

THE EFFECT OF FAMILY HEALTH EDUCATION ON KNOWLEDGE OF HYPERGLYCEMIC EMERGENCY PREVENTION AT PEKAUMAN PRIMARY HEALTH CENTER, BANJARMASIN

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Abstract

Background: Hyperglycemia is a condition characterized by elevated blood glucose levels that can progress to emergencies such as diabetic ketoacidosis (DKA) and hyperosmolar hyperglycemic state (HHS), both of which carry a high risk of mortality if not promptly treated. A lack of family knowledge in recognizing the signs and symptoms of hyperglycemic emergencies is one of the contributing factors to delayed treatment. This study aimed to determine the effect of health education on family knowledge regarding the prevention of hyperglycemic emergencies. **Methods:** This study employed a pre-experimental design using a one-group pre-test and post-test approach. The population consisted of 133 family members of patients with type 2 diabetes mellitus at Pekauman Primary Health Center, Banjarmasin. A total of 57 respondents were selected through purposive sampling. The research instrument was a knowledge questionnaire that had been tested for validity and reliability. **Results:** The findings showed an increase in family knowledge after the health education intervention. Statistical analysis using the Wilcoxon Signed Rank Test revealed a p-value of 0.001 ($p < 0.05$), indicating a significant effect of health education on improving family knowledge in preventing hyperglycemic emergencies. **Conclusion:** Health education is effective in enhancing family knowledge, enabling them to be better prepared to handle hyperglycemic emergency situations in patients with diabetes mellitus.

Keywords: Diabetes Mellitus, Family Knowledge, Health Education, Hyperglycemic Emergency

Background

Diabetes mellitus is a non-communicable disease resulting from metabolic disorders, primarily involving impaired insulin production. When insulin levels decrease, the body struggles to convert blood glucose into stored energy, leading to elevated blood sugar levels or hyperglycemia. This condition has become a major public health concern due to its high prevalence (Maheswara et al., 2024).

Diabetes mellitus is a chronic metabolic disorder that causes a total or partial deficiency of insulin, affecting how the body processes fats, proteins, and carbohydrates. It occurs when the body cannot produce enough insulin or when insulin does not function effectively, resulting in blood glucose levels rising above the normal range (Montororing et al., 2024). According to WHO data from 2019, diabetes directly caused approximately 1.5 million

deaths and contributed to an additional 460,000 deaths related to kidney failure and hyperglycemia. The International Diabetes Federation (IDF) has classified diabetes as a global health issue with the fastest-growing prevalence in the 21st century.

In 2021, an estimated 537 million people worldwide were living with diabetes, a number projected to increase to 643 million by 2030 and 783 million by 2045. Additionally, 541 million individuals are at risk of developing diabetes or are currently in a prediabetic state (Ministry of Health, 2022). In Indonesia, particularly in South Kalimantan, diabetes ranks 18th in national prevalence (Risksedas, 2018).

The South Kalimantan Health Office recorded 26,667 diabetes cases in 2023, with 14,658 cases reported in Banjarmasin City. At the

Pekauman Primary Health Center, 1,551 cases were reported in 2023 and increased to 1,836 in 2024. The Banjar community's cultural preference for sweet foods—such as lempung, kolak, and coconut sugar—is a long-standing tradition. However, excessive sugar consumption contributes to elevated blood glucose levels and increases the risk of diabetes, highlighting the need for greater public awareness of sugar intake for maintaining health.

Diabetes can also lead to severe complications, including hyperglycemic crises such as diabetic ketoacidosis (DKA) and hyperosmolar hyperglycemic state (HHS), both of which are life-threatening (Adinata et al., 2022). DKA is an acute complication caused by insulin deficiency, characterized by high blood glucose levels, acidosis, and increased ketone production. It can occur in both type 1 and type 2 diabetes and requires prompt medical intervention. The incidence of DKA is relatively high, particularly among patients with type 1 diabetes, with mortality rates ranging from 0.5% to 7% (Lugito & Kurniawan, 2023). In contrast, HHS involves severe hyperglycemia and dehydration due to relative insulin deficiency, with a mortality rate of approximately 20%—significantly higher than DKA. Both conditions require immediate treatment and intensive care. While DKA has a mortality rate of less than 1%, HHS can be ten times more fatal. Outcomes are influenced by factors such as dehydration, comorbidities, and age over 60 years (Khalilati et al., 2021).

