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Research Article

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

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Abstract

Background: Diabetes Mellitus (DM), a chronic disease characterized by elevated blood glucose levels, is associated with severe complications. Type 2 DM (T2DM), the most prevalent form of DM in adults, is characterized by varying degrees of insulin deficiency or resistance. The prevention or delay of macrovascular and microvascular problems associated with DM depends on achieving appropriate glycemic control. The percentage of T2DM patients failing to reach glycemic targets keeps rising even with the expanded availability of numerous anti-hyperglycemic drugs and evidence-based treatment guidelines. The delay in treatment intensification despite inadequate glucose control—often referred to as clinical or therapeutic inertia-contributes significantly to this trend. *Objective:* This study aims to evaluate the understanding and perceptions of insulin therapy among patients with T2DM. The study focuses on patients under follow-up care at the Adult Endocrine Clinic of St. Paul Hospital Millennium Medical College. *Method and Material:* An institutional-based, cross-sectional study was carried out from January to March 2021 to evaluate knowledge and attitudes regarding insulin therapy and related factors. A structured questionnaire was used for interviews with a representative sample of 271 T2DM patients who are receiving follow-up care at the endocrine clinic at SPHMMC. The SPSS, version 25, was the software utilized. The statistical significance of the relationship between the dependent and independent variables was assessed using a 95% confidence interval and a p-value less than 0.05. *Results:* The majority of the respondents were between the ages of 56 and 65, with a mean age of 57.35 years. More than half of the participants, accounting for 231 (85.2%) of the total, were from urban areas. Out of the 271 respondents, approximately 85.6% demonstrated poor knowledge of insulin therapy, and around 37.6% exhibited negative attitudes towards it. Factors such as age, occupation, and a history of long-term Oral Antidiabetic Drug use were found to be associated with the level of knowledge about insulin. In addition to these factors, marital status and a family history of insulin use were found to be associated with patients'

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attitudes towards insulin. *Conclusions:* Our study identified a significant knowledge gap about insulin usage among T2DM patients in the designated study area. We recommend the implementation of regular, structured health education programs, delivered by trained health professionals. This approach is expected to enhance both the knowledge and attitudes toward insulin usage among patients attending follow-up sessions at the SPHMMC diabetic clinic.

Keywords

Diabetes Mellitus, Insulin, Knowledge, Attitude, Ethiopia

1. Introduction

Diabetes mellitus is a serious, long-term condition that occurs when there is a raised level of glucose in the blood because the body can't produce any or enough insulin, or can't effectively use the insulin it produces [1]. It is recognized as an important cause of premature death and disability and is one of four priority non-communicable diseases (NCDs) targeted by world leaders in the 2011 Political Declaration on the Prevention and Control of NCDs. The declaration recognizes that the incidence and impacts of DM and other NCDs can be largely prevented or reduced with an approach that incorporates evidence-based, affordable, cost-effective, population-wide, and multi-sectoral interventions [2].

Diabetes mellitus has become a global epidemic. An estimated 463.0 million people aged 20–79 years worldwide have DM; 79.4% live in low- and middle-income countries. This is expected to rise to 578.4 million by 2030 and 700.2 million by 2045 [1]. In Africa, around 19 million people are living with DM according to the 2019 IDF report, which is projected to increase to 29 million and 47 million by 2030 and 2045 respectively [1]. The same report estimated the prevalence of DM in Ethiopia to be around 3.2%, meaning 1 in 31 adults aged 20-79 years have DM [1].

Diabetes is a major cause of microvascular and macrovascular complications such as diabetic retinopathy and blindness, chronic kidney disease (CKD), myocardial infarction (MI), stroke, and lower limb amputation due to diabetic foot [2, 3]. In 2019, the total burden of deaths from DM and its complications was estimated to be 4.2 million, with DM-related health expenditure of around 760 billion USD [1]. The largest number of deaths resulting from high blood glucose occurs in upper and middle-income countries (1.5 million), and the lowest number in low-income countries (0.3 million) [2].

Maintaining good glycemic control with timely treatment intensification, combined with good treatment adherence, can prevent or delay these complications, leading to reductions in healthcare and pharmacy costs in the long term [2, 4-6]. However, despite the availability of effective glucose-lowering therapies, almost half of the patients with T2DM do not achieve globally recognized blood glucose targets [5, 6]. The main challenge in DM management is to optimize quality of life and prevent well-known morbidity and premature mortality, which can only be achieved with quality DM care, adequate resources, and keeping patients informed, motivated, and empowered [7].

Early use of insulin in the management of poorly controlled DM has been recommended to prevent and reduce long-term DM complications. Reducing patient exposure to prolonged hyperglycemia ultimately reduces the risks of DM-related complications. However, a delay in insulin initiation is common, and about 50% of T2DM patients with poor control who could benefit from insulin therapy did not receive it or did not start it promptly [1, 8-11]. The initiation was usually three to five years after the failure of Oral Anti Diabetics (OADs), regardless of already developed complications [6, 10-11]. This is partly attributable to resistance to taking insulin among patients and resistance to prescribing insulin among health care providers (HCPs), which can be caused by different factors [12]. Treatment guidelines that have advocated insulin therapy only if all other treatment strategies have failed may also have contributed [8].

About 50% of patients with poorly controlled T2DM did not start insulin therapy, and the initiation was usually three to five years after the failure of oral hypoglycemic agents [11]. There is a perception that insulin represents the last line of treatment and is associated with personal failure, increases the patient's self-management burden, and imposes hazards such as hypoglycemia and weight gain. So, despite improvements in insulin delivery and support systems, insulin is often not used optimally [13].

A study from the UK reported that the mean HbA1c on insulin initiation was 8.7% (71.6mmol/mol) for subjects taking one OAD, 9.1% (76.0mmol/mol) for those taking two OADs, and 9.7% (82.5 mmol/mol) for those taking three OADs. The median time to intensification was more than 7.1 years, more than 6.1 years, and 6.0 years, respectively. In support of this, the UK cohort database showed that patients on 1–4 OADs continued on oral therapy despite mean HbA1c increasing to 9.5–10.1% (80–87 mmol/mol) before the initiation of insulin, exposing these patients to chronic hyperglycemia [4]. Therefore, achieving early tight HbA1c control through lifestyle changes and the use of medications, including insulin, is important to prevent or delay DM-related complications and mortality [14, 15].

In Ethiopia, most studies related to DM focus on the prev-

alence of DM and its complications. However, there are no studies that focus on the use of insulin therapy, or the knowledge and attitudes among T2DM patients. Therefore, the purpose of this study is to assess the knowledge and attitude towards insulin therapy among T2DM patients at SPHMMC and the associated factors, to plan interventions to address the problem and improve the quality of care.

DM-related complications and the associated morbidity and mortality from DM, which is globally recognized as one of the top causes of mortality and morbidity, can be largely prevented or at least delayed by the timely initiation and intensification of treatment. Knowing the barriers and the associated factors for these treatment intensifications is very helpful not only for the patient but also for the healthcare system and the country as a whole.

