

Evaluation of Treatment Adherence, Blood Sugar Control, and Related Factors in Patients with Diabetes Detected in Aran and Bidgol in 2020–2021

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Abstract

Aims: Diabetes is a chronic, progressive, and metabolic disease that its prevalence is increasing in the world. Poor treatment adherence is a barrier to controlling diabetes. The aim of this study was to evaluate the treatment adherence and blood sugar control in patients with diabetes and related factors. **Materials and Methods:** This descriptive-analytical study was performed on 385 patients with diabetes in 2020–2021 at both Aran and Bidgol health centers. A proportion of diabetic patients in each center were selected based on the covered population by simple random sampling. The tools was Madanloo's treatment adherence questionnaire and also measured glycosylated hemoglobin (HbA1C) level of patients during the last 3 months. Data were statistically analyzed by SPSS-19. *T*-test, analysis of variance, Spearman correlation coefficient, Tukey, and multiple linear regression were used. **Results:** The mean \pm standard deviation total score of treatment adherence was 61.43 ± 10.02 that 15.1% of patients had a mean adherence score, 79.5% had a good adherence score and 5.5% received a very good treatment adherence score. Various factors such as marital status ($P = 0.013$), employment status ($P = 0.003$), housing status ($P = 0.001$), other diseases ($P = 0.004$), drug side effects ($P = 0.001$), belief in the need for medication ($P = 0.001$), insurance ($P = 0.002$), number of children ($P = 0.003$), and monthly income ($P = 0.003$) affect the rate of adherence to treatment. **Conclusion:** The treatment adherence in patients with diabetes was desirable. The results of the research can be used to design interventions to increase compliance with treatment to better control HbA1C and diabetes and reduce treatment costs.

Keywords: Blood sugar, diabetes, treatment adherence

INTRODUCTION

Diabetes is a chronic disease characterized by decreased beta cell function, insufficient insulin secretion, and insulin resistance.^[1] The number of people with diabetes in the Middle East and North Africa region, where Iran is also located, will double from today to 2040.^[2] Diabetes is a cause of blindness, end-stage renal disease, lower limb amputation, coronary heart disease, and stroke^[3] diabetic foot.^[4]

According to the World Health Organization, treatment adherence is the amount of behavioral therapy performed by an

individual that includes medication, diet, or lifestyle changes that are in accordance with the recommendations provided by health-care personnel.^[5] Adherence to drug treatment is associated with improved outcomes such as reduced health-care costs, hospitalization, and reduced mortality.^[6]

Acharya *et al.*, stated that low treatment adherence was seen in 33% of outpatients and 79.5% of patients had poor glycemic

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control.^[7] However, Marinho *et al.* showed that 93.5% of patients with diabetes had good adherence to treatment.^[8] Gholamaliei *et al.* showed that people with higher education and good economic status, older age, married and male gender are more adherent to the drug regimen. Furthermore, glycosylated hemoglobin (HbA1C) is related with drug adherence.^[5] In contrast, in a study of Bdollahi *et al.*, it was stated that there was no significant relationship between demographic characteristics including gender, marital status, education, income level, employment and suffering from other diseases and HbA1C with adherence to the drug regimen.^[9]

As mentioned, there are conflicting results regarding the degree of treatment adherence and the various factors that can affect it. Furthermore, in most studies, data collection has been self-reported, which is less valid.^[5,7-9] Whereas in this study in addition to using a questionnaire, assessing the HbA1C levels is correcting this limitation. Also by sampling in all health centers of Aran and Bidgol we are trying to get generalizable results to the city. On the other hand, according to the information obtained from the diabetes center of Aran and Bidgol, the number of diabetic patients with cases in health centers in the city and surrounding villages is 4514, of which only 2389 patients have taken action to file and follow up the treatment in Aran and Bidgol cities. Maybe they did not go to medical centers due to lack of knowledge. Therefore, it was decided to conduct a study to determine the degree of adherence to treatment, blood sugar control, and related factors in patients with diabetes in Aran and Bidgol in 2020–2021.

MATERIALS AND METHODS

This research is a descriptive-analytical study. It was performed in patients with type 2 diabetes referred to Aran and Bidgol health clinics in 2020–2021. Based on the treatment adherence rate of 37% in diabetic patients in previous study^[4] with $\alpha = 0.05$ and $d = 0.05$ and 10% drop, the minimum acceptable sample was 385 people.