Risk factors for DKA and HHS include poor medication adherence, infrequent medical check-ups, and high consumption of sugary beverages. Other contributing factors include infections, myocardial infarction, stroke, certain medications, alcohol use, trauma, and gastrointestinal disorders (Lugito & Kurniawan, 2023). Prolonged hyperglycemia increases the risk of serious complications such as kidney damage, neuropathy, retinopathy, and cardiovascular diseases (Pebriyanti et al., 2024).

Currently, many families lack sufficient knowledge regarding the warning signs of hyperglycemic emergencies, as they do not understand the underlying disease. Many are unaware of what hyperglycemia is and how to recognize its symptoms. They also do not know when to seek emergency medical help or provide

appropriate first aid. Early symptoms, such as fatigue, frequent urination, or excessive thirst, are often perceived as normal, when in fact they may indicate serious conditions. This lack of knowledge can delay treatment, increasing the risk of complications and even mortality.

Ideally, families should possess basic knowledge of hyperglycemia, be able to identify emergency signs such as DKA and HHS, know the appropriate initial actions to take—such as administering insulin or fluids—and recognize when to seek hospital care. Families also need to understand the importance of regular blood glucose monitoring, healthy dietary habits, and adherence to treatment regimens. They should be able to identify when to contact healthcare providers and provide initial support during emergencies.

The role of the family is crucial in managing diabetic emergencies at home, as they are the primary caregivers for patients (Windyastuti et al., 2024). Health education serves to improve the knowledge, attitudes, and skills of family members so they can adopt healthier lifestyles and effectively manage the disease (Hertiana & Saleh, 2020).

A preliminary study and interviews conducted with families of patients at Pekauman Primary Health Center revealed that among 10 family members interviewed, 7 stated that the patient had never experienced high blood glucose levels. The remaining 3 reported that the patient had experienced elevated blood glucose, but the only response was to advise dietary changes and adequate rest. These families lacked awareness of emergency symptoms, as they had never received education or information regarding hyperglycemic emergencies.

Based on this phenomenon, the researcher is interested in examining the effect of health education on family knowledge in preventing hyperglycemic emergencies at Pekauman Primary Health Center, Banjarmasin.

Method

This study employed a quantitative approach using a pre-experimental design with a one-group pre-test and post-test design. The

research involved an intervention to examine the effect of health education on family knowledge regarding hyperglycemic emergencies.

The sampling technique used in this study was non-probability sampling with purposive sampling to select participants from the population who met the inclusion criteria. The population consisted of 133 family members of patients with type 2 diabetes mellitus recorded between November and December 2024. A total of 57 participants were selected using the Slovin formula and were chosen based on predefined inclusion criteria. The study was conducted from April to June 2025 at Pekauman Primary Health Center, Banjarmasin.

Data collection involved the use of educational leaflets and structured learning materials (SAP) for delivering the health education intervention, and a questionnaire to assess the level of family knowledge. The questionnaire was adapted from a previous study and modified by the researcher to suit the objectives of this research. It had been tested for validity and reliability. The research data were analyzed using the Wilcoxon Signed Rank Test, as the data were not normally distributed.

Results and Discussion

Table 1. Frequency of Respondents by Age

Age (years)	f	%
20	5	9
21-40	33	58
41-60	17	29
>60	2	4
Total	57	100

Table 1 shows that the highest percentage of respondents were aged 21–40 years, accounting for 33 individuals (58%), while the lowest percentage was respondents over 60 years old, totaling 2 individuals (4%).

