



Lipid profile among diabetes patients in Gaborone, Botswana

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A cross-sectional study was undertaken to determine the serum lipid profile of diabetes mellitus (DM) patients receiving treatment at Gaborone City Council clinics. A total of 401 patients were studied over a 3-month period. It was found that 33.5% had hypercholesterolaemia and 38.9% hypertriglyceridaemia. The mean low-density lipoprotein (LDL) levels were higher in females than in males, but there was no difference in LDL levels between type 1 and 2 DM

patients. There was no difference in cholesterol, triglyceride and high-density lipoprotein (HDL) levels between genders or between type 1 and 2 patients. Hyperlipidaemia was associated with high body mass index. Only hypertriglyceridaemia was associated with high blood pressure. Hyperlipidaemia was not associated with exercise, smoking or alcohol consumption in the DM patients studied.

S Afr Med J 2006; **96**: 147-148.

Hyperlipidaemia has been incriminated as a risk factor in coronary heart disease (CHD) and atherosclerosis,^{1,2} in addition to other risk factors including diabetes mellitus (DM). DM affects several lipid metabolism mechanisms. Low insulin levels in type 1 DM are associated with high levels of chylomicrons and very-low-density lipoprotein (VLDL) and lipoprotein lipase deficiency, resulting in hypertriglyceridaemia. Such hyperlipidaemia improves with tighter control of type 1 DM. Obesity and insulin resistance result in hypertriglyceridaemia due to overproduction of VLDL. Management of hyperlipidaemia in type 2 DM involves rigorous dietary and drug treatment. Treatment of hyperlipidaemia has been shown to benefit DM patients in decreasing CHD risk.²⁻⁴

In a study of DM patients in Ethiopia,⁵ 18.5% and 14.2% were found to have hypercholesterolaemia and hypertriglyceridaemia respectively. In the same study hypercholesterolaemia was found in a high proportion of females and type 2 DM patients. In a report from the third US National Health and Nutrition Examination Survey and the Behavioral Risk Factors Surveillance System⁶ which monitored 4 085 adults with diabetes, 58% had serum low-density lipoprotein (LDL) cholesterol levels greater than or equal to 3.4 mmol/l. Of the 2 481 patients aged over 45 years studied in the UK to assess the universal screening of diabetes in general practice, 73% (45 - 92%) had a cholesterol level > 5 mmol/l.⁷ In a cross-sectional survey in South Africa⁸ undertaken to assess dietary patterns in type 2 DM patients (133 men, 155 women), high triglyceride levels were detected in 24 - 25% of men and in 17 - 18% of women.

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Subjects and methods

A cross-sectional study was carried out in Gaborone, Botswana. The study subjects were all DM patients receiving diabetic care at 14 Gaborone City Council (GCC) clinics. A medical officer examined the patients and administered a questionnaire, and patients were sent for laboratory investigations. Glycosylated haemoglobin, serum cholesterol, triglyceride, high-density lipoprotein (HDL) and LDL levels were determined by the Botswana National Laboratory using Cobas Integra 400. The study period was between 1 December 2003 and 28 February 2004. All subjects who gave consent were included in the study.

Overweight was defined as a body mass index (BMI) > 25 up to 30 and obesity as BMI > 30. Hypercholesterolaemia was defined as total cholesterol > 5.3 mmol/l, while hypertriglyceridaemia was defined as > 1.82 mmol/l.

The questionnaire was coded and analysed using EpiInfo 2002. Analysis of variance (ANOVA), *t*-test, chi-square test, correlation and regression analysis were used. PubMed was used to search for the relevant literature.

Results

Four hundred and one patients with DM participated in the study, of whom 287 (71.6%) were female and 114 (28.4%) male. The mean age of the subjects was 53.8 years (standard deviation (SD) 12.2 years). The mean glycosylated haemoglobin was 9.56% (SD 2.6%). Of the subjects 61.2% had hypertension, 27.2% were overweight (BMI > 25 up to 30), 56.4% were obese (BMI > 30), 4% had a history of smoking and 3.1% had a history of alcohol intake. Only 13.7% did regular exercise.

