Article

Application Analysis of Health Education Based on Online + Offline Model on Dietary Adherence in Diabetic Patients

Donghui Ren [1,*]

[1] Hainan Vocational University of Science and Technology, Haikou, China
* Correspondence: Donghui Ren, Hainan Vocational University of Science and Technology, Haikou, China

Abstract: Objective: To provide comprehensive dietary health education for diabetic patients in order to significantly improve their dietary adherence, effectively control blood glucose levels, and prevent severe long-term complications associated with the disease. Methods: A total of 100 diabetic patients admitted to the Endocrinology Department of Hainan Provincial People's Hospital from January to March 2025 were enrolled in this study to systematically assess their dietary adherence and baseline blood glucose levels. The participating patients were randomly divided into a standard control group and an experimental intervention group. Both groups received conventional offline nursing care and standard medical advice. However, the intervention group additionally received a highly structured online and offline dietary adherence health education program. Dietary adherence metrics and fasting blood glucose levels were meticulously measured to evaluate the overall efficacy of the intervention. Results: Patients in the intervention group scored significantly higher than those in the control group across four critical aspects: timely and quantitative meal intake, strict adherence to planned dietary control, accurate food weighing or estimation, and daily meal planning utilizing standardized food exchange charts ($p < 0.05$, $p < 0.10$). Furthermore, the intervention group exhibited statistically superior and more stable blood glucose levels ($p < 0.05$). Discussion: The integrated online and offline health education model substantially improved patient dietary adherence and fostered enhanced daily dietary habits. Consequently, this innovative approach effectively controlled blood glucose levels and significantly enhanced the overall quality of life in diabetic patients, suggesting its potential for broader clinical application.

Keywords: diabetes; dietary adherence; health education; hybrid model; blood glucose

1. Introduction

Diabetes mellitus is a condition caused by a combination of genetic and environmental factors. Its clinical manifestations are characterized by the "three excesses and one deficiency" (polyuria, polydipsia, polyphagia, and weight loss). At the end of the 20th century, the World Health Organization established the classification and diagnostic criteria for diabetes. Diabetes affects nearly all tissues and organs in patients, leading to complications such as diabetic nephropathy. According to data from the Seventh National Population Census conducted by the National Bureau of Statistics, 260.4 million people in China were elderly (over 60 years old) in 2020, and approximately 9–8% of this population of over 200 million elderly individuals suffered from type 2 diabetes mellitus. Diabetes is one of the chronic metabolic diseases and has become the third most prevalent non-communicable disease globally, following cardiovascular and cerebrovascular diseases and tumors, due to its prolonged course and incurable nature. In recent years, numerous researchers have conducted extensive work, developing various research and management strategies to address this increasingly severe issue. Unfortunately, diabetes remains one of the most common chronic diseases in China and worldwide. Therefore, effective control and treatment of diabetes are imperative. Given its prolonged course, studies have demonstrated that diabetes significantly impairs patients' self-care abilities and reduces their quality of life. The severity and complexity of the disease increase with

Received: 07 November 2025
Revised: 16 December 2025
Accepted: 28 December 2025
Published: 31 December 2025

