

**THE ASSOCIATION BETWEEN FOOD INSECURITY, QUALITY OF
LIFE (QoL), AND SOCIODEMOGRAPHIC FACTORS WITH
GLYCAEMIC CONTROL AMONG TYPE 2 DIABETES MELLITUS
PATIENTS AT HOSPITAL PAKAR UNIVERSITI SAINS MALAYSIA**

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UNIVERSITI SAINS MALAYSIA

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by

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**Thesis submitted in partial fulfilment of the requirements for the degree
of Bachelor of Dietetics with Honours**

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LIST OF ABBREVIATIONS

ADDQoL	Audit of Diabetes-Dependent Quality of Life
ADA	American Diabetes Association
AWI	Average Weighted Impact
B40	Bottom 40% Household Income Group
BMI	Body Mass Index
HPUSM	Hospital Pakar Universiti Sains Malaysia
HbA1c	Glycated Haemoglobin
MFIES	Malaysian Food Insecurity Experience Scale
M40	Middle 40% Household Income Group
MNT	Medical Nutrition Therapy
NHMS	National Health and Morbidity Survey
QoL	Quality of Life
SPSS	Statistical Package for the Social Sciences
T2DM	Type 2 Diabetes Mellitus
T20	Top 20% Household Income Group
USM	Universiti Sains Malaysia
WHO	World Health Organization

**HUBUNGKAIT ANTARA KETIDAKJAMINAN MAKANAN,
KUALITI HIDUP, DAN FAKTOR SOSIODEMOGRAFI DENGAN
KAWALAN GLISEMIK DALAM KALANGAN PESAKIT DIABETES
MELITUS JENIS 2 DI HOSPITAL PAKAR UNIVERSITI SAINS
MALAYSIA**

ABSTRAK

Kawalan glisemik yang tidak optimum merupakan cabaran utama dalam kalangan pesakit Diabetes Melitus Jenis 2 (T2DM). Selain faktor klinikal, ketidakjaminan makanan dan kualiti hidup (QoL) turut mempengaruhi pengurusan diabetes, terutamanya di negeri berprevalens tinggi seperti Kelantan. Oleh itu, kajian ini bertujuan untuk mengkaji hubungan antara ketidakjaminan makanan, kualiti hidup dan faktor sosiodemografi dengan kawalan glisemik yang diukur menggunakan hemoglobin terglikat (HbA1c) dalam kalangan pesakit T2DM di Hospital Pakar Universiti Sains Malaysia (HPUSM). Seramai 110 orang pesakit T2DM telah dipilih melalui kaedah pensampelan mudah. Data dikumpul menggunakan borang soal selidik berstruktur, *Food Insecurity Experience Scale* versi Melayu (MFIES), dan *Audit of Diabetes-Dependent Quality of Life (ADDQoL-19)*, manakala profil glisemik diambil daripada rekod perubatan. Purata tahap HbA1c peserta adalah $9.33\% \pm 2.47\%$, dengan 82.7% (n=91) mengalami kawalan glisemik yang tidak optimum ($HbA1c \geq 7.0\%$). Prevalens ketidakjaminan makanan dalam kalangan peserta adalah sebanyak 18.2% (n=20). Skor median Purata Impak Berwajaran (*Average Weighted Impact - AWI*) bagi *ADDQoL-19* adalah -3.62 (IQR= 3.23), menunjukkan bahawa penyakit diabetes memberikan impak negatif terhadap kualiti hidup (QoL) peserta secara keseluruhan. Namun, analisis korelasi

Spearman menunjukkan tiada hubungan signifikan antara ketidakjaminan makanan dengan kawalan glisemik ($p = 0.089$). Walau bagaimanapun, terdapat hubungan korelasi negatif sederhana yang signifikan secara statistik antara QoL spesifik-diabetes dengan tahap HbA1c ($r_s = -0.326, p < 0.001$), menunjukkan bahawa tahap HbA1c yang lebih tinggi dikaitkan dengan QoL spesifik-diabetes yang lebih rendah. Selain itu, tiada hubungan yang signifikan antara faktor sosiodemografi yang dikaji dengan kawalan glisemik ($p > 0.05$). Kesimpulannya, prevalens kawalan glisemik yang tidak optimum adalah sangat tinggi dalam institusi tertiar ini. Walaupun ketidakjaminan makanan tidak menunjukkan hubungan langsung dengan HbA1c, kemerosotan kualiti hidup terbukti berkait rapat dengan kawalan glisemik yang tidak optimum. Penemuan ini menekankan keperluan terhadap pelan pengurusan diabetes secara holistik yang menyepadukan sokongan psikososial bersama terapi klinikal konvensional bagi mengoptimumkan hasil rawatan pesakit T2DM.

