OPEN ACCESS

ISAR Journal of Medical and Pharmaceutical Sciences

Volume 3, Issue 2, 2025 | Page: 17-26

Abbriviate Title- ISAR J Med Pharm Sci

ISSN (Online)- 2584-0150

https://isarpublisher.com/journal/isarjmps

Blood lipid profile in diabetics followed at Yaounde Central Hospital: influence of some risk factors, diabetic imbalance and high blood pressure

Tsague MV[1]*, Dehayem Yefou M[2,3], La'mere Noutanewo T[4], Memokou Fouedjeu GF[5], Betbo Bakambeu M[1], Guedong Fouodji M[1]

[1]Department of Biomedical Sciences, Faculty of Sciences, University of Ngaoundere, Ngaoundere, Cameroon

[2]Department of Internal Medicine and Specialties, Faculty of Medicine and Biomedical Sciences, University of Yaounde, Cameroon

[3]Department of Endocrinology and Metabolic Diseases, Yaounde Central Hospital, Cameroon

[4]General Surgery Department, Hospital Saint Vincent de Paul, Dschang, Cameroon.

[5]Cameroon Evangelical University Institute, Bandjoun, Cameroon.

***Corresponding Author**

Tsague Marthe Valentine

Department of Biomedical Sciences, Faculty of Sciences, University of Ngaoundere, Ngaoundere, Cameroon.

Article History
Received: 29.12.2024
Accepted: 14.01.2025
Published: 06.02.2025

Abstract: - Diabetes is one of the main causes of mortality and morbidity in Cameroon, with type 2 diabetes (T2D) being the most common. Our work is part of the search for additional solutions to improve the management of diabetic patients. The general objective was to identify the factors likely to adversely modify the lipid profile in people suffering from type 2 diabetes. This was a prospective analytical cross-sectional study conducted at the Yaounde Central Hospital (YHC), over a period of (03) months, from 1st May 2023 to 31 July 2023, on volunteer participants suffering from either diabetes or diabetes hypertension. A questionnaire was used to collect the various data. Statistical analyses using SPSS version 23 software enabled us to identify the factors likely to adversely modify the lipid profile in people with type 2 diabetes followed at Yaounde Central Hospital. Of the 159 patients recruited 109 (69%) were women, 50 (31%) were men, 74 (46.5%) had diabetes alone and 85 (53.5%) had diabetes and hypertension. We have seen that factors such as age, female sex, living environment, high BMI, and hypertension are risk factors for diabetes in the study population, total cholesterol (TC) is influenced by religion and type of anti-diabetic medication, LDL cholesterol (LDL-c) by the urban environment and the triglyceride and HDL association by high blood sugar levels. Diabetic imbalance influences triglyceride levels in the study population as a whole, in non-hypertensive diabetics and hypertensive diabetics, while hypertension does not influence the lipid profile.

Keywords: Type 2 diabetes, Hypertension, Dyslipidemia, Lipid profile, Yaounde Central Hospital.

Introduction

Hypertension and diabetes are two components of the metabolic syndrome and often occur together; this association is frequent[1]. According to the European Centre for Diabetes Studies (2023), 6.7 million people died of diabetes in 2021, an increase of 2.5 million compared with 2019. In Cameroon, there are 615,000 people with diabetes, corresponding to 6% of adults, with a higher prevalence in urban than in rural areas. While hyperglycemia increases the risk of microvascular complications, dyslipidemia is a major cause of macrovascular complications in patients with type 2 diabetes.

Dyslipidaemia is a disorder of lipoprotein metabolism, which may be expressed by elevated total cholesterol, low-density lipoprotein (LDL) cholesterol and triglyceride concentrations, and/or decreased high-density lipoprotein (HDL) cholesterol in the blood (Common Court of Residanat, 2019). In diabetics, the ideal level of LDL cholesterol should be below 100 mg/dL, while that of non-HDL cholesterol should be below 130 mg/dL[2]. In a study of Cameroonians, it was found that hypertensive subjects had significantly higher levels of total cholesterol, HDL, LDL, and triglycerides than normotensive subjects, while apolipoprotein levels were lower[3]. In poorly controlled diabetes, there is an increase in triglycerides, VLDL, and IDL and a decrease in HDL-C, while LDL-C increases modestly[4].