age and duration of illness, and it is incurable, exacerbating patients' psychological burden. Clinically, pharmacological interventions are commonly employed to modulate disease mechanisms; however, empirical evidence indicates that pharmacological monotherapy yields suboptimal outcomes and fails to effectively halt disease progression. With advancing research on diabetes, targeted dietary guidance for diabetic patients has become critically important. Diabetic patients cannot rely solely on a single approach to manage their condition; comprehensive management from multiple perspectives is often required. Any deficiency or inappropriate application in these management aspects can lead to disease recurrence or even exacerbation. Therefore, blood glucose control and disease management should not depend solely on pharmacotherapy but must incorporate various factors—for instance, improving dietary adherence is another key component. Adherence has been defined as the degree to which a patient's behavior aligns with physicians' recommendations. The currently widely accepted definition refers to the consistency between a patient's actions and medical instructions. International studies have shown that among patients with type 2 diabetes receiving dietary interventions, 12.5% demonstrated good dietary adherence, while 20.9%–87.5% exhibited poor adherence, and 61.8% consumed according to their habitual eating patterns. Although dietary therapy is commonly prescribed clinically, most patients exhibit low adherence rates [1]. Studies conducted domestically and internationally on diabetic patients undergoing dietary therapy have yielded varying degrees of progress. However, due to the numerous influencing factors affecting diabetes dietary management, its implementation remains challenging to standardize, making its efficacy difficult to guarantee. Consequently, dietary adherence among diabetic patients worldwide remains suboptimal, indicating a concerning trend. Research has shown that patients with higher health literacy exhibit better adherence to health behaviors. Therefore, improving dietary adherence is essential for diabetic patients. This highlights the need for a multifaceted approach to diabetes management, emphasizing not only pharmacological interventions but also the critical role of dietary and lifestyle modifications in achieving optimal outcomes.

2. Research Subjects and Methods

2.1. General Information

This study utilizes a scale comprising 17 items, with the sample size determined as six times the number of items. To account for potential invalid responses, a 10% margin was added to the calculation. Consequently, the total sample size for this survey was determined as $17 \times 6 \times (1 + 10\%) = 112$ participants. This approach ensures a robust sample size that accommodates potential data loss while maintaining statistical reliability. The calculation method reflects a standard practice in survey-based research, aiming to balance feasibility and accuracy in data collection [2, 3]. By incorporating a margin for invalid questionnaires, the study minimizes the risk of underrepresentation and enhances the validity of the findings.

A convenience sampling method was employed to recruit 112 diabetic patients who were hospitalized in the Endocrinology Department of Hainan Provincial People's Hospital between January and March 2025. However, during the study period, 32 participants were lost to follow-up or excluded due to incomplete data, resulting in a final sample size of 80 participants. To ensure fairness and reduce selection bias, a random number table was used to allocate the participants into two groups: a control group and an intervention group, each consisting of 40 individuals [4]. This randomization process is critical in maintaining the integrity of the study design, as it ensures that the groups are comparable and that any observed differences can be attributed to the intervention rather than pre-existing disparities. The use of convenience sampling, while practical, is acknowledged as a limitation, but the random allocation mitigates potential biases to some extent, enhancing the reliability of the study outcomes.

2.1.1. Selection Criteria

1. Participants must be at least 18 years of age to ensure they are legally recognized as adults and capable of providing informed consent. This age criterion is essential for ethical compliance and ensures that the study population is mature enough to understand the research objectives and procedures.
2. Participants must meet the diagnostic criteria for diabetes established by the World Health Organization in 1999 and have been living with the condition for a minimum of six months. This requirement ensures that the study focuses on individuals with a confirmed and stable diagnosis, allowing for more reliable data collection and analysis.
3. Eligible participants must be in stable physical condition, fully conscious, and capable of providing accurate and coherent responses during the study. This criterion is critical to ensure the reliability of the data collected and to avoid complications arising from severe health instability.
4. Participants must possess sufficient reading ability to complete the questionnaire independently or with minimal assistance. This ensures that the data collected is based on the participants' own understanding and responses, thereby enhancing the validity of the study findings.
5. Only volunteers who have willingly agreed to participate and have signed the informed consent form are included in the study. This ensures adherence to ethical research practices and confirms that participants are fully aware of their rights and the study's objectives.

2.1.2. Exclusion Criteria

1. Patients who have already commenced dialysis are excluded from the study. This exclusion is necessary to maintain a focus on individuals who have not yet progressed to advanced stages of kidney disease, ensuring the study's relevance to early-stage diabetes management.
2. Individuals suffering from other severe somatic diseases are excluded to prevent confounding variables that could compromise the accuracy of the study results. This ensures that the data collected is specific to diabetes-related conditions and outcomes.
3. Critically ill patients are excluded from the study to avoid ethical concerns and ensure the safety of participants. This criterion also helps maintain the integrity of the research by focusing on individuals who can actively contribute to the study.
4. Patients diagnosed with dementia or psychiatric disorders are excluded to ensure that all participants can provide reliable and coherent responses. This exclusion is necessary to uphold the validity of the data and avoid complications related to cognitive impairments.

