Original article

The relation of obesity with serum resistin levels in smoker and nonsmokers

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Background: The demonstration that adipose tissue produces numerous cytokines increases interest of investigators in their role in the pathogenesis of obesity. Resistin is one of those cytokines. There are conflicing reports as cigarette smoking impairs insulin secretion, augments insulin resistance, or has no effect on glucose metabolism. In our study, we intended to examine the relationship of obesity with resistin levels in smokers and nonsmokers. **Patients and Methods:** The study included 52 male smokers and 34 age matched nonsmoker male control subjects. We classified smoker and nonsmoker groups according to their body mass index as BMI < 27 and ≥27. As well as making physical and anthropometric examinations, fasting plasma glucose and insulin, postprandial plasma glucose, lipid profile, and resistin levels were measured in all male subjects. We compared all parameters in smoker and nonsmokers either having BMI < 27 or ≥27. **Results:** In both BMI levels, resistin levels were higher in smoker groups than nonsmoker ones (P<0.01 all), we did not find any difference in other parameters. **Conclusion:** in conclusion we may speculate that if someone smokes resistin levels increase.

Key words: Obesity, resistin, smoking

INTRODUCTION

Studies on human adipose tissue reveal that this tissue is not only an energy storing, but an endocrine organ that secrets a variety of hormones, cytokines, growth factors, and bioactive compounds, known as adipokines into the circulation that have effects on endocrine, metabolic, and inflammatory processes that take part in the control of energy homeostasis.[1-3] Resistin is an adipocytokine that has been suggested to link obesity, diabetes, and atherosclerosis.[4-6]

After administration of resistin to mice, it was shown that glucose homeostasis and insulin sensitivity worsened and antibody neutralization of resistin in obese mouse decreased blood glucose levels and improved insulin sensitivity.[4] This study suggested that resistin could possibly be one of the many factors contributing to the complex disease of insulin resistance. The subject of the role of resistin in insulin resistance, obesity and type-2 diabetes mellitus (T2DM) in human is more conflicting. In different studies resistin found to be either correlated[7-9] or not correlated[10-12] with these disorders. The effect of resistin on obesity is also controversial.[4,7,13]

Smoking is the leading cause of avoidable death globally.[14] It also alters adipokine levels that are associated with insulin resistance, type-2 diabetes, atherosclerosis, cardiovascular disease, and obesity.[15-18]

We thought that it will be interesting to examine both smoking and obesity, two cardiovascular risk factors with respect to an adipokine, resistin. Bearing in mind the complex relationship of smoking, insulin resistance, resistin, and obesity, we planned to investigate resistin levels in smoker and nonsmokers whether they are obese or not.

PATIENTS AND METHODS

Patients

For our cross-sectional study, a total of 52 male smokers, 33 with BMI<27, 19 with BMI ≥ 27, aged from 25–45 years, were randomly recruited from the outpatient Clinic of Ankara Education and Research Hospital from January 2009 to May 2009. Thirty-four-aged matched nonsmoker male subjects, 15 with BMI<27 and 19 with BMI ≥ 27, selected randomly formed other groups. Smokers have

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been smoking at least for 2 years and at least ten cigarettes daily. As resistin serum and mRNA levels were significantly higher in females than males at all ages, in order to obtain an homogenous group we examined only males. We also excluded females from the study because in Turkey the number of female smokers, although incresing, is smaller compared with that of male smokers.

Subjects with female gender, hypertension, diabetes mellitus, glucose intolerance, hyperlipidemia, conditions that may effect metabolic parameters (such as tiroid dysfunctions in history or nowadays), chronic diseases, infection, and coronary artery disease were excluded.

After detailed physical examination, in all subjects, body weight and height were measured. Waist was measured when fasting, in standing position halfway between the costal edge and iliac crest, whereas hip was measured at the greatest circumference around the buttocks, by a nonelastic measure. The waist to hip ratio (WHR) was calculated. The body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters (kg/m^2). Body fat were estimated by Tanita body composition analayser TBF-300 after the subjects rested 30 min.