After obtaining the necessary license, a proportion of diabetic patients were selected from both existing centers based on covered population by simple random sampling through their electronic records. Inclusion criteria were willingness to participate in the study, at least 6 months history of diabetes, having a record in a clinic, not having any disease affecting the study such as psychiatric disorders, and a reliable HbA1c test (performed in the past 3 months). Questionnaires were completed by tracking and recruiting selected patients. In this way, during a phone call, the patient was asked to attend the health center to participate in the study. If the patient was unwilling or did not meet the entry criteria, another person was randomly selected. Exclusion criteria included patients who did not refer to complete the questionnaire after the call. If was so; another person was replaced randomly. If there was not reliable HbA1c in the patient file, the patient was invited to perform the test, otherwise other patients were randomly selected. There were not incomplete questionnaires.

The questionnaires were completed in a self-report manner and by researcher or questioner with a bachelor's degree during office hours in the desired centers. Patient satisfaction was obtained. In illiterate people, the questionnaire was completed by interview.

Data were collected by two-part questionnaire including demographic factors and the Madanloo questionnaire for treatment adherence in chronic diseases. Madanloo questionnaire has been designed and psychometrically assessed in 2013. This questionnaire has 40 questions in the dimensions of: treatment effort, participate in treatment, compatibility, combining treatment with life, treatment adherence, commitment to treatment, and treatment plan. To calculate the score of the questionnaire, we collect the scores of all related items. Minimum and maximum points in areas of interest in treatment 0–45, willingness to participate in treatment 0–35, ability to adapt 0–35, integration of treatment with life 0–25, treatment adherence 0–20, commitment to treatment 0–25, and caution in treatment is 0–15, which according to the instructions of the questionnaire designer, the initial scores are 0–100. According to this questionnaire, obtaining a score of 75%–100% means excellent, 50%–74% means good, 26%–49% means medium and 0%–25% means weak adherence to treatment.^[10] In Madanloo research, the average content validity index of the questionnaire was 0.91. The internal consistency of the questionnaire is calculated by alpha Cronbach's that was 0.921.^[10] The reliability of this tool was measured using the test-retest method with an interval of 2 weeks and its correlation coefficient was 0.875.

After collecting data and entering SPSS 16 (SPSS Inc., Chicago, IL, USA), they were reviewed and debugged. The Kolmogorov–Smirnov test was used to check the normality of the data. Descriptive analyzes were used to analyze the data. Descriptive tests, *t*-test, analysis of variance, Tukey, Pearson correlation coefficient, and multiple linear regression were used. Significance level in the present study was <0.05.

This research is approved by the ethics committee of Kashan University of Medical Sciences with the code of IR.KAUMS.NUHEPM.REC.1399.033.

RESULTS

Patients with diabetes scored the highest score in the area of combined treatment with life (82.40 ± 14.59) and the lowest score in the area of commitment to treatment (34.68 ± 16.91). The overall score of Treatment Adherence in patients with diabetes is 61.43 ± 10.02 , which according to the classification, the results indicate that 15.1% (58 people) of patients have a score of adherence to moderate treatment, 79.5% (306 people) got a good, 5.5% (21 people) got a very good treatment adherence score; and none of the patients scored poorly on adherence to treatment.

According to the obtained information, the highest frequency of participants is related to married people (78.4%), illiterate and

primary education (65.2%), employed (60.8%), has personal housing (86%), with type 2 diabetes (99%), people with a family history (72.2%), no diabetic foot ulcer (94.3%), having other diseases (83.9%), no side effects of drugs (77.7%), belief in the need to use drugs (96.1%), nonsmoking (81%), doctor's explanation about the use of drugs (84.2%), explanation of health personnel about the use of drugs (68.3%), lack of control over the use of drugs by the family (73.2%), with insurance (96.6%), with oral medication (72.5%), with 3–5 children (54.6%), and the income rate is low (50.4%).

Based on the findings, the degree of treatment adherence has a positive correlation with some characteristics of the participants [Table 1]. However, the variables of type of diabetes, family history of diabetes, having diabetic foot

ulcers, smoking, use the doctor's description, use of personnel descriptions, and family drug control has not significant correlation ($P > 0.05$).

The variables of age and HbA1C level have a negative and significant correlation with the degree of adherence to treatment; Thus, with decreasing age and decreasing HbA1C, we see an improvement in the treatment adherence score [Table 2].