This study aimed to identify the factors likely to negatively modify the lipid profile in people with type 2 diabetes followed at the Yaounde Central Hospital. More specifically, the aim was to: Identify the sociodemographic, anthropometric, and clinical factors of the participants that could inform compliance with hygienic-dietary measures about their diabetic status; Identify the

Cite this article:

Tsague, M. V., Dehayem, Y. M., La'mere, N. T., Memokou, F. G. F., Betbo, B. M., Guedong, F. M., (2025). Blood lipid profile in diabetics followed at Yaounde Central Hospital: influence of some risk factors, diabetic imbalance and high blood pressure. *ISAR Journal of Medical and Pharmaceutical Sciences, 3*(2), 17-26.

sociodemographic, anthropometric, and clinical determinants that negatively influence the lipid profile of diabetics followed at the Yaounde Central Hospital and evaluate the effect of arterial hypertension and type 2 diabetes imbalance on the lipid profile of diabetic participants.

1. Materials and methods

1.1. Participants and Ethical Considerations

The present prospective, cross-sectional, and analytical study was performed by Yaounde Central Hospital over a period of (03) months, from 1st May to 31 July 2023. The study included hypertensive and non-hypertensive type 2 diabetics of both sexes aged 25 and over who were treated at the Yaounde Central Hospital and who had given their consent. The data collected were anonymized to protect the privacy of participants.

All study procedures were authorized by the Director of the Yaounde Central Hospital ref: N°2023/244/AR/MINSANTE/SG/DYHC/UAF on 13 July 2023. Based on this ethical approval, the study was conducted in strict compliance with the physical, psychological, and moral integrity of all participants; following the principles outlined in the Helsinki Declaration.

1.2. Study procedures

From May 1 to July 31, 2023, a cross-sectional and analytic study was conducted at Yaounde Center Hospital, where simple random sampling was used to recruit hypertensive and non-hypertensive T2DM patients of both sexes aged 25. Not included were non-diabetics and T1DM, pregnant women, type 2 diabetics with hypertension and not aged ≤ 25 years, and people who had eaten.

1.3. Sampling and study sample size

We applied simple probability sampling, with each patient having the same chance of being selected as any other. The sample consisted of 56 participants with a margin of error of *m* 5%. This was calculated using Lorentz's formula (1), which takes into account the 95% confidence level; *Z*=1.96. It also takes into account the prevalence of the diabetes-hypertension association, which is P=3.8%[5].

$$n = \frac{z^2 x\, p(1-p)}{m^2} \qquad \textbf{(1)}$$

Finally, 159 diabetic patients were included in this study and subdivided into 2 groups: 74 (46.5%) had diabetes alone and 85 (53.5%) had diabetes and hypertension.

1.4. Biochemical parameters analyses

Biochemical parameters were analyzed in blood. whole blood samples had been collected from all participants by a laboratory technician, after an overnight fast, using ordinary vacutainers, EDTA, and an anticoagulant-free test tube. Dry tube samples were left to coagulate at room temperature for approximately 30 minutes. Serum was then collected after centrifugation at 3,000 rpm for 15 minutes. The serum is then transferred to a clean polypropylene tube using a Pasteur pipette for further biochemical analysis.

In serum, triglycerides (TG), total cholesterol (TC), and high-density lipoprotein cholesterol (HDL-C) were quantified using commercial kits (Cholestérol liquicolor). Low-density lipoprotein cholesterol (LDL-C) was deduced using the Friedewald equation[6]. Glucose was quantified by the kinetic method described by Trinder (1969) using the Liquick Cor-Glucose commercial kit from Cormay Laboratories.

The blood sample collected in the EDTA tube was tested for glycated hemoglobin (HbA1c) using the Rapid Quantitative Test kit. Based on fluorescence immunoassay technology, this quantitative test uses the sandwich immunodetection method.

Primary endpoints were changes in BMI, waist circumference, and blood pressure from baseline. Secondary endpoints were changes in HbA1c, fasting plasma glucose, and lipid profile from baseline.

2. Results

2.1. Socio-demographic characteristics

The socio-demographic characteristics of the source population are shown in Table 1. It can be seen that the age group most affected was between 60 and 70 years, at 31.4% (50). Females were most represented, at 69% (109). The Christian religion, married status, and monogamy were more represented, at 93.1% (148), 58% (93), and 63.5% (101) respectively; the highest occupation was a housewife (22.6%); 6.9% of the population was under-educated; the present study covered a total of 159 patients, 59.7% of whom lived in urban areas.