THE ASSOCIATION BETWEEN FOOD INSECURITY, QUALITY OF LIFE (QoL), AND SOCIODEMOGRAPHIC FACTORS WITH GLYCAEMIC CONTROL AMONG TYPE 2 DIABETES MELLITUS PATIENTS AT HOSPITAL PAKAR UNIVERSITI SAINS MALAYSIA

ABSTRACT

Suboptimal glycaemic control is a major challenge among patients with Type 2 Diabetes Mellitus (T2DM). In addition to clinical factors, food insecurity and quality of life (QoL) also influence diabetes management, especially in states with a high prevalence, such as Kelantan. Therefore, this study aimed to investigate the association between food insecurity, quality of life, and sociodemographic factors with glycaemic control, measured using glycated haemoglobin (HbA1c) among T2DM patients at Hospital Pakar Universiti Sains Malaysia (HPUSM). A total of 110 T2DM patients were selected using a convenience sampling method. Data were collected using a structured questionnaire, the Malay version of the Food Insecurity Experience Scale (MFIES), and the Audit of Diabetes-Dependent Quality of Life (ADDQoL-19), while glycemic profile were retrieved from medical records. The mean HbA1c level of the participants was $9.33\% \pm 2.47\%$, with 82.7% (n=91) experiencing poor glycaemic control ($\text{HbA1c} \geq 7.0\%$). The prevalence of food insecurity among the participants was 18.2% (n=20). The median of Average Weighted Impact (AWI) score for the ADDQoL-19 was -3.62 (IQR= 3.23), indicating that diabetes mellitus had a negative impact on the participants' overall quality of life (QoL). Spearman's correlation analysis showed no significant association between food insecurity and glycaemic control

($p = 0.089$). However, there was a statistically significant moderate negative correlation between diabetes-specific QoL and HbA1c levels ($r_s = -0.326$, $p < 0.001$), indicating that that higher HbA1c levels were associated with lower diabetes-specific QoL. Furthermore, there was no significant association between the studied sociodemographic factors and glycaemic control ($p > 0.05$). In conclusion, the prevalence of poor glycaemic control is remarkably high in this tertiary institution. Although food insecurity did not show a direct relationship with HbA1c, a decline in quality of life was proven to be closely associated with poor glycaemic control. These findings highlight the need for a holistic diabetes management plan that integrates psychosocial support alongside conventional clinical therapy to optimise treatment outcomes for T2DM patients.

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Diabetes mellitus is one of the most common chronic non-communicable diseases worldwide and contributes to morbidity, mortality, reduced quality of life (QoL), and healthcare burden. According to the International Diabetes Federation 2024, an estimated 563 million adults worldwide were living with diabetes in 2024, and this number is expected to rise to 643 million by 2030. Southeast Asia, including Malaysia, is experiencing a rapid rise in diabetes prevalence due to urbanisation, population ageing, and lifestyle changes.

According to the National Health and Morbidity Survey (NHMS) conducted by the Ministry of Health Malaysia 2023, approximately 18–20% of Malaysian adults had diabetes, showing a continuously high national burden. Around 21–23% of adults had diabetes in Kelantan, and this led to an increase in prevalence. Prolonged hyperglycaemia leads to the development of microvascular and macrovascular complications such as retinopathy, nephropathy, neuropathy, and cardiovascular disease, which reduces quality of life and increases healthcare expenditure (Chandran et al., 2020).

Food insecurity has been recognised as a significant global public health concern. Conceptually, food insecurity is the opposite of food security, which exists when all people at all times have physical, social, and economic access to sufficient, safe, and nutritious food. Consequently, food insecurity occurs when there is limited or uncertain availability of nutritionally adequate and safe foods, or an inability to acquire acceptable foods in socially acceptable ways (FAO, 2022). Globally, more than 2.3 billion individuals worldwide

experienced moderate to severe food insecurity (FAO, 2022). Rising living costs and widening socioeconomic gaps in Malaysia have increased the risk of food insecurity among households (Mansoor et al., 2021). According to Sulaiman et al. (2021), food insecurity was more common among low-income families and individuals living with chronic diseases, including type 2 diabetes mellitus.

Among individuals with type 2 diabetes mellitus, food insecurity serves as a critical barrier to optimal disease management. Food insecurity is associated with poor dietary quality, inconsistent carbohydrate intake, reduced medication adherence due to financial trade-offs between food and healthcare, psychological distress, and challenges in self-management. These integrated pathways frequently lead to suboptimal glycaemic control and worsen clinical outcomes (Seligman et al., 2023; Beltrán-Sánchez et al., 2021).

Quality of life (QoL) is another important factor that influences diabetes outcomes. Individuals living with T2DM often experience physical limitations, emotional distress, dietary restrictions, and treatment burdens that collectively affect their overall well-being. Poor quality of life (QoL) has been associated with reduced motivation for self-care, lower adherence to dietary recommendations, and difficulties in maintaining consistent diabetes management routines. International studies have shown that individuals with lower quality of life (QoL) scores tend to have higher HbA1c levels and poorer glycaemic control due to challenges in coping with daily disease demands (Alshayban & Joseph, 2020; Khunkaew et al., 2019). Malaysian studies also reported that T2DM patients frequently experienced reduced quality of life (QoL) related to pain, mobility issues, psychological stress, and financial strain, all of which might interfere with effective self-management (Shahar et al., 2019; Omar et al., 2020). Since quality of life (QoL) is closely linked to treatment adherence,

dietary behaviour, and emotional well-being, understanding its relationship with glycaemic control is essential for improving clinical outcomes among T2DM patients.

