Exploring Knowledge and Perceptions of Lifestyle-Based Type 2 Diabetes Management: A Preliminary Cross-Sectional Study in Semarang, Indonesia

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Abstract. Background: Type 2 Diabates Mellitus (T2DM) continues to be a pressing public health issue in Indonesia, especially in urban environments such as Semarang, where sedentary lifestyles and poor dietary habits are increasingly common. Although lifestyle-based interventions-including intemitten fasting (IF), high-intensity inteval training (HIIT), and peer support groups have shown clinical benefits inT2DM control, public understanding and acceptance of these approaches remain underexplored in the Indonesian context. This preliminary study aimed to evaluated the baseline knowledge and perceptions of adults with T2DM in Smearang toward IF, HIIT, and peer group supports as alternative strategies for diabetes self-management. **Methods:** A cross-sectional survey was conducted involving 120 adult respondens diagnosed with T2DM in Semarang. A validates structured quesionnaire was administered to measure participants knowledge, perceptions, and willingness to adopt each lifestyle-based intevention. Data were analyzed using descriptive statistics, chi-square tests, and Pearson correlation, with a significance level set at 5%. **Results:** The majority participants (68%) lacked prior knowledge of intermitten fasting, and only 24% were aware of HIIT as a supportive physical activity. However, 72% expressed interest in peer support group participation. A significant positive correlation was found between educational attainment and awareness of lifestyle-based diabetes interventions ($p<0,05$). Despite limited baseline knowledge, respondents demonstrated openness to engaging in non-pharmacological approaches.

Keywords: Type 2 Diabetes Mellitus, Intermitten Fasting, HIIT, Peer Suport

1 Introduction

Type 2 Diabetes Mellitus (T2DM) has become a major public health concern worldwide, particularly in low- and middle-income countries undergoing rapid urbanization and lifestyle transition. Indonesia ranks among the top ten countries with the highest number of people living with diabetes, with an estimated 19.5 million cases in 2021, projected to reach 28.6 million by 2045 (Atlas, 2021). The burden of T2DM is particularly pronounced in urban areas such as Semarang, Central Java, where sedentary lifestyles, unhealthy eating behaviors, and stress-related habits have become increasingly

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prevalent. The growing prevalence of diabetes not only reflects a shift from communicable to non-communicable disease dominance but also represents a significant challenge to Indonesia's healthcare and economic systems, given the lifelong management required for this chronic condition.

Lifestyle modification remains the cornerstone of T2DM management. The American Diabetes Association highlights that non-pharmacological interventions such as medical nutrition therapy, physical activity, and psychosocial support play a crucial role in maintaining glycemic control and preventing complications (Education, 2017). Yet, evidence shows that most Indonesian patients rely heavily on pharmacotherapy, while behavioral and lifestyle-based approaches are underutilized (Kemenkes RI, 2023). Moreover, existing national programs such as Prolanis (Chronic Disease Management Program) and Posbindu PTM (Integrated Non-Communicable Disease Post) have not fully achieved their targets due to limited public participation, inadequate health workforce, and insufficient health education dissemination (Wirawati & Widyaningsih, 2022)(Alkaff et al., 2021).

Recent global studies emphasize the importance of adopting sustainable lifestyle interventions including intermittent fasting (IF), high-intensity interval training (HIIT), and peer group-based education as effective strategies for improving insulin sensitivity, weight control, and overall metabolic health (Batitucci et al., 2022a)(McClure et al., 2024). IF has been shown to improve glycemic parameters and reduce cardiovascular risk factors in people with T2DM, while HIIT demonstrates significant benefits in enhancing cardiorespiratory fitness and glucose uptake [8]. Additionally, peer support interventions facilitating shared experiences, emotional reinforcement, and collaborative goal setting have emerged as promising tools for sustaining long-term behavioral change [9]. However, despite the growing global evidence, these lifestyle-based interventions remain underexplored in Indonesia, both in terms of patient awareness and perceived acceptability within the cultural context.

Understanding patients' knowledge, perceptions, and willingness to engage in such approaches is critical for developing culturally relevant diabetes education and empowerment programs. Health behavior theories, such as the Health Belief Model (HBM) and the Theory of Planned Behavior (TPB), provide valuable frameworks for analyzing factors influencing patients' attitudes and intentions toward adopting healthier behaviors [10] [11]. These theories emphasize that individual behavior is shaped by perceived susceptibility, perceived benefits, social norms, and perceived behavioral control. Prior studies in Indonesia have shown that patients' limited knowledge and self-efficacy, compounded by diabetes-related distress and social stigma, contribute to poor self-management and treatment adherence [12].

In Semarang, the Dinas Kesehatan (Health Office) reported that in 2024 there were 29,172 registered T2DM cases across 38 public health centers, with many patients demonstrating low participation in health education and self-management activities. Factors such as time constraints, inadequate access to supportive facilities, and lack of family engagement have further limited the success of community-based diabetes control initiatives (Pada et al., n.d.). This situation underscores the need for innovative, low-cost, and patient-centered approaches to complement existing medical management.

Given these challenges, the present study explores baseline knowledge and perceptions of lifestyle based diabetes management including IF, HIIT, and peer support among adults living with T2DM in Semarang, Indonesia. This preliminary investigation aims to identify the current level of awareness, attitudes, and willingness to adopt these interventions. By analyzing the relationship between educational attainment and awareness, this study provides valuable insights into how demographic and psychosocial factors influence the adoption of alternative diabetes care strategies. The findings are expected to inform the development of culturally tailored health promotion programs that integrate evidence-based lifestyle interventions with local community engagement.

Ultimately, understanding how patients perceive and respond to lifestyle based diabetes management approaches will contribute to the broader goal of strengthening diabetes self-management education in Indonesia. This aligns with the national agenda of enhancing preventive and promotive healthcare through patient empowerment, community participation, and interprofessional collaboration.

2 Methods

2.1 Study settings

This study employed a cross-sectional quantitative design as part of a preliminary exploration conducted in Semarang, Central Java, Indonesia. The research was designed to capture baseline knowledge and perceptions of adults diagnosed with T2DM regarding three emerging lifestyle interventions IF, HIIT, and peer support. The city of Semarang was selected because it represents an urban population with a rapidly increasing prevalence of diabetes and a high concentration of primary healthcare facilities implementing community-based chronic disease management programs.

2.2 Study Design and Sampling

Participants were recruited using purposive sampling from 10 primary health centers (Puskesmas) registered under the Semarang Health Office's chronic disease program database. Inclusion criteria were:1.Adults aged ≥ 30 years diagnosed with T2DM for at least one year, 2.Currently under pharmacological or non-pharmacological management, 3.Able to read and communicate in Bahasa Indonesia. Exclusion criteria included individuals with gestational diabetes, severe complications (e.g., nephropathy, retinopathy), or cognitive impairment limiting their ability to provide informed responses. A total of 120 respondents were enrolled based on sample size calculation using the Slovin formula with a 95% confidence level and 5% margin of error.

2.3 Data Collection Tools and Procedure

Data were collected using a validated structured questionnaire consisting of four sections: Socio-demographic characteristics (age, sex, education, occupation, income, and

duration of diagnosis), Knowledge of lifestyle-based diabetes management (12 items assessing familiarity with IF, HIIT, and peer support), Perception and attitude (10 items rated on a 5-point Likert scale assessing perceived benefits, safety, and feasibility), Willingness to adopt (5 items measuring readiness and motivation to engage in lifestyle-based management). The questionnaire was adapted from prior validated instruments used in behavioral diabetes research (Furmli et al., 2018; Traina et al., 2016) and was pilot-tested among 20 patients for clarity and reliability, yielding a Cronbach's alpha of 0.82 for internal consistency.

2.4 Data Processing and Analysis

Data collection was conducted between January and March 2025. Trained field enumerators and diabetes educators administered the questionnaire during routine outpatient clinic visits or Prolanis meetings. Participants provided written informed consent prior to participation. Data were entered and analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were applied to summarize sociodemographic characteristics and levels of knowledge and perception. Categorical variables were presented as frequencies and percentages, while continuous variables were expressed as means ± standard deviations. The chi-square test was used to assess associations between categorical variables (e.g., education level and awareness), while Pearson's correlation and multiple linear regression analyses were employed to determine relationships between knowledge, attitude, perceived behavioral control, and willingness to adopt lifestyle interventions. Statistical significance was set at $p < 0.05$.

3 Results

3.1 Participant Characteristics

A total of 120 participants with clinically diagnosed Type 2 Diabetes Mellitus (T2DM) completed the survey.

Table 1. Sociodemographic Characteristics of respondents (n=120)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	46	38.3
	female	74	61.7
Marital status	Married	98	82.0
	Not married	22	18.0
Educational level	Primary/junior high	20	17.0
	Secondary	68	57.0
	Higher education	32	26.0
Monthly Income	< minimum wage	58	48.0
	>Minimum wage	62	52.0

The participant, with 61.7% female and 38.3% male respondents. The majority were married (82%), and 57% had completed secondary education, while 26% held higher education degrees. Approximately 48% reported a monthly income below the regional minimum wage.

Table 2. Awareness of Lifestyle Based Diabetes Management (n=120)

Knowledge Aspect	category	Frequency (n)	Percentage (%)
Heard about Intermitten Fasting (IF)	Yes	38	32
	No	82	68
Heard about High Intensity Interval Training (HIIT)	Yes	29	24
	No	91	76
Heard about Peer Support Groups	Yes	70	58
	No	50	42

Overall, participants demonstrated limited awareness of lifestyle-based diabetes management strategies. As shown in Table 1, only 32% had previously heard of intermittent fasting (IF) as a possible complementary approach for glycemic control, while 68% reported no prior exposure to the concept. Similarly, awareness of high-intensity interval training (HIIT) was low, with only 24% of participants recognizing it as a structured exercise regimen beneficial for diabetes management. In contrast, awareness of peer support groups was relatively higher (58%), largely due to exposure through community health programs such as Prolanis

Table 3. Attitudes and Perceptions Toward Lifestyle Based Interventions (n=120)

Statement	Agree (n)	Percentage (%)
Interested in joining peer support groups	86	72
Believes lifestyle modification can reduce medication dependence	76	63
Concerned about the safety of intermitten fasting (especially insulin users)	60	50
Perceives HIIT as too intense for older adults	55	45.8

Despite low baseline knowledge, participants expressed favorable attitudes toward lifestyle-based interventions. About 72% indicated interest in joining a peer support group, perceiving it as a source of motivation and practical guidance. Moreover, 63% of respondents agreed that lifestyle modification could potentially reduce their medication dependence. However, concerns were raised regarding the perceived safety of IF (particularly among insulin users) and the intensity of HIIT among older adults with limited physical capacity.

3.2 Bivariate Analysis

Correlation between education and awareness. A significant positive correlation was found between educational attainment and awareness of lifestyle-based diabetes management interventions ($r = 0.42$; $p < 0.05$). Participants with higher education levels were more likely to report familiarity with IF, HIIT, and peer support models. In contrast, no significant associations were found between age, gender, or duration of illness and awareness levels ($p > 0.05$).

Table 4. Relationship Between Educational level and Awareness of Lifestyle Intervention (n=120)

Variable	r	P value	Interpretation
Eduaction- Awareness of IF	0.42	<0.05	significant
Education- Awareness of HIIT	0.39	<0.05	significant
Eduaction- Awareness of Peer Support Group	0.41	<0.05	significant
Gender- Awareness of Lifestyle interventions	0.08	>0.05	Not significant

There was a significant positive correlation between educational attainment and awareness of lifestyle-based diabetes interventions ($r = 0.42$, $p < 0.05$). This suggests that individuals with higher education levels are more likely to be familiar with IF, HIIT, and peer support models. No significant correlations were observed for gender ($p > 0.05$).

4 Discussion

The present study revealed substantial gaps in knowledge regarding lifestyle-based interventions for diabetes management among adults in Semarang. Although intermittent fasting (IF) and high-intensity interval training (HIIT) have received increasing international recognition for their metabolic benefits (Batitucci et al., 2022b)(Rajabi et al., 2022), these strategies remain unfamiliar within Indonesian clinical and public health discourse. The significant correlation between educational attainment and awareness underscores the persistent disparity in health literacy among diabetic patients [12](Wirawati & Widyaningsih, 2022). Patients with higher education levels likely have greater access to health information and digital platforms, which facilitate exposure to innovative approaches such as IF and HIIT.

