

# Knowledge and Attitudes of Patients with Type 2 Diabetes Mellitus toward Insulin Therapy in Erbil city: a Cross-Sectional Study

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Attitude; Insulin therapy; Knowledge.

## ABSTRACT

**Background:** Insulin therapy plays a major role in controlling glycemic status of type 2 diabetes mellitus patients. Knowledge and attitude of patients regarding insulin therapy is essential in better adherence to therapy.

**Objective:** To assess the knowledge and attitudes of patients with T2DM regarding insulin therapy and to identify the influencing sociodemographic and clinical factors.

**Methods:** A cross sectional project conducted in two primary public health centers (Azadi and Shadi centers) in Erbil city-Kurdistan region/Iraq in a period of 9 months from 1<sup>st</sup> of October 2024, to 30<sup>th</sup> of June, 2025 on sample of 200 type 2 diabetic patients. The knowledge and attitude of patients were assessed by self administered questionnaire.

**Results:** In current study, 49% of type 2 diabetic patients had good knowledge about insulin therapy and 51% of them had poor knowledge, while 33.5% of patients had positive attitude regarding insulin therapy and 66.5% of them had negative attitude. The poor knowledge about insulin therapy of patients was significantly related to single marital status ( $p=0.03$ ), low educational level ( $p=0.003$ ), obesity ( $p=0.03$ ), low socioeconomic status ( $p=0.001$ ), current DM treatment ( $p<0.001$ ), hypoglycemic attack ( $p=0.03$ ) and lack of family member or friend using insulin ( $p<0.001$ ). The negative attitude regarding insulin therapy for patients was significantly related to low educational level ( $p=0.01$ ), insufficient family income ( $p=0.003$ ), current DM treatment ( $p<0.001$ ), hypoglycemic attack ( $p=0.01$ ) and lack of family member or friend using insulin ( $p<0.001$ ).

**Conclusions:** The type 2 diabetic patients in Erbil city have an acceptable knowledge regarding insulin therapy, while the attitude about insulin therapy is negative in high proportion of them.

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## Introduction

People are frequently addicted to sugar because it gives them energy and aids in storing calories, which helps them survive hunger. Moreover, carbohydrates (glucose and fructose) elicit the release of dopamine and serotonin hormones in the brain, which are linked to the experience of pleasure and contribute to an overall enhancement of mood [1]. Higher glycemic load leads to obesity and metabolic abnormalities, that may cause diabetes. One of the most common types of diabetes, type 2 diabetes mellitus (T2DM) affects people of almost any age. One of the primary indicators of type 2 diabetes is an elevated blood sugar level. Chronic hyperglycemia, along with pancreatic  $\beta$ -cell failure, insulin resistance, and immunological inflammation, intensifies the pathophysiology of T2DM [2]. Resistance to insulin in muscle mass, liver, and fatty tissue, along with gradually decreased insulin production by pancreatic

$\beta$ -cells, is the primary cause of type 2 diabetes [3]. A number of micro- and macrovascular disorders, including diabetic retinopathy, nephropathy, neuropathy, atherosclerosis, and cardiovascular illnesses, including tumors, are greatly accelerated by uncontrolled T2DM which a serious public health issue [4].

The T2DM treatment plan necessitates patient involvement. Consequently, sufferers necessitate an integrated approach to comprehend the sickness and therapy alternatives, engage in wellness, and avert consequences [5]. Furthermore addition, individuals with T2DM need to keep healthy eating habits, exercise frequently, check the sugar levels in their blood, take their medications as prescribed, get vaccinated, and manage their illness [6]. Depending on the sufferer's existing hemoglobin A1c (HbA1c) level, treatment with insulin might be administered either alone or in conjunction with other anti diabetic medications to manage type 2 diabetes. Patients with ketoacidosis caused by diabetes must receive insulin treatment; it may also be considered for any patient who continues to have symptoms, loses weight, or has a blood glucose level that is consistently elevated in either fasting state (>126 mg/dl) or postprandial (>180 mg/dl) even after receiving alternative therapies [7]. The insulin decreases HbA1c levels and facilitates the achievement of glycemic objectives [8]. Nonetheless, additional variables may influence a patient's tolerance and adherence to insulin therapy, such inadequate education, a hectic timetable, traveling, mealtime omission, stress or nervousness, and regret [9]. For similar reasons, 33.2% of insulin-using individuals with type 1 or type 2 diabetes, according to recent data, miss their doses on average 3.3 days each month [10]. Because of this, individuals with type 2 diabetes who are on insulin therapy need to be taught about the indications for the medication, how to take it, how to avoid adverse effects, and how to administer it themselves [11].

