RELATIONSHIP BETWEEN DIABETES KNOWLEDGE, SELF-EFFICACY, AND EATING BEHAVIORS AMONG TYPE 2 DIABETIC PATIENTS WITH POOR GLYCEMIC CONTROL

Jiali Jiang, R.N.[1], Chintana Wacharasin, Ph.D.[2]*, Jinjutha Chaisena Dallas, Ph.D.[3]

Abstract

This study aimed to investigate the relationship between diabetes knowledge, self-efficacy, and eating behaviors among patients with Type 2 diabetes with poor glycemic control. Using simple random sampling, 185 patients with type 2 diabetes mellitus with poor glycemic control were recruited from the Department of Endocrinology, the First Affiliated Hospital of Wenzhou Medical University, Wenzhou, China. Research tools included Demographic Record Form, Chinese Version of Diabetes Knowledge Scale, Chinese Version of Type 2 diabetes Self-efficacy Scale, and Eating Behavior Compliance Scale for type 2 Diabetes Patients. Data analysis was performed using descriptive statistics and Pearson correlation coefficient.

The results of this study showed that the average score of eating behaviors among patients with type 2 diabetes with poor glycemic control was 75.25 (SD = 14.72), which indicating relatively moderate level. Diabetes self-efficacy was positively and significantly correlated with diabetes knowledge ($r = 0.183$, $p < 0.05$) and eating behaviors ($r = 0.439$, $p < 0.01$). Diabetes knowledge was positively and significantly correlated with eating behaviors ($r = 0.250$, $p < 0.01$).

The findings suggest that Clinical nurses can help patients with type 2 diabetes with poor glycemic control enhance their eating behaviors by improving their diabetes self-efficacy and diabetes knowledge.

Key words: Type 2 diabetes mellitus, diabetes knowledge, self-efficacy, eating Behavior

[1] Student of Master of Nursing Science Program Adult Nursing (International Program), Faculty of Nursing, Burapha University, Thailand

[2] Professor, Faculty of Nursing, Burapha University,Thailand

[3] Associate professor, Faculty of Nursing Panyapiwat Institute of Management EEC

* Corresponding author e-mail: chintana@buu.ac.th

Received 07/11/2024 Revised 07/02/2025 Accepted 05/03/2025

INTRODUCTION

Diabetes is a chronic metabolic disease characterized by elevated blood sugar. The most common of these is type 2 diabetes (T2DM), which is more common in adults. Around 422 million people worldwide have diabetes, most of whom live in low - and middle-income countries, and 1.5 million people die each year as a direct result of diabetes. The global prevalence of diabetes among people aged 20-79 was estimated to be 10.5% (536.6 million people) in 2021, which rose to 12.2% (783.2 million people) by 2045 (Sun et al., 2022) Similarly, the prevalence of diabetes in China is still rising, reaching 11.2% between 2015 and 2017 (Peiru, 2021).

Globally, about 40.0–60.0% of patients with diabetes have poorly controlled blood glucose (Alzaheb & Altemani, 2018). Glycated hemoglobin (HbA1c) levels are an indicator of blood glucose control in the 2-3 months prior to testing. In China, the goal of blood sugar control was HbA1C less than 7%, so if HbA1C is greater than 7%, it means that blood sugar control is not good (Zhu, 2021). In contrast, good blood sugar control can reduce the occurrence of complications and improve quality of life. Chronic complications of diabetes include microvascular and macrovascular complications, among which microvascular complications include neuropathy, nephropathy and retinopathy. Macrovascular complications include cardiovascular disease, stroke, and peripheral artery disease (Papatheodorou et al., 2018). Studies have shown that the probability of complications will be significantly reduced if the blood sugar index was well controlled, which had a good promoting effect on the reasonable protection of patients' quality of life (Liu & Sun, 2020). Achieving good blood sugar control is closely related to effective diabetes self-management, which includes strict adherence to a medication regimen, continuous monitoring of diet and blood sugar levels, participation in physical activity, and effective foot care.

