Clinical characteristics in type 2 diabetic patients in Ouest of Algeria

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The objective of this study was to control blood glucose levels and determine the factors that influence the variation of HbA1c levels in patients with type 2 diabetes in the wilaya of Relizane. The identification of these factors (BMI, diet...etc.), allows in patients with type 2 diabetes a good control of glycemia and prevent serious complications. 70 patients with T2DM recruited in the house of diabetes in Relizane, average age 51, 2 ±12, 98, made their HbA1c test.The majority of the study population is female; the age most often affected by T2D is over 45 years for both sexes. Overweight was noted in 44.28%, physical activity in 10.01% versus sedentary living in 37.14%, walking and other activities in 52.85%, neglecting to test blood glucose levels in 18.57%, occasional self-testing in 47.14%, and smoking in 51.85% and high blood pressure in 61.43%. Half of the patients suffer from stress and are not dieting.
In conclusion, understanding and knowing the factors that influence HbA1c variation is important for better blood glucose control.

Keywords: type 2 diabetes, HbA1c, risk factors, glycemic control.

INTRODUCTION

New cases of diabetes continue to be registered day after day in Algeria and in 2018; it marked about 14.4% of diabetes cases in the age group between 18 and 69 years, which corresponds to about 4 million people with diabetes (Belhadj et al. 2019). Relizane is a wilaya of the ouest of Algeria in Africa, it is distant from the capital by approximately 300Km. Diabetes mellitus is a chronic metabolic disease defined by hyperglycemia (Rahman et al. 2020, Turkistani et al. 2021). It is directly related to a partial or total absence of insulin or insulin resistance, or both (Onalan et al. 2019). Diabetes in type 1 it is defined as the result of an autoimmune defect which causes the destruction of pancreatic beta cells (Norris et al. 2020). On the other hand, T2DM it represents a high percentage appreciated by 90% of the cases (Kenny and Abel, 2019). The International Diabetes Federation has stated that diabetes has become the greatest threat to global health and that the rate of diabetes is expected to increase by 2040 to approximately 642 million (Zheng et al. 2018). There are many risk factors causing the development of type 2 diabete such as age, heredity, high blood pressure, sedentary time; smoking, alcohol consumption, psychosocial stress, physical inactivity, diet and abdominal obesity (Kolb and Martin, 2017; Zheng et al. 2018; Martín-Timón et al. 2014).

The risk of developing certain chronic diseases increases with age, such as type 2 diabetes, which affects more than 95% of

diabetics over the age of 45 (Tsai et al. 2002). A sedentary lifestyle and physical inactivity are factors for fat accumulation and weight gain which promotes the insulin resistance characteristic of T2DM (Davies et al. 2018). Glycemic control in the diabetic patient is based on measurement of glycated hemoglobin, which corresponds to the average concentration of glucose in the blood during for six to eight weeks. The standard value of HbA1c is less than 7%. HbA1c helps prevent the risk of developing diabetic complications such as risk for cardiovascular, the neuropathy (Albashir et al. 2020; Ikeda and Shimazawa, 2019; Lee et al. 2019).

HbA1c is a non-enzymatic glycosylated product of hemoglobin, it is fundamentally irreversible (Ikeda and Shimazawa, 2019; Lee et al. 2019). It occurs between proteins and sugars, the sugars react with amino groups of proteins (Ramis et al. 2019; Kazemi et al. 2019). For a good glycemic control it is essential to sensitize and educate diabetic patients on the importance of self-management, which is represented by the following procedures: the importance of physical activity, a balanced and healthy diet, self-monitoring of glycemia and adherence to medication (Almutairi et al. 2020).

MATERIALS AND METHODS

Population studied
This is a study on a former group of type 2 diabetics (discovered T2DM before 4 years). 70, (43/27) (Women /men) in a house of diabetics in the wilaya of Relizane, a questionnaire of patient characteristics (Table 1) containing the HbA1c value for each one.

Methods
The determination of HbA1c is performed by a fully automated HbA1c analyzer called the ADAMS A1$_C$ HA-8180, which is a high performance liquid chromatography (HPLC) analyzer designed for the separation and quantification of HbA1c.

Statistical analysis
All results were represented as mean values ± standard error (Means ± ES). Shown HbA1c values of our patients according to different factors (age, psychological stress, and diet compliance, physical activity, and hypertension, BMI...). Data were analyzed by SPSS (Statistical Packages for Social Science, version 23.0, IBM

Corporation, New York, USA). P values < 0.05 were considered to be statistically significant.

