and ratio of VAT to subcutaneous adipose tissue than American men at all levels of waist circumference in our other study setting [5]. The larger VAT in the Japanese men may also result in higher fasting blood glucose at any level of waist circumference (Table 1).

Other possibilities affecting the levels of adiponectin may be genetic polymorphisms or diet. As for genetic polymorphisms, no definite determinant gene has been ascertained that may explain the levels of adiponectin between the American and Japanese men. As for dietary factors, American men had greater energy intake and total fat energy intake than Japanese men [6]. Differences in dietary habits other than energy intake may also affect the levels of adiponectin.

There are limitations in the present study. First, we do not have abdominal fat distribution data. Second, the American men were volunteer participants and may be healthier than the general US population. However, despite the potential bias, the American men, who were more atherosclerotic than the Japanese men, as was ascertained by the prevalence of coronary calcification, had higher levels of adiponectin. We believe that the potential bias does not limit the importance of our findings.

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Table 1

Comparison of adiponectin and other factors between the American and Japanese men by tertile categories of waist circumference

Waist circumference (cm)	**68–85**		**85–95**		**95–125**	
n (% of the total population)	**64 (33.7%)**		**58(305%)**		**68 (35.8%)**	
n (% of each site)	**USA: 17 (17.3%)**	**Japan: 47 (51.1%)**	**USA: 23 (23.5%)**	**Japan 35 (38.0%)**	**USA: 58 (59.2%)**	**Japan: 10 (10.9%)**
Body mass index (kg/m^2)	23.52 ± 1.28	21.19 ± 2.30	24.87 ± 1.43	24.39 ± 1.53	28.65 ± 2.72	28.37 ± 1.65
	P < .001		*P* = .228		*P* = .668	
Adiponectin (μg/mL)	16.19 ± 7.50	8.04 ± 4.00	12.65 ± 4.72	6,32 ± 4.60	12.66 ± 5.42	7.60 ± 3.49
	p < .001		*P* <.001		*P* = .001	
Total cholesterol (mmol/L)	5.01 ± 0.53	5.66 ± 1.02	4.99 ± 0.91	5.68 ± 1.03	4.95 ± 0.82	5.84 ± 0.47
	P = .002		*P* = .010		*P* < .001	
Triglycerides (mmol/L)	0.994 (0.718, 1.300)	1.209 (0.893, 1.480)	1.085 (0.881, 1.751)	1.842 (1.480,2.497)	1.582 (1.170, 2.359)	1.706 (0.980), 2342)
	P = .0.60		*P* = .001		*P* = .822	
HDL cholesterol (mmol/L)	1.28 ± 0.31	1.62 ± 0.41	1.31 ± 0.33	1.19 ± 0.25	1.12 ± 0.27	1.43 ± 026
	P = .0.01		*P* = .160		*P* = .005	
LDL cholesterol (mmol/L)	3.27 ± 0.50	3.43 ± 1.00	3.10 ± 0.75	3.48 ± 1.07	3.02 ± 0.84	3^60 ± 0.78
	P = .417		*P* = .117		*P* = .049	
Fasting glucose (mmol/L)	5.15 ± 0.37	5.71 ± 0.49	5.11 ± 0.50	5.71 ± 0.44	5.34 ± 0.42	5.74 ± 0.43
	P < .001		*P* <.00l		*P* = .018	
Coronary calcification (%)	17.6	2.1	21.7	5.7	29.3	20.0
	P = .054		*P* = .102		*P* = .714	

Values are medians and interquartile ranges for triglycerides, proportion of Agatston score of 10 or more for coronary calcification, and means ± standard devotions for other variables. *P* values were obtained by Mann-Whitney tests for triglycerides, Fisher exact tests for coronary calcification, and *t* test for other variables. HDL indicates high-density lipoprotein; LDL, low-density lipoprotein.