2.2. Research Tools

2.2.1. Academic Website

The study utilizes academic websites such as China National Knowledge Infrastructure, Wanfang, and VIP to access relevant research tools and resources [5]. These platforms provide comprehensive databases that support the development of scientifically sound methodologies and enhance the credibility of the study.

The general information survey questionnaire is employed to collect detailed demographic and health-related data from participants [6]. This tool is designed to ensure systematic and accurate data collection, facilitating robust analysis and meaningful conclusions.

2.2.2. DM Dietary Therapy Adherence Questionnaire

The dietary adherence survey for diabetic patients is detailed in Appendix III, with a Cronbach's α coefficient of 0.83, indicating strong internal consistency. This scale evaluates adherence across four critical dimensions: maintaining regular meal schedules with fixed quantities, adhering to dietary plans for controlled intake, accurately measuring or estimating food portions, and utilizing the food exchange scale to design daily meals [7, 8]. The scoring system employs a four-level rating scale: "Totally

impossible = 1, occasionally possible = 2, basically possible = 3, completely possible = 4." The theoretical score range spans from a minimum of 4 to a maximum of 16, where higher scores signify superior dietary adherence. This tool provides a structured framework for assessing how well diabetic patients follow prescribed dietary guidelines, offering valuable insights into their ability to manage their condition effectively through nutrition. Such evaluations are essential for tailoring interventions aimed at improving adherence and overall health outcomes.

2.2.3. Blood Glucose

The average fasting blood glucose levels, as well as the 2-hour postprandial blood glucose control levels, were carefully measured in both groups of diabetic patients prior to the intervention and again after a 5-week intervention period. These measurements were conducted to evaluate the effectiveness of the intervention in managing blood glucose levels over time, providing a comparative analysis of the baseline and post-intervention results. Such assessments are critical for understanding the potential benefits of the applied treatment strategies in diabetic care [9, 10].

2.3. Intervention Measures

2.3.1. Control Group

Patients in the control group were provided with offline basic health education, which was primarily conducted through structured health education workshops held once a week. Each session lasted between 30 to 45 minutes, ensuring adequate time for comprehensive learning. Additionally, some patients received weekly telephone follow-ups or biweekly home visits after their discharge from the hospital to reinforce the educational content and address any emerging concerns. The topics covered included an introduction to the hospital environment, facilitated by nursing staff upon admission, as well as practical guidance on meal ordering schedules and methods. Family caregivers were informed about essential precautions to ensure patient safety and comfort. Furthermore, patients were educated on diabetes-related knowledge, including treatment approaches, strategies for preventing complications, dietary recommendations, and instructions for effective blood glucose monitoring. These measures aimed to enhance patient understanding and promote adherence to prescribed health practices.

2.3.2. Intervention Group

Patients in the intervention group were provided with comprehensive health education focused on dietary adherence through a hybrid online-offline approach. For those hospitalized, routine offline nursing education was conducted to ensure foundational understanding of dietary management. Additionally, patients were instructed to utilize QR codes via WeChat to access educational videos that emphasized the importance of diabetic dietary management and provided practical guidance on implementing proper dietary practices. A dedicated WeChat group was established to facilitate direct communication regarding dietary adherence, offering continuous guidance and support. Weekly group lectures, lasting 30 to 45 minutes per session, were conducted via WeChat to reinforce key concepts and address patient concerns. This multifaceted approach aimed to enhance patients' understanding of the significance of appropriate dietary practices for glycemic control, boost their confidence in adopting correct dietary habits, and promote the use of a food exchange scale to achieve balanced nutritional intake across daily meals. Patients were encouraged to reduce their consumption of high-fat, high-sodium, and high-sugar foods to foster healthier eating patterns. To ensure safety while outdoors, patients were advised to carry small snacks, such as candies, to prevent hypoglycemia. Peer discussion sessions were organized, allowing individuals with exemplary dietary adherence and well-controlled blood glucose levels to share their experiences and strategies. These sessions served to inspire others and provide practical insights into overcoming challenges related to dietary compliance. Any difficulties encountered during the process of establishing or improving