3.1. Type of study
Study prospective descriptive study involving 70 type 2 diabetics a wilaya of Relizane.

RESULTS

Study characteristics
The characteristics of ours patients with type 2 diabetes of the 70 patients with more than 4 years of T2DM, Exclusion criteria included age below 20 years and pregnancy, alcoholism, The mean age 51.2 ± 12.98 years ,61,43% women) (mean ± standard deviation), distributed patients by BMI (Ideal (22,86%), Skinny (18,57%), Overweight (44,28%), Obese (14,29%) (Table1).
Comparison between the HbA1c values of our patients according to different factors (age, psychological stress, and diet compliance, physical activity, and hypertension, body mass index, self-monitoring of blood glucose and smoking) (Table 1).
Significant association between HbA1c and the following factors: psychological stress (7.99 ± 0.79 vs. 7.54 ±1.34); physical activity (7.00 ±1.06 vs. 8.43±0.93), smoking (8.81 ± 0.73 vs. 7.27 ± 0.89), hypertension (7.95±1.35 vs. 6.9 ± 1.5), diet compliance (7.0 ± 0.7 vs. 8.08±1.01), self-monitoring of blood glucose (7.10±1.11 vs. 8.35±0.75). Our patients' HbA1c levels are moderately unbalanced 7.60 ± 1.43 (M ± S) (Table 1.)

Table 1: Proportion of patients with poor glycemic control according to demographic, anthropometric and clinical characteristics

The characteristics of patients	Percentage (%)		HbA1c
Sex	Woman	61,43%	7, 60 ± 1, 43
	Men	38,57%	
Age (years)	Over 45 years old	72,86%	8.33±0,71
	Under 45 years old	27,14%	7,31±0,98*
Psychological stress	Stressed	58,57%	7,99 ± 0,79
	Non Stressed	41,43%	7.54 ±1.34*
Physical activity	sedentary	37,14%	8,43±0,93
	Walking and other activities	52 ,85%	8,28±0,97
	Activity physics 30min/day	10,01%	7.00 ±1.06*
The respect of the diet	Yes	42,86%	7.0 ± 0.7*
Body Mass Index (BMI)	Ideal	22,86%	6,9± 1,23*
	Skinny	18,57%	7,24 ±1,17
	Overweight	44,28%	7,89±1,18
	Obese	14,29%	8,3±0,85
Hypertension	Hypertensive	61,43%	7,95±1,35
	Not Hypertensive	38,57%	6.9 ± 1.5*
Self-monitoring of blood glucose levels.	Yes	34,29%	7,10±1,11*
	No	18,57%	8.35 ±0.75
	Sometime	47,14%	7,65± 1,18

Body mass index (BMI) was calculated: BMI= P/ T^2 (in Kg/m²), (P= weight in Kg, T= height in m). Skinny < 18.5 kg/m², ideal= 18.5 to 24.9 kg/m², overweight = 25 to 29.9 kg/m², obese > 30 kg/m². HbA1c: glycated hemoglobin. * $P < 0.05$.

DISCUSSION

Our work consisted of a study, interested in the influence of risk factors on the control of glycemic in patients with type 2 diabetes. At the time of our survey, the 61, 43% were female which shows that there is a female predominance in T2DM which is consistent with the work of (Amara et al. 2020). Showed a female predominance in T2DM of 60, 3% in Tunisia, this predominance is due to hormonal changes during menopause, which in turn is a catalyst for the development of overweight and obesity and insulin resistance, in addition the Decrease in physical activity that have demonstrated by the study of (Simkin-Silverman and Wing, 2000). The age category most represented in our population is the over-45 age group at 72.86%. The prevalence of T2D in elderly populations is confirmed by (Sue Kirkman et al. 2012). This explains the association between T2D and the elderly, due to the decrease in physiological functions in the body (in particular the decrease in islet function) and physical inactivity during the aging phase, leading to insulin resistance. HbA1c levels increase with age in patients with diabetes 2, which is consistent with the study by (Ani et al. 2019). In a study shows an age-related increase in HbA1c (positive relationship) in Nigerians without diabetes between 11 and 70 years of age. This study confirms the association between stress and T2D. Stress is a major factor in the emergence and development of serious chronic diseases, including diabetes. (de Souza Santos et al. 2020). Exposure to constant stress contributes to changes in the level of certain vital indicators, including cortisol, which leads to weight gain, particularly in abdominal fat, which causes insulin resistance, and finally diabetes. (Afrisham et al. 2019). HbA1c of patients stressed is higher than 7 %. These results comparable to several studies (Shuhaida et al. 2019; Roy et al. 2020; Ramkisson et al. 2016) which show the influence of psychological stress, anxiety and depression on glycemic control, and that those who are stressed have higher HbA1c levels and poor glycemic control than patients who are less stressed. The

