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ORIGINAL ARTICLE

Dyslipidaemia among Nigerian Oil Workers with Type 2 Diabetes Mellitus

Dyslipidémie chez les travailleurs du pétrole du Nigeria avec diabète de type 2

A. Edo*, O. S. Adediran†

ABSTRACT

BACKGROUND: **Nigerians working in the oil industry appear to maintain a 'westernised' lifestyle and thus may be at increased risk for diabetes mellitus and related disorders. There are several reports on lipid profile in type 2 DM among Nigerians (non-oil workers) in the general population from different parts of the country. However the lipid profile of Nigerian oil workers with type 2 DM has not been previously reported.**

OBJECTIVE: **To determine the serum lipid profile of Nigerian oil workers with or without type 2 diabetes mellitus.**

METHODS: **Hospital records of Nigerian oil workers with type 2 diabetes mellitus were retrieved for the study. Data extracted included the patient's age, sex, weight, height, waist circumference, blood pressure and fasting lipid profile. Hospital staff without DM served as controls.**

RESULTS: **There were 52 Nigerians with type 2 DM and 99 controls. Serum triglyceride levels were significantly higher in diabetics than in controls (1.91±1.10 vs 1.27 ± 0.58mmol/l, p<0.001). The other lipid fractions were comparable in both diabetics and non-diabetics. High-density lipoprotein cholesterol abnormality was found in 32.7% of diabetic subjects. Serum total cholesterol dyslipidaemia, triglyceride dsylipidaemia and low-density lipoprotein cholesterol dyslipidaemia were found in 26.9%, 19.2% and 9.6% of the diabetic subjects respectively.**

CONCLUSION: **Dyslipidaemia in Nigerian oil workers with T2DM is common and consists mainly of hypertriglycendaemic and low HDL cholesterol. Measures should be instituted to reduce the lipid levels in these patients in order to minimize the risk of cardiovascular events. WAJM 2011; 30(3): 206–209.**

Keywords: **Serum lipids, Type 2 diabetes mellitus, oil workers, Nigerians, dyslipidaemia.**

RÉSUMÉ

CONTEXTE: Nigerians travailler dans l'industrie du pétrole semblent maintenir un «occidentalisé» lifestyle et peut donc être plus à risque pour le diabète sucré et des troubles connexes. Il existe plusieurs rapports sur le profil lipidique en diabète de type 2 les Nigérians (hors pétrole travailleurs) dans la population générale différentes parties du pays. cependant le profil lipidique des travailleurs du pétrole du Nigeria avec diabète de type 2 n'a pas été préalablement rapportees.

OBJECTIF: déterminer le profil des lipides sériques de pétrole nigérian travailleurs avec ou sans diabète de type 2.

MÉTHODES: Hospital Records de travailleurs du pétrole du Nigeria avec diabète de type 2 ont été récupérés pour l'étude. Données extraites inclus âge du patient, son sexe, poids, taille, tour de taille-férence, pression artérielle et profil lipidique à jeun. Personnel hospitalier sans DM ont servi de témoins.

RÉSULTATS: Il y avait 52 Nigérians diabète de type 2 et contrôle 99. Taux de triglycérides sériques étaient significativement plus élevés chez les diabétiques que chez les témoins (1,91 ± 1,10 ± 1,27 VS 0.58MMOL / L, P <0,001). Les fractions lipidiques autres ont comparable dans les deux diabétiques et non diabétiques. Haute densité cholestérol des lipoprotéines anomalie a été trouvé dans 32,7% des sujets diabétiques. Serum dyslipidémie total dyslipidémie cholestérol, dsylipidaemia triglyceride et de faible densité de cholestérol des lipoprotéines ont été retrouvés dans 26,9%, 19,2% et 9,6% des diabétiques respectivement.

CONCLUSION: la dyslipidémie chez les travailleurs du pétrole du Nigeria avec le DT2 est commun et se compose principalement de cholestérol HDL hypertriglycendaemic et basse. Mesures devraient être prises pour réduire les niveaux lipid chez ces patients afin de minimiser le risque d'événements cardiovasculaire. **WAJM 2011; 30(3): 206–209.**

Mots-clés: les lipides sériques, diabète de type 2, travailleurs du pétrole, Nigérians, dyslipidémie.