Sociodemographic factors such as age, education level, income, and employment status further influence food insecurity, quality of life (QoL), and glycaemic control. Older age, higher BMI, and dyslipidaemia have been shown to increase the risk of poor glycaemic outcomes (Yusof et al., 2025). Education level and employment status are also associated with HbA1c outcomes among patients with T2DM (Marzuki et al., 2023).

Despite strong international evidence, local studies in Malaysian tertiary hospitals remain limited. Most existing research focused on community populations rather than patients receiving specialist care in tertiary settings, who often present with longer disease duration, higher rates of diabetic complications, and potentially poorer baseline glycaemic control (higher HbA1c levels) due to case complexity. Given the high prevalence of diabetes in Kelantan and the diverse patient population at Hospital Pakar Universiti Sains Malaysia (HPUSM), it is crucial to examine how food insecurity, quality of life (QoL), and sociodemographic characteristics interact to influence glycaemic control. This study aimed to address these gaps by providing local evidence to guide clinical practice and public health interventions.

1.2 Problem Statement

The prevalence of type 2 diabetes mellitus (T2DM) in Malaysia is increasing rapidly, and a large proportion of patients do not achieve optimal glycaemic control. According to the National Diabetes Registry Report 2013–2019, less than one-third of registered T2DM

patients achieved good glycaemic control ($\text{HbA1c} < 7.0\%$) (Chandran et al., 2020). Poor glycaemic control increases the risk of long-term complications and contributes to actual clinical and economic burdens on healthcare systems.

Food insecurity has emerged as a crucial potential contributor to poor glycaemic control. Individuals experiencing food insecurity are more likely to skip meals and consume cheaper, calorie-dense foods due to financial constraints. These leading unhealthy dietary patterns often result in greater glycaemic variability and difficulty adhering to standard diabetes management plans (Seligman et al., 2023). Although food insecurity has been widely studied in community settings, empirical evidence remains limited in Kelantan which is a state consistently reporting among the highest prevalence rates of diabetes in Malaysia (21–23%), paired with unique socioeconomic dynamics and lower average household incomes.

Quality of life (QoL) is another critical factor that heavily influences glycaemic control. Patients with T2DM often experience physical discomfort, emotional distress, and treatment-related burdens that collectively reduce their overall well-being. Poor quality of life (QoL) has been consistently associated with decreased motivation for self-care, lower adherence to dietary and medication regimens, and difficulties in coping with daily disease demands, all of which inevitably contribute to suboptimal glycaemic outcomes.

Critically, most local literature has concentrated on primary healthcare or general community cohorts. Patients managed in a tertiary referral hospital such as Hospital Pakar Universiti Sains Malaysia (HPUSM) present a distinct clinical profile. Unlike primary care patients, tertiary care patients generally exhibit longer disease duration, established micro- or macrovascular complications, and more complex treatment regimens (such as multi-daily

insulin therapy). In these high-risk clinical settings, food insecurity and compromised QoL may create severe operational barriers to treatment adherence and dietary management, leading to even greater glycaemic instability.

According to Hill-Briggs et al. (2021), sociodemographic factors such as age, education level, income, and employment status may interact with food insecurity and quality of life to influence glycaemic control. Previous studies have shown that individuals with lower socioeconomic status or limited education are more likely to experience poor glycaemic outcomes. However, the extent to which these factors collectively interact among complex T2DM patients in a tertiary setting like HPUSM remains unclear.

Without adequate evidence, healthcare providers face substantial challenges in identifying high-risk groups and designing comprehensive interventions that address both clinical and social determinants of health. Therefore, this study aimed to investigate the associations between food insecurity, quality of life (QoL), sociodemographic characteristics, and glycaemic control among T2DM patients receiving care at HPUSM.

1.3 Rationale and Justification of Study

Hospital Pakar Universiti Sains Malaysia (HPUSM) serves a large and diverse population from Kelantan and neighbouring states, many of whom come from low- and middle-income households. Studies have shown that a substantial proportion of Kelantanese households fall within the B40 category, where low household income is consistently linked with higher food insecurity and compromised diet quality in Malaysia (Mansoor et al., 2021; Sulaiman et al., 2021). While dietary management is the cornerstone of Medical Nutrition

Therapy (MNT), clinical practice often assumes that non-adherence is solely a issue of patient knowledge or motivation, ignoring structural barriers like food insecurity. Thus, determining the extent of food insecurity in this specific clinical cohort is necessary to shift clinical care from passive advice to practical, socioeconomic-sensitive dietary counselling.

