

Original Article

Diabetes mellitus: glycemic control, weight status, and state of application of hygiene and dietary measures of adult diabetic patients

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Abstract

In diabetics, effective management of glycemic control is based on compliance with hygiene and dietary rules. The purpose of this study was to explore the relationship between glycemic control, weight status, and the application of hygiene and dietary measures among diabetic adults. The study was conducted among 322 diabetic patients. Weight, height and waist circumference (WC) were measured. Glycated haemoglobin (HbA1c) was used to evaluate the glycemic control: under control diabetes (HbA1c≤7%) uncontrolled diabetes (HbA1c>7%). The questionnaire addressed the socio-demographic characters, diabetes characteristics, nutrition knowledge and application of hygiene and dietary measures in the last three months. Statistical analysis was performed with SPSS. 50.60% of subjects had uncontrolled diabetes and 50.3% of them had obesity. Obesity was more pronounced in females than males ($p=0.0001$) and in Type 2 diabetes mellitus (T2DM) than Type 1 patient's ($p=0.0001$). Body mass index ($p=0.005$) and WC ($p=0.0100$) were inversely associated to HbA1c values. Application of hygiene and dietary measures was significantly related to HbA1c ($p=0.0100$) and weight-status ($p=0.0200$). General nutritional knowledge was limited among diabetic patients. A personalized approach combining a healthy lifestyle and regular medical monitoring of the diabetic patient will help them to adhere to these measures for optimal glycemic control.

Keywords: diabetes mellitus, glycemic control, weight status, hygiene and dietary measures, nutritional knowledge

Introduction

Diabetes mellitus (DM) commonly referred to as diabetes, is one of the top 10 causes of death worldwide either four million in 2017 [1]. According to the most recent Diabetes Atlas, the 10th edition, it is affecting around 537 million adults aged 20–79 years worldwide (10.5%). By 2030, 643 million, and by 2045, 783 million adults are projected to be living with diabetes [2]. Fur-

thermore, 50% of world diabetes cases were undiagnosed. The burden of diabetes is rising especially in middle- and low-income countries; in 2045, the prevalence of diabetes expected to shift from 4.7% to 5.2% [3]. Similar to much of the world countries, Algeria is facing a high proportion of no-communicable diseases (NCDs), including diabetes mellitus. Whither, it is estimated to affect 14.6% of adult women and 14.5% of adult men [4].



Diabetes management and awareness are the major challenges faced by diabetes patients worldwide. Medical treatment combined with good knowledge of diet rules and practice of regular physical activity help to achieve better management of the illness [5]. Diabetes is considered as one of the serious comorbidities of obesity and over the past 2 decades, its prevalence has increased parallel to the global rise in obesity rates [6]. According to a report by World Health Organization, approximately 2.5 billion adults are overweight, with 890 million who were living with obesity [7]. Food intake has been strongly linked with obesity in diabetic patients, not only related to the volume of food but also in terms of the composition and quality of diet. Lifestyle interventions, including weight management through hygieno-dietetic measures, may prevent type 2 diabetes mellitus/T2DM [6]. For this, the aim of this study was to study the link between diabetes glycemic control, weight status and application of hygieno-dietetic measures in diabetic adult population.

Material and methods

Study design

The present study was a cross-sectional study conducted among diabetic patients attending the endocrinology department in the Constantine's university hospital center or the Diabetic Home (eastern of Algeria), between 28th January to 2nd May 2024.

All patients who were eighteen years and above and had been diagnosed and confirmed diabetes mellitus (type 1/T1DM or T2DM), were interviewed. We excluded no-diabetes, children, women with gestational diabetes and those diagnosed with diabetes less than a year ago. The convenience sampling method was used to recruit 322 subjects. The study was performed according to the principles established by the Declaration of Helsinki guideline.

Study variables

The study variables included socio-demographic characters (age, sex, instruction level and professional activity), anthropometric parameters (weight, height, waist circumference/WC) and glycemic control (Glycated haemoglobin/HbA1c level).

Anthropometric evaluation

The weight was measured to the nearest 0.1 kg with a digital electronic weight scale, while the height was measured to the nearest 0.1 cm with a stadiometer. The Body Mass Index (BMI) was calculated for each subject with the formula: $BMI = \text{weight (kg)} / \text{height (m)}^2$. Participants were then classified into [8]: normal weight ($18.00 \text{ kg/m}^2 \leq BMI < 25.00 \text{ kg/m}^2$), overweight ($25.00 \text{ kg/m}^2 \leq BMI < 30.00 \text{ kg/m}^2$) and obese ($BMI \geq 30.00 \text{ kg/m}^2$). The WC was measured using a professional measuring tape. Abdominal obesity was defined as $WC \geq 88 \text{ cm}$ and $\geq 102 \text{ cm}$ for women and men, respectively [9].

