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KNOWLEDGE, ATTITUDE, AND PRACTICE TOWARDS THE IMPACT OF GLYCEMIC CONTROL AND ITS ASSOCIATED FACTORS AMONG TYPE TWO DIABETES MELLITUS PATIENTS ATTENDING AL-RUSAFASPECIALIZED CENTER OF ENDOCRINE DISEASES AND DIABETES IN BAGHDAD

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ABSTRACT

Background: Diabetes mellitus is a chronic disease that require continuous medical care with multiple strategies to reduce the risks of long term complications. Better glycemic management of diabetes requires not only the prescription of an appropriate nutritional and pharmacological regime by the physician but also intensive education of the patient. So good knowledge, attitude, and practices of glycemic control are necessary in the management of diabetes mellitus. **Objectives:** To investigate knowledge, attitude and practice towards glycemic control and its associated factors among Diabetes patients. **Patients and methods:** A cross sectional study included 400 participants was conducted from 1st February 2022 till 30th June 2022 at the specialized center of endocrine disease and Diabetes/AlRusafa. Data was collected by structured questionnaire Which contained different items like socio-demographic and knowledge, attitude, and practice towards glycemic control. The data analyzed using Statistical Package for Social Sciences (SPSS) version 25**. Results**: The overall knowledge score of the participants towards glycemic controls of diabetes was as follow: 52 (13%) had good knowledge, 248 (62%) had fair knowledge, and the remaining100 (25%) were with poor knowledge. Regarding the overall attitude score, 112 participants (28%) had positive attitudes, and 288 (72%) had negative attitudes towards glycemic controls of diabetes. The overall practice score towards glycemic controls revealed that 78 (19.5%) were with good practices and the remaining 322 (80.5%) were with poor practices. Good knowledge was significantly higher among female gender, highly educated participants, employed participants, participants who live in urban areas, those who had a positive family history of diabetes mellitus, those who attended educational programs or lectures regarding diabetes mellitus, and those who had normal levels of fasting and postprandial blood glucose. Positive attitude was significantly higher among highly educated patients, employed patients and patients with positive family history of diabetes mellitus, the participants who attended educational programs or lectures regarding diabetes mellitus and among the participants who had high fasting glucose level and high HBA1C level. Good practices towards glycemic controls was significantly higher in highly educated participants and employed participants, the participants who attended educational programs or lectures regarding diabetes mellitus and among those who had normal levels of fasting and postprandial glucose. **Conclusions:** About two third of participants had fair knowledge, more than two third of participants had negative attitude and majority of the participants had poor practice towards glycemic control of DM. Education and counseling about all the aspects of DM are needed toincrease patient involvement and self-reliance in the glycemic control of DM.

INTRODUCTION

Diabetes mellitus is a chronic disease that require continuous medical care with multiple strategies to reduce the risks of long term complications.[1] Beyond glycemic control, Diabetes is one of the largest global public health concerns, imposing a heavy global burden on public health and socio-economic development. The prevalence of diabetes has increased in recent decades in most developed and developing countries. Type 2 diabetes is the most common type of diabetes, accounting for over 90% of all diabetes cases worldwide, the exact time of the onset of Type 2 diabetes is usually difficult to determine, as there is often a long pre-diabetic period and as many as one-third to one-half of

people with Type 2 diabetes in the population may be undiagnosed.[2] Ongoing diabetes self-management education and support are important to prevent the acute complications and to reduce the risk of long term complications. Significant evidence exists that supports a range of interventions to improve diabetes outcomes.[1] For people with diagnosed diabetes, delivery of essential medications, management of hyperglycemia and cardio-metabolic risk factors, and early screening for complications via well-organized care reduces acute and chronic complications and extends life expectancy. Furthermore, Type 2 diabetes can be prevented through intensive lifestyle interventions directed at high-risk individuals or through population wide changes to diet, physical activity levels, and levels of obesity.[3]

Many studies have shown that good glycemic control in diabetic patients can prevent or reduce the risks of diabetic complications.[4]

Better glycemic management of diabetes requires not only the prescription of an appropriate nutritional and pharmacological regime by the physician but also intensive education of the patient.[4]

The management of Diabetes mellitus largely depends on the patient's ability to do self-care in their daily lives, and therefore, patient education is always considered an essential element of diabetes management. Studies have shown that patients, who are knowledgeable about the diabetes self-care, have better long-term glycemic control. Knowledge about glycemic control can help the people to understand the risk of diabetes and motivate them to seek proper treatment and care and to keep the disease under control.[4]

PATIENTS AND METHODS

A Cross sectional study with analytic elements. The study was conducted in a sample of patients who was attending Al-Rusafa specialized center of endocrinology and diabetes in Baghdad. The study carried out during period from 1st February 2022 till 30th June 2022. A convenient sample of 400 patients who were attending Al-Rusafa specialized center of endocrinology and diabetes during the 5 months period of collecting the data in a rate of 2 visits per week.