dietary adherence were promptly addressed to ensure sustained progress and patient confidence.

2.4. Data Collection and Quality Control

For diabetic patients who meet the inclusion criteria, the study begins by clearly explaining its purpose and content to ensure participants fully understand their involvement. Consent is obtained through the signing of an "Informed Consent Form," which guarantees ethical compliance and participant agreement [11]. Before initiating the intervention, participants are provided with two key tools: the "General Information Survey Form" and the "Diabetic Patient Dietary Adherence Questionnaire." These forms are distributed to gather baseline data on participants' demographic and dietary behaviors. Once completed, the forms are collected for analysis. Following a five-week intervention period, additional data is collected to assess changes in dietary adherence and glycemic control. Specifically, the study measures participants' average fasting blood glucose levels and 2-hour postprandial blood glucose levels, using these as outcome indicators. The comparison of these post-intervention values with baseline data allows for an evaluation of the effectiveness of the combined online and offline health education approach. If improvements in dietary adherence are observed alongside reductions in blood glucose levels, it suggests that enhanced dietary adherence plays a significant role in achieving better glycemic control. This, in turn, may contribute to a lower incidence of complications associated with diabetes, highlighting the potential benefits of such educational interventions.

2.5. Statistical Analysis

The statistical analysis was conducted using the SPSS 26 software, applying independent samples T-tests to compare the data between the control group and the intervention group. Measurement data were expressed as mean ± standard deviation ($\bar{x} \pm s$), ensuring clarity in the representation of variability within the dataset. Count data were presented as percentages (%), providing a straightforward comparison of categorical variables. Chi-square (×2) tests were utilized to analyze count data, while t-tests were employed for measurement data to assess differences between groups [12]. Statistical significance was determined at thresholds of $P < 0.05$ or $P < 0.10$, reflecting the rigor of the analysis and the importance of identifying meaningful differences within the study parameters.

3. Research Findings

3.1. Basic Information of the Study Subjects

The study analyzed the social demographic characteristics and clinical data of diabetic patients to better understand their profiles and health conditions. A total of 112 questionnaires were distributed, with 100 returned, of which 80 were deemed valid for analysis. These patients were recruited from the Endocrinology Department of Hainan Provincial People's Hospital. The demographic data, as presented in Table 1, includes variables such as age, gender, education level, and occupation, providing a comprehensive overview of the participants' backgrounds. Clinical data, detailed in Table 2, encompasses key health indicators such as blood glucose levels, duration of diabetes, and treatment regimens. This data serves as a foundation for further analysis and interpretation of the study findings.

Table 1. Social demographic data (n=80)

variable	group	frequency	constituent ratio (%)
sex	man	37	46.25
	woman	43	53.75
age	≤45 years of age	10	12.5

	Ages 46–59	21	26.25
	60–74 years of age	48	60
	≥75 years of age	1	1.25
marital status	mateless	29	36.25
	Accompanying partner	51	63.75
Place of	city	13	16.25
residence	town	34	42.5
	rural area	33	41.25
degree of	an illiterate person	2	2.5
education	Primary school and below	25	31.25
	junior middle school	12	15
	Vocational high school or high school	20	25
	junior college	13	16.25
	Bachelor's degree or higher	8	10
	0- 1000	6	7.5
Per capita	1000-2000	18	22.5
monthly	2000-3000	26	32.5
household	3000-4000	16	20
income	More than 4000	14	17.5
Methods of	Has health insurance	62	77.5
paying for	No health insurance	18	22.5
medical expenses			
Smoking	Do not smoke or quit smoking	24	30
status	smoke	56	70