Critically, understanding Quality of Life (QoL) specifically within a tertiary referral hospital like HPUSM is paramount compared to primary healthcare clinics. Primary care clinics primarily manage early-stage, stable T2DM patients under routine oral regimens. In contrast, patients receiving specialist care at HPUSM represent a highly complex cohort, characterised by longer disease duration, multiple co-morbidities, advanced micro- and macrovascular complications, and intensive treatment regimens such as multiple daily insulin injections. This clinical complexity severely exacerbates disease-related distress, treatment fatigue, and financial strain, leading to a unique deterioration of QoL that directly hinders daily self-care and glycaemic management. Evaluating QoL in this high-risk tertiary group provides actionable insights into how psychosocial burden directly drives persistent hyperglycaemia despite advanced clinical therapy.

Although previous studies have evaluated sociodemographic factors, food insecurity, and QoL in isolation within community or primary care settings, a significant research gap exists regarding how these determinants interact simultaneously to influence glycaemic outcomes among tertiary-managed T2DM patients in East Coast Malaysia. Addressing this empirical gap is vital because clinical interventions at tertiary centers frequently focus exclusively on pharmacological escalation while overlooking underlying social determinants of health.

Addressing these gaps provides direct clinical and practical significance ("so what"). Findings from this study will enable dietitians, endocrinologists, and multidisciplinary healthcare teams at HPUSM to identify high-risk patients who require routine screening for food insecurity and distress. Furthermore, it supplies essential local data to formulate targeted nutritional support, tailored dietary strategies, and psychosocial integration within tertiary diabetes management, ultimately optimizing long-term glycaemic control and reducing hospital readmissions.

1.4 Research Question

1. Is there an association between food insecurity and glycaemic control among patients with type 2 diabetes mellitus attending Hospital Pakar Universiti Sains Malaysia (HPUSM)?
2. Is there an association between quality of life (QoL) and glycaemic control among patients with type 2 diabetes mellitus attending Hospital Pakar Universiti Sains Malaysia (HPUSM)?
3. Is there an association between sociodemographic factors and glycaemic control among patients with type 2 diabetes mellitus attending Hospital Pakar Universiti Sains Malaysia (HPUSM)?

1.5 Research Objective

1.5.1 General Objective

To determine the associations between food insecurity, quality of life (QoL) and sociodemographic factors with glycaemic control among patients with type 2 diabetes mellitus attending Hospital Pakar Universiti Sains Malaysia (HPUSM).

1.5.2 Specific Objectives

1. To examine the association between food insecurity and glycaemic control among type 2 diabetes mellitus patients in Hospital Pakar Universiti Sains Malaysia (HPUSM).
2. To examine the association between quality of life (QoL) and glycaemic control among type 2 diabetes mellitus patients in Hospital Pakar Universiti Sains Malaysia (HPUSM).
3. To examine the association between sociodemographic factors and glycaemic control among type 2 diabetes mellitus patients in Hospital Pakar Universiti Sains Malaysia (HPUSM).

1.6 Research Hypothesis

1.6.1 Hypothesis I

Null hypothesis (H_0): There is no significant association between food insecurity and glycaemic control among type 2 diabetes mellitus patients in Hospital Pakar Universiti Sains Malaysia (HPUSM).

Alternative hypothesis (H_1): There is a significant association between food insecurity and

glycaemic control among type 2 diabetes mellitus patients in Hospital Pakar Universiti Sains Malaysia (HPUSM).

1.6.2 Hypothesis II

Null hypothesis (H_0): There is no significant association between quality of life (QoL) and glycaemic control among type 2 diabetes mellitus patients in Hospital Pakar Universiti Sains Malaysia (HPUSM).

Alternative hypothesis (H_1): There is a significant association between quality of life (QoL) and glycaemic control among type 2 diabetes mellitus patients in Hospital Pakar Universiti Sains Malaysia (HPUSM).

1.6.3 Hypothesis III

Null hypothesis (H_0): There is no significant association between sociodemographic factors and glycaemic control among type 2 diabetes mellitus patients in Hospital Pakar Universiti Sains Malaysia (HPUSM).

Alternative hypothesis (H_1): There is a significant association between sociodemographic factors and glycaemic control among type 2 diabetes mellitus patients in Hospital Pakar Universiti Sains Malaysia (HPUSM).

CHAPTER 2

LITERATURE REVIEW

2.1 Review of Type 2 Diabetes Mellitus

Type 2 diabetes mellitus (T2DM) is fundamentally characterized by a progressive impairment of insulin secretion by pancreatic beta-cells, alongside tissue-level insulin resistance that leads to chronic hyperglycemia. Unlike acute metabolic disturbances, the chronic elevation of blood glucose triggers underlying systemic inflammation and vascular damage, which ultimately drive both microvascular and macrovascular complications. Understanding the pathophysiology and metabolic burden of T2DM is essential for contextualizing how patient-related factors, lifestyle modifications, and self-care behaviors directly influence long-term glycemic management.