Table 2. Frequency of Respondents by Gender

Gender	f	%
Female	40	70
Male	17	30
Total	57	100

Table 2 indicates that the majority of respondents were female, totaling 40 individuals (70%), whereas male respondents accounted for only 17

individuals (30%).

Table 3. Frequency of Respondents by Last Education Level

Education Level	f	%
Elementary School	7	12
Junior High School	12	21
Senior High School	30	53
Diploma	3	5
Bachelor's Degree	5	9
Total	57	100

According to Table 3, the most common education level among respondents was senior high school, with 30 individuals (53%), and the least common was a diploma (D3), with only 3 individuals (5%).

Table 4. Frequency of Respondents by Occupation

Occupation	f	%
Housewife	30	53
Private Sector Employee	8	14
Civil Servant	19	33
Total	57	100

Table 4 shows that the most frequent occupation among respondents was housewife, with 30 individuals (53%), while the fewest were employed in the private sector, totaling 8 individuals (14%).

Table 5. Family Knowledge Level Before Health Education Intervention

Level of Knowledge	f	%
Low	25	44
Fair	22	38
Good	10	18
Total	57	100

Table 5 presents data on the family's knowledge level before receiving health education regarding hyperglycemic emergency prevention. The majority of respondents had a low level of knowledge (25 respondents, 44%), and the minority had a good level of knowledge (10 respondents, 18%).

Table 6. Family Knowledge Level After Health Education Intervention

Level of Knowledge	f	%
Low	10	18
Fair	17	30
Good	30	52
Total	57	100

After the health education intervention (Table 6), most respondents demonstrated a good level of knowledge (30 respondents, 52%), while only 10 respondents (18%) remained at a low level. This indicates an overall increase in family knowledge following the health education.

Table 7. Wilcoxon Test Analysis Results			
Variable	N	Rank	p-value
Knowledge Level Before Health Education	57	Positive Ranks = 26	0.001
Knowledge Level After Health Education		Ties = 31	

Table 7 displays the results of the Wilcoxon Signed Rank Test for 57 respondents, showing an improvement in knowledge after the health education intervention. Of the participants, 26 showed an increase in scores, while 31 maintained their scores. The p-value was 0.001 ($p < 0.05$), indicating a statistically significant effect of health education on improving family knowledge of hyperglycemic emergency prevention.

Table 8. Mean Scores of Pre-Test and Post-Test Knowledge Levels					
Variable	N	Mean	SD	Min	Max
Pre-Test	57	21.28	2.477	17	28
Post-Test	57	24.89	2.723	20	28
p-value = <0.001					

As presented in Table 8, the average knowledge score increased from 21.28 (SD = 2.477) in the pre-test to 24.89 (SD = 2.723) in the post-test. The minimum score increased from 17 to 20, while the maximum remained at 28. Statistical analysis yielded a p-value of < 0.001 , confirming a statistically significant difference before and after the intervention. Therefore, health education proved to be effective in increasing family knowledge regarding the prevention of hyperglycemic emergencies.

Discussion
Family Knowledge Prior to Receiving Health Education on Hyperglycemic Emergency Prevention
 Based on the results of a study involving 57 respondents who were family members of patients with diabetes mellitus, it was found that prior to the intervention in the form of health education,

most respondents demonstrated a "low" level of knowledge, totaling 25 individuals (44%). Meanwhile, 22 respondents (38%) had a "moderate" level of knowledge, and only 10 respondents (18%) were categorized as having "good" knowledge.

These findings indicate that before the educational intervention, the majority of patient families lacked adequate understanding of hyperglycemic emergencies, particularly regarding prevention strategies, early symptom recognition, and initial management steps during acute conditions such as diabetic ketoacidosis (DKA) or hyperosmolar hyperglycemic syndrome (HHS). This lack of knowledge could lead to delays in appropriate treatment and may worsen the patient's condition before receiving professional medical assistance at home.

