

**KNOWLEDGE AND PREVENTION PRACTICE
TOWARD HYPOGLYCEMIA AMONG DIABETIC
PATIENTs USING INSULIN INJECTION IN
HOSPITAL PAKAR UNIVERSITI SAINS
MALAYSIA**

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MALAYSIA**

by

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**Dissertation submitted in partial fulfilment of the requirements
for the degree of
Bachelor in Nursing**

August 2025

CERTIFICATE

This is to certify that the dissertation entitled “Knowledge and Prevention Practice Toward Hypoglycemia among Diabetic Patient Using Insulin Injection in Hospital Pakar Universiti Sains Malaysia” is the bona fide record of research work done by Ms. Awanis Binti Mohd Ashri during the period from October 2024 to August 2025 under my supervision. I have read this dissertation and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation to be submitted in partial fulfillment for the degree of Bachelor of Nursing (Honours).

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DECLARATION

I hereby declare that this dissertation “Knowledge and Prevention Practice Toward Hypoglycemia among Diabetic Patient Using Insulin Injection in Hospital Pakar Universiti Sains Malaysia” is the result of my own investigations, except where otherwise stated and duly acknowledged. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at Universiti Sains Malaysia or other institutions. I grant Universiti Sains Malaysia the right to use the dissertation for teaching, research and promotional purposes.



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LIST OF ABBREVIATIONS

HPUSM	Hospital Pakar Universiti Sains Malaysia
KRK	Klinik Rawatan Keluarga
KPP	Klinik Pakar Perubatan

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**PENGETAHUAN DAN AMALAN PENCEGAHAN HIPOGLISEMIA
DALAM KALANGAN PESAKIT DIABETES YANG MENGGUNAKAN
SUNTIKAN INSULIN DI HOSPITAL PAKAR UNIVERSITI SAINS MALAYSIA**

ABSTRAK

Kajian ini dijalankan untuk menilai tahap pengetahuan dan amalan pencegahan terhadap hipoglisemia dalam kalangan pesakit diabetes yang menggunakan suntikan insulin di Hospital Pakar Universiti Sains Malaysia (HPUSM). Hipoglisemia, yang merupakan komplikasi biasa dan berpotensi mengancam nyawa akibat terapi insulin, masih kurang difahami oleh kebanyakan pesakit. Reka bentuk kajian keratan rentas telah digunakan dengan melibatkan 185 orang responden yang hadir ke Klinik Pakar Perubatan (KPP) dan Klinik Rawatan Keluarga (KRK). Data dikumpul menggunakan soal selidik yang telah disahkan dan dianalisis menggunakan statistik deskriptif, ujian chi-square dan korelasi Pearson melalui SPSS Versi 28. Hasil kajian menunjukkan bahawa 54.1% daripada peserta mempunyai tahap pengetahuan yang rendah, manakala 58.4% menunjukkan tahap amalan pencegahan yang rendah. Terdapat hubungan yang signifikan antara tahap pengetahuan dan amalan pencegahan ($p < 0.05$), dan faktor sosiodemografi seperti umur, tahap pendidikan dan pendapatan isi rumah juga didapati mempunyai kaitan yang signifikan dengan kedua-dua pemboleh ubah tersebut. Kajian ini menekankan keperluan mendesak untuk melaksanakan program pendidikan diabetes yang berstruktur bagi meningkatkan pengetahuan serta amalan pengurusan sendiri yang berkesan dalam kalangan pesakit diabetes yang menggunakan insulin.

**KNOWLEDGE AND PREVENTION PRACTICE TOWARD
HYPOGLYCEMIA AMONG DIABETIC PATIENTS USING INSULIN
INJECTION IN HOSPITAL PAKAR UNIVERSITI SAINS MALAYSIA**

ABSTRACT

This study aimed to assess the knowledge and prevention practices toward hypoglycemia among diabetic patients using insulin injections at Hospital Pakar Universiti Sains Malaysia (HPUSM). Hypoglycemia, a frequent and potentially life-threatening complication of insulin therapy, remains inadequately understood by many patients. A cross-sectional design was used involving 185 respondents attending the outpatient clinics at Klinik Pakar Perubatan (KPP) and Klinik Rawatan Keluarga (KRK). Data were collected through a validated, self-administered questionnaire and analyzed using descriptive statistics, chi-square test, and Pearson correlation in SPSS Version 28. The findings showed that 54.1% of participants had low knowledge levels, and 58.4% demonstrated low levels of prevention practices. There was a significant association between knowledge and preventive practices ($p < 0.05$), and sociodemographic factors such as age, education level, and household income were significantly associated with both outcomes. The study highlights a pressing need for structured diabetes education programs tailored to improve knowledge and promote effective self-care practices to reduce the risk of hypoglycemia among insulin-using diabetic patients.