people who do not comply with the diet have an HbA1c >7%, which represents the relationship between food quality and glycemic control, Similar results were found in some other studies. (Flint et al. 2020; Djazayeri and Ataie-Jafari, 2020) which found food insecure patients with poor glycemic control versus food secure patients with good control. Certain dietary practices are unhealthy, in particular excessive consumption of sugars, which leads to the risk of developing diabetes due to weight gain, and poor glycemic control in patients with type 2 diabetes. Such as the negative effect of fructose, as it causes an alteration of glucose and lipids metabolism. (Smajis et al. 2020) This causes insulin resistance. (Jalilvand et al. 2020) Results were found in studies Jalilvand et al. 2020 confirms the low fructose diet for eight weeks resulted in a noticeable increase improvement of some biological parameter such as HbA1c. Another 6-year study (Unwin et al. 2020) shows the relationship between the lower dietary carbohydrates intakes leading to lower HBA1c and body weight loss. Physical activity is one of the methods principal used to control and prevent hyperglycemia in T2DM patients due to the many benefits such as improving HbA1c levels, because it improved insulin secretion (Munan et al. 2020; Duclos et al. 2013). Compared to patients who are physically active for 30 minutes per day, who were sedentary based on HbA1c values, our findings highlight the influence of physical activity (duration and intensity of activities) and sedentary lifestyle on glycemic control. This result is similar to the previous study by **(**Boniol et al. 2017**)** which confirms the influence of the duration of physical activity on the HbA1c (100 min in physical activity per week), which is improved by 0.14%. Another similar study by **(**Fajriyah et al. 2020**)**, showing the benefits of physical activity on HbA1c, blood glucose and quality of life. The results obtained show that most patients with T2DM had hypertension (61, 43%). This frequency of hypertension in most diabetic patients and the positive correlation between hypertension and insulin resistance can be explained by the deregulation of blood pressure which favours the development of obesity and thus the onset of diabetes (Petrie et al. 2018; Shu et al. 2018). Hypertensive patients have an HbA1c level > 7%. These results can be compared to the study of (Song et al. 2020) which was conducted on 1462 non-diabetic Chinese subjects who demonstrated a risk of isolated systolic hypertension (ISH) with an increase in HbA1c levels (positive association).Another study (Jung et al. Another

study (Jung et al. 2018), conducted over 10 years in 2830 non-diabetic Korean adults, confirms the increase in HbA1c and blood pressure; they are predictive of the evolution of T2DM risk in pre-diabetic patients. Obesity and overweight increase the risk of preventing T2D (Klein et al. 2004). Based on body mass index (BMI), we find that 44.28% of our patients are overweight. This result is similar to that of (Schnurr et al. 2020) who found in his study that most diabetic patients are distinguished by a BMI > 25 kg / m2. The accumulation of body fat, mainly intra-abdominal, which induces the phenomenon of insulin resistance (Shivaprasad et al. 2020). Overweight patients have an HbA1> 7%, our result is similar to that of several studies confirming the influence of BMI on HbA1c. (Bower et al. 2017; Babikr et al. 2016) (Nakanishi et al. 2019) the latter show that to prevent diabetes complications, HbA1c must be kept below 7% and BMI below 25 kg/m2. According to the results obtained, that 48.15% of men are smokers who have HbA1c levels greater than 7% compared to non-smokers. This result was confirmed by the study by (Hong et al, 2015), which was conducted on the non-diabetic Korean population, divided into four categories according to smoking habits; it revealed that smokers had higher HbA1c levels than never smokers; and several studies that confirmed the influence of smoking on HbA1c (Vlassopoulos et al. 2013; Kar et al. 2016). Patients who are not self-monitored or who occasionally monitor their blood glucose have an HbA1c >7% versus those who self-monitored their blood glucose have an HbA1c Optimal our result similar to the study by (García de la Torre et al. 2013) which shows that regular self-monitoring reduce HbA1c levels. In other studies (Zhu et al. 2016). In the 6- and 12-month follow-up study in patients with T2DM, which demonstrated a significant improvement in HbA1c levels through self-monitoring of blood glucose levels in patients with T2DM not treated with insulin.

Patients who are not self-monitored or who occasionally monitor their blood glucose have an HbA1c level >7%, compared to those who monitor their own blood glucose, they have an optimal HbA1c level. Our result is similar to the study by (García de la Torre et al. 2013) which shows that regular self-monitoring reduces HbA1c levels. In other studies (Zhu et al. 2016). In the 6- and 1-year follow-up study in type 2 diabetic patients, that there is a significant improvement in HbA1c levels through self-monitoring of blood glucose levels in non-insulin-treated type 2 diabetic

patients.

CONCLUSION
To improve blood sugar control, Knowing the factors that influence the contrast of HbA1c is very important, such as self-monitoring of blood glucose, hypertension, smoking, lack of physical activity (sedentary lifestyle), BMI> 25 kg/m², unbalanced diet, psychological stress. Taking into account these factors allows a good glycemic control in T2DM patients and prevents risk of complications; our study requires more in-depth studies to improve blood glucose control in diabetic patients.

CONFLICT OF INTEREST
The authors declared that present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS
FB performed the experiments, data analysis and also wrote the manuscript. FZB, AB, OK, provided scientific advice, All authors read and approved the final version

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