The key to glycemic control among people with T2DM is eating behaviors and diet quality. Eating behaviors play a vital role in maintaining health and preventing disease and have been linked to chronic diseases such as obesity (Onofrei et al., 2024). The previous study found that patients with poor diet quality were 2.92 times more likely to have poor blood sugar control than those with a better diet quality (Antonio et al., 2019). Eating behaviors also can maintain health and prevent diseases including obesity and other chronic diseases (Benbaibeche et al., 2023). Many factors influence the eating behaviors of people with T2DM who have poor glycemic control. According to several studies, including physical aspects, psychological aspects, and social factors such as gender, age, course of disease, complications social knowledge, and diabetes knowledge.

A study on the diet management status of 365 diabetic patients in China showed that about 60% of the overall diet management scores of middle-aged and young diabetic patients were in the lower level (Xuejiao et al., 2024). People with diabetes have good knowledge and awareness of diabetes, which is conducive to them using appropriate methods to solve health problems in a timely manner (Cunningham et al., 2018). However, most studies from developing countries in Asia report that patients with T2DM still have poor knowledge of diabetes and lack scientific glycemic control, diet management, and complication prevention (Al-Maskari et al., 2013; Carballo et al., 2018).

In Saudi Arabia, for example, only 13.3% of people with diabetes demonstrated good knowledge (Al-Aboudi et al., 2016). A Chinese study found that people with type 2 diabetes generally had low mastery of diabetes knowledge, with the three items with the lowest correct answer rates being hypoglycemia, foot care, and diet/food dimensions (Yan et al., 2019). A study on knowledge awareness of community diabetic patients in China found that the knowledge awareness rate of diabetes was 57.27%, which was at a moderate level (Fang et al., 2023). The research also indicates that people with T2DM have a moderate understanding of food types (50%), which means that 50 percent of patients have poor knowledge of food types (Sami et al., 2020). At the same time, a study showed that people with T2DM who received knowledge education were nearly twice as likely to engage in healthy behaviors in one dietary dimension than in unhealthy behaviors, compared to people with T2DM who did not receive knowledge education (Gebreyesus et al., 2021b).

Self-efficacy is defined as a person's ability to perform goal-directed behaviors in the presence of obstacles or impediments (Bandura & Wessels, 1997). Putting this concept in the context of T2DM, it is the patient's confidence in controlling blood sugar. Diabetes knowledge was also highly associated with better psychosocial self-efficacy and was also a strong predictor of behavioral intentions and eating behavior in people with T2DM (Didarloo et al., 2014). Diabetes self-efficacy only had an indirect effect on glycemic control through diabetes self-management (Lin et al., 2017). Although there are many researches focusing on diet self-management behavior in China, there are few in-depth studies on specific influencing factors, previous studies have mostly looked at age-specific and location-specific populations, such as young adults with diabetes and older adults with diabetes in the community, and are not representative of all adults with T2DM. Previous study populations included patients with good blood sugar control whose eating behavior was biased toward those with poor blood sugar control. This study focuses on adult patients with T2DM with poor glycemic control and excludes some patients with good glycemic control. Having more comprehensive knowledge of diabetes can improve self-efficacy and eating behavior, such as more appropriate food choices and eating times, and better self-efficacy and eating behavior can encourage patients to learn more about diabetes. Good eating behavior enables patients to better control blood sugar, thus enhancing self-efficacy can improve eating behavior. Previous studies rarely paid attention to the relationship between these three aspects. This research examining the relationship between these three variables is more conducive to synergistic promotion of patients' blood glucose management, reducing the occurrence of complications and mortality. The results of this study can provide a basis for nursing interventions.