Departments of *Medicine, University of Benin Teaching Hospital, Benin City, Edo State, †Medicine, College of Health Sciences, Benue State University, Makurdi, Benue State, Nigeria.
*Correspondence: Dr Andrew Edo, PO BOX 10458, Ugbowo, Benin City, Edo State.   E-mail: osayumen@yahoo.com. Tel No.: 08023343923.
Abbreviations: BMI, Body Mass Index; **DL,** Dyslipidaemia; **DM,** Diabetes Mellitus; **HDLC,** High density lipoprotein cholesterol; **LDLC,** Low density lipoprotein cholesterol; **NNPC,** Nigerian National Petroleum Company; **SBP,** systolic blood pressure; **WC,** Waist circumference.

INTRODUCTION

Warri is a cosmopolitan city in Delta State, in the oil-rich Niger Delta region of Nigeria. The presence of multinational oil companies contributes to increasing affluence of the city's population, especially Nigerians who work in these companies. Diabetes mellitus (DM) is believed to be increasing among Nigerian oil workers due to the effect of 'westernized' and 'affluent' lifestyles especially with regards to their diet and sedentary lifestyles.

Diabetes mellitus and dyslipidaemia (DL) are risk factors for cardiovascular disease.[1]

There are several reports on lipid profile in type 2 DM among Nigerians (non-oil workers) in the general population from different parts of the country.[2–9] However the lipid profile of Nigerian oil workers with type 2 DM has not been previously reported. The aim of this study was to determine the lipid profile of this category of Nigerians with type 2 DM using those residing in Warri as a prototype.

SUBJECTS, MATERIALS, AND METHODS

Hospital records of all patients with type 2 DM seen at Nigerian National Petroleum Company (NNPC) Diabetes Clinic in Warri between 1st of August 2005 and 31st July 2006 were retrieved for the study. Data documented included the patient's age, sex, body mass index (BMI), blood pressure, use of anti-hypertensive agents, fasting lipid profile (total cholesterol, triglyceride, high density lipoprotein cholesterol, low density lipoprotein cholesterol) and anthropometric indice including: height, weight, and waist circumference (WC).

Medical records of apparently healthy Nigerian NNPC workers who came for their annual medical evaluation and who had no diabetes mellitus were used as control. Statistical analysis was carried out using the Statistical Package for Social Sciences (SPSS) version 10.The mean ± SD values were calculated for all the variables. Comparison of means was done using t-test for continuous data and Chi-square test for categorical data. Level of statistical significance was set at $p < 0.05$.

Definition of Terms

Diabetes mellitus was defined according to the 1999 American Diabetes Association criteria[10] short term glycaemic control was assessed with fasting plasma glucose[4] (<5.8mmol/L was taken as good glycamic control, 5.8–6.7 mmol/L as fair and > 6.7mmol/L as poor). Glycated haemoglobin A_{1c} was not available at our practice locale at the time of this study.

Using World Health Organization criteria,[11] metabolic syndrome was defined as type 2 DM, impaired fasting glucose, impaired glucose tolerance plus any 2 of the following:

Antihypertensive medication and / or high blood pressure: systolic $\geq$ 140mmHg or diastolic $\geq$ 90mmHg, dyslipidaemic if he/she was receiving statin treatment or had plasma triglycerides $\geq$ 150mg/dL ($\geq$1.7 mmol/L), HDL cholesterol: men < 35mg/dL (0.9 mmol/L); women < 39mmol/L (1.0mmol/L), BMI >30kg/m^{-2}.

