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Full Length Research Paper

Study of C- peptide and glycoslated hemoglobin in obese and obese with type 2 diabetes and its relation with lipid profile from Sohag Governarate-Egypt

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Individuals with coexisting diabetes and metabolic syndrome have the highest prevalence of lipid abnormalities and cardiovascular disease. The aim of this study give attention for the risk associated with the increase of obesity rates and its complications in Egypt. This study was conducted on 91 subjects at Hospital of Sohag University to evaluate the relationship between levels of HbA1C, c-peptide and lipid profile in obese and obese diabetic patients. The results showed that both obese and obese diabetic subject has higher blood pressure, blood glucose, HbA1C, C-peptide, total cholesterol, TG, LDL-C and lower HDL than normal control subjects. In addition, the previous parameters were higher in diabetic obese than normal obese subject. It is concluded that these results suggest that HbA1c, C-peptide level can be used as tools for predicting the lipid profile of both normal obese and obese diabetic patients. Glycated hemoglobin (HbA1C) is the indicator of glycamic status over long term. C-peptide is inflammatory markers elevated in diabetic patients.

Keywords: HbA1c, C-peptide, lipid profile, obese, diabetes.

INTRODUCTION

Obesity is a chronic disease of multi-factorial origin that develops from the interaction of social, behavioral, psychological, metabolic, cellular, and molecular factors. It is the condition under which adipose tissue is increased

and can be defined as an increase in body weight that results in excessive fat accumulation (Kaufer et al., 2001). Egypt is the fattest African country and the 14th fattest country in the world, according to the most recent World Health Organization statistics issued for the year 2010. Among Egyptians above the age of 20, there are more overweight and obese females than males. According to WHO statistics, an estimated 76.9 % of females in this age group are said to be overweight and

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obese, in comparison with approximately 62.4% of Egyptian males (World Health Organization, 2008). Overweight and obese populations place additional burdens on health care expenditure because are associated with an increased risk for many medical problems Kahn and Flier, 2000; Rahmouni et al., 2005). One of these problems is Type 2 diabetes which is one of the most common chronic diseases, affecting about 150 million people worldwide (Matthaei et al., 2000). It is characterized by insulin resistance of peripheral tissues such as liver, muscle, and fat which cannot be overcome by hyper secretion of pancreatic β cells. Insulin resistance is often associated with increased body weight and recently, various adipocyte-secreted proteins have been described which are altered in obesity, affect insulin sensitivity and might, therefore, provide a link between these two pathological states (Saltiel, 2000).

Obesity and type 2 diabetes both are independent risk factors for hypertension and dyslipidemia. Multiple modifications of serum lipids and lipoproteins are frequently noted in overweight/obese individuals. The most common modifications are hypertriglyceridemia and decreased HDL-C levels. There is a strong negative correlation between obesity and HDL-C levels (Despres, 1991; Kimberly et al., 2012). The dyslipidemia associated with obesity no doubt plays a major role in the development of atherosclerosis and CVD (Castelli et al., 1986; Jingyao et al., 2013). Increased serum concentrations of triglycerides (TGs) have also been recognized as a risk factor for cardiovascular disease (Gaziano et al., 1997; Onat et al., 2006). Epidemiologic studies demonstrated that the total cholesterol (TC)/HDL-C and the LDL-C/HDL-C ratios are better predictors of atherosclerosis and cardiovascular disease than any other single lipid marker (Kinosian et al., 1994; Ridker et al., 2001). The present study therefore aimed to assess the complications related to obesity and type 2 diabetes through determination of glucose tolerance, hypertension and lipid profile, HbA1c and c-peptide levels in serum of obese subjects with and without Type 2 diabetes in Sohag governorate.

Ethics statement

This study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the ethics committees of Sohag University. All the subjects gave their written informed consent for inclusion before they participated in the study. All the data were analyzed anonymously throughout the study. This study

was part of PhD in biochemistry registered in Sohag University.

Subjects

The 91 participants over the age of 20 years who have no serious health problems including cardiovascular diseases. The exclusion criteria at the beginning of the study were pregnancy, mental disorders and cancer. Hypertension and dyslipidemia occurred with type 2 diabetes in 37% (19/51) and 39% (20/51) of the subjects, respectively. According to the criteria, obesity was defined as a BMI of 30 kg/m^2 or greater. Ninety one individuals include 49 obese with $\text{BMI} \geq 30 \text{ kg/m}^2$, 8 obese diabetic type 2 and 34 control individuals.