In Iraq, sedentary lifestyle, westernization of dietary habits and increased obesity prevalence in last two decades had a great impact on elevating T2DM from 8.5% to 13.9% [12]. Management of type 2 diabetic Iraqi patients is commonly concentrated on oral anti-diabetic medicines, while about 30% of them are on insulin to control glycemic status. Unfortunately, changing lifestyle habits and the physical activity programs are limited [13]. Diabetes is becoming more common worldwide, its burden is increasing, its long-term effects are getting worse, and individuals with T2DM are becoming more reluctant to take their medications as prescribed. Consequently, evaluating the knowledge and attitudes of patients with T2DM concerning insulin therapy is essential in promoting behavioral modifications and adherence to diabetes care [14]. This study aimed to assess the knowledge about insulin therapy in T2DM patients & identify the source of their knowledge & existed believes with their perception about insulin therapy.

## Methods

The design of present study is a cross sectional conducted in two primary public health centers (Azadi and Shadi centers) in Erbil city-Kurdistan region/Iraq in a period of 9 months from 1<sup>st</sup> of October 2024, to 30<sup>th</sup> of June, 2025. All patients diagnosed with T2DM presented to any one of these two primary public health centers were the study population. Adults ( $\geq 18$  year's age) with type 2 diabetes mellitus and disease duration of one year and more were inclusion criteria. Exclusion criteria were type 1 diabetes mellitus, gestational diabetes mellitus, severe diabetes complications, psychiatric illness, inability to communicate like deafness and patients refused to participate. This study included 200 type 2 diabetic patients.

Information of selected patients were collected directly by researchers and fulfilled in self-administered questionnaire that designed by the researchers and included the following information: general characteristics of patients (age, gender, marital status, educational level, body mass index and smoking), socioeconomic characteristics of patients (car ownership, home

ownership, family income, occupation and socioeconomic score), clinical characteristics of patients (DM duration, co-morbidity with chronic diseases, current diabetes treatment, mode of insulin administration, type of insulin used, hypoglycemic attack and family member or friend using insulin), knowledge assessment of patients regarding insulin therapy and attitude assessment regarding insulin therapy. Type 2 diabetes mellitus was diagnosed by Physicians Specialists in Family Medicine and Internal Medicine at centers in regard to Iraqi guidelines (HbA1c  $\geq 6.5\%$  for symptomatic patients) [12]. Socioeconomic score was measured according to equation of SES = Education + Occupation + House ownership \* 0.5 + Car ownership \* 0.1 + (age-20)/100– Retired/unemployed/deceased [15]. Knowledge of T2DM patients regarding insulin therapy was assessed through 10 questions regarding with correct answer=1 and wrong answer=0; after summation of answers, good knowledge with total of  $\geq 5$  and poor knowledge with total of less than 5 [16]. Attitude toward insulin therapy was assessed through Insulin Therapy Appraisal Scoring (ITAS) that had twenty questions (16 negative statements of barriers and four positive statements of benefits, with total possible score ranges from 20-100, as higher score leads to worse attitude about insulin therapy (poor attitude was defined with score of  $\geq 65$ ) [17].

The Research Protocol Ethics Committee of Hawler Medical University/College of Medicine approved this study on 4<sup>th</sup> of February 2025 (code 8). Oral informed consent of was obtained from each patient who agreed to participate in the study at the time of first interview. All participants were assured that their information would be kept confidential and would be used for research purposes only.

### Statistical analysis

The data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 26. Numbers and percentages were used to describe patient characteristics such as gender, education, marital status, smoking status, and treatment. For continuous variables such as age, body mass index, diabetes duration, and socioeconomic score, means and standard deviations were reported.

Knowledge and attitude toward insulin were categorized into two groups (good vs. poor knowledge, and positive vs. negative attitude). Associations between categorical variables and these outcomes were tested using Chi-square or Fisher's exact tests, while independent-samples t-tests were applied for continuous variables. A p-value of  $\leq 0.05$  was considered statistically significant.