Data collection method

Data was collected by specially designed written structured questionnaire by the researcher and modified by supervisors and specialized community medicine doctor and translated to the Arabic language by researcher. The researcher collected the data from patients through direct interview.

Pilot study

A pilot study was conducted in outpatients clinic at Baghdad teaching hospital with 21 patients to test the content validity of the questionnaire, this group was excluded from the study.

Ethical considerations and official approvals

An official agreement document was obtained, all participants has been informed about the aim of the study and those who were willing to participate in the study recruited, a verbal consent was also taken from all them, privacy was taken into consideration.

Statistical analysis

The data analyzed using Statistical Package for Social Sciences (SPSS) version 25. For continuous data the data expressed as mean, standard deviation and ranges. Categorical data presented by frequencies and percentages. Chi square test was used to assess the association between knowledge, attitude and practice scores of the glycemic control with certain information, while fisher exact test was used instead when the expected frequency was less than 5. A level of P – value less than 0.05 was considered significant.

Scoring system

Scoring for Knowledge, Attitude and Practice items, a correct response was scored (1) and the incorrect (zero). For each area, the scores of the items were summed-up and the total divided bythe number of the items, giving a mean score for the part. These scores were converted into a percent score. The Knowledge was considered poor if the percent score was less than 50 %, fair knowledge if the percent score was 51% to 75% and good knowledge if the percent score was more than 75%. Attitude and Practice were considered satisfactory if the percent score was 50% or more and unsatisfactory if less than 50%.

RESULTS

A total of 400 diabetic patients were recruited in this study Participants' age ranged from 19 to81 years with a mean of 52.41 and standard deviation (SD) of ± 12.17 years, and the highest proportion of study participants 130 (32.5%) aged ≥ 60 years.

Table 1: Distribution of the participants' responses to knowledge items.

Responses			
Knowledge Questions	**Yes no. (%)**	**No no. (%)**	**Don't know. no. (%)**
1. Diabetes is a chronic condition in which the body contains high levels of sugars in the blood	298 (74.5)	14 (3.5)	88 (22.0)
2. Causes of DM are lack of insulin production from the pancreas or increase resistance of the body towards insulin.	254 (63.5)	10 (2.5)	136 (34.0)
3. Obesity and lack of physical activity are risk factors for DM.	280 (70.0)	8 (2.0)	112 (28.0)
4. Increased thirst and frequent urination are symptoms of DM.	390 (97.5)	2 (0.5)	8 (2.0)
5. Diabetes if not treated it will lead to serious complications.	364 (91.0)	10 (2.5)	26 (6.5)
6. Tremor, pallor and headache are symptoms of hypoglycemia.	312 (78.0)	18 (4.5)	70 (17.5)
7. Urine testing and blood testing are both equally as good as for testing the level of blood glucose.	252 (63.0)	38 (9.5)	110 (27.5)
8. In case of good glycemic control there is no need for physical activity.	162 (40.5)	172 (43.0)	66 (16.5)
9. Extra salt intake in food can worsen glycemic control	196 (49.0)	98 (24.5)	106 (26.5)
10. Eating a lot amount of rice and white bread and potato can worsen glycemic control.	356 (89.0)	22 (5.5)	22 (5.5)
11. Upon control of diabetes the medications can be stopped.	222 (55.5)	110 (27.5)	68 (17.0)
12. Attending your diabetes appointments will stop you getting diabetes complications.	370 (92.5)	12 (3.0)	18

Correct answer

Table 1 showed that the highest proportion 390 (97.5%) of the participants agreed with Q4.

Table 2: Distribution of the participants' responses to attitude items.

Attitude Questions		**Responses**			
	S. Agree no. (%)	**Agree no. (%)**	**Not Sure no. (%)**	**Disagree no. (%)**	**S. Disagree no. (%)**
1. Do you think glycemic control is necessary for DM?	158 (39.5)	162 (40.5)	76 (19.0)	2 (0.5)	2 (0.5)
2. Do you think regular physical activity leads to good glycemic control?	204 (51.0)	140 (35.0)	48 (12.0)	8 (2.0)	0 (0)
3. Do you think smoking can increase the complications of DM?	124 (31.0)	148 (37.0)	104 (26.0)	14 (3.5)	10 (2.5)
4. Do you think blood pressure control is necessary for glycemic control?	98 (24.5)	156 (39.0)	122 (30.5)	24 (6.0)	0 (0)
5. Do you think herbal treatments are good for glycemic control?	42 (10.5)	100 (25.0)	142 (35.5)	92 (23.0)	24 (6.0)
6. Do you think diet alone glycemic control is better than medications with diet glycemic control?	138 (34.5)	152 (38.0)	50 (12.5)	58 (14.5)	2 (0.5)
7. Do you believe fruits and vegetables are good for glycemic control	128 (32.0)	202 (50.5)	36 (9.0)	28 (7.0)	6 (1.5)
8. Do you think insulin drug has harmful effects to the organs of the body?	118 (29.5)	102 (25.5)	102 (25.5)	68 (17.0)	10 (2.5)

Correct answer

Table 2 the participants' responses to attitude questions revealed that 204 (51%) strongly agreed when they were asked Q2.