Objectives

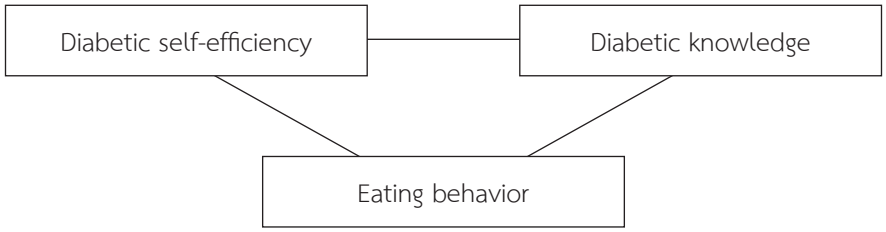
The objective was to describe eating behaviors of patients with T2DM with poor glycemic control and to examine the relationships between diabetes knowledge, self-efficacy, and eating behaviors among patients with T2DM with poor glycemic control in Wenzhou city, China.

Hypotheses

There is a positive and significant correlation between diabetes knowledge, diabetes self-efficacy, and eating behavior.

Conceptual Framework

The conceptual framework was developed based on the Pender's Health Promotion Model (Pender et al., 2011) and research evidence. Diabetes knowledge derived from the individual characteristics. It was suggested that knowledge of diabetes had a positive impact self-efficacy and eating behavior of people with diabetes by changing the sociocultural factors in individual quotes to promote behavioral change. Diabetes self-efficacy is a part of the behavioral specific affects in the model, where positive emotions and eating behaviors were linked, the likelihood of commitment and action increases, so self-efficacy had a positive correlation on eating behaviors. Eating behavior is a behavioral outcome in the model, changing the behavior will be able to control the condition of the disease, so that they can survive longer and have an increasingly better quality of life (Sari et al., 2021).



Methods

Study design and participants

A correlational cross-sectional design was used and conducted in the outpatient department of Endocrinology, the First Affiliated Hospital of Wenzhou Medical University. The samples were adults with T2DM with poor glycemic control who were treated at a hospital under the jurisdiction of the Endocrinology Clinic of the First Affiliated Hospital of Wenzhou Medical University, Wenzhou, Zhejiang, China. The inclusion criteria included:1) Aged of 18-60, conscious, and without mental disorder or severe physical activity disorder (from medical records), 2) Clinically diagnosed with poor blood glucose control (HbA1C > 7%) (Zhu, 2021), 3) Treated with oral medication, insulin therapy or combined therapy with oral medication and insulin, and 4) Having ability to write and speak Chinese. The sample size was calculated using G*Power 3.1 software. Using a power estimate of .90, the α level .05, and the effect size is 0.21 (Onofrei et al., 2024). Pearson correlation was used for the analysis. The calculated sample size is 191. A total of 191 questionnaires were distributed, but 185 questionnaires were completed.

Research instruments

The first part included questions on demographic information including gender, age, education level, marital status, residence, economic income, clinic diagnosis, and body mass index (BMI) and

course of disease. The following information was obtained from the hospital computer system with the patient's consent: recent glycated hemoglobin level, recent fasting blood glucose, number of complications, therapy method.

The Chinese Version of Diabetes Knowledge Scale was used to study the degree of knowledge mastery of diabetes patients. The diabetes knowledge scale developed by Speight and Bradley (Speight & Bradley, 2001). It was translated by Zhu Weiyan (Zhu, 2010). It included 111 questions of 8 dimensions, which included diet/food (19 items); therapy (15 items); during sick period (8 items); Foot care (24 items); impact of physical exercise (9 items); effects of smoking/drinking (11 items); reducing the risk of complications (16 items); hypoglycemia (14 items). Each item had three options: right, score = 1; wrong and unknown, score = 0. A higher score indicated a higher diabetes knowledge, while a low score indicated a poor mastery of diabetes knowledge. Results Content validation index of the Chinese AD Knowledge form was 0.92, and Cronbach's alpha index was 0.90.