According to the information obtained from the results of multiple linear regression, decrease in the amount of HbA1C ($P < 0.001$), having a number of children more than 4 ($P = 0.027$), increasing the level of education ($P = 0.025$) and using explanation health personnel regarding drugs ($P = 0.049$) have a significant effect on increasing the adherence to the treatment of patients with diabetes. As by increasing one standard deviation (SD) in HbA1C, the SD treatment score decreased by 0.67; with increasing a SD in the number of children more than 4, the SD rate of treatment decreased by 0.12 SD, with increasing one SD in education, the SD score of adherence to the treatment increased by 0.098 and by decreasing one SD in use of the explanation of the health personnel about the use of drugs, the score of adherence to the treatment is reduced by 0.069 SD [Table 3].

The results of Tukey's test showed that the average score of treatment adherence in patients with more than 4 children is lower compared to 0–2 children ($P = 0.003$); and 3–4 children ($P = 0.13$) significantly. Also, the results showed that the average score of treatment adherence in people with low income is lower significantly compared to people with medium income ($P \leq 0.001$) and good income ($P = 0.05$).

DISCUSSION

The results showed that the majority of participants in the study scored a good follow-up score. The results of the present study are in line with the results of some other studies that have reported that patients' treatment Adherence in Nigeria, UAE and Iran is desirable^[11-16] However, there are studies that have shown patients with diabetes have a poor score for treatment adherence.^[4,5,17,18] Among the reasons for the different finding is the use of volunteer samples^[19] That is, people were included in these studies who had regular visits to medical centers; Therefore, it can be argued that people with good treatment adherence have entered these studies and as a result have obtained a higher score of treatment adherence. Other reasons include differences in the study population (conducting studies on heart patients and Glaucoma)^[20,21] as well as use of different questionnaires.^[4,5,17,18,20]

The findings of the present study showed that there is a positive and significant relationship between education, having job and higher income, with treatment adherence. Other studies have shown that patients with higher education have more treatment Adherence^[6,13,16,22] Also some studies showed that having a higher level of income is effective in optimal

Table 1: Relationship between the studied qualitative variables and the degree of adherence to the treatment of patients with diabetes

Adherence to treatment variables	Mean ± SD	n (%)	P
Marital status			
Single	59.01±11.02	83 (21.6)	0.013*
Married	62.09±9.64	302 (78.4)	
Education			
Illiterate and rudimentary	60.12±9.70	251 (65.2)	0.001*
High school and above	63.88±10.18	134 (34.8)	
Employment status			
Unemployed	60.22±10.17	234 (60.8)	0.003*
Employed	63.30±9.51	151 (39.2)	
Housing			
Personal	62.13±9.69	334 (86.8)	0.001*
Rent	56.83±10.96	51 (13.2)	
Getting another disease			
Yes	60.79±9.87	323 (83.90)	0.004*
No	64.77±10.18	62 (16.10)	
Creating drug side effects			
Yes	57.04±10.13	86 (22.30)	0.001*
No	62.69±9.64	299 (77.70)	
Belief in the need to take medicine			
Yes	62.05±9.60	370 (96.10)	0.001*
No	46.04±7.63	15 (3.90)	
Insurance			
Yes	63.16±9.67	372 (96.60)	0.002*
No	58.10±9.87	13 (3.40)	
Treatment regimen			
Injection	58.44±10.65	106 (27.50)	0.001*
Oral	62.56±9.55	279 (72.50)	
Number of children			
0-2	63.32±11.12	84 (21.80)	0.003**
3-5	61.97±9.55	210 (54.60)	
>5	58.44±9.46	91 (23.60)	
Income			
Low	59.83±9.56	194 (50.40)	0.003**
Medium	62.81±10.10	177 (46.00)	
Good	66.11±11.74	14 (3.60)	

*t-test, **ANOVA. SD: Standard deviation, ANOVA: Analysis of variance

Table 2: Relationship between the studied quantitative variables and the degree of adherence to the treatment of patients with diabetes

Variable	Minimum	Maximum	Mean±SD	r*	P*
Age	15	92	60.04±10.75	-0.185	<0.001
HbA1C	4.9	14	8.24±1.87	-0.724	<0.001
Duration of infection	0.4	46	9.45±6.82	-0.037	0.475
Duration of treatment	0.4	46	9.46±6.81	-0.033	0.520

*Univariate analysis (Pearson correlation coefficient), SD: Standard deviation, HbA1C: Glycosylated hemoglobin

Table 3: Factors associated with treatment compliance in patients with diabetes, using multiple linear regression analysis

