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Original Article

Lipid profile in type 2 patients with diabetes from Tlemcen: A Western Algerian population

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ABSTRACT

In Algeria, diabetes mellitus is a public health problem and it is strongly associated with lower levels of physical activity, increasing obesity rates, an ageing population, unhealthy lifestyle and eating habits.

In this study, we performed a transversal investigation on 100 patients with diabetes type 2 and 10 controls with no clinical history of diabetes. A questionnaire was developed with the anthropometric data and biochemical following values: fasting blood glucose (GLU), total cholesterol (TCHOL), triglycerides (TRG), high-density lipoproteins (HDL-C) and glycosylated hemoglobin (GHbA1c) and calculated levels of low-density lipoprotein (LDL-C). We describe further the characteristics of lipid parameters in the study population. To this end, we analyzed the data using descriptive statistics by mean and standard deviation.

According to our results, a female predominance was recorded in our population with a high breakdown for the age group between 51 and 71 years. The average blood glucose was 206 mg/dl, and the average glycated hemoglobin was 8.2%. The majority of diabetic patients had a lipid profile considered normal. 60% of the patients had cholesterol values less than 200 mg/dl; 57.7% had TG values less than 150 mg/dl; 54% had HDL-C values more than 40 mg/dl and 87.5% had LDL-C values less than 160 mg/dl.

Our study shows that the lipid profile of a diabetic population of the Tlemcen region is normal and has no lipid abnormality. It is different from that in the West, where the lipid profile is lower but at inferior proportions.

1. Introduction

Diabetes is a metabolic disease that remains a real public health problem. In recent decades, we have seen a steady increase in the number of diabetes cases and the prevalence of the disease. Globally, we estimated that 422 million adults were living with diabetes in 2014, compared to 108 million in 1980. This first WHO Global Report on Diabetes highlights the enormous scale of the diabetes problem as well as the ability to reverse current trends [1].

In Algeria: the STEPS-WHO study conducted by the Ministry of Health and the World Health Organization in 2003, shows a total prevalence of diabetes of 7.3%, which increases significantly with age [14].

Governments, healthcare providers, people with diabetes, civil society, food producers, drug and technology manufacturers and suppliers can make a significant contribution to stopping diabetes growth and improving of the lives of people living with diabetes [1].

Diabetes-related complications have a common origin: too much glucose in the blood. If the glucose in the blood is too often high with time, it has a damaging impact on several organs of the body, mainly: the nephropathy, the retinopathy, the neuropathy, the infarction, hypertension, arteriosclerosis, stroke, etc … [2].

Once patient have diabetes, lipid abnormalities are frequent and pronounced and are an important factor in the increase of cardiovascular risk, especially in type 2 diabetics. The objective of lipid profile studies in diabetics is to summarize the benefits of the treatment of dyslipidemia for these patients and especially to present the therapeutic strategy of this dyslipidemia, the ultimate

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goal of treatment is to reduce the excess cardiovascular morbidity and mortality of these patients [3].

The aim of our work is to describe the lipid profile of diabetic population in Tlemcen (Algeria) region.

2. Materials and methods

2.1. Type of investigation and data collection

In order to achieve our objectives, we conducted a cross-sectional recruitment survey. The study focused on a population of Tlemcen region (Algeria) and was spread over a period of 5 months (January 2018 to May 2018). This survey was conducted using self-administered questionnaires, which were sent to the attending physicians to recruit survey subjects during their visits to medical practices (internists, family doctors and general practitioners) of Tlemcen. Without access to patient details, the survey was conducted without recall. The questionnaire gives us all the information concerning the patient:

- General information (anthropometric) (sex, age, age of diabetes, type of diabetes).
- Biochemical assessment (fasting glucose, glycated hemoglobin, total cholesterol, triglycerides, HDL-c, LDL-c).

2.2. Population and sample size

The target population for this survey is 100 newly diagnosed Type 2 diabetics and 10 controls. The study population included type 2 diabetic patients, adults, non-institutionalized and resident in Tlemcen.