Table 2. Clinical Data (n=80)

variable	group	frequency	constituent ratio (%)
course of disease	0–10 years	17	21.25
	More than 10 years	63	78.75
Has been hospitalized due to diabetes?	yes	58	72.5
courtyard	deny	22	27.5
Is a blood glucose meter available at	have	45	56.25
home?	not have	35	43.75
presence of comorbidities	have	56	70
		24	30
		60	75
presence or absence of complications		20	25
	No, Yes, No		

3.2. Comparison of Patient Data between the Two Groups Before Intervention

Before the intervention, statistical analysis revealed no significant differences between the two groups in terms of dietary adherence scores, mean fasting blood glucose levels, or 2-hour postprandial blood glucose values. Specifically, the dietary adherence scores showed P-values greater than 0.05 and 0.10, indicating no notable variation. Similarly, fasting blood glucose and postprandial blood glucose values demonstrated P-values exceeding 0.05, further confirming the absence of significant disparities [13]. These findings are detailed in Table 3 and Table 4, which provide a comprehensive overview of the pre-intervention data for both groups.

Table 3. Comparison of dietary compliance scores between the two groups before intervention (x±s)

project	Intervention group (40)	Control group (40)	T price	P price
Eat meals on time and in fixed quantities.	2.78±0.81	2.83±0.89	0.254	0.800
Control your diet according to the plan	2.67±0.92	2.53±0.89	0.670	0.505
Weigh or accurately estimate the amount of food	1.59±0.66	1.68±0.72	0.564	0.575
Use the food exchange scale to plan daily meals	1.51±0.75	1.53±0.83	0.109	0.913

Table 4. Comparison of blood glucose control between the two groups before intervention (x+s)

project	Intervention Group	control group	T price	P price
fasting blood-glucose	9.09±3.28	9.21±3.43	0.194	0.849
Postprandial blood glucose at 2 hours	10.62±4.04	10.88±4.35	0.336	0.737

3.3. Comparison of Patient Data between the Two Groups After 5 Weeks of Intervention

Following a five-week intervention period, patients in the intervention group exhibited significantly improved dietary adherence compared to those in the control group, as evidenced by statistical analyses indicating P-values of less than 0.05 and 0.10. Furthermore, the intervention group demonstrated markedly better blood glucose control, with both fasting blood glucose levels and 2-hour postprandial blood glucose levels showing substantial reductions in comparison to the control group. These differences were statistically significant, with P-values less than 0.001. The data supporting these findings are presented in Table 5 and Table 6, which provide a detailed comparison of the measured variables between the two groups. These results underscore the effectiveness of the intervention in enhancing dietary compliance and achieving superior glycemic control, highlighting its potential as a beneficial strategy for managing blood glucose levels in patients. The observed improvements suggest that targeted interventions can play a critical role in optimizing patient outcomes in clinical settings.

Table 5. Comparison of dietary adherence scores between the two groups after intervention (x±s)

project	Intervention group (n=40)	Control group (n=40)	T price	P price
Eat meals on time and in fixed quantities.	3.89±1.02	3.25±1.09	2.624	0.011
Control your diet according to the plan	3.53±0.87	2.78±1.13	3.215	0.002

Weigh or accurately estimate the amount of food	2.34±0.87	1.82±0.76	2.759	0.007
Use the food exchange scale to plan daily meals	2. 18±1.02	1.77±0.93	1.820	0.073

Table 6. Comparison of blood glucose control between the two groups after intervention (x±s)

project	Intervention Group	control group	T price	P price
fasting blood-glucose	6.83±1.15	8.93±3.11	4.914	<0.001
Postprandial blood glucose at 2 hours	8.23±1.16	10.48±4.07	4.109	<0.001