2.2. Concerning their illness

We can see that 40.9% (65) of the study population drink alcohol, 1.3% (2) smoke tobacco, and 33.3% (53) of patients eat fried eggs. 29.6% (47) of preferred dishes were vegetables; 37.7% (60) consumed fruit more than 4 times; 14.5% (23) consumed coffee; 25.8% (41) consumed tea; 61.0% (97) of patients took part in physical activity and sport, and 45.9% in low-level physical activity. In addition, there was a significant difference between gender and education (Table 2).

2.3. Anthropometric characteristics and clinical characteristics

The anthropometric characteristics of the study population are shown in Table 3. It can be seen that 1.9% of the study population were lean, 29.6% were of normal weight, 31.4% were overweight, 25.2% were class I obese, 8.8% were class II obese and 3.1% were class III obese. By waist circumference, we can see that 55.3% (88) of women have a high waist circumference, while 17.6% (28) of men have a low waist circumference.

The clinical characteristics of the population are also shown in Table 3. In our source population, 69% (110) of patients came to the laboratory for routine check-ups; 53.5% (85) of patients were hypertensive and 46.5% (74) were non-hypertensive. 37.7% (60) of patients had stage 1 hypertension (SBP > 140-159 and/or DBP > 90-99 mmHg) and 56.0% (89) had an elevated blood glucose value. 15.1% (24) of patients had a history of cardiovascular and/or renal disease. The antihypertensive drug class 17.6 (28) most commonly used in patients is the calcium channel blocker family. The most widely used antihypertensive drug was Ramipril 5% (8); the most widely used antidiabetic drug class was the biguanide family, 44.7% (71). 27.7% used traditional treatment.

For this purpose, we have, with a few exceptions, presented only the results for significant effects. The distribution of lipid profile

abnormalities in diabetic participants at YCH as a function of religion, place of residence, antidiabetic treatment, antidiabetic class, and class of blood glucose values :

- Hypercholesterolemia is significantly (p=0.023) more observed in people practicing animism and in Muslims (Table 4), and the comparison of TC averages between the three groups reveals a significant difference p=0.027 (Table 4). The mean cholesterol level (Table 4) was significantly higher in participants from the urban area than in those from the rural area (p=0.037).

- HyperLDLemia was significantly (p=0.028) higher in urban residents (Table 4). However, mean LDL levels in the two groups were not significantly different (Table 4).

The distribution of lipid profile abnormalities in diabetic participants followed at YCH according to antidiabetic treatment, antidiabetic class, and a class of blood glucose values is shown in Table 5. Total hypercholesterolemia was observed only in participants on biguanide therapy, while hyperHDLemia was evenly distributed between participants on hypoglycemic sulfonamide and those on biguanides. Hypertriglyceridemia was predominantly (22.5%) observed in people with blood glucose levels above 1.2g/L. Hypertriglyceridemia + hypoHDLemia was more prevalent in participants with normal blood glucose levels, whereas hypertriglyceridemia + hyperLDLemia was more prevalent in those with blood glucose levels above 1.2g/L.

The effect of type 2 diabetic imbalance on the lipid profile of non-hypertensive diabetics is shown in Table 6. Hypertriglyceridemia was significantly (p=0.006) more observed in diabetics whose HBA1c was greater than 7%, while diabetic imbalance did not affect total cholesterol values (p=0.144), HDL cholesterol (p=α) and LDL cholesterol (p=0.878).

The distribution of lipid abnormalities in hypertensive diabetics as a function of diabetic control is also shown in Table 6. It may be noted that hypertriglyceridemia was significantly (p=0.025) more observed in diabetics whose HBA1c was greater than 7%, while diabetic imbalance did not affect total cholesterol (p=0.703), HDL cholesterol (p=0.226), and LDL cholesterol (p=0.062) values.

3. Discussion

3.1. Socio-demographic characteristics

Risk factors for type 2 diabetes include non-modifiable factors such as family history, age, race, or ethnic origin, and modifiable factors such as obesity and physical activity. In the present study, advanced age emerged as one of the factors, especially as the vast majority of the study population was over 40. Indeed, type 2 diabetes is considered a disease of the elderly because it manifests itself after the age of 40 and is diagnosed at an average age of 65[7].