Thus, the criteria for inclusion and exclusion of patients were:

2.2.1. Inclusion criteria

- Person with type 2 diabetes diagnosed for less than 12 months,
- Adult ($\geq$18 years) non-institutionalized, residing in the Tlemcen willaya,
- Subjects with all the information in the questionnaire,
- Consent to participate.

2.2.2. Exclusion criteria

We excluded from our sample any person:

- Type 2 diabetic subjects old
- Type 1 diabetic subjects
- Any type 2 diabetic with acute illness
- Gestational Diabetes
- Obvious cognitive disorders
- Subjects under lipid-lowering treatment

The witnesses are represented by consulting patients for a reason other than diabetes.

2.3. Parameter analysis and analysis method

The results obtained are presented in the form of means accompanied by the standard deviation, maximum value and minimum value. The processing and the calculation of the results as well as the comparison between the groups and the witnesses was carried out realized by the software SPSS version 21.0 and Excel 2007.

3. Results and interpretations

3.1. Age

The age average of the targeted population was 58.47 years with extremes of 29 and 94 years, while the average age of the controls was 61.6 years. These two averages remain relatively close (Table 1).

3.2. Characteristics of the studied population

The studied population contains 100 type 2 diabetics, of whom 37% are men and 63% are women, with a sex ratio of 0.58. Comparing with the controls, women represent 60% and men 40% (Table 1, Fig. 1).

3.3. Breakdown by age groups and sex

The distribution of our population by age group and sex is shown in Fig. 2 and Table 1. It represents the number of subjects by age group and sex. The analysis of this figure shows the increase in the frequency of diabetics in terms of age, as less than 10% of the population in our study is under 40 years of age and 31% is between 51 and 60 years of age. The distribution of subjects by age also shows a predominance of females in males in all groups age. We also find that the prevalence of the disease is highest among adults whose age is between 51 and 70 years, for women and between 51 and 60 years for men, with a maximum of 30.9% for the age group 51–60 years old, all sexes combined. However, a not inconsiderable frequency (16%) was recorded between 41 and 50 years old, regardless of gender.

3.4. Analysis of biochemical parameters

3.4.1. Glycemia

All patients have above-average blood glucose levels, or the average is 206 mg/dl. The average for men was 212 mg/dl and for women was 202 mg/dl (Table 1). The analysis of the results reveals that 49.3% of the cases had a fasting glucose greater than 200 mg/dl during the consultation.

3.4.2. Distribution according to HbA1c

The results of the variation of the level of the glycated hemoglobin are grouped in Table 1 and Fig. 3. According to our results, we note indeed, a bad glycemic balance of our patients and an elevation of the HbA1c, more marked in men (8.72%) than in women (8.37%). The average HbA1c in men (8.72%) is higher than the average population of the study (8.50%), while that observed in women is lower (8.37%). Over the 100 diabetics in the study: 3% of the population have a near normal HbA1c, 16% have an HbA1c less than 7%, while more than 56% of the population are very unbalanced and have an HbA1c greater than 8%.

3.4.3. Variation in cholesterol level

Fig. 4 shows the average total cholesterol in the population study. We find that the average cholesterol in our population is equal to 190 mg/dl, a value that remains in the norms (Table 1). 59.5% of the population remains in the norm below 200 mg/dl.

Fig. 5 shows the distribution of cholesterol results by sex. Almost 2/3 of the studied population has a normal total cholesterol level. Our results also show that 51.7% of men have normal total cholesterol levels, while 3.4% have levels> 240 mg/dl. For women 64% have normal values, while almost 8% have high levels of total cholesterol (>240 mg/dl).

Table 1
Characteristics of the studied population.

