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# DYSLIPIDAEMIA IN TYPE II DIABETIC PATIENTS IN SOUTH WEST REGION OF CAMEROON

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By

**SANDRA-CLAIRE SOH AZAH**

*Department of Medical Laboratory Science,  
University of Buea,  
Cameroon.*

and

**BENJAMIN D.THUMAMO POKAM**

*Department of Medical Laboratory Science,  
University of Buea,  
Cameroon.*

## **Abstract**

*Dyslipidaemia are lipid disorders which can come about as a complication of diabetes. A cross sectional study design was carried out to determine the prevalence of dyslipidaemia and management of diabetes in diabetics attending the Buea and Limbe Regional Hospitals in the South West Region of Cameroon. The study included 130 diabetics and 130 non diabetics who served as control. A fasting blood glucose test (Glucose oxidase method) and lipid profile which comprised of Triglycerides (oxidase P-aminophenozone; GPO-PAP method), HDL-Cholesterol (precipitation method) and Total Cholesterol (oxidase P-aminophenozone; CHOD-PAP method) was carried out while LDL-Cholesterol was calculated using the Friedewald equation. The sample was constituted of 109(41.9%) males and 151(58.1%) females. The mean age of the diabetics was 54.99 years. The prevalence of dyslipidaemia in diabetics was 51.5%. The mean HDL-Cholesterol value in diabetics was 76.64mg/dl and 61mg/dl in non-diabetics. Also, the mean LDL-Cholesterol level in diabetics was 77.11mg/dl and 98.18mg/dl in non-diabetics. The mean Triglycerides level in diabetics was 130.33mg/dl and 77.55mg/dl in non-diabetics. The mean cholesterol level in diabetics was 175.89mg/dl and 174.05mg/dl in non-diabetics. When compared, the differences in the mean Triglycerides, HDL and LDL- Cholesterol were statistically significant while the Total cholesterol was not statistically significant. There was no statistical significant difference in the prevalence of dyslipidaemia and age, Basal Metabolic Rate (BMR), Systolic and Diastolic blood pressure, duration of*

*diabetes and duration of hypertension in the diabetics. Sixty-four (64) % of the diabetics had high glycosylated haemoglobin (HbA1c) with the mean being 7.66%. This study showed significant difference in dyslipidaemia prevalence in diabetics compared to non-diabetics and the poor management of diabetes in diabetics attending the Buea and Limbe Regional Hospitals. Regular HbA1c and lipid profile check-ups will increase diabetes management in diabetics in these localities and prevent them from cardiovascular diseases.*

**Key Words:** Type II diabetes mellitus, Lipid profile, Glycosylated haemoglobin, Cardiovascular disease, Cameroon

Diabetes mellitus (DM), a non communicable disease (NCD) is a pathology characterized by an absolute or relative deficiency of insulin action and or insulin secretion. This causes a rise in blood glucose. There are two types of diabetes, type 1 known of as juvenile diabetes, and type 2 also called non-insulin dependent diabetes mellitus (NIDDM) or maturity-onset diabetes mellitus. This disease may be discovered by routine blood glucose test or from the complications associated with untreated diabetes (WHO, 1999). The prevalence of diabetes is increasing rapidly worldwide and the World Health Organization (2003) has predicted that by 2030 the number of adults with diabetes would have almost doubled worldwide, from 177 million in 2000 to 370 million. The distribution, prevalence and incidence are linked to genetic susceptibility and environmental factors. Lifestyle changes and diet associated with modernization and westernization have contributed to major increases in the prevalence and incidence of diabetes mellitus and linked disorders (WHO, 1999). One of these disorders is dyslipidaemia (disorders of lipids). Dyslipidaemia is one of the major risk factors for cardiovascular disease (CVD) in diabetes mellitus (Kingue *et al*, 2000), and has been shown to increase morbidity and mortality rates in diabetes. According to the World Health Organization, CVD account for 9.2% of total deaths in Africa (WHO, 2005). The Cameroonian adult population has experienced an upsurge of the disease (Mbanya *et al.*, 2014). This study therefore aimed to determine the prevalence of dyslipidaemia in type 2 diabetics attending two Regional Hospitals (Buea and Limbe) located in the south western region of Cameroon, as well as the prognosis of the management of the disease in some patients.