Table 3: Distribution of the participants responses to practice items.

Practice Questions		**Responses**			
	Never no. (%)	**Rarely no. (%)**	**Half Time no. (%)**	**Most Time no. (%)**	**Every Time no. (%)**
1. I take foods containing dietary fiber like grain, vegetable and fruit every day	32 (8.0)	78 (19.5)	102 (25.5)	122 (30.5)	66 (16.5)
2. I Do regular physical activities e.g. brisk walking for 30 min. 5 days/week.	86 (21.5)	86 (21.5)	58 (14.5)	86 (21.5)	84 (21.0)
3. I Take diabetic medication (insulin, tablets) as prescribed.	8	10	20	64	298

	(2.0)	(2.5)	(5.0)	(16.0)	(74.5)
4. I do a self-blood sugar test according to recommendations of doctors	24 (6.0)	58 (14.5)	64 (16.0)	128 (32.0)	126 (31.5)
5. I eat a lot of sweets or other foods rich in carbohydrates because I`m on diabetic medication	110 (27.5)	96 (24.0)	112 (28.0)	46 (11.5)	36 (9.0)
6. I add extra salt to my daily foods.	170 (42.5)	106 (26.5)	38 (9.5)	38 (9.5)	48 (12.0)
7. I strictly follow the dietary recommendations given by my doctor to maintain good body weight and glycemic control.	34 (8.5)	56 (14.0)	110 (27.5)	88 (22.0)	112 (28.0)
8. I drink herbal tea when my blood sugar is high.	190 (47.5)	74 (18.5)	28 (7.0)	50 (12.5)	58 (14.5)
9. I am carrying food like sweet drink, candy or chocolate just in case of hypoglycemia.	196 (49.0)	42 (10.5)	22 (5.5)	44 (11.0)	96 (24.0)

Correct answer

Table 3: 298 (74.5%) of the study participant reported that they always take diabetic medication (insulin, tablets) as prescribed.

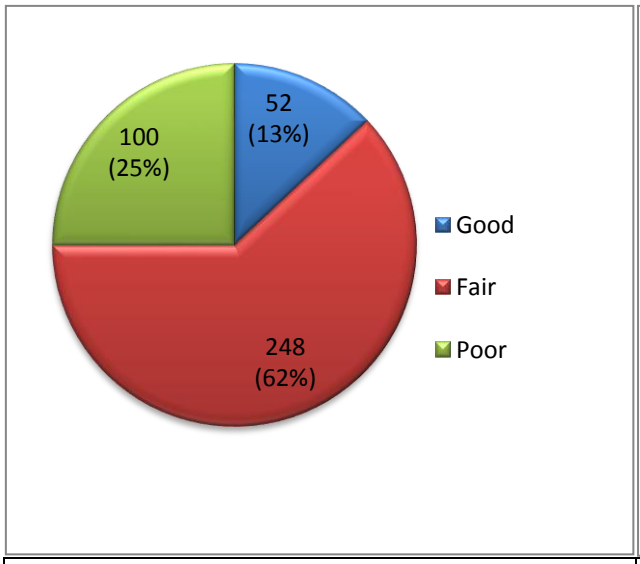

Figure 1: Overall knowledge score towards glycemic controls of diabetes.

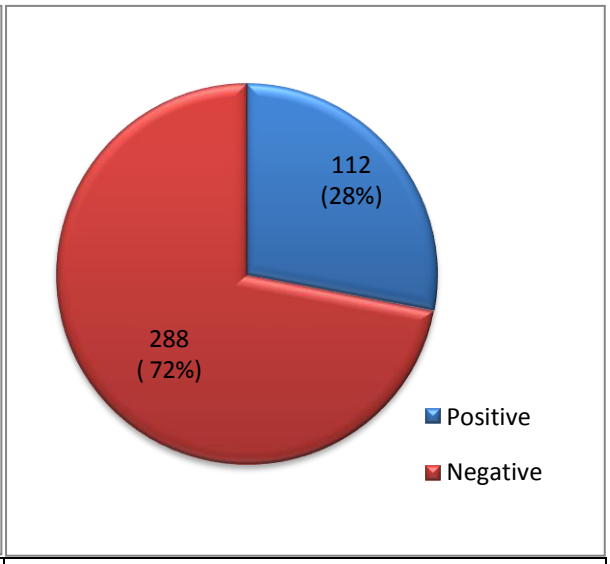

Figure 2: Overall Attitude score towards glycemic controls of diabetes.