Questionnaire

The questionnaire survey was conducted in face-to-face interview and contained basic information such as age, sex, instruction level, professional activity, diabetes characteristics, as well as dietary advices source (doctors or nutrition specialist), benefits of diabetes control knowledge and HbA1c recommended values knowledge. Nutrition knowledge and application of hygieno-dietetic measures in the last three months were also addressed. It concerned the changes made in general diet and physical activity based on the doctor advises during last control. In regards to that, participants were classified into applied and non applied hygieno-dietetic measures groups. Nutrition basic knowledge concepts were also evaluated: calories, general and carbohydrate nutrition labelling, starch recommended

Table 1: Description of the study population (N=322).

		Effective (n)	Percentage (%)
Socio-demographic characteristics			
Age groups (years)	<40	53	16.5
	40–60	147	45.6
	≥60	122	37.9

Table 1: Continued.

		Effective (n)	Percentage (%)
Sex	Male	90	28.0
	Female	232	72.0
Instruction level	Illiterate	46	14.3
	Primary school	43	13.4
	Middle school	89	27.6
	High school	96	29.8
Professional activity	University	48	14.9
	None	207	64.3
	Employee	50	15.5
	Liberal function	24	7.5
	Pensioner	41	12.7
Characteristics of diabetes			
Type of diabetes	Type 1 (T1DM)	97	30.1
	Type 2 (T2DM)	225	69.9
Treatment	OAD	142	44.1
	Insulin	95	29.5
	Both	79	24.5
Duration of diabetes (years)	Without treatment	6	1.9
	≤5	107	33.2
	5–10	82	25.5
	10–15	62	19.3
	>15	71	22.0
Glycaemic control HbA1c (%)	≤7	159	49.4
	>7	163	50.6
Anthropometric parameters			
Weight status (kg/m ²)	Normal weight	44	13.7
	Overweight	116	36.0
	Obese	162	50.3
Abdominal obesity (cm)	≥88 for women	206	88.8
	≥102 for men	35	38.9
Diabetes dietary advices			
Dietary advice from doctors	Yes	215	66.7
	No	107	33.3
Dietary advice from nutrition specialist	Yes	68	21.2
	No	254	78.8
Application of hygieno-dietetic measures for the last 3 months	Yes	184	57.3
	No	138	42.7

Table 1: Continued.

		Effective (n)	Percentage (%)
Benefits of diabetes control knowledge	Yes	238	73.8
	Non	84	26.1
Knowledge of HbA1c recommended values	Yes	192	59.6
	No	130	40.4

Note: T1DM – Type 1 diabetes mellitus; T2DM – Type 2 diabetes mellitus; OAD – Oral Anti-Diabetic drugs; HbA1c – Glycated haemoglobin.

portions, dietary fat types (saturated and unsaturated), balanced diet rules, dietary fibers, glycemic index (GI). For confirmation, three definitions of each one of the concepts were proposed and only one of them was correct [10]. These concepts were selected based on their importance in the diabetes's management.

Diabetes control evaluation

HbA1c was used to evaluate the states of glycemic control. In diabetic patients, the overall goal of diabetes control is HbA1c level <7.0%. Based on the blood tests results, patients were divided into two diabetes control groups [11]: either under control group (HbA1c ≤7% or ≤53 mmol/mol) or uncontrolled group (HbA1c >7% or >53 mmol/mol).

Statistical analysis

Statistical analyses were conducted using SPSS software (IBM Corporation, version 25, SPSS Inc, Chicago, USA). Data were presented as means±standard deviation (SD), except for comparison charts where the data were presented as percentages (%). The Chi2 test was used in comparison analyses. ANOVA test was used in comparison of mean averages with a post hoc Tukey-test. T-test was used in comparisons between two means. Non-parametric tests were used in each test. p-values<0.05 were considered statistical significant.

Results

Description of the population

Data were collected from 322 diabetes patients, of whom 232 were female and 90 were male (Table1).

The average age of the population was 52.96±14.74 years. The university instruction level presented

14.9% of participants and more than half of those interviewed were not performing any professional activity (64.30%).

Out of the total of participants, 69.90% had T2DM, 44.4% were on Oral Anti-Diabetic drugs (OAD) and 24.5% were on both (OAD+insulin). The mean duration of diabetes was 10.90±8.69 years, and one third of the participants have had diabetes recently since 5 years or less (33.20%).

Glycemic control results showed that 49.40% of subjects had HbA1c levels at or below 7% and 50.60% had HbA1c levels over 7%. According to weight status, only 13.70% of the participants had normal weight, while 36.0% of them had overweight and 50.3% had obesity.

