Studying the Relation between lipid profile and HbA1c in elderly patients with Type 2 Diabetes

Marwa Abdel azim Abdel Gawad and Hend F Mahmoud

Faculty of Medicine, Department of Geriatrics and Gerontology, Ain Shams University, Cairo, Egypt.

ABSTRACT

Introduction: Diabetes mellitus is characterized by chronic hyperglycemia with disturbances in carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action or both. Glucose and lipid metabolism are linked to each other. It is well known that dyslipidemia is considered a major risk factor for macrovascular complications in patients with type-2 diabetes mellitus. Recently, obesity-related metabolic syndrome has received widespread attention. The aim of the current study was to find out the correlation between HbA1c, lipid profile and BMI of elderly patients with type 2 Diabetes mellitus.

Methods: A cross-sectional observational study was conducted in a sample consists of one hundred and sixty elderly patients with type 2 diabetes. Glycemic control, lipid profile, body mass index (BMI) were assessed.

Results: There was a significant positive correlation between HbA1c and FBS with total cholesterol, LDL and triglycerides and a significant negative correlation with HDL. Also, there was a significant positive correlation between HbA1c and FBS with BMI.

Conclusion: Increased levels of HbA1c, is associated with dyslipidemia and increased BMI.

Keywords: Type 2 diabetes, elderly patients, HbA1c, lipid profile.
Introduction:
Diabetes mellitus is characterized by chronic hyperglycemia with disturbances in carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action or both. It is estimated that the number of patients with diabetes will rise from 415 million to 642 million by 2040 with increasing its incidence worldwide, it will be a leading cause of morbidity and mortality in the future. The prevalence of T2DM increases with age, in developing countries, most diabetics are in the age group between 45 and 64 years, while in developed countries most patients with diabetes are found in those aged 65 years and above. Glucose and lipid metabolism are linked to each other. It is well known that dyslipidemia is considered a major risk factor for macrovascular complications in patients with type-2 diabetes mellitus (T2DM) and it affects about 10%-73% of this population. However, in the last decade we have learned that the interaction is much more complex. Hypertriglyceridemia and low HDL-C are not only the consequence but also the cause of a disturbed glucose metabolism. Recently, obesity-related metabolic syndrome has received widespread attention. To account for the correlation between obesity and T2DM, body mass index (BMI) has been introduced as a composite covariate for adjustment in T2DM studies. BMI is obtained by dividing weight by the square of height (ie, kg/m2). subjects with a BMI ≥25 kg/m2are defined as overweight and those with a BMI ≥30 kg/m2 are defined as obese. Some Studies have shown a direct relationship between increasing BMI and raised TC, LDL-C, and TG and an inverse correlation with HDL-C. This correlation between BMI and lipoprotein levels, especially LDL-C, has been proposed to be a strong contributing risk factor for cardiovascular diseases in obese individuals. However, other studies validated a correlation between BMI and TG or HDL-C in obese patients, except LDL-C levels. These results have raised the question of a possible "obesity paradox" where LDL-C levels may elevate or decline with extreme BMI levels.
Glycated hemoglobin (HbA1c) is a marker that is used for long-term glycemic control. Besides its function as an indicator for the blood glucose level, it also predicts the risk for the development of diabetic complications in patients with diabetes. Many studies have proposed HbA1c to be used as a biomarker of both glycemic control and dyslipidemia in type 2 diabetes mellitus.

Materials and Methods:
A cross-sectional observational study was conducted to find out the correlation between HbA1c, lipid profile and BMI of elderly patients with type 2 diabetes mellitus. Participants were 160 elderly patients with history of type 2 diabetes mellitus aged 60 years and above both males and females recruited from geriatric outpatient clinic and geriatric department in Ain Shams University Hospital. Exclusion criteria included patients under 60 years, patients with disturbed level of consciousness due to any medical condition or drug effect, patients with delirium, and those who refused to participate. Data collection included detailed medical history included duration of diabetes and presence of complications, clinical examination, comprehensive geriatric assessment, measurement of the weight and height was done, and BMI was calculated by dividing weight (in kg) by the square of height (by meter). A venous blood sample was collected from each participant to measure HbA1c, FBS, Lipid profile (total cholesterol, LDL, HDL and TGs). Informed consent was obtained from all participants.

Data analysis:
Analysis of data was performed by using the 16th version of statistical package for social science (SPSS). Descriptive statistics were done for numerical parametric data as mean, standard deviation and minimum & maximum of the range and for categorical data as frequency and percentage. Correlation analysis (using pearson correlation) to assess the strength of a
monotonic relationship between paired data. Significance level measured according to P value (probability), P>0.05 is insignificant, P<0.05 is significant and P<0.01 is highly significant.

**Results:**
The study included 160 participants. The patients’ mean age was (66.4) ± 5.4 years. (56.2%) of them were women and (43.8%) were men. (75.6%) of them were not working and (24.4%) were working. (22.5%) of our patients were living alone but the rest (77.5%) living with others. Most of them (49.4%) were illiterate, (36.2%) educated for 5 years, (11.9%) 6-10 years, and (2.5%) for > 10 years education and (66.2%) of them were nonsmokers but smokers were (33.8%) of patients (table 1).

