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# Assessment of the awareness of patients with type 2 diabetes of their disease: A multi-center cross-sectional study in Lebanon

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## Abstract

Background: This study aims to estimate the knowledge, attitude, and practices of patients with diabetes towards the disease and to assess the predictors of a higher awareness of diabetes. Methods: A multi-center cross-sectional study was performed targeting 384 patients from five endocrinology clinics in Lebanon. A self-reported survey was developed and validated and an awareness score was generated. Results: Around 18% of patients reported that they stopped taking diabetes medication when feeling good and 21.1% stopped them when in bad health status. In the case of hyperglycemia, 16.6% said that they doubled the dose of medication, and 14.6% stopped taking it when fasting. The mean awareness score of patients was 15.7±3.9 over 25. After adjusting for covariates, The odds for higher awareness were 2.24 and 3.11 times higher among patients with higher education levels. These odds were 38% lower among patients with medical assistance at home. Physical activity significantly increased the odds of high awareness than those not practicing. Conclusion: Moderate awareness was noted among patients with lower knowledge of the symptoms of diabetes and good practices. Practice implications: Based on the findings of this study, healthcare stakeholders can explore the knowledge gaps and promote targeted interventions.

Keywords: Type 2 diabetes; Knowledge; Attitudes; Self-management; Patient education

### Highlights

- Patients with type 2 diabetes in Lebanon had moderate awareness of diabetes.
- Poor self-management of medication was reported among patients with type 2 diabetes.
- Higher awareness of diabetes increased with higher levels of education, physical activity, and family history.
- Medical assistance at home and smoking significantly decreased the odds of higher awareness.
- The developed short 25-item tool can be applied in clinics to assess the awareness of patients with diabetes.

## 1. Introduction

The World Health Organization reported that type 2 diabetes (T2D) was the seventh cause of death worldwide, and its prevalence was estimated to increase substantially by 2030 [1, 2]. A recent report showed that diabetes contributed to around 11.2% of deaths globally, with the highest percentage in the Eastern Mediterranean region (16.2%) [3]. Higher mortality was found among patients with T2D in low- and middle-income countries, such as Lebanon [4]. This increased risk can be partially avoided through self-care and knowledge of the disease, namely its management, symptoms, complications, and recommendations [5, 6].

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Patients' awareness of T2D can help its early detection and prevention of severe adverse health outcomes that can adversely affect their quality of life [7]. Among others, early symptoms include thirst, frequent urination, fatigue, and blurred vision [8]. Patients should also be informed of the risk factors for developing the disease, such as positive family history, older age, obesity, sedentary lifestyle, and hypertension [9]. Accordingly, patients with T2D can optimize the management of diabetes by tackling the modifiable risk factors and increasing self-practices to control it [10]. Misinformation and misconceptions about diabetes can induce negative attitudes and behaviors, which calls for involving different healthcare providers (nurses, doctors, and pharmacists) to clarify these misconceptions [11]. Medication adherence can also impact diabetes management and can be promoted through optimal awareness of patients. Marital status (single or widowed) and abnormal hemoglobin A1c (HbA1c) levels were found to be the main drivers of medication non-adherence [12].

Adequate communication that offers reassurance is crucial to the successful self-management of T2D [13]. A good understanding of patients and knowledge of the disease, its complications, and self-practices can help control the progress of T2D in addition to the clinical follow-up with healthcare professionals [14]. During the past two years, Coronavirus disease of 2019 (COVID-19) patients were prioritized [15], putting a high proportion of the population at risk of exacerbating their chronic conditions. Self-management of T2D derives from sufficient knowledge, attitude, and practices of patients that can be endorsed through support groups and continuing education to clarify misconceptions and encourage patients with T2D to share their experiences [16]. This study aims to estimate the knowledge, attitude, and practices of patients with T2D towards the disease and to assess the predictors of a higher awareness of diabetes. Based on the findings of this study, healthcare stakeholders can explore the knowledge gaps and promote targeted interventions.