The mean serum cholesterol level was 4.9 mmol/l and 33.5% of the subjects had serum cholesterol levels higher than 5.3 mmol/l. There was no difference ($p = 0.17$) in mean serum cholesterol level between males (4.99 mmol/l) and females (4.77 mmol/l). There was no significant difference in mean



HbA_{1c} between DM patients with normal cholesterol levels and those with hypercholesterolaemia ($p = 0.45$). The mean serum triglyceride level was 1.79 mmol/l; 38.9% of DM patients had serum triglyceride levels higher than 1.82 mmol/l. There was no difference ($p = 0.09$) in mean serum triglyceride level between males (1.73 mmol/l) and females (1.92 mmol/l). There was no difference between type 1 and type 2 DM patients with regard to serum cholesterol ($p = 0.77$) or triglyceride levels ($p = 0.22$). There was no significant difference in mean HbA_{1c} between DM patients with normal triglyceride levels and those with hypertriglyceridaemia ($p = 0.07$).

The mean HDL level was 1.27 mmol/l; 11.4% of patients had an HDL level above 1.6 mmol/l. There was no difference in HDL levels between males and females ($p = 0.64$) or between type 1 and 2 DM patients ($p = 0.99$). The mean LDL level was 3.44 mmol/l; 58.2% of patients had an LDL level higher than 3.36 mmol/l. LDL levels were higher in females (3.54 mmol/l) than males (3.14 mmol/l) ($t = 2.01$, $p = 0.04$), but there was no difference in LDL levels between type 1 and 2 DM patients ($p = 0.87$).

Table I. Mean serum lipid levels among male and female diabetes mellitus patients in Gaborone City Council clinics, Gaborone, Botswana, 2004

	N (%)	Cholesterol (mmol/l)	Triglyceride (mmol/l)	HDL (mmol/l)	LDL (mmol/l)
Male	114 (28.4)	4.99	1.82	Mean	3.14
Female	287 (71.6)	4.77	1.92	1.27	3.54
Total	401			(NS)	

Hypercholesterolaemia was associated with overweight ($r^2 = 0.03$, $F = 6.88$, $p = 0.009$) and obesity ($r^2 = 0.03$, $F = 8.02$, $p = 0.0048$). Hypertriglyceridaemia was associated with overweight ($r^2 = 0.03$, $F = 6.79$, $p = 0.0095$) and obesity ($r^2 = 0.03$, $F = 7.7$, $p = 0.0057$). Hyperlipidaemia was not associated with exercise, smoking or alcohol consumption. Variables included in the regression were age, sex, BMI, serum lipid levels, hypertension, alcohol consumption, smoking and exercise.

Discussion

In the study about one-third of the DM patients had hypercholesterolaemia and about half had hypertriglyceri-

daemia. This finding is higher than other reports from Africa,^{5,8} but lower than reports from the UK.⁷ Similar to the findings of a USA survey,⁶ the majority of DM patients had LDL levels higher than 3.36 mmol/l, which is considered to pose a risk of CHD and atherosclerosis. Only a few of the DM patients were found to have HDL levels higher than 1.6 mmol/l, which is associated with low risk of CHD and atherosclerosis. When such lipid profiles co-exist with high levels of overweight and obesity among DM patients, a high incidence of CHD and atherosclerosis may be inevitable in the future.

The study showed that obesity is strongly associated with elevated plasma lipid levels. Hyperlipidaemia was not associated with exercise, smoking or alcohol consumption. Except for LDL levels, which tend to be higher in female DM patients, there was no significant difference between males and females with regard to the other plasma lipid levels.

Conclusion

Hyperlipidaemia is a common finding among DM patients. DM patients should be screened and appropriate management should be instituted to reduce the risk of CHD and atherosclerosis. Further studies should be undertaken to establish dietary patterns in Botswana and other factors that may lead to hyperlipidaemia.

Acknowledgement: Ministry of Health Research Unit and Gaborone city council clinics.

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Accepted 5 October 2005.