HbA1c and FBS were significantly positively correlated with total cholesterol, LDL and triglycerides and had a significant negative correlation with HDL (table 2). HbA1c and FBS had a significant positive correlation with BMI (table 2).

| Table 1. Demographic characteristics of cases |
|---------------------------------------------|
| Range | Mean ± SD |
| Age | 60-86 | 66.4±5.4 |
| **Gender** | | |
| | Frequency | Percent |
| male | 70 | 43.8 |
| female | 90 | 56.2 |
| Total | 160 | 100.0 |
| **Occupation** | | |
| | Frequency | Percent |
| working | 39 | 24.4 |
| no woking | 121 | 75.6 |
| Total | 160 | 100.0 |
| **living arrangment** | | |
| | Frequency | Percent |
| with others | 124 | 77.5 |
| alone | 36 | 22.5 |
| Total | 160 | 100.0 |
| **Education** | | |
| illiterate | 79 | 49.4 |
| 5 yrs education | 58 | 36.2 |
| 6-10 yrs education | 19 | 11.9 |
| >10 yrs education | 4 | 2.5 |
| Total | 160 | 100.0 |
| **Smoking** | | |
| no | 106 | 66.2 |
| yes | 54 | 33.8 |
| Total | 160 | 100.0 |
Table 2. The correlation of HbA1c and FBS with lipid profile and BMI.

|                  | HbA1c       | FBS        |
|------------------|-------------|------------|
|                  | Pearson Correlation | Sig. (2-tailed) | N |
| Cholesterol      | .247**      | .002       | 160 |
|                  |             | .338**      | .000      |
| TGs              | .338**      | .002       | 160 |
|                  | .305**      | .000       | 160 |
| LDL              | .212**      | .007       | 160 |
|                  | .280**      | .000       | 160 |
| HDL              | - .489**    | .000       | 160 |
|                  | - .489**    | .000       | 160 |
| BMI              | .225**      | .004       | 160 |
|                  | .249**      | .001       | 160 |

**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).

Discussion:

Dyslipidemia is likely to increase HbA1c and vice versa as the correlation between these parameters are directly proportional and goes together\textsuperscript{16}. Several reports have shown a significant influence of lipid concentration on hemoglobin glycation and increased CVD risk due to increased insulin resistance\textsuperscript{22}. Hyperglycemia promotes increase in LDL glycation and affinity towards LDL-receptors on macrophages; stimulate foam cell formation, endothelial cell toxicity and smooth muscle proliferation responsible for coronary artery and macrovascular complications\textsuperscript{23}.

Reduction in HbA1c in T2DM is associated with improved insulin sensitivity and better lipid parameters.\textsuperscript{12} Also, improved blood sugar control has favorable effects on lipoprotein levels, with a reduction in cholesterol and triglyceride levels through decreased circulating very-low-density lipoprotein (VLDL) and by increased catabolism of LDL through reduced glycation and upregulation of LDL receptors\textsuperscript{18}.

The aim of the current study was to investigate the relation between HbA1c, lipid profile and BMI in elderly patients with type 2 diabetes.

In the current study HbA1c and FBS were significantly positively correlated with total cholesterol, LDL and triglycerides and had significant negative correlation with HDL.

In addition to the storage of lipids in the adipose tissue, adipocytokines like adiponectin, leptin, TNF, IL-6, resistin play an important role in tissue physiology and have been shown to be linked to obesity, insulin resistance and β-cell dysfunction\textsuperscript{17}. McTernan et al. in their animal study showed an increased resistin expression in adipose cells obtained from abdominal and omental region possibly contributing to insulin resistance, glucose intolerance and development of T2DM\textsuperscript{18}. This may explain the results obtained from the current study which showed significant positive correlation between HbA1c and FBS with BMI.

These results agree with the results of the study done by Sheth et. Al., 2015 who concluded that Dyslipidemia and obesity are significantly associated with poorly controlled hemoglobin glycation in T2DM. Also, Eglal et al performed a study on 50 patients with type 2 diabetes mellitus in Khartoum Sudan, they found significant correlation of HbA1c and TGs (14). Also,
Agrawal et al. have found a positive correlation between fasting blood glucose level and BMI\textsuperscript{15}. Yan et al conducted a study on 128 patients with type 2 diabetes in China. They observed a significant correlation between HbA1c and LDL in diabetic patients. However, they did not observe a significant correlation of HbA1c with TG, TC or HDL\textsuperscript{20}.

However other studies failed to demonstrate a relation between HbA1c and lipid profile as in the study done by Senthilkumar et al, who conducted a perspective study on 162 type 2 diabetes mellitus patients. They found no significant correlation of HbA1c with TC, LDL, HDL and TG\textsuperscript{13}. Also, a study done in India found no significant correlation between HbA1c and various parameters of lipid profile\textsuperscript{21}.

In conclusion, patients with diabetes have dyslipidemia to varying degrees. With the increased levels of HbA1c, dyslipidemia become more severe which increased risk for cardiovascular disease.

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