The doctors (66.70%) mostly communicated diabetes dietary advices and only 21.2% of participants had took advice from nutrition specialist. More than half of the population (57.30%) applied the hygieno-dietetic measures for the last three months after seeing a doctor.

Weight status of the population

The prevalence of obesity and abdominal obesity was more pronounced in females than in males (p=0.0001), whereas the prevalence of normal weight was higher in male patients (23.33%) as compared to female patients (9.91%). Moreover, according to the type of diabetes, T2DM patients had expressed more obesity (p=0.0100) and abdominal obesity (p=0.0001) compared to T1DM patients (Figure 1).

Associations between the study variables

The mean values of HbA1c of our population was 7.70±1.81% with a maximum value of 17.1%. Our results indicated that TDM2 patients had presented higher

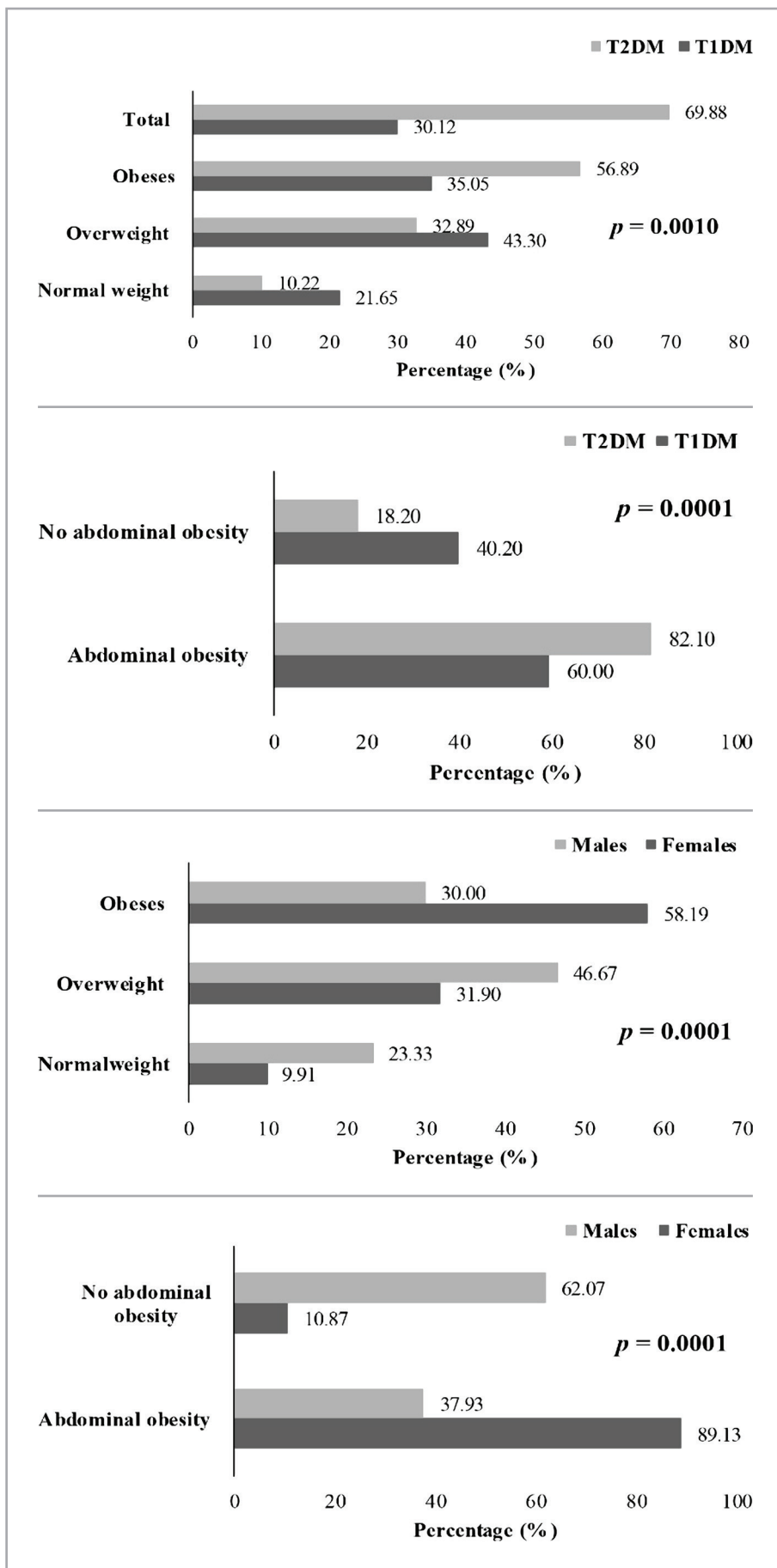


Figure 1: Weight status and abdominal obesity according to type of diabetes and sex. T1DM – Type 1 diabetes mellitus; T2DM – Type 2 diabetes mellitus.