This study will help in identifying barriers to timely treatment intensification by assessing the knowledge and attitude of patients towards insulin therapy. This is the first of its kind to be done in our hospital and probably also in our country. Therefore, it serves as a stepping stone for future studies. More importantly, it will be used as a basis and guide for the hospital to develop institution-based interventions and can be used as an initiative for other institutions and the country at large to combat this problem. This will ultimately improve the quality of healthcare, reduce morbidity and mortality, lessen the burden on the healthcare system, and decrease healthcare costs related to poor glycemic control.

2. Methods

2.1. Study Area and Period

The study was conducted at SPHMMC, in an endocrinology follow-up clinic. St. Paul's Hospital is one of the largest tertiary referral public hospitals in the capital, under the Federal Ministry of Health. The hospital is located in Gullele Sub city, on Swaziland Street, Addis Ababa, Ethiopia. Established by Emperor Haile Selassie in 1961, the hospital primarily provides service to those unable to afford care elsewhere. It has over 1200 clinical and non-clinical staff. The hospital added a medical college in 2007. There are over 21 departments, which include: internal medicine, pediatrics, gynecology/obstetrics, general surgery, emergency medicine, psychiatry, ophthalmology, radiology, and dermatology. Under the Department of Internal Medicine, there are several sub-specialties, including gastroenterology, nephrology, and cardiology. The endocrinology specialty unit is one of the core areas where outpatient and inpatient services, as well as academic activities, are carried out despite the scarcity of human resources. The study was conducted from January 1, 2021, to March 30, 2021 G.C.

2.2. Study Design

A cross-sectional study was conducted on T2DM patients who were on follow-up at the SPHMMC adult endocrine clinic.

2.3. Population

2.3.1. Source Population

All T2DM patients on follow-up at SPHMMC adult endocrine clinic were the source population.

2.3.2. Study Population

All T2DM patients on follow-up at SPHMMC during the study period.

2.4. Inclusion and Exclusion Criteria

2.4.1. Inclusion Criteria

1) T2DM patients who were not on insulin therapy
2) Those who were above the age of 18 years
3) T2DM patients who were on one or more OADs
4) T2DM patients who were on follow-up at endocrine clinic

2.4.2. Exclusion Criteria

Health conditions that compromise the patient's ability to understand & complete the interview (patients with mental/cognitive disorders consequently precluding the interview).

2.5. Sample Size and Sampling Technique

To determine the sample size for the study a single population proportion sample size formula was used:

$$n = Z^2p(1-p) / d^2$$

Where n = minimum sample size required
p= prevalence (0.8)…from a similar study conducted [24]
d= margin of sampling error (precision)…0.05
$Z_{1-\alpha/2}$=Value of z at 95% confidence interval level which is 1.96
Hence

$$n = \frac{(1.96)^2(0.8)(0.2)}{(0.05)^2}$$

$$n = 246$$

Adding a 10% non-response rate the final sample size was 271

2.6. Study Variables

2.6.1. Independent Variables

1) Age
2) sex
3) educational level
4) marital status
5) occupation

6) income
7) duration of DM
8) family history of DM/Insulin use
9) number and duration of OADs
10)DM knowledge
11)EDA membership

2.6.2. Dependent Variables

1) Knowledge about insulin therapy
2) Attitudes towards insulin therapy

2.7. Operational Definitions

1) Negative attitude: when patients score above 40 on attitude questions on ITAS
2) Positive attitude: when patients score 40 or less on attitude questions on ITAS
3) Good insulin knowledge: when patients score 5 or more on insulin knowledge questions
4) Poor insulin knowledge: when patients score less than 5 on insulin knowledge questions
5) Good DM knowledge: when patients score above the mean on DM knowledge questions
6) Poor DM knowledge: when patients score below the mean on DM knowledge questions

2.8. Data Collection and Analysis

Data were collected using a structured questionnaire during face-to-face interviews. The questionnaire was prepared by reviewing various pieces of literature and making modifications for the population being studied. It was further modified after a pre-test was conducted before data collection. The pre-test was carried out at Zewditu Memorial Hospital (ZMH), involving about 5% of the total sample size. The questionnaire was prepared in English and translated into Amharic during the interview. It consisted of the following four parts:

Demographic and clinical characteristics

It contains questions about age, gender, ethnicity, marital status, education level, employment status, duration of diabetes, the number and duration of OADs, and whether they are members of the Ethiopian Diabetic Association (EDA). Participants were also asked whether a relative took insulin (in the present or past) and, if so, whether the relative had any drug side effects.

Insulin attitude

The Insulin Treatment Appraisal Scale (ITAS) is a 20-item instrument (16 negative and 4 positive items) designed to determine attitudes toward insulin therapy and is a validated measure of psychological insulin resistance. Answers were provided on a 5-point Likert-type scale, ranging from 'strongly disagree' to 'strongly agree' (0–4). Positive scores were reversed to allow for summation. The sum score could range from 0 to 80. A score greater than 40 represents a negative attitude, and a score of 40 or less represents a positive attitude towards insulin [17].

Insulin knowledge

Insulin therapy knowledge was defined from eight; good knowledge was defined in all patients with a score ≥ 5 and poor knowledge was defined in all patients with a score between 0 and 4 [18].

DM knowledge

DM Knowledge was measured with the validated revised Diabetes Knowledge Test (DKT2). It is a 14-item general test with modifications for the population to be studied. Good knowledge was defined in those who scored above the mean and those who scored below the mean were taken as having poor knowledge [19].

2.9. Data Quality Assurance and Management

The questionnaire was prepared in English and translated into Amharic. To ensure consistency, the questionnaire was then translated back into English. Data were collected by general practitioners and nurses under the supervision of the principal investigator. The data collectors were trained by the principal investigator on the objective, the relevance of the study, and the interview process. A pretest was conducted on 5% of the sample size at ZMH two weeks before actual data collection to check its variability. The questionnaire was assessed for its clarity, length, and completeness, and the necessary corrections were made accordingly. Immediately after the administration of the questionnaire, each paper was checked for completeness, and it was checked again during and after data entry.

2.10. Ethical Consideration

Before conducting the research, ethical clearance was obtained from the Research Ethics Committee of SPHMMC. Informed verbal consent was obtained from each participant after a careful clarification of the aim and significance of the study. Each participant had the right to refuse participation in the study or withdraw at any time. To ensure confidentiality, the names of the respondents were not written on the questionnaire.

3. Result

3.1. Sociodemographic Characteristics

Altogether, 271 T2DM patients were enrolled in the study, making a response rate of 100%. Of those, 134 (49.4%) were male and 137 (50.6%) were female. The mean age was 57.35 years, with the majority of the respondents being in the age group of 56-65 years [85 (31.4%)]. Most of the respondents, 231 (85.2%), were from urban areas, and 121 (44.6%) were Orthodox. More than half, 181 (66.8%), of the respondents were married. Regarding the educational status of the study, 92 (34%) were in grades 9–12; whereas 70 (26%) had a college education or higher. About 57 (21%) subjects had a monthly income of ≤ 1000 birr, and 117 (43.2%) earned > 3000 birr.

Table 1. Socio-demographic result (N=271).