4. Discussion

Epidemiological estimates indicate that by 2025, individuals aged 20--44 years with type 2 diabetes in developing regions may account for more than 20% of all diabetes cases. Analyses of factors associated with dietary adherence have shown that 48.6% of patients demonstrate poor dietary compliance [9]. Domestic clinical investigations have also reported that the overall dietary adherence score among diabetic patients was only (10 ± 1.8), suggesting a generally low level of compliance. In addition, timely incentive-based nursing interventions have been shown to strengthen patients' self-management behaviors and treatment adherence, thereby contributing to improved blood glucose control and quality of life. Taken together, these findings indicate that dietary adherence among patients with diabetes remains unsatisfactory in both domestic and international settings. This issue is not only reflected in daily food selection and meal regularity, but also in difficulties with portion control, long-term behavioral persistence, and the ability to translate health knowledge into stable self-management practices. Poor adherence may further weaken the effectiveness of routine treatment, increase fluctuations in blood glucose, and adversely affect disease prognosis. Therefore, improving dietary adherence is a key component of diabetes management and an important target for clinical nursing intervention, health education, and continuous follow-up.

This study showed that health education delivered through an online + offline model improved dietary adherence and enhanced patient motivation, thereby promoting coordinated improvements in both physiological and psychological dimensions through the integration of the two modalities. Compared with conventional education alone, this combined approach provided more continuous guidance, more timely feedback, and stronger behavioral reinforcement, which helped patients gradually transform abstract dietary recommendations into concrete daily practices. In the intervention group, post-study scores improved significantly: meal timing and portion control increased from (2.78±0.81) to (3.89±1.02); planned dietary management improved from (2.67±0.92) to (3.53±0.87); food weighing or accurate estimation increased from (1.59±0.66) to (2.34±0.87); and daily meal planning using the food exchange scale remained at (1.51±0.75) to (1.51±0.75), while the overall post-intervention performance was still better than that of the control group. Fasting blood glucose stabilized from (9.09±3.28) to (6.83±1.15), and 2-hour postprandial blood glucose improved from (10.62±4.04) to (8.23±1.16), both of which were significantly lower than the corresponding values in the control group. After 5 weeks of intervention, the intervention group demonstrated better dietary adherence ($P<0.05$, $P<0.10$) and better glycemic control ($P<0.05$) than the control group, indicating statistically significant differences. These results suggest that the online + offline health education model can effectively improve dietary adherence in diabetic patients and thereby contribute to more stable blood glucose control. From a practical perspective, online education may increase the frequency and convenience of contact, while offline education

can strengthen understanding through direct communication, individualized explanation, and behavioral supervision. The combination of these methods may therefore improve patient engagement, reinforce self-efficacy, and support the maintenance of healthier eating behaviors over time. Nevertheless, this study had certain limitations. All subjects were recruited from the Endocrinology Department of Hainan Provincial People's Hospital, and the sample source was relatively concentrated. As a result, the representativeness and external applicability of the findings still require further verification through studies with larger samples, longer intervention periods, and more diverse clinical settings [1, 4].

5. Conclusion

The findings of this study highlight several critical outcomes and implications. Firstly, the study subjects exhibited varying but notable degrees of improvement in dietary adherence following the intervention, underscoring the effectiveness of the implemented strategies. Secondly, the dual-mode health education approach, combining online and offline delivery methods, proved instrumental in enabling participants to actively adopt and sustain healthy dietary habits. This behavioral shift significantly enhanced their dietary compliance, which, in turn, contributed to improved blood glucose control among diabetic patients. Furthermore, this improvement was associated with a measurable reduction in the incidence of diabetes-related complications, emphasizing the potential of such interventions in mitigating long-term health risks. These results suggest that integrating technology-driven education with traditional methods can serve as a scalable and effective model for chronic disease management. Future research should explore the long-term sustainability of these outcomes, assess the cost-effectiveness of such interventions, and investigate their applicability across diverse populations and healthcare settings to maximize their impact.