Collocation of blood and biochemical analysis

Venous blood samples were collected from participants after an overnight fasting for determination of fasting C-peptide, total Cholesterol, HDL-C, and TG. Also, fasting and postprandial blood glucose level, HbA1c and blood pressure were measured for all participants. HbA1c was measured in venous EDTA whole blood by the colorimetric method according to Trivelli, LA *et al.* C-peptide concentration was measured in serum by ELISA kit according to kit instructions (wkeamedsupplies, China). Serum TC, HDL-C, and TG concentrations were determined calorimetrically by kits purchased from (STANBIO LABORATORY, Texas) Serum LDL-C was calculated according to the Friedewald formula (1972): $\text{LDL} = \text{TC} - \text{HDL} - \text{TG}/5.0 \text{ (mg/dL)}$ (Naoto et al., 2008).

Statistics

Statistics was performed using the statistical graph pad prism 5. One way analysis of variables (ANOVA) was used posted by Newman-keuls test. All results are expressed as mean \pm SE and the level of significance between groups were * $p < 0.05$, ** $p < 0.01$, *** $p < 0.0001$.

RESULTS

The study was conducted on 49 normal obese, 8 obese diabetic patients and 34 control participants. As in table 1 the BMI was significantly higher in obese and obese diabetic patients than normal, but there is no difference

Table 1. Showing the general characters and different study parameters in different subjects.

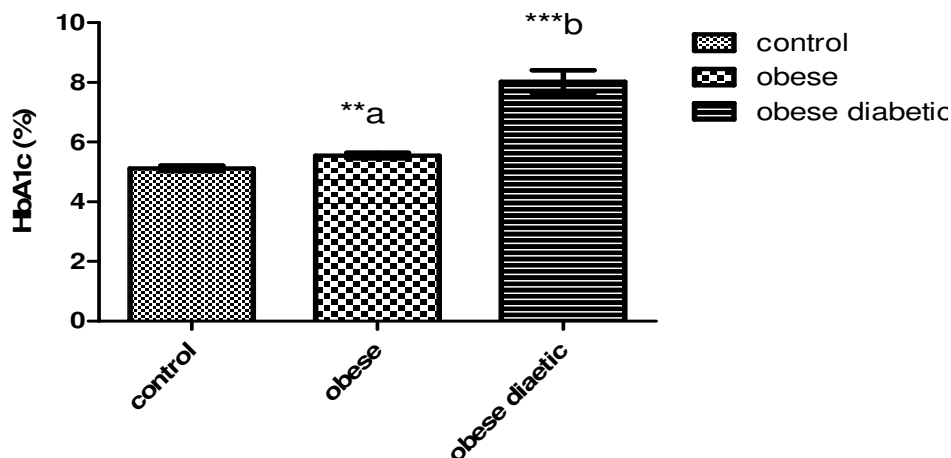
<i>Parameters</i>	<i>Control</i>	<i>Obese</i>	<i>Obese diabetic</i>
Number of subject	34	49	8
BMI (kg/m ²)	21.83±0.2428	35.61±0.6045 ^{*** a}	34.13±1.137
Waist circumference (cm)	84.26±1.105	120.0±1.434 ^{***a}	121.0±1.732
Systolic blood pressure (mmHg)	125.1±3.221	134.3±2.253 ^a	160.0±7.498 ^{***b}
Diastolic blood pressure (mmHg)	85.18±2.541	91.15±1.781 ^a	109.8±2.498 ^{***b}
Fasting blood glucose level	84.32±1.438	92.04±1.394 ^a	179.3±12.47 ^{***b}
Postprandial 2 hours blood glucose level	108.8±3.252	118.0±2.811	257.3±11.78 ^{***b}
Triglycerides (mg/dL)	113.5±5.491	142.1±7.204 ^{**a}	143.8±6.167
Total cholesterol (mg/dL)	147.8±5.063	164.2±5.906 ^a	188.6±3.875
HDL-cholesterol (mg/dL)	42.04±0.8381	36.98±0.8574 ^{***a}	37.26±1.048
LDL-cholesterol (mg/dL)	83.04±4.964	98.76±5.641 ^a	122.6±5.179
Triglyceride/HDL cholesterol ratio	2.751±0.1572	4.048±0.2658 ^{***a}	3.868±0.1575
LDL-cholesterol/HDL-cholesterol ratio	2.016±0.1314	2.732±0.1752 ^{**a}	3.321±0.2025
Cholesterol/HDL ratio	3.566±0.1429	4.541±0.1928 ^{***a}	5.095±0.1948
c-peptide (ng/ml)	1.163±0.04672	2.463±0.1753 ^{***a}	2.213±0.02932
HbA1c (%)	5.118±0.09172	5.548±0.08763 ^{**a}	8.025±0.3867 ^{***b}