Table 2: Associations between study variables, diabetes, corpulence and socio-demographic parameters.

Type of diabetes	Age (years)	p	Diabetes duration (years)	p	HbA1c (%)	p	BMI (kg/m ²)	p	WC (cm)	p
T1DM	44.24±18.49	0.0001	15.16±9.68	0.0001	8.38±1.91	0.0001	28.40±5.43	0.0001	96.76±14.07	0.0001
T2DM	56.72±10.85		9.14±7.53		7.41±1.69		31.23±5.50		104.71±13.11	
Diabetes control										
Under control	54.62±12.69	0.0510	8.66±7.30	0.0001	6.42±0.51	0.0001	31.26±5.80	0.0005	104.13±12.42	0.01900
Uncontrolled	51.33±16.37		13.05±9.41		8.95±1.76		29.52±5.32		100.48±14.98	
Diabetes treatment										
OAD	55.90±11.39	0.0001	6.96±5.74	0.0001	6.92±1.14	0.0001	30.73±4.83	0.0001	103.12±12.49	0.0001
Insulin	44.38±18.57		15.03±9.65		8.41±1.94		28.50±5.72		96.86±14.57	
Both	57.68±9.95		13.51±8.81		8.19±2.06		32.02±6.25		106.72±12.94	
Weight status										
Normal weight	44.41±18.37	0.0001	11.04±9.43	0.0001	8.75±2.47	0.0001	22.13±1.95	0.0001	82.05±11.31	0.0001
Overweight	53.30±16.10		11.70±9.17		7.52±1.62		27.41±1.45		98.28±8.64	
Obese	55.03±11.55		10.31±8.14		7.53±1.63		34.74±4.06		110.29±10.70	
Abdominal obesity										
Yes	55.38±12.72	0.0001	131.58±102.79	0.2840	7.49±1.52	0.0002	32.27±4.94	0.0001	107.39±10.74	0.0001
None	45.01±17.42		133.53±110.89		8.31±2.39		24.90±3.57		86.87±10.50	

Table 2: Continued.

	Age (years)	p	Diabetes duration (years)	p	HbA1c (%)	p	BMI (kg/m ²)	p	WC (cm)	p
Sex										
Males	52.74±16.53	0.6680	10.97±9.11	0.9740	7.88±1.91	0.4350	27.78±4.81	0.0001	98.17±14.69	0.0003
Females	53.10±14.02		10.89±8.57		7.63±1.77		31.36±5.60		103.77±13.27	
Instruction level										
Illiterate	65.54±7.60	0.0001	13.90±11.21	0.0730	7.16±1.58	0.2290	31.34±4.92	0.0510	106.28±9.92	0.0001
Primary school	60.14±9.55		11.97±9.79		7.61±1.56		31.18±4.88		105.37±12.75	
Middle school	52.64±13.06		10.47±8.06		7.80±1.69		30.64±6.29		103.60±14.26	
High school	50.33±14.05		9.56±7.95		7.74±1.85		30.39±5.05		101.73±12.74	
University	40.29±15.75		10.62±6.92		7.98±2.28		28.23±6.28		94.42±16.62	
Professional activity										
None	51.97±14.97	0.0001	10.84±8.76	0.1420	7.61±1.84	0.3930	31.30±5.80	0.0010	103.58±13.81	0.0020
Employee	51.20±10.49		9.89±7.60		7.66±1.78		28.57±4.34		100.63±11.22	
Liberal function	41.46±12.18		9.11±7.49		8.24±2.09		27.65±5.77		92.22±17.22	
Pensioner	66.83±9.17		13.56±9.92		7.85±1.48		29.52±4.95		103.35±12.88	
Total	52.96±14.74	10.90±8.69	7.70±1.81	30.38±5.62	102.28±13.88					

Note: HbA1c – Glycated haemoglobin; BMI – Body Mass Index; WC – Waist Circumference; T1DM – Type 1 diabetes mellitus; T2DM – Type 2 diabetes mellitus; OAD – Oral Anti-Diabetic drugs. Under control diabetes: HbA1c ≤ 7%; Uncontrolled diabetes: HbA1c > 7%. Normal weight: 18.00 ≤ BMI < 25.00 kg/m²; Overweight: 25.00 ≤ BMI < 30.00 kg/m²; Obesity: ≥ 30.00 kg/m²; Mean ± SD; p < 0.05 (bold means it's significant).

