Journal of Experimental and Clinical Medicine
http://dergipark.ulakbim.gov.tr/omujecm

Clinical Research

J. Exp. Clin. Med., 2017; 34(1): 67-71
doi: 10.5835/jecm.omu.33.04.012

The comparison of insulin levels between over weighted and non-obese smokers

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ARTICLE INFO

Article History
Received 14 / 10 / 2016
Accepted 06 / 02 / 2017

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Keywords:
BMI
Insulin
Obesity
Smoking
WC

ABSTRACT

Cardiovasculer diseases are the most common reason for morbidity and mortality in the world. Smoking and obesity are among the most important avoidable reasons for these diseases. However, in Turkey, there are not enough studies about the effect of obesity (central and androgenic) on insulin levels of smokers. With this aim; oral glucose tolerance test (OGTT) was performed on 84 patients who meet the study criteria among 211 patients treated at the second internal diseases clinic of Taksim Hospital between November 1997 and May 1998, who were volunteers, smokers and older than 18. In addition, the total cholesterol, HDL, LDL and triglicerid levels of these patiens were checked. Heights, weights and waist circumferences of patients were measured. From these datas, body mass indexes (BMI) and waist circumferences (WC) were calculated. Nicotine addiction levels of patients were evaluated by Fagerstrom Nicotine Dependency Test (FNDT) and package/year amounts were calculated. According to the results based on the data obtained from the studies, no difference were determined ($p>0.05$), in ages, FNDT scores, insulin, TC, LDL and HDL levels between overweighted and normal weighted patients. On the other hand; there was statistically significant difference between two groups in BMI values, WC measurements (between different genders) and TG levels. In the regression analysis; BMI [OR: 1.512, (95% CI min=0.928, max=2.069)] and WC [OR: 1.912, (95% CI min=1.051, max=2.125)] was founded as a risk factor for the insulin increment. Additional information about the subject for the large participation cross-sectional studies. More action about life style modification (smoking cessation and an effective weight control) may increase risk of cardiovascular diseases in populations.

1. Introduction

Around the globe various studies on the effects of smoking on the insulin levels are started to be done recently (Hinnouho et al., 2013). There is increasing evidence that smoking is conducive to a greater accumulation of visceral fat tissue and greater insulin resistance (Istvan et al., 1982). Smoking also increases the risk of metabolic syndrome and type 2 diabetes. It is well known that smokers' blood glucose rise to levels higher than normal promoting insulin resistance. This condition was often tried to be explained by the mechanism of rising the stress hormone, cortisol by cigarette smoking. As cortisol excess is known to induce insulin resistance, it has been suggested that glucocorticoids, such as cortisol, may be the missing link between cigarette smoking and insulin resistance

(Harris et al., 2016). Although smokers tend to lose weight and have less fat tissue compared to nonsmokers they may still develop prediabetes and have high levels of cortisol in their blood and tissues. This situation may aggravates the cardiovascular disease and atherosclerosis which reflects the high rate of mortality from cardiovascular diseases in smokers. According to the Framingham study, the life expectancy of obese smokers was approx. 13 years shorter than that of normal-weight nonsmokers. In the same cohort, one third to one-half of obese smokers died between the ages of 4t0 and 70 years, whereas only 10% of normal-weight nonsmokers did so (Fox et al., 2004).

The global trend in increasing rates of obesity around the globe puts challenging tasks for the physicians in developing world. The aim of this study is to determine the relationship between insulin levels in over-weighted and normal weighted smokers in a Turkish sample.

2. Material and method

2.1. Study design

This study is designed as a case control study. It was conducted among Taksim State Hospital 2nd Internal Diseases Clinic between November 1997 to May 1998. The study sample was selected between this time among volunteered obese and non-obese smokers who had presented to 2nd Internal Diseases Clinic who are currently smoking more than a year (A total of 211). The patients who are <18 years, with Diabetes Mellitus (DM), or not using medication which impairs glucose-insulin metabolism (steroids etc.), patients with severe kidney (Acute/chronic renal failure) or liver diseases were omitted the study (n=119). Oral Glucose Tolerance Test (OGTT) was performed to these patients in accordance with WHO criteria's.

In order to achieve this goal, 75 grams of glucose were given to the patients orally after 12 hours of hunger. The blood glucose levels were obtained at pre-prandial; 30. 60. 90. and 120. minutes. From all the patients whose pre-prandial glucose level >140 mgr. / dl, 1. hour >200 mgr/dl and 2. hour >200 mgr/dl were omitted from the study and were diagnosed as DM (n=8). Remaining 84 patients (over weighted n=48, normal weighted n=36) were included in the study. Every participant's blood plasma who were included into study was obtained after 12 hours night hunger in sitting position, and sent to laboratory for evaluating their insulin, LDL, HDL and triglyceride levels. Diagnostic Systems Laboratories, DSL-1600 İnsülin Radioimmunassey Kits were used at evaluating insulin levels.