Variable	Frequency	Percent
Age		
45 &below	47	17.3
46-55	76	28.0
56-65	85	31.4
Above 65	63	23.2
Sex		
Male	134	49.4
Female	137	50.6
Residency		
Urban	231	85.2
Rural	40	14.8
Religion		
Orthodox	121	44.6
Muslim	68	25.1
Catholic	20	7.4
Protestant	61	22.5
Other	1	.4
Marital status		
Married	181	66.8
Widowed	37	13.7
Single	37	13.7
Divorced	16	5.9
Income		
<1000	57	21.0
1000-3000	97	35.8
>3000	117	43.2

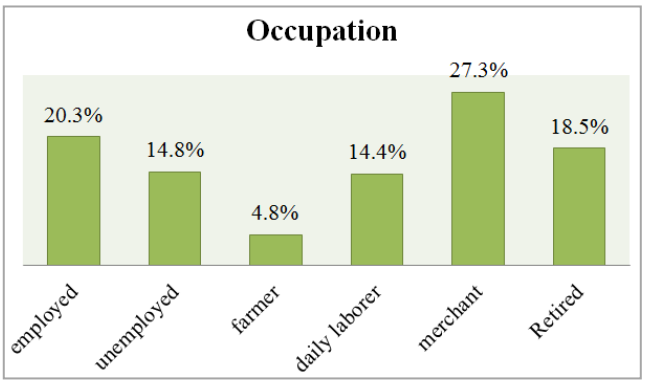

Figure 1. Occupation of the respondents.

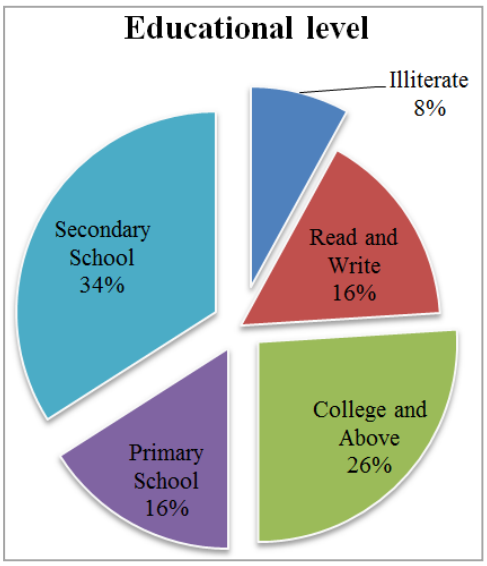

Figure 2. Educational level of the respondents.

3.2. DM-Related Characteristics

Regarding DM-related characteristics of patients, around 109 (40.2%) patients were diagnosed with T2DM for 5-10 years & more than half of the respondents 162 (59.8%) were on two OADs with 153 (56.5%) being on this medication for more than 5 years. Only 75 (27.7%) had a positive family history of insulin use. The majority of diabetic patients 190 (70.1%) were not members of EDA. (Table 2)

Table 2. DM-related characteristics (N=271).

Variable	Frequency	Percent
Duration of DM		
<5yrs	82	30.3
5-10yrs	109	40.2
>10yrs	80	29.5
Current medication		
One OAD	109	40.2
Two OADs	162	59.8
For how long been on this medication		
<3yrs	64	23.6
3-5yrs	54	19.9
>5yrs	153	56.5
Family hx of insulin use		
Yes	75	27.7
No	196	72.3
Member of EDA		

Variable	Frequency	Percent
Yes	81	29.9
No	190	70.1

3.3. Insulin Knowledge of the Respondents

According to insulin knowledge, above half the respondents [152 (56.1%)] knew insulin was prescribed for DM to lower blood glucose levels; most of the respondents [85 (31.4%)] didn't know where or how to store insulin whereas 84 (31%) said that refrigerator should be used to store insulin. Most of the respondents [103 (38%)] didn't know the sites of insulin injection & above half of them [192 (70.8%)] didn't know how to inject insulin. Almost all of the respondents [228 (84.1%)] didn't know about the different types of insulin/insulin delivery systems and only [115 (42.4%)] think that it's necessary to rotate sites of injection while [143 (52.8%)] didn't think it's necessary and the rest [13 (4.8%)] didn't know whether it's important to rotate the injection site.

Table 3. Insulin knowledge of the respondents.

Variable	Frequency	Percent
Do you know why insulin is prescribed for DM?		
To treat high blood pressure	10	3.7
To lower blood glucose level	152	56.1
To cure DM	77	28.4
Don't know	32	11.8
Do you know where or how to store insulin?		
Refrigerator	84	31.0
Any cold place	36	13.3
Sand soaked with water	52	19.2
Anywhere	14	5.2
Don't know	85	31.4
Do you know the sites of insulin injection (more than one answer is possible)		
Deltoid	40	14.8
Abdomen	65	24.0
Thigh	52	19.2
Gluteus	11	4.1
Don't know	103	38.0
Do you know how to inject insulin?		
Yes	74	27.3
No	192	70.8
Don't know	5	1.8
Do you know the different types of insulin/insulin delivery systems?		
Yes	35	12.9
No	228	84.1
don't know	8	3.0
Do you think it's necessary to rotate sites of injection?		
Yes	115	42.4
No	143	52.8
Don't know	13	4.8

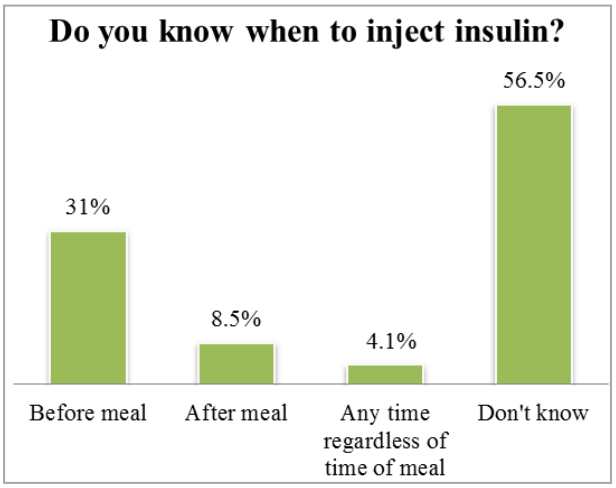

Figure 3. Knowledge of the respondents on what time to inject insulin.

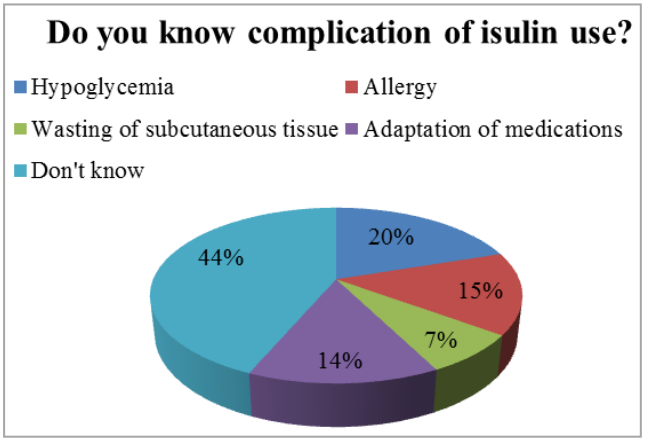

Figure 4. Knowledge of the respondents on complications of insulin use.