### **Patients and Methods**

This cross sectional study was carried out at the Buea and Limbe Regional Hospital Diabetic Centers located at the south western region of Cameroon. Two hundred and sixty individuals (130 diabetics and 130 non diabetics who served as the control), aged 30 years and above were randomly selected. Authorization to carry out the research was obtained from the Regional Delegation of Public Health, and the ethical clearance from the Faculty of Health Science Institutional Review Board.

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Consent form was signed by all participants following an explanation of the test procedure.

A questionnaire was distributed to the participants to assess their knowledge on diabetic dyslipidemia. A fasting blood sample of 2ml was collected in a fluorinated tube for fasting blood glucose test, and 3ml was collected in a dry tube for lipid profile test.

The Glucose oxidase method was used to confirm or exclude diabetes. A lipid profile test comprising of Triglycerides (oxidase P-aminophenozone; GPO-PAP method), HDL-Cholesterol (precipitation method) and Total Cholesterol (oxidase P-aminophenozone; CHOD-PAP method) was equally carried out on all the participants. However, Low Density Lipoprotein Cholesterol (LDL-C) was calculated from values of total cholesterol, HDL cholesterol and triglycerides using the Friedewald equation stated as follows:

$$\text{LDL-cholesterol (mg/dl)} = \text{Total cholesterol} - (\text{Triglycerides} / 5 + \text{HDL-cholesterol}).$$

Following a stratified sampling technique, 50 diabetics were selected for glycated hemoglobin (HbA1c) test. HbA1c was read using the Myocard Reader 2. The blood pressure of all the participants was measured and their basal metabolic rate (BMR) calculated using the Garrow and Webster method as  $\text{weight (kg)} / \text{height}^2 \text{ (m)}$ . The data collected were analysed using Stata/ IC 10.1 and Microsoft Excel, and the significance level set at  $p < 0.05$ .

## **Results**

Age and gender distribution of subjects

The distribution of the gender showed that of the 130 diabetics, 81 (62.31%) were females and 49 (37.69%) were males while in the 130 non-diabetics 70 (53.85%) were females and 60 (46.15%) males.

The ages of the diabetics ranged from 30 years to 70 years with the mean age of 54.99 years, while the ages of the non-diabetics ranged from 23 years to 56 years with the mean age of 35.88 years (Table 1).

Fasting blood sugar and lipid profile parameters of the studied subjects

Fasting blood sugar

There was a statistical significant difference ( $p=0.000$ ) between the mean fasting blood sugar of the diabetics (151.02mg/dl) when compared to the non-diabetics (98.24mg/dl).

Lipid profiles parameters of the studied subjects

The lipid profiles parameters of the studied subjects are shown in table 2.

### ***HDL- cholesterol***

The mean HDL cholesterol value for the diabetics was 76.64 mg/dl, while the mean HDL cholesterol value for the non-diabetics was 61.32 mg/dl. When the mean HDL-Cholesterol values were compared in both groups, it was statistically significant ( $p = 0.000$ ).

### **Cholesterol**

The mean LDL Cholesterol value for the 130 diabetics was 77.11 mg/dl, and the mean LDL Cholesterol value for the non-diabetics was 98.18 mg/dl. When the mean LDL-Cholesterol values were compared in both groups, it was statistically significant ( $p = 0.001$ ).

### **Triglycerides**

The mean triglycerides value for the diabetics was 130.33 mg/dl, and the mean triglycerides value for the non-diabetics was 77.55 mg/dl, comparison of both means values showed a statistically significant difference ( $p = 0.000$ ).

### **Total Cholesterol**

The mean total cholesterol value for the diabetics was 175.89 mg/dl, and the mean total cholesterol value for the non-diabetics was 174.05 mg/dl, and both groups showed statistically significant difference ( $p = 0.7711$ ).

### **Prevalence of Dyslipidaemia in Diabetics**

The prevalence of dyslipidaemia in diabetics attending the Buea and Limbe regional hospitals was 51.5% (67 diabetics out of 130). The prevalence was calculated as number of dyslipidaemic diabetics (having one or more abnormal lipids) at the time the study was carried out divided by the total number of diabetics who took part in the study (figure 1).

### **Comparison of Dyslipidaemia with Age and Gender**

The prevalence of dyslipidaemia was compared with various age groups showed that dyslipidaemia was more prevalent in the age group 50-59years (44.78%) and least prevalent in the age groups 30-39years and  $\geq 70$ years (5.97%). Dyslipidaemia and non-dyslipidaemia in diabetics was compared in the various age groups (data not shown) and was not statistically significant ( $p = 0.27$ ). However, the comparison of dyslipidaemia with gender in diabetics (Table 3) showed that 48 (59.26%) of the 67 dyslipidaemic patients were females compared to 19(38.78%) males ( $p = 0.024$ ).

