

RISK OF TYPE 2 DIABETES MELLITUS IN RIPARIAN ZONE COMMUNITY IN LANGKAT REGENCY

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ABSTRACT

Background: Type 2 Diabetes Mellitus (T2DM) is a growing public health challenge, particularly in riparian zone communities with limited access to healthcare services. **Objectives:** This study aimed to describe the T2DM risk profile and dietary patterns among the population in the working area of Puskesmas Stungkit, Wampu District, Langkat Regency, situated in a riparian zone. **Methods:** A preliminary survey was conducted with 60 respondents using the Finnish Diabetes Risk Score (FINDRISC) for risk screening, Fasting Blood Glucose (FBG) measurement to establish diabetes status (ADA 2019 criteria), and Semi-Quantitative Food Frequency Questionnaire (SQFFQ) for dietary analysis. A qualitative approach was employed through brief interviews with five informants to explore health perceptions and family health behaviors. **Results:** 83.3% of respondents were classified as high risk for T2DM based on FINDRISC. FBG examination revealed that 50% were diagnosed with DM and 50% were in a prediabetes condition. SQFFQ analysis found that all DM respondents (100%) and 70% of the prediabetes group had high-risk dietary patterns. Qualitative findings revealed low perceived susceptibility, limited health literacy regarding DM, and internalization of unhealthy dietary habits as family norms. **Conclusions:** The study revealed a very high T2DM risk profile in the riparian zone community of Langkat Regency, underscoring the urgency of developing contextual family empowerment-based health promotion strategies. **Keywords:** Type 2 Diabetes Mellitus; Riparian Zone; FINDRISC; Family Health Promotion; Prediabetes

INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) is one of the non-communicable diseases that has become the greatest global health burden in the 21st century. The International Diabetes Federation (IDF) reported that in 2021 approximately 589 million people aged 20–79 years worldwide were living with diabetes, and this number is projected to increase to 853 million by 2050, representing an increase of approximately 45 percent (IDF, 2024). In 2024, diabetes is estimated to have caused approximately 3.4 million deaths, with about 43 percent of people with diabetes undiagnosed, mostly from low- and middle-income countries (IDF, 2024). Indonesia ranks seventh in the world with approximately 20.4 million people with diabetes aged 20–79 years, and is projected to increase to 28.6 million by 2050. Based on the Indonesian Health Survey (SKI) 2023, the prevalence of diabetes in the adult population based on blood glucose examination reached 11.7 percent, increasing significantly from 8.5 percent in Riskesdas 2018 (Ministry of Health Republic of Indonesia, 2023). About 50 percent of people with diabetes in Indonesia are unaware of their disease status, so many cases are detected at an advanced stage with complications.

At the regional level, North Sumatra Province faces a considerable diabetes burden. Based on the Provincial Health Profile of North Sumatra 2023, the number of people with diabetes reached more than 228,000 people. Langkat Regency ranks third highest in the proportion of

people with diabetes in North Sumatra. Puskesmas Stungkit in Wampu District, located in the riparian zone, recorded significant case increases from 209 cases in 2022 to 487 cases in 2023, and 430 cases in 2024 (Langkat Regency Health Office, 2022).

The riparian zone is an area along riverbanks with distinctive geographical and social characteristics. Limited transportation access, distance to referral facilities, and challenging environmental conditions are the main obstacles in utilizing health services, particularly for promotive and preventive activities (WHO, 2018). In this community, people must cross the river using traditional transportation (raft) to reach the nearest hospital when complications occur, potentially causing delays in medical treatment. Food consumption patterns, physical activity, and health service utilization in this community are strongly influenced by the family environment and prevailing social norms (Glanz et al., 2015).

Various studies have shown that family-based health promotion is effective in improving adherence to dietary management, physical activity, and self-care behavior in people with T2DM, and is able to significantly reduce HbA1c levels (Nugroho et al., 2023; Almotairy et al., 2024). However, research that specifically examines the T2DM risk profile and health behaviors in riparian zone communities remains very limited. This study aimed to describe the T2DM risk profile, glycemic status, dietary patterns, and family health perceptions in the riparian zone community of Langkat Regency as a basis for developing contextual health promotion strategies.

METHODS

This study was a preliminary survey with a descriptive mixed-methods design, combining quantitative and qualitative approaches. The research was conducted in the working area of Puskesmas Stungkit, Wampu District, Langkat Regency, a riparian zone area with distinctive geographical characteristics. The study was conducted from January to March 2025.

The research subjects consisted of 60 respondents selected by purposive sampling from the community in the working area of Puskesmas Stungkit. Inclusion criteria included adults aged 20–64 years who had lived in the riparian zone area for at least one year and were willing to participate in the study. Quantitative data collection was carried out using three instruments: (1) Finnish Diabetes Risk Score (FINDRISC) for non-invasive T2DM risk screening based on eight components of biological and behavioral risk factors, with a total score range of 0–26, where scores ≥ 15 indicate high risk; (2) Fasting Blood Glucose (FBG) examination for determination of diabetes status based on ADA 2019 diagnostic criteria, where FBG ≥ 126 mg/dl indicates diabetes and FBG 100–125 mg/dl indicates prediabetes; and (3) Semi-Quantitative Food Frequency Questionnaire (SQFFQ) validated by a nutritionist for dietary pattern analysis related to T2DM risk.

The qualitative approach was implemented through brief interviews with five informants selected purposively to explore perceptions, attitudes, and family health behaviors related to T2DM. Qualitative informants were selected based on criteria of residing in the riparian zone and being willing to provide in-depth information about health perceptions and family habits. Quantitative data analysis was carried out descriptively by presenting frequency distributions and percentages. Qualitative data was analyzed using a thematic approach to identify dominant patterns of perception and behavior in the community. Ethical approval for this study was granted by the Health Research Ethics Committee of Sekolah Tinggi Ilmu Kesehatan Flora Medan (Certificate Number: 021/KEPK/STIKES-FL/I/2025, Approved on January 6, 2025).

RESULTS AND DISCUSSIONS

T2DM Risk Profile Based on FINDRISC Screening

Initial screening using the FINDRISC instrument on 60 respondents in the working area of Puskesmas Stungkit showed a significant risk profile. The majority of respondents were in the high-risk category for developing T2DM within 10 years, as presented in Table 1.

Table 1. Distribution of T2DM Risk Category Based on FINDRISC Score (n=60)

FINDRISC Risk Category	n	%
High Risk T2DM (Score ≥ 15)	50	83.3
Low Risk / Safer	10	16.7
Total	60	100.0

Based on Table 1, FINDRISC screening results showed that 50 of 60 respondents (83.3%) were in the high-risk T2DM category, while only 10 respondents (16.7%) were in the low-risk or safer category. The high proportion of high-risk groups indicates an accumulation of behavioral and biological risk factors in the riparian zone community, including unhealthy dietary patterns, lack of physical activity, excess body weight, and family history of diabetes. FINDRISC has been proven to have good validity in predicting T2DM risk in various populations and has been tested in more than 15 countries (Zhang et al., 2014). This finding far exceeds the national average and warrants immediate attention from health authorities.

Fasting Blood Glucose (FBG) Status

As a clinical follow-up to the FINDRISC screening, FBG examination was performed on all 60 respondents. The examination results are presented in Table 2.

Table 2. Distribution of Fasting Blood Glucose (FBG) Status of Respondents (n=60)

FBG Status	n	%
Diagnosed DM (FBG ≥ 126 mg/dl)	30	50.0
Prediabetes (FBG 100–125 mg/dl)	30	50.0
Total	60	100.0

Based on Table 2, FBG examination results showed an equal distribution between two groups. As many as 30 respondents (50%) were diagnosed with DM based on the FBG threshold ≥ 126 mg/dl, while the other 30 respondents (50%) were in a prediabetes condition with FBG values of 100–125 mg/dl. No respondents were found with normal FBG levels. This finding indicates that all screened respondents were in a hyperglycemic condition, either already diagnosed with DM or in the prediabetes phase at high risk of developing into T2DM. This aligns with IDF (2024) reporting that approximately 43 percent of people with diabetes globally are undiagnosed. The high proportion of prediabetes affirms the urgency of immediate preventive intervention, considering that prediabetes is a reversible condition that can still be prevented from developing into T2DM through lifestyle modification (Tuomilehto et al., 2001).

Dietary Pattern Based on SQFFQ Analysis

Dietary pattern analysis using the nutritionist-validated SQFFQ instrument was performed on all respondents to assess the risk of dietary patterns toward T2DM. The analysis results are presented in Table 3.

Table 3. Distribution of Dietary Patterns Based on SQFFQ Instrument per Respondent Group (n=60)

Group	At-Risk Dietary Pattern	Non-At-Risk Dietary Pattern	Total
Diagnosed DM (n=30)	30 (100%)	0 (0%)	30
Prediabetes (n=30)	21 (70%)	9 (30%)	30
Total	51 (85%)	9 (15%)	60

Based on Table 3, SQFFQ analysis revealed a dominance of at-risk dietary patterns in all respondent groups. In the group diagnosed with DM, all respondents (100%) had dietary patterns categorized as at-risk for DM, characterized by consumption of high-sugar, high-fat, high-simple-carbohydrate, and low-fiber foods. Meanwhile, in the prediabetes group, 21 respondents (70%) had at-risk dietary patterns, and only 9 respondents (30%) had non-at-risk dietary patterns. Overall, 51 of 60 respondents (85%) showed at-risk dietary patterns, indicating that unhealthy consumption behavior is the dominant risk factor in this community. Diet is a key behavioral determinant strongly influencing T2DM risk; consumption of excess energy, saturated fat, and simple carbohydrates contributes to weight gain and impaired glucose regulation (Bonora & DeFronzo, 2018). The finding that 100% of respondents in the DM group had at-risk dietary patterns reinforces the close relationship between diet quality and glycemic status.

Qualitative Findings: Health Perceptions and Family Health Behaviors

Qualitative interviews with five informants revealed several dominant themes related to risk perceptions and T2DM prevention behaviors in the riparian zone community.

First, low perceived susceptibility was identified as a primary barrier. Most informants had not considered DM a serious health threat, especially while no physical complaints had appeared. The perception of DM as a disease exclusively associated with old age was dominant in the community. This is consistent with the Health Belief Model (HBM), which states that individuals with low perceived susceptibility tend to be less motivated to perform prevention actions even when they objectively have high risk (Rosenstock, 1974; Glanz et al., 2015).

Second, the internalization of unhealthy consumption patterns as family norms was identified. Consumption behavior of high-sugar, high-fat, and simple carbohydrate foods was perceived by the community as a natural family habit that had been passed down from generation to generation. Dietary patterns including sweet rice, sweet tea, cakes, and coconut milk-based foods were considered family norms that did not need to be changed. This reflects the strong role of cultural factors and family habits in maintaining at-risk consumption patterns in the riparian zone community.

Third, limited health literacy related to T2DM was found. Community knowledge about DM was partial and limited, generally only associated with the general condition of "sugar disease" without in-depth understanding of disease mechanisms, the prediabetes phase, and the importance of early prevention. Awareness of modifiable risk factors, such as dietary patterns and physical activity, was still very low. Information received through Puskesmas programs such as GERMAS was still one-directional and had not encouraged sustained behavioral changes.

Fourth, family communication not yet oriented toward prevention was identified. Although family relationships and communication were generally good, that communication had not been utilized as a means of forming preventive behaviors. Health discussions in families tended

to only occur when a family member was sick, rather than as a preventive effort. This shows that the potential of families as health behavior change agents had not been optimized. Pamungkas et al. (2022) proved that family-based DM management education significantly improved self-care and patient adherence. These findings reinforce the argument that family empowerment-based health promotion through Participatory Action Research (PAR) is the most relevant and potentially sustainable strategy for riparian zone communities (Kemmis & McTaggart, 2005).

CONCLUSIONS

This preliminary survey revealed a very high T2DM risk profile in the riparian zone community in the working area of Puskesmas Stungkit, Langkat Regency. As many as 83.3% of respondents were in the high-risk category based on FINDRISC, 50% were diagnosed with DM, and 50% were in a prediabetes condition based on FBG examination. No respondents were found with normal FBG levels, indicating that all screened respondents were in a hyperglycemic condition. Dominance of at-risk dietary patterns (85%) and low health literacy related to T2DM were identified as main determinant factors. Qualitative findings identified low perceived susceptibility, internalization of unhealthy consumption patterns as family norms, limited health literacy, and not yet optimal family communication for prevention purposes.

Based on the research findings, it is recommended that: (1) Puskesmas Stungkit and health workers develop family empowerment-based health promotion programs adaptive to riparian zone conditions, utilizing FINDRISC as a screening and education tool; (2) interventions be directed at increasing perceived susceptibility and T2DM health literacy, particularly in the productive age group; (3) family nutrition education programs be developed to change internalized unhealthy consumption norms; (4) the Participatory Action Research (PAR) approach be recommended as a methodological framework for participatory and sustainable health promotion interventions; and (5) further research with a more comprehensive PAR design be conducted to design and evaluate family-based health promotion strategies specific to the riparian zone context.

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CONFLICT OF INTEREST AND FUNDING DISCLOSURE

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AUTHOR CONTRIBUTIONS

HT: conception, data curation, formal analysis, investigation, methodology, project administration, resources, validation, visualization, writing original draft, writing review and editing.

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