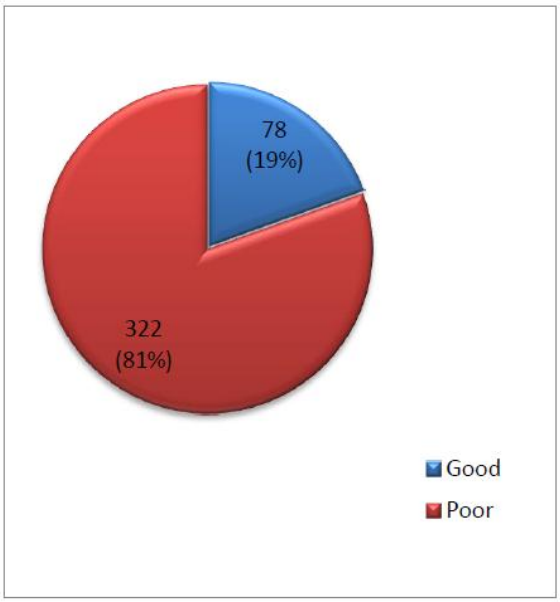

Figure 3: Overall practice towards glycemic controls of diabetes.

Table 4: Distribution of the participants by KAP score and baseline characteristics.

Participants' characteristics	Knowledge Score			P-Value	Attitude Score		P-Value	Practice Score		P-Value
	Poor (%) n= 100	Fair (%) n= 248	Good (%) n= 52		Positive (%) n= 112	Negative (%) n= 288		Good (%) n= 78	Poor (%) n= 322	
Age (Years)										
< 40	10 (15.2)	48 (72.7)	8 (12.1)	0.211	22 (33.3)	44 (66.7)	0.759	16 (24.2)	50 (75.8)	0.723
40 - 49	20 (22.2)	56 (62.2)	14 (15.6)		24 (26.7)	66 (73.3)		18 (20.0)	72 (80.0)	
50 - 59	28 (24.6)	72 (63.2)	14 (12.3)		30 (26.3)	84 (73.7)		20 (17.5)	94 (82.5)	
≥ 60	42 (32.3)	72 (55.4)	16 (12.3)		36 (27.7)	94 (72.3)		24 (18.5)	106 (81.5)	
Gender										
Male	52 (26.5)	132 (67.3)	12 (6.2)	0.003	50 (25.5)	146 (74.5)	0.277	40 (20.4)	156 (79.6)	0.653
Female	48 (23.5)	116 (56.9)	40 (19.6)		62 (30.4)	142 (69.6)		38 (18.6)	166 (81.4)	
Educational Level										
Illiterate	36 (58.0)	20 (32.3)	6 (9.7)	0.001	8 (12.9)	54 (87.1)	0.016	6 (9.7)	56 (90.3)	0.003
Primary School	28 (24.6)	74 (64.9)	12 (10.5)		28 (24.6)	86 (75.4)		18 (15.8)	96 (84.2)	
Secondary School	28 (19.2)	100 (68.5)	18 (12.3)		47 (32.2)	99 (67.8)		26 (17.8)	120 (82.2)	
University or Higher	8 (10.3)	54 (69.2)	16 (20.5)		29 (37.2)	49 (62.8)		28 (35.9)	50 (64.1)	
Occupation										
Employed	8 (15.1)	29 (54.7)	16 (30.2)	0.013	24 (45.3)	29 (54.7)	0.031	16 (30.2)	37 (69.8)	0.025
Unemployed	62 (27.4)	143 (63.3)	21 (9.3)		53 (23.5)	173 (76.5)		44 (19.5)	182 (80.5)	
Retired	19 (24.1)	54 (68.4)	6 (7.6)		22 (27.8)	57 (72.2)		10 (12.7)	69 (87.3)	
Disabled	6 (21.4)	17 (60.7)	5 (17.9)		8 (28.6)	20 (71.4)		8 (28.6)	20 (71.4)	