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**Comparison of Dyslipidaemia with BMR and Blood Pressure**

Though the comparison of BMR between diabetics and non diabetics was significant ( $p=0.000153$ ), the BMR between dyslipaemic and non-dyslipidaemic diabetics was not significant ( $p = 0.4078$ ). Equally, dyslipidaemia was not associated with blood pressure (Systolic blood pressure:  $p= 0.696$ ; Diastolic blood pressure:  $p = 0.552$ ) – (data not shown).

**Glycated Hemoglobin**

The mean glycated hemoglobin value (HbA1c) was 7.66%. The number of females who had normal HbA1c values was 23(46%) while 9(18%) of males had normal HbA1c values. Those with high HbA1c values included 9(18%) males and 9(18%) females. Thirty-two (64%) of the diabetics had normal HbA1c values while 18(36%) had high HbA1c values as shown in figure 2.

**Dyslipidaemia and Duration of Diabetes**

The prevalence of dyslipidaemia in diabetics when compared with duration of diabetes was not statistically significant ( $p= 0.489$ ) as shown in table 4. In diabetics without dyslipidaemia the mean duration of diabetes was 6.45 years. In diabetics with dyslipidaemia the mean duration of diabetes was 6.40 years. The minimum duration of diabetes was 0.042years and maximum duration was 23years.

**Discussions**

Experts project that the incidence of diabetes is set to soar by 64% by 2025, meaning that a staggering 53.1 million citizens will be affected by the disease (Rowley *et al.*, 2012). The estimated worldwide prevalence of diabetes among adults in 2010 was 285 million (6.4%) and this value is predicted to rise to around 439 million (7.7%) by 2030 (Shaw *et al.*, 2002).

In Cameroon the prevalence of DM in rural and urban areas in 1997 to 1998 ranged from 2.9% to 6.2% (Sobngwi *et al.*, 2002), an almost a 10-fold increase in diabetes prevalence over a 10-year period (1994-2003) in Cameroonian adults was experienced (Mbanya *et al.*, 2014). In 2010, the International Diabetes Federation (IDF) estimated the nation prevalence of diabetes among adults aged 20 to 79 years at 4.4%. Prevalent undiagnosed diabetes is also very high and is about 80% (Diabetes Atlas).

It is well established that inadequate management and/or control of hyperglycaemia predisposes diabetic patients to a number of complications. The aim of this study was to determine the prevalence of dyslipidaemia (hypercholesterolemia, hypertriglyceridaemia and high LDL-cholesterol disorders) in diabetic patients visiting

the Diabetic Centers of the Buea and Limbe Regional Hospitals. The study showed that the overall prevalence of dyslipidaemia was 51.5% in the above population which is higher when compared to 43% as the national prevalence gotten by Thornalley *et al.* (1996). This difference can be due to the fact that this study was limited to two hospitals in the same region. The high prevalence of dyslipidaemia in diabetics in this study is comparable with other research carried out in Africa (Werk *et al.*, 1993; Adinortey *et al.*, 2012).

The diabetic females and males with dyslipidaemia were 48(59.3%) and 19(38.8%) respectively, the difference was statistically significant. The mean age of diabetics was 54.99 years which is similar to 55.1years gotten in a study done by Adinortey *et al.*, (2012). However there was no statistical significance between the prevalence of dyslipidaemia and age.

The higher BMR recorded for diabetic patients in this study are consistent with previous reports (Nyarko *et al.*, 1997; Nyarko *et al.*, 2003), though there was no statistically significant difference in the prevalence of dyslipidaemia and BMR. The number of overweight diabetics was 52(40%), while 51(39.1%) were obese. This agrees with 44.3% and 30% respectively gotten by two authors (Tamba *et al.*, 2013; Epacka *et al.*, 2011), who showed that BMR was inversely correlated with sport and physical activities (SPA) in Cameroon. This suggests the emergence of other lifestyle risk factors already incriminated by another author in Cameroon (Awah *et al.*, 2007), such as dietary habit and physical inactivity in relation with reduced SPA. Those factors inducing insulin resistance can lead to diabetes complications.