RESULTS

The study group consisted of 52 Nigerians with type 2 DM and 99 controls. The mean age of the diabetic subjects was 54.17± 8.33 years (min–max 31–71 years). The mean duration of DM

Table 1: Characteristics of the Diabetic and Control Subjects

Variables	Mean ± SD		P-value
	Type 2 DM Subjects	Non-DM Subjects	
N	52	99	
Age(years)	54.17±8.33	38.28±8.67	<0.05
BMI(kgm^{-2})	27.97±4.4	27.85±5.18	0.89
WC(cm)	97.62±13.87	89.14±13.08	<0.05
SBP(mmHg)	132.69±13.59	119.24±15.28	<0.05
DBP(mmHg)	82.69±10.50	78.94±13.50	0.083
TC(mmol/L)	4.49±0.92	4.44±1.15	0.78
TG(mmol/L)	1.91±1.098	1.27±0.58	<0.05
HDLC(mmol/L)	1.07±0.43	1.30±1.10	0.146
LDLC(mmol/L)	2.77±0.80	2.81±1.13	0.824

BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; WC, waist circumference; TC, total cholesterol; TG, triglyceride; HDLC, high density lipoprotein cholesterol; LDLC, low density lipoprotein cholesterol.

Table 2: Comparison of Characteristics of Nigerian Oil Workers with Type 2 Diabetes Mellitus by Sex

Variables	Mean ± SD		P-value
	Male Patients	Female Patients	
Age(years)	58.25±5.99	47.65±7.42	<0.00
BMI(kgm^{-2})	27.61±4.11	28.53 ±4.80	Ns
WC(cm)	97.66±14.16	97.55±13.76	Ns
SBP(mmHg)	136.56±12.34	126.5±13.48	0.008
DBP(mmHg)	85.0±10.47	79.0±9.68	0.044
TC(mmol/L)	4.31±0.94	4.68±0.84	Ns
TG(mmol/L)	1.53±0.87	1.23±0.70	Ns
HDLC(mmol/L)	1.0±0.42	1.15±0.44	Ns
LDLC(mmol/L)	2.62±0.86	2.97±0.64	Ns
FPG(mmol/L)	9.45±4.83	9.39±4.39	Ns

BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; WC, waist circumference; TC, total cholesterol; TG, triglyceride; HDLC, high density lipoprotein cholesterol; LDLC, low density lipoprotein cholesterol; FPG,fasting plasma glucose.

was 8.5 ±5.2 years (min–max 2 – 21 years). Among the study subjects, 32 (61.5%) were males, 20 (38.5%) were obese, 24 (46%) were hypertensive, 35 (67.3%) had metabolic syndrome and 46(88.5%) had dyslipidaemia, 49 of the study subjects were on varying doses of oral antidiabetic drugs (glibenclamide metformin, and rosiglitazone) while three of them were insulin-treated. Thirteen (25%) of them had good control of the diabetes mellitus.

The characteristics of the study subjects and controls are summarized in Table 1. Age, waist circumference, systolic blood pressure (SBP) were significantly higher in the diabetic subjects than in the non-diabetic subjects (p<0.05). The serum lipid levels of the diabetic subjects and control showed significant differences only in the triglyceride level between the diabetic and non diabetic subjects (p<0.05) and

Fig. 1: Types and Frequency of Dyslipidae-mia among Oil Workers with Diabetes and Non-diabetes.   , Diabetics; , Non-Diabetics.

Fig. 2: Comparison of types and frequency of dyslipidaemia among male and female Nigerian oil workers. The pattern and frequency of dyslipidaemia were similar between male and female workers.   , Female; , Male.

in triglyceride level between male diabetic and non-diabetic subjects. The common types and frequency of dyslipidaemia in the study subjects and controls are summarized in Figure 1. No significant difference was seen in the frequency of the different types of DL in the study subjects compared to the controls.There was no significant difference in mean serum lipid levels (Table 2) and in the frequency of the different types of DL (Figure 2) between male and female subjects.

DISCUSSION

Our study showed that there was a high frequency of dyslipidaemia (88.5%) and metabolic syndrome (67.3%) among Nigerian oil workers with diabetes mellitus. The commonest types of dyslipidaemia in both diabetic and non-diabetic subjects were low HDL cholesterol and elevated total cholesterol dyslipidaemias.