Interviewers asked information about tobacco use to the participants, investigated the age that they started to smoke, calculated their package/year. All of the participants were administered the Fagerström Nicotine Dependency Test (FNTD) (Fagerstrom et al., 1996). The interviewers also measured weight, height and waist circumference (WC) of the participants and calculated their Body Mass Index (BMI). Weight and height were measured using standard calibrated digital weighing scale and portable inflexible measurement tapes. WC was measured after the patients exhale breath from halfway between the lowest border of the ribs (the mid of the 12th rib) and the upmost part of the hip (iliac crest) on the middle axillary line using constant-tension tape device. The BMI is calculated by dividing weight (Kg) to the square of the height (cm). The patients who had BMI between 25 to 30 Kg/m^2 is accepted as over weighted. The patients who had BMI≥30 kg/m^2 is accepted as obese and WC ≥88 cm in females and ≥102 cm in males according to National Cholesterol Education Program-Third Adult Treatment Panel (ATP III) criteria (NIH, 2002).

2.2. Fagerstrom test for nicotine dependence

This test is a questionnaire used to determine the degree of smoking addiction commonly in the world. It was developed by Karl O. Fagerström in order to determine the level of physical smoking addiction and contains six questions (Fagerström et al., 1996). The patient can both be applied face to face and can be filled individually. A score between 1 and 10 can be taken from the questionnaire and the dependence level is considered to increase as the amount of the score taken increases. Those who take a score below 5 points from the test are defined as low nicotine addicts, and those who take 7 points and above are defined as severe nicotine addicts. In the adaptation made for our country, test and retest correlations were found 0.85 and 0.88 in order (Fidancı et al., 2015). A standardization study is available for the Turkish sampling (Uysal et al., 2004) and this scale was applied only to smoking participants (Şenyüz and Coştur, 2010).

2.3. Statistical analyses

The acquired data were examined and evaluated using SPSS 16.0 statistics program. Characteristics of the study group were presented with definitive type of analyses (number, percentage, average and standard deviation). Data were evaluated using mutual independent group comparisons Mann-Whitney-U groups test and Pearson chi-square and Kruskall Wallis test analysis methods. Statistical significance level 'p' value was accepted as those below 0.05.

2.4. Ethics

Ethical Approval was obtained from Minister of Health of Turkish Republic

3. Results

A total of 84 participants (43 men 51.2% and 41 women

Table 1. The comparison between overweighed and normal weighted smokers FNTD scores, package year, insulin, TG, HDL and LDL levels

Variables	Overweighted N=43	Normal weighted N= 41	t	p
FNDT	4.52±1.23	4.56±1.25	0.258	0.624
Pack/year	12.5±2.5	12.9±2.3	0.154	0.754
BMI (kg/m^2)	28.6±2.4	23.04	12.739	<0.001
WC (cm)	Women 98±1.2 Men 120.2±1.8	Women 90±1.5 Men 116.1±1.3	10.247 9.245	<0.001 <0.001
Insulin (μIU/ml)	25.16±5.3	24.97±6.2	0.153	0.878
TC (mgr/dl)	146±2.2	143±2.8	0.541	0.154
LDL (mgr/dl)	139.8±32.6	127.72±27.1	1.813	0.074
TG (mgr/dl)	219.5±77.7	169.2±106.1	2.509	0.014
HDL (mgr/dl)	42.7±9.4	44.5±9.6	0.694	0.489

FNDT: Fagerstrom nicotine dependency test; **BM**: Body, mass index; **WC:** Waist circumference; **TC:** Total cholesterol

48.8%) volunteered to participate into the study. There was no difference between the ages of the women and men participants in different groups (t=0.425, p=0.672). The comparison between two groups' FNDT, package/year, BMI, Insulin, total cholesterol, LDL, TG and HDL values are presented at Table 1. Only the TG levels in over weighted participants were high when compared to other group (p=0.014). It was seen that BMI (r=0.3) and WC (r=0.36) is correlated with insulin levels in both groups. In a linear regression model the BMI [OR: 1.512, (95% CI min=0.928, max=2.069)] and WC [OR: 1.912, (95% CI min=1.051, max=2.125)] was founded as a risk factor for the insulin increment. The model had a Durbin Watson value of 1.045, and its r^2 value was 0.296. The linear regression analyses are presented at Table 2.

5. Discussion

We obtained interesting results in this study in which we researched for the factors that can affect the insulin levels in overweight and normal weight smoker individuals. There is detailed information about insulin secretion, resistance, obesity and metabolic syndrome in the non-smokers. De Fronzo et al. (1985) had studied insulin resistance, glucose response and insulin response as dependent variables in over weighted and obese participants. They have reported that insulin response has only significant relation with decrease of leptin level independently. More importantly in the same study it was concluded that there is correlation between leptin concentration and a decrease in insulin response after weight loss. Also this decrease had no correlation regardless of which BMI measurement that patients have (De Fronzo et al., 1985). There are serious information that WC which is another anthropometric measurement method, is a risk factor for insulin level, insulin resistance and prediabetes (Li et al., 2016). Carantoni et al. (1999) reported that local distribution of body fats are important signs for NIDDM and cardiovascular disease. In a study performed on premenapausal women, visceral adipose tissue level has relation with lipoprotein rate that is used in cardiovascular disease risk analysis. In the same study it was revealed that high visceral fat level has relation with decrease in glucose tolerance and also it remains importantly after total body fat levels are taken under