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Diabetes mellitus has become a significant public health concern due to its steadily rising prevalence in recent years. According to the National Health and Morbidity Survey (NHMS 2023, n.d.), diabetes mellitus is one of the main causes of death in Malaysia, affecting a startling 15.6% of adults, which is approximately one in six.

Hypoglycemia, a common complication of insulin therapy in diabetes management, refers to a condition where blood glucose levels fall below the normal range, typically below 3.9 mmol/L or 70 mg/d. (Davis et al., 2024) It can present with a variety of symptoms, including sweating, trembling, confusion, and in severe cases, unconsciousness or seizures. (Mathew & Thoppil, 2022) While hypoglycemia is often preventable, it remains a significant concern, particularly among individuals with Type 1 and Type 2 diabetes who are treated with insulin injections (Committee et al., 2024)

Besides, the risk of hypoglycemia is influenced by multiple factors, including intensive glycemic control, particularly in those targeting an HbA1c below 6.5%, which increases the frequency of hypoglycemic episodes without necessarily raising the severity risk (Committee et al., 2024) The key risk factors include tight glycemic control, advanced age, alcohol use, and physical activity. (McCall et al., 2023) Thus, preventive measures play a crucial role in reducing hypoglycemia risk by ensuring patients have access to consistent monitoring, education, and affordable

care. Important tactics to avoid acute problems include individualized insulin administration, routine glucose monitoring, and healthcare reforms that cover necessary diabetes supplies.

World Health Organization (2024), emphasize the severity of hypoglycemia as a global public health concern, especially for those managing diabetes. Hypoglycemia significantly increases risks of mortality and cardiovascular complications, notably arrhythmias, due to the physiological stress it places on the heart. According to Li et al., (2023) revealed that individuals with diabetes experiencing hypoglycemia had a higher risk of both arrhythmic events and all-cause mortality, highlighting the dangers posed by this condition even with advanced diabetes treatments.

A study conducted by Yeow et al., (2024) found that many diabetic patients in the Federal Territory of Labuan lacked proper understanding of diabetes management, including hypoglycemia prevention, highlighting a gap in both knowledge and self-care practices. Poor diabetes knowledge, including lack of awareness regarding insulin types, dosage, and management of blood glucose, is strongly linked to higher risks of hypoglycemia and impaired awareness. A study shows that a significant percentage of people receiving insulin do not know how to avoid hypoglycemia, which can have severe consequences for their health. (Muche & Mekonen, 2020) Additionally, these gaps in knowledge are linked to inadequate medical follow-up as well as a lack of education, which increases the risk of problems such hypoglycemia unawareness. (Surrati et al., 2023). This highlights the need for continuous diabetes education and regular screening for hypoglycemia in managing diabetes patients effectively.

1.2 Problem Statement

Hypoglycemia remains a key concern for diabetic patients using insulin, many of whom worry about low blood sugar episodes. Nearly half of Malaysians with diabetes are unaware that diabetes is incurable, and 49% believe it can be managed without medical help. (National Health and Morbidity Survey (NHMS) 2023, n.d.). Additionally, 40% lack knowledge of target blood glucose levels, increasing hypoglycemia risk. This highlights the need for comprehensive education to improve awareness and safe management of diabetes.

Hypoglycemia prevention is essential to public health, particularly for diabetic patients managing their condition with insulin, as the complications of hypoglycemia can be severe, including cognitive impairment, cardiovascular risks, and mortality (Koehn et al., 2023). Recent studies emphasize that both patient education and structured support from healthcare providers can significantly reduce the incidence and severity of hypoglycemic episodes, especially in high-risk groups like older adults with diabetes and long-term insulin users (Koehn et al., 2023).

Furthermore, most of them are unaware of the target blood glucose levels, reflecting a lack of crucial knowledge for effective diabetes management. These results highlight a considerable gap in understanding the severity of diabetes among Malaysians, potentially leading to adverse health outcomes and a higher risk of complications. Kelantan, being predominantly rural, has been reported to have one of the highest diabetes rates in Malaysia, attributed to lifestyle and dietary factors. The awareness and understanding of hypoglycemia a potentially life-threatening

condition caused by insulin-induced low blood glucose levels remain inadequate among patients undergoing insulin therapy. (National Diabetes Registry Report 2023 Disease Control Division Ministry of Health Malaysia, n.d.)