Others	5 (35.7)	5 (35.7)	4 (28.6)		5 (35.7)	9 (64.3)		0 (0)	14 (100.0)	
Marital Status										
Single	4 (25.0)	8 (50.0)	4 (25.0)	0.062	6 (37.5)	10 (62.5)	0.359	5 (31.3)	11 (68.8)	0.239
Married	74 (23.3)	204 (64.2)	40 (12.6)		84 (26.4)	234 (73.6)		57 (17.9)	261 (82.1)	
Widowed/ Divorced	22 (33.3)	36 (54.5)	8 (12.1)		22 (33.3)	44 (66.7)		16 (24.2)	50 (75.8)	
Residence										
Urban	76 (21.2)	234 (65.4)	48 (13.4)	0.011	102 (28.5)	256 (71.5)	0.523	68 (19)	290 (81)	0.456
Rural	24 (57.1)	14 (33.3)	4 (9.5)		10 (23.8)	32 (76.2)		10 (23.8)	32 (76.2)	
Smoking										
Smoker	20 (34.5)	32 (55.2)	6 (10.3)		10 (17.2)	48 (82.8)		10 (17.2)	48 (82.8)	
Non smoker	70 (22.9)	194 (63.4)	42 (13.7)		88 (28.8)	218 (71.2)		60 (19.6)	246 (80.4)	
Ex-smoker	10 (27.8)	22 (61.1)	4 (11.1)	0.430	14 (38.9)	22 (61.1)	0.063	8 (22.2)	28 (77.8)	0.835
Alcohol Drinking										
Drinker	6 (37.5)	6 (37.5)	4 (25.0)	0.104	7 (43.8)	9 (56.3)	0.163	6 (37.5)	10 (62.5)	0.063
Non drinker	94 (24.5)	242 (63)	48 (12.5)		105 (27.3)	279 (72.7)		72 (18.8)	312 (81.3)	
Past Medical History										
Yes	52 (26.5)	116 (59.2)	28 (14.3)	0.511	52 (26.5)	144 (73.5)	0.521	38 (19.4)	158 (80.6)	0.956
No	48 (23.5)	132 (64.7)	24 (11.8)		60 (29.4)	144 (70.6)		40 (19.6)	164 (80.4)	
Family History										
Yes	59 (22.7)	158 (60.8)	43 (16.5)	0.014	84 (32.3)	176 (67.7)	0.009	54 (20.8)	206 (79.2)	0.383
No	41 (29.3)	90 (64.3)	9 (6.4)		28 (20.0)	112 (80.0)		24 (17.1)	116 (82.9)	
BMI										
Underweight	2 (33.3)	4 (66.7)	0 (0)	0.570	0 (0)	6 (100.0)	0.301	0 (0)	6 (100.0)	0.342
Normal Weight	16 (18.2)	62 (70.5)	10 (11.4)		24 (27.3)	64 (72.7)		20 (22.7)	68 (77.3)	
Overweight	36 (26.1)	82 (59.4)	20 (14.5)		44 (31.9)	94 (68.1)		30 (21.7)	108 (78.3)	
Obese	46 (27.4)	100 (59.5)	22 (13.1)		44 (26.2)	124 (73.8)		28 (16.7)	140 (83.3)	