Parameters		Average	standard error	Minimum	Maximum
Age		58,47	13,04	29,00	94,00
fasting glucose g/L	Male	2,12	0,80	1,27	5,13
	Female	2,02	0,56	1,29	3,50
	Total	2,06	0,67	1,25	5,13
Glycated hemoglobin %	Male	8,72	1,77	6,00	13,50
	Female	8,50	1,61	5,50	13,10
	Total	8,50	1,67	5,50	13,50
Cholesterol Total g/L	Male	1,92	0,32	1,41	2,57
	Female	1,90	0,95	1,19	3,31
	Total	1,90	0,37	1,19	3,31
Triglyceride g/L	Male	1,44	0,71	0,54	3,80
	Female	1,47	0,67	0,40	3,20
	Total	1,46	0,68	0,40	3,80
HDL-c g/L	Male	0,39	0,11	0,23	0,70
	Female	0,51	0,22	0,26	1,19
	Total	0,47	0,19	0,23	1,19
LDL-c g/L	Male	1,28	0,27	0,84	1,74
	Female	1,19	0,30	0,52	1,74
	Total	1,22	0,29	0,52	1,74

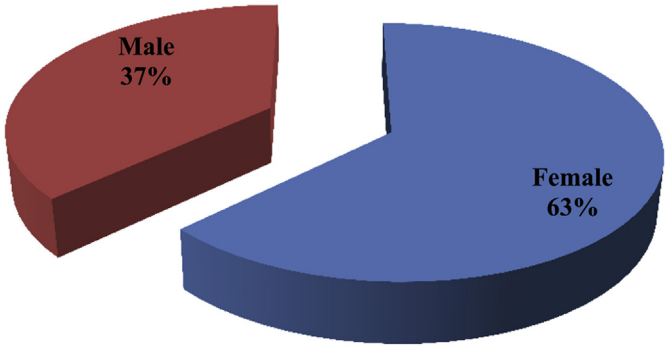

Fig. 1. Distribution of diabetic subjects by gender.

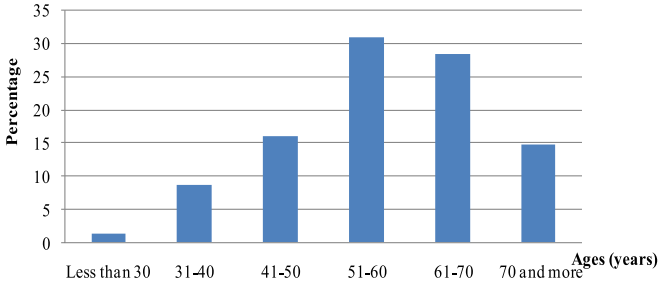

Fig. 2. Distribution of diabetic subjects by age.

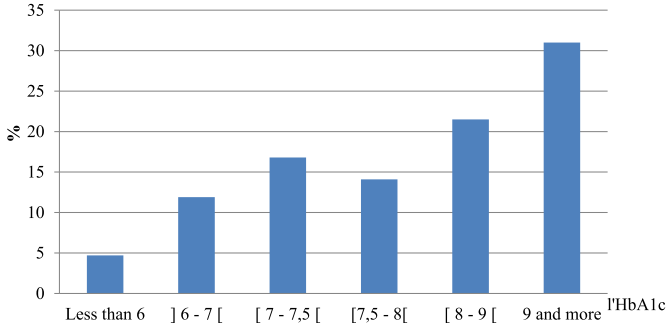

Fig. 3. Distribution of diabetics by HbA1c value.

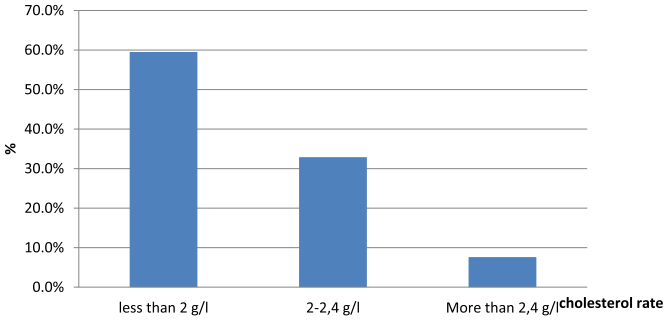

Fig. 4. Distribution of the population according to level of risk of cholesterol.