BMI and WC values than TDM1 patients had ($p=0.0001$). However, they expressed better control of diabetes with lower HbA1c level ($7.41\pm 1.69\%$ vs. $8.38\pm 1.91\%$; $p=0.0001$) (Table 2).

A statistically significant difference was also observed between diabetes control groups and anthropometric parameters. Subjects with under control diabetes expressed higher values of BMI (31.26 ± 5.80 kg/m² vs. 29.52 ± 5.32 kg/m²; $p=0.005$) and WC (104.13 ± 12.42 cm vs. 100.48 ± 14.98 cm; $p=0.01$) compared to those with uncontrolled diabetes. These later had also expressed longer duration of having diabetes (13.05 ± 9.41 years vs. 8.66 ± 7.30 years; $p=0.0001$).

Types of diabetes treatments were significantly related to all parameters. Patients with OAD treatment had better glycemic control compared to those with insulin ($6.92\pm 1.14\%$ vs. $8.41\pm 1.94\%$; $p=0.0001$). They also had expressed higher values of BMI and WC ($p=0.0001$).

According to the weight status classification and compared to normal weight subjects, those with obesity were older (55.03 ± 11.55 years vs. 44.41 ± 18.37 years; $p=0.0010$), expressed lesser diabetes duration (7.53 ± 1.63 years vs. 11.04 ± 9.43 years; $p=0.0001$) and lesser values of HbA1c ($7.53\pm 1.63\%$ vs. $8.75\pm 2.47\%$; $p=0.0001$) which indicate better control of the disease. Same results were found when comparing overweight to normal weight category.

No significant difference was observed between gender and most of parameters (age, duration of diabetes and level of HbA1c values). However, females had higher values of BMI (31.36 ± 5.60 kg/m² vs. 27.78 ± 4.81 kg/m²; $p=0.0001$) and WC (103.77 ± 13.27 cm vs. 98.17 ± 14.69 cm; $p=0.003$) than males. Abdominal obesity was positively associated to BMI values ($p=0.0001$). It was also significantly related to age and to HbA1c level, but not to the duration of diabetes. Participants with abdominal obesity had better control of diabetes with lower level of HbA1c ($7.49\pm 1.52\%$ vs. $8.31\pm 2.39\%$; $p=0.002$) and were older (55.38 ± 12.72 years vs. 45.01 ± 17.42 years; $p=0.0001$) compared to participants without abdominal obesity.

Gender was significantly associated to BMI ($p=0.0001$) and WC ($p=0.003$). No difference was observed when it concerned control of diabetes ($p=0.43$).

Instruction level of our population was associated to weight status ($p=0.0001$) but not to HbA1c level. Not practicing professional activity was positively related to overweight and obesity ($p=0.0010$). Same results were observed when it concerned the instruction level. Means of BMI and WC values decreased with the increase of the instruction level respectively ($p=0.0500$; $p=0.0001$). Subjects with university degree had lower

BMI values. No significant difference was found with HbA1c level ($p=0.2300$).

Hygiono-dietetic measures application

Compared to subjects who applied hygiono-dietetic measures, those who did not applied them had higher imbalance in general glycemic control with higher values of HbA1c ($8.63\pm 2.03\%$ vs. $7.80\pm 1.65\%$; $p=0.0100$).

Weight status was also significantly associated to the application of hygiono-dietetic measures. Obese participants applied more these measures compared to normal weight participants (55.00% vs. 11.00% ; $p=0.0200$) (Figure 2). No significant difference was observed between type of diabetes or gender and the application of hygiono-dietetic measures.

Nutrition basic knowledge concepts

To investigate the relation between general nutrition knowledge and diabetes control, basic key concepts knowledge for the disease management were evaluated (Figure 3).

The most well-known concepts among diabetic patients were balanced diet rules (70.81%), dietary fiber (60.56%) and general nutrition labelling (52.13%). While the most limited concepts, knowledge concerned GI (25.78%) and dietary fat types (31.68%). Subjects with good glycemic control presented more knowledge of GI concept compared to those with uncontrolled diabetes (30.19% vs. 21.47% ; $p=0.0400$). No difference was observed between basic nutrition knowledge concepts and weight status ($p>0.05$).

Discussion

In Algeria, despite the importance of the present subject, available studies and sources remain limited and insufficient, which can be difficult and restrictive for the diabetic patients to find clear information and guidance. In fact, hygiono-dietetic measures might influence in a positive way the weight status of diabetic subjects especially those with obesity as well as the diabetes balance and reduce the complications related to this disease. Therefore, the aim of this study was to evaluate the link between diabetes glycemic control, weight status and application of hygiono-dietetic measures in diabetic adult Algerian population.