## 2. Material and methods

### 2.1. Research design

A cross-sectional study was performed over six months (April-September 2021) targeting T2D patients from five endocrinology clinics in Lebanon.

### 2.2. Study sample and sample size

Adult T2DM patients were asked to participate in the study if they were diagnosed with diabetes for at least six months. No selection criteria were based on sex or ethnicity. Those with dementia or mental disorders making them unable to fill out the survey were excluded.

Epi-info was used to calculate the required sample size using the following equation:

$$N= \frac{(Z_{1-\alpha/2})^2 p(1-p)}{d^2}$$

Where Z is a standard normal variate (Z1-α/2= 1.96 at 95% confidence interval), d is the absolute accuracy or precision (5% margin of error), P is the expected proportion of the population with a specific outcome and was set at 0.5 (the advised value if the proportion in the population is not known). This yielded a required sample size of 384 patients.

### 2.3. Data collection

Two pharmacists approached the patients during the opening hours of the clinics. They described the study's aims orally and asked them to participate by completing a survey. The first page of the survey included the written objectives and consent form. The survey took around 12 minutes to be filled out.

### 2.4. Study tool

An existing questionnaire was used for data collection. This questionnaire was previously used for similar purposes on patients with T2D in Iran [17]. It was initially piloted on 30 patients, and questions that lacked clarity were either adjusted or deleted. The first part included questions about the general characteristics of the participants (sex, age, height, weight, area of residence (rural or urban area), level of education (illiterate, primary and high school or more), employment, and marital status, and the availability of house assistance and medical insurance). Age was classified into three categories: <50, 50-60, and >60). The Body Mass Index (BMI) of patients was calculated by dividing the weight (kilograms) by the square of height (meters) and then categorized as recommended [18]. The survey also collected the lifestyle habits of patients such as smoking, alcohol consumption, physical activity, and its frequency. Patients were

asked if the doctor recommended them a specific diet and if they followed his recommendations. Furthermore, they were asked if they usually add sugar to their drinks.

## 2.5. Medical history of the patients and clinical information

Patients were asked about the duration of diabetes diagnosis, family history, the latest laboratory results of HbA1c, and the frequency of testing it. They were also asked if they had a glucometer at home and whether they usually tested their serum glucose at fasting or two hours after meals. Participants reported other comorbidities such as hypertension, dyslipidemia, mental disorders, coronary artery disease, chronic kidney disease, thyroid dysfunction, and respiratory disease. They reported who diagnosed them with T2D (doctor or pharmacist) and their primary source of information regarding the disease. Patients were asked if they postponed their visits to the doctor, if the doctor explained the medication plan and whether they understood it, and if they knew or had any of the diabetes complications (retinopathy, neuropathy, cardiovascular, and nephropathy).

## 2.6. Self-management of medication of patients with type 2 diabetes

Patients were given different scenarios (See Table 3) to assess how they self-managed their medication (stopping, dose changing, no action). They were also asked about their behavior in case they missed a dose of their medication (taking it as soon as remembering, skipping the dose, contacting the doctor) and to suggest the best solution to avoid missing T2D medication (having it always, assistance from a close person, reminder or alarm and nothing can work).

## 2.7. Knowledge, attitudes, and practices of patients with type 2 diabetes

Patients were asked to answer a set of 36 questions, out of which those with poor inter-item correlation were deleted. Accordingly, a list of 13 knowledge, 6 attitudes, and 6 practice statements was generated (See Table 4). They had to answer each statement with "Agree", "Disagree" or "I don't know".