According to Notoatmodjo (2018), knowledge is the result of sensory perception of an object through the senses, which is then processed cognitively. Knowledge is influenced by several factors, such as education, experience, environment, and access to information. In this context, the respondents' low level of knowledge can be attributed to various sociodemographic characteristics, including age, gender, educational level, and occupation.

The majority of respondents were women (70%), aged between 21 and 40 years (58%), and had a high school level education (53%). Although this age group is considered productive and theoretically capable of receiving and processing information, the findings are in line with Wahyuni et al. (2021), who reported that successful education on diabetic emergencies is highly dependent on active family involvement—especially women, who often act as health decision-makers in the household and are more likely to absorb health-related information when in their productive years.

However, most respondents only completed secondary education, suggesting they may be unfamiliar with medical terminology or scientific approaches. Bloom (1956) states that knowledge is the foundational domain in the cognitive hierarchy, which must first be developed to influence attitudes and behaviors.

Nasution and Harahap (2021) assert that individuals with lower educational attainment often require visual or practical educational media such as leaflets or short videos to understand complex medical conditions. This underscores the importance of aligning educational strategies with the literacy level of the target population. Inadequate knowledge can hinder the ability of families to manage or prevent chronic conditions like diabetes independently.

Occupation also plays a significant role; in this case, many respondents were housewives who are primarily engaged in domestic activities and therefore may have limited access to health information. A study by Putri, Sari, and Marlina (2022) indicates that housewives are at greater risk of low health literacy, especially when there is minimal interaction with healthcare facilities or health promotion activities. Limited time and daily priorities can further reduce the focus on learning about emergency prevention measures such as hyperglycemia.

The Health Belief Model (Becker, 1974) explains that perceptions of threat and the benefits of preventive actions are shaped by personal experiences and exposure to health information. Individuals who have never been exposed to information regarding hyperglycemia are more likely to have low awareness and knowledge of the condition. Without sufficient awareness, early signs may be overlooked, increasing the risk of adverse outcomes.

These characteristics reveal that, despite being in their productive years, the respondents were not optimally accessing health information—whether from healthcare workers, printed media, or digital sources. The World Health Organization (2024) also emphasizes that family engagement in health education remains a global challenge, particularly in managing chronic diseases like diabetes that require continuous monitoring and support.

The low intensity and poor quality of health education sessions are contributing factors to the low knowledge levels observed. According to the PRECEDE-PROCEED model by Green and Kreuter (1980), knowledge serves as a key predisposing factor influencing an individual's readiness for health behavior change. When knowledge is lacking, effective preventive action against hyperglycemia cannot be expected.

A study by Azmiardi, Lestari, and Handayani (2021) also shows that the success of health education relies heavily on family involvement and the strengthening of basic knowledge. Inconsistency in health promotion or the use of inappropriate media significantly undermines educational effectiveness. Yuliana, Dewi, and Rahman (2021) similarly found that families of diabetic patients often lack adequate understanding of hyperglycemic emergencies due to the absence of continuous education and limited availability of contextually appropriate educational tools. This is echoed by interviews conducted by the researcher, in which several respondents admitted they had never received direct counseling on diabetic emergencies.

Cultural and local beliefs also play a role in the lack of knowledge. Some respondents perceived symptoms such as fatigue, frequent urination, or excessive thirst as common conditions manageable with rest or traditional remedies. This indicates that community perceptions of health are still shaped by cultural values and unscientific information passed through word of mouth. The WHO (2024) also highlights that local cultural beliefs often serve as major barriers to implementing evidence-based health education, especially in communities unfamiliar with modern medical approaches.

The researcher concludes that in this context, most families lacked both the opportunity and capacity to access and fully understand health information. This situation does not exist in isolation, but rather stems from an interplay of structural and cultural factors. Limited access to credible health information sources, infrequent interaction with healthcare professionals, and one-way educational approaches that do not reflect the realities of the community have left families in a passive position regarding emergency prevention, particularly for hyperglycemia. Consequently, families are often unable to recognize the early signs of a hyperglycemic crisis and delay taking appropriate action, increasing the risk of serious complications for patients with diabetes mellitus. Therefore, a comprehensive health education intervention is urgently needed.