Blood was withdrawn after 12 h overnight fasting, at 08.30 a.m. for fasting plasma glucose (FPG), insulin (FI), serum total, and HDL cholesterol, triglyceride, and resistin levels. Another blood sample was taken for postprandial plasma glucose (PPPG) 2 h after breakfast.

Systolic and diastolic blood pressures (SBP and DBP) were measured after a 5 min rest in the semisitting position with a sphygmomanometer. Blood pressure was determined at least three times in the upper-right arm, and the mean was used in the analysis. The patients who were taking antihypertensive drugs or patients whose determined mean blood pressure levels ≥140/90 mmHg were diagnosed as hypertensive and excluded.

This sudy was performed according to the Helsinki decleration 2008. The local ethics comitee approved this study and all the subjects gave written informed consent.

Laboratory methods

Plasma glucose, total cholesterol, TG, and HDL-C concentrations were determined by enzymocalorimetric spectrophotometric method in a Roche/Hitachi molecular PP autoanalyser. LDL-C was calculated by the Friedewald Formula (LDL: Total cholesterol –HDL-TG/5). Insulin was measured by means of DRG Diagnostics (DRG Instruments GmbH, Germany) ELISA kits.

An indirect measure of insulin resistence was calculated from the fasting plasma insulin (μ unite/mL) × fasting plasma glucose (mmol/L)/22. 5 formula as homeostasis model assessment (HOMA-IR).

For the measurements of resistin, after fasting blood samples were drawn, put into a dry tube and were santrifuged 5000 cycle/min in 10 min. Serum was then seperated and put into another dry tube before storing at −80°C. Serum resistin levels were assayed by a commercial resistin ELISA kit.

Statistical analysis

Calculations were performed using SPSS version 11,5 (Customer ID 30000105 930). Data are presented as mean ± SD. Student t-test was used to compare the groups in a parametric way. A P value of < 0.05 was considered as statistically significant.

RESULTS

This study was performed with 52 male smoker, and 33 male nonsmoker subjects. When we classified our subjects according to their BMI's, 33 smoker and 15 nonsmoker fell into BMI<27 group and 19 smoker and 19 nonsmoker fell into the BMI≥27 group. All the demographic and laboratory findings of the groups were compared and illustrated in [Table 1].

Both in BMI <27, BMI≥27 groups resistin levels were significantly high in smokers than in nonsmokers (P< 0.01 both). Any other parameters were not different in these groups.

DISCUSSION

In our study we planned to determine whether resistin levels differ when subjects with different BMI's smoke or do not smoke. Resistin is a protein involved in glucose homeostasis, lipid metabolism and insulin action. Some papers reported that in humans plasma resistin levels correlate with obesity,[4,7] while others failed to observe any correlation of plasma resistin levels with anthropometric measures.[13]

There have been conflicting results about metabolic syndrome features and smoking.[19-22] Smokers tend to be thinner than nonsmokers or former smokers, and several studies have shown that smokers' BMI is lower.[23] However, it was demonstrated that smokers, especially heavy smokers tend to have higher BMIs than ligher smokers and even some nonsmokers.[24] It was interesting that adipose tissue distrubition expressed as the waist to hip ratio showed a preponderance for abdominal sites in smokers.[25,26] This may be the reason why with a normal BMI, smokers have a greater abdominal fat accumulation compared with

Table 1:

	BMI<27			BMI≥27		
	Smoker	Non-smoker	P	Smoker	Non-smoker	P
Age (year)	36.88 ± 11.73	35.86 ± 6.22	NS	36.68 ± 7.07	37.42 ± 7.87	NS
SBP (mmHg)	114.24 ± 11.73	116.07 ± 12.7	NS	118.42 ± 12.58	118.42 ± 13.0	NS
DBP (mmHg)	76.67 ± 6.92	77.5 ± 9.35	NS	80.53 ± 8.48	78.95 ± 8.09	NS
Waist cir. (cm)	90.21 ± 8.01	85.0 ± 4.70	NS	96.63 ± 8.20	93.05 ± 5.50	NS
Hip cir. (cm)	102.57 ± 5.48	99.71 ± 5.52	NS	106.86 ± 5.75	106.31 ± 4.61	NS
WHR	0.92 ± 0.73	0.84 ± 0.04	NS	0.91 ± 0.06	0.86 ± 0.06	NS
Body fat (%)	24.23 ± 5.26	26.22 ± 6.53	NS	28.41 ± 6.50	30.61 ± 7.20	NS
FBG (mg/dL)	85.18 ± 9.62	87.36 ± 6.04	NS	90.47 ± 7.40	89.79 ± 9.37	NS
PPBG (mg/dL)	92.33 ± 19.28	90.71 ± 15.3	NS	103.21 ± 26.84	108.16 ± 25.1	NS
Chol.(mg/dL)	185.12 ± 49.30	184.43 ± 36.0	NS	200.15 ± 42.23	176.32 ± 37.3	NS
TG (mg/dL)	125.70 ± 56.40	100.36 ± 46.2	NS	137.11 ± 61.59	141.63 ± 66.2	NS
LDL- C (mg/dL)	125.03 ± 35.19	115.50 ± 31.8	NS	132.05 ± 34.5	105.11 ± 35.7	NS
HDL- C (mg/dL)	48.21 ± 13.30	49.86 ± 12.20	NS	43.05 ± 14.32	42.79 ± 9.16	NS
FI (mIU/mL)	10.75 ± 5.11	11.59 ± 3.38	NS	14.95 ± 8.09	14.76 ± 5.50	NS
HOMA-IR	3.30 ± 2.15	2.34 ± 0.73	NS	3.35 ± 1.85	2.67 ± 1.05	NS
Resistin (ng/mL)	5.72 ± 2.55	3.33 ± 1.58	<0.01	3.33 ± 1.58	3.28 ± 1.29	<0.01

nonsmokers. In our study, although it was not statistically significant, subjects who smoked had higher WHR than who did not smoke in both BMI groups.

In a study investigating the hypothesis that circulating resistin reflects the degree of pulmonary inflammation, in smokers, resistin-showed significant inverse correlations with markers of lung capacity and positive significant correlations with BMI and HOMA-IR.[27] Hyperresistinemia were found to be significantly higher among cigarette smokers with type-2 diabetes in Saudi Arabian population and smoking cessation restored the resistin levels.[28] In concordance with these studies, we determined hyperresistinemia in both of the smoker groups, either obese or nonobese comparing the nonsmoker ones.

Different results about cigarette smoking and insulin resistance have been reported by authors.[29-31] Most of the examiners have suggested that cigarette smoking may increase insulin resistance by altering the distribution of body fat or by exerting a direct toxic effect on pancreatic tissue. A chemical component of cigarettes was blamed to effect intracellular glucose transport directly, or to alter it through changes in serum chemistry or diminished vascular blood flow indirectly.[32] High catecholamine levels, being antagonistic hormones to insulin, were demonstrated in smokers.[33, 34] It is evident that catecholamines have long-term effects on insulin-regulated proteins such as GLUT- 4.[35]

Although in this study, HOMA-IR of smoker groups were higher than nonsmoker groups in both obese and nonobese subjects, we could not be able to determine statistically significant difference in HOMA-IR of smoker and nonsmoker groups in subjects with both BMIs. We speculate that if we will be able to perform another study with larger population in the future, we may obtain satisfactory results.

The limitations of this study include its cross-sectional nature, limited applicability to the general population because of the selection criteria, and the number of study subjects.

In conclusion, we found that plasma resistin levels are associated with smoking in at least a small group of Turkish population. We want to speculate that if one smokes obesity does not have any additive effect on resistin levels.

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