## 2.8. Statistical analysis

Statistical analyses were computed using Statistical Package for Social Sciences (SPSS Inc, Chicago, Illinois) Version 27. Based on the values of the skewness (0.052) and kurtosis (0.327), data are normally distributed and converge to their expected values [19]. Categorical variables are presented through frequencies and percentages. In contrast, the age, BMI, and the different scores are given through Means and Standard Deviations (SD). Negative questions were transformed into positive questions. Right answers for the knowledge, attitudes, and practices questions were given a score of 1, while they were given a score of zero if answers were incorrect or if patients answered with "I don't know". The maximum possible score for knowledge (13), attitude (6), and practice (6) was 25. The index had good reliability (Cronbach alpha 0.743) and positive inter-item correlations. After validating the scale (3 weeks), the survey was readministered to 30 patients to test its reliability. The percentage agreement between the two items for each question was acceptable. The mean value of the total score was taken as the cut-off point for the classification of the awareness (lower awareness if ≤Mean and higher awareness if >Mean). Binary logistic regression was done to assess the predictors of a higher awareness producing Odd Ratios with a 95% Confidence Interval (CI). A p-value <0.05 was considered statistically significant.

## 2.9. Ethical considerations

This study used a survey for data collection without invasive procedures or interventions. The protocol, survey, and consent form were reviewed and approved by the institutional review board of the faculty of pharmacy of the Lebanese University. Legal approvals were obtained from the endocrinologists of the different clinics. Data were anonymous and non-identifiable, and data storage followed the university's general data protection regulation guidelines. Written informed consent was obtained from each included participant.

# 3. Results

## 3.1. General characteristics of the patients

Overall, 431 patients were approached and 384 (89.1%) agreed to participate in the study. Table 1 presents the general characteristics of patients. Sex distribution was comparable between males (48.2%) and females (51.8%). The mean age of the sample was 58.3 (10.9) years distributed as follows: 19% were less than 50 years, 38% were between 50 and 60 years of age and the rest (43%) were older than 60. The mean BMI of the patients was 30.2 (5.4) with higher percentages of obese (48.3%) and overweight (37.2%) patients. Most patients were married (82.5%). Around 38% of patients were illiterate and 35.2% had a high school degree or more. As regards employment status, 48.3% did not

work, and the rest (51.7%) were either employed or benefited from retirement funds. Almost 40% of patients were current smokers and 10.2% were alcohol consumers. Doctors recommended special diets for most patients (96.9%) and only 22.4% followed the recommended diet.

**Table 1** General characteristics and lifestyle habits of patients with Type 2 Diabetes

| | | Total (N=384) |
|---|---|---|
| **General characteristics** | | **Frequency (%)** |
| **Sex** | Male | 185 (48.2%) |
| | Female | 199 (51.8%) |
| **Age** (years) | **Mean (SD)** | 58.3 (10.9) |
| | <50 | 73 (19.0%) |
| | 50-60 | 146 (38.0%) |
| | >60 | 165 (43.0%) |
| **Body Mass Index (BMI)** | **Mean (SD)** | 30.2 (5.4) |
| (kg/m$^2$) | Underweight (<18.5) | 2 (0.5%) |
| | Normal weight (18.5-24.9) | 53 (13.8%) |
| | Overweight (25.0-30.0) | 143 (37.2%) |
| | Obese (>30.0) | 185 (48.3%) |
| **Area of residence** | Urban area | 253 (65.9%) |
| | Rural area | 131 (34.1%) |
| **Marital status** | Married | 317 (82.5%) |
| | Single | 28 (7.3%) |
| | Divorced/Widowed | 39 (10.2%) |
| **Level of education** | Illiterate | 144 (37.5%) |
| | Primary school | 105 (27.3%) |
| | High school or more | 135 (35.2%) |
| **Employment** | Do not work | 183 (48.3%) |
| | Employed/retirement funds | 196 (51.7%) |
| **Medical assistance at home** | Yes | 167 (43.5%) |
| **Medical insurance** | Yes | 276 (72.1%) |
| **Lifestyle habits** | | **Frequency (%)** |
| **Smoking status** | Non-smoker/Former smoker | 230 (59.9%) |
| | Smoker | 154 (40.1%) |
| **Alcohol consumption** | Yes | 39 (10.2%) |
| **Physical activity** | <150 min/week | 81 (21.1%) |
| | ≥150 min/week | 64 (16.7%) |
| | Do not practice | 239 (62.2%) |
| **Recommended diet** | Yes | 372 (96.9%) |
| **Are you following the recommended diet?** (N=373) | Yes | 86 (22.4%) |
| **Do you add sugar to your drinks?** | Yes | 83 (21.6%) |