## Results

### Sociodemographic characteristics

This study included 200 type 2 diabetic patients with mean age of (60.9 years); 35% of were 60-69 years age and 51% of them were males. More than two thirds of diabetic patients were married and 22% of them were illiterate. Mean body mass index of type 2 diabetic patients was (28.2 Kg/m<sup>2</sup>); 28.5% of them were obese. The smoking was current in 27% of type 2 diabetic patients. (Table 1)

**Table 1:** General characteristics of examined type 2 diabetic patients.

Variable	No.	%
Age mean $\pm$ SD (60.9 $\pm$ 11.5 years)		
<50 years	36	18.0
50-59 years	42	21.0
60-69 years	70	35.0
$\geq 70$ years	52	26.0
Gender		
Male	102	51.0

Female	98	49.0
<b>Marital status</b>		
Married	143	71.5
Single	27	13.5
Divorced	4	2.0
Widow	26	13.0
<b>Educational level</b>		
Illiterate	44	22.0
Read & write	23	11.5
Primary level	47	23.5
Secondary level	46	23.0
College and above	40	20.0
<b>Body mass index mean±SD (28.2±4.2 Kg/m<sup>2</sup>)</b>		
Normal	49	24.5
Overweight	94	47.0
Obese	57	28.5
<b>Smoking</b>		
Smoker	54	27.0
Ex-smoker	40	20.0
Non-smoker	106	53.0
Total	200	100.0

Car ownership was observed in 67% of type 2 diabetic patients and home ownership was recorded for 70.5% of them, while family income was not sufficient in 23.5% of them and 55.5% of them were unemployed. Mean socioeconomic score of type 2 diabetic patients was (4.2); 70.5% of them had low socioeconomic status, 14% of them had middle status and 15.5% of them had high socioeconomic status. (Table 2)

**Table 2:** Socioeconomic characteristics of studied type 2 diabetic patients.

Variable	No.	%
<b>Car ownership</b>		
No	66	33.0
Yes	134	67.0
<b>Home ownership</b>		
Rented	59	29.5
Owned	141	70.5
<b>Family income</b>		
Sufficient for daily	128	64.0
Not sufficient	47	23.5
More than sufficient	25	12.5
<b>Occupation</b>		
Unemployed	111	55.5
Unskilled manual	31	15.5
Skilled manual	15	7.5
Non manual	37	18.5
High rank	6	3.0
<b>Socioeconomic score mean±SD (4.2±2.5)</b>		
Low	141	70.5
Middle	28	14.0
High	31	15.5
Total	200	100.0

**DM related characteristics**

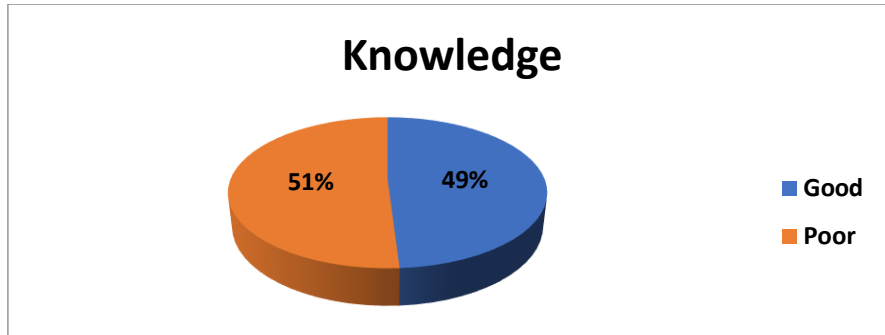
Mean diabetes mellitus duration of studied patients was (9.3 years); 32% of patients had DM duration of more than 10 years. More than two thirds of type 2 diabetic patients had positive clinical co-morbidity especially hypertension. The prevalent current DM treatment was oral anti-diabetic medication (73%) and insulin was used in 20% of them, with needle as main mode of administration (60%) and basal insulin alone as a prevalent type (40%). Hypoglycemic attacks were reported by 60% of type 2 diabetic patients on insulin treatment. Patients with family member or friend using insulin represented only 19% of type 2 diabetic patients. **(Table 3)**