In Malaysia, national survey data show that the prevalence of diabetes among adults has increased over time. The National Health and Morbidity Survey (NHMS) 2023 reported that approximately one in five Malaysian adults was living with diabetes, demonstrating a steady increase compared with earlier survey cycles (Institute for Public Health, 2023). This pattern is consistent with a recent systematic review and meta-analysis, which found a pooled prevalence of type 2 diabetes and prediabetes of about 14–16% among Malaysian adults and documented a clear upward trend over the past two decades (Nazri et al., 2022). Within this national context, Kelantan has been highlighted as one of the states with higher-than-average diabetes prevalence, and tertiary hospitals such as Hospital Pakar Universiti Sains Malaysia (HPUSM) manage a large proportion of patients with long-standing disease and established complications (Institute for Public Health, 2023; Chandran et al., 2020).

Chronic hyperglycaemia in T2DM is associated with a wide range of microvascular and macrovascular complications, including retinopathy, nephropathy, neuropathy, cardiovascular disease, and stroke, which reduce quality of life, increase disability, and lead to higher healthcare utilisation (Khan et al., 2019; de Moraes et al., 2022). Malaysian registry and hospital-based studies consistently show that many patients do not achieve recommended glycaemic targets and often present with multiple cardiometabolic risk factors such as obesity, dyslipidaemia, and hypertension (Ministry of Health Malaysia, 2023; Chandran et al., 2020; Omar et al., 2020). These findings underline the importance of effective glycaemic control to delay or prevent complications in routine clinical practice.

Effective management of T2DM requires sustained adherence to medical nutrition therapy, pharmacological treatment, self-monitoring, and regular follow-up, as outlined in national and international clinical practice guidelines (Ministry of Health Malaysia, 2020; American Diabetes Association, 2024). However, achieving good glycaemic control is influenced by sociodemographic, behavioural, and psychosocial factors such as education levels, income, health literacy, medication adherence, and access to health services (Omar et al., 2020; Shahar et al., 2019).

Recent Malaysian and international studies have demonstrated that social determinants, including food insecurity, the food environment, and quality of life (QoL), significantly influence dietary quality and diabetes self-management. These factors have become increasingly important for understanding glycaemic outcomes in clinical populations, particularly among individuals with type 2 diabetes mellitus (Patel et al., 2021; Beltrán-Sánchez et al., 2021; Sulaiman et al., 2021).

2.2 Food Insecurity Among Malaysian Adults and Diabetes Patients

Food insecurity is defined as limited access to sufficient, safe, and nutritious food required for an active and healthy life, and it is increasingly recognised as a key public health concern in both high-income and middle-income countries (FAO, 2022). According to the Food and Agriculture Organization (2022), more than 2.3 billion people experienced moderate to severe food insecurity due to factors such as economic instability, rising food prices, climate change, and social inequalities. In this context, food insecurity is understood not only as a problem of inadequate calories but also as a complex condition that affects diet quality, mental health, and the management of chronic diseases, including type 2 diabetes.

In Malaysia, recent studies demonstrated that food insecurity is more common than previously assumed, particularly among low-income (B40) households, urban poor communities, university students, and families with young children. A systematic review by Sulaiman et al. (2021) reported that the prevalence of food insecurity typically ranged from approximately 20% to more than 60%, depending on the population group and measurement tools utilised. Economic pressures, inflation, and the rising cost of living have further increased the vulnerability of Malaysian households to food insecurity (Wahab et al., 2022). Local studies consistently indicated that households with lower income, larger family size, and lower educational attainment are at a significantly higher risk of experiencing food insecurity (Mansoor et al., 2021).

Food insecurity has profound implications for individuals living with type 2 diabetes mellitus, who require stable access to appropriate foods to support medical nutrition therapy effectively. International and regional studies showed that adults with diabetes who experienced food insecurity tended to skip meals, relied on inexpensive energy-dense foods,

and reported difficulties adhering to dietary recommendations, which could inevitably worsen glycaemic control and increase the risk of acute and chronic complications (Patel et al., 2021; Beltrán-Sánchez et al., 2021). Malaysian research further suggested that food-insecure households may prioritise cheaper refined carbohydrates and processed foods over fruits, vegetables, and lean protein, leading to poorer diet diversity and suboptimal nutrient intake (Sulaiman et al., 2021; Ministry of Health Malaysia, 2020).

Despite the growing body of international literature on food insecurity and diabetes, clinical data from Malaysian tertiary settings remain limited. Most local studies have focused on community samples, school or university populations, or general household surveys, with relatively few examining food insecurity specifically among adults with diagnosed T2DM receiving ongoing care in hospitals or specialist clinics (Sulaiman et al., 2021; Wahab et al., 2022). This gap is particularly relevant in Kelantan, where both diabetes prevalence and socioeconomic vulnerabilities are relatively high. Understanding the impact of food insecurity among clinic-attending T2DM patients could inform more targeted nutrition and social support interventions.