Table 4. Summary of Insulin knowledge score of the respondents (n=271).

	Frequency	Percent
Good knowledge	39	14.4
Poor knowledge	232	85.6

By forming a summary indicator for the insulin knowledge level of the respondents as described in the Methodology section, 39 (14.4%) had good knowledge &232 (85.8%) had poor knowledge.

3.4. Insulin Attitude

Regarding attitudes towards insulin, more than half of the respondents [150(55.4%)] agreed that taking insulin means 'I have failed to manage my DM with diet and tablets'. Seventy-two (26.6%) of the respondents strongly disagreed that taking insulin means 'my DM has become worse'. The majority [126(46.5%)] agreed that taking insulin helps to prevent complications of DM. Most respondents neither agreed nor disagreed [79(29.2%)] that taking insulin means 'other people see me as a sicker person'. The majority of participants [95(35.1%)] neither agreed nor disagreed that 'taking insulin makes life less flexible'. Eighty-five (31.4%) disagreed and 82(30.3%) agreed that 'I'm afraid of injecting myself with a needle'. The majority [101(37.3%)] neither agreed nor disagreed that 'taking insulin increases the risk of low blood glucose level (hypoglycemia)', while most participants [117(43.2%)] agreed that 'taking insulin helps to improve my health '. More than half [152(56.1%)] neither agreed nor disagreed that 'insulin causes weight gain', and the majority of respondents [85(31.4%)] disagreed that 'taking insulin injections takes a lot of time and energy', while most [102(37.6%)] neither agreed nor disagreed that 'taking insulin means I have to give up activities I enjoy'. Eighty-eight (32.5%) strongly disagreed that 'taking insulin means my health will deteriorate', and the majority [121(44.6%)] disagreed that 'injecting insulin is embarrassing'. Ninety-nine (36.5%) disagreed and 92(33.9%) agreed that 'injecting insulin is painful'. Most respondents [109(40.2%)] strongly agreed that 'it's difficult to inject the right amount of insulin correctly at the right time every day', while most [87(32.1%)] neither agreed nor disagreed that 'taking insulin makes it more difficult to fulfill my responsibilities at work/home'. The majority of respondents [125(46.1%)] strongly agreed that 'taking insulin helps to maintain good control of blood glucose', whereas [127(46.9%)] agreed that 'being on insulin causes family and friends to be more concerned about me', and [70(25.8%)] agreed that 'taking insulin makes me more dependent on others'. (Table 4)

Table 5. Insulin Attitude (n=271).

Variable	S. agree	Agree	Agree nor Disagree	Disagree	S. disagree
Taking insulin means I have failed to manage my DM with diet and tablets	53 (19.6%)	150 (55.4%)	34 (12.5%)	22 (8.1%)	12 (4.4%)
Taking insulin means my DM has become worse	45 (16.6%)	64 (23.6%)	48 (17.7%)	42 (15.5%)	72 (26.6%)
Taking insulin helps to prevent complications of DM	27 (10.0%)	126 (46.5%)	71 (26.2%)	41 (15.1%)	6 (2.2%)
Taking insulin means other people see me as a sicker person	33 (12.2%)	66 (24.4%)	79 (29.2%)	67 (24.7%)	26 (9.6%)
Taking insulin makes life less flexible	25 (9.2%)	57 (21.0%)	95 (35.1%)	76 (28.0%)	18 (6.6%)
I'm afraid of injecting myself with a needle	37 (13.7%)	82 (30.3%)	40 (14.8%)	85 (31.4%)	27 (31.4%)
Taking insulin increases the risk of low blood glucose level (hypoglycemia)	17 (6.3%)	78 (28.8%)	101 (37.3%)	56 (20.7%)	19 (7.0%)
Taking insulin helps to improve my health	32 (11.8%)	117 (43.2%)	72 (26.6%)	44 (16.2%)	6 (2.2%)
Insulin causes weight gain	4 (1.5%)	29 (10.7%)	152 (56.1%)	71 (26.2%)	15 (5.5%)
Managing insulin injection takes a lot of time and energy	20 (7.4%)	82 (30.3%)	68 (25.1%)	85 (31.4%)	16 (5.9%)
Taking insulin means I have to give up activities I enjoy	25 (9.2%)	73 (26.9%)	102 (37.6%)	62 (22.9%)	9 (3.3%)
Taking insulin means my health will deteriorate	7 (2.6%)	43 (15.9%)	62 (22.9%)	71 (26.2%)	88 (32.5%)
Injecting insulin is embarrassing	21 (7.7%)	40 (14.8%)	57 (21.0%)	121 (44.6%)	32 (11.8%)
Injecting insulin is painful	28 (10.3%)	92 (33.9%)	37 (13.7%)	99 (36.5%	15 (5.5%)

Variable	S. agree	Agree	Agree nor Disagree	Disagree	S. disagree
It's difficult to inject the right amount of insulin correctly at a tight time every day	109 (40.2%)	98 (36.2%)	31 (11.4%)	24 (8.9%)	9 (3.3%)
Taking insulin makes it more difficult to fulfill my responsibilities (at work/home	24 (8.9%)	70 (25.8%)	87 (32.1%)	78 (28.8%)	12 (4.4%)
Taking insulin helps to maintain good control of blood glucose	38 (14.0%)	125 (46.1%)	72 (26.6%)	34 (12.5%)	2 (.7%)
Being on insulin causes family and friends to be more concerned about me	70 (25.8%)	69 (25.5%)	63 (23.2%)	60 (22.1%)	9 (3.3%)
Taking insulin helps to improve my energy level	15 (5.5%)	127 (46.9%)	70 (25.8%)	48 (17.7%)	11 (4.1%)
Taking insulin makes me more dependent on others	45 (16.6%)	70 (25.8%)	35 (12.9%)	62 (22.9%)	59 (21.8%)

Table 6. *Summary of Insulin Attitude score of the respondents (n=271).*

	Frequency	Percent
Negative Attitude	102	37.6
Positive Attitude	169	62.4

By forming a summary indicator for the Insulin Attitude level of the respondents as described in the Methodology section, the finding on the level of Insulin Attitude is 102 (37.6%) had a negative attitude, 169 (62.4%) had a positive attitude.