3.2. Concerning their illness

Women were more represented in the study population than men, and no significant differences were observed in the distribution of diabetics according to sex and BMI. Men generally have a lower body fat mass than women. The large number of women in the study population may also be explained by the fact that women seem to bear a greater burden of risk factors, in particular, obesity[8], with no cases of class III obesity observed in men and class two obesity observed in women versus only 2 men.

In addition, psychological stress may play a greater role in women's risk of diabetes [9], with the great majority of women having been women or shopkeepers, whereas men were more likely to be civil servants and pensioners. A significant difference (p=0.000) was also observed between men and women according to the level of education, with women recruited more from the secondary, primary, and under-educated levels. Diabetes education plays a central role in the management of type 2 diabetes mellitus (T2DM), as it significantly improves the percentage of patients achieving therapeutic goals, as well as medication adherence and self-management performance[10]. This diabetes education will be all the easier if the patient understands the issues and mechanisms. This education should be observed in the change in attitudes of patients followed at Yaounde Central Hospital.

3.3. Anthropometric characteristics and clinical characteristics

Overall, we observed a satisfactory level of compliance with dietary hygiene measures by participants, even if efforts need to be stepped up. Indeed, although the level of alcohol consumption (40%) is high, we can be pleased to note that tobacco consumption is virtually nil and that participants consume mostly fruit and little coffee and tea. The quality of dietary fats and carbohydrates consumed is more crucial than their quantity. Unfortunately, we did not address this issue in the present study. Diets rich in whole grains, fruits, vegetables, legumes, and nuts; moderate alcohol consumption; and low in refined grains, red or processed meats, and sweetened beverages are strongly recommended for glycemic and blood lipid control in diabetic patients[11]. From a hygienic point of view, a good proportion of the population is physically active, and this practice is very high among men (78%). Being physically active makes your body more sensitive to insulin, which helps you manage your diabetes. Physical activity also helps control blood sugar levels and reduces the risk of heart disease and nerve damage[12].

With increasing urbanization, obesity is on the rise and could significantly increase the prevalence of diabetes by 2030[13]. This trend was observed in this study, where more people living in urban areas were represented in the study population. It should be noted that the Yaounde Central Hospital is one of the city's referral hospitals, and receives both people living in Yaounde and those living outside the city. In the study population, participants from the West and Central regions were the most numerous. Although the structure of the study does not allow us to interpret this result properly, it is worth mentioning that race and ethnicity are predisposing factors for type 2 diabetes in the same way as a family history of diabetes[14].

Hypertension (high blood pressure) and diabetes are two components of the metabolic syndrome and are common comorbidities. Hypertension is twice as common in diabetic patients as in those without diabetes. In Cameroon, the prevalence of hypertension was 30.9% in 2019 [15]. In the present study, it was 61% among diabetics. This result seems to confirm the fact that hypertension is twice as common in diabetic patients than in those who are not[16]. However, only 53% of these hypertensive diabetics were on antihypertensive treatment. Yet, without treatment, hypertension damages the smooth tissues that line artery walls. This damage allows fats (cholesterol) in the bloodstream to build up against the inner walls of the arteries, eventually forming

plaques that narrow and stiffen the blood vessels. As the arteries contract, the heart pumps harder to supply the blood your body needs, causing further damage to the arteries[17]. However, we can take heart from the fact that hypertension does not influence the lipid profile of diabetics, which suggests that people declared hypertensive are following their treatment well.

Regarding dyslipidemias, patients with T2DM often have an atherogenic lipid profile, which significantly increases their risk of cardiovascular disease (CVD) compared with non-diabetics [18]. However early intervention to normalize circulating lipids reduces cardiovascular complications and mortality. Generally speaking, neither sociodemographic nor anthropometric factors, let alone clinical characteristics of the population, influenced the rate of dyslipidemia in the study population. Total hypercholesterolemia was more prevalent in urban areas (45%) than in rural areas (30%). This result is partly in line with the findings of a study that, in a meta-analysis, showed that total and LDL cholesterol levels, as well as triglycerides, were systematically higher in urban than in rural residents[19].

In the present study, hypertriglyceridemia was more observed in participants with blood glucose levels above 1.2 g/L. Blood glucose levels were positively associated with TG and LDL-C levels and with TG/HDL-C and LDL-C/HDL-C ratios, suggesting that people with higher blood glucose levels have higher levels of harmful lipids (TG, LDL, TG/HDL-C, LDL-C/HDL-C) that could increase their risk of T2D complications[20].