The difference in the prevalence of dyslipidaemia with systolic and diastolic blood pressure was not statistically significant. The dyslipidaemia seen in the Type 2 DM patients with hypertension could be due to the effects of treatment. Though not significant in this study, other studies have showed that treatment of hypertension with  $\beta$ -blockers, as well as high doses of thiazide diuretics can exacerbate the dyslipidaemia in patients with hypertension and diabetes mellitus (Andrew *et al.*, 1994). This study showed that the major complication found in the diabetics was hypertension, since 68% of the diabetics were hypertensive. These findings are consistent with reports from other studies (Adufour *et al.*, 1993; Fabian *et al.*, 2005).

The difference in the prevalence of dyslipidaemia and duration of diabetes (6.4years) was not statistically significant. Similar findings were gotten by Tamba *et al.*, (2013). The duration of diabetes is known to be related to the development of complications (Davis, 1992). However, in this study no such association was found. The reason for this is not apparent. Meanwhile, it is reasonable to attribute it to delay in diagnoses.

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The study revealed combined hyperlipidaemia, hypercholesterolaemia and hypertriglyceridaemia among diabetics. The cause of the lipid alteration among DM subjects has been attributed to differential insulin distribution which leads to increased Very Low Density Lipoprotein cholesterol (VLDL-C) and triglyceride production through hepatic hyperinsulinaemia accompanied by decreased catabolism of triglyceride-rich lipoprotein as a result of relative peripheral insulin deficiency (Reaven, 1987). The difference in the mean HDL cholesterol of diabetics and non diabetics was statistically significant. The number of diabetics (n=15) with low HDL-Cholesterol was thrice as high as that of their non diabetic counterparts (n=4). This is similar with findings gotten by the Framingham Heart Study (Kannel, 1985) with the number of diabetics with low HDL-Cholesterol twice higher than the number of non diabetics.

The difference in the mean LDL cholesterol of diabetics and non-diabetics was statistically significant. Diabetics in this study had lower LDL- Cholesterol than non-diabetics which is in line with Ruderman and Haudenschild (1984), who reported a low-density lipoprotein cholesterol level to be normal in diabetics. The difference in the mean Triglyceride value of diabetics and non-diabetics was statistically significant. Diabetics had higher triglycerides levels than non- diabetics; similar findings were gotten in a United Kingdom Prospective Diabetes Study (UKPDS) (UK prospective Diabetes Study, 1997) and Framingham heart Study (Kannel, 1985).

The difference in the mean total cholesterol of diabetics and non-diabetics was not statistically significant. A similar pattern of altered plasma lipid profiles was observed in the UK prospective Diabetes Study (1997). In their study, total cholesterol levels of those with diabetes mellitus and control individuals did not differ. All these lipid disorders in diabetics are comparable with other studies (Abdul *et al.*, 1995; Akbar, 2001).

This study showed a high HbA1c values (>7%) in the studied subjects. This is an indication of poorly managed diabetes in diabetics. This can be explained by the long intervals between HbA1c check- ups as shown in the study carried out by Tamba *et al.* (2013) where, over 55% of patients made only one diabetic check-up. In addition, the mean time between two check-ups was 3 years and might be long enough for one to develop complications. Measuring glycated hemoglobin assesses the effectiveness of therapy by monitoring long-term serum glucose regulation. The HbA1c level is proportional to average blood glucose concentration over the previous four weeks to three months. The non-compliance could be due to high cost and reduced access to care.

## Conclusions

This study has shown that dyslipidaemia is prevalent in diabetic patients attending the Diabetic Centers of the Limbe and Buea Regional hospitals. Dyslipidaemia is more common in diabetics than in non diabetics. Dyslipidaemia in these individuals was characterized by high triglycerides levels, high cholesterol levels and low LDL- Cholesterol levels. This study also showed that the management of diabetes in the diabetics was poor as shown by their glycated hemoglobin values. However, diabetes is better managed in females than in males. Normalizing HbA1c and lipid profile check-ups might reduce dyslipidaemia complications in diabetics.