2.3 Quality of Life (QoL) among Type 2 Diabetes Mellitus Patients

Quality of life (QoL) is a key outcome in diabetes management and reflects an individual's physical, psychological, and social well-being. According to Khattab et al. (2019), patients with type 2 diabetes mellitus (T2DM) often experience long-term treatment demands, dietary restrictions, medication burden, and fear of complications, all of which negatively affect their daily functioning and overall QoL. As diabetes is a lifelong condition,

maintaining an acceptable quality of life is essential for sustaining long-term self-management.

Recent international studies consistently reported that individuals with T2DM have lower QoL compared with the general population. Common issues include pain, mobility limitations, fatigue, emotional distress, and sleep disturbances, which contribute to reduced QoL and poorer self-management of diabetes (Khunkaew et al., 2019). According to Alshayban and Joseph (2020), poor QoL was associated with lower motivation for self-care, reduced adherence to dietary recommendations, and difficulties in maintaining regular physical activity and medication routines, which inevitably lead to poorer glycaemic control.

In Asian populations, including Malaysia, cultural expectations, family responsibilities, and financial constraints further influence QoL among individuals with T2DM. Malaysian studies reported that patients frequently experienced psychological stress, fear of complications, and financial strain related to medication costs, clinic visits, and dietary requirements (Omar et al., 2020; Shahar et al., 2019). These factors can reduce emotional well-being and interfere with effective self-management. Lower QoL has also been linked to higher HbA1c levels, suggesting that QoL plays a meaningful role in determining glycaemic outcomes (Alshayban and Joseph, 2020).

Sociodemographic factors such as age, gender, education level, and household income have been identified as predictors of QoL among T2DM patients. Gebreyohannes et al. (2021) demonstrated that older adults, women, individuals with lower education, and those with lower income tended to report poorer QoL. Omar et al. (2020) stated that patients with longer disease duration or multiple comorbidities also experienced lower QoL due to increased treatment burden and functional limitations. Understanding how these factors

influence QoL is important for designing patient-centred interventions that address both clinical and psychosocial needs.

Given the complex relationship between QoL, self-management behaviours, and glycaemic control, examining QoL among T2DM patients in tertiary care settings such as Hospital Pakar Universiti Sains Malaysia (HPUSM) is essential. Patients attending tertiary hospitals often present with more advanced disease, multiple complications, or greater treatment demands, which may further impact their QoL. Local evidence is required to better understand these relationships and to guide the development of supportive interventions that can improve both QoL and clinical outcomes.

2.4 Glycaemic Control Among Type 2 Diabetes Mellitus Patients

Achieving and maintaining optimal glycaemic control is essential to reduce the risk of diabetes-related complications among individuals with T2DM. Glycated haemoglobin (HbA1c) is widely accepted as the gold standard indicator of long-term glycaemic control, reflecting mean blood glucose levels over the previous two to three months (Ministry of Health Malaysia, 2020; American Diabetes Association, 2024). Current clinical practice guidelines generally recommend a target HbA1c of less than 7.0% for most non-pregnant adults with T2DM, with individualisation of targets based on age, comorbidities, and risk of hypoglycaemia (Ministry of Health Malaysia, 2020; American Diabetes Association, 2024).

Despite these recommendations, glycaemic control among Malaysian adults with T2DM remains suboptimal. National Diabetes Registry data demonstrated that only a minority of patients achieved the recommended HbA1c target, with many recording values

above 7.0% and a considerable proportion above 8.5% (Ministry of Health Malaysia, 2023). Hospital- and clinic-based studies in different states similarly reported a high prevalence of poor glycaemic control, often exceeding 60–70% of clinic attendees, and highlighted the frequent coexistence of obesity, dyslipidaemia, and hypertension (Chandran et al., 2020; Omar et al., 2020; Alramadan et al., 2018). These findings underline a substantial gap between guideline recommendations and real-world outcomes, particularly in public sector settings.

Multiple demographic, clinical, and behavioural factors have been associated with glycaemic control in T2DM. Malaysian and regional studies indicated that older age, longer duration of diabetes, higher body mass index (BMI), presence of comorbidities, lower educational attainment, and lower income are frequently linked to poorer HbA1c outcomes (Omar et al., 2020). Inadequate medication adherence, limited diabetes knowledge, and insufficient access to diabetes education or dietetic services further contribute to suboptimal glycaemic control (Ganasegeran et al., 2025). Collectively, this evidence highlights the importance of considering sociodemographic characteristics and broader social determinants, alongside clinical factors, when examining glycaemic control in T2DM populations attending tertiary care facilities such as Hospital Pakar Universiti Sains Malaysia (HPUSM).

2.5 Association Between Food Insecurity and Glycaemic Control

While general food insecurity influences overall health outcomes, its direct association with glycaemic control is specifically reflected through elevated glycated haemoglobin (HbA1c) levels. The biological and behavioural pathways connecting food

insecurity to poor HbA1c control operate through distinct mechanisms rather than general lifestyle disruptions.