The Chinese Version of Type 2 Diabetes Self-efficacy Scale was used to measure participants' self-efficacy. This scale was designed by Lorig and Holman (Lorig & Holman, 2003) of Stanford University in the United States, and translated into Chinese by Sun Shennan (Sun, 2010). A total of 8 items were included, which reflected the self-efficacy of diabetes in many aspects, each item was scored on a 1-10 scale, which 1 means no confidence at all, and 10 means absolute confidence. The possible range was o 1-10 points, the average score of the 8 items reflected self-efficacy, and the higher the score, the higher the self-efficacy. The Cronbach's alpha index of this scale was 0.86.

The Eating Behavior Compliance Scale for patients with Type 2 Diabetes was used to assess the eating behavior of people with type 2 diabetes developed by Qiuli Zhao et al (Zhao et al., 2017). It included five dimensions, namely dietary self-control, glycolipid compliance, oil and salt compliance, fruit and vegetable compliance, and cooking and eating habits. There was a total of 23 items, using Likert Type 5-level scoring method, never = 1, rarely = 2, sometimes = 3 often = 4, always = 5. A higher score indicates better adherence to eating behavior. The overall Cronbach's A coefficient was .88, and the Cronbach's A coefficient of each dimension was .76- .88.

Data collection procedure

The data was collected from October 1st to December 1st, 2022. Simple random sampling was used to collect data. The list of participants was derived from the computer system of outpatient patients who signed in every day in the endocrinology Department of the First Affiliated Hospital of Wenzhou Medical University. Patients who met the inclusion criteria were numbered and were randomly selected by drawing of the list without replacement. The 3-4 eligible participants per day were randomly selected from the list of patients meeting the inclusion criteria to receive services from 8:00-12:00 AM and 14:00-17:00 PM Monday to Friday.

Ethical considerations

Approval for conducting the study was obtained from the Institutional Review Board (G-HS038/2565), Burapha University, Thailand. After the proposal was approved, it was submitted to the Research Ethics Committee of The First Affiliated Hospital of Wenzhou Medical University

(KY2022-125). All participants signed an informed consent form.

Data analysis

Data analysis was performed by SPSS software version 26. Descriptive statistics including frequency, percentage, mean (M) and standard deviation (SD), possible range and actual range were used to describe demographic and other variables. Normal distribution of each variable was examined using Skewness and Kurtosis. Pearson correlation coefficient was used to analyze the relationship among diabetes knowledge, diabetes self-efficacy and diabetes eating behavior. Differences were considered statistically significant at $p < .05$.

Results

A total of 191 sets of questionnaires were distributed. 185 questionnaires were completed because 6 questionnaires were incomplete. The majority participants were men (55.70%), aged between 45 and 59 (67.60%), married (87.00%), and living in rural areas (55.10%). The proportion of patients' educational background in each stage was relatively equal. 45.90% of people have an annual income of less than RMB 100,000, the median of it was 136,756.75. Most people had a BMI of 25-30kg/m^2 (54.60%), no complications (64.30%), and oral hypoglycemic drugs combined with insulin (81.10%). The highest HBA1c was 20.8 mmol/L, the lowest is 7.1 mmol/L, and the average was 10.1 mmol/l. The highest fasting blood glucose value was 22 mmol/L, the lowest value was 4.4 mmol/L, and the average value was 9.9 mmol/L. 40.00% of people with the diabetes course of 1-10 years. The demographic characteristics of the participants are described in table 1.