Results are given in frequency (percentage) or Mean (SD); SD: Standard deviation, BMI: Body Mass Index

**Table 2** Medical history of the patients and clinical information

| Medical history and clinical information | | Total (N=384) |
|---|---|---|
| | | Frequency (%) |
| **Duration of diabetes** (years) | Mean (SD) | 8.2 (7.5) |
| **Family history** | Yes | 266 (69.3%) |
| **HbA1c value** (%) (N=373) | <7% | 131 (35.1%) |
| | ≥7% | 242 (64.9%) |
| **Frequency of HbA1c testing** (months) | 3-6 months | 231 (60.2%) |
| | 12 months | 122 (31.8%) |
| | >12 months | 31 (8.0%) |
| **Glucometer at home** | Yes | 281 (73.2%) |
| **Fasting blood glucose measurement** (N=376) | Yes | 224 (59.6%) |
| **Blood glucose measurement 2h after meals** (N=376) | Yes | 110 (29.3%) |
| **Comorbidities** (N=378) | Hypertension | 226 (59.8%) |
| | Dyslipidemia | 221 (58.5%) |
| | Mental disorders | 50 (13.2%) |
| | Coronary artery disease | 39 (10.3%) |
| | Thyroid dysfunction | 39 (10.3%) |
| | Chronic kidney disease | 29 (7.7%) |
| | Respiratory disease | 17 (4.4%) |
| **Who diagnosed you with T2D?** | Doctor | 355 (92.4%) |
| | Pharmacist | 29 (7.6%) |
| **Main source of information regarding T2D** (N=329) | Doctor | 270 (82.1%) |
| | Pharmacist | 59 (17.9%) |
| **Frequency of follow-up with your doctor** (N=356) | 1-6 months | 211 (59.3%) |
| | 6-12 months | 104 (29.2%) |
| | >12 months | 41 (11.5%) |
| **Do you usually postpone your visit to the doctor?** (N=356) | Yes | 161 (45.2%) |
| **Did the doctor explain to you the medication plan?** (N=356) | Yes | 334 (93.8%) |
| **Did you understand the doctor's explanation?** (N=356) | Yes | 248 (69.7%) |
| **Did the doctor explain to you the causes and complications?** (N=378) | Yes | 236 (62.4%) |
| **Have you ever had any diabetes-related complications?** (N=378) | Yes | 177 (46.8%) |
| **Complications** (N=177) | Retinopathy | 83 (46.9%) |
| | Neuropathy | 78 (44.1%) |
| | Cardiovascular | 61 (34.4%) |
| | Nephropathy | 28 (15.8%) |

Results are given in frequency (percentage) or Mean (SD); SD: Standard deviation, HbA1b: Hemoglobin A1c

The mean duration of diabetes among the sample was 8.2 (7.5) years. Around 70% of patients had a family history of T2D and 64.9% had an HbA1b value of 7% or more. Most patients (73.2%) had a glucometer at home. As regards blood glucose measurement, 59.6% said that they measured it at fasting time and only 29.3% measured it two hours after meals. The most common comorbidities among patients were hypertension (59.8%) and dyslipidemia (58.5%). Most patients reported that a doctor diagnosed them with T2D (92.4%) and was their main source of information (82.1%) and almost 45% declared that they usually postponed their appointments. Doctors explained the medication plan for most patients (93.8%) and 69.7% reported that they understood the explanation. Around 47% of patients had T2D complications, out of which retinopathy (46.9%) and neuropathy (44.1%) were the most common (Table 2).