3.5. DM Knowledge

Regarding DM knowledge, above half of the respondents [182(67.2%)] defined DM as a raised blood sugar level only, while [66(24.4%)] defined DM as a disease that can affect any part of the body. The majority of them knew that DM can be detected through blood examination [198(73.1%)] or by urine examination [55(20.3%)]. In terms of knowledge on symptoms of poorly controlled DM, passing lots of urine and excessive thirst were reported by most; 47.2% and 32.1% respectively. Hunger, nervousness, dizziness, light-headedness, and sleepiness were reported as symptoms of hypoglycemia by 25.5%, 31.4%, 31.7%, and 10.7% respectively. As for lifestyle modification, more than half of the patients (52.8%) responded that dietary modification helps to control DM, followed by exercise (41%) and weight reduction (6.3%). Almost all of the respondents [228 (84.1%)] knew that controlling blood glucose levels is important for reducing DM-related complications. Above half of the respondents, 157(57.9%), knew about HgbA1C. About 106(39.1%), 111(41%), and 27(10%) of participants explained how diabetic patients should measure their blood glucose levels weekly, monthly, and daily respectively, with another 27(10%) saying every six months. In terms of the best method for home glucose monitoring, the majority of the respondents 209 (77.1%) believed urine is the best way. Above half, 106 (39.1%) of the participants were not aware that insulin was mandatory for T2DM at some point in the disease course. (Table 5)

Table 7. *DM knowledge.*

Variable	Frequency	Percent
What is DM		
DM is a raised blood sugar level only	182	67.2
DM is a disease which can affect any part of the body	66	24.4
I don't know	23	8.5
DM can be detected through		
Blood examination	198	73.1
Urine examination	55	20.3

Variable	Frequency	Percent
Don't know	18	6.6
Do you know the symptoms of poorly controlled DM?		
Passing lots of urine	128	47.2
Excessive thirst	87	32.1
Tiredness	36	13.3
Weight loss	13	4.8
Don't know	7	2.6
What are the symptoms of hypoglycemia?		
Hunger	69	25.5
Nervousness	85	31.4
Dizziness and lightheadedness	86	31.7
Sleepiness	29	10.7
Don't know	2	.7
What type of lifestyle modification do you think will help the control of DM?		
Exercise	111	41.0
Dietary modification	143	52.8
Weight reduction	17	6.3
Controlling blood glucose levels is important for reducing DM-related complications		
True	228	84.1
False	17	6.3
Don't know	26	9.6
Do you know about hgba1c		
Yes	157	57.9
No	114	42.1
How frequently should a diabetic patient measure his/her glucose level?		
Daily	27	10.0
Weekly	106	39.1
Monthly	111	41.0
Every six month	27	10.0
Which is the best method for home glucose		
Blood	9	3.3
Urine	209	77.1
Don’t know	53	19.6
Are you aware that insulin is mandatory for T2DM at some point?		
Yes	165	60.9
No	106	39.1

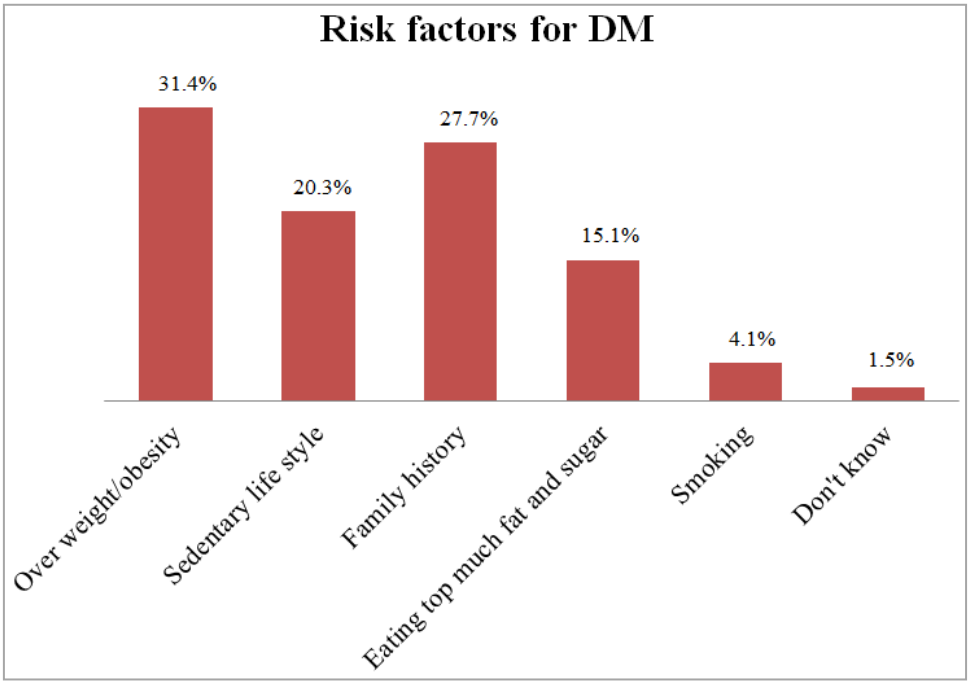

Figure 5. Risk factors for DM.

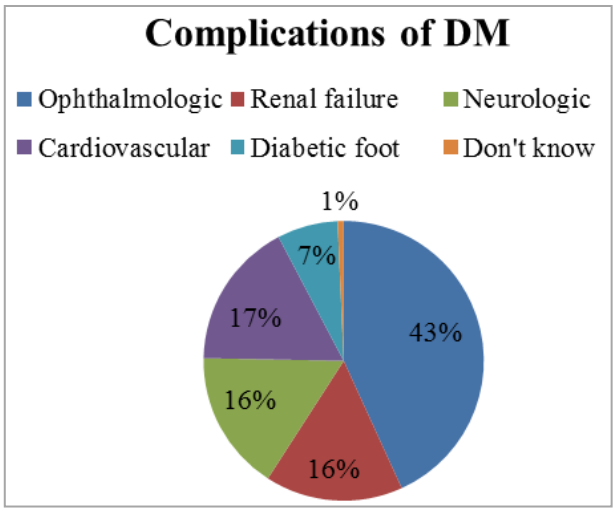

Figure 6. Complications of DM.

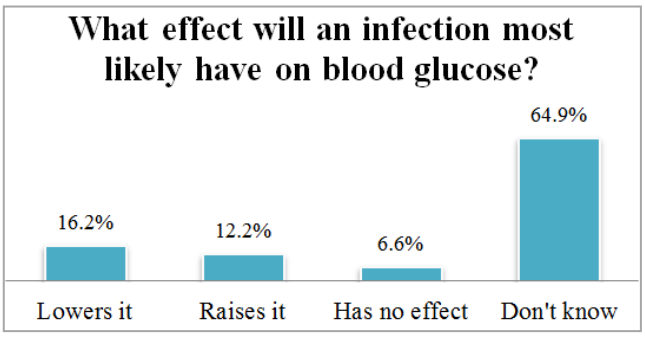

Figure 7. Effect of infection on blood glucose level.

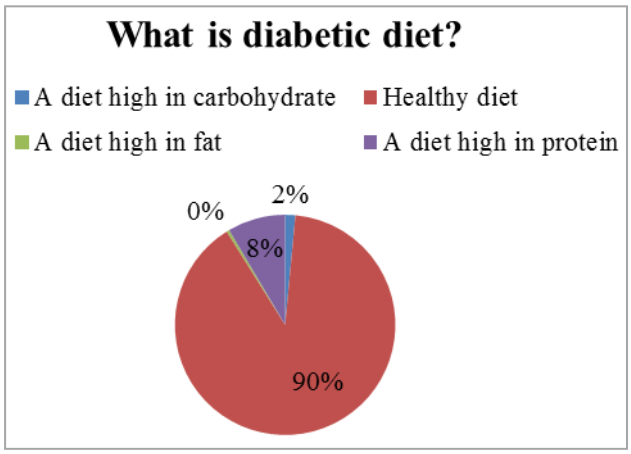

Figure 8. What a diabetic diet is.

By forming a summary indicator for the DM knowledge level of the respondents as described in the Methodology section, 167 (61.6%) had good DM knowledge, and 104 (38.4%) had poor knowledge about DM.