Table 1 Description of demographic characteristics of the sample (n = 185)

Variables	Number (*n*)	Percentage (%)
Gender		
Male	103	55.70
Female	82	44.3
Age (Max = 59 Min = 19, mean = 46.10, SD = 10.40)		
18-44 years	60	32.40
45-59 years	125	67.60
Years of having diabetes (Max = 25 Min = 0.1, mean = 4.70, SD = 5.26)		
< 1 year	66	35.70
1-10 years	74	40.00
> 10 years	45	24.30
Education Background		
Primary High School	39	21.10
Junior High School	52	28.10
Senior High School	57	30.80
University or above	37	20.00

Table 1 (Cont)

Variables	Number (*n*)	Percentage (%)
Marital status		
Single	24	13.00
Married	161	87.00
Place of residence		
Urban area	102	55.10
Rural area	83	44.90
Annual income (Max = 560,000 Min = 300,000 mean = 136,756.75, SD = 95,759.38)		
< 100,000 RMB	85	45.90
100,000 - 200,000 RMB	69	37.30
> 2000,000RNB	31	16.80
BMI (kg/m^2)		
< 18.5	6	3.20
18.5-23.9	62	33.50
24.0-26.9	66	35.70
27.0-29.9	43	23.20
> 30.0	8	4.3
Treatment plan		
Oral medication	17	9.20
Insulin injection	18	9.70
Oral medication and Insulin	150	81.10
HbA1c (mmol/L): M = 10.1; SD = 2.02; Rang = 7.1-20.8		
FBG (mmol/L): M = 9.9; SD = 2.1; Rang = 4.4-22		

Description of the study variables

Table 2 shows that the score of diabetes eating behavior ranges from 33 to 111, with an average score of 75.23 (SD = 14.72), the score of diabetes self-efficacy ranges from 1.50 to 10, with an average score of 6.92 (SD = 1.85). The score of diabetes knowledge ranged from 26 to 99, with an average score of 74.48 (SD = 13.41).

Table 2 Description of diabetes knowledge, self-efficacy, and eating behavior (n = 185)

Variables	Possible range	Actual range	Mean	SD	Level
Diabetes eating behavior	23-115	33-111	75.25	14.72	Moderate
Diabetes self-efficacy	1-10	1.5-10	6.92	1.85	-
Diabetes knowledge					
Oral medication group	0-96	40-91	70.58	13.23	-
Insulin group	0-103	41-88	71.50	11.00	-
Oral medication and insulin group	0-111	26-99	74.48	13.41	-

The kurtosis and skewness were used to test normal distribution. Each variables including diabetes eating behavior, diabetes knowledge and self-efficacy, their kurtosis and skewness were not between (-1.96) and (+1.96), indicating that they were not normally distributed. Pearson correlation coefficient was used to analysis, which was shown in table 3. Diabetes self-efficacy was positively and significantly correlated with diabetes knowledge ($r = 0.183$, $p < 0.05$). Diabetes self-efficacy was positively and significantly correlated with diabetes eating behavior ($r = 0.439$, $p < 0.01$). Diabetes knowledge was positively and significantly correlated with diabetes eating behavior ($r = 0.250$, $p< 0.01$).

Table 3 Correlation matrix between diabetes knowledge, self-efficacy, and eating behavior (n = 185)

Variables	Diabetes self-efficacy	Diabetes knowledge	Diabetes eating behavior
Diabetes self-efficacy	1.000	.183*	.439**
Diabetes knowledge		1.000	.250**
Diabetes eating behavior			1.000

Note: *$p < .05$, **$p < .01$

Discussion

The results showed that type 2 diabetic patients with poor glycemic control had moderate levels of eating behavior (mean = 75.25±14.72). This is similar to another relevant study in China, which showed that diabetic patients had poor self-supervision ability (45.7%), strong dietary supervision and control behavior (35.9%), and good dietary supervision ability (18.4%) (Ruijie et al., 2024). A study in Northern Ethiopia found that 54.4% of people with T2DM had unhealthy eating behaviors (Gebreyesus et al., 2021a). In addition, other studies showed that diabetes eating behavior was at a moderate to low level in all countries. (Aklima et al., 2013; Putra et al., 2015)

The results of this study show a significant association between diabetes knowledge and self-efficacy. This may be because more knowledge of diabetes leads to more confidence in

overcoming diabetes and a higher sense of self-efficacy, which in turn encourages patients to learn more about diabetes. Some previous studies have shown that educating patients about diabetes can effectively improve self-efficacy, which can sufficiently affect patients' ability to self-manage (Liu et al., 2018; Paragas & Barcelo, 2019). This study was the first of its kind in Wenzhou which can be used as a baseline to guide blood glucose management and dietary intervention in patients with T2DM in the future since this study collected data from only one large general hospital in the Wenzhou area.