Table 4: knowledge score was significant in highly educated participants (20.5%, P= 0.001), employed participants (30.2%, P= 0.013), participants who live in urban areas (13.4%, P= 0.011) and those who had a positive family history of diabetes mellitus (16.5%, P= 0.014), attitude score was significantly higher among highly educated patients (37.2%, P= 0.016), employed patients (45.3%, P= 0.031) and patients with positive family history of diabetes mellitus (32.3%, P= 0.009) and practice score was significantly higher in highly educated participants (35.9%, P=0.003) and employed participants (30.2%, P= 0.025).

Table 5: Distribution of the participants by KAP score and certain clinical characteristics.

Clinical characteristics	Knowledge Score			P- Value	Attitude Score		P- Value	Practice Score		P- Value
	Poor (%) n= 100	Fair (%) n= 248	Good (%) n= 52		Positive (%) n= 112	Negative (%) n= 288		Good (%) n= 78	Poor (%) n= 322	
Attending Educational Program or Lecture Regarding DM										
Yes	14 (17.1)	50 (61.0)	18 (22.0)	0.012	32 (39.0)	50 (61.0)	0.024	25 (30.5)	57 (69.5)	0.004
No	86 (27.0)	198 (62.3)	34 (10.7)		80 (25.2)	238 (74.8)		53 (16.7)	265 (83.3)	
History of Hypoglycemic Attack										
Yes	36 (22.8)	100 (63.3)	22 (13.9)	0.686	48 (30.4)	110 (69.6)	0.392	26 (16.5)	132 (83.5)	0.214
No	64 (26.4)	148 (61.2)	30 (12.4)		64 (26.4)	178 (73.6)		52 (21.5)	190 (78.5)	
Fasting Plasma Glucose Level										
Normal	11 (18.0)	31 (50.8)	19 (31.1)	0.002	25 (41.0)	36 (59.0)	0.043	23 (37.7)	38 (62.3)	0.002
Abnormal	60 (26.5)	146 (64.6)	20 (8.8)		60 (26.5)	166 (73.5)		35 (15.5)	191 (84.5)	
Don't Remember	29 (25.7)	71 (62.8)	13 (11.5)		27 (23.9)	86 (76.1)		20 (17.7)	93 (82.3)	
Postprandial Plasma Glucose Level										
Normal	16 (15.4)	70 (67.3)	18 (17.3)	0.039	28 (26.9)	76 (73.1)	0.459	30 (28.8)	74 (71.2)	0.009
Abnormal	50 (28.7)	100 (57.5)	24 (13.8)		54 (31.0)	120 (69.0)		24 (13.8)	150 (86.2)	
Don't Remember	34 (27.9)	78 (63.9)	10 (8.2)		30 (24.6)	92 (75.4)		24 (19.7)	98 (80.3)	
HBA1C Level										
<7	14 (24.1)	34 (58.6)	10 (17.2)	0.401	25 (43.1)	33 (56.9)	0.005	14 (24.1)	44 (75.9)	0.212
>7	48 (22.2)	144 (66.7)	24 (11.1)		63 (29.2)	153 (70.8)		46 (21.3)	170 (78.7)	
Don't Remember	14 (25.9)	32 (59.3)	8 (14.8)		8 (14.8)	46 (85.2)		10 (18.5)	44 (81.5)	
Not Done	24 (33.3)	38 (52.8)	10 (13.9)		16 (22.2)	56 (77.8)		8 (11.1)	64 (88.9)	
Duration of Disease (Years)										
< 5	22 (23.4)	64 (68.1)	8 (8.5)	0.249	24 (25.5)	70 (74.5)	0.495	16 (17)	78 (83)	0.149
5 – 10	38 (28.8)	79 (59.8)	15 (11.4)		34 (25.8)	98 (74.2)		33 (25.0)	99 (75.0)	
> 10	40 (23.0)	105 (60.3)	29 (16.7)		54 (31)	120 (69)		29 (16.7)	145 (83.3)	
Treatment										
Oral Drugs	22 (23.4)	64 (68.1)	8 (8.5)	0.107	56 (27.6)	147 (72.4)	0.779	42 (20.7)	161 (79.3)	0.806
Oral Drugs & Insulin	38 (28.8)	79 (59.8)	15 (11.4)		26 (25.5)	76 (74.5)		20 (19.6)	82 (80.4)	
Insulin	40 (23.0)	105 (60.3)	29 (16.7)		27 (31.0)	60 (69.0)		14 (16.1)	73 (83.9)	
Diet	22 (23.4)	64 (68.1)	8 (8.5)		3 (37.5)	5 (62.5)		2 (25.0)	6 (75.0)	
DM Complications										
Yes	72 (25.5)	180 (63.8)	30 (10.6)	0.094	74 (26.2)	208 (73.8)	0.226	48 (17.0)	234 (83.0)	0.073
No	28 (23.7)	68 (57.6)	22 (18.6)		38 (32.2)	80 (67.8)		30 (25.4)	88 (74.6)	

Table 5:Showed that the participants who attended educational programs or lectures regarding diabetes mellitus, and those who had normal levels of fasting and postprandial blood glucose were with significantly good knowledge towards glycemic controls of diabetes (22%, P= 0.012; 31.1%, = 0.002; and 17.3%, P= 0.039, respectively), Positive attitude was significantly higher among highly educated patients (37.2%, P= 0.016), employed patients (45.3%, P= 0.031) and patients with positive family history of diabetes mellitus (32.3%, P= 0.009). good practices towards glycemic controls were significantly higher among the participants who attended educational programs or lectures regarding diabetes mellitus (30.5%, P= 0.004) and among those who had normal levels of fasting and postprandial glucose (37.7%, P= 0.002 and 28.8%, P= 0.009, respectively).

DISCUSSION

According to ADA patients education, self-care behaviors and clinical treatment are critical to prevent chronic problems associated with this public health issue and managing it effectively[1], in this study, diabetic patients were asked questions related to their knowledge, attitude and practice towards glycemic control and its associated factors.

- **Knowledge**

Out of 400 participants, (74.5%) of them were correctly knowing the meaning of DM and (70%) were knowing the risk factors of DM, which is better than the 2019 study done by Amelash D, et al.[4] in Ethiopia in which(62.3%) knew the meaning of DM and (59.8%) can identify the risk factors of DM. Majority of the participants (97%) correctly identified DM symptoms such as increased thirst and frequent urination which higher than studies done by Ng SH, et al.[5] in Malaysia (90%), Mansy W, et al.[6] in Saudi Arabia (70.9%) and Upadhyay DK[7] in Nepal which only (37%) of participants could correctly identify diabetic symptoms. In this finding(63.5%) of participants know the cause of DM; this finding was a little higher than Amelash D, et al.[4] (58.3%)and lower than a Islam FMA, et al.[8] 2014 study in rural Bangladesh (93%). Most of the participant (92.5%) agreed that attending their diabetes

