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Brief report

Altered levels of adipocytokines in type 2 diabetic cigarette smokers☆

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ABSTRACT

Hyperleptinemia, hypoadiponectinemia, and hyperresistinemia were found to be significantly higher with odds ratios (CI 95%) of 2.15, 2.05 and 3.05, respectively, among cigarette smokers with type 2 diabetes in Saudi Arabian population. Smoking cessation restored the adiponectin and leptin levels while having a modest effect on resistin levels.

1. Introduction

Adipocytokines including leptin, adiponectin and resistin are the major adipose tissue derived protein hormones, with multiple biological functions [1]. Cigarette smoking alters adipocytokine levels which are associated with insulin resistance, type 2 diabtes, atherosclerosis and cardiovascular disease [2–8]. Interestingly smoking cessation is associated with abnormal weight gain and metabolic abnormalities [9]. In this study we measured the leptin, adiponectin and resistin levels in type 2 diabetic non-smokers, smokers and ex-smokers in Saudi Arabian population. Incidentally, both type 2 diabetes and cigarette smoking are highly prevalent in Saudi Arabia [10].

2. Subjects and methods

This cross-sectional study was conducted in accordance with the guidelines set by the ethics committee of the College of Medicine, King Saud University. Written and informed consent was obtained from all the participants. Serum glucose, total cholesterol and triglycerides were measured using standard enzymatic methods and a fully automated

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analyzer (Konelab instruments, Finland). HDL–cholesterol levels were determined by phosphotungstic acid/magnesium chloride precipitation (Kone instruments, Finland). LDL–cholesterol was calculated using the Friedewald equation. Adiponectin and resistin were measured using the sandwich enzyme linked immunosorbent assay (ELISA) by Linco (Linco Ltd., USA). Leptin was quantified using ELISA kits from R&D (R&D Systems, Ltd., UK).

2.1. Statistics

SPSS for Windows Version 11.5 (Chicago, IL) was employed for statistical evaluation. Variables exhibiting non-Gaussian distribution, such as leptin, adiponectin and resistin were logarithmically transformed prior to analysis. The remaining variables were presented as means ± S.D. Analysis of variance (ANOVA) was done with post-hoc analysis to compare groups. The odds-ratio was used to assess risk. A p-value of <0.05 was considered statistically significant.

3. Results

Clinical and biochemical parameters of 154 adult diabetic males, categorized as non-smokers, smokers and ex-smokers, were shown in Table 1. Leptin, adiponectin and resistin levels were given as mean (range). Smokers had significantly lower diastolic blood pressure and HDL cholesterol. Percent prevalence and odds ratios (CI 95%) of hyperleptinemia, hypoadiponectinemia and hyperresistinemia were presented in Fig. 1. Leptin, adiponectin and resistin levels were significantly increased in smokers compared to non-smokers. Smoking cessation restored the leptin and adiponectin levels, while having a non-significant effect on resistin levels.

4. Discussion

Significantly reduced levels of HDL–cholesterol in smokers confirm the role of cigarette smoking in altering the lipid profile. It has been shown that cigarette particulate matter alters catecholamine release and thus free fatty acid release, which in turn affects VLDL and LDL concentrations to favor their accumulation in the blood, contributing to a lower HDL concentration [11]. The finding in our study of increased hyperleptinemia among cigarette smokers is in agreement with other studies [2,12]. At the same time, reports indicate the reduced leptin levels in cigarette smokers [13,14]. These contradictions may be attributed to differences in the study design, ethnicity, gender, and other coexisting pathologies. The increased hypoadiponectinemia among type 2 diabetic smokers in this study is consistent with reports which have linked cigarette smoking to decreased adiponectin levels [3,15]. Increased plasma resistin levels correlated with markers of atherosclerosis, cardiovascular diseases and type 2 diabetes [6,8,16]. Hyperresistinemia found in the present study suggests the effect of cigarette smoking on resistin. Moreover, the persistence of hyperresistinemia in ex-smokers may be a causative event in abnormalities related to smoking cessation [9].

Hypoadiponectinemia, hyperleptinemia and hyperresistinemia are all associated with cigarette smoking and in turn are linked to insulin resistance, type 2 diabetes, cardiovascular disease and atherosclerosis [2–8]. Incidentally Saudi Arabia is among the nations with the highest incidence of type 2

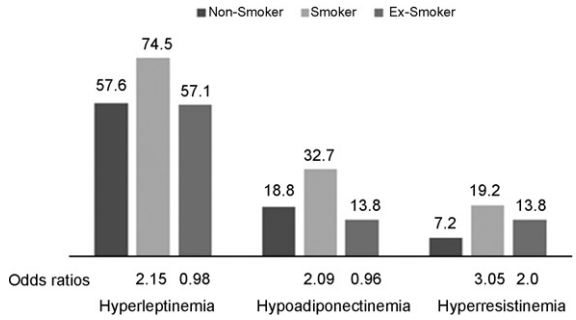

Fig. 1 – Prevalence (%) and odds ratios of hyperleptinemia, hypoadiponectinemia, and hyperresistinemia among type 2 diabetic non-smokers, smokers and ex-smokers.

Table 1 – Clinical and biochemical parameters in non-smokers, smokers and ex-smokers.

Parameter	Non-smokers ($N = 70$)	Smokers ($N = 55$)	Ex-smokers ($N = 29$)
Age (years)	51.6 ± 8.3	44.0 ± 11.7*	55.4 ± 10.3
Body mass index (kg/m^2)	29.4 ± 4.3	28.3 ± 5.4	28.4 ± 4.1
Systolic BP (mmHg)	117.4 ± 22.0	115.8 ± 17.8	119.1 ± 23.0
Diastolic BP (mmHg)	94.6 ± 13.5	83.9 ± 12.8*	91.6 ± 12.8
Glucose (mmol/L)	9.6 ± 2.6	7.2 ± 2.8	8.8 ± 3.1
T. Cholesterol (mmol/L)	5.0 ± 1.2	5.3 ± 1.2	4.6 ± 1.1
Triglycerides (mmol/L)	2.2 ± 1.2	2.0 ± 1.3	2.2 ± 1.9
HDL–cholesterol (mmol/L)	0.86 ± 0.4	0.50 ± 0.55*	0.99 ± 0.4
LDL–cholesterol (mmol/L)	3.1 ± 1.0	3.3 ± 1.1	2.7 ± 0.9
Leptin (ng/mL)	12.4 (9.5–15.3)	12.2 (9.8–14.7)	9.7 (5.7–13.6)*
Adiponectin (μg/mL)	10.2 (8.9–11.5)	9.0 (7.5–10.5)	11.3 (8.7–14.0)
Resistin (ng/mL)	14.5 (13.0–16.0)	16.9 (14.1–19.7)	14.5 (12.3–16.6)

Data presented as mean ± S.D.; *denotes significance compared with non-smokers and ex-smokers; adipocytokine levels were presented as mean (range); significant at $p < 0.05$.

diabetes and cigarette smoking [10]. Therefore the occurrence of one or more of these adipocytokine abnormalities may aggravate the diabetes pathology and lead to serious medical complications. Due to cross-sectional nature of this study the observations need to be followed up on a larger population and in a prospective setup to make a causal inference. In summary, our report representing the Saudi population reveals for the first time that cigarette smoking in individuals with type 2 diabetes collectively alters the leptin, adiponectin and resistin levels and that hyperresistinemia may exemplify a causal relationship between smoking cessation and the associated abnormalities.

Conflict of interest

The authors declare that they have no conflict of interest.

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