As this research is focus among the diabetic outpatient, there are several research highlights findings on knowledge and practices concerning hypoglycemia. According to Lankrew Ayalew et al., (2022), respondents showed low levels of understanding and practice, with most unable to identify hypoglycemia symptoms or recognize that exercise could worsen the condition. Meanwhile, knowledge about symptom identification, carrying identification bands, and performing self-monitoring of blood glucose at home for treatment and prevention was notably poor. Besides, according to Muche & Mekonen, (2020b), most participants in this study had a good understanding of low blood glucose levels (hypoglycemia). However, less than half were aware of hypoglycemia risk factors, which aligns with one Indian study but is slightly higher than findings from another report in the same country (Mathur et al., 2022).

1.3 Research Questions

The research questions for this study are as follows:

1. What is the level of knowledge of hypoglycemia among diabetic patients using insulin injection at Hospital Pakar USM?
2. What is the level of prevention practice toward hypoglycemia among diabetic patients using insulin injection at Hospital Pakar USM?
3. Is there any association between the level of knowledge of hypoglycemia and the level of prevention practice toward hypoglycemia among diabetic patients using insulin injection at Hospital Pakar USM?
4. Is there any association between selected sociodemographic data (age, gender, marital status, occupation, educational level and household income) and the level of knowledge of hypoglycemia among diabetic patients using insulin injection at Hospital Pakar USM?
5. Is there an association between selected sociodemographic data (age, gender, marital status, occupation, educational level and household income) and the level of preventive practice toward hypoglycemia among diabetic patients using insulin injection at Hospital Pakar USM?

1.4 Research Objectives

1.4.1 General Objective

To assess the knowledge of hypoglycemia and level of prevention practice toward hypoglycemia among diabetic patients using insulin who attend the outpatient clinics at Hospital Pakar Universiti Sains Malaysia (HPUSM).

1.4.2 Specific Objectives

The specific objectives for this study are as follows:

1. To determine the level of knowledge of hypoglycemia among diabetic patients using insulin injection at Hospital Pakar USM.
2. To determine the level of prevention practice toward hypoglycemia among diabetic patients using insulin injection at Hospital Pakar USM.
3. To determine the association between the level of knowledge of hypoglycemia and the level of prevention practice toward hypoglycemia among diabetic patients using insulin injection at Hospital Pakar USM.
4. To determine the association between selected sociodemographic data (age, gender, marital status, occupation, educational level and household income) and level of knowledge of hypoglycemia among diabetic patients using insulin injection at Hospital Pakar USM.
5. To determine the association between selected sociodemographic data (age, gender, marital status, occupation, educational level and household income) and the level of preventive practice toward hypoglycemia among diabetic patients using insulin injection at

Hospital Pakar USM.

1.5 Research Hypothesis

Hypothesis 1 (H₀): There is no association between the level of knowledge of hypoglycemia and the level of prevention practice toward hypoglycemia among diabetic patients using insulin injection at Hospital Pakar USM.

(H₁): There is an association between the level of knowledge of hypoglycemia and the level of prevention practice toward hypoglycemia among diabetic patients using insulin injection at Hospital Pakar USM.

Hypothesis 2 (H₀): There is no association between selected sociodemographic data (age, gender, marital status, occupation, educational level and household income) and the level of knowledge of hypoglycemia among diabetic patients using insulin injection at Hospital Pakar USM.

(H1): There is an association between selected sociodemographic data (age, gender, marital status, occupation, educational level and household income) and the level of knowledge of hypoglycemia among diabetic patients using insulin injection at Hospital Pakar USM.

Hypothesis 3 (H0): There is no association between selected sociodemographic factors data (age, gender, marital status, occupation, educational level and household income) and the level of preventive practice toward hypoglycemia among diabetic patients using insulin injection at Hospital Pakar USM.

(H1): There is an association between selected sociodemographic data (age, gender, marital status, occupation, educational level and household income) and the level of preventive practice toward hypoglycemia among diabetic patients using insulin injection at Hospital Pakar USM.