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**Table 1: Gender and Age distribution in Diabetics and non Diabetics**

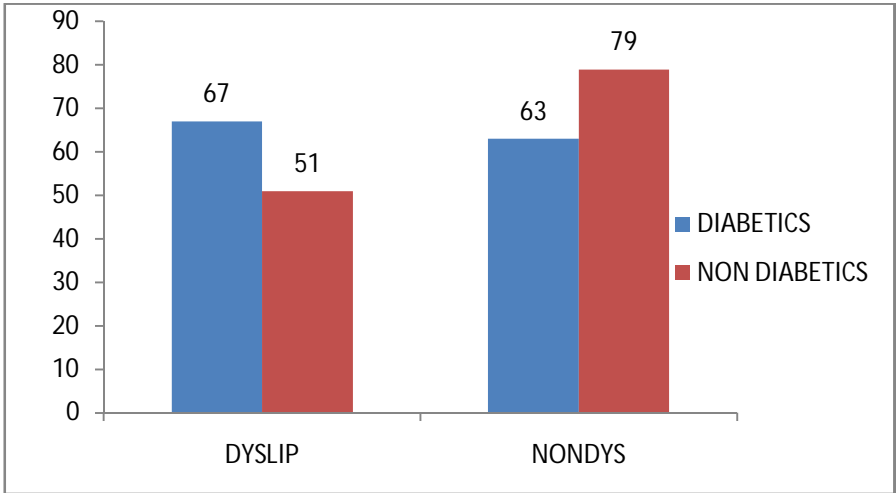
Population	Gender		Age		
	Males	Females	Minimum	Maximum	Mean
Diabetics	49(37.69%)	81(62.31%)	30years	70years	54.99years
Non Diabetics	60(46.15%)	70(53.85%)	23years	56years	35.88years

**Table 2: Comparison of Mean Lipid Profile Values in Diabetics And Non Diabetics**

Variable	Diabetic mean mg/dl (SD)	Non-diabetics mean mg/dl (SD)	t- value	P value
HDL-Cholesterol	76.64 (32.42)	61.32 (18.97)	4.6506	0.0000
LDL-Cholesterol	77.11 (43.17)	98.18 (41.18)	4.0271	0.0001
Triglycerides	130.33 (71.81)	77.55 (40.33)	7.3058	0.0000

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Total cholesterol                      175.89 (52.74) 174.05 (49.25)                      0.2913                      0.7711

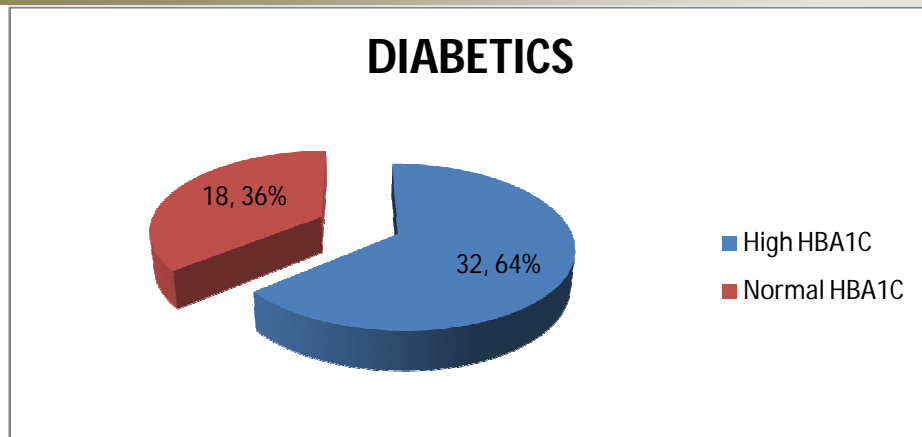


**Figure 1:** Prevalence of dyslipidaemia in diabetics and non diabetics  
 Key: DYSLIP = dyslipidemic NONDYS = non dyslipidemic

**Table 3: Prevalence of Dyslipidaemia with Gender in Diabetics**

Gender	Non dyslipidemic N (%)	Dyslipidemic N (%)	Total
Male	30 (61.22)	19 (38.78)	49
Female	33 (40.74)	48 (59.26)	81
Total	63 (48.46)	67 (51.54)	130

$\chi^2 = 5.1289, p = 0.024.$



**Figure 2: Prevalence of Glycated Haemoglobin in some Diabetics**

**Table 4: Prevalence of Dyslipidemia with Duration of Diabetes in Diabetics**

Duration of diabetes	Dyslipidemic	Nondyslipemic	Total
< 10 years	50 (50.50)	51 (49.5)	101
11-20 years	15 (60)	10 (40)	25
21-30 years	2 (50)	2 (50)	4
Total	67 (51.54)	63 (48.46)	130

$f = 0.48$  p