Behaviourally, individuals experiencing food insecurity frequently encounter cyclic food availability which is alternating between periods of food adequacy and severe shortage. This phenomenon triggers irregular dietary intakes and rapid shifts between high-carbohydrate, low-cost foods and skipped meals, causing acute glycaemic variability. Repeated episodes of hypoglycaemia followed by compensatory overeating lead to severe postprandial hyperglycaemia, directly driving up long-term HbA1c averages (Berkowitz et al., 2023; Patel et al., 2021). Furthermore, financial trade-offs force food-insecure patients to prioritize purchasing basic household necessities over anti-diabetic medications or blood glucose monitoring supplies, resulting in medication non-adherence and persistent unmanaged hyperglycaemia.

Physiologically, chronic food insecurity acts as a continuous psychosocial stressor. Sustained financial distress activates the hypothalamic-pituitary-adrenal (HPA) axis, elevating neuroendocrine hormones such as cortisol and catecholamines. Elevated cortisol secretion promotes hepatic gluconeogenesis and exacerbates peripheral insulin resistance, directly elevating blood glucose levels independent of dietary intake. Combined, these behavioural and physiological mechanisms explain the strong direct association between food insecurity and poor glycaemic control.

2.6 Association Between Quality of Life (QoL) and Glycaemic Control

Rather than viewing quality of life solely as a passive health outcome, accumulating evidence confirms that compromised QoL actively drives suboptimal glycaemic control in individuals with type 2 diabetes mellitus. The relationship between diabetes-specific QoL and HbA1c operates through interdependent psychological and behavioural pathways.

Psychologically, lower QoL is heavily manifested as diabetes distress which is a state characterized by regimen-related fatigue, fear of long-term complications, and emotional burnout. Sustained distress leads to chronic neuroendocrine activation, elevating stress hormones that directly impair insulin sensitivity and increase hepatic glucose production.

Behaviourally, severe reduction in QoL undermines patient self-efficacy and motivation for continuous disease management. Individuals with lower QoL scores demonstrate significantly reduced adherence to daily glucose monitoring, dietary modifications, physical activity, and prescribed medication schedules. Consequently, this behavioural disruption manifests as heightened glycaemic variability and elevated HbA1c levels. Addressing QoL within clinical evaluation is therefore essential for mitigating both the psychological burden and the physiological progression of poor glycaemic control (Alshayban & Joseph, 2020; Khunkaew et al., 2019).

2.7 Association Between Sociodemographic Factors and Glycaemic Control

Sociodemographic characteristics play an important role in determining glycaemic control among individuals with type 2 diabetes mellitus (T2DM). These factors influence health behaviours, access to healthcare, dietary choices, and the ability to adhere to diabetes self-management recommendations. Recent studies demonstrated that sociodemographic

variables such as age, gender, education level, income, employment status, and marital status are significantly associated with HbA1c levels in diverse populations (Gebreyohannes et al., 2021; Al-Khawaldeh et al., 2021).

Age is one of the most frequently reported determinants of glycaemic control. Older adults often experience poorer glycaemic outcomes due to declining physical function, multiple comorbidities, and reduced ability to engage in physical activity or manage complex medication regimens (Omar et al., 2020). However, some studies suggested that younger adults may also present with suboptimal glycaemic control due to work demands, lifestyle factors, and lower adherence to treatment plans. These findings indicated that age-related influences on glycaemic control may vary depending on individual circumstances and healthcare access.

Education level and health literacy are also critical predictors of glycaemic control. Individuals with lower educational attainment often have a limited understanding of diabetes management, reduced awareness of dietary requirements, and lower confidence in self-care practices, all of which contribute to higher HbA1c levels (Ganasegeran et al., 2025). Income and employment status further shape diabetes outcomes by influencing access to nutritious foods, medication affordability, and the ability to attend regular clinic appointments. Studies in Malaysia and neighbouring countries consistently showed that lower-income groups are more likely to experience poor glycaemic control due to financial strain and competing household priorities (Shahar et al., 2019; Omar et al., 2020).

Clinical factors such as the duration of diabetes, body mass index (BMI), and the presence of comorbidities also interact with sociodemographic characteristics to influence glycaemic outcomes. Longer disease duration is associated with progressive beta-cell

decline and an increased treatment burden, making glycaemic control more difficult to achieve. Higher BMI and obesity are strongly linked to insulin resistance and poorer metabolic outcomes, while comorbidities such as hypertension and dyslipidaemia further complicate diabetes management (Chandran et al., 2020).

In Malaysia, these sociodemographic and clinical factors are particularly relevant in public healthcare settings, where patients often come from diverse socioeconomic backgrounds and may face barriers to optimal diabetes care. Understanding how these factors influence glycaemic control among T2DM patients attending Hospital Pakar Universiti Sains Malaysia (HPUSM) is essential for identifying vulnerable groups and developing targeted interventions that address both clinical and social needs.

2.8 Conceptual Framework

The conceptual framework for this study was guided by models of social determinants of health in diabetes, which highlight how sociodemographic factors and food insecurity influence glycaemic outcomes (Hill-Briggs et al., 2021; Beltrán-Sánchez et al., 2021). In this framework, sociodemographic characteristics such as gender, age, ethnicity, education level, marital status, employment status, and household income are positioned as upstream factors that may affect both food insecurity and quality of life (QoL), as well as glycaemic control among adults living with type 2 diabetes mellitus.

Previous studies showed that food insecurity was associated with higher HbA1c levels through mechanisms involving poor diet quality, psychological stress, and reduced adherence to diabetes self-management (Beltrán-Sánchez et al., 2021; Patel et al., 2021;

Sulaiman et al., 2021). Quality of life has also been linked to glycaemic control, particularly in individuals experiencing emotional distress, functional limitations, or financial strain (Ismail et al., 2021; Teoh et al., 2021).

In this study, sociodemographic factors, food insecurity, and quality of life (QoL) were conceptualised as primary independent variables, while glycaemic control was measured using HbA1c and categorised into good and poor control as the dependent variable. Additional clinical characteristics (such as duration of diabetes and comorbidities) alongside behavioural factors like medication adherence are acknowledged in the literature as part of the broader causal pathway influencing glycaemic control. However, these specific variables were not directly measured as distinct analytical variables in this study and were therefore excluded from the analytical model.

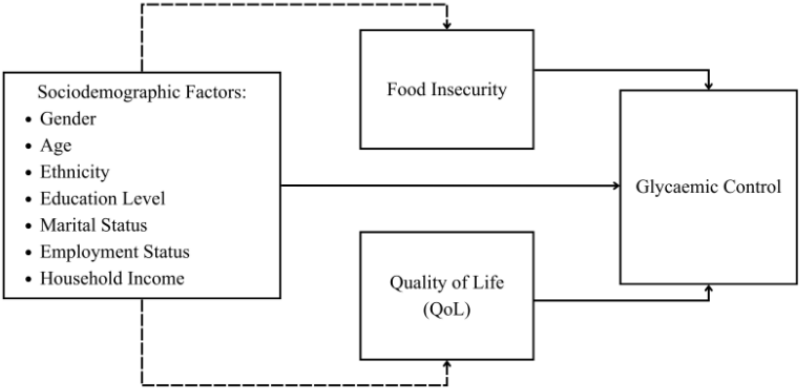


Figure 1: Conceptual framework of the relationship between food insecurity, quality of life (QoL), sociodemographic factors, and glycaemic control among T2DM patients at

HPUSM (adapted from Hill-Briggs et al., 2021; Beltrán-Sánchez et al., 2021; Sulaiman et al., 2021).

As illustrated in Figure 1, the solid arrows (straight lines) represent the direct associations investigated in this study, specifically between independent variables (food insecurity, quality of life, and sociodemographic factors) and the primary outcome variable, glycaemic control. Conversely, the dashed/dotted arrows depict the indirect relationships or potential mediating effects, showing how sociodemographic factors may influence food insecurity and quality of life (QoL), which subsequently impact glycaemic control.

CHAPTER 3

METHODOLOGY

3.1 Research Design

This was a cross-sectional study conducted to determine the association between food insecurity, quality of life (QoL), sociodemographic factors, and glycaemic control among adults with type 2 diabetes mellitus (T2DM) receiving outpatient care at multiple clinical services in Hospital Pakar Universiti Sains Malaysia (HPUSM). The cross-sectional design allowed simultaneous assessment of exposure (food insecurity, quality of life, and sociodemographic factors) and outcome (glycaemic control) within the same period. Although causality could not be inferred, this design was appropriate for identifying patterns and associations in a clinical population.

3.2 Study Area

The study was conducted across five outpatient clinics and diabetes-related services in Hospital Pakar Universiti Sains Malaysia, Kubang Kerian, Kelantan. These clinics provided comprehensive care for T2DM patients at different levels of management:

1. Klinik Warga USM: Manages chronic diseases among USM staff and dependents.
2. Klinik Pakar Perubatan (Medical Specialist Clinic): Manages complicated diabetes cases under Internal Medicine.
3. Klinik Rawatan Keluarga (KRK): Primary care clinic with a high T2DM patient load.

4. Klinik Dietetik Pesakit Luar: Provides diabetes medical nutrition therapy and diet counselling.
5. Pusat Diabetes: Centre providing diabetes monitoring, education, and follow-up services.

The inclusion of multiple clinics allowed the recruitment of patients across different stages of diabetes care, ensuring a more diverse and representative sample of T2DM patients within HPUSM.

3.3 Study Population

The study population consisted of T2DM patients (aged ≥ 19 years) receiving care at the outpatient diabetes clinics in HPUSM during the study period. T2DM patients were eligible if they had a documented diagnosis, an HbA1c result recorded within the previous three to six months and were able to complete the questionnaire in the Malay language. Patients who were critically ill, hospitalised, pregnant, or presented with severe cognitive or psychiatric conditions that could prevent reliable responses were excluded, in line with the exclusion criteria described below.

3.3.1 Reference Population

All adults living with type 2 diabetes mellitus in Kelantan.