1.6 Significance of study

Public knowledge of hypoglycemia is essential, particularly for insulin-dependent diabetic patients. Assessing patients' understanding of hypoglycemia includes evaluating their awareness of symptoms, preventive measures, and influencing factors, such as socio-demographic characteristics and clinical history

(Lankrew Ayalew et al., 2022). Results from recent studies show that many patients require improved knowledge of hypoglycemia and its management, emphasizing the need for targeted educational programs. Such initiatives can help enhance self-care practices and reduce hypoglycemia risks. This highlights the broader necessity for diabetes education that focuses on the safe use of insulin and awareness of hypoglycemia prevention in healthcare settings worldwide.

Prevention on hypoglycemia is important action that needs to be taken by the patient with the strategy Paiement et al., (2022), emphasizes that improved management strategies, such as insulin adjustments and monitoring physical activity, are crucial in reducing hypoglycemia risks in adults with Type 1 diabetes. By enhancing understanding and application of these strategies, the occurrence of hypoglycemic episodes can be significantly reduced, highlighting the importance of comprehensive diabetes education and personalized care for better health outcomes.

The study aims to assess knowledge and prevention practice toward hypoglycemia among diabetes patients using insulin who attended outpatient clinics at HPUSM. The study will help to improve awareness of hypoglycemia symptoms and the role of insulin and also improve the level of prevention practice among the patient towards hypoglycemia.

1.7 Definitions of Operational Terms

There operational terms used in this research proposal are shown below :

Table 1.1 Conceptual and Operational Definitions

	Conceptual Definition	Operational Definition
Knowledge of hypoglycemia	Understanding of or information about the signs, symptoms, and consequences of hypoglycemia. This includes recognizing physical and cognitive indicators such as dizziness, sweating, confusion, and shakiness((Cambridge Dictionary, n.d.)	In this study, knowledge is referred to a respondent who are knowledgeable toward hypoglycemia.
Prevention practice of hypoglycemia	Actions and behaviors aimed at reducing the occurrence and severity of low blood sugar episodes. (Cambridge Dictionary, n.d.)	It measured using a Four Likert-scale questionnaire consisting 11 items to assess an individual's self-care prevention practice toward hypoglycemia.
Hypoglycemia	Hypoglycemia is considered when the blood glucose level is lower than 3.9 mmol/L (70 mg/dl) (Committee, 2022)	Participants response the experienced of low blood sugar such as sweating, dizziness or tremor of hands.
Insulin Injection	Insulin injection will be defined as the administration of insulin via a syringe, insulin pen, or insulin pump, as prescribed by a healthcare provider. (Cambridge Dictionary, n.d.)	This will be measured by the process of administering a dose of insulin either subcutaneous or mixed insulin.
Diabetic Patient	A person that diagnosed with diabetes mellitus (Cambridge Dictionary, n.d.)	Patients that have been diagnosed and is undergoing treatment to manage their condition especially insulin therapy, lifestyles changes or dietary management at outpatient clinic KRK and KPP.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

This chapter provides a review of the literature concerning the knowledge and prevention practice on hypoglycemia among diabetic patients using insulin. It is divided into six sections, each addressing topics relevant to the study's research questions, objectives, and hypotheses. The first section introduces about the hypoglycemia which contains of hypoglycemia event, symptoms of hypoglycemia, pathophysiology of body reaction to insulin, complication and immediate action when hypoglycemia occurs. The second section covers hypoglycemia, examining patients' knowledge levels and prevention practice toward hypoglycemia. Following this, the relationship between socio-demographic factors such as age, gender, marital status, occupation, educational level and household income will be discussed in detail. The final section will focus on the study's conceptual framework

2.2 Epidemiology of Diabetes

Diabetes mellitus has become a significant public health issue in Malaysia, with its prevalence steadily rising in recent years. The National Health and Morbidity Survey (NHMS) 2023 identifies diabetes as one of the country's leading causes of death, affecting around 15.6% of the adult population—or approximately 1 in every 6 Malaysians. Although the likelihood of developing diabetes increases with age, many individuals remain undiagnosed. Alarmingly, 2 out of 5 adults with diabetes are unaware of their condition, and this figure soars to 84% among younger adults aged 18 to 29. While diabetes is often linked with older age groups, these findings reveal its

growing burden among younger populations as well, indicating a nationwide concern across all age demographics. Moreover, a substantial number of individuals are unaware of their target blood glucose levels, exposing a serious gap in knowledge critical to effective diabetes self-management (National Diabetes Registry Report 2023 Disease Control Division Ministry of Health Malaysia, n.d.)