Variable	B	SE	Beta coefficient	t	P
Constant	92.36	5.97	-	15.45	>0.001
Age	-0.066	0.048	-0.071	-1.368	0.172
HbA1C	-3.606	0.208	-0.674	-17.35	>0.001
Number of children <4 (compared to 0-2)	-2.830	1.278	-0.120	-2.215	0.027
Number of children 3-4 (compared to 0-2)	-1.494	0.977	-0.074	-1.529	0.127
Marital status (being married)	0.478	0.952	0.020	0.502	0.616
Education (high school and above)	2.060	0.918	0.098	2.244	0.025
Employment	0.389	0.725	0.019	0.536	0.592
Low income (compared to good income)	-0.668	0.932	-0.033	-0.717	0.474
Average income (compared to good income)	-0.474	2.039	-0.009	-0.232	0.816
Housing (no)	-1.443	1.075	-0.049	-1.342	0.180
Insurance (have)	1.416	0.801	0.067	1.769	0.078
Family history of diabetes (no)	0.243	0.502	0.016	0.485	0.628
Suffering from other diseases (none)	0.565	0.989	0.021	0.571	0.568
Belief in the necessity of taking medicine (doesn't)	-2.533	1.896	-0.049	-1.336	0.182
Occurrence of drug side effects (has)	1.581	1.068	0.066	1.480	0.140
Explanation of health personnel about medicines (no)	-1.484	0.752	-0.069	-1.973	0.049
Control of drug use by the family (no)	-0.011	0.879	-0.001	-0.013	0.990
Diet therapy (food)	0.209	0.997	0.009	0.210	0.834

Adjusted R²: 0.581, R²: 0.601, r: 0/775. SE: Standard error, HbA1C: Glycosylated hemoglobin

treatment adherence.^[6,23] But there are studies that found no link between education level and treatment adherence.^[23,24] Also some studies showed that there is no significant relationship between job and treatment adherence score.^[25] It seems that people with higher income levels, in addition to public sector services, can use private sector services, more expensive drugs and services at home.

According to the results, marital status, housing and insurance have a positive and significant relationship with the degree of treatment adherence. It was previously showed that with older age, the rate of treatment Adherence decreases.^[26,27] However, in another study, with increasing age, treatment adherence has also increased.^[4] One of the reasons for poor treatment adherence in the elderly is their cognitive impairment, which increases the possibility of incorrect use of the drug.^[27] Differences in the results of these studies can be due to differences in the type of studied patients and also the different locations, which leads to differences in demographic characteristics between participants.

In the present study, belief in drug use has a positive and significant relationship with the degree of treatment adherence. The results of other studies showed that there is a significant

relationship between drug-related concerns and drug adherence in patients with type 2 diabetes.^[5,18]

This study showed, there is no significant relationship between gender and treatment adherence. Also Some studies have reported that there is no significant relationship between gender and treatment adherence.^[20,28] In contrast, another study found that men with diabetes had better drug adherence.^[29] The reasons for this difference are factors such as cultural differences between men and women in different places.

According to the results of present study, the amount of HbA1C has a significant negative correlation with the rate of treatment adherence. Similarly, another study showed that patients with higher HbA1C had less adverse treatment adherence.^[9,30] In contrast, another study concluded that there was no significant correlation between HbA1C level and treatment adherence.^[17] The use of different tools to measure the degree of treatment Adherence in the studies can lead to different results of treatment Adherence and estimation of correlation between HbA1C and treatment adherence.

The strengths of the study include a relatively high number of samples, sampling in all diabetes centers in the city based on the population covered in each health center, taking

into account the level of HbA1C in addition to using a questionnaire. Weaknesses of the study include the small number of people studied with type 1 diabetes compared to people with type 2 and sampling only on patients with records in diabetes health centers.

The limitations of the study include the lack of measurement of HbA1c levels during the last 3 months, the lack of cooperation of patients in completing the questionnaire, the prevalence of corona disease at the time of sampling, which led to the noncooperation of a large number of people.

CONCLUSION

In the present study, the rate of treatment adherence in patients with diabetes in Aran and Bidgol is desirable; treatment Adherence in these patients is influenced by various factors, including reducing the level of HbA1C, having the number of children <4, increasing the level of education and using the explanations of the health personnel about the use of drugs. Each of which, directly or indirectly play their role. Therefore, it is recommended to help patients adhere to their treatment regimen as much as possible in terms of related factors and by using strategies to improve patients' self-efficacy.

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Conflicts of interest

There are no conflicts of interest.

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