HbA1c is an important indicator of long-term glycemic control, capable of reflecting the cumulative glycemic history of the previous two to three months. It not only provides a reliable measure of chronic hyperglycemia but is also well-correlated with the risk of long-term diabetes complications[21]. Elevated HbA1c is also considered an independent risk factor for coronary heart disease and stroke in diabetic and non-diabetic subjects. It is a reliable biomarker for the diagnosis and prognosis of diabetes [22]. From this study, it appeared that apart from TG whose mean was significantly affected by diabetic imbalance (p=0.006) the other lipid balance parameters, TC, HDL, and LDL were not significantly affected. This result may suggest that the participants, beyond their diabetic imbalance, are generally complying with the hygienic-dietary measures prescribed to them. However, it should be noted that triglycerides are the most dangerous markers of metabolic syndrome, hyperinsulinism, cardiovascular disease, and arteriosclerosis, and must be monitored[23].

Conclusion

At the end of this study, the aim of which was to identify the factors likely to negatively modify the lipid profile in people suffering from type 2 diabetes and followed at the Yaounde Center Hospital, it emerged that factors such as age, female gender, living environment, high BMI and hypertension were risk factors for diabetes in the study population. Generally speaking, the participants in this study applied the hygienic-dietary measures associated with their condition relatively well. Hypercholesterolemia was significantly influenced by religion and type of anti-diabetic medication, LDLemia by the urban environment, and hypertriglyceridemia and hypoHDLemia by high blood sugar. The lipid profile was not significantly influenced by hypertension, and diabetic imbalance influenced the rate of hypertriglyceridemia in the study population as a whole, in non-hypertensive diabetics and hypertensive diabetics. All in all, dyslipidemia was relatively well controlled in the study population, and few factors were associated with negative changes in their lipid profile.

Acknowledgements

The authors would like to thank Doctor Dehayem Yefou M, for his commitment to this study

Conflict of interest

The authors have no conflict of interest.

Author's contribution

Tsague MV, Memokou Fouedjeu GF, Dehayem Yefou M: Methodology; Tsague MV, Memokou Fouedjeu GF, Betbo Bakambeu M, Guedong Fouodji M: Analysis and interpretation of data; Tsague MV, Dehayem Yefou M, Memokou Fouedjeu GF: Manuscript writing; Tsague MV, La'mere Noutanewo Critical revision; Tsague MV, Guedong Fouodji M, Dehayem Yefou M: Statistical analysis; Dehayem Yefou M: Study supervision

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Table 1: Sociodemographic characteristics

Characteristics	**Modalities**		**Frequency (N)**	**Percentage (%)**
Age range (year)	]30-40]		10	6.3
	]40-50]		35	22
	]50-60]		46	28.9
	]60-70]		50	31.4
	>70		18	11.3
Gender	Female		109	69
	Male		50	31
Religion	Animist		4	2.5

	Christian		148	93.1
	Muslim		7	4.4
Region	Center		54	34
	Littoral		4	2.5
	North		5	3.1
	West		84	52.8
	South		12	7.5
Marital Status	Single		20	12.6
	Divorced		15	9.4
	Married		93	58.5
	Widower		31	19.5
Matrimonial regime	Monogamy		101	63.5
	Polygamy		37	23.3
Occupation	Others		32	20.1
	Retailer		21	13.2
	Designer		5	3.1
	Tiller		10	6.3
	Housewife		36	22.6
	Civil servant		29	18.2
	Retired		26	16.4
Educational level	Primary		43	27
	Secondary		77	48.4
	Undereducated		11	6.9
	University		28	17.6
Residence	Rural		64	40.3
	Urban		95	59.7

			Educational level				p
		Primary		Secondary	Undereducated	University	
sexe	Female	35(32.10%)		54(49.50%)	11(10.10%	9(8.30%)	0.000
	Male	8(16%)		23(46%)	0(0.00%)	19(38%)	

Table 2: Attitudes regarding their status

Characteristics	**Modalities**	**Frequency (N)**	**Percentage (%)**
Alcohol consumption	No	94	59.1
	Yes	65	40.9
Smoking	No	157	98.7
	Yes	2	1.3
Egg consumption form	Boiled	37	23.3