These findings point to a troubling lack of awareness regarding the seriousness of diabetes among Malaysians, which may contribute to poorer health outcomes and a higher likelihood of complications. In particular, understanding of hypoglycemia a potentially life-threatening condition resulting from insulin-induced low blood sugar—remains insufficient among patients receiving insulin therapy (National Diabetes Registry Report 2023 Disease Control Division Ministry of Health Malaysia, n.d.).

2.3 Hypoglycemia Event

A study by Lakshmi et al., (2022) identified that inadequate dietary intake and improper insulin administration were key contributors to hypoglycaemia among diabetic patients. Their research also found that hypoglycaemic episodes occurred more frequently in the evening and were often asymptomatic. In response, the hospital introduced enhanced dietary management protocols and timely interventions such as oral glucose and intravenous fluids, which significantly reduced the incidence of severe hypoglycaemia.

The findings from a study by Henao-Carrillo et al., (2024) discovered that individuals with greater awareness of their hypoglycaemia risk were more likely to adopt preventive measures, including regular self-monitoring and seeking timely medical attention. These behaviours were linked to better disease control and fewer

severe hypoglycaemic episodes. In clinical practice, hypoglycaemia remains a frequent and concerning issue, often linked with complications such as rhabdomyolysis, a condition involving the breakdown of muscle tissue and cardiomyopathy. According to Yang et al., (2024) highlighted the effectiveness of triheptanoin therapy, which improved patient outcomes by reducing hospital stays and major events associated with hypoglycemia.

According to the study from Walczuk et al., (2024) compared the original insulin glargine with its biosimilar counterpart within the Veterans Health Administration. The findings showed no significant differences in the rates of hypoglycemia between the two formulations. Both were equally effective in managing blood glucose levels and had similar rates of hospitalizations or emergency visits related to hypoglycemia. Although the overall occurrence of hypoglycemia was low, the study supports the biosimilar insulin glargine as a safe and effective alternative for diabetes treatment.

2.4 Hypoglycemia Symptoms

Hypoglycemia is characterized by a low plasma glucose concentration, which can potentially cause harm to patients. It is particularly common among individuals with type 1 diabetes, with the annual occurrence of severe hypoglycemia ranging between 3.3% and 13.5% (Pettus et al., 2019). Symptoms of hypoglycemia, such as confusion and loss of consciousness, the needs for awareness of the potential for hypoglycemia in diabetic patients on medications. (Venkatesvaran & Rosenfeld, 2022)

A study done by Lee et al., (2023) compared hypoglycemia symptoms between insulin-treated Type 2 diabetes patients with and without impaired awareness of hypoglycemia (IAH). The results showed that individuals with IAH had a reduced ability to recognize hypoglycemia symptoms, making them more vulnerable to severe hypoglycemic episodes.

According to Shabbir et al., (2022) found that 36% of insulin-treated patients with Type 2 diabetes experienced hypoglycemic events. The majority (86.11%) had mild to moderate symptoms, such as tremors, numbness, and drowsiness, while 15.28% had severe episodes, including loss of consciousness. The prevalence of hypoglycemia was higher in patients who had diabetes for more than five years and those with comorbid conditions. The study highlights the importance of careful insulin management and monitoring, particularly in older adults and those with prolonged diabetes duration.

A study done by Nguyen et al., (2021) identified that hypoglycemia in older adults with Type 2 diabetes highlights the unique challenges this population faces in preventing and managing hypoglycemia. Common symptoms include shakiness, confusion, sweating, and dizziness, which can be particularly difficult to recognize in older adults due to cognitive impairment or coexisting medical conditions. The study emphasizes the need for tailored prevention and treatment strategies in outpatient and long-term care settings, including regular blood glucose monitoring, adjusting insulin doses, and providing proper education for both patients and caregivers to minimize the risk of hypoglycemia*

2.4.1 Complication of Hypoglycemia

Hypoglycemia, characterized by abnormally low blood glucose levels, poses a significant risk for individuals, particularly those with diabetes who rely on insulin or other glucose-lowering medications. A recent study from Hashmi et al., (2024), discusses the complications arising from hypoglycemia, particularly impaired awareness of hypoglycemia (IAH). It emphasizes that severe hypoglycemia can lead to cognitive dysfunction, seizures, and even life-threatening complications. The review also explores potential pharmacological treatments to restore awareness of hypoglycemia in patients who have lost this critical defense mechanism, thus prevented dangerous episodes and improved quality of life for diabetic individuals at risk of severe hypoglycemia.

Repeated episodes of hypoglycemia may result in hypoglycemic unawareness, a condition where neurohormonal counterregulatory responses become less sensitive to hypoglycemia. According to a study led by Hölzen et al., (2024), explains that some people with diabetes fail to recognize the symptoms of low blood sugar, a condition known as hypoglycemia unawareness. This is dangerous because it prevents timely intervention, leading to potentially severe consequences like unconsciousness or seizures. The condition occurs due to changes in how the body senses and responds to low glucose levels. Factors such as frequent hypoglycemia, alcohol use, and poor blood sugar control contribute to this issue. The condition is worsened over time, making it crucial for individuals to manage their blood sugar levels carefully and avoid severe lows to maintain awareness.

In clinical settings, a study that conducted by Dharma et al., (2024), emphasizes the significant risks associated with hypoglycemia, particularly as a complication in hospitalized patients. It identifies the biochemical and clinical validity of reporting hypoglycemia, noting that its occurrence can exacerbate patient conditions and complicate recovery. It further highlights the need for better monitoring and management practices to prevent hypoglycemic events in clinical settings, which are linked to poorer patient outcomes and extended hospital stays.

2.4.2 Action in Hypoglycemia

Hypoglycemia, or low blood sugar, occurs when blood glucose levels drop below normal, posing immediate risks for those affected, especially diabetic patients on insulin. Recognizing symptoms like sweating, shakiness, confusion, and dizziness is crucial, as untreated hypoglycemia can lead to unconsciousness or seizures. It is good to be cautious of taking immediate action to prevent the symptoms and complications of hypoglycemia. Identifying a patient with hypoglycemia is essential, as it can lead to serious outcomes, including coma or death. Severe cases require immediate treatment with intravenous (IV) dextrose, followed by a glucose infusion (La Sala & Pontiroli, 2021). For alert patients who can take oral (PO) medications, fast-acting carbohydrates like fruit juice should be administered. If a patient cannot take oral medications, glucagon should be provided. Glucagon can be delivered either intramuscularly or, with newer formulations, intranasally (Isaacs et al., 2021) The research highlights the importance of immediate action when hypoglycemia occurs, particularly in

primary care settings. It stresses that timely intervention, such as administering fast-acting carbohydrates, is crucial to prevent severe consequences.

According to research that conducted by Ibrahim et al., (2020) emphasizes educating patients and healthcare providers about recognizing early signs of hypoglycemia and managing it promptly to avoid complications, ensuring better outcomes for diabetic patients. Besides, a study done by Mathew & Thoppil, (2022), explore that managing recurring hypoglycemia non-pharmacologically includes patient education and lifestyle adjustments, as some individuals may not fully understand the risks associated with chronic hypoglycemia. Patients should learn the importance of regular blood glucose checks and recognizing their unique symptoms of low blood sugar. If lifestyle adjustments do not prevent additional episodes, medication may need to be modified. Patients should wear a medical alert bracelet or necklace and keep a quick source of glucose, such as gel, candy, or tablets, readily available. Reviewing blood sugar and dietary logs in an outpatient setting can also help pinpoint issues for each patient

Glycemic control is a crucial part of managing type 2 diabetes due to the link between glycosylated hemoglobin (HbA1C) levels and cardiovascular events. The 2008 ACCORD trial found that intensive therapy, targeting an HbA1C below 6.0%, did not significantly lower the incidence of major cardiovascular events but was associated with increased mortality and a higher risk of hypoglycemia (HC et al., 2008). Notably, a larger percentage of participants in the intensive therapy group used rosiglitazone compared to the standard therapy group (91.2% versus 57.5%), which may have contributed to the elevated cardiovascular risk in that group.(Mathew & Thoppil, 2022).

2.5 The importance of insulin

Insulin is very crucial for the diabetic patient. According to study by Eledrisi & Danjuma, (2024), emphasizes the significance of insulin in managing diabetes. It compares insulin analogs to human insulins, highlighting the benefits of analogs in achieving better glycemic control, reducing hypoglycemia risk, and providing more flexible dosing. The review underscores the importance of choosing the right type of insulin for optimal patient outcomes, particularly in terms of safety, efficacy, and convenience in

A study done by Bhavya & Sanjay, (2022) emphasizes the importance of insulin in managing diabetes, especially in preventing complications like hypoglycemia. Insulin, produced either through recombinant DNA technology or modified from animal sources, plays a vital role in reducing plasma glucose levels. Over time, advancements in insulin therapy, including rapid and long-acting insulin analogs, have improved the sensitivity and control over glucose levels, benefiting patients in managing diabetes and reducing risks like hypoglycemia.

According to De Block et al., (2022) emphasizes the importance of rapid-acting insulin analogs in the treatment of both type 1 and type 2 diabetes, as they offer improved glucose control and reduce the risk of hypoglycemia. These insulin analogs are crucial for maintaining better postprandial glucose levels, providing flexibility in meal timing and insulin dosing. The research advocates for their use in clinical practice to optimize diabetes management and improve patient outcomes.

Meanwhile, Kabakov & Merker, (2022), investigates the efficacy of intermediate and long-acting insulins in controlling glycemia in adults with Type 1 and Type 2 diabetes. The findings of the study suggest that long-acting insulins

may offer superior glycemic control compared to intermediate-acting insulins, improving patient outcomes by reducing the frequency of hypoglycemic events. Proper insulin management and individualized care are emphasized to minimize risks and enhance treatment effectiveness in diabetic patient.

2.6 Pathophysiology of Body Reaction to insulin

In 2023, according to the study from Kerr et al., (2024), investigates insulin resistance in adipocytes, highlighting its role in the pathophysiology of metabolic syndrome (MetS). It found that insulin sensitivity for lipolysis inhibition and lipogenesis stimulation was significantly reduced in MetS patients. The antilipolytic resistance remained significant even after adjusting for factors like age, sex, and body shape. These insights suggest that impaired insulin signaling at the receptor level contributes to the metabolic disturbances seen in MetS.

However, a study done by Ikeda et al., (2022), explores the role of iron in the pathophysiology of obesity and diabetes. It discusses how high body iron content is associated with the development of these conditions, with a focus on macrophages. These immune cells play a crucial role in both iron metabolism and the progression of obesity and insulin resistance. The research suggests that macrophage polarization how these cells handle iron affects adipocyte hypertrophy and insulin resistance, thus offering a potential target for therapeutic strategies in managing obesity and diabetes. A study that conducted by (Duc Nguyen et al., 2022), explores how diabetes affects inflammatory pathways, particularly in the hippocampus. It suggests that diabetes can activate the TREM-1 pathway and increase pro-inflammatory mediators like IL-1 β , Cox2, and

iNOS, potentially contributing to cognitive decline. The research indicates that medication might reduce these inflammatory responses, offering a possible therapeutic benefit in managing diabetes-induced brain inflammation.

2.7 Prevention Incidence on Hypoglycemia among diabetic patients

A study conducted by Mohsin & Sadiq, (2022), the behavioral and neurological impacts of hypoglycemia can lead to serious, potentially irreversible complications. Another study conducted from Fløde et al., (2023), found that older adults with diabetes living at home experienced a high number of hypoglycemic episodes, identified using continuous glucose monitoring (CGM). The results emphasize the importance of effective prevention strategies, including improved glucose monitoring and individualized insulin management, to reduce the incidence of hypoglycemia in this vulnerable population. The study suggests that CGM could be a valuable tool for better detecting and preventing hypoglycemic events, enhancing patient safety and glycemic control.

Recent research conducted by Urakami, (2020), underscores the importance of effective prevention strategies to mitigate the incidence of severe hypoglycemic events in children and adolescents. It emphasizes the need for continuous glucose monitoring, personalized insulin therapy adjustments, and education for both patients and caregivers to manage insulin dosages and prevent potentially dangerous hypoglycemia episodes. Improved patient education and proactive monitoring are key to reducing hypoglycemic risks and ensuring better long-term health outcomes for young patients with Type 1 diabetes.

In emergency settings, according to the study by Bakar et al., (2020) explores factors contributing to the incidence of hypoglycemia among diabetes mellitus patients. It emphasizes the need for preventive measures, such as better glucose monitoring and patient education on managing insulin dosage, particularly in emergency situations. The study suggests that early intervention, timely treatment, and patient awareness are key to preventing severe hypoglycemic events and improving patient outcomes.