**Table 3:** Clinical characteristics of studied type 2 diabetic patients.

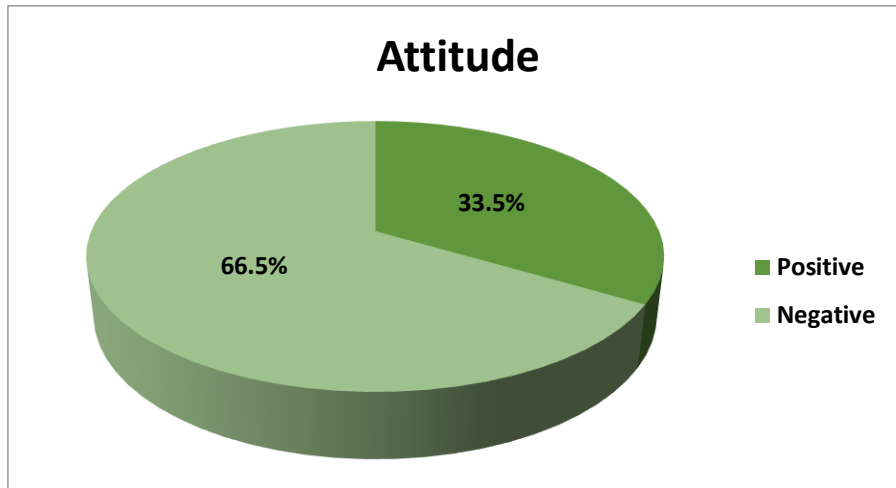
Variable	No.	%
<b>DM duration mean±SD (9.3±6.9 years)</b>		
<5 years	58	29.0
5-10 years	78	39.0
>10 years	64	32.0
<b>Co-morbidity with chronic disease</b>		
Yes	140	70.0
No	60	30.0
<b>Current diabetes treatment</b>		
Lifestyle modification	12	6.0
Oral anti-diabetes	146	73.0
Insulin therapy	17	8.5
Combination of oral agents and insulin	23	11.5
Lifestyle modification & anti-diabetes medication	2	1.0
<b>Mode of insulin administration</b>		
Pen	16	40.0
Needle	24	60.0
<b>Insulin type used</b>		
Basal insulin alone	16	40.0
Basal and bolus together	14	35.0
Premixed	10	25.0
<b>Hypoglycemia attack</b>		
Yes	24	60.0
No	16	40.0
<b>Family member or friend using insulin</b>		
Yes	38	19.0
No	162	81.0
Total	200	100.0

**Knowledge and information source about insulin**

The mean knowledge score of type 2 diabetic patients regarding insulin therapy was (5.49); 49% of them had good knowledge and 51% of them had poor knowledge. Mean ITAS of type 2 diabetic patients was (61.3); 33.5% of patients had positive attitude regarding insulin therapy and 66.5% of them had negative attitude regarding insulin therapy. **(Figures 1, 2)**



**Figure 1:** Knowledge regarding insulin therapy.



**Figure 2:** Attitude regarding insulin therapy.

**Knowledge and attitude with sociodemographic and DM related characteristics**

No significant differences were observed between patients with different knowledge levels in regard to age, gender and smoking ( $p > 0.05$ ). Type 2 diabetic patients with single marital status, low educational level and obesity were significantly related to poor knowledge regarding insulin therapy ( $p \leq 0.05$ ). No significant differences were observed between patients with different attitude levels in regard to age, gender, marital status, body mass index and smoking ( $p > 0.05$ ). Type 2 diabetic patients with low educational level were significantly related to negative attitude toward insulin therapy ( $p = 0.01$ ). **(Table 4)**

**Table 4:** General characteristics in regard to knowledge and attitude.

Variable	Poor knowledge		P	Negative attitude		P
	No.	%		No.	%	
<b>Age</b>			0.7 <sup>NS</sup>			0.3 <sup>NS</sup>
<50 years	18	50.0		21	58.3	
50-59 years	24	57.1		32	76.2	
60-69 years	33	47.1		45	64.3	
≥70 years	27	51.9		35	67.3	
<b>Gender</b>			0.2 <sup>NS</sup>			0.5 <sup>NS</sup>
Male	48	47.1		66	64.7	
Female	54	55.1		67	68.4	
<b>Marital status</b>			0.03 <sup>S</sup>			0.1 <sup>NS</sup>
Married	65	45.5		92	64.3	
Single	18	66.7		17	63.0	
Divorced	1	25.0		2	50.0	

Widow	18	69.2		22	84.6	
<b>Educational level</b>			0.003 <sup>S</sup>			0.01 <sup>S</sup>
Illiterate	26	59.1		34	77.3	
Read & write	14	60.9		15	65.2	
Primary level	32	68.1		38	80.9	
Secondary level	18	39.1		24	52.2	
College and above	12	30.0		22	55.0	
<b>Body mass index</b>			0.03 <sup>S</sup>			0.1 <sup>NS</sup>
Normal	24	49.0		29	59.2	
Overweight	41	43.6		60	63.8	
Obese	37	64.9		44	77.2	
<b>Smoking</b>			0.3 <sup>NS</sup>			0.4 <sup>NS</sup>
Smoker	32	59.3		39	72.2	
Ex-smoker	18	45.0		24	60.0	
Non-smoker	52	49.1		70	66.0	

S=Significant, NS=Not significant.