Table 3 presents the medication self-management of patients with T2D. Around 18% of patients reported that they stopped taking diabetes medication when feeling good and 21.1% stopped them when in bad health status. In the case of hyperglycemia, 16.6% reported that they doubled the dose of medication and 14.6% stopped taking the medication when fasting. Most patients (91.9%) agreed that treatment improved their health. Nevertheless, 26.3% reported that they could not always afford to buy it. A higher proportion of patients (44.1%) declared that they skipped the dose if they forgot to take it and 29.5% said they took it as soon as they remembered. Around half of the patients (51.4%) reported that nothing worked to avoid missing doses of diabetes medication and 31.7% reported that carrying the drugs was the best solution.

**Table 3** Self-management of medication among patients with type 2 diabetes

| Do you agree with the following statements? | | |
| --- | --- | --- |
| I stop taking my medication when I am in good health status (N=356) | Yes | 63 (17.7%) |
| I stop taking my medication when I am in bad health status (N=356) | Yes | 75 (21.1%) |
| I double the dose of medication in case of hyperglycemia (N=356) | Yes | 59 (16.6%) |
| I stop taking the medication when fasting (N=356) | Yes | 52 (14.6%) |
| I usually forget to take my medication during trips (N=356) | Yes | 61 (17.1%) |
| I cannot always buy the medication because it is expensive (N=369) | Yes | 97 (26.3%) |
| I never stop taking my medication (N=369) | Yes | 149 (40.4%) |
| Treatment improves T2D patients' health (N=369) | Yes | 339 (91.9%) |
| **Self-management of drug-related issues** | | |
| What do you do if you missed a dose of your medication? (N=356) | | |
| I have never missed a dose | | 88 (24.7%) |
| I take it as soon as I remember. | | 105 (29.5%) |
| I skip the dose | | 157 (44.1%) |
| I contact my doctor | | 6 (1 .7%) |
| **Best solution to avoid missing a dose of your medication? (N=356)** | | |
| To always carry the drug | | 113 (31.7%) |
| To ask a family member/friend for a reminder. | | 57 (16.0%) |
| Putting an alarm on the phone | | 3 (0.8%) |
| Nothing works | | 183 (51.4%) |

Results are given in frequency (percentage); T2D: Type 2 diabetes.

Table 4 presents each statement's means of individual patients' knowledge, attitudes, and practice scores. Overall, patients had a total score of 15.7 (3.9) over 25. Of knowledge statements, higher scores were noted for those related to the fact that T2D is a lifelong disease (0.84), can be treated by oral drugs or insulin (0.89), and cannot be transmitted by contacting another patient (0.81). Most patients agreed that regular exercise (0.82), weight control (0.90), dietary modifications (0.89) and self-monitoring of blood glucose (0.89) can help manage diabetes. As regards practices, fewer patients have undergone eye (0.47) and foot examination (0.36) and were able to maintain a normal weight (0.53). A

high proportion of patients answered many questions with "Do not know", namely those related to the fact that both sexes can have T2D with a higher risk for women and that it requires regular follow-up.

**Table 4** Knowledge, attitudes, and practices of patients with T2D

| | Agree | Disagree | Do not know | Score/1 |
|---|---|---|---|---|
| **Knowledge of T2D (N=384)** | **Frequency (%)** | **Frequency (%)** | **Frequency (%)** | **Mean** |
| T2D is a lifelong disease | 322 (83.9%) | 25 (6.5%) | 37 (9.6%) | 0.84 |
| T2D can be transmitted by contacting other patients | 3 (0.8%) | 312 (81.3%) | 69 (18.0%) | 0.81 |
| T2D can be genetic | 265 (69.0%) | 112 (28.9%) | 7 (2.1%) | 0.69 |
| T2D mostly affects adults and elderly | 189 (49.2%) | 62 (16.1%) | 133 (34.6%) | 0.49 |
| Both sexes can have T2D | 196 (51.0%) | 83 (21.6%) | 105 (27.3%) | 0.51 |
| Women have a higher risk of T2D | 237 (61.7%) | 42 (10.9%) | 105 (27.3%) | 0.62 |
| T2D is characterized by high blood glucose levels | 287 (74.7%) | 10 (2.6%) | 87 (22.7%) | 0.75 |
| Patients with T2D loose or gain weight | 29 (7.6%) | 305 (79.4%) | 50 (13.0%) | 0.08 |
| Patients with T2D have frequent urination | 124 (32.3%) | 210 (54.7%) | 50 (13.0%) | 0.32 |
| Patients with T2D have a frequent thirst | 47 (12.2%) | 285 (74.2%) | 52 (13.5%) | 0.12 |
| T2D can be prevented | 209 (54.4%) | 124 (32.3%) | 51 (13.3%) | 0.54 |
| T2D can be treated by oral drugs or insulin | 342 (89.1%) | 25 (6.5%) | 17 (4.4%) | 0.89 |
| T2D requires regular follow-up | 267 (69.5%) | 4 (1.0%) | 113 (29.4%) | 0.70 |
| **Attitudes about T2D (N=384)** | **Frequency (%)** | **Frequency (%)** | **Frequency (%)** | **Mean** |
| Regular exercise can help self-managing diabetes | 315 (82.0%) | 25 (6.5%) | 44 (11.5%) | 0.82 |
| Weight control can help self-managing diabetes | 347 (90.4%) | 18 (4.2%) | 21 (5.5%) | 0.90 |
| Dietary modification can help self-managing diabetes | 343 (89.3%) | 22 (5.7%) | 19 (4.9%) | 0.89 |
| Patients should monitor their own blood glucose at home | 344 (89.6%) | 26 (6.8%) | 14 (3.6%) | 0.89 |
| Patients with controlled T2D can have a normal life | 279 (72.7%) | 62 (16.1%) | 43 (11.2%) | 0.73 |
| Patients with controlled T2D can have eating restrictions | 153 (39.8%) | 158 (41.1%) | 73 (19.0%) | 0.40 |
| **Practices (N=384)** | **Frequency (%)** | **Frequency (%)** | **Frequency (%)** | **Mean** |
| I test the HbA1c levels at least once a year | 354 (92.2%) | 30 (7.8%) | -- | 0.92 |
| I follow a low-sugar diet | 266 (69.3%) | 53 (13.8%) | 65 (16.9%) | 0.69 |
| I try to have or maintain a normal weight | 204 (53.1%) | 156 (40.6%) | 24 (6.3%) | 0.53 |
| I take the medication prescribed by my doctor | 259 (67.4%) | 125 (32.6%) | -- | 0.67 |
| I undergo eye examinations at least once a year | 182 (47.4%) | 202 (52.6%) | -- | 0.47 |
| I undergo foot examination at least once a year | 138 (35.9%) | 246 (64.1%) | -- | 0.36 |
| | | Total score/25 | Mean (SD) | 15.7 (3.9) |

Results are given in frequency (percentage), and the total score is given in Mean (SD); SD: Standard deviation, T2D: Type 2 diabetes; HbA1c: emoglobin A1c

After categorizing patients according to their awareness scores, 162 patients (42.2%) had lower awareness, and 222 (57.8%) had higher awareness. Table 5 shows the predictors of higher awareness scores among patients with T2D. After adjusting for covariates, the odds for higher awareness were 2.24 (OR 2.24, 95% CI 1.30-3.89; p=0.004) and 3.11 (OR

3.11, 95% CI 1.83-5.27; p<0.001) times higher among patients with primary school and high school or more respectively compared to illiterate patients. These odds were 38% lower among patients with medical assistance at home (OR 0.62, 95% CI 0.38-0.99; p=0.049) than those without it. Furthermore, smokers had 38% lower odds of higher awareness than non-smokers (OR 0.62, 95% CI 0.39-0.97; p=0.042). Patients with a physical activity <150 minutes per week had significantly greater odds of high awareness than those not practicing (OR 2.46, 95% CI 1.48-3.94; p=0.005). The odds of a higher awareness were 2.42 times higher among patients with a family history of diabetes than others (OR 2.42, 95% CI 1.48-3.94; p<0.001).

**Table 5** Predictors of a higher awareness score among patients with type 2 diabetes

| | Unadjusted model | | Adjusted model | |
|---|---|---|---|---|
| Variables | OR [95% CI] | p-value | OR [95% CI] | p-value |
| Female sex (male as reference) | 0.66 [0.41-1.05] | 0.080 | 0.68 [0.42-1.09] | 0.109 |
| Age (<50 as reference) | | | | |
| 50-60 years | 0.91 [0.51-1.65] | 0.765 | | |
| >60 years | 0.50 [0.28-0.89] | 0.018 | | |
| Rural residence area (urban as reference) | 0.76 [0.50-1.17] | 0.212 | | |
| Marital status (Single as reference) | | | | |
| Married | 0.97 [0.44-2.14] | 0.936 | | |
| Divorced/Widowed | 0.41 [0.15-1.10] | 0.075 | | |
| Level of education (Illiterate as reference) | | | | |
| Primary school | 1.96 [1.18-3.27] | 0.010 | 2.24 [1.30-3.89] | 0.004 |
| High school or more | 3.74 [2.26-6.20] | <0.001 | 3.11 [1.83-5.27] | <0.001 |
| Employment (Do not work as reference) | | | | |
| Employed/retirement funds | 1.01 [0.67-1.52] | 0.962 | | |
| Medical assistance at home (No as reference) | 0.63 [0.42-0.95] | 0.028 | 0.62 [0.38-0.99] | 0.049 |
| Medical insurance (No as reference) | 0.72 [0.46-1.15] | 0.169 | | |
| Smoker (Non-smoker as reference) | 0.59 [0.39-0.89] | 0.011 | 0.62 [0.39-0.97] | 0.042 |
| Alcohol drinker (No as reference) | 0.75 [0.38-1.45] | 0.385 | | |
| Physical activity (No as reference) | | | | |
| <150 min/week | 3.17 [1.76-5.69] | <0.001 | 2.46 [1.32-4.58] | 0.005 |
| ≥150 min/week | 1.69 [0.97-2.94] | 0.063 | 1.56 [0.84-2.88] | 0.155 |
| Family history (No as reference) | 2.37 [1.52-3.68] | <0.001 | 2.42 [1.48-3.94] | <0.001 |
| HbA1c ≥7% (<7% as reference) | 0.74 [0.48-1.15] | 0.178 | | |

\* Higher awareness score with baseline answer "lower awareness" **\*\*OR:** Odds Ratio; **CI**: Confidence interval; \*\*\*omnibus test (p<0.001), Nagelkerke r square (0.202), Hosmer & Lemeshow (p= 0.017)

## 4. Discussion

This study explored the knowledge, attitudes, and practices of 384 patients with T2D regarding the disease and assessed the predictors of higher self-awareness. Overall, moderate awareness was noted among patients with lower knowledge of the symptoms of diabetes and good practices. A high proportion of patients answered with "I don't Know" many questions reflecting the need for interventions for patient education. The odds of a higher awareness were increased with higher levels of education compared to illiterate patients, among those practicing sports, and those with a family history of diabetes compared to others. Nevertheless, medical assistance at home and smoking significantly decreased these odds.

Around 65% of patients had an HbA1c value of 7% or more, which emphasizes the poor control of diabetes and could probably be associated with lifestyle habits or non-adherence to medication. Doctors were the main source of information regarding T2D. Most patients reported that doctors explained their medication plan, but not all understood it. This can partially explain the moderate awareness of patients about T2D and call for the need to provide workshops tailored for patient education [20], and include it in the continuing education program of healthcare providers [21, 22]. Almost 45% of patients postponed their medical appointments, which can exacerbate diabetes complications and highlight the need for strict lifestyle and behavioral interventions [23]. It could be also related to the concurrence of the pandemic with the data collection period and the fear of this highly susceptible group of adverse health outcomes [24, 25]. Most patients had a glucometer at home and measured their fasting blood glucose levels. A recent meta-analysis showed an association between the presence of a glucometer at home and good medication adherence [26], in contrast with the findings of this study. Several barriers such as the cost of the strips, fear of needles, pain, and lack of knowledge could have influenced the limited use of the glucometer after meals [27].