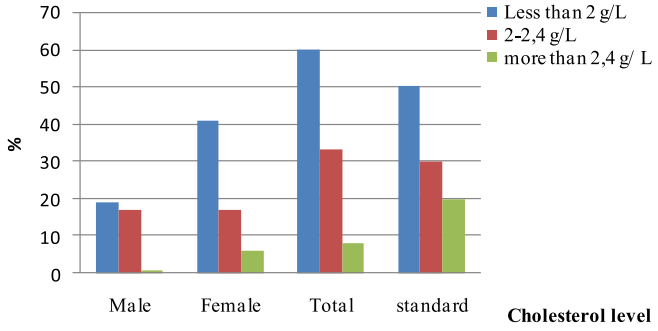

Fig. 5. Distribution of cholesterol results by sex.

3.4.4. *Variation in triglyceride levels*

In our study, the average of triglyceride level was 146 mg/dl with a mean of 143 mg/dl for men and 156 mg/dl for women (Table 1). 57.7% of the population study had normal triglyceremia. 40% of men had a normal triglyceride level (less than 150 mg/dl) compared to 54% of women.

While in the control group, the proportion of cases that have a hypertriglyceridemia is high 60% (a rate higher than 150 mg/dl) against 42% in the studied population (Fig. 6).

3.4.5. *HDL-c rate variation*

In general, 46% of patients have decreased HDL-c levels compared to 54% who had a normal level. In women, 16% of patients

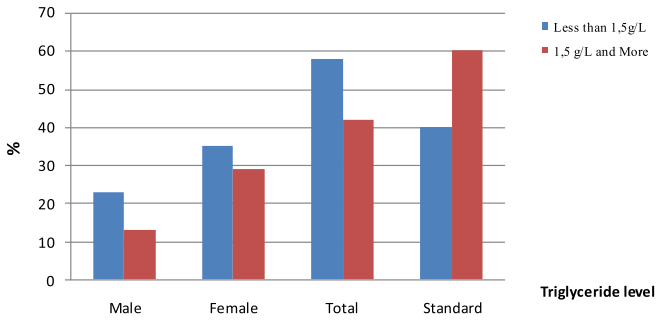

Fig. 6. Distribution of glycerides results by sex.

had normal values (>0.40 g/L), while 84% had low values < 0.40 g/L) (Fig. 7). The values of our patients remain in the standards compared to the controls in which it has been found that 60% of the cases have a rate higher than that of 0.4 mg/dl.

3.4.6. Change in LDL-c level

From Fig. 8, we find that 87.5% of patients have normal values, while the remaining 12.5% have high levels of LDL-c. The average is 1.46 mg/dl for women and 1.41 mg/dl for men. 75.8% of the women in this study had normal LDL-c, compared with 12.1% with levels above 1.60 g/l and 12.1% with values below 0.80 mg/dl. In our study, the percentage of cases with normal LDL-c levels remains as high as that found in controls.

4. Discussion

To date, T2D represents not only an invalidity of the patient's life but also a major public health problem requiring major expenses for the state. During diabetes, lipid abnormalities are frequent and pronounced and are an important factor in the increase in cardiovascular risk, especially in T2D.

The aim of our work is to make a cross-sectional prospective study to describe the lipid profile of a T2D population in the Tlemcen region. This study was conducted via a questionnaire made available to treating physicians. We were able to recruit 110 cases including 100 patients with type 2 diabetes and 10 non-diabetic controls.

In this study, the percentage of women with type 2 diabetes is 63%, while among men it is 37%. These results are consistent with those found by Nibouche, (2015), where women represented 63% while men accounted for 37%. This female predominance is probably explained by the higher frequency of consultation among Algerian women [4].