Type 2 diabetic patients with rented house, insufficient family income and unemployment were significantly related to poor knowledge regarding insulin therapy ( $p \leq 0.05$ ). Mean socioeconomic score was significantly lower in patients with poor knowledge regarding insulin therapy ( $p = 0.001$ ). Type 2 diabetic patients with rented house, insufficient family income and unemployment were significantly related to negative attitude toward insulin therapy ( $p \leq 0.05$ ). Mean socioeconomic score was not significantly different between patients with positive and negative attitude toward insulin therapy ( $p = 0.07$ ). (**Table 5**)

**Table 5:** Socioeconomic characteristics in regard to knowledge and attitude.

Variable	Poor knowledge		P	Negative attitude		P
	No.	%		No.	%	
<b>Car ownership</b>			0.056 <sup>NS</sup>			0.1 <sup>NS</sup>
No	40	60.6		48	72.7	
Yes	62	46.3		85	63.4	
<b>Home ownership</b>			0.001 <sup>S</sup>			0.02 <sup>S</sup>
Rented	41	69.5		46	78.0	
Owned	61	43.3		87	61.7	
<b>Family income</b>			<0.001 <sup>S</sup>			0.003 <sup>S</sup>
Sufficient for daily	59	46.1		81	63.3	
Not sufficient	36	76.6		40	85.1	
More than sufficient	7	28.0		12	48.0	
<b>Occupation</b>			0.002 <sup>S</sup>			0.04 <sup>S</sup>
Unemployed	68	61.3		80	72.1	
Unskilled manual	12	38.7		16	51.6	
Skilled manual	10	66.7		13	86.7	
Non manual	11	29.7		20	54.1	
High rank	1	16.7		4	66.7	
<b>Socioeconomic score</b>			0.001 <sup>S</sup>			0.07 <sup>NS</sup>
Mean±SD	1.27±0.6			1.38±0.6		

S=Significant, NS=Not significant.

No significant differences were observed between patients with different knowledge levels in regard to DM duration and clinical co-morbidity ( $p>0.05$ ). Type 2 diabetic patients with lifestyle modification only as DM treatment, insulin needle administration, insulin type, hypoglycemic attack and lack of family member or friend using insulin were significantly related to poor knowledge regarding insulin therapy ( $p\leq 0.05$ ). No significant differences were observed between patients with different attitude levels in regard to DM duration, clinical co-morbidity, mode of insulin administration and type of insulin used ( $p>0.05$ ). Type 2 diabetic patients with lifestyle modification only as DM treatment, hypoglycemic attack and lack of family member or friend using insulin were significantly related to negative attitude toward insulin therapy ( $p\leq 0.05$ ). (Table 6)

**Table 6:** Clinical characteristics regard to knowledge and attitude.

	Poor knowledge		P	Negative attitude		P
	No.	%		No.	%	
DM duration			0.2 <sup>NS</sup>			0.3 <sup>NS</sup>
<5 years	35	60.3		43	74.1	
5-10 years	37	47.4		49	62.8	
>10 years	30	46.9		41	64.1	
Co-morbidity			0.6 <sup>NS</sup>			0.9 <sup>NS</sup>
Yes	70	50.0		93	66.4	
No	32	53.3		40	66.7	
Current diabetes treatment			<0.001 <sup>S</sup>			<0.001 <sup>S</sup>
Lifestyle modification only	9	75.0		11	91.7	
Oral anti-diabetes medication	87	59.6		110	75.3	
Insulin therapy	4	23.5		2	11.8	
Combination of oral agents and Lifestyle modification & anti-DM	2	8.7		9	39.1	
	0	-		1	50.0	
Mode of insulin administration			0.03 <sup>S</sup>			0.6 <sup>NS</sup>
Pen	0	-		5	31.3	
Needle	6	25.0		6	25.0	
Insulin type used			0.001 <sup>S</sup>			0.6 <sup>NS</sup>
Basal insulin alone	0	-		4	25.0	
Basal and bolus together	6	42.9		5	35.7	
Premixed	0	-		2	20.0	
Hypoglycemia attack			0.03 <sup>S</sup>			0.01 <sup>S</sup>
Yes	6	25.0		10	41.7	
No	0	-		1	6.3	
Family member or friend using			<0.001 <sup>S</sup>			<0.001 <sup>S</sup>
Yes	8	21.1		13	34.2	
No	94	58.0		120	74.1	

S=Significant, NS=Not significant.