This study revealed a significant association between diabetes knowledge and eating behavior, which is similar to the results of a study in Africa that showed a significant association between good diabetes knowledge and good behavior, encouraging lifestyle and eating behavior changes through diabetes health education (Alaofè et al., 2021). An interesting finding in one study was that misinterpreting and misusing food labels was a barrier to accessing information and engaging in correct and healthy eating behaviors (Dumoitier et al., 2019), which suggests that knowledge of diabetes has a positive guiding effect on eating behaviors. A study in Ethiopia showed that patients who received health education were more knowledgeable about diabetes, more likely to recognize the benefits of eating behaviors for diabetes treatment, and believe that poor eating behaviors lead to more severe outcomes (Mohammed & Sharew, 2019). Therefore, a diabetes nutrition education program for patients with T2DM with poor glycemic control has achieved positive results (Gebreyesus et al., 2024).

The results revealed that self-efficacy had a significant positive correlation with eating behavior among patients with T2DM with poor glycemic control. It confirmed the Pender Health Promotion Model, which explains the self-efficacy affects health behaviors. Self-efficacy is an individual's belief in their ability to successfully practice, when people believe they are capable of doing something, they will take action; When they believe they are likely to fail, they avoid action (Williams et al., 2014). When people with diabetes are confident in their diet, they are motivated to change their eating behavior. This was consistent with another study showing that self-efficacy had a positive effect on eating behavior in people with T2DM (Putra et al., 2015). At the same time, patients' knowledge and self-efficacy of diabetes are important tools to help treat diabetes, and improving diabetes awareness and self-efficacy can affect patients' eating behavior management. In addition, changing the behavior will be able to control the condition of the disease, so that they can survive longer and have an increasingly better quality of life (Sari et al., 2021). Increasing self-efficacy in patients with T2DM could foster confidence in patients' ability to overcome obstacles and improve eating behaviors (Liang et al., 2021). If people with T2DM have good self-efficacy in eating behaviors, it will improve their eating management behaviors and the amount of healthy food choices they make, and they can manage the conditions for adhering to healthy eating behaviors (Putra et al., 2016). Another study showed that neither general self-efficacy nor diabetic self-efficacy was associated with blood sugar control (Dehghan et al., 2017), which include eating behaviors.

Conclusions and Implementation

The results showed that the eating behavior of patients with T2DM in this study was at a moderate level. There was a significant association between diabetes knowledge and eating behavior, self-efficacy and eating behavior, diabetes knowledge and self-efficacy. People with T2DM should increase knowledge, self-efficacy, and maintain good eating behaviors. It can prevent complications of diabetes. Clinical nurses can help patients improve their eating behavior by intervening in these aspects, thereby improving glycemic control, reducing and preventing the occurrence of complications and diabetes mortality.

Acknowledgement

Thanks to the Department of Nursing and Endocrinology of the First Affiliated Hospital of Wenzhou Medical University for your support for this article. The author would also like to express his heartfelt thanks to all the participants.

References

Aklima, A., Kritpracha, C., & Thaniwattananon, P. (2013). Dietary behaviors among patients with type 2 diabetes mellitus in Indonesia. *Nurse Media Journal of Nursing, 3*(1), 499-509.

Al-Aboudi, I. S., Hassali, M. A., & Shafie, A. A. (2016). Knowledge, attitudes, and quality of life of type 2 diabetes patients in Riyadh, Saudi Arabia. *Journal of Pharmacy Bioallied Sciences, 8*(3), 195-202.

