

## The Role of Type 2 Diabetes Mellitus Education in Preventing Type 2 Diabetes Mellitus in Students of the Nutrition DIII Study Program Cirebon Tasikmalaya Polytechnic

**Jongga Adiyaksa\*, Dewi Vimala, Maheswari Adya Sasi, Regita Rahmadina**

Poltekkes Kemenkes Tasikmalaya, Indonesia

Email: [jongga.adiyaksa@dosen.poltekkestasikmalaya.ac.id](mailto:jongga.adiyaksa@dosen.poltekkestasikmalaya.ac.id)\*

### KEYWORDS

Diabetes mellitus;  
Education;  
Degenerative diseases;  
Nutrition Students;  
Disease prevention;

### ABSTRACT

The International Diabetes Federation (IDF) reports that the global prevalence of type 2 diabetes mellitus (T2DM) was 9.3% in 2019, with projections indicating that the number of people affected will reach 578 million by 2030 and 700 million by 2045. Indonesia ranks seventh globally, with 10.7 million people living with diabetes—figures expected to rise to 13.7 million by 2030 and 16.6 million by 2045. West Java Province ranks 18th nationally based on diagnoses in populations aged  $\geq 15$  years. The purpose of this study is to examine the effectiveness of type 2 diabetes mellitus education in prevention efforts. This study employed a quantitative descriptive design to assess the impact of T2DM education on prevention among 77 nutrition students at Tasikmalaya Polytechnic, selected using Slovin's formula with a 5% margin of error. Data were collected through structured questionnaires administered before and after the educational intervention, and analyzed using frequency distribution. Results revealed significant improvements in knowledge: prior to education, 53% of respondents demonstrated good knowledge, 44.1% adequate knowledge, and 2.9% poor knowledge. Following the intervention, 93.5% exhibited good knowledge, 6.5% adequate knowledge, and 0% poor knowledge—representing an increase of 31 respondents in the good knowledge category. The educational program was highly effective in enhancing students' understanding of T2DM prevention. This improvement provides a vital foundation for fostering preventive health behaviors among future nutritionists, who will serve as health promoters in their communities. The findings offer implications for curriculum development, community health education initiatives, and long-term behavioral change strategies.

Attribution-ShareAlike 4.0 International (CC BY-SA 4.0)



### INTRODUCTION

Diabetes Mellitus (DM), or commonly called diabetes, is a chronic disease that often occurs in adults and requires continuous medical supervision and patient self-education (Abdillah & Suwarno, 2016; Mohamed Ali et al., 2024; Nanayakkara et al., 2021). However, depending on the type of DM and the age of the patient, needs can vary significantly (LeMone, Priscilla, 2016 in Rosliana Dewi, 2022). A person is said to have diabetes mellitus if their blood sugar level exceeds 126 mg/dL during fasting, more than 200 mg/dL two hours after the oral glucose tolerance test (TTGO), or if random blood glucose levels exceed 200 mg/dL (PERKENI, 2019).

Most people with diabetes mellitus are unaware of their condition or do not receive appropriate treatment until complications arise. Blood sugar levels in people with diabetes mellitus must be carefully controlled to reduce the risk of complications. One of the four noncommunicable diseases targeted by world leaders is diabetes mellitus, which represents a major public health problem (WHO, 2019).

Over the past few decades, the prevalence and number of diabetes cases have increased dramatically. Most individuals worldwide suffer from type 2 diabetes mellitus (DM2) (Sun et al., 2024; Zeng et al., 2018). Type 2 diabetes mellitus can affect all organs of the body and cause various health disorders—such as blurred vision, cataracts, heart disease, kidney disease, sexual impotence, and wounds that are difficult to heal—if not managed properly. It may also lead to lung infections, vascular diseases, and stroke (Fatimah, 2019). Type 2 diabetes mellitus affects both physical and psychological health (Kartikasari, 2018).

The International Diabetes Federation (IDF, 2017) reported that the global prevalence of diabetes was 9.3% (463 million adults) in 2019, with the highest burden among individuals aged 65–79 years (111.2 million). This figure is projected to rise to 578 million by 2030 and 700 million by 2045, marking an alarming 51% increase over 26 years (IDF, 2019). Indonesia ranks seventh among the top ten countries with the highest diabetes prevalence, with an estimated 10.7 million people living with diabetes in 2019. National projections estimate an increase to 13.7 million by 2030 and 16.6 million by 2045 (Ministry of Health of the Republic of Indonesia, 2020). Within Indonesia, West Java Province ranks 18th nationally based on physician-diagnosed diabetes in populations aged  $\geq 15$  years, with a prevalence of 1.9% (Riskseddas, 2018).

Adolescents and young adults with diabetes mellitus who do not receive appropriate therapeutic management face higher risks of premature cardiovascular disease, chronic kidney disease, increased insulin resistance, and arterial damage that accelerates atherosclerosis (Ahmad et al., 2023). Impaired glucose metabolism leads to inadequate cellular glucose utilization, manifesting as polydipsia (excessive thirst), polyphagia (increased hunger), erectile dysfunction in males, and visual disturbances. Individuals with type 1 diabetes require insulin therapy and dietary modifications to maintain glycemic stability, while those with type 2 diabetes often need lifestyle interventions alongside oral hypoglycemic agents or insulin (Andini & Awwalia, 2018).

Given the rising burden of diabetes mellitus among younger populations, prevention through structured health education is of critical importance. Increasing awareness among adolescents and young adults about healthy lifestyle choices—including balanced nutrition, regular physical activity, weight management, and avoidance of tobacco use—can substantially reduce diabetes incidence (Suwandewi & Normeilida, 2023; Silalahi, 2019). Evidence shows that adolescents equipped with comprehensive diabetes knowledge are more likely to engage in proactive health-protective behaviors and avoid diabetes-related complications (Yatun Khomsah & Dian Nurani, 2024).

Although previous studies have demonstrated the positive effects of diabetes education on knowledge and behavior change in adults (Suwandewi & Normeilida, 2023; Silalahi, 2019), limited empirical evidence exists regarding how structured educational interventions influence knowledge acquisition and preventive behaviors among health profession students, particularly

those in nutrition programs. This research gap is significant because nutrition students represent a unique population with dual importance: they are at-risk youth who require diabetes prevention education and, simultaneously, future health professionals who will serve as nutrition counselors and health educators in clinical and community contexts. Understanding the effectiveness of diabetes education among this group has important implications for curriculum development and workforce preparation in chronic disease prevention.

The novelty of this study lies in its focus on evaluating knowledge gains regarding type 2 diabetes mellitus among nutrition students—a population with high preventive potential given their future professional roles in dietary counseling, nutrition therapy, and public health promotion. Furthermore, this research addresses a critical gap in the Indonesian context, where the integration of structured diabetes education into health profession curricula remains inconsistent despite the growing national diabetes burden.

This study aims to assess the role of type 2 diabetes mellitus education in preventing T2DM among students enrolled in the Diploma Three (DIII) Nutrition Study Program at Tasikmalaya Polytechnic, Cirebon Campus. Specifically, the objectives are to: (1) describe baseline knowledge levels regarding T2DM prevention among nutrition students prior to the educational intervention; (2) evaluate knowledge changes following structured diabetes education; and (3) determine the effectiveness of the educational intervention in enhancing students' understanding of T2DM prevention strategies.

The findings of this research hold significant implications for multiple stakeholders. For educational institutions, the study provides evidence to support curriculum integration of structured diabetes education in nutrition and other health profession programs. For public health policymakers, it highlights the potential of investing in health education for future healthcare professionals as a sustainable chronic disease prevention strategy. For students, enhanced knowledge represents the foundational step in the knowledge-attitude-practice (KAP) continuum, ultimately contributing to both personal health protection and professional competence in community health promotion.

## METHOD

This study employed a quantitative descriptive research design to evaluate the effectiveness of type 2 diabetes mellitus educational intervention in enhancing knowledge among nutrition students. Quantitative descriptive research is appropriate for systematically describing phenomena, documenting characteristics of study populations, and analyzing relationships between variables using numerical data and statistical analysis (Sugiyono, 2017). The descriptive approach enabled the researchers to document and quantify changes in students' knowledge levels before and after educational intervention without manipulating variables or establishing causal relationships through experimental control.

The research was conducted at the Diploma Three (DIII) Nutrition Study Program, Cirebon Campus, Tasikmalaya Health Polytechnic, West Java, Indonesia. The study setting was selected based on accessibility and relevance, as nutrition students represent a critical target population for diabetes education given their future professional roles in nutritional counseling and health promotion.

The study population comprised all active students enrolled in the DIII Nutrition Study Program at Tasikmalaya Polytechnic, totaling 95 students. Sample size determination employed Slovin's formula, a statistical method appropriate for descriptive research when population size is known and finite:

$$n = N / [1 + N(e)^2]$$

Where:

n = required sample size

N = total population (95 students)

e = margin of error (0.05 or 5%)

Calculation:

$$n = 95 / [1 + 95(0.05)^2]$$

$$n = 95 / [1 + 95(0.0025)]$$

$$n = 95 / [1 + 0.2375]$$

$$n = 95 / 1.2375$$

$$n = 76.77 \approx 77 \text{ students}$$

Therefore, the study sample consisted of 77 students, representing 81.1% of the total population. This substantial sample proportion enhances the representativeness and generalizability of findings to the study population.

Data collection utilized a structured questionnaire designed to assess knowledge regarding type 2 diabetes mellitus prevention. The instrument was developed based on comprehensive literature review of diabetes education materials, clinical practice guidelines (PERKENI, 2019; American Diabetes Association, 2019), and validated diabetes knowledge assessment tools. The questionnaire contained 20 multiple-choice items covering key domains including:

1. Definition and diagnostic criteria of type 2 diabetes mellitus
2. Risk factors and etiology of T2DM
3. Clinical manifestations and complications
4. Primary prevention strategies (dietary modification, physical activity, weight management)
5. Secondary prevention and early detection methods
6. Role of nutrition in diabetes management

Each correct response was scored as 1 point, yielding a total possible score of 20 points. Knowledge level was categorized using the following classification adapted from Arikunto (2013):

1. Good knowledge: 76-100% correct responses (15-20 points)
2. Adequate knowledge: 56-75% correct responses (11-14 points)
3. Poor knowledge: <56% correct responses (<11 points)

The questionnaire underwent content validation by two expert reviewers (one endocrinologist and one nutrition education specialist) to ensure accuracy, relevance, and comprehensiveness of items. Pilot testing was conducted with 10 nutrition students from different campuses to assess clarity and comprehension, resulting in minor wording modifications to enhance understanding.

The data collection was systematically conducted in three sequential phases, beginning with a baseline assessment where all 77 participants completed a diabetes knowledge questionnaire under standardized conditions. Following this pre-test, they received a structured 120-minute educational intervention delivered by qualified health educators, which utilized a multimedia presentation and covered comprehensive modules on topics ranging from the epidemiology and pathophysiology of type 2 diabetes to primary prevention strategies. The session was designed to be interactive, incorporating discussions and case studies, and was supported by printed educational materials for the participants.

Immediately after the educational session, the procedure concluded with the follow-up assessment phase. In this final phase, participants completed the exact same knowledge questionnaire again, adhering to the same standardized procedures as the pre-test. This post-test was essential for measuring the short-term knowledge gains resulting directly from the educational intervention, thereby allowing for a direct comparison with the baseline data to evaluate the intervention's immediate effectiveness.

The data were analyzed using descriptive statistics to characterize respondent demographics and quantify knowledge levels, with procedures including frequency distributions, cross-tabulations of knowledge categories, and comparisons of pre-test and post-test mean scores. This analysis was performed using SPSS Statistics version 25.0, and the results are presented in tables displaying frequency distributions and categorical changes to facilitate clear interpretation.

Throughout the research process, strict ethical standards were upheld in accordance with the Declaration of Helsinki. This involved obtaining formal ethical clearance from the institutional committee, securing written informed consent from all participants, and protecting confidentiality using numeric codes. The study was designed to be beneficent by providing participants with valuable professional knowledge relevant to their future careers while posing minimal risk, as it only required their time for a questionnaire and an educational session pertinent to their academic program.

## RESULTS AND DISCUSSIONS

### Overview of Respondent Characteristics

Respondents in this study demonstrated diverse characteristics across demographic and health-related variables including gender, personal diabetes diagnosis, family history of diabetes mellitus, and prior exposure to diabetes education.

**Table 1. Respondent Characteristics**

| Yes | Variable                              | Frequency | Percentage |
|-----|---------------------------------------|-----------|------------|
| 1   | Gender                                |           |            |
|     | Man                                   | 5         | 6,5 %      |
|     | Woman                                 | 72        | 93,5 %     |
| 2   | Have Been Diagnosed with DM           | 1         | 1,3 %      |
| 3   | Family History With Diabetes Mellitus | 13        | 16,9 %     |
| 4   | History of Education about DM         |           |            |
|     | Yes                                   | 64        | 83,1%      |
|     | No                                    | 13        | 16,9 %     |

Table 1 shows the results of the study in the form of the frequency distribution of respondents based on the characteristics of the respondents. The distribution of respondents by gender showed that the frequency of female sex was 72 people (93.5%) more than men, namely 5 people (6.5%). The distribution of respondents based on having been diagnosed with DM was 1 person (1.3%). In this study, 13 respondents (16.9%) had a family history of DM. Meanwhile, based on the history of education about DM, 64 people (83.1%) have been educated and 13 people have never been educated about DM (16.9%)

### Overview of Knowledge Before Being Given Diabetes Mellitus Educational Interventions

**Table 2. Distribution of respondent frequency based on respondents' knowledge prior to Diabetes Mellitus educational intervention (n=77)**

| Knowledge level | Frequency (n) | Percentage |
|-----------------|---------------|------------|
| Less            | 2             | 2,9 %      |
| Enough          | 34            | 44,1 %     |
| Good            | 41            | 53 %       |
| Total           | 77            | 100%       |

Table 2 shows an overview of the respondents' knowledge before being given diabetes mellitus educational interventions, the respondents' knowledge was categorized into 3 categories, namely lacking, adequate and good. Of the 77 respondents, 2 (2.9%) respondents had insufficient knowledge about diabetes mellitus, 34 (44.1%) respondents had sufficient knowledge and 41 (53%) respondents had good knowledge.

### Overview of Knowledge After Being Given Diabetes Mellitus Educational Intervention

**Table 3. Distribution of respondent frequency based on respondents' knowledge after Diabetes Mellitus educational intervention (n=77)**

| Knowledge level | Frequency (n) | Percentage |
|-----------------|---------------|------------|
| Less            | 0             | 0 %        |
| Enough          | 5             | 6,5 %      |
| Good            | 72            | 93,5 %     |
| Total           | 77            | 100%       |

Table 3 shows an overview of respondents' knowledge after being given diabetes mellitus educational interventions, respondents' knowledge is categorized into 3 categories, namely lacking, sufficient and good. Of the 77 respondents, 0 (0%) respondents had poor knowledge about diabetes mellitus and 5 (6.5%) respondents had sufficient knowledge and 72 (93.5%) respondents had good knowledge

**Table 4. Overview of Changes in scores or categories after being given Diabetes Mellitus Education Intervention**

| Knowledge level | Before education (F) | After Education (F) | Number of changes in score or category |
|-----------------|----------------------|---------------------|----------------------------------------|
| Less            | 2                    | 0                   | Less than 2 respondents                |
| Enough          | 34                   | 5                   | Reduced to 29 people                   |

| Knowledge level | Before education (F) | After Education (F) | Number of changes in score or category |
|-----------------|----------------------|---------------------|----------------------------------------|
| Good            | 41                   | 72                  | Increase of 31 people                  |
| Total           | 77                   | 77                  | 100%                                   |

Table 4 shows an overview of changes in scores or categories after being given Diabetes Mellitus educational interventions, respondents' knowledge is categorized into 3 categories, namely lacking, sufficient and good. Of the 77 respondents, 2 respondents showed that there was a decrease in the number of respondents who had insufficient knowledge about diabetes mellitus, a decrease in the number of respondents by 29 people who had sufficient knowledge and an increase in the number of respondents by 31 people who had good knowledge

## Discussion

The findings of this study demonstrate that structured educational intervention on type 2 diabetes mellitus significantly enhanced knowledge levels among nutrition students at Tasikmalaya Polytechnic. The substantial increase from 53.0% to 93.5% of respondents achieving good knowledge represents a meaningful improvement in students' cognitive understanding of diabetes prevention—a critical foundation for subsequent attitude formation and behavioral adoption.

According to Notoatmodjo's health behavior theory (2014), knowledge represents the cognitive domain that forms the foundation for health-related actions and behaviors. As stated by Alief Saputra (2018), knowledge is a crucial determinant of behavioral intention and action, with evidence suggesting that behaviors based on solid knowledge foundations demonstrate greater sustainability than those lacking cognitive understanding. This theoretical framework aligns with the Knowledge-Attitude-Practice (KAP) model widely applied in health education, which posits that knowledge acquisition serves as the first step toward attitude modification and ultimately behavioral change. In the context of diabetes prevention, enhanced knowledge about risk factors, complications, and prevention strategies can motivate individuals to adopt healthier lifestyles including improved dietary patterns, increased physical activity, and regular health screenings.

The baseline knowledge assessment revealed that 53.0% of respondents already possessed good knowledge prior to intervention, which may reflect several factors. First, 83.1% of participants reported prior exposure to diabetes education, suggesting that previous academic coursework, public health campaigns, or informal learning had provided foundational knowledge. Second, as nutrition students, participants had likely encountered diabetes-related content in their core curriculum covering medical nutrition therapy, chronic disease management, and public health nutrition. Third, the high proportion of female participants (93.5%) may contribute to better baseline knowledge, as research suggests females often demonstrate greater health literacy and engagement with health information compared to males (Okan et al., 2015). Fourth, 16.9% of respondents reported family history of diabetes mellitus, which may have motivated personal information-seeking regarding the disease and prevention strategies.

The educational intervention proved highly effective in addressing knowledge gaps, with post-test results showing 93.5% of respondents achieving good knowledge. This 40.5 percentage point improvement suggests that the structured, comprehensive educational session successfully clarified misconceptions, filled knowledge gaps, and reinforced accurate understanding. Several mechanisms likely contributed to this effectiveness:

First, the multimedia instructional approach combining PowerPoint presentations, video demonstrations, and case discussions accommodated diverse learning styles and enhanced information retention. Research by Mayer's cognitive theory of multimedia learning (2021) demonstrates that combining visual and verbal information facilitates deeper cognitive processing and improves learning outcomes compared to single-modality instruction.

Second, the 120-minute session duration provided sufficient time for comprehensive content coverage while maintaining attention and engagement. The inclusion of interactive components such as question-and-answer sessions and group discussions promoted active learning, which is more effective than passive information reception for knowledge acquisition and retention (Freeman et al., 2014).

Third, the provision of printed educational booklets allowed participants to review and reference key information beyond the immediate session, supporting continued learning and knowledge consolidation. This aligns with principles of spaced repetition and distributed practice, which enhance long-term memory formation.

Fourth, the content relevance to participants' academic program and future professional roles likely enhanced motivation and engagement. As future nutrition professionals who will counsel patients on diabetes prevention and management, participants recognized the practical value of this knowledge for their careers, potentially increasing attention and encoding depth during the educational session.

The finding that all respondents in the poor knowledge category ( $n=2$ ) successfully transitioned to higher categories post-intervention is particularly encouraging, suggesting that the educational approach was accessible and comprehensible even for those with minimal baseline understanding. Similarly, the dramatic reduction in the adequate knowledge category from 44.1% to 6.5% indicates that the intervention effectively elevated moderate knowledge to optimal levels for the vast majority of participants.

These findings align with previous research demonstrating the effectiveness of structured health education interventions for knowledge enhancement. Suwandewi and Normeilida (2023) reported significant knowledge improvement following diabetes education among high school students in Banjarmasin, with post-test scores increasing substantially compared to baseline. Similarly, research by Deakin et al. (2005) in a systematic review found that structured diabetes education programs consistently improved knowledge, self-management behaviors, and glycemic control in adult populations. The present study extends this evidence base by demonstrating comparable effectiveness in a population of health profession students who represent both at-risk youth and future health educators.

However, several limitations and considerations warrant discussion. First, this study assessed only short-term knowledge gain immediately following intervention, without evaluating knowledge retention at later time points. Research suggests that knowledge decay occurs over time without reinforcement, with significant forgetting observed at 3-6 month

follow-up in health education studies (Custers, 2010). Therefore, future research should incorporate longitudinal assessment to determine knowledge retention and the need for booster education sessions.

Second, the study measured only the knowledge domain of the KAP model, without assessing changes in attitudes or preventive health behaviors. While knowledge is necessary for behavior change, it is not sufficient; individuals must also develop positive attitudes and self-efficacy beliefs, and overcome practical barriers to behavior adoption. Subsequent research should employ comprehensive evaluation frameworks assessing all three KAP domains, potentially using validated instruments such as the Diabetes Knowledge Test (DKT), Diabetes Attitude Scale, and behavioral frequency questionnaires.

Third, the single-group pre-post design lacks a control or comparison group, limiting causal inference regarding intervention effectiveness. While the substantial magnitude of knowledge improvement strongly suggests intervention impact, alternative explanations such as test-retest effects (familiarity with questions improving performance) or history effects (external events influencing knowledge) cannot be definitively excluded. Future studies should employ quasi-experimental or randomized controlled trial designs with control groups receiving usual education or delayed intervention, allowing stronger causal conclusions.

Fourth, the educational intervention was delivered as a single 120-minute session, which may not provide optimal learning for all participants. Educational theory and empirical evidence support the superiority of distributed practice (multiple shorter sessions over time) compared to massed practice (single intensive session) for durable learning and transfer to long-term memory. Future curriculum integration should consider implementing diabetes education across multiple sessions or throughout the academic program to enhance retention and allow progressive skill development.

Fifth, the study sample consisted predominantly of female nutrition students (93.5%), limiting generalizability to male students or students in other health profession programs. Future research should include more diverse samples across gender, academic disciplines (nursing, public health, medical students), and educational institutions to assess intervention effectiveness across different populations.

Despite these limitations, this study makes important contributions to both educational practice and diabetes prevention efforts. For educational institutions, the findings provide evidence supporting formal integration of structured diabetes education into nutrition and other health profession curricula. Given that nutrition students will serve as frontline health educators and counselors in clinical and community settings, ensuring they possess comprehensive, accurate knowledge about diabetes prevention is essential for workforce preparation. Curriculum committees should consider developing standardized diabetes education modules covering etiology, prevention, and management, integrated longitudinally across multiple courses and reinforced through clinical practicums.

From a public health perspective, the study highlights the potential of investing in health profession student education as a sustainable prevention strategy with multiplier effects. Each educated nutrition professional can subsequently educate hundreds or thousands of patients, clients, and community members throughout their careers, creating cascading prevention impacts far exceeding the initial educational investment. This aligns with WHO's

recommendation for strengthening health workforce capacity as a core strategy for noncommunicable disease prevention and control (WHO, 2013).

The theoretical mechanisms underlying the effectiveness of diabetes education deserve further consideration. The present findings support the Knowledge-Attitude-Practice model, demonstrating that knowledge enhancement is achievable through structured educational intervention. However, translating enhanced knowledge into sustained behavioral change requires additional elements. According to Bandura's Social Cognitive Theory (1986), behavior change depends on reciprocal interactions among personal factors (knowledge, self-efficacy), environmental factors (social support, resource availability), and behavioral factors (skills, reinforcement). Therefore, comprehensive diabetes prevention education should extend beyond knowledge transmission to include:

1. Self-efficacy enhancement through mastery experiences, vicarious learning, and verbal persuasion, building students' confidence in their ability to adopt and maintain preventive behaviors
2. Behavioral skills training in practical competencies such as meal planning, label reading, physical activity integration, and blood glucose monitoring
3. Environmental modification strategies addressing barriers and facilitators in students' living, academic, and social environments
4. Social support mobilization encouraging peer accountability, family involvement, and community engagement in healthy lifestyle promotion

Future educational interventions should incorporate these additional components within comprehensive, multilevel programs addressing the full spectrum of knowledge, attitudes, skills, and environmental factors influencing health behavior.

Comparison with international diabetes education research reveals both similarities and unique contextual considerations. Studies conducted in developed countries such as the United States and Europe consistently report knowledge improvements following structured diabetes education, with effect sizes comparable to those observed in the present study. However, cultural factors, healthcare system characteristics, and resource availability differ substantially between high-income and middle-income countries like Indonesia, necessitating culturally adapted educational approaches. For example, dietary recommendations must account for traditional Indonesian food patterns, with emphasis on appropriate rice portion control, tempeh and tofu as protein sources, and vegetable-rich sambal, rather than simply translating Western dietary guidelines. Educational materials should feature culturally relevant imagery, case examples, and language that resonates with Indonesian students' lived experiences.

The finding that 16.9% of respondents reported family history of diabetes mellitus highlights the importance of targeted prevention efforts for high-risk individuals. Research demonstrates that first-degree relatives of individuals with type 2 diabetes face 2-6 times higher risk of developing the disease compared to those without family history (InterAct Consortium, 2013). Educational interventions for this subgroup should emphasize intensive prevention strategies including regular screening, aggressive lifestyle modification, and consideration of pharmacological prevention (metformin) in high-risk cases with prediabetes, as recommended by diabetes prevention clinical practice guidelines (American Diabetes Association, 2021).

## CONCLUSION

This study provides strong evidence that structured educational interventions effectively enhance knowledge of Type 2 Diabetes Mellitus (T2DM) prevention among nutrition students, with the proportion demonstrating “good” knowledge rising from 53% pre-intervention to 93.5% post-intervention. Such cognitive gains form a crucial first step in the knowledge-attitude-practice continuum, laying the groundwork for health-promoting behaviors and equipping future nutritionists with essential competencies to act as health educators in their communities. To build on these results, future research should employ longitudinal quasi-experimental designs with control groups to assess long-term knowledge retention and track changes in attitudes, self-efficacy, and preventive behaviors, including diet and physical activity. Comparative studies examining delivery methods such as peer-led sessions, digital tools, and simulation-based learning are recommended to identify sustainable, engaging approaches, and expanding the scope to other health professional student groups would strengthen generalizability and inform multi-professional strategies for diabetes prevention.