BMI: body mass index; HDL: high density lipoprotein; LDL: low density lipoprotein; HbA1c: haemoglobinA1c.

All results are expressed as mean ± SE and the level of significance between groups were *p<0.05, ** p<0.01, *** p<0.0001.

a: comparison between control and obese subjects

b: comparison between obese and obese diabetic groups.

**Figure 1.** Showing the HbA1C in sera of different subjects

among obese and obese diabetic. Also, the same table showed that both obese and obese diabetic patients were has hypertension and the obese diabetic has higher blood pressure than obese subjects. Obese diabetic when compared to obese control subjects showed statistically significant increase in the levels of fasting and postprandial 2 hours blood glucose (Table 1). As in

Figure 1 HbA1C in normal obese and diabetic obese showed significant increase than normal subjects, however it highly significant increase in obese diabetic than normal obese. Plasma c-peptide was significantly increased in both obese and obese diabetic than normal subjects (Figure 2). Total cholesterol (Figure 3), triglycerides (Figure 4, LDL (Figure 6) were statistically

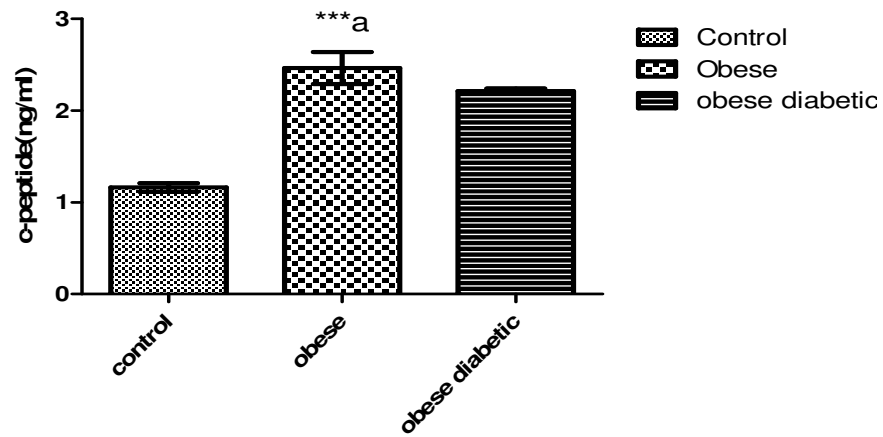


Figure 2. Showing the C-peptide in sera of different subjects

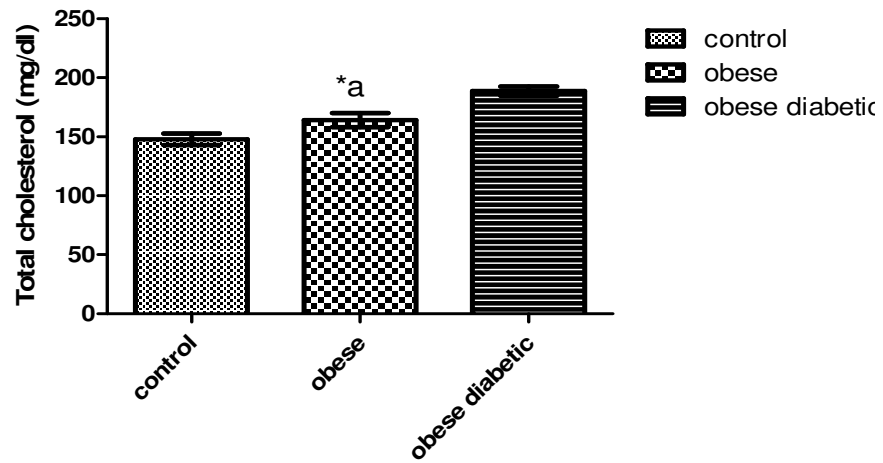


Figure 3. Showing the total cholesterol in sera of different subjects

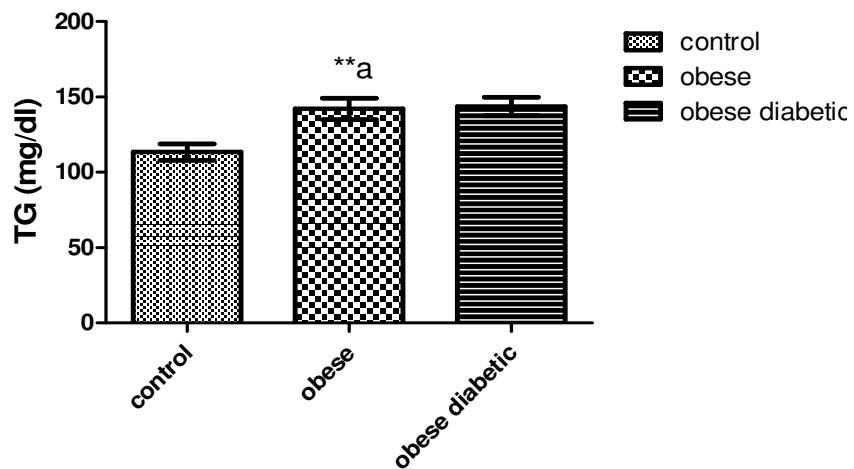


Figure 4. Showing the triglycerides in sera of different subjects

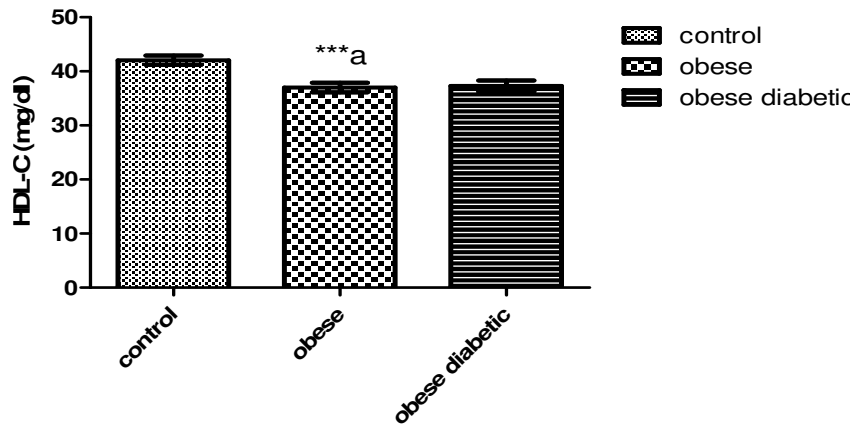


Figure 5. Showing the HDL-C in sera of different subjects

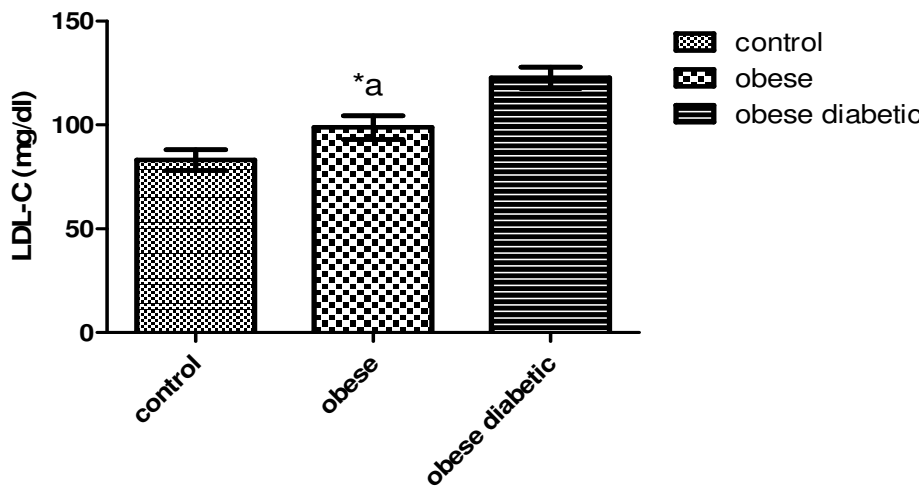


Figure 6. Showing the LDL-C in sera of different subjects

significant increase in normal obese and obese diabetic subjects in comparison with normal control, however, HDL (Figure 5) showed a significant decrease in the two obese group. The ratio between TG /HDL, cholesterol/HDL, and TG/HDL showed statistically significant increase in normal obese and obese diabetic subjects in comparison with normal control with no differences among the two obese groups (Table 1).