As highlighted in a study from Herges et al., (2023), explores the role of glucagon prescription in preventing severe hypoglycemic episodes and reducing the need for hospitalization. The research indicates that appropriate glucagon use, alongside better awareness and preventive strategies, plays a key role in reducing the frequency of severe hypoglycemia in diabetic patients. The study suggests that providing patients with prescriptions for glucagon kits can significantly decrease hospital admissions related to hypoglycemia, particularly when combined with comprehensive diabetes education and regular blood glucose monitoring

2.8 Knowledge on Hypoglycemia Symptoms

A study that performed by Hussaini et al., (2023) investigates the knowledge gaps and contributing factors to hypoglycemia in hospitalized diabetic patients. It highlights that many patients lack adequate awareness of hypoglycemia symptoms, risk factors, and management strategies. In particular, the study identifies poor glycemic control, improper insulin administration, and insufficient patient education as major factors contributing to the occurrence of hypoglycemic events. It emphasizes the need for enhanced education on hypoglycemia prevention

and better monitoring practices to reduce risks for hospitalized individuals with Type 2 diabetes. Among the participants, 69.8% received information from clinics, 26.4% from group education, 2.8% from the public health system, and 10.7% through mass media, such as television or the internet. When asked if they knew the definition of hypoglycemia, only 19.4% accurately defined it as a glucose level below 70 mg/dL. Additionally, 23.5% of participants monitored their blood glucose 2 to 3 times per day, while 23.8% did so only 2 to 3 times per week. Compare to the study conducted from Sakyi et al., (2023), a total knowledge score was calculated, revealing that nearly half of the patients had limited knowledge about hypoglycemia (234, 52.7%), while 210 patients (42.7%) demonstrated adequate knowledge of the condition.

A recent study from Ghandi et al., (2021), examines various methods for assessing impaired awareness of hypoglycemia (IAH) in individuals with Type 1 diabetes. It highlights the importance of knowledge and awareness of hypoglycemia in diabetes management. The findings suggest that while many patients with Type 1 diabetes may lack awareness of hypoglycemia, using validated tools to assess IAH can aid in identifying those at higher risk for severe episodes. The study emphasizes the need for improved education and regular monitoring to help patients recognize symptoms and manage their condition more effectively, thus reducing the risk of hypoglycemic events.

2.9 Practice on prevention on Hypoglycemia

Preventing hypoglycemia is an essential part of diabetes care. According to the study from Gebremichael & Mariye Zemicheal, (2020), examines the

prevention practices for hypoglycemia among diabetic patients in Ethiopia. The findings show that while many patients are aware of hypoglycemia, there is a gap in the practice of effective prevention measures. Factors such as insufficient knowledge, irregular blood glucose monitoring, and improper insulin management contribute to the occurrence of hypoglycemic episodes. The study stresses the importance of improving patient education on hypoglycemia prevention, emphasizing routine glucose monitoring, proper meal planning, and tailored insulin use to reduce the risk of hypoglycaemia.

A study conducted from Wolderufael & Dereje, (2021), emphasize that a strong knowledge of hypoglycemia was significantly linked to effective hypoglycemia prevention practices. Specifically, patients with a good understanding of hypoglycemia had 10.34 times higher odds of engaging in prevention practices. This relationship aligns with findings from studies in Addis Ababa Hospital Wolderufael & Dereje, (2021). This association suggests that knowledge equips patients with the skills needed to prevent hypoglycemia, promoting proactive preventive behavior. Additionally, having a glucometer at home showed a statistically significant link with effective hypoglycemia prevention practices. Similar findings were reported in studies from central zone public hospitals in Addis Ababa Hospital Wolderufael & Dereje, (2021). This could be because home glucometers encourage patients to monitor their blood glucose levels and promptly adjust treatment, fostering lifestyle changes that prevent hypoglycemia.

2.10 Association between socio-demographic factors and Knowledge and Prevention Practice

2.10.1 Age

According to the study from Kifle et al., (2022) age showed a significant association with good knowledge at a 5% level of significance. People in the age group of 26–45 years were 66.7% (AOR = 0.333, 95% CI: 0.12–0.918) less likely to have good knowledge towards chronic complications of diabetes as compared to people less than the age of 25 years. However, for type 2 diabetes and hypoglycemia, it is also reasonable to argue that adults in this age group (26-45) could have relatively good knowledge due to several factors.

Firstly, individuals in the 26-45 age range are likely to have accumulated more life experience and may have had longer exposure to healthcare systems, thus gaining awareness about chronic illnesses such as diabetes. Since Type 2 diabetes tends to develop later in life, adults in this age group may have encountered healthcare advice or preventive measures earlier, allowing them to become more informed about the condition. Many individuals in this stage of life are proactive about their health as they may be balancing responsibilities like work and family, which can encourage better self-care practices and attention to chronic disease management, including insulin use and hypoglycemia awareness.

Hence, nurses play a crucial role in supporting individuals in the 26-45 age range in gaining knowledge and improving their self-care practices for managing Type 2 diabetes and hypoglycemia. For example, they can provide targeted health education to this age group about diabetes management, including the importance