Al-Maskari, F., El-Sadig, M., Al-Kaabi, J. M., Afandi, B., Nagelkerke, N., & Yeatts, K. B. (2013). Knowledge, attitude and practices of diabetic patients in the United Arab Emirates. *PloS One, 8*(1), e52857.

Alaofè, H., Hounkpatin, W. A., Djrolo, F., Ehiri, J., & Rosales, C. (2021). Knowledge, attitude, practice and associated factors among patients with type 2 diabetes in Cotonou, Southern Benin. *BMC Public Health, 21*, 1-11.

Alzaheb, R. A., & Altemani, A. H. (2018). The prevalence and determinants of poor glycemic control among adults with type 2 diabetes mellitus in Saudi Arabia. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy, 11*, 15-21.

Antonio, J. P., Sarmento, R. A., & de Almeida, J. C. (2019). Diet quality and glycemic control in patients with type 2 diabetes. *Journal of the Academy of Nutrition and Dietetics, 119*(4), 652-658.

Bandura, A., & Wessels, S. (1997). *Self-efficacy*. Cambridge: Cambridge University Press.

Benbaibeche, H., Saidi, H., Bounihi, A., & Koceir, E. A. (2023). Emotional and external eating styles associated with obesity. *Journal of Eating Disorders, 11*(1), 67.

Carballo, M., Mohammad, A., Maclean, E. C., Khatoon, N., Waheedi, M., & Abraham, S. (2018). Knowledge, attitudes, behaviours and practices towards diabetes mellitus in Kuwait. *Eastern Mediterranean Health Journal, 24*(11), 1098-1102.

Cunningham, A. T., Crittendon, D. R., White, N., Mills, G. D., Diaz, V., & LaNoue, M. D. (2018). The effect of diabetes self-management education on HbA1c and quality of life in African-Americans: A systematic review and meta-analysis. *BMC health services research, 18*, 1-13.

Dehghan, H., Charkazi, A., Kouchaki, G. M., Zadeh, B. P., Dehghan, B. A., Matlabi, M., . . . Pashaei, T. (2017). General self-efficacy and diabetes management self-efficacy of diabetic patients referred to diabetes clinic of Aq Qala, North of Iran. *Journal of Diabetes Metabolic Disorders, 16*, 1-5.

Didarloo, A., Shojaeizadeh, D., Niknami, S., & Khorami, A. (2014). Psychosocial correlates of dietary behaviour in type 2 diabetic women, using a behaviour change theory. *Journal of Health, Population, Nutrition, 32*(2), 335.

Dumoitier, A., Abbo, V., Neuhofer, Z. T., & McFadden, B. (2019). A review of nutrition labeling and food choice in the United States. *Obesity Science Practice, 5*(6), 581-591.

Fang, W., Hongpu, H., Quan, C., Yuqing, Y., Xiaoze, L., Yan, S., & Yanli, W. (2023). Investigation and analysis of health knowledge among elderly diabetic patients in Dongcheng District, Beijing. *Journal of Medical Informatics, 44*(1), 42-46. https://doi.org/10.3969/j.issn.1673-6036.2023.01.008

Gebreyesus, H. A., Abreha, G. F., Besherae, S. D., Abera, M. A., Weldegerima, A. H., Kidane, E. G., . . . Nigatu, T. G. (2021b). Eating behavior among persons with type 2 diabetes mellitus in North Ethiopia: A cross-sectional study. *BMC Endocrine Disorders, 21*(1), 99.

Gebreyesus, H. A., Abreha, G. F., Beshirie, S. D., Abera, M. A., Weldegerima, A. H., Bezabih, A. M., . . . Nigatu, T. G. (2024). Patient-centered nutrition education improved the eating behavior of persons with uncontrolled type 2 diabetes mellitus in North Ethiopia: A quasi-experimental study. *Frontiers in Nutrition, 11*, 1352963.

Liang, D., Jia, R., Zhou, X., Lu, G., Wu, Z., Yu, J., . . . