# Adherence of Type 2 Diabetic Patients to Antidiabetic Medications and its Associated Factors in Najran Armed Forces Hospital, Saudi Arabia

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## Abstract

**Background:** Adherence to antidiabetic medications is crucial for optimum glycemic control and decreasing complications. This study aimed to assess adherence to antidiabetic medications and the associated factors among individuals with type-2 diabetes mellitus (T2DM) attending chronic illness clinics at Najran Armed Forces Hospital (NAFH), Najran Region, Saudi Arabia.

**Methods:** A cross-sectional study was conducted. A systematic sampling technique was used. Morisky Medication Adherence Scale (MMAS) scores were used for labeling patients as adherent or non-adherent. Data were entered and analyzed using SPSS version 20. To see the association of variables logistic regression with OR and 95% CI was done.

**Results:** A total of 288 study participants were interviewed with a response rate of 100%. The level of adherence was found to be 85%. Factors found to be significantly associated with antidiabetic medication adherence were level of education (AOR = 14.27, 95% CI = 3.0, 67.82), duration of diabetes (AOR = 6.10, 95% CI = 2.03, 18.34), and knowledge about DM and its medications (AOR = 28.05, 95% CI = 8.96, 87.8).

**Conclusions and Recommendations:** Our study, a family medicine-based cross-sectional study, found high medication adherence by patients with T2DM regarding their prescribed diabetes medication. Low adherence was significantly associated with educational status, duration of diabetes, and knowledge. We recommend improving T2DM patients' knowledge related to diabetes and note the importance of compliance with the medication regimen through several health education sessions at diabetic educators, coaches, and other healthcare facilities. These sessions can be delivered by physicians and other healthcare providers, namely, nurses and community pharmacists.

**Keywords:** Type 2 diabetes, adherence to medications, Najran Armed Forces Hospital, Najran Region.

## Background

Diabetes mellitus (DM) is "a chronic, metabolic disease characterized by an elevated level of blood glucose (or blood sugar), which leads over time to serious complication" and may lead to death (1-2). The prevalence of diabetes among adults in Saudi Arabia is experiencing a rapid rise; it is expected that the total number of cases will reach around 7.5 million by 2035 (3).

DM has been determined as the sixth leading cause of death in Saudi Arabia (4-5). Adherence to the treatment is indispensable for the successful management of DM. Adherence to the medication is the first step on a path leading away from complications (6-7). According to the World Health Organization (WHO), the average rate of medication adherence is only 50% in developed countries. Nevertheless, a suboptimal level of adherence prevails (8).

This growing healthcare issue is costly in multiple aspects. Its financial burden may surpass that of managing the disease itself (9). In Saudi Arabia, the care of diabetic patients is 10-fold higher compared to other diseases, which exerts an economic burden (10). Furthermore, as suboptimal adherence may manifest as complications, it is the underlying cause of more than 30% of medicine-related hospital admissions (11).

Given the above, it is deleterious in terms of both health and economy. Adherence and compliance are terms that are sometimes equated with one another and used interchangeably (11). However, adherence is deemed superior to compliance, as it entails that the patient's management plan is mutually tailored by the healthcare provider and the patient (12). WHO defines adherence as "the extent to which a person's behavior - taking medication, following a diet, and/or executing lifestyle changes - corresponds with agreed recommendations from a healthcare provider" (13-14).

Meanwhile, compliance is defined as "the extent to which the patient's behavior matches the prescriber's recommendations". The term "adherence" will be mainly used in this study. The literature review reveals significant determinants of adherence. These can be categorized into three major categories: the medical status, personal characteristics of the patient, and the agreed-upon therapeutic plan and medical encounter (15). The number of medications, dispensing of medication via a third-party provider (Wasfaty), complexity of the regimen, side effects, cost, and lack of trust in treatment efficacy are under the umbrella of the therapeutic plan and medical encounter (16). Adherence to antidiabetic medications decreases the risks of DM complications especially macrovascular (17-18).

Several factors play roles in adherence and non-adherence to antidiabetic medications among diabetic patients according to multiple studies worldwide (19-21). In Saudi Arabia, some areas and regions have assessment studies that measure adherence and its factors, to antidiabetic medications (22-24). Up to the evidence in Najran Region, there are no assessment studies investigating medication adherence among diabetic patients, so we aimed to assess the level of adherence to the medications and the associated factors among T2DM patients treated in Najran Armed Forces Hospital (NAFH) in this study.

## Method and Subjects

**Study Design**: Cross-sectional analytical research design.
**Study Population:** All T2DM patients registered at the NAFH.
**Sampling:** The sample size was calculated by the Slovin's Formula [n/(1+Ne2) to be 288 T2DM patients registered at NAFH, where:

    N= Population size = 1030 type 2 diabetic patients
    e = margin of error (0.05) = 0.0025
    n = Sample size = 1030/[(1030 x 0.0025) + 1] = 288

**Tools:**
An interview-administered questionnaire assessing the following:
- Socio-demographic data
- Associated factors:
  A. Patients' medical status;
  B. personal characteristics of the patient;
  C. The agreed-upon therapeutic plan and medical encounter;
  D. forgetfulness, E. personal beliefs;
  F. number of medications;
  G. dispensing of medication via a 3rd party provider (i.e., Wasfaty);
  H. complexity of the regimen; I. side effects;
  K. cost, and lack of trust in treatment efficacy are under the umbrella of the therapeutic plan and medical encounter.
- The Morisky medication adherence scale (MMAS-4) consists of four questions designed to describe the medication-taking behavior of patients (25). It has dichotomous response categories with YES = 1 or NO = 0. Its scores for the adherence levels with correct numbers are: high (0), moderate (1-2), and (3-4).
  The rationale behind the four items was that drug errors of omission could occur in any or all of several ways: forgetting, carelessness, stopping the drug when feeling better, or starting the drug when feeling worse.

The sensitivity and specificity were 81% and 44% respectively. Cronbach's alpha reliability is 0.61, which is below the acceptable value of 0.7. (26). We classified the adherence level into two groups, adherent (high and moderate) and non-adherent (low adherent).

**Study Area & Setting:** Armed Forces Hospital in Najran City, outpatient clinic (family medicine, internal medicine, and chronic illness clinic)

**Study duration:** July –September 2023.

**Ethical Consideration:**
We followed and completed the requirements of the Ethical Approval Committee in NAFH & IRB.

**Data Collection** Procedure: We sent an official letter describing the aims, objectives, and processes of the study to the director of NAFH to request permission to assess all diabetic patients in the outpatient clinic for recruitment to this study. After obtaining the permission, the questionnaire was sent to all randomly selected patients by the assigned teams.

Covering letters informing the participants about the aims of the study and asking them for their permission to participate covered the questionnaires. The participants were informed that confidentiality and anonymity would be respected.

**Data Management (Entering, Analysis of Data):**
The Statistical Package for Social Sciences (IBM, SPSS version 25.0) for data entry analysis. We computed the descriptive statistics in the form of frequency and percentage for categorical data and in the form of measures of central tendency (arithmetic mean and median) and measures of dispersion (standard deviation and range) for continuous variables. Regarding analytic statistics, the Chi-square test was utilized to test for the association and /or difference between categorical variables. Fisher's exact test was applied instead of the Chi-square test if the frequency in at least one cell was less than five.

## Results

**Sociodemographic Characteristics:**
A total of 288 diabetes patients were involved in this study. The response rate was 100%. Among the total of 288 respondents, 111 (38.5%) and 177 (61.5%) were males and females, respectively. The mean age was 55.2 (SD 10.966) years. The majority, 272 (94.4%) and 256 (88.9%) of the respondents were inside the Najran region and main city, respectively. One hundred and sixty-nine (58.7%) were married. Ninety-eight (34%) had a bachelor certificate and above, while seventy-two (25%) could not read and write. The majority, 98 (34%), of the participants were housewives and government employees, 50 (17.4%). The mean average monthly income was 8106 (SD 2108.120) SR. A large proportion, 240 (83.3%), resided in an Urban area. One hundred and fifty-seven (54.5%) took below half an hour for a single trip to arrive at the hospital (Table 1).

**Medication Adherence**
The majority, 245 (85.1%), of the respondents were adherent (Figure 1).

**Clinical and Medication Characteristics of Respondents**
One hundred and eighty-one (62.8%) of the respondents were treated with oral hypoglycemic agents (OHAs) only.

The majority, 190 (66%) and 175 (60.8%) had been 3 years and more since medically diagnosed and treated for diabetes, respectively. The mean duration since being medically diagnosed with diabetes was 63.69 (SD 54.754) months. The majority, 143 (49.7%), had been taking two types of drugs and the mean number of tablets taken per day was 3.33 (1.638). The frequency of daily dose and number of comorbidities section of the responses indicated that 170 (59%) would have been taking their medications three times or more a day and 119 (41.3%) of the respondents had one comorbidity. As to the cost of medication, 18.6% were buying their medication by themselves from outside private clinics and 53.3% of the respondents were getting their medication for free (Table 2).

**Knowledge and Attitude toward Diabetes**
Most of the respondents, 243 (84.4%), were knowledgeable about diabetes and its medication, and a large proportion, 220 (76.4%), of them had a positive attitude toward diabetes (Table 3).

**Reasons for Non-adherence**
For the respondents who could not adhere to their antidiabetic medications, the most common reasons adduced for this scenario include the following: being busy 96 (33.3%) and forgetfulness 93 (32.3%) followed by being away from home 85 (29.5%) and not having companions (Figure 2).

**Factors Associated with Antidiabetic Medication**
Variables considered in the bivariate analysis were sex, age, educational status, occupation, monthly income, place of residence, distance from follow-up, duration of diabetes, duration of treatment, type of treatment, number of tablets, number of drugs, frequency of daily dose, number of comorbidities, coverage of drug cost, knowledge on diabetes, attitude towards diabetes, and patient-provider relationship. Variables with a value ≤ 0.2 were included in the multiple logistic regressions. Lastly educational status, occupation, duration of diabetes, and knowledge of diabetes remained to be significantly associated with adherence to antidiabetic medications.

According to the result of the multivariate analysis, a shift from being unable to read and write to grades 1–6th will increase the probability of antidiabetic medication adherence by 5.25 (AOR = 5.25, 95%, CI = 1.19, 23.12). Similarly, patients with an educational level of bachelor's certificate and above were 14 times more likely to be adherent with medications than those who cannot read and write (AOR = 14.27, 95% CI = 3.0, 67.82). Individuals with three years or more since being medically diagnosed with diabetes were 12 times more likely to be adherent to their medications than patients with less than three years' duration (AOR = 6.10, 95% CI (2.03, 18.34)). Regarding knowledge, the analysis showed that clients who are knowledgeable about diabetes and its medications were about 28 times more probable to be adherent to antidiabetic medications (AOR = 28.05, 95%, CI (8.96, 87.8) (Table 4).

**Table 1: Sociodemographic characteristic of the study participants (n=288)**

| Variables | Frequency | % |
|---|---|---|
| **Sex** | | |
| Male | 111 | 38.5 |
| Female | 177 | 61.5 |
| **Age (years)** | | |
| 18-40 | 31 | 10.8 |
| 41-59 | 173 | 60.1 |
| ≥ 60 | 84 | 29.2 |
| **Residency** | | |
| Najran Region | 272 | 94.4 |
| Najran City | 10 | 3.5 |
| Outside Najran Region | 6 | 2.1 |
| **Marital status** | | |
| Unmarried | 15 | 5.2 |
| Married | 169 | 58.7 |
| Divorced | 38 | 13.2 |
| Widowed | 66 | 22.9 |
| **Educational status** | | |
| Cannot read and write | 72 | 25.0 |
| Grades 1-6 | 46 | 16.0 |
| Grades 7-12 | 72 | 25.0 |
| **Bachelor's Certificate and above** | 98 | 34.0 |
| **Employment status** | | |
| Government | 50 | 17.4 |
| Merchant | 37 | 12.8 |
| Student | 1 | 0.3 |
| Housewife | 98 | 34.0 |
| Homework | 20 | 6.9 |
| Retired | 39 | 13.5 |
| Other | 43 | 14.9 |
| **Monthly income** | | |
| <8000 *SR* | 103 | 35.8 |
| 8000 - 12000 *SR* | 63 | 21.9 |
| > 12000 *SR* | 122 | 42.4 |
| **Residence** | | |
| Urban | 240 | 83.3 |
| Rural | 48 | 16.7 |
| **Distance from the hospital (a trip)** | | |
| <0.5 hours | 157 | 54.5 |
| ≥ 0.5 hours | 131 | 45.5 |

**Figure 1: Level of adherence towards antidiabetic medications among type II diabetic patients in NAFH, Saudi Arabia**
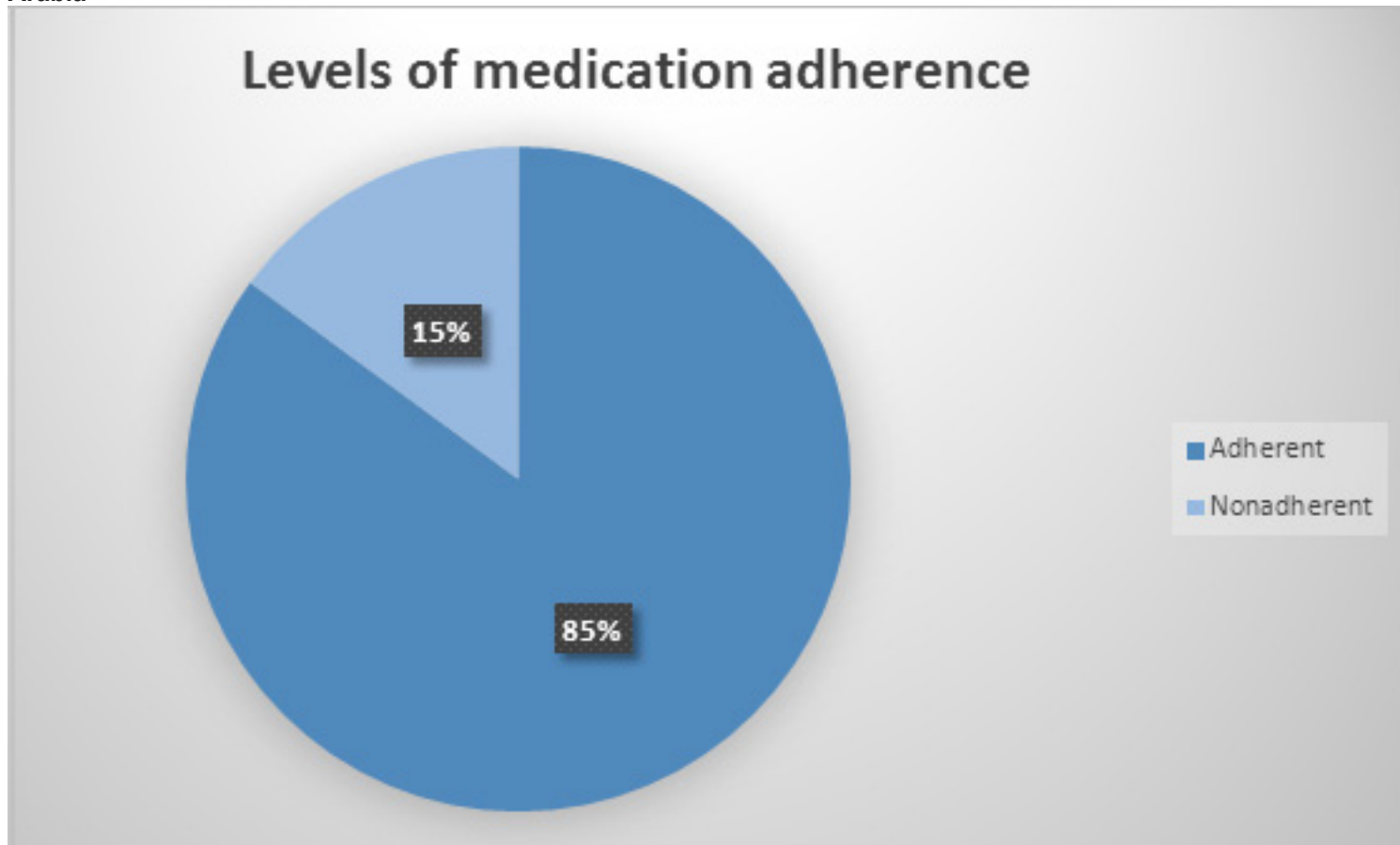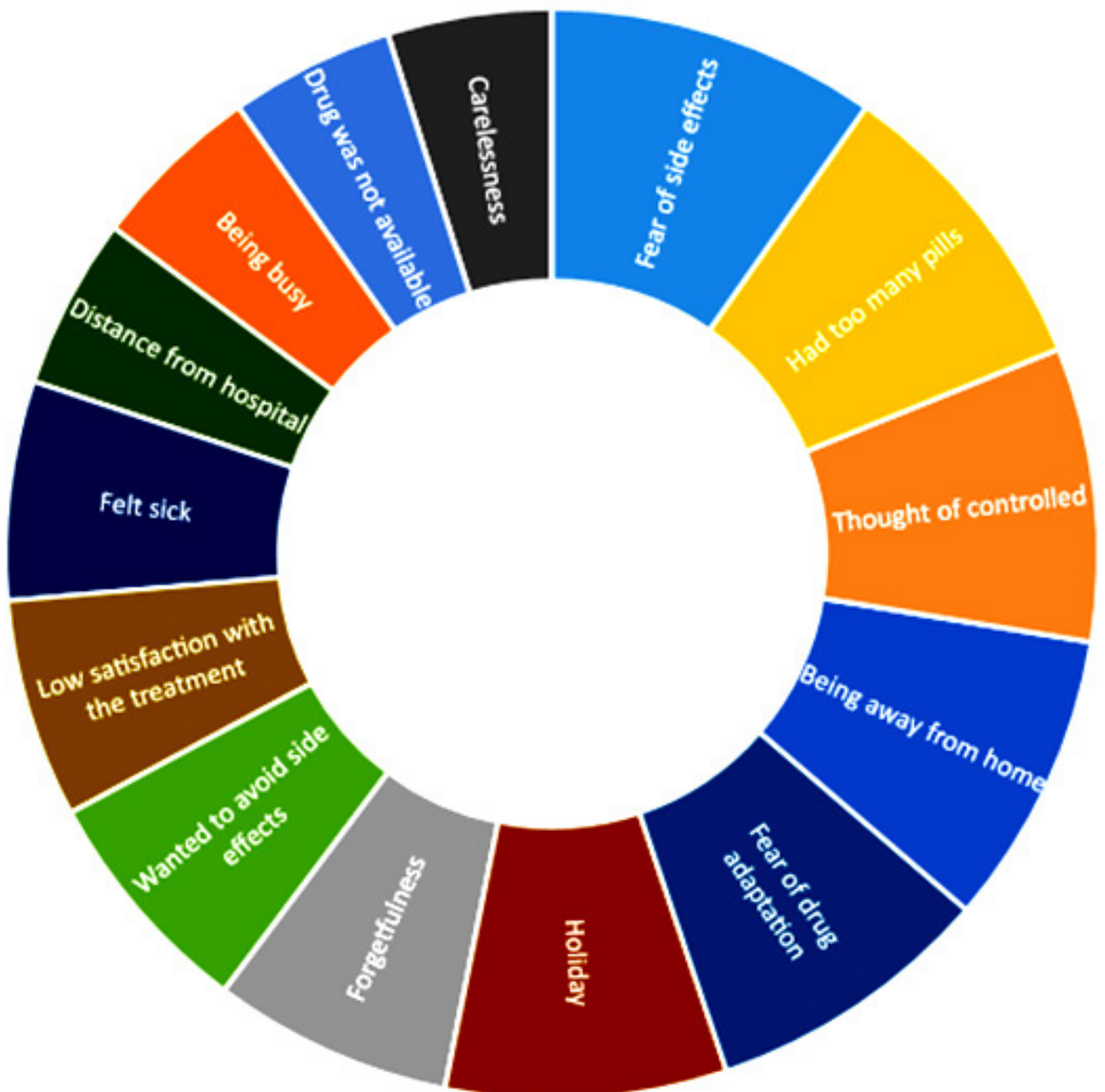
**Table 2: Clinical and medication characteristics of respondents, among T2DM patients in NAFH, Najran Region Saudi Arabia**

| Variables | Frequency | % |
|---|---|---|
| **Duration of DM (years)** | | |
| 1/12-3 | 98 | 34.0 |
| > 3 | 190 | 66.0 |
| **Duration of treatment(years)** | | |
| 1/12-3 | 113 | 39.2 |
| > 3 | 175 | 60.8 |
| **Type of treatment** | | |
| OHA | 181 | 62.8 |
| OHA+ insulin | 44 | 15.3 |
| Insulin | 63 | 21.9 |
| **Number of tablets/days** | | |
| ≤ 2 | 105 | 36.5 |
| >2 | 183 | 63.5 |
| **Number of drugs** | | |
| Monotherapy | 142 | 49.3 |
| Two | 143 | 49.7 |
| Three or more | 3 | 1.0 |
| **Frequency of daily dose** | | |
| Once | 25 | 8.7 |
| BID | 93 | 32.3 |
| TID or more | 170 | 59.0 |
| **Number of comorbidities** | | |
| None | 122 | 42.4 |
| One | 119 | 41.3 |
| Two | 42 | 14.6 |
| Three or more | 5 | 1.7 |
| **Who pays for medications** | | |
| Self | 53 | 18.6 |
| Government | 108 | 37.5 |
| Welfare/charity | 1 | 0.3 |
| Employer | 4 | 1.4 |

**Table 3: Knowledge and attitude towards DM and its medication, among T2DM patients in NAFH, Najran Region Saudi Arabia**

| Variables | Frequency | Percent (%) |
|---|---|---|
| **Knowledge level** | | |
| Knowledgeable | 243 | 84.4 |
| Not knowledgeable | 45 | 15.6 |
| **Attitude level** | | |
| Good attitude | 220 | 76.4 |
| Poor attitude | 68 | 23.6 |

**Figure 2: Reasons for non-adherence toward antidiabetic medications, among T2DM patients in NAFH, Najran Region, Saudi Arabia**

**Table 4: Logistic regression output showing the impact of selected sociodemographic, clinical, and other characteristics on adherence to antidiabetic medications, among T2DM patients in NAFH, Najran Region, Saudi Arabia**

| Variables | Adherence status | | COR (95% CI) | AOR (95% CI) |
|---|---|---|---|---|
| | Non-adherent | Adherent | | |
| **Educational status** | | | | |
| Illiterate | 26 | 46 | 1 | 1 |
| Grades 1-6th | 6 | 40 | 3.76 (1.40, 10.07) | 5.25 (1.19 , 23.12)** |
| Grades 7-12th | 8 | 64 | 4.52 (1.87, 10.88) | 2.64 (0.64, 10.86) |
| University | 3 | 95 | 17.89 (5.14, 62.21) | 14.27 (3.0, 67.82) ** |
| **Residence** | | | | |
| Urban | 26 | 214 | 1 | |
| Rural | 17 | 31 | 0.22 (0.10, 0.45) | |
| **Type of treatment** | | | | |
| OHA | 29 | 152 | 1 | |
| OHA + insulin | 9 | 35 | 0.74 (0.32, 1.70) | |
| Insulin | 5 | 58 | 2.21 (0.81, 5.99) | |
| **Dosage frequency** | | | | |
| Once daily | 9 | 16 | 1 | |
| BID | 13 | 80 | 3.46 (1.26, 9.45)* | |
| TID and above | 21 | 149 | 3.99 (1.26, 10.7)* | |
| **Duration of diabetes** | | | | |
| < 3 years | 35 | 63 | 1 | 1 |
| ≥ 3 years | 8 | 182 | 12.63 (5.56, 28.69) | 6.10 (2.03, 18.34)** |
| **Duration of treatment** | | | | |
| < 3 years | 37 | 76 | 1 | |
| ≥ 3 years | 6 | | 13.71 (5.55, 33.86) | |
| **Number of tabs per day** | | | | |
| ≤ 2 | 20 | 85 | 1 | |
| >2 | 23 | 160 | 1.63 (0.85, 3.14) | |
| **Knowledge towards DM and medications** | | | | |
| Not knowledgeable | 31 | 14 | 1 | 1 |
| Knowledgeable | 12 | 231 | 42.62 (18.08, 100.4) | 28.05 (8.96, 87.8)** |
| **Attitude toward DM and medication** | | | | |
| Negative | 17 | 51 | 1 | |
| Positive | 26 | 194 | 1.43 (0.15, 13.15)* | |

*Variables that were significant during bivariate logistic analysis at p ≤ 0.2 but were not significant by backward multivariate logistic regression analysis at p<0.05.

**Variables that were found to have significant association both during bivariate and multivariate analysis at p ≤ 0.2 and < 0.05, respectively.

## Discussion

We evaluated T2DM patients' medication adherence, knowledge, and the factors in our study at NAFH, Najran region, Saudi Arabia. Adherence to prescribed medications by T2DM patients is correlated with lower healthcare spending costs for a country, better clinical outcomes, decreased morbidity, decreased hospital admission rates, and decreased mortality, as stated by the World Health Organization (WHO) (4,8).

This finding is in concordance with the health statistics of MOH, KSA as it reported a high incidence of DM among adult patients in Saudi Arabia (27). Diabetes education, based on a patient's knowledge to protect their health, is the theme of the current year of the World Diabetes Day 2021–23 activities (28).

We discovered that 85% of patients with T2DM were adherent to the medications prescribed by doctors. A study by AlQarni et al. in Al Khobar City, KSA, reported that a slightly higher proportion (35.8%) of diabetes patients were highly adherent to medications (29). The difference between our study and that of AlQarni et al. could be due to the inclusion of participants and study settings. Our study was conducted among T2DM patients attending the Chronic Diseases clinics in the Family Medicine Department, while AlQarni et al. included participants from the endocrine and diabetic clinics at a tertiary care center. An institutionally based observational survey conducted by Ayele et al. stated that a higher proportion of patients with T2DM were poorly adherent to medications (30).

Murwanashyaka et al. also reported that a higher proportion of participants had poor adherence practices (31). Interestingly, Balkhi et al. of the KSA reported that nearly half of their participants complied well with diabetes medication adherence (32). These large discrepancies across these findings by different authors could be attributed to various factors, namely, study settings, tools used to assess medication adherence, and the access to and availability of appropriate diabetes care services. Furthermore, our results emphasized the need for implementing the suggested activities of the WHO and the American Diabetes Association (7,8).

Adherence with antidiabetic medications in our study (85%) was higher than the earlier finding in Ethiopia (75%) (33), Malaysia (66%) (34), and Iran (18%) (35). The discrepancy is possibly because of the time gap, the age limit of participants enrolled, differences in source population, and medication adherence measurement method. The age limit and knowledge (Malaysia) and the participants enrolled in a study done in Iran were randomly selected from eight healthcare centers (Iran); the level of medication adherence measured was based on patients' blood glucose record (Ethiopia) and pill count (Malaysia), in addition to self-report.

In our study, a significant association between educational level and adherence level was observed. Accordingly, patients with Bachelor's degrees were more adherent than those who are unable to read and write.

This finding is in line with a study done in Spain (36), Malaysia (34), and Isfahan-Iran (35). The studies done in India (37), Uganda (38), and Ethiopia (39) also support the findings of our current study. Individuals with elementary educational status were more likely to be adherent than unable to read and write individuals. A possible justification for this could be the fact that educational level is the most important predictor of knowledge of patients. Low schooling makes learning more difficult; as diabetes drug therapy gets more complex, patients are required to have more complex cognitive skills to be able to understand the prescribed drug therapy and to adhere to treatment for good glucose control.

The duration of diabetes was another variable, significantly associated with the adherence status of respondents. Those patients who had been three years and above since medically diagnosed with diabetes were more likely to be adherent than those with less than three years duration.

This finding agrees with the study done in Malaysia (34) Iran (AOR = 3.6, 95% CI: 2.1, 5.7) (35), and Sudan (40); patients who had been diabetic for 3 years and above are more adherent than those less than 3 years. This could be explained by patients with longer duration of diabetes by their frequent contact with health facilities and health professionals making them more likely to be given repetitive instruction on medication adherence and become aware of the acute and chronic complications of uncontrolled blood glucose. In addition, it could reflect wider social interaction with other diabetic patients on antidiabetic medication adherence.

Participants' knowledge about DM and its medications was found to be positively associated to the adherence level of patients. This finding is in line with studies done in Malaysia (34) and Ethiopia (39), where knowledgeable patients were found to be significantly associated with a higher adherence rate. The possible justification of why people with better knowledge were adherent could be the right knowledge about DM and its medications creates a clear understanding and avoids confusion about the treatment and the disease condition. But people with wrong/poor knowledge may make wrong decisions. Knowledge of patients has an impact on diabetic patients' adherence to antidiabetic medications in health care settings.

## Conclusion and Recommendations

Our study revealed a high medication adherence by patients with T2DM regarding their prescribed diabetes medication. Low adherence was significantly associated with educational status, duration of diabetes, and knowledge. Moreover, we found that medication adherence is lowly correlated with diabetes knowledge and patients' inability to read and write about their diabetes status. We recommend improving T2DM patients' knowledge related to diabetes and note the importance of compliance with the medication regimen through several health education sessions with diabetic educators, coaches, and other healthcare facilities. These sessions can be delivered by physicians and other healthcare providers, namely, nurses and community pharmacists. Furthermore, we recommend mixed-method medication adherence assessment surveys in other regions of the KSA.

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