	Boiled, Fried	37	23.3
	Fried	53	33.3
	No consumption	32	20.1
Consumption of fruit per week	0 time	20	12.6
	1 time	12	7.5
	2 times	15	9.4
	3 times	13	8.2
	4 times	10	6.3
	Do not know	1	0.6
	Occasionally	28	17.6
	> 4 times	60	37.7
Coffee consumption	No	136	85.5
	Yes	23	14.5
Tea consumption	No	118	74.2
	Yes	41	25.8
Sports activities	No	62	39.0
	Yes	97	61.0
Level of physical activity	Low	73	45.9
	Intense	1	0.6
	Moderate	23	14.4
	Don't do sport	62	39

Table 3: Anthropometric and clinical characteristics of the study population

Characteristics	**Modalities**		**Frequency (N)**	**Percentage (%)**
Anthropometric characteristics				
BMI class	Underweight (< 18.5)		3	1.9
	Normal weight (18.5-24.9)		47	29.6
	Overweight (25-29.9)		50	31.4
	Obese class I (30-34.9)		40	25.2
	Obese class II (35-39.5)		14	8.8
	Obesity class III (over 40)		5	3.1
Waist circumference	Female	Low*: <80	5	3.1
		Normal* : 80-88	15	9.4
		High* : >88	88	55.3
	Male	Low*: <94	28	17.6
		Normal*: 94-102	9	5.7
		High* : >102	14	8.8

Clinical characteristics			
Reason for consultation	Routine checks	110	69.2
	Tiredness	23	14.5
	Discomfort	26	16.4
Blood pressure status	Non-hypertensive	74	46.5
	Hypertensive	85	53.5
Blood pressure class	Normal high	40	25.2
	Stage 1 HBP	60	37.7
	Stage 2 HBP	23	14.5
	Severe hypertension or stage 3	6	3.8
	Normal	18	11.3
	Optimal	12	7.5
Blood glucose class	Normal	67	42.1
	Low	3	1.9
	High	89	56
History of heart or kidney disease	No	135	84.9
	Yes	24	15.1
Class of antihypertensive	Angiotensin receptor blockers	1	0.6
	Beta-blocker	4	2.5
	Diuretic	11	6.9
	Calcium channel blocker	28	17.6
	Converting enzyme inhibitor	20	12.6
	Not taking antihypertensive medication	74	46.5
	Not identified	21	13.2
Antidiabetic therapy class	Biguanides	93	58.5
	Hypoglycemic sulfonamide	66	41.5
Treatment with plants?	No	115	72.3
	Yes	44	27.7

%: Percentage; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; HBP: High blood pressure

Blood pressure

High normal *SBP: 130-139 and/or DBP: 85-89 mmHg; Stage 1 hypertension: SBP > 140-159 and/or DBP > 90-99 mmHg

Stage 2 HBP: SBP > 160 and/or DBP > 100 mmHg; severe HBP or stage 3: SBP > 180 and/or DBP > 110 mmHg.

Normal * SBP : 120-129 and/or DBP : 80-84 mmHg ; Optimal *SBP : <120 and/or DBP : < 80 mmHg

Glycemia

Normal* 0.8-1.2 g/L; low* < 0.8 g/L; High* > 1.2 g/L

Table 4: Distribution of lipid profile abnormalities in diabetic participants followed at Yaounde Center Hospital according to religion and place of residence

		Religion			**P**
		Animist	**Christian**	**Muslim**	
Total cholesterolemia	Normal	3(75.0%)	144(97.30%)	6(87.70%)	0.023
	Total Hypercholesterolemia	1(25.00%)	4(2.70%)	1(14.30%)	
		Residence			P
		Rural	**Urban**		
LDLemia	Normal	43(69.4%)	48(51.6%)		0.028
	HyperLDLmia	19(30.6%)	45(48.4%)		

Normal CT : < 200 mg/dL ; Total Hypercholesterolemia : > 200 mg/dL ; Normal LDL : < 100 mg/dL

HyperLDLmia: 100-190 mg/dL

Table 5: Distribution of lipid profile abnormalities in diabetic participants followed at Yaounde Center Hospital according to antidiabetic treatment, antidiabetic class, and class of blood glucose values