We then found that the prevalence of the disease is highest among adults whose age is between 51 and 70 years. The STEPS-

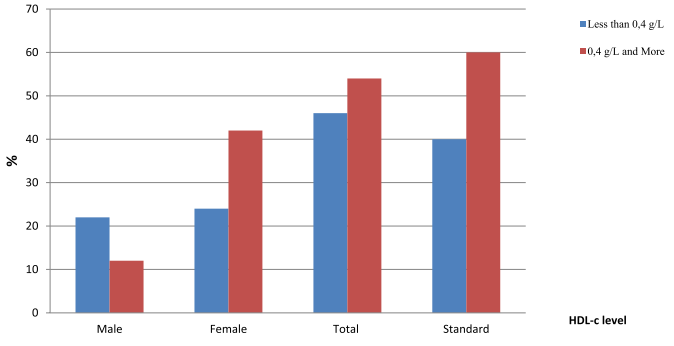

Fig. 7. Distribution of HDL-c results by sex.

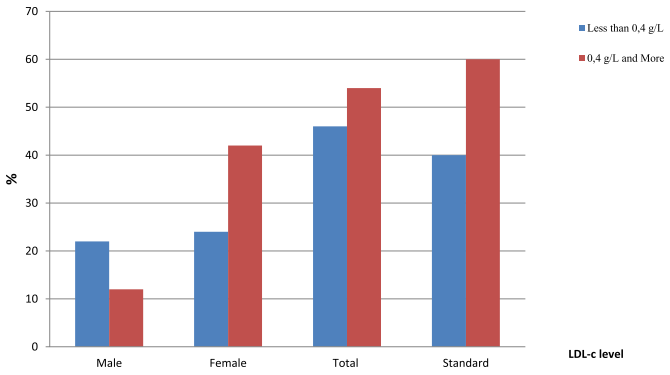

Fig. 8. Distribution of LDL-c results by sex.

WHO study conducted by the Ministry of Health and the WHO in 2003 in Algeria showed that the prevalence of diabetes increases significantly with age, especially for those aged 55–64. (WHO, 2005). The average age at the time of the diabetes diagnosis of our patients and close to that of several studies notably that of [4] (Ain-Taya, Algeria), ENTRED (France) and [5](Tunisia) [4].

Regarding blood glucose, our patients have a very low glycemic level compared to that found in patients with type 2 diabetes in several studies. The [6]; Harzallah and Nibouche (2015) studies found the following averages glycemic levels 214; 353 and 250 mg/dl respectively. That said, the value of blood glucose found in our population is high compared to non-diabetic controls and falls within the range of blood glucose values of diabetic subjects.

According to some authors, the increase in blood glucose is due to a lack or inactivity of insulin, knowing that the latter stimulates the synthesis of glucokinase which promotes the storage of glucose and its transformation into glycogen [7].

The approach for therapeutic decision making in T2D is usually based on HbA1c, a parameter that is unable to explore short-term changes in blood glucose. This observation raises the question of when, and how, therapeutic options can be accelerated and improved in T2D (Monnier et al., 2011). The glycated hemoglobins and more specifically the HbA1c are used in the study for the retrospective evaluation of the long-term glycemic equilibrium [8]. According to our results, we find, in fact, high glycated hemoglobin values of our patients in the diagnosis, both in men (8.71%) and in women (8.37%). The HbA1c values of our population are still low compared to the values of the [6] (9.1%) [5], (9.2%) and [4] (9.58%) studies. This testifies to the more or less early diagnosis of our patients.

It is important to note that the lipid profile dose the different lipid components present in the blood to assess the risk of atherosclerosis of a patient and to take preventive measures (eating habits, hygiene of life) or adapted therapeutics. From a fasting blood test, the classic lipid profile evaluates 4 parameters: Total cholesterol, LDL-c, HDL-c and triglycerides. Mostly present in the blood, the maximum level of LDL-c desirable for an individual is determined by the doctor, according to the cardiovascular risks specific to his patient. High HDL-c (>60 mg/dl) protects against cardiovascular disease and cancels a risk factor [9].