appointments will stop them getting diabetes complications and diabetes if not treated it will lead to serious complications (91%), this higher than N. Asharani, B. Anagha[9] 2021 study in South India (89%) and (77%) respectively. The 2019 study in Iraq by Mikhael EM, et al.[10] at national diabetes center also showed most of the participants were able to define diabetes correctly and major symptoms of hyperglycemia, The patients general awareness of diabetes symptoms and complications was relatively high, perhaps because they had experienced these symptoms themselves or observed them in fellow patients which is comparable with the findings obtained. Out of participants, only (13%) had good knowledge. This finding was similar to 2016 study which was done by Al-Aboudi IS, Hassali MA and Shafie AA[11] in Riyadh, Saudi Arabia (13.3%)and lower when compared to a Khaznadar AA, Al-Banna HI and Saeed NHR[12] 2015 study in Sulaimania (54.8%), Mansy W, et al.[6] 2022 study in Saudi Arabia(37.6%), Al-Maskari F, El-Sadig M and Alkaabi JM[13] 2013 study in united Arab Emirates 2013 (33%), Islam, et al[14] 2015 study in Bangladesh (45,6%), Amelash D, et al.[4] (62%), Waris, et al.[15] 2021 study in Pakistan (85.5%). This might be due to the difference in sample size, place of the study, health education, and cultural differences.

About two third of participants had fair knowledge about their glycemic control, this result higher than study in a Khaznadar AA, Al-Banna HI and Saeed NHR[12] study (34.4%), Al- Maskari F, El-Sadig M and Alkaabi JM[13] study (36%), Islam, et al[14] study (37.7%), and lowerthan a Mansy W, et al.[6] (72%), this result might be due to that (65%) of the participants their educational level was primary and secondary school and less than half of them had history of DM for more than ten years. In this study Good knowledge was significantly higher among female gender. This result was same in studies in Alaofe H, et al[16] 2021 study in southern Benin, Rahman KS, et al[17] 2017 study in Dhaka and in contrast to Islam, et al[14] study, Al- Maskari F, El-Sadig M and Alkaabi JM[13] study, Waris, et al[15] study, in which males have better knowledge than female. Highly educated participants and those who had a positive family history of diabetes mellitus were also associated with high knowledge score. This result consistent with studies by Islam, et al[14], Al-Adsani AMS, et al in Kuwait.[18] Also employed participants and who attended educational programs or lectures regarding diabetes mellitus have significant association with knowledge in this study which is consistent with Khaznadar AA, Al-Banna HI and Saeed NHR study[12] which was also has higher knowledge score with employed participants, higher educational level, and positive family history and in those who attended educational programs regarded DM. Participants who live in urban areas, also have association in this study. Sabri AA, et al[19] 2007 study in Pakistan showed that that urban diabetic patients are more aware than rural diabetic patients about diabetes mellitus, this in contrast with other studies by Khaznadar AA, Al-Banna HI and Saeed NHR study[12], Al-Adsani AMS, et al 2009 study in Kuwait[18], Waris, et al study[15] and Amelash D, et al. study (62%)[4] where there is no association, this may be because in our study most of our patient were living in urban (89.5%) and living in city make medical centers easy accessible regarding both near distance and availability. The participants who had normal levels of fasting and postprandial blood glucose had good knowledge score this inconsistent with N. Asharani, B. Anagha study[9] which it's result show no associations, this may because their normal fasting and postprandial glucose levels may be due to their good knowledge about diabetes.

- **Attitude**

The healthy diet, regular exercise and medication adherence are considered as crucial measures to regulate blood glucose level[6], in our study the participants believe that healthy diet (82.5%) and regular physical activity(86%) are good for glycemic control, while their believe about the necessity of medication for controlling glucose level with diet rather diet alone were only (15%). Amelash D, et al. study[4] showed (46.9%) of participants believed that healthy diet is important for DM control, (86.4%) of them believed that regular physical activity is important too and (35.7%) of them believed that medication with diet is better than diet alone. Results of the participants' responses to attitude questions revealed that about half of participants (55%) believed that insulin drug has harmful effects to the organs of the body this result was higher than Gawand KS[20] 2016 study in India who only (28.57%) of participants thought insulin can cause harm, This might be due to misconceptions about this important and effective diabetes treatment and also due to lack of education and encouragement from the medical staffs to the patients to make informed decisions as active participants in their diabetes treatment plan.[21] In this study only (28%) of the participants had positive attitudes towards glycemic control, This finding was lower than studies done by Sharaf SE, et al[22] in Saudi Arabia(65%), Amelash D, etal.[4] (67.2%), N. Asharani, B. Anagha.[9] (88%). Positive attitude in the current study was significantly higher among highly educated patients, employed patients and patients with positive family history of diabetes mellitus, Sunny A, et al[23] 2021 study in India found that positive attitude was significantly higher among highly educated patients, employed patients but not with positive family history of DM, The explanation may be that the presence of other family member with DM was a source of health information.[24] Positive attitude towards glycemic controls was significantly higher among the participants who attended educational programs or lectures regarding diabetes mellitus and among the participants who had high fasting glucose level and high HBA1C level. Waris, et al study[15] showed that education had a significant association with knowledge and attitude while there is no association between Hba1c level and blood glucose levels and the attitude of participants. The association between high Hba1c and high fasting blood sugar levels

with positive attitude may be due to that these patients had the desire to control DM but lacked the motivation to do so.