Many malpractices were noted in terms of medication self-management among patients with T2D. Among others, discontinuing the medication when feeling good, doubling the dose in case of hyperglycemia, and forgetting to take medication during trips were frequently observed. Non-adherence to diabetes medication was also reported in the literature and was primarily related to side effects, self-perceived drug efficacy, and weight gain [28]. Although the reasons for these practices were not assessed in this study, patient counseling and awareness programs can improve adherence and as a result, the management of diabetes. Around 26% of patients reported that they could not afford diabetes drugs. Previous research also reported cost-related medication challenges [29]. These challenges can be managed by promoting low-cost generic drug prescription [30], and clarifying misconceptions to increase their acceptance and use [31]. Around half of the sample said that nothing improved their medication adherence. Despite the evidence-based effectiveness of interventions such as reminders, electronic drug monitoring, and providing incentives [32], the negative attitudes of patients in this study could be related to their lower education level and other comorbidities, which increased the odds of polypharmacy.

Low awareness scores were found for statements related to the symptoms of diabetes, such as weight changes, frequent urination, and thirst. These findings were also reported in a similar study published in 2018 in Bangladesh [33], which could reflect low levels of health literacy among patients with T2D in Lebanon. A high proportion of patients answered with ''I don't Know'' many questions, particularly those targeting the risk factors of diabetes. Although some of these factors were non-modifiable risks, adequate knowledge can help prone patients to focus on practices and lifestyle changes to prevent and control their conditions. Patients with higher levels of education had significantly increased odds of higher awareness than illiterate patients. Research showed similar results [34], where the language barrier and the fear of being singled out were the main barriers [35]. Those with medical assistance at home had lower awareness of T2D, possibly due to their reliance on another person for the management of their cases. Physical activity significantly increased the odds of higher awareness. A healthier lifestyle could explain this finding given that good practices are mostly associated with higher awareness. More than two-thirds of patients in this study had a family history of diabetes and had higher awareness scores than other patients. In contrast with the findings of another study [36], having another member of the family with diabetes could have promoted support between them and information sharing.

This study had limitations. Recall bias may have been induced since a self-reported survey was used for data collection. Interviewer bias was reduced since the data collectors were uniformly trained and did not interfere with the patient's answers. Moreover, data coding and analysis were performed by a different researcher, which minimized the subjectivity of data collectors. Although the sample size was enough, patients were recruited from only five clinics which may affect the extrapolation of the results to other patients. A nationwide longitudinal study is recommended to allow better external validity and representativeness of Lebanon.

## 5. Conclusion

Patients with T2D in Lebanon had moderate awareness of diabetes. A lack of knowledge was found for some risk factors and was translated into bad practices regarding the follow-up of complications. Predictors of higher awareness can help target patients with certain characteristics to improve their knowledge, attitudes, and practices. The short 25-item tool used in this study can be applied in clinics to assess the awareness of patients with T2D. Accordingly, informed interventions and awareness campaigns can be developed.

## Compliance with ethical standards

*Disclosure of conflict of interest*

The Authors declare that there is no conflict of interest.

*Statement of ethical approval*

The study protocol, questionnaire was reviewed and approved by the institutional review board of the faculty of pharmacy of the Lebanese University.

*Statement of informed consent*

Informed Consent form were reviewed and approved by the institutional review board of the faculty of pharmacy of the Lebanese University.

*Authors' contributions*

- GH: Conceptualization, formal analysis, Validation, and Writing-original draft;
- ZS and DM: Data curation, methodology, and writing-original draft;
- AAH: Methodology, project administration, writing-original draft;
- SR: Conceptualization, Methodology, and Writing-original draft;
- DK and SZ: Conceptualization, data curation, methodology, Writing-review, and editing
- All authors read and approved the final manuscript.

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