DISCUSSION

In the present study, the obese subject (BMI 35.6 and waist circumference 120 cm) and obese diabetic (BMI 34.1 and waist circumference 121) have blood pressure

134.3/91.15 and 160/109.9, fasting blood glucose 92 and 179.3 and postprandial 2 hours blood glucose 118 and 257.3, respectively. In this aspect, **Janssen et al. (2002)** claimed that body mass index and waist circumference independently contributed to the prediction of abdominal, subcutaneous and visceral fat. It is known that both lipid profile and body fat have been shown to be the important predictors for metabolic disturbances including dyslipidaemia, hypertension, diabetes and cardiovascular diseases (Sandhu et al., 2008). Waist circumference and waist/hip ratio have been used as measures of central obesity and body mass index has been used as a measure of general obesity. Central obesity has been associated with decreased glucose tolerance, alterations in glucose insulin homeostasis, reduced

metabolic clearance of insulin, and decreased insulin-stimulated glucose disposal (Vazquez et al., 2007). While there are no conclusive studies to demonstrate the advantage of BMI or waist circumference as an indicator of diabetes, at least there is an indication of waist circumference being an important indicator of progression to diabetes (Gautier et al., 2010). In addition, Kamath et al. (2011) found that blood glucose levels did not differ significantly between the obese and nonobese individuals. However, blood glucose levels were found to be lesser in those with increased waist circumference.

The most characteristic lipid abnormality in diabetics is hypertriglyceridaemia, with or without associated increase in plasma cholesterol (Taskinen, 1990). In the present study, normal obese and obese diabetic participants showed significant higher levels of cholesterol, TG, LDL and lower level of HDL than normal subjects. Similarly, Zargar et al. (1995) obese diabetics when compared to obese control subjects showed statistically significant increase in the levels of serum total lipids, total cholesterol, triglycerides and LDL-cholesterol. Also, Brehm et al. (2004) found that TG/HDL-C ratio positively correlates with insulin resistance in severely obese nondiabetic individuals.

HbA1c is a marker routinely used for long-term glycemic control and they observed a direct and significant correlation between HbA1c with TC, TG and LDL, and reverse correlation with HDL (Arivarasan et al., 2012)). In the present study HbA1C and C-peptide were significantly increased in obese diabetic patents. In this topic, there was no difference in the glycemic status of males and females as measured by fasting glucose levels and HbA1c. HbA1c showed positive correlations with TC, TG, LDL & VLDL and negative correlations was found between HbA1c and HDL levels. These findings suggest that HbA1c level can be used as good parameter for predicting the lipid profile of diabetic patients (Meenu et al., 2014). HbA1c can be used as a potential biomarker for predicting dyslipidemia in diabetic patients (Singh and Kumar, 2011). Moreover, high C reactive protein may be a marker of oxidative stress on the endothelium in diabetic patients. In fact, high levels of serum C reactive protein and other inflammatory markers in a normal population is an indicator of future development of diabetes (Pradhan et al., 2001). The levels of C reactive protein in blood correlate with the severity of diabetes and degree of control vary with blood HbA1C levels (King et al., 2003) and showed significant positive correlation with serum TG and HbA1C (Bandyopadhyay et al., 2013). In addition, High levels of serum glucose are

associated with high level of TC and LDL (Sheikhpour et al., 2013). Khan (2007) suggests that HbA1c can provide valuable supplementary information about the extent of circulating lipids besides its primary role in monitoring long-term glycemic control.

The present data found a significant change in TG/HDL, LDL/HDL, and cholesterol/HDL ratio in both normal and diabetic obese participant. Lopes-Verefla et al. (1981), Schmitt et al. (1982) found that LDL/HDL-cholesterol ratios have been shown to be inversely correlated with prevailing blood glucose levels or with HbA1C levels as an index of blood glucose control.

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