Table 8. Summary of DM knowledge score of the respondents (n=271).

	Frequency	Percent
Good knowledge	167	61.6
Poor knowledge	104	38.4

3.6. Factors Affecting Insulin Knowledge Using Multivariable Analysis

By using a multivariable model and binary logistic regression, the independent or net effect of each of the explanatory factors affecting insulin knowledge was assessed. The final result of this study confirmed that age, occupation, and duration of OAD use were significantly associated with insulin knowledge in T2 DM patients.

Age was identified as one of the major factors affecting insulin knowledge. The results confirmed that patients who were between 56 and 65 years of age were 94.9% less likely to have insulin knowledge than patients who were aged 45 years and below [AOR=.051; 95% CI(.004,.732)]. Occupation was another associated factor; patients who were merchants were 83 times more likely to have insulin knowledge than those who were employed [AOR=83,212; 95%CI (1.921, 3603.823)]. The duration of a patient's OAD use was also an associated factor. Patients who had been taking OADs for 3-5 years were 7 times more likely to have insulin knowledge than patients who had used the medications for less than 3 years [AOR=7,227; 95%CI (1,561, 33,464)].

Table 9. *Factors affecting Insulin knowledge using multivariable analysis.*

Variables		Knowledge of Insulin Model 1	
	n	P-value	AOR 95%CI
Age			
45 &below	47	.031*	1 (R)
46-55	76	.005*	.015 (.001,.285)
56-65	85	.029*	.051 (.004,.732)
Above 65	63	.072	.103 (.009, 1.221)
Sex			
Male	134		1 (R)
Female	137	.550	1.506 (.393, 5.779)
Residency			
Urban	231		1 (R)
Rural	40	.997	.000 (.000)
Marital status			
Married	181	.735	1 (R)
Widowed	37	.642	.580 (.058, 5.768)
Single	37	.749	1.572 (.099, 25.044)
Divorced	16	.884	.823 (.060, 11.326)
Income			
<1000	57	.315	1 (R)
1000-3000	97	.903	.855 (.069, 10.612)
>3000	117	.247	3.096 (.456, 21.021)
Occupation			
Employed	55	.070	1 (R)
Unemployed	40	.858	.787 (.056, 10.992)
Farmer	13	.745	1.557 (.108, 22.507)
Daily laborer	39	.693	2.072 (.055, 77.424)
Merchant	74	.021*	83.212 (1.921, 3603.823)

Variables		Knowledge of Insulin Model 1	
	n	P-value	AOR 95%CI
Retired	9	.355	3.198 (.272, 37.561)
Other	41	.999	30204655.138 (.000)
Educational level			
Illiterate	21	.385	1 (R)
Read and write	42	.998	8603684.196 (.000)
Literate	71	.282	.277 (.027, 2.871)
Primary school	44	.462	.472 (.064, 3.494)
Secondary school	93	.056	.152 (.022, 1.048)
Duration of DM			
<5yrs	82	.339	1 (R)
5-10yrs	109	.551	2.339 (.144, 38.049)
>10yrs	80	.142	2.692 (.719, 10.078)
Complications of DM			
Ophthalmologic	117	.240	1 (R)
Renal failure	43	1.000	16754178.241 (.000)
Neurologic	44	1.000	11659548.937 (.000)
Cardiovascular	46	1.000	14800764.571 (.000)
Diabetic foot ulcer	19	1.000	81166411.411 (.000)
Don’t know	2	1.000	3675091.924 (.000)
For how long been on this medication			
<3yrs	64	.040*	1 (R)
3-5yrs	54	.011*	7.227 (1.561, 33.464)
>5yrs	153	.171	2.426 (.682, 8.631)
Family hx of insulin use			
Yes	75		1 (R)
No	196	.220	.472 (.142, 1.566)
Member of EDA			
Yes	81		1 (R)
No	190	.094	.376 (.120, 1.180)
DM knowledge			
Good knowledge	167		1 (R)
Poor knowledge	104	.108	.310 (.074, 1.295)

*Statistically significant at p-value<0.05

3.7. Factors Affecting Insulin Attitude Using Multivariable Analysis

By using a multivariable model and binary logistic regression, the independent or net effect of each of the explanatory factors affecting insulin knowledge was assessed. The final result of this study's analysis confirmed that age, marital status, occupation, length of OAD use, and family history of insulin use were significantly associated with the insulin attitude of type 2 DM patients.

Age was identified as one of the major factors associated with insulin attitude. The results confirmed that patients who were between 46 and 55 years old were 79% less likely to have a positive attitude towards insulin than patients who were aged 45 years and below [AOR=.210; 95% CI (.050,.878)].

Marital status is also a factor. Single patients are 90.4% less likely to have a positive attitude towards insulin than married patients [AOR=.096; 95%CI (.011,.816)].

Occupation was another associated factor. Patients who were farmers were 82.2% less likely to have a positive attitude towards insulin than those who were employed [AOR=.178; 95%CI (.034,.937)].

Long-term OAD use was also an associated factor. Patients who have been taking OADs for 3-5 years were 7 times more likely to have a positive attitude towards insulin than patients who have been using the medications for less than 3 years [AOR=7,227; 95%CI (1,561, 33,464)].

The last associated factor was a family history of insulin use. Patients who did not have a family history of insulin use were 75.6% less likely to have a positive insulin attitude than patients who did have a family history of insulin use [AOR=.244; 95%CI (.104,.569)].

Table 10. *Factors affecting Insulin Attitude using multivariable analysis.*

Variables		Attitude of Insulin Model 2	
	n	P-value	AOR 95%CI
Age			
45 &below	47	.155	1 (R)
46-55	76	.033*	.210 (.050,.878)
56-65	85	.091	.329 (.091, 1.194)
Above 65	63	.297	.535 (.165, 1.734)
Sex			
Male	134		
Female	137	.577	.793 (.351, 1.792)
Residency			
Urban	231		1 (R)
Rural	40	.146	.291 (.055, 1.536)
Marital status			
Married	181	.075	1 (R)
Widowed	37	.036*	.142 (.023,.883)
Single	37	.032*	.096 (.011,.816)
Divorced	16	.416	.423 (.053, 3.360)
Income			
<1000	57	.189	1 (R)
1000-3000	97	.256	.374 (.069, 2.042)
>3000	117	.068	.309 (.087, 1.090)
Occupation			

Variables		Attitude of Insulin Model 2	
	n	P-value	AOR 95%CI
Employed	55	.482	1 (R)
Unemployed	40	.086	.230 (.043, 1.229)
Farmer	13	.042*	.178 (.034,.937)
Daily laborer	39	.676	.515 (.023, 11.578)
Merchant	74	.099	.165 (.020, 1.404)
Retired	9	.113	.332 (.085, 1.298)
Other	41	.085	.085 (.005, 1.406)
Educational level			
Illiterate	21	.595	1 (R)
Read and write	42	.464	2.428 (.225, 26.144)
Literate	71	.134	3.676 (.670, 20.153)
Primary school	44	.335	1.918 (.510, 7.208)
Secondary school	93	.712	1.297 (.327, 5.146)
Duration of DM			
<5yrs	82	.275	1 (R)
5-10yrs	109	.233	2.611 (.539, 12.645)
>10yrs	80	.120	2.105 (.823, 5.388)
Complications of DM			
Ophthalmologic	117	.161	1 (R)
Renal failure	43	1.000	.000 (.000)
Neurologic	44	1.000	.000 (.000)
Cardiovascular	46	1.000	.000 (.000)
Diabetic foot ulcer	19	1.000	000 (.000)
Don’t know	2	1.000	000 (.000)
For how long been on this medication			
<3yrs	64	.040*	1 (R)
3-5yrs	54	.011*	7.227 (1.561, 33.464)
>5yrs	153	.171	2.426 (.682, 8.631)
Family hx of insulin use			
Yes	75		1 (R)
No	196	.001*	.244 (.104,.569)
Member of EDA			
Yes	81		1 (R)
No	190	.083	2.064 (.909, 4.687)
DM knowledge			
Good knowledge	167		1 (R)

Variables		Attitude of Insulin Model 2	
	n	P-value	AOR 95%CI
Poor knowledge	104	.074	.467 (.203, 1.076)

*Statistically significant at p-value<0.05

4. Discussion

Diabetes mellitus (DM) is a chronic metabolic disorder that shares the phenotype of hyperglycemia. It has long-term consequences that drastically impact the health of people around the world. A cross-sectional study was conducted to assess the knowledge and attitude toward insulin therapy in T2DM among diabetic patients on follow-up at SPHMMC.

In this study, more than half of the patients (67.2%) believed that DM only raises blood glucose levels, and 8.3% of the participants didn't even know the definition of DM. This is similar to the study done at Felegehiwot Referral Hospital, where more than half of the patients didn't know the definition of DM. Patients with T2DM had disproportionately poor knowledge compared to T1DM patients. However, in contrast to this study, where more than half of the patients were found to have poor DM knowledge, our study found that 61.6% of the participants had good DM knowledge [19]. This difference may be due to a difference in sample size.

Regarding insulin knowledge, 85.6% of the participants had poor knowledge. This is similar to the study done in Cyprus, where 82.5% of the participants were found to have poor insulin knowledge [20]. In this study, age, occupation, and duration of OADs used were found to be significantly associated with the insulin knowledge of type 2 DM patients. Individuals who are younger than 45 years, merchants, and those who took OADs for more than 3-5 years had better insulin knowledge. This is similar to the study done in India, where individuals with a higher educational level, better economic class, longer duration of DM (> 10 years), and OAD use for > 3 years were found to have better insulin knowledge [21].

In this study, the prevalence of PIR was found to be 37.6%, which was similar to the prevalence found in Egypt (40%) [22]. Similar to the study done in Pakistan, this study found that a lack of basic knowledge regarding DM and insulin therapy was associated with high PIR, while knowledge about the method of insulin injection was not a significant factor [3]. This is in contrast to Nam et al., who found no association between PIR and DM knowledge and attitude [23]. In this study, age, marital status, occupation, length of OAD use, and family history of insulin use were significantly associated with the insulin attitude of T2DM patients, with younger age, being married, being traders, and those with a positive family history of insulin use having a more positive attitude towards insulin. This is in contrast to the Kenyan study, where a family history of insulin use was not found to be associated with insulin attitude [24]. Personal failure, perceived disease severity, difficulty in taking the correct amount of insulin at the correct time, fear of pain, and fear of injection were reported by participants as major barriers to insulin in our study, being reported in 55.4%, 30.3%, 36.2%, 33.9%, and 23.6% respectively. This is similar to the studies done in Pakistan and Egypt, where perceived personal failure, loss of self-autonomy, perceived illness severity, and restriction in diet and lifestyle were reported by participants as major barriers to insulin use [3, 7]. Fear of hypoglycemia and fear of weight gain were reported by 28.8% and 10.7% of participants respectively. Similar to the study in Kenya, where 17.4% of individuals reported fear that insulin use will make their health worse [24]; in our study, also 15.9% of individuals stated fear of health deterioration as a barrier to acceptance of insulin.

5. Strength and Limitations

5.1. Strength of the Study

The major strengths of this study are that it is an institutional-based study with a random selection of the study population, as well as the study samples were directly selected from the targeted population. These may make generalization possible. The data were collected by the department's health professionals so it gives the advantage of keeping the quality of data.

5.2. Limitation

The study was conducted solely among the diabetic outpatient clinics of SPHMMC (a university referral hospital). This may not represent the current type two diabetic patients in private and other public hospitals, thus it may not be generalizable to the overall population of diabetics. Additionally, due to the nature of the study, it was challenging to establish a cause-and-effect relationship between the dependent and independent variables. Furthermore, the study did not assess other factors for PIR (provider and healthcare-related factors), which are also significant contributors to PIR.

6. Conclusion and Recommendation

This study concluded that approximately 85.6% of respondents had poor knowledge about insulin, and 37.6% had negative attitudes towards it. Meanwhile, 61.6% demonstrated good knowledge regarding diabetes mellitus. Additionally, the current study revealed that factors such as age, occupation, and prolonged OAD use were significantly associated with both the knowledge and attitude of patients toward insulin. In contrast, a family history of insulin use and marital status were specifically associated with attitudes towards insulin.

In general, this cross-sectional study found poor knowledge about insulin but relatively good attitudes towards it. Therefore, a structured, regular health education program should be implemented for diabetic patients on follow-up at SPHMMC. This program, conducted by trained health professionals, aims to foster positive behavioral change, improve knowledge levels, and further enhance the attitudes of DM patients. DM teaching pamphlets in different languages should be made available for patients to take home, especially as appointments are often prolonged.

Every clinician caring for diabetic patients must acknowledge, address, and alleviate these factors to achieve optimal success with insulin therapy. There should be periodic assessments of knowledge and attitudes on diabetes care among diabetic patients on follow-up. Educational interventions designed to make initiating therapy easier should enhance awareness of insulin efficacy and the role of insulin therapy in T2DM.

Last but not least, providers seeking to facilitate the initiation of insulin therapy should avoid using insulin as a threat to encourage more active self-care. They should identify and address the specific beliefs that support an individual patient's resistance to insulin therapy.

More research that can demonstrate cause-and-effect links between dependent and independent factors should be carried out in light of the limitations of this study. Community members, patients from other hospitals, and private clinics should all be included in this research.

Abbreviations

T2DM: Type 2 Diabetes Mellitus
GDM: Gestational Diabetes Mellitus
WHO: World Health Organization
NCD: Non-Communicable Disease
MI: Myocardial Infarction
OADs: Oral Anti-Diabetics
HbA1C: Glycated Hemoglobin
CVD: Cardiovascular Disease
IDF: International Diabetic Federation
SPHMMC: Saint Paul Hospital Millennium Medical College
SPSS: Statistical Package for Social Sciences
IGT: Impaired Glucose Tolerance
ITAS: Insulin Treatment Appraisal Scale
ADA: American Diabetic Association
AACE: American Association of Clinical Endocrinologists
GDP: Gross Domestic Product
ESRD: End Stage Renal Disease
PIR: Psychological Insulin Resistance
EDA: Ethiopian Diabetic Associations
HCPs: Health Care Providers

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Institutional Review Board Statement

The study was conducted according to the guidelines of the Declaration of Helsinki (2013 version) and was approved by the Ethical Committee of SPHMMC.

Author Contributions

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Robel Habtamu Ababiya: Conceptualization, Software, Writing - original draft, Project administration
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Tsion Habtamu Ababiya: Formal Analysis, Funding acquisition, Validation
Lijalem Abera Tema: Validation, Investigation, Visualization
Bemnet Gossaye Teka: Writing - original draft, Writing - review & editing
Bezaye Lemma Deregasso: Data curation, Supervision, Methodology
Dereje Kebede Shane: Data curation, Funding acquisition, Validation
Hundaol Shiferaw Bekele: Writing - original draft, Writing - review & editing
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Data Availability Statement

The dataset used and analyzed during this study is available

from the corresponding author upon reasonable request.

Conflicts of Interests

The authors disclose no conflicts of interest.

References

[1] Atlas IDFD. (2019). IDF 2019. Retrieved from http://www.diabetesatlas.org/en/

[2] World Health Organization. (n.d.). Global report on Diabetes. Retrieved from http://www.who.int

[3] Muhammad, S., Shah, A., Butt, Z., & Hussain, K. (2017). Factors Leading to Psychological Insulin Resistance Among Patients with Type 2 Diabetes Mellitus. Annals of Pakistan Institute of Medical Sciences, 226-230.

[4] Khunti, S., Davies, M. J., & Khunti, K. (2015). Clinical inertia in the management of type 2 diabetes mellitus: A focused literature review. British Journal of Diabetes & Vascular Disease, 15(2), 65-69.

[5] van Bruggen, R., Gorter, K., Stolk, R., Klungel, O., & Rutten, G. (2009). Clinical inertia in general practice: Widespread and related to the outcome of diabetes care. Family Practice, 26(6), 428-436.

[6] Gherman, A. (2011). Psychological insulin resistance: a critical review of the literature. Practical Diabetes International. Retrieved from Wiley Online Library.

[7] Haque, M., Navsa, M., Emerson, S. H., Dennison, C. R., & Levitt, N. S. (2005). Barriers to initiating insulin therapy in patients with type 2 diabetes mellitus in public-sector primary health care centers in Cape Town. Journal of Endocrinology, Metabolism and Diabetes of South Africa, 10(3), 94–99.

[8] Peyrot, M., Rubin, R. R., Lauritzen, T., Skovlund, S. E., Snoek, F. J., Matthews, D. R., & others. (2005). Resistance to insulin therapy among patients and providers: Results of the cross-national Diabetes Attitudes, Wishes, and Needs (DAWN) study. Diabetes Care, 28(11), 2673–2679.

[9] Tan, A. M., Muthusamy, L., Ng, C. C., Phoon, K. Y., Ow, J. H., & Tan, N. C. (2011). Initiation of insulin for type 2 diabetes mellitus patients: What are the issues? A qualitative study. Singapore Medical Journal, 52(11), 801–809.

[10] Woudenberg, Y. J. C., Lucas, C., Latour, C., & Scholte Op Reimer, W. J. M. (2012). Acceptance of insulin therapy: A long shot? Psychological insulin resistance in primary care. Diabetic Medicine, 29(6), 796–802.

[11] Abu Hassan, H., Tohid, H., Mohd Amin, R., Long Bidin, M. B., Muthupalaniappen, L., & Omar, K. (2013). Factors influencing insulin acceptance among type 2 diabetes mellitus patients in a primary care clinic: A qualitative exploration. BMC Family Practice, 14.

[12] Reach, G., Pechtner, V., Gentilella, R., Corcos, A., & Ceriello, A. (2017). Clinical inertia and its impact on treatment intensification in people with type 2 diabetes mellitus. Diabetes & Metabolism, 43(6), 501–511. Available from: http://dx.doi.org/10.1016/j.diabet.2017.06.003

[13] Ellis, K., Mulnier, H., & Forbes, A. (2018). Perceptions of insulin use in type 2 diabetes in primary care: A thematic synthesis. BMC Family Practice, 19(1), 1–21.

[14] Lee, K. P. (2015). Psychosocial factors associated with psychological insulin resistance in primary care patients in Hong Kong. Journal of Clinical Translational Endocrinology, 2(4), 157–162. Available from: http://dx.doi.org/10.1016/j.jcte.2015.10.001

[15] Matthew, C. R., et al. (2020). Standards of Medical Care in Diabetes 2020 ADA. American Diabetes Association, 42(479), 960–1010. Available from: https://care.diabetesjournals.org/content/diacare/suppl/2019/12/20/43.Supplement_1.DC1/Standards_of_Care_2020.pdf

[16] Snoek, F. J., Skovlund, S. E., & Pouwer, F. (2007, December 20). Development and validation of the insulin treatment appraisal scale (ITAS) in patients with type 2 diabetes. Health and Quality of Life Outcomes.

[17] Rita, S. L., Lubaki, F. J. P., Bompeka, L. F., Ogunbanjo, G. A., & Ngwala, L. P. (2019). Prevalence and determinants of psychological insulin resistance among type 2 diabetic patients in Kinshasa, Democratic Republic of Congo. African Journal of Primary Health Care & Family Medicine, 11(1), 1–5.

[18] Fitzgerald, J. T., Funnell, M. M., Anderson, R. M., Nwankwo, R., Stansfield, R. B., & Piatt, G. A. (2016). Validation of the Revised Brief Diabetes Knowledge Test (DKT2). Diabetes Educator, 42(2), 178-187. https://doi.org/10.1177/0145721715624968

[19] Feleke, S. A. (2013). Assessment of the Level and Associated Factors with Knowledge and Practice of Diabetes Mellitus among Diabetic Patients Attending at FelegeHiwot Hospital, Northwest Ethiopia. Clinical Medical Research, 2(6), 110.

[20] Yilmaz, Ü. D., & Tarhan, S. (2017). Determination of attitude and knowledge of type 2 diabetic patients towards insulin therapy in northern Cyprus. Journal of Pakistan Medical Association, 67(3), 343–349.

[21] Choudhury, S., Das, S., & Hazra, A. (2014). Survey of knowledge-attitude-practice concerning insulin use in adult diabetic patients in eastern India. Indian Journal of Pharmacology, 46, 425–429.

[22] Lele, R. D. (2015). Psychological insulin resistance in patients with type 2 diabetes mellitus. Journal of Association of Physicians of India, 63(OCTOBER 2015), 94.

[23] Nam, S., Nam, S., & Song, Y. (2015). Role of Self-Efficacy in the Relationship Between Patient-Provider Relationships and Psychological Insulin Resistance Among Patients with Type 2 Diabetes. Journal of Contemporary Diabetes Research, 1(1), 1–15. Available from: http://www.ncbi.nlm.nih.gov/pubmed/25584361%0Ahttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC4288822

[24] Gulam, A. H., CF Otieno, F., & Oyoo, G. O. (2017). Prevalence of Psychological Insulin Resistance among Patients with Type 2 Diabetes at Kenyatta National Hospital, Kenya. Health Science Journal, 11.