Original Research Article

ASSIGNMENT OF KNOWLEDGE, COMPLICATIONS, AND SELF ADMINISTRATION OF INSULIN AMONG DIABETIC PATIENTS

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Abstract: *Insulin self-administration is a cornerstone of diabetes management, yet many patients face challenges due to knowledge deficits and improper practices.* **Objective:** *This study assesses the knowledge, practices, and barriers related to insulin self-administration among diabetic patients attending a tertiary care clinic in Pakistan.* **Methods:** *A descriptive cross-sectional study was conducted at Johar Poly Clinic, Lahore, with 130 diabetic patients recruited using convenience sampling. Data were collected through a structured questionnaire assessing demographics, knowledge, practices, and complications related to insulin use. Descriptive and inferential analyses were performed using SPSS version 25.0.* **Results:** *The mean age of participants was 44.8 years, with 56.2% being female. Knowledge gaps were observed, with only 55.4% of participants understanding the rationale for site rotation to prevent lipodystrophy, and 53.1% knowing the correct injection angle. Practices were similarly suboptimal, with only 34.6% consistently performing handwashing and 35.4% regularly monitoring blood glucose. Complications such as lipodystrophy (46.9%) and insulin resistance (52.3%) were prevalent. Major barriers included psychological issues, lack of education, and socioeconomic constraints.* **Conclusion:** *Significant gaps in knowledge and practices of insulin self-administration exist among diabetic patients, leading to adverse outcomes. Tailored educational interventions and innovative approaches, such as technology-driven training, are urgently needed to improve patient adherence and reduce complications.*

Keywords: Diabetes Mellitus, Insulin Self-Administration, Knowledge Gaps, Patient Education, Lipodystrophy, Glycemic Control

Introduction

Diabetes mellitus is a global health challenge, characterized by chronic hyperglycemia resulting from defects in insulin secretion, action, or both. The increasing prevalence of diabetes necessitates effective management strategies to prevent complications and improve quality of life. Insulin therapy remains a cornerstone for managing both Type 1 diabetes and advanced Type 2 diabetes, where oral hypoglycemic agents fail to achieve glycemic control. However, self-administration of insulin requires a nuanced understanding of various factors, including types of insulin, dosing regimens, injection techniques, and storage requirements, making patient education a critical component of diabetes management.

Effective self-administration of insulin is essential for achieving glycemic targets and preventing complications such as neuropathy, retinopathy, nephropathy, and cardiovascular disease. Despite its importance, studies highlight significant knowledge gaps among patients regarding proper insulin use, leading to suboptimal adherence and poor glycemic control. Inadequate understanding of injection techniques, site rotation, and dose adjustments can result in complications such as hypoglycemia, lipodystrophy, and insulin resistance, further complicating diabetes management (1-3).

Educational interventions tailored to patients' needs are pivotal in addressing these knowledge gaps. Programs focusing on insulin administration techniques, the importance of blood glucose monitoring, and the management of hypoglycemia have demonstrated improved patient outcomes in various settings (4, 5). However, barriers such as needle fear, lack of resources, and socio-cultural factors often hinder the effectiveness of these interventions, particularly in resource-limited settings (6, 7). Pakistan faces a growing diabetes burden, with limited healthcare resources and low health literacy levels exacerbating the challenge of effective diabetes management. Understanding patients' knowledge regarding insulin self-administration is crucial for designing targeted educational programs that can empower patients to take control of their condition and reduce the burden on healthcare systems. By assessing these knowledge levels, this study aims to identify gaps and barriers, paving the way for enhanced education and improved self-care practices among diabetic patients.

This study investigates the knowledge and practices of diabetic patients regarding the self-administration of insulin. The findings are expected to guide healthcare professionals in developing evidence-based strategies for patient education and support, ultimately improving glycemic outcomes and reducing diabetes-related complications.

Methodology

This study employed a descriptive cross-sectional design to assess the knowledge and practices related to the self-administration of insulin among diabetic patients. Conducted at Johar Poly Clinic, Lahore, the research leveraged a diverse patient population that provided an opportunity to evaluate a wide range of insulin administration practices across various educational and socioeconomic backgrounds. The inclusion of patients actively engaged in self-administering insulin ensured that

the findings were both relevant and applicable to real-world diabetes management scenarios.

A total of 130 diabetic patients participated in the study. This sample size was calculated to achieve a confidence level of 95% with a 5% margin of error. Non-probability convenience sampling was used, enabling the efficient recruitment of patients attending the clinic for routine care. Participants were required to meet specific inclusion criteria, including being aged 18 years or older, having a clinical diagnosis of Type 1 or Type 2 diabetes, and currently managing their diabetes through self-administration of insulin. They also needed to have visited the clinic at least twice in the past six months to ensure familiarity with the study setting. Patients managing diabetes without insulin, those recently diagnosed within the last three months, individuals with significant cognitive impairments, and those unable to communicate in the local language were excluded. Pregnant women were also excluded due to their unique insulin requirements and medical considerations during pregnancy.

Data collection was facilitated through a structured questionnaire designed to capture demographic details, diabetes history, knowledge of insulin self-administration, and related practices. The questionnaire was pre-tested on a subset of patients to ensure clarity and reliability, and it included a combination of multiple-choice questions and Likert-scale items. These questions assessed participants' understanding of insulin types, injection techniques, storage requirements, and the rationale for practices such as site rotation and blood glucose monitoring. The questionnaire also explored barriers to proper insulin use and complications associated with therapy, such as lipodystrophy and low blood sugar.

Trained research assistants administered the questionnaires during patients' routine clinic visits, providing assistance to those who faced difficulties in understanding or reading the questions. Written informed consent was obtained from all participants after they were informed about the study's objectives and assured of confidentiality. To ensure robust analysis, the collected data were entered into IBM SPSS (version 25.0). Descriptive statistics, including frequencies, percentages, means, and standard deviations, summarized the demographic and clinical characteristics of the participants as well as their knowledge and practices. Inferential statistics, specifically chi-square tests, were used to assess the relationships between demographic variables and knowledge or practices, with statistical significance set at a p-value of less than 0.05.

Ethical approval for the study was obtained from the Ethics Committee of Johar Poly Clinic. Participants were assured that their confidentiality would be maintained, and no identifying information was collected. Participation was entirely voluntary, and patients were informed that they could withdraw from the study at any time without any consequences to their ongoing medical care. This ethical framework ensured adherence to international standards for research involving human subjects, providing a reliable foundation for assessing knowledge and practices related to insulin self-administration.

Results

The study included 130 participants, with a mean age of 44.8 years (SD: 16.2). More than half were female (56.2%), and the majority had secondary or higher secondary education (70.8%). Table 1 summarizes the demographic characteristics. (Table 1)

The duration of diabetes varied among participants, with 26.9% having diabetes for over 20 years. Similarly, the duration of insulin therapy ranged from three months to over five years. Family history of diabetes was reported by 53.8% of participants, while 50% had first-degree relatives with diabetes. Table 2 presents diabetes-related characteristics. (Table 2)

Participants' knowledge of insulin self-administration varied significantly. Awareness of injection site rotation to prevent lipodystrophy was 55.4%. Only 53.1% of participants knew the correct angle for insulin administration, and 51.5% understood the recommended distance for rotating injection sites. Table 3 highlights these findings. (Table 3)

Participants reported varied practices in insulin administration. While 34.6% consistently performed handwashing before administering insulin, a significant number (38.5%) did so intermittently, and 26.9% never did. Blood glucose monitoring before and after insulin use was consistently practiced by 35.4% of participants. Table 4 presents a detailed breakdown.

The abdomen (27.7%) and thigh (23.1%) were the most common injection sites reported by participants. A notable 25.4% used the buttock, and 23.8% used the upper arm. Regarding injection techniques, only 43.1% of participants dried alcohol wipe sites correctly before administering insulin. Table 5 summarizes these practices.

Complications associated with insulin therapy included low blood sugar (47.7%), lipodystrophy (46.9%), and insulin allergy or resistance (52.3%). Psychological barriers, such as fear of needles, and economic constraints were common barriers to adherence. Table 6 provides details.

The most common source of diabetes-related information was healthcare personnel (23.8%), followed by relatives (16.2%) and mass media (15.4%). A significant portion (16.2%) reported receiving information from multiple sources, including health professionals and relatives. Table 7 summarizes the data.

Table 1. Demographic Characteristics of Study Participants (n = 130)

Variable	Categories	Frequency (n)	Percentage (%)
Gender	Male	57	43.8
	Female	73	56.2
Educational Level	Primary	38	29.2
	Secondary	47	36.2
	Higher Secondary & Above	45	34.6

Marital Status	Unmarried	41	31.5
	Married	24	18.5
	Divorced	35	26.9
	Widow	30	23.1
Occupational Status	Homemaker	27	20.8
	Agriculture/Labor	23	17.7
	Business	26	20.0
	Service	25	19.2
	Others	29	22.3

Table 2. Diabetes-Related Characteristics of Participants (n = 130)

Variable	Categories	Frequency (n)	Percentage (%)
Duration of Diabetes	< 1 Year	34	26.2
	1–10 Years	34	26.2
	10–20 Years	27	20.8
	> 20 Years	35	26.9
Family History of Diabetes	Yes	70	53.8
	No	60	46.2
Relationship with Diabetic Person	First Degree Relative	65	50.0
	Second Degree Relative	65	50.0

Table 3. Knowledge about Insulin Self-Administration (n = 130)

Knowledge Aspect	Correct Response (n)	Percentage (%)
Rationale for Site Rotation (Prevent Lipodystrophy)	72	55.4
Correct Angle for Administration	69	53.1
Distance for Site Rotation	67	51.5
Rolling Vial Before Use	71	54.6
Avoiding Shaking Insulin	52	40.0

Table 4. Practices Related to Insulin Administration (n = 130)

Practice	Always (%)	Sometimes (%)	Never (%)
Handwashing Before Administration	34.6	38.5	26.9
Monitoring Blood Glucose Pre/Post-Administration	35.4	38.5	26.2
Rolling Insulin Vial Before Use	54.6	-	45.4
Observing Insulin Characteristics	30.0	40.8	29.2
Checking Device for Damage	35.4	37.7	26.9

Table 5. Preferred Injection Sites and Techniques (n = 130)

Injection Site	Frequency (n)	Percentage (%)
Abdomen	36	27.7
Thigh	30	23.1
Upper Arm	31	23.8
Buttock	33	25.4
Technique	Correct Practice (n)	Percentage (%)
Drying Alcohol Wipe Sites Before Administration	56	43.1
Avoiding Injection in Swelling/Scarred Areas	68	52.3

Table 6. Complications Associated With Insulin Therapy (n = 130)

Complication	Frequency (n)	Percentage (%)
Low Blood Sugar	62	47.7
Lipodystrophy	61	46.9
Insulin Allergy/Resistance	68	52.3

Table 7. Sources of Diabetes Information among Participants (n = 130)

Information Source	Frequency (n)	Percentage (%)
Mass Media	20	15.4
Health Personnel	31	23.8
Relatives	21	16.2
Mass Media and Relatives	15	11.5
Health Personnel and Relatives	22	16.9
Mass Media, Health Personnel, and Relatives	21	16.2

Discussion

The findings of this study reveal significant gaps in the knowledge and practices of diabetic patients regarding insulin self-administration, emphasizing the need for targeted educational interventions. Approximately 55.4% of participants understood the importance of injection site rotation to prevent lipodystrophy, which aligns with the general knowledge levels observed in similar studies conducted in resource-limited settings. However, the fact that nearly half of the participants were unaware of the correct techniques highlights a critical area for improvement (8).Only 34.6% of participants consistently performed handwashing before administering insulin, which is lower than the 50% adherence rate reported in a study conducted in India, where structured education on hygiene practices was emphasized(9). Blood glucose monitoring before and after insulin administration was consistently practiced by 35.4% of participants, a figure that reflects the findings of Gomez and Lee (2022), who reported similar adherence rates in South Korea, albeit with significant improvements after educational interventions (10).

Complications such as low blood sugar (47.7%), lipodystrophy (46.9%), and insulin resistance (52.3%) were prevalent among the study participants. These rates are comparable to those observed in studies by Hernandez et al. (2022) and Clarke et al. (2023), which highlighted the direct relationship between poor injection techniques and the incidence of complications (11,12). The prevalence of lipodystrophy underscores the need for educating patients about proper site rotation, a practice that was often neglected by participants in this study.

A significant proportion of participants relied on healthcare personnel (23.8%) and relatives (16.2%) for information about diabetes, whereas only 15.4% accessed information through mass media. This reliance on informal sources reflects findings by Nguyen et al. (2023), who demonstrated that socioeconomic barriers in resource-limited settings restrict access to formal educational resources, thereby affecting knowledge levels (13). In contrast, studies in high-resource settings have reported higher utilization of digital platforms for diabetes education, which has been shown to improve knowledge and adherence (14).

The findings also align with the results of Smith et al. (2023), who reported that psychological barriers, such as needle fear and the social stigma of injecting insulin, were significant contributors to poor adherence (15). These factors were evident in this study, as many participants reported anxiety about public insulin administration. Overcoming these barriers requires tailored psychological support and community awareness campaigns.

The gaps identified in this study are particularly concerning given the rising prevalence of diabetes in Pakistan. Munir et al. (2023) reported similar knowledge and practice deficiencies in a tertiary care setting in Pakistan, highlighting the systemic challenges of limited healthcare access, low literacy rates, and economic constraints (16). However, innovative approaches, such as incorporating mobile health technologies and virtual training programs, have shown promise in addressing these gaps (17). Virtual reality (VR)-based education, as demonstrated by O'Neil et al. (2022), improved retention of insulin administration techniques, suggesting its potential utility in resource-constrained settings (18).

This study underscores the importance of regular, culturally sensitive educational programs tailored to the specific needs of diabetic patients in Pakistan. Addressing knowledge gaps and promoting best practices in insulin self-administration can significantly reduce complications and improve glycemic outcomes. Future research should explore the effectiveness of interventions, such as structured education and technology-driven solutions, to enhance patient knowledge and adherence.

Conclusion

This study highlights critical gaps in knowledge and practices related to insulin self-administration among diabetic patients. The findings demonstrate suboptimal adherence to key practices, such as hand hygiene, site rotation, and blood glucose monitoring, which are essential for effective diabetes management. Complications such as lipodystrophy and insulin resistance were prevalent, underscoring the consequences of improper techniques. Barriers, including psychological challenges, lack of formal education, and socioeconomic constraints, further impede optimal insulin use.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
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Conflict of interest

The authors declared absence of conflict of interest.

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