- **Practice**

Regarding practices (74.5%) of the study participant reported that they always take diabetic medication (insulin, tablets) as prescribed similar finding was reported in studies by Mikhael EM, et al.[10], Tewahido D and Berhane[25] in Ethiopia 2017 which showed that adherence to medication was the most commonly practiced diabetes self-management practice. This may be because that adherence to medication is easier than adherence to other components of practices towards glycemic control, in addition to that most diabetic medications are available for free to Iraqi patients in public hospitals and health care centers. Only (21%) of participants were doing regular physical activity this consistent with Abdulsalam AJ, Al-Daihani AE and Francis K[26] 2017 study in Kuwait (23.3%) and higher than Karaoui LR, et al[27] 2018 study in Lebanon (15.9%). This might be because highest proportion of study participants (32.5%) aged ≥ 60 years and may have other geriatric problems that interfere with their physical activity and also in Iraq there is lack of free places for sport activities.

In this study only (31.5%) of participants were doing a self-blood sugar test, the result a little lower than Salih AA, Sadiq MA and Rayed MH[28] 2021 study in Iraq at Al-Najaf city (35.9%).This might be due to lack of education about the importance of blood glucose home monitoring or due to the high cost of the glucometers and there strips. The overall score of practice toward DM in this study revealed that (19.5%) were with good practices, This result is consistent with Mikhael EM, et al. study[10] which also showed poor practice among diabetic patient. This result was lower compared to the by Shawahna R, Samaro S and Ahmed Z[29] 2021 study conducted among Palestinians of the West Bank (36.4%). This study found that good practices towards glycemic controls was significantly higher in highly educated participants and employed participants this is consistent with other studies by Amelash D, et al. (5), Alaofe H, et al[16] and Sunny A, et al.[23] Also good practices towards glycemic controls were significantly higher among the participants who attended educational programs or lectures regarding DM. Chawla SS, et al[30] 2019 case control study in India concluded that effective health education improves knowledge, attitude, and practices, particularly with regard to lifestyle modifications and dietary management, culminating into better glycemic control that can slow down the progression of diabetes and prevent downstream complications. Sunny A, et al[23] also showed that education and occupation of patients have significant association with overall KAP practice. Studies by Shawahna R, Samaro S and Ahmed Z study[29] and Chawla SS, et al study[30] also found that good practices significantly higher among those who attended educational programs regarding DM. Those who had normal levels of fasting and postprandial glucose were significantly had higher score of good practices towards glycemic controls in this study. Ng SH, et al[31] 2012 study in Malaysia and Waris, et al study[15] showed that there was no correlation between the KAP and blood glucose control, based on patients fasting blood glucose and HbA1cresults. This could be because that Optimum glycemic control can be achieved only when the patients are adherent to self-management behaviors such as healthy diet, physical activity, monitoring of blood glucose, taking medications, reducing the risk factors, ability to resolve diabetes problems, and healthy coping.[10, 32]

CONCLUSIONS AND RECOMMENDATIONS

In our study we found that about two third of participants had fair knowledge towards glycemic control of DM.Regarding the attitude, more than two third of participants had negative attitude towards glycemic control of DM. Majority of the participants had poor practice towards glycemic control of DM. Good knowledge was highly significant among female with higher education, employed participants, living in urban areas, who had a positive family history of DM, attended educational programs or lectures regarding DM, and participants who had normal levels of fasting and postprandial blood glucose. Positive attitude was significantly higher among highly educated patients, employed patients, patients with positive family history of DM, who attended educational programs or lectures regarding DM and among the participants who had high fasting glucose level and high HBA1C level. Good practices towards glycemic controls was significantly higher in highly educated participants and employed participants, who attended educational programs or lectures regarding DM and among those who had normal levels of fasting and postprandial glucose. Knowledge, attitude and practice are essential and very important in preventing, controlling and follow up of DM. so we recommend education and counseling about all the aspects of DM are needed in primary and secondary health centers to increase patient involvement and self-reliance in the glycemic control of DM. Group education as well as individualized education programs are needed in the endocrine centers to improve prevention and management techniques in DM. Conduct further studies about KAP of diabetic patients in different parts of Iraq.

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