		Antidiabetic drug class			**P**
		Biguanides	Hypoglycemic sulfonamide		
CT	Normal	87(93.5%)	66(100%)		0.035
	Total hypercholesterolemia	6(6.5%)	0(0%)		
LDLemia	Normal	59(64.8%)	32(50%)		0.065
	HyperLDLmia	32(35.2%)	32(50%)		
Presence of dyslipidemia	Without dyslipidemia	50(53.8%)	23(34.8%)		0.018
	With dyslipidemia	43(46.2%)	43(65,2%)		
Type of dyslipidemia	None	45(48.4%)	18(27.3%)		0.021
	Hypertriglyceridemia + hypoHDLmia	35(37.6%)	38(57.6%)		
		Blood glucose value class			**P**
		Normal* 0.8-1.2 g/L	Low* < 0.8 g/L	High* > 1.2 g/L	
TG	Normal	61(91.0%)	3(100%)	69(77.5%)	0.058
	Hypertriglyceridemia	6(9.0%)	0(0%)	20(22.5%)	
Type of dyslipidemia	Hypertriglyceridemia + hypoHDLmia	38(56.7%)	2(2.7%)	33(37.1%)	0.034
	Hypertriglyceridemia + hyperLDLmia	4(6.0%)	0(0%)	19(21.3%)	

Normal CT : < 200 mg/dL ; Total hypercholesterolemia : > 200 mg/dL; Normal LDL: < 100 mg/dL

HyperLDLmia : 100-190 mg/dL; Normal TG: < 150 mg/dL; Hypertriglyceridemia: >150 mg/dL; HypoHDLmia: < 30 mg/dL

Table 6: Distribution of lipid abnormalities in non-hypertensive and hypertensive diabetics as a function of HBA1c levels (diabetes control)

Parameters	Modalities	Balanced diabetes	Unbalanced diabetes	P
Non-hypertensive diabetics				
CT	Normal	28(93.3%)	31(100%)	0.144
	Total hypercholesterolemia	2(6.7%)	0(0%)	
HDL	Normal	30(100%)	30(100%)	
LDL	Normal	18(60.0%)	18(58.1%)	0.878
	HyperLDLmia	12(40.0%)	13(41.9%)	
TG	Normal	28(93.3%)	20(64.5%)	0.006
	Hypertriglyceridemia	2(6.7%)	11(35.5%)	
Presence of dyslipidemia	Whithout dyslipidemia	16(53.3%)	8(25.8%)	0.28
	With dyslipidemia	14(46.7%)	23(74.2%)	
Type of dyslipidemia	None	11(36.7%)	9(29.0%)	0.21
	Hypertriglyceridemia + hypoHDLmia	17(56.7%)	11(35.5%)	
	Hypertriglyceridemia + hyperLDLmia	2(6.7%)	11(35.5%)	
Hypertensive diabetics				
CT	Normal	56(96.6%)	38(95.0%)	0.703
	Total hypercholesterolemia	2(3.4%)	2(5%)	
HDL	HypoHDLmia	0(0%)	1(2.5%)	0.226
	Normal	58(100%)	39(97.5%)	
LDL	Normal	29(50.9%)	26(70,3%)	0.062
	HyperLDLmia	28(49.1%)	11(29.7%)	
TG	Normal	54(93.1%)	31(77.5%)	0.025
	Hypertriglyceridemia	4(6.9%)	9(22.5%)	
Presence of dyslipidemia	No dyslipidemia	27(46.6%)	22(55%)	0.411
	With dyslipidemia	31(53.4%)	18(45%)	
Type of dyslipidemia	None	23(39.7%)	20(50.0%)	0.034
	Hypertriglyceridemia + hypoHDLmia	32(55.2%)	13(32.5%)	
	Hypertriglyceridemia + hyperLDLmia	3(5.2%)	7(17.5%)	

Non-hypertensive diabetics

Normal TC: < 200 mg/dL; Total hypercholesterolemia: > 200 mg/dL; Normal HDL: > 30 mg/dL; HypoHDLmia: < 30 mg/dL; Normal LDL: < 100 mg/dL; HyperLDLmia: 100-190 mg/dL; Normal TG: < 150mg/dL;Hypertriglyceridemia: > 150 mg/dL

Hypertensive diabetic

Normal TC: < 200 mg/dL; Total hypercholesterolemia: > 200 mg/dL; HypoHDLmia: < 30 mg/dL; Normal HDL: > 30 mg/dL; Normal LDL: < 100 mg/dL; HyperLDLmia: 100-190 mg/dL; Normal TG: < 150mg/dL