## Discussion

This study showed that 49% of T2DM patients had good knowledge in insulin therapy and 51% of them had poor knowledge in insulin therapy. These findings are close to results of previous cross sectional study conducted in Iraq which revealed that 55.6% of T2DM patients had good knowledge in insulin therapy [18]. However, our study percentage of good knowledge is superior to the results of recent cross sectional carried out in Sudan which revealed that only 15% of T2DM patients had good knowledge [1]. In recent study, 33.5% of

T2DM patients had positive attitude regarding insulin therapy and 66.5% of them had negative attitude regarding insulin therapy. These findings are close to results of recent study implemented in Ethiopia which showed 37.6% of T2DM patients had positive attitude regarding insulin therapy and 62.4% of them had negative attitude regarding insulin therapy [20]. Close to our results, previous Iranian cross sectional study found that 62% of T2DM patients had positive attitude toward insulin therapy [21].

Current study revealed that type 2 diabetic patients with single marital status, low educational level and obesity were significantly related to poor knowledge regarding insulin therapy ( $p \leq 0.05$ ). These findings are consistent with results of different recent literatures [22] [23]. Type 2 diabetic patients in our study with rented house, insufficient family income and unemployment were significantly related to poor knowledge regarding insulin therapy ( $p \leq 0.05$ ). Similarly, recent systematic review study implemented in Iran reported that poverty and unemployment of type 2 diabetic patients had a profound effect on their knowledge regarding insulin therapy [24]. In our study, mean socioeconomic score was significantly lower in patients with poor knowledge regarding insulin therapy ( $p = 0.001$ ). It was shown that low socioeconomic status of T2DM patients was related to poor glycemic control and poor knowledge about insulin therapy [25]. In this study, type 2 diabetic patients with lifestyle modification only as DM treatment, insulin needle administration, insulin type, hypoglycemic attack and lack of family member or friend using insulin were significantly related to poor knowledge regarding insulin therapy ( $p \leq 0.05$ ). These findings are in agreement with results of recent cross sectional study conducted in Saudi Arabia [26].

The current study demonstrated a substantial correlation between type 2 diabetic patients negative attitudes toward insulin therapy and their poor educational attainment ( $p = 0.01$ ). This finding coincides with results of previous Iraqi cross sectional study [27]. In this study, type 2 diabetic patients with rented house, insufficient family income and unemployment were significantly related to negative attitude toward insulin therapy ( $p \leq 0.05$ ). Consistently, previous prospective cohort study carried out in Mexico revealed that poverty and unemployment played a major role in developing negative attitude toward insulin therapy [28]. In our study, type 2 diabetic patients with lifestyle modification only as DM treatment, hypoglycemic attack and lack of family member or friend using insulin were significantly related to negative attitude toward insulin therapy ( $p \leq 0.05$ ). These findings are parallel to results of different literatures conducted in United Arab Emirates and Spain [14] [29].

## Conclusions

Type 2 diabetic patients in Erbil city have an acceptable knowledge regarding insulin therapy, while the attitude about insulin therapy is negative in high proportion of them. Factors related to poor knowledge about insulin therapy are single marital status, low educational level obesity, low socioeconomic status, current DM treatment, hypoglycemic attack and lack of family member or friend using insulin. Factors related to negative attitude toward insulin therapy are low educational level low socioeconomic status, current DM treatment, hypoglycemic attack and lack of family member or friend using insulin. This study recommends targeted educational programs for patients with type 2 diabetes in Erbil to enhance their understanding and acceptance of insulin therapy.

## Conflict of interest

The authors declare no conflict of interest, the study is self funded.