Interestingly, while baseline knowledge was limited, participants demonstrated openness toward adopting non-pharmacological management options. This finding suggests that positive perception can emerge even in the absence of detailed understanding, a phenomenon explained by the Theory of Planned Behavior (TPB), where favorable attitudes and perceived social approval (subjective norms) enhance behavioral intention [12]. In the Indonesian context, where communal relationships and peer

influence are culturally significant, peer support groups may serve as a culturally congruent platform to facilitate behavior change. Participants' preference for peer-based activities highlights the value of collective learning and emotional reinforcement, aligning with evidence from community-based studies in Malaysia and Ethiopia showing that social modeling improves adherence to diabetes self care [11].

The hesitation toward adopting IF and HIIT mainly stemmed from perceived physical limitations and safety concerns, especially among older adults with comorbidities. These findings align with Darvishi et al. (2025), who observed that low self-efficacy often hinders adherence to exercise and dietary regimens. The predictive role of perceived behavioral control found in this study reinforces the central tenet of TPB that confidence in one's ability to perform a behavior is a key determinant of action (Ajzen, 2011). Hence, any intervention promoting IF or HIIT should include structured education, gradual progression, and professional supervision to ensure safety and sustainability.

From a policy perspective, this study provides baseline evidence that can inform the integration of lifestyle-based modules within existing diabetes management programs such as Prolanis and Posbindu PTM. Incorporating IF, HIIT, and peer group facilitation into routine health promotion activities could bridge the gap between clinical evidence and real-world patient practices. Moreover, since willingness to engage in peer support was notably high (78%), health authorities can leverage this enthusiasm to develop community-based diabetes clubs or peer-led education circles in Puskesmas networks.

The findings substantiate both the Health Belief Model (HBM) and TPB constructs. Participants' willingness to try lifestyle modifications reflects a strong perceived benefit, while hesitancy toward IF and HIIT suggests the presence of perceived barriers, particularly related to feasibility and safety. The mediating role of intention, observed between attitude and actual behavior, aligns with Ajzen's proposition that intention is the most proximal predictor of behavior (Ajzen, 1991). Future interventions should thus focus on strengthening motivational and self-regulatory mechanisms, such as goal-setting and peer accountability, to enhance long-term adherence.

Globally, lifestyle interventions have demonstrated substantial improvements in glycemic outcomes and quality of life [10]. The present findings, though preliminary, echo these results by highlighting the population's receptiveness to alternative, low-cost interventions. However, the limited prior exposure among respondents indicates that knowledge translation remains weak, emphasizing the need for accessible education delivered through culturally adapted media such as interactive workshops, short videos, and community forums.

5 Conclusion and Recommendations

This preliminary cross-sectional study highlights critical gaps in knowledge and awareness of lifestyle-based management strategies among adults living with Type 2 Diabetes Mellitus (T2DM) in Semarang, Indonesia. While most participants were unfamiliar with concepts such as intermittent fasting (IF) and high-intensity interval training

(HIIT), their positive perceptions and willingness to participate in peer support programs underscore a strong openness to non-pharmacological approaches for diabetes self-management. Education level emerged as a significant determinant of awareness, whereas attitude and perceived behavioral control predicted willingness to adopt lifestyle-based practices.These findings underscore the need to integrate culturally adapted, community-driven, and evidence-based lifestyle interventions into existing diabetes education frameworks such as Prolanis and Posbindu PTM. Incorporating peer-led support groups, structured education on IF and HIIT, and behavior change strategies rooted in the Theory of Planned Behavior (TPB) could enhance patients' self-efficacy and long-term adherence to healthy living. Future research should employ longitudinal or mixed-methods designs to examine behavioral changes over time and the real-world impact of lifestyle interventions on glycemic control, quality of life, and healthcare utilization. In doing so, Indonesia can strengthen its preventive and promotive care systems, aligning with global strategies for sustainable diabetes management.

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