In the present study, most of the diabetic patients were found to be obese (50.3%) and only 13.7% of them

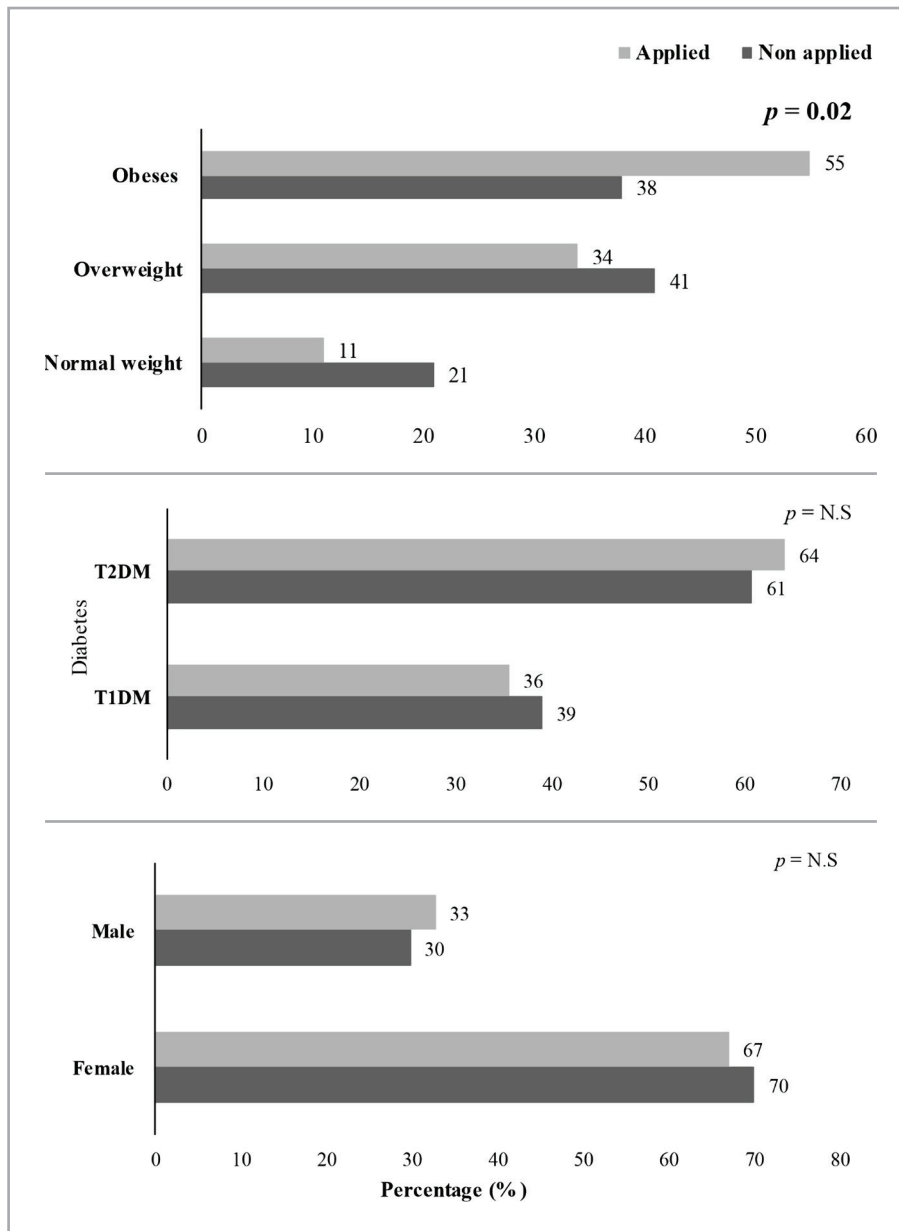


Figure 2: Application of hygieno dietetic measures, weight status, type of diabetes and sex. T1DM – Type 1 diabetes mellitus; T2DM – Type 2 diabetes mellitus; N.S – Non significant; N.S – Non significant.

had normal weight. Previous studies reported the high prevalence of overweight and obesity among diabetic subjects worldwide. Overweight and obesity accounted for 44% of the diabetes cases [12]. These results corroborate the fact that 69.9% of our population had T2DM with an obesity rate of 56.89%. In fact, T2DM was the morbidity that most strongly associated with obesity and 80% of T2DM patients had overweight or obesity [13]. In Algeria, previous studies [14–16] had reported high prevalence of obesity in T2DM subjects ranging from 23.2% in Maghnia, to 40.82% in Tebessa (North-Eastern), to 35.8% and 41.3% in Algiers (North-Central). The association between T2DM and obesity is probably the result of multiple

mechanisms, including rises in plasma free fatty acids and tumour necrosis factor alpha released from “full” adipocytes [17].