Table 2. The Linear regression model investigating the relation of dependent variables of FNDT, with dependent variables of BMI, WC, FNDT, package year, gender, age, LDL, TG and HDL

Model	Unstandardized coefficients	Standardized coefficients			95% Confidence interval for B	
	B	Std. error	Beta	t	Sig.	Lower bound
(Constant)	-40.067	11.265		-3.557	0.001	-62.503
GENDER	-2.039	1.200	-0.179	-1.699	0.093	-4.429
BMI	1.512	0.293	0.907	5.154	0.000	0.928
AGE	0.024	0.065	0.036	.369	0.713	-0.106
LDL	0.022	0.019	0.116	1.111	0.270	-0.017
TG	0.004	0.006	0.068	0.650	0.518	-0.009
HDL	0.034	0.065	0.057	0.527	0.600	-0.095
WC	1.912	1.927	0.728	4.338	0.000	1.051
FNDT	0.251	0.021	0.521	0.541	514	0.621
Package/year	0.317	0.841	0.745	0.127	0.754	0.124
TC	0.08	0.148	0.124	0.05	0.147	0.08

INSULIN: Dependent variable; **FNDT:** Fagerstrom nicotine dependency test; **BM**: Body, mass Index; **WC:** Waist circumference; **TC:** Total cholesterol

control. More interestingly that there are significant relations between abdominal visceral obesity, insulin resistance and dyslipidemia and that visceral obesity is an important component for Syndrome X (Carantoni et al., 1999).

Only recently that data has started to be gathered about smoking addiction and insulin secretion, insulin resistance, central obesity (BMI) and/or androgenic obesity (WC) and metabolic syndrome. It is well known that nicotine acutely increases energy expenditure and could reduce appetite, which may explains why smokers tend to have lower BMI (Williamson et al. 1991). However in several cross sectional studies there has been clustering evidence of relationship between smoking and central (BMI) or androgenic (WC) obesity (Wild and Byrne, 2006). It is observed that; in overweight smokers there is a strong relation between obesity, metabolic syndrome, insulin resistance and diabetes (Chiolero et al., 2008). It has been argued that the increased insulin resistance in smokers may be related to their tendency towards increased abdominal fat accumulation (Canoy et al., 2005). Cross-sectional studies indicate that smokers tend to have both a larger waist circumference and a smaller hip circumference, compared to nonsmokers (Leite at al., 2006). This situation may be partly explained by the increase at visceral fat tissue. However this topic need more investigation as the association between smoking and visceral fat accumulation may be partly explained by a confounding with the low degree of physical activity and unhealthy diet frequently encountered among smokers.

In a study with a participating 729 dyslipidemia patients (143 of them were smokers) it has been revealed that insulin resistance is more common in smokers compared to non-smokers (Cibickova et al., 2014). In study which was conducted in Japan 1199 men who were at the baseline of impaired insulin secretion and insulin resistance were investigated (Morimoto et al., 2013). This study revealed that cigarette smoking is a modifiable risk factor for impaired insulin secretion. The interesting factor was this study showed that ex-smokers were at danger for impaired insulin secretion compared with non-smokers [1.06 (95% CI, 0.84-1.33)]. The most risky group was the current smokers [1.95 (95% CI, 1.44-2.63)]. The number of pack-years was positively associated with the risk for impaired insulin secretion in a dose-dependent manner (P-values for trend <0.001). The multivariable-adjusted HRs for insulin resistance were 0.95 (95% CI 0.56-1.61) in ex-smokers and 1.11 (95% CI 0.67-1.79) in current smokers compared with never-smokers. Szulinska et al., (2013) conducted a study investigating the potential influence of obesity and smoking on insulin resistance. In this study it was stated that smoking has a significant effect on insulin resistance, TNF-α concentration. Moreover, the coexistence of smoking and obesity significantly aggravates the abnormalities observed. The insulin levels (μİU/ml) of obese nonsmokers were (36.1±19.3), obese smokers (45.7±15.5) and normal weight smokers (7.5±2.8). The normal weighted non-smokers had the lowest insulin levels . Compared with that study our results confirmed lower insulin levels in both groups however they are both higher than the normal weight smokers. Although there were no differences between two groups' (over weighted and normal weighted) mean insulin levels there was a positive correlation between insulin levels and BMI and WC measurements in linear regression analyses.

Our study may have some flaws. First of all in our study we didn't included a healthy nonsmoker normal weight group. The results of this group might help us better understand the relationship and effect of smoking to insulin levels in smokers. Our aim in this study was to reflect that the insulin levels of normal weighted smokers may be as high as obese smokers. Although our design was a case control study so large cross sectional studies may confirm our results.

As a conclusion both smoking and obesity (increased BMI and WC) may be contributed to the levels of insulin, insulin resistance which is a key factor and significant predictive factor cardiovascular disease. More action about life style modification (smoking cessation and an effective weight control) may increase risk of cardiovascular diseases in populations.

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