Based on the normal limit values, we established the distribution of our population for the study of the lipid profile. We found that the average total cholesterol in our population is in the range of 190 mg/dl, a value considered normal. This value agrees with that of [4] with an average of total cholesterol close to 2 g/L but unlike European studies where it exceeds 200 mg/dl. In addition, in one study in Mali, 50% had a moderately high total cholesterol level (200–290 mg/dl) [10]. An exception made for the SOUL-D study

whose total cholesterol level is close to ours with an average of 194 mg/dl. The figure found in this English study is probably the result of the risk factor strategy implemented in the United Kingdom [4].

The measurement of blood triglyceride concentration is important in the diagnosis and monitoring of hyperlipidemia, a vascular risk factor especially in diabetics [11]. In our study, the average triglyceride level is 146 mg/dl 57.7% of the study population had a normal triglyceride. 40% of men had a normal triglyceride level (less than 150 mg/dl) compared to 54% of women. The average triglyceride level is lower than that found in the [4] study, as well as all studies in developed countries, whether for newly diagnosed patients (UKPDS) or by screening. Our results show that the frequency of hypertriglyceridemia frank (>250 mg/dl) is not very high in our patients (9% of cases).

The average HDL-c level of our patients is close to that found in the UKPDS, SOUL-D, and HOORN studies, it is much lower than that found in ADDITION, AUSDIAB where the diagnosis of diabetes was made following a screening, and ENTRED [4].

The low level of HDL-c (<40 mg/dl) is a prevalent risk and is found in 46% of patients in our population. This result shows a lower frequency than that found by Harzallah, (2006) (65.2%). The average HDL-c level in our patients is lower than that of newly diagnosed patients in recent studies in developed countries. Patients have an HDL-c rate as low in men as women (22% and 24%), the difference is statistically significant in the study [4] (47% vs. 32.7%); however, diabetics with an HDL-c level of less than 40 mg/dl are, therefore, more exposed to a pro-oxidant and inflammatory phenotype due to the loss of the protective role of HDL-c [12]. According to the French Federation of Cardiology, the decrease in HDL-c is considered a risk factor for cardiovascular diseases. While a rate of less than 40 mg/dl in men and less than 50 mg/dl in women increases the risk of coronary disease (FFC, 2016).

According to Ref. [13]; HDLs protect β cells against the apoptotic effect of LDL-c and VLDL, by inhibiting caspase 3 cleavage and counteracting the deleterious effects of oxidized LDL-c on the β-cell.

In our study population, the mean LDL-c level found is 121 mg/dl. These results are consistent with those found by Ref. [4] with a mean LDL-c level which is not very high (119 ± 0.34 mg/dl) in our series, compared to that of the majority of patients. International studies at the time of diagnosis of type 2 diabetes, or we find higher rates like UKPDS 141 mg/dl.

The high LDL-c level (levels above 160 mg/dl) is uncommon in our study (12.50%). This is consistent with the results of [4] (12.9%)

However, we note a lack in the literature of studies showing the average levels of lipid fractions in newly diagnosed type 2 diabetic patients in the Maghreb or Arab countries.

5. Conclusion

Diabetes is a pathology associated with lipid abnormalities significantly increases the risk of having cardiovascular disease. It is for this reason that lipid levels not to be exceeded are lower in a person with diabetes. These rates will be defined with the attending physician. For this, the doctor must help the patient to better understand how he can act daily on certain parameters, including: adopt a balanced diet adapted to their needs, particularly limiting the consumption of animal-derived fats; practice regular physical activity to reduce lipid storage; Stop smoking because it promotes lipid abnormalities.

If this approach is insufficient to achieve the goals defined by the treating physician for LDL-c levels or triglyceride levels, then drug therapy may be necessary.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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