Even if BMI is the most frequently used tool for the diagnostic of obesity, abdominal fat accumulation has stronger influence on the development of diabetes comorbidities through the decrease of glucose intolerance [18]. BMI coupled with WC is more predictive of these comorbidities than each body parameter separately [19]. For this, abdominal obesity of our population was evaluated and it was positively associated to BMI values ($p=0.0001$). Our results indicated that unlike men (37.93%), the majority of women (89.13%) had expressed abdominal obesity ($p=0.0001$). Furthermore,

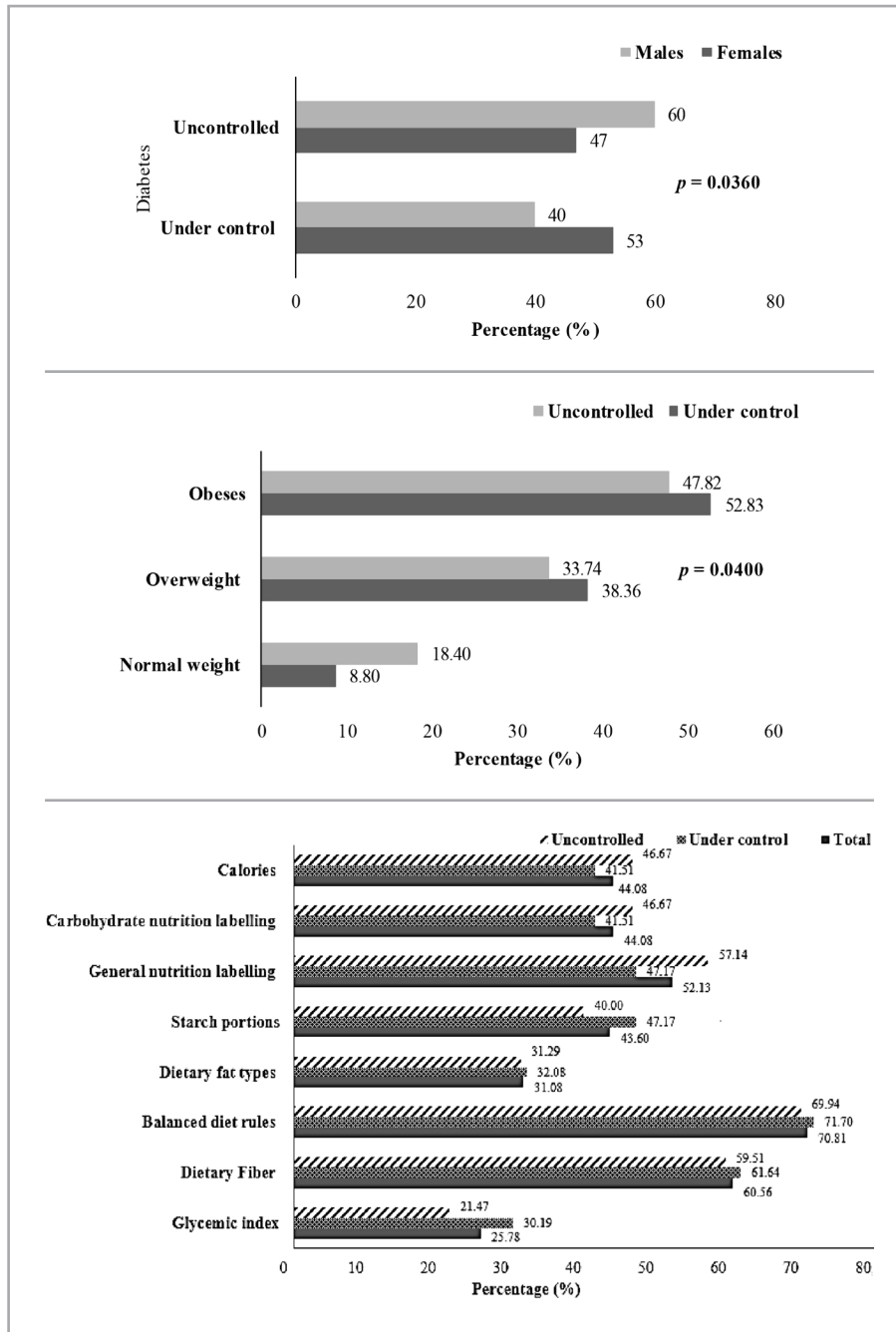


Figure 3: Diabetes control according to sex, weight status and basic nutrition knowledge concept.

the prevalence of obesity was more pronounced in females than in males ($p=0.0001$). Gender was significantly associated to BMI and WC. Similar results [14, 20, 21] were found in other studies conducted in Algeria and outside. We also observed that T2DM patients had presented more obesity and abdominal obesity than T1DM patients had ($p=0.001$; $p=0.0001$). Previous studies confirmed the link between obesity and diabetes [14]. The Diab Care (2008) study conducted in Algeria has demonstrated observed that the majority of patients had T2DM and were overweight [22].