## REFERENCES

- Abdillah, A. A., & Suwarno. (2016). Diagnosis of Diabetes Using Support Vector Machines with Radial Base Function Kernels. *International Journal of Technology*, 5, 849–858.
- Ahmad, A., Banda, V. A., Wati, E., Dodja, K. P. P., & Patmawati, T. A. (2023). Gaya Hidup Remaja Terhadap Penyakit Tidak Menular: Literatur Review. *Jurnal Kesehatan Masyarakat Indonesia (JKMI)*, 1(2), 66–73. <https://doi.org/https://doi.org/10.62017/jkmi.v1i2.646>
- Andini, A., & Awwalia, E. S. (2018). Studi Prevalensi Risiko Diabetes Melitus pada Remaja Usia 15--20 Tahun di Kabupaten Sidoarjo. *Medical and Health Science Journal*, 2(1), 19–22. <https://doi.org/https://doi.org/10.33086/mhsj.v2i1.600>
- Association, A. D. (2019). Diagnosis and classification of diabetes mellitus. *Diabetes Care*, 37(Supplement 1), S81--S90. <https://doi.org/10.2337/dc14-S081>
- Fatimah, R. N. (2019). Diabetes Melitus Tipe 2. *Jurnal Majority*, 4(5), 93–101.
- International Diabetes Federation (IDF). (2017). *International Diabetes Atlas*. International Diabetes Federation.
- Kartikasari, N. D. (2018). Hubungan Antara Religiusitas Dengan Kesejahteraan Psikologis Pada Penderita Diabetes Melitus Tipe 2. 1–8.
- Lestari, Zulkarnain, & Sijid, S. A. (2020). Diabetes Melitus: Review Etiologi, Patofisiologi, Gejala, Penyebab, Cara Pemeriksaan, Cara Pengobatan dan Cara Pencegahan. *Prosiding Seminar Kesehatan [Nama Seminar]*.
- Mohamed Ali, K. B., Sathish Kumar, S., Govindarajan, P. K., Mujibur Rahman, K. B., & Nancy, S. (2024). Predictors for diabetes and hypertension among bus drivers and conductors in South India. *Bioinformation*, 20(5), 495–501. <https://doi.org/10.6026/973206300200495>
- Nanayakkara, N., Curtis, A. J., Heritier, S., Gadowski, A. M., Pavkov, M. E., Kenealy, T., Owens, D. R., Thomas, R. L., Song, S., Wong, J., Chan, J. C.-N., Luk, A. O.-Y., Penno, G., Ji, L., Mohan, V., Amutha, A., Romero-Aroca, P., Gasevic, D., Magliano, D. J., ...

- Zoungas, S. (2021). Impact of age at type 2 diabetes mellitus diagnosis on mortality and vascular complications: systematic review and meta-analyses. *Diabetologia*, 64(2), 275–287. <https://doi.org/10.1007/s00125-020-05319-w>
- PERKENI. (2019). Pedoman Pengelolaan Dan Pencegahan Prediabetes Di Indonesia 2019 (1st ed.). Airlangga University Press.
- Price, S. A., & Wilson, L. M. (2021). Pathophysiology: Clinical Concepts of Disease Processes (9th ed.). Elsevier Health Sciences.
- Riskesdas. (2018). Hasil Riset Kesehatan Dasar Tahun 2018 (Vol. 53, Issue 9).
- Salma. (2020). Tetap Sehat Setelah Usia 40: 100 Artikel Kesehatan Pilihan (J. Haryani (ed.)). Gema Insani.
- Silalahi, L. (2019). Hubungan Pengetahuan dan Tindakan Pencegahan Diabetes Melitus Tipe 2. *Jurnal PROMKES*, 7(2), 223. <https://doi.org/https://doi.org/10.20473/jpk.v7.i2.2019.223-232>
- Sun, Y., Liu, H., Mu, C., Liu, P., Hao, C., & Xin, Y. (2024). Early puberty: a review on its role as a risk factor for metabolic and mental disorders. *Frontiers in Pediatrics*, 12(September). <https://doi.org/10.3389/fped.2024.1326864>
- Suwandewi, A., & Normeilida, S. A. (2023). Pengaruh Pendidikan Kesehatan Terhadap Tingkat Pengetahuan Deteksi Dini Penyakit Diabetes Melitus pada Remaja di SMAN 7 Banjarmasin. *CNJ*, 7(1), 43.
- WHO. (2019). Diagnosis and Classification of Diabetes Mellitus.
- Yatun Khomsah, I., & Dian Nurani, R. (2024). Upaya Pencegahan Diabetes Mellitus melalui Edukasi dan Pemeriksaan Kadar Gula Darah pada Ibu-Ibu di Wilayah Akademi Keperawatan Bunda Delima. *Jurnal Pengabdian Masyarakat Bunda Delima*, 3(1), 29–36. <https://doi.org/https://doi.org/10.59030/jpmdb.v3i1>
- Zeng, X. T., Weng, H., Jin, Y. H., & al., et. (2018). Association between Diabetes Mellitus and Hypertension in Benign Prostatic Hyperplasia Patients. *Chinese Medical Journal (English)*, 131(09), 1120–1121. <https://doi.org/10.4103/0366-6999.230730>