The significantly higher triglyceride levels found in our diabetic subjects when compared to the apparently healthy non-diabetic controls are similar to findings in previous reports FROM nIGERIA,[3,5–7,9] Hypertriglyceridemia is common in persons with DM both as a transient accompaniment of poor metabolic control and as a persistent finding in some relatively well-controlled patients.[12] In DM clearance of triglycerides may be impaired by reduction in lipoprotein lipase levels.[13] Seventy-five percent of our patients had poor glycaemic control. The mean serum triglyceride level of 1.91± 1.098 mmol/L among Nigerian oil workers with DM was higher than those of Nigerians (non- oil workers) with type 2 DM in previous reports including the mean triglyceride level of 0.9 ± 0.4 mmol/L reported by Adediran et al[2] in the cosmopolitan city of Lagos. Apart from the triglyceride level that was significantly more elevated in our DM patients, the other lipid fractions in the diabetics and non-diabetics were comparable. There was no significant gender difference in the lipid profile of our DM patients which is similar to findings in previous Nigerian studies.[2,3,9] The mean total cholesterol, HDL cholesterol and LDL cholesterol levels of our DM patients were generally lower

than those of other Nigerian studies except that of Agboola-Abu et al.[4] The reasons for the lower lipid levels in our DM patients compared to those in previous studies in Nigerians are not known with certainty but could be due to the fact that our patients had free and easy access to nutrition counselling and exercise facilities on a regular basis. They were usually placed on low fat diets. The effect, if any, of these low fat diets on lipid levels of diabetic subjects has not been prospectively evaluated in our environment. Studies in Caucasians have shown beneficial effects of low fat diet and regular exercise on lipid profile.[14,15] Another possible reason for the low lipid levels in our DM subjects is lipid-lowering effects of the good glycaemic control and oral hypoglycaemic drugs.

There is controversy concerning the effect of glycaemic control on the prevalence and pattern of dyslipidaemia in Nigerians with type 2 DM. Agboola-Abu et al[4] reported that improved glycaemic control ameliorated dys-lipidaemia in some Nigerian patients with non-insulin dependent diabetes mellitus. However, Akanji et al[5] reported that the higher levels of triglyceride in persons with DM compared with those in persons without DM was not influenced by the degree of glycaemic control. All but three of our patients were on metformin and glibenclamide. Metformin has some lipid lowering effect through reducing low-density lipoprotein and triglyceride levels.[16]

The mean lipid levels of our DM patients were lower than those of DM patients in Saudi Arabia despite the fact that there was 29% use of statins among the Saudi patients.[17] The frequency of the different types of dyslipdaemia were all lower in our study when compared with those reported in the Framingham Heart Study[18] (elevated total cholesterol DL: 26.9% vs 37% ; reduced HDL cholesterol DL : 32.7% vs 46% ; elevated Triglyceride DL : 19.2% vs 36%; elevated LDL cholesterol : 9.6% vs 24%).This may in part explain the lower incidence of coronary heart disease among our patients.

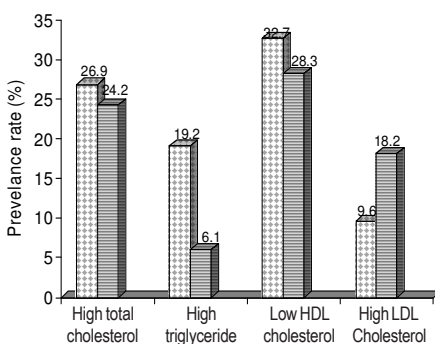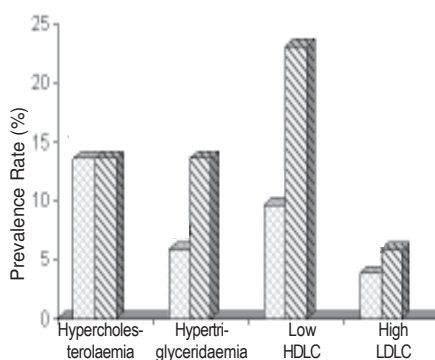Diabetes mellitus is regarded as a coronary heart disease (CHD) risk equivalent.[1] An LDL cholesterol level of

<100mg/dL is the recommended goal of therapy for persons with CHD or CHD equivalent.[1] Only a third of our study attained the recommended level of LDL.