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## References

1. Beecher K, Alvarez Cooper I, Wang J, et al. Long-Term Overconsumption of Sugar Starting at Adolescence Produces Persistent Hyperactivity and Neurocognitive Deficits in Adulthood. *Front Neurosci* 2021; 15:670430. <http://doi:10.3389/fnins.2021.670430>
2. Lu X, Xie Q, Pan X, et al. Type 2 diabetes mellitus in adults: pathogenesis, prevention and therapy. *Signal Transduct Target Ther* 2024; 9(1):262. <http://doi:10.1038/s41392-024-01951-9>
3. DeFronzo RA. Banting Lecture. From the triumvirate to the ominous octet: a new paradigm for the treatment of type 2 diabetes mellitus. *Diabetes* 2009; 58(4):773-95. <http://doi:10.2337/db09-9028>
4. Singh A, Shadangi S, Gupta PK, et al. Type 2 Diabetes Mellitus: A Comprehensive Review of Pathophysiology, Comorbidities, and Emerging Therapies. *Compr Physiol* 2025; 15(1):e70003. <http://doi:10.1002/cph4.70003>
5. Kant R, Thapliyal V. Knowledge attitude and practice of type 2 diabetic patients in a tertiary care teaching hospital in India. *Integr Food Nutr Metab* 2015; 2:131–5. <http://doi:10.15761/IFNM.1000115>
6. Davies MJ, D'Alessio DA, Fradkin J, et al. Management of Hyperglycemia in Type 2 Diabetes, 2018. A Consensus Report by the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD). *Diabetes Care* 2018; 41(12):2669-2701. <http://doi:10.2337/dci18-0033>
7. American College of Physicians, Burns C. MKSAP® 18 Endocrinology and Metabolism. United States. 2018: 14-15. Available at: <https://www.amazon.com/MKSAP%C2%AE-Endocrinology-Metabolism-Cynthia-editor/dp/1938245547>
8. Home P, Riddle M, Cefalu WT, et al. Insulin therapy in people with type 2 diabetes: opportunities and challenges? *Diabetes Care* 2014; 37(6):1499-508. <http://doi:10.2337/dc13-2743>
9. AP V, Kamath L, Shankar S. Knowledge, attitude and practice of insulin use of diabetic patients in India. *Pharmacology and Clinical Pharmacy Research (PCPR)* Is an International Peer-Reviewed Journal Devoted to Publish Origina 2020; 5:23. <http://doi:10.15416/pcpr.v4i3.26564>
10. Peyrot M, Barnett AH, Meneghini LF, et al. Insulin adherence behaviours and barriers in the multinational Global Attitudes of Patients and Physicians in Insulin Therapy study. *Diabet Med* 2012; 29(5):682-9. <http://doi:10.1111/j.1464-5491.2012.03605.x>
11. American Association of Diabetes Educators. Strategies for insulin injection therapy in diabetes self-management. 2011. Available at: [https://www.diabeteseducator.org/docs/defaultsource/legacydocs/\\_resources/pdf/research/aade\\_meded.pdf?sfvrsn=2](https://www.diabeteseducator.org/docs/defaultsource/legacydocs/_resources/pdf/research/aade_meded.pdf?sfvrsn=2)
12. Abusaib M, Ahmed M, Nwayyir HA, et al. Iraqi Experts Consensus on the Management of Type 2 Diabetes/Prediabetes in Adults. *Clin Med Insights Endocrinol Diabetes* 2020; 13:1179551420942232. <http://doi:10.1177/1179551420942232>
13. Ali EH, Al-Khafaji KHA, Abood AH. A review study of researches conducted on diabetes mellitus type 2 patients in Iraq. *AJB* 2022; 14 (3): 42-50. Available at:

- <https://iasj.rdd.edu.iq/journals/uploads/2024/12/27/14d7c4986b6cb7f95d27b581466726eb.pdf>
14. Almheiri A, Binjab EA, Abloushi MM, et al. Knowledge, attitude and practices of insulin therapy among patients with type 2 diabetes: a cross-sectional study. *BMJ Open* 2024; 14(3):e079693. <http://doi:10.1136/bmjopen-2023-079693>
  15. Omer W, Al-Hadithi T. Developing a socioeconomic index for health research in Iraq. *East Mediterr Health J*. 2017; 23(10):670-7. <http://doi:10.26719/2017.23.10.670>
  16. Fitzgerald JT, Funnell MM, Anderson RM, et al. Validation of the Revised Brief Diabetes Knowledge Test (DKT2). *Diabetes Educator* 2016; 42(2): 178-87. <http://doi:10.1177/0145721715624968>
  17. Hernández-García F, González-Velázquez VE, Pérez García ER, et al. Validation and application of the Insulin Treatment Appraisal Scale in Cuban patients with type 2 diabetes mellitus. *Endocrinol Diabetes Nutr (Engl Ed)* 2022; 69(10):791-801. <http://doi:10.1016/j.endien.2021.11.036>
  18. Lafta RK, Salih AA, Sadiq MA. Knowledge and Attitude towards Insulin Therapy among Type 2 Diabetics. *Iraqi J Comm Med* 2011; 24 (3): 196-9. Available at: <https://iasj.rdd.edu.iq/journals/uploads/2024/12/13/725feab5a7a73f8ee57d2e5af1d40025.pdf>
  19. Osman AR, Amir O. Assessment of the knowledge on insulin therapy among adult diabetics patients in Jabir Abuleiz center, Khartoum, Sudan. *J Family Med Prim Care* 2022; 11(6):2643-7. [http://doi:10.4103/jfmpe.jfmpe\\_2064\\_21](http://doi:10.4103/jfmpe.jfmpe_2064_21)
  20. Hailu SS, Ababiya RH, Nurfeta RA, et al. Knowledge and attitude towards insulin therapy in type 2 diabetes mellitus patients and associated factors at an adult endocrine clinic of SPHMMC Addis Ababa Ethiopia. *Int J Diabetes Endocrinol* 2024; 9 (2): 22-38. <http://doi:10.11648/j.ijde.20240902.11>
  21. Davoudi Z, Chouhdari A, Mir M, et al. Attitude and Compliance with the Onset of Insulin Therapy in Patients with Type 2 Diabetes. *Shiraz E-Med J* 2020; 21(6):e95408. <https://doi.org/10.5812/semj.95408>
  22. Ilyan A, Abuhailima D, Al-Jabi SW, et al. Assessment of diabetes knowledge, hypoglycaemia awareness, and adherence to insulin pen usage practices among diabetic patients: a cross-sectional study of determinants and educational needs. *BMC Public Health* 2025; 25(1):2305. <http://doi:10.1186/s12889-025-23566-7>
  23. Al Jarad FAS, Narapureddy BR, Derkaoui HR, et al. Prevalence and Risk Factors of Obesity Among Type 2 Diabetic Participants in Abha, Saudi Arabia: A Cross-Sectional Study. *Healthcare (Basel)* 2025; 13(6):658. <http://doi:10.3390/healthcare13060658>
  24. Shah MK, Farzadmehr M, Rezaie A, et al. Diabetic patients' knowledge and related factors towards insulin therapy: A systematic review. *Journal of Nursing Reports in Clinical Practice* 2024; 3 (3): 268-78. <http://doi:10.32598/JNRCP.2407.1128>
  25. Houle J, Lauzier-Jobin F, Beaulieu MD, et al. Socioeconomic status and glycemic control in adult patients with type 2 diabetes: a mediation analysis. *BMJ Open Diabetes Res Care* 2016; 4(1):e000184. <http://doi:10.1136/bmjdr-2015-000184>
  26. Alarfaj RM, Alayed D. Knowledge and Practice of Use of Insulin Therapy Among Patients With Type 2 Diabetes Attending Primary Health Care Centers, Riyadh, Saudi Arabia: A Cross-Sectional Study. *Cureus* 2023; 15(2):e35486. <http://doi:10.7759/cureus.35486>
  27. Zidane RN, Hussein WA. Barriers for Insulin Therapy Initiation among Type 2 Diabetic Patients Attending the Specialized Center for Endocrinology and Diabetes/Baghdad 2019. *IPMJ* 2021; 20 (2): 186-92. Available at: <https://iasj.rdd.edu.iq/journals/uploads/2024/12/11/4184661acf71ff139ea15d4ce3847289.pdf>

28. Lerman I, Díaz JP, Ibarquengoitia ME, et al. Nonadherence to insulin therapy in low-income, type 2 diabetic patients. *EndocrPract* 2009; 15(1):41-6. <https://doi.org/10.33279/jkcd.v14i03.624>
29. GaldónSanz-Pastor A, JustelEnríquez A, Sánchez Bao A, et al. Current barriers to initiating insulin therapy in individuals with type 2 diabetes. *Front Endocrinol (Lausanne)* 2024; 15:1366368. <http://doi:10.3389/fendo.2024.1366368>