The instruction level and professional activity had no effect on HbA1c values ($p>0.05$), but had an effect on the weight status of our population. BMI and WC were positively associated to the instruction level ($p<0.05$). Illiterate participants had the highest values of BMI and WC, while participants with university degree had the lowest values. Moreover, not practicing any professional activity was also associated to the highest values of BMI ($p=0.0010$) and WC ($p=0.0020$). These results indicate that overweight and obesity are associated to low educational and socioeconomic status among diabetes

patients. In fact, being professionally inactive reduces activity related to work, and limits the general energy expenditure, which results in low physical activity and causes or aggravates overweight and obesity. Previous studies [23, 24] have demonstrated that obesity and physical inactivity were diabetes risk factors that were related to low socioeconomic status.

The mean HbA1c of our population was $7.70 \pm 1.81\%$ and glycemic control was poor in 50.60% of diabetes subjects. Studies in Egypt and Saudi Arabia showed higher rates of poor glycemic control with respectively 74.3% and 67.7% [25, 26]. These results indicate that most of diabetic patients do not manage their HbA1c values, which requires more attention to the factors associated to this situation in order to limit the long-term consequences. Moreover, the patients with poorer glycemic control had longer duration of diabetes ($p=0.0001$). Previous studies had demonstrated that HbA1c was positively associated to the duration of diabetes [27].

No gender effect was found on mean HbA1c values of our population. However, male participants had presented more uncontrolled diabetes compared to females participants ($p=0.0360$). This result might be explained by the fact that men consume more cigarettes, which is shown to increase HbA1c [28].

The mean HbA1c was higher in T1DM subjects compared to T2DM subjects ($p=0.0001$). This was probably related to the duration of diabetes. T1DM patients had longer duration of diabetes ($p=0.0001$). As the duration of having diabetes increases, patients usually become less careful in their general diet, physical activity and medication, which influences glycemic control. The type of diabetes treatment had an effect on glycemic control. In fact, patients with insulin treatment had higher HbA1c compared to those with OAD treatment ($p=0.0001$). A study carried out in Egypt among 300 T2DM adult subjects showed that patients under insulin treatment had more uncontrolled diabetes than those under oral treatment only [25]. Overall management of diabetes in subjects using insulin is often not good and is probably related to a poor adaptation between carbohydrate's meal intake and doses of fast-acting insulin. This requires more attention to therapeutic education of patients.

BMI was inversely associated to HbA1c level ($p=0.0001$). Obese participants had better control of diabetes compared to normal weight participants ($p=0.04$). Those with abdominal obesity had expressed same results with lower HbA1c values ($p=0.002$). The application of hygieno-dietetic measures was inversely

associated to general glycemic control of our population ($p=0.0100$). Moreover, weight status was also significantly associated to the application of these measures. In fact, obese subjects applied more these measures compared to normal weight participants ($p=0.0200$). These results might explain the previous observations. The application of hygieno-dietetic measures for the last three months among the obese group following nutritional advices, contributed to better control of the HbA1c levels and is due mostly to a weight loss. We suggest that control of diabetes is more related to weight gain or loss than the actual weight status. The HbA1c was positively related to BMI of diabetic patients and it is due to the effect of weight gain in poor glycemic control patients [29]. It could be also related to the duration of diabetes. The longer the duration of the illness, the more HbA1c increases.

The results of the evaluation of basic key concepts knowledge showed that, globally, nutritional knowledge was limited among our population. Especially the concept of GI, its knowledge was the lowest and was significantly-associated to the control of diabetes ($p=0.0400$). Subjects with uncontrolled diabetes had more limited knowledge of the concept. It has been demonstrated that foods with low GI may contribute to better glycemic control and HbA1c compared to foods with high GI through the promotion of insulin sensitivity and reducing fluctuations in blood glucose levels [30]. Therefore, diabetic patients may rely on the use of diets with low glycemic index as a good approach to approve diabetes management. For this, in this study, glycemic index is considered as a basic and effective concept in controlling HbA1c in diabetic patients.

Conclusion

Overweight and obesity are common health problems in diabetic subjects. Following hygiene and dietary rules is essential for glycemic control in this study population. Most patients know the rules of a balanced diet, but not the importance of nutritional labeling. The education of these diabetics must be individualized in order to overcome the challenge of reducing the risks of complications related to the disease and improving their quality of life.

Conflict of interest

The authors declare no conflict of interest.

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