In conclusion, our study has shown that hypertriglyceridaemia, low HDL-cholesterol and metabolic syndrome are common among Nigerian oil workers with diabetes mellitus. The combination of hypertriglyceridemia, low HDL-cholesterol dyslipidaemia, poor glycaemic control, obesity and hypertension in our patients put them at increased risk of cardiovascular events. Therapeutic lifestyle changes including reduced intakes of saturated fat, increased physical activity and measures to control hyperglycaemia and dyslipidaemia with diet and drugs should be instituted to prevent cardiovascular events.

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REFERENCES

1. National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III).Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). Final report. *Circulation* 2002; **106:** 3143–421.

2. Adediran OS, Edo AE, Jimoh AK, Ohwovoriole AE. Dyslipidaemia in type 2 diabetes mellitus with metabolic syndrome. *Journal of Clinical Sciences* 2005; **5:** 54–56.

3. Adedeji OO. Plasma lipids in Nigerians with non-insulin dependent (Type 2) diabetic patients. *Niger Med J.* 1991; **21:** 45–47.

4. Agboola-Abu CF, Ohwovoriole AE, Akinlade KS. The effect of glycaemic control on the prevalence and pattern of dyslipidaemia in Nigerian patients with newly diagnosed non-insulin dependent diabetes mellitus. *West Afr. J. Med.* 2000; **19:** 27–33.

5. Akanji AO, Agbedana EO, Ugbode C. Plasma lipid profiles in relation to diabetic control in Nigerians. *Afr J med Med Sci.* 1989; **18:** 229–34.

6. Bello-Sani F, Bakari AG, Anumah FE. Dyslipidaemia in persons with type 2 diabetes mellitus in Kaduna, Nigeria. *Int J Diabetes á Metabolism* 2007; **15:** 9–13.

7. Isezuo SA. Is high density lipoprotein cholesterol useful in diagnosis of metabolic syndrome in native Africans with type 2 diabetes? *Ethn Dis* 2005; Winter **15:** 6–10.

8. Okafor C I, Fasanmade OA, Oke DA. Pattern of dyslipidaemia among Nigerians with type 2 diabetes mellitus. *Nigerian Journal of Clinical Practice* 2008; **11:** 25–31.

9. Maduka I C, Onyeanusi J O, Shu EN, Duru C. Lipid and lipoprotein profiles in Nigerian non-insulin dependent diabetic patients. *Biomed Res (India)* 2007; **18:** 49–53.

10. American Diabetes Association: World Health Organization. Definition, Diagnosis and Classification of Diabetes Mellitus and its Complication. Report of a WHO Consultation. WHO, Geneva, 1999.

11. Alberti KG, Zimmet PZ. Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: Diagnosis and classification of diabetes mellitus: provisional report of a WHO consultation. *Diabet Med* 1998; **15:** 539–553.

12. Brunzell JD, Hazzard WR, Motulsky AG, Bierman EL. Evidence for diabetes mellitus and genetic forms of hypertriglyceridemia as independent entities. *Metabolism* 1975; **24:** 1115–1121.

13. Brunzell JD, Porte D Jr, Bierman EL. Abnormal lipoprotein lipase-mediated triglyceride removal in untreated diabetes mellitus associated with hypertriglyceridemia. *Metabolism* 1979**; 28:** 901–907.

14. Forsythe CE, Phinney SD, Fernandez ML, Quann EE, Wood RJ, Bibus DM *et al.* Comparison of low fat and low carbohydrate diets on circulating fatty acid composition and markers of inflammation. *Lipids* 2008; **43:** 65–77.

15. Kelly GA, Kelly KS, Tran ZV. Exercise, lipids, and lipoproteins in older adults: a meta-analysis. *Prev Cardiol.* 2005; **8:** 206–14.

16. Rains SG, Wilson GA, Richmond W, *et al.* The reduction of low density lipoprotein cholesterol by metformin is maintained with long-term therapy. *J R Soc Med* 1989; **82:** 93–94.

17. Qari FA. Glycaemic and lipid control in diabetic patients at public and private hospitals in Saudi Arabia. *Diabetes International* May 2007; **29:** 17–18.

18. Kannel WB. Lipids, diabetes, and coronary heart disease: insights from the Framingham study. *Am Heart J* 1985; **110:** 1100–1107.