Such interventions must not only be

informative—conveying accurate facts and emergency management procedures—but also communicative, meaning they should be easy to understand, visually engaging, and relevant to the lived experiences of the community. Community-based health education should be prioritized to ensure broader outreach. This approach must involve local leaders or health cadres who are emotionally and geographically close to the community and can adapt the content to align with prevailing cultural values. By doing so, the program is more likely to be accepted, culturally appropriate, and effectively internalized into the daily practices of patients' families.

Based on the research findings, it can be concluded that the low level of family knowledge regarding hyperglycemic emergencies prior to educational intervention resulted from a complex interplay of factors. These include sociodemographic characteristics, such as being in the productive age group without sufficient health literacy. Although the families were of working age, this did not automatically translate into the ability to access and comprehend medical information. Additionally, the dominant role of women in managing family health—particularly mothers—was hindered by limited access to health information and minimal participation in counseling activities, especially among those who were full-time housewives without broad social networks.

Low formal education levels also contributed to the lack of analytical and critical skills required to filter health information, including the misinterpretation or dismissal of early hyperglycemia symptoms as mere fatigue. The absence of regular health promotion sessions further exacerbated this condition, as families did not receive continuous guidance on managing their loved ones' health. Furthermore, local cultural values—often fatalistic—and the common misperception that diabetes is only dangerous when it leads to a "coma" reinforced a passive attitude and reliance on quick-fix solutions.

To strengthen family preparedness in responding to emergency conditions such as hyperglycemia, a holistic and sustained educational intervention rooted in local culture is needed. This approach is expected not only to improve knowledge but also to shape family attitudes and develop practical

skills to respond to emergencies promptly and appropriately. Cross-sectoral collaboration involving healthcare professionals, community leaders, and local media will be essential in building a robust and effective support system for health education.

Family Knowledge After Receiving Health Education on Hyperglycemic Emergency Prevention

The results of this study demonstrated a significant improvement in family knowledge following the intervention, which consisted of direct health education sessions and the distribution of informational leaflets. The post-test findings revealed that 30 respondents (52%) had a “good” level of knowledge, 17 respondents (30%) were categorized as having “moderate” knowledge, and only 10 respondents (18%) remained in the “poor” knowledge category.

This increase indicates that the applied educational approach effectively addressed the knowledge gap identified in the pre-test. These results suggest that systematically designed, visual, and contextually relevant health education can enhance family capacity in recognizing symptoms, risks, and initial responses to emergency conditions such as diabetic ketoacidosis (DKA) and hyperosmolar hyperglycemic syndrome (HHS).

These findings are consistent with the study by Yusuf, Prasetyo, and Wahyuni (2024), which confirmed that structured education significantly improves preparedness and knowledge, especially in recognizing early symptoms such as polyuria, polydipsia, muscle weakness, fruity-smelling breath, and loss of consciousness. The success of educational programs in enhancing knowledge is often associated with the methods employed.

The health education intervention in this study combined interactive lectures, Q&A sessions, and the use of leaflets that incorporated simple language, visual illustrations, and systematically organized information. According to Amini, Prasetya, and Widodo (2023), illustrated leaflets significantly increase knowledge scores and participant retention, particularly among populations with

limited health literacy.

This effective learning strategy aligns with cognitive learning principles proposed by Bruner (1960), which emphasize that optimal learning occurs when individuals are actively engaged in the process of assimilating information. When learners are presented with relevant and meaningfully delivered material, their comprehension and memory retention are enhanced.

Leaflets serve as concrete and accessible visual aids. This concept is supported by Edgar Dale's Cone of Experience theory, which states that visual information and direct experiences result in the highest retention rates compared to abstract methods such as pure lectures (Dale, as cited in Utaminingsya and Lestari, 2020b). In other words, the more tangible and practical the medium of information delivery, the greater the likelihood of comprehension and recall by the participants.

Similar research by Zai, Manurung, and Lubis (2020) also demonstrated that family-based education programs improve the effectiveness of diabetes self-management. By placing families at the center of education, there were marked improvements in knowledge, treatment adherence, and recognition of complication symptoms. This is further supported by Hati, Setyaningrum, and Putri (2023), who found that structured educational approaches supplemented with contextually appropriate media significantly enhance knowledge and management skills within household settings.

Respondent characteristics also played a significant role in the effectiveness of the intervention. The majority were women of productive age with a senior high school education. Although some respondents had limited formal education, the contextual and visual nature of the intervention bridged the literacy gap. This aligns with Bloom's taxonomy (1956), which posits that improvements in the cognitive domain (knowledge) can influence changes in the affective (attitude) and psychomotor (behavior) domains, provided that learning is tailored to the participants' abilities and needs.

Active participation during the educational sessions also contributed significantly to

knowledge improvement. The researcher noted that many respondents showed interest, asked questions, and shared personal experiences during discussions. This engagement indicates that the learning process was not merely one-way but interactive and communicative. According to Bandura's social learning theory (1986), learning is reinforced when individuals actively participate and observe relevant demonstrations in real-life contexts. In this case, leaflets served not only as supplementary materials but also as reference tools that respondents could revisit at home when faced with suspicious or emergency situations.

Another factor contributing to the success of this intervention was the respondents' sociocultural context. In Indonesian culture, women often serve as the primary health caregivers in families, making them more receptive to health information perceived as beneficial. This supports the findings of Putri, Sari, and Marlina (2022), who noted that although rural women often have low health literacy, their willingness to learn and receptiveness to educational interventions is relatively high. Utilizing interpersonal approaches and simple printed media like leaflets proved to be a strategic and targeted choice. Consistent information delivery and the use of language appropriate to the respondents' comprehension level further enhanced the effectiveness of the health education.

The leaflets not only provided medical information but also included practical steps, such as when to seek professional medical care and what to prepare at home for initial emergency response. According to the World Health Organization (2024), one indicator of successful health promotion is the ability of individuals to make independent health decisions—something achievable only through relevant, contextual, and comprehensible health education.

These findings reinforce the idea that the success of an intervention depends not only on content but also on delivery methods, participant engagement, and the appropriateness of media in relation to the participants' social backgrounds. Health

education that is visual, participatory, and communicative has been shown to not only improve knowledge scores but also build family confidence in managing emergency conditions.

Based on the study's findings, it can be concluded that health education interventions delivered through interactive lectures and visual leaflets were effective in improving family knowledge regarding the prevention of hyperglycemic emergencies. This improvement was influenced by a combination of easy-to-understand media, active participant engagement, and the contextual relevance of the materials to the participants' daily lives. These results highlight the importance of designing educational programs that are responsive to participant backgrounds and utilizing media that can bridge gaps in health literacy. Such education not only enhances knowledge but also lays a critical foundation for creating families who are more prepared and responsive in dealing with acute diabetes-related complications.

The Effect of Health Education on Family Knowledge Regarding the Prevention of Hyperglycemic Emergencies

The statistical analysis using the Wilcoxon test revealed a significant effect of health education on the improvement of family knowledge in preventing hyperglycemic emergencies, with a p -value = 0.001 ($p < 0.05$). This finding indicates that the implemented health education program had a meaningful and positive impact on the family's understanding of early management of hyperglycemia, a condition that may progress into critical emergencies such as diabetic ketoacidosis (DKA) and hyperosmolar hyperglycemic syndrome (HHS). Furthermore, it suggests that health education does not merely serve as a medium for conveying information, but also plays a crucial role in building family preparedness to respond effectively and promptly to health crises.

These results are consistent with the findings of Thirsk and Schick-Makaroff (2021), who reported that family- and community-based educational interventions significantly improve self-efficacy and understanding of chronic diseases such as diabetes. Theoretically, the effectiveness of health education can be explained through Bruner's (1960) cognitive learning theory, which posits that active and relevant learning experiences enhance knowledge internalization. In the context of this

study, health education was delivered through a combination of lectures, interactive discussions, and illustrated leaflets, allowing participants to not only receive information passively but also engage actively by asking questions, participating in discussions, and reviewing the material at home.

This process aligns with the concept of experiential learning, which emphasizes meaningful reflection on concrete experiences. The use of leaflets served as a visual aid that enhanced understanding and retention. As stated by Dale's Cone of Experience theory, concrete visual media are more memorable than abstract or verbal content (Utaminingsyas & Lestari, 2020a).

The researchers noted that the significant impact of health education on family knowledge was influenced not only by the content but also by the appropriateness of the methods used in relation to participant characteristics. Most respondents were women of productive age (21–40 years), had a high school level education, and were housewives. These characteristics have important implications for information absorption.

According to Yuliana, Dewi, and Rahman (2021), women of productive age possess strong cognitive capacities and play a central role in managing family health, including overseeing diet, medications, and decision-making in health matters. However, this role also presents challenges, particularly in terms of time constraints, domestic responsibilities, and access to information. Thus, educational strategies and content must be tailored accordingly.

The moderate education level of most respondents was a key consideration in selecting the appropriate educational method. The use of technical language or complex medical terminology can pose a barrier if not simplified and supported by visual elements. Therefore, leaflets containing images, symbols, and step-by-step action schemes proved to be effective in bridging the gap caused by limited health literacy. Maqfiroch, Zakiyah, and Putri (2024) affirmed that visual approaches in health education are highly effective in reaching populations with low to

moderate educational backgrounds by simplifying complex concepts and facilitating informed decision-making.

Health education also offers the advantage of sustainable knowledge transfer. Printed materials such as leaflets can be shared with family members who did not attend the education session, thereby expanding the educational impact and creating a multiplier effect within the family community. Moreover, face-to-face sessions allow for two-way interactions between educators and participants, enabling direct clarification and question-and-answer opportunities. According to Rezai Asl, Naderimagham, and Khosravi (2023), education that incorporates interpersonal communication enhances information acceptance, deepens understanding, and boosts participants' confidence in applying acquired knowledge in real-life situations.

However, implementing health education also poses certain challenges. One such challenge is the limited availability of healthcare personnel and time to reach all members of the community. The effectiveness of health promotion is also highly influenced by the psychological readiness and motivation of participants. Not all families possess a proactive culture of seeking health information, making single-session education without follow-up less effective in achieving long-term behavioral change. Efendi, Rochmawati, and Hadisuyatmana (2024) emphasized the importance of social and familial support, along with the integration of educational programs into ongoing primary health care activities, to ensure that education results in lasting behavioral transformation.

According to the Health Promotion Model by Pender, Murdaugh, and Parsons (2011), the success of health education is largely determined by individuals' perceptions of the benefits and barriers to health actions. When individuals perceive that the information is not relevant or applicable to their daily context, the potential for behavior change decreases. Thus, adapting educational content to local socio-cultural realities is essential. In this study, the materials were developed by considering local context, language, and cultural practices, making the health messages more relatable and applicable.

A multimodal approach is also critical to enhancing educational effectiveness. Kurniawan,

Susanti, and Marlina (2024) argued that a combination of lectures, discussions, simulations, and visual media is more effective than unidirectional methods. In emergency education, such as in cases of hyperglycemia, participants need not only to understand theoretical knowledge but also to recognize real-life situations and take prompt action. Accordingly, this intervention also included brief simulations to introduce symptom recognition and initial responses, which enabled participants to internalize the information more deeply.

The health education intervention in this study resulted in a statistically significant increase in knowledge scores and had long-term implications for building family preparedness. Respondents demonstrated improved understanding not only of early symptoms such as polyuria, polydipsia, and extreme fatigue but also of the appropriate actions to take before seeking medical care. This proves that health education can shift the role of families from passive observers to active managers of chronic conditions and emergencies. This finding is supported by Azmiardi, Siregar, and Rahmawati (2021), who noted that families equipped with sufficient education play a crucial role in preventing diabetes complications and making early clinical decisions at home.

Based on these findings, it can be concluded that systematically delivered, contextual, and participant-responsive health education significantly improves family knowledge in preventing hyperglycemic emergencies. The success of the intervention was not solely dependent on the educational content but also on participatory delivery methods, communicative visual media, and message alignment with participants' social realities. Effective health education addresses the cognitive, affective, and practical dimensions of participants, promoting attitude change and preparedness in emergency situations.

Therefore, such educational programs should be continued and integrated into primary health services with support from healthcare providers, adaptive educational media, and policies that reinforce the role of families as partners in managing diabetes complications.

Nursing Implications

The findings of this study underscore the strategic role of community nurses in promotive and preventive efforts against hyperglycemic emergencies through family-based educational approaches. Health education has been shown to significantly enhance family knowledge, highlighting the need for nurses to address not only the theoretical aspects of diabetes but also to foster mental preparedness and practical skills in managing emergency situations. Multimodal and contextually tailored education—utilizing materials such as leaflets, videos, and simulations—can be adapted to meet the characteristics of target participants. Cross-sector collaboration with community health workers and local institutions is also essential to expand the reach of educational interventions and establish a sustainable health information ecosystem.

These implications reinforce the notion that nursing practice must extend beyond curative care to the empowerment of families as the frontline of prevention. Nurses at primary health care centers (puskesmas) can develop training modules focused on recognizing symptoms of hyperglycemia and initiating early interventions, as well as conduct routine evaluations of educational effectiveness. Furthermore, institutional support is needed to facilitate the educational role of nurses by providing training, resources, and dedicated time within service hours. Broadly, these findings support the reformulation of community nursing policies that position families at the center of emergency management efforts, with the goal of reducing incidence rates and improving the quality of life for patients with diabetes and their families.

Conclusion

Based on the results of a study involving 57 family members of diabetes mellitus patients in the working area of Pekauman Public Health Center, Banjarmasin, several conclusions can be drawn. Prior to the provision of health education, the majority of families (44.00%) demonstrated a low level of knowledge, which may be attributed to influencing factors such as age, educational background, and prior exposure to relevant information. After receiving health education, over half of the participants (53.00%) exhibited a good level of knowledge. This improvement was driven by participants' willingness and self-awareness to enhance their understanding, which

fostered engagement with the educational content. The findings also indicate a significant effect of health education on family knowledge regarding hyperglycemic emergency prevention. Educational interventions stimulated interest and cognitive processing, thereby enhancing the participants' ability to comprehend and retain the delivered information.

In light of these findings, several recommendations are proposed. Educational institutions, particularly libraries and nursing programs, are encouraged to expand their collections of up-to-date and relevant literature to support academic development and scientific writing. Access to current references, both printed and digital, can enhance literacy, research culture, and ease of access to information. Health centers are advised to improve the frequency and quality of health education programs, especially for families of diabetes patients, by incorporating diverse educational media such as videos, practical simulations, and digital applications tailored to the community's literacy level.

Collaboration with community health workers, local leaders, and women's organizations (PKK) can help extend outreach to families with limited access to information. Families themselves are expected to be more proactive in seeking health information, participating in educational activities, and applying the acquired knowledge in daily life, while involving other family members to foster collective understanding and preparedness for diabetes-related emergencies. Future researchers are recommended to explore the use of varied educational media and evaluate not only knowledge, but also attitudes and practical skills. Further studies should also include communities with different socio-cultural characteristics to enhance the generalizability of findings.

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