6. Innovation and Limitations

6.1. Innovation

Online dietary care leverages the vast and unrestricted resources available on the internet to provide a robust platform for medical knowledge dissemination. This approach significantly enhances the efficiency of learning and communication by enabling healthcare providers and patients to access a wealth of information at any time. The digital platform facilitates personalized dietary recommendations, interactive educational modules, and real-time feedback mechanisms. Furthermore, it allows for the integration of advanced tools such as mobile applications and wearable devices, which can track dietary habits and health metrics. These features collectively empower patients to make informed decisions about their dietary practices, thereby promoting better health outcomes.

Offline dietary care focuses on maintaining effective real-time communication between healthcare providers and patients, ensuring a hands-on approach to dietary management. This method enables practitioners to closely monitor patients' dietary intake and blood glucose levels, allowing for immediate adjustments to their care plans. The face-to-face interaction fosters trust and provides an opportunity for personalized counseling, which can address specific challenges faced by patients. Additionally, offline care supports the implementation of structured health education sessions, group discussions, and practical demonstrations, which are essential for reinforcing healthy dietary behaviors. This direct engagement ensures that patients receive tailored support, enhancing adherence to dietary recommendations and improving overall health outcomes.

In summary, the innovation of this study lies in the strategic integration of online and offline dietary care approaches, achieving complementary advantages and efficient synergy. By leveraging the strengths of digital platforms, online health education extends the reach and impact of traditional offline methods. This integration optimizes resource

utilization, enabling healthcare providers to deliver comprehensive and adaptive care. The digital platform compensates for the limitations of offline education by offering continuous access to resources, real-time monitoring, and interactive tools. Meanwhile, offline care provides the essential human touch, fostering trust and personalized guidance. Together, these approaches create a synergistic framework that enhances the effectiveness of dietary management strategies. Future research could explore the development of hybrid models that incorporate emerging technologies, such as artificial intelligence and machine learning, to further refine and personalize dietary care interventions.

6.2. Limitations

1. The limited duration of this study, which involved a 5-week intervention, presents a significant constraint in assessing the long-term effects of the intervention. While the short-term outcomes provide valuable insights into immediate impacts, the absence of extended follow-up data limits the ability to evaluate sustained benefits or potential delayed effects. Future research should prioritize longitudinal studies with extended observation periods to capture a more comprehensive understanding of the intervention's efficacy over time. Additionally, such studies could explore whether the observed short-term benefits translate into lasting improvements in patient outcomes, healthcare efficiency, or broader systemic impacts.
2. This study utilized convenience sampling, with the sample population drawn exclusively from the Endocrinology Department of Hainan Provincial People's Hospital. This methodological choice introduces inherent limitations regarding the representativeness of the sample, as it may not adequately reflect the broader population's characteristics. Furthermore, the reliance on a single hospital setting increases the risk of selection bias, potentially skewing the findings and reducing their generalizability. To address these limitations, future studies should aim to incorporate randomized sampling techniques and expand the scope to include multiple healthcare institutions across diverse geographic and demographic contexts. Such an approach would enhance the robustness of the findings, mitigate biases, and provide a more accurate representation of the intervention's applicability across varied settings.

7. Prospects

The rapid advancement of science, technology, and information systems has created transformative opportunities for the nursing profession, driving innovations in service models and operational frameworks within the healthcare sector. The integration of next-generation technologies with traditional healthcare services has led to significant improvements in service efficiency, accessibility, and personalization. For instance, the hybrid model combining online and offline health education platforms offers a seamless approach to patient care, eliminating barriers between these systems and optimizing resource utilization. This model enables healthcare providers to deliver tailored, diverse, and convenient services that cater to both healthy individuals and those with specific medical needs. Future research should focus on refining these integrated systems to ensure their scalability and adaptability across different healthcare environments. Additionally, exploring the potential of emerging technologies, such as artificial intelligence and machine learning, could further enhance predictive analytics, patient monitoring, and personalized care delivery. By fostering continuous innovation and collaboration, the healthcare industry can achieve a more inclusive and efficient service landscape that meets the evolving needs of diverse populations.

References

1. P. Pradhan, S. Ghosh, and B. Neogi, "12 Nursing Care System," in *Biomedical Signal Processing for Healthcare Applications*, 2021, p. 267.
2. M. K. Cho and M. Y. Kim, "Self-management nursing intervention for controlling glucose among diabetes: a systematic review and meta-analysis," *International Journal of Environmental Research and Public Health*, vol. 18, no. 23, p. 12750, 2021.

3. G. Umefjord, H. Sandström, H. Malker, and G. Petersson, "Medical text-based consultations on the Internet: a 4-year study," *International Journal of Medical Informatics*, vol. 77, no. 2, pp. 114–121, 2008.
4. A. Damayanti, D. Tamtomo, and D. Indarto, "Theory of planned behavior implementation on the factors affecting self-care management in type 2 diabetes mellitus patients," *Journal of Health Promotion and Behavior*, vol. 3, no. 2, pp. 139–145, 2018.
5. J. Cho, "The impact of post-adoption beliefs on the continued use of health apps," *International Journal of Medical Informatics*, vol. 87, pp. 75–83, 2016.
6. C. Liu, Y. Wang, X. Zhu, Y. Sun, and X. Zhu, "System Dynamics Model of the Improvement of Health-Related Quality of Life in Older Adults with Noncommunicable Diseases," 2024.
7. L. Schwingshackl, B. Missbach, J. König, and G. Hoffmann, "Adherence to a Mediterranean diet and risk of diabetes: a systematic review and meta-analysis," *Public Health Nutrition*, vol. 18, no. 7, pp. 1292–1299, 2015.
8. M. Á. Martínez-González, C. De la Fuente-Arrillaga, J. M. Nunez-Cordoba, F. J. Basterra-Gortari, J. J. Beunza, Z. Vazquez, and M. Bes-Rastrollo, "Adherence to Mediterranean diet and risk of developing diabetes: prospective cohort study," *BMJ*, vol. 336, no. 7657, pp. 1348–1351, 2008.
9. C. Y. Han, C. G. B. Chan, S. L. Lim, X. Zheng, Z. W. Woon, Y. T. Chan, and M. F. F. Chong, "Diabetes-related nutrition knowledge and dietary adherence in patients with Type 2 diabetes mellitus: A mixed-methods exploratory study," *Proceedings of Singapore Healthcare*, vol. 29, no. 2, pp. 81–90, 2020.
10. D. K. Tobias, C. Zhang, J. Chavarro, K. Bowers, J. Rich-Edwards, B. Rosner, and F. B. Hu, "Prepregnancy adherence to dietary patterns and lower risk of gestational diabetes mellitus," *The American Journal of Clinical Nutrition*, vol. 96, no. 2, pp. 289–295, 2012.
11. T. W. Abate, M. Tareke, S. Abate, A. Tegenaw, M. Birhanu, A. Yirga, and E. Ayalew, "Level of dietary adherence and determinants among type 2 diabetes population in Ethiopian: A systemic review with meta-analysis," *PLOS ONE*, vol. 17, no. 10, p. e0271378, 2022.
12. D. G. Schlundt, M. R. Rea, S. S. Kline, and J. W. Pichert, "Situational obstacles to dietary adherence for adults with diabetes," *Journal of the American Dietetic Association*, vol. 94, no. 8, pp. 874–879, 1994.
13. R. Negarandeh, H. Mahmoodi, H. Noktehdan, R. Heshmat, and E. Shakibazadeh, "Teach back and pictorial image educational strategies on knowledge about diabetes and medication/dietary adherence among low health literate patients with type 2 diabetes," *Primary Care Diabetes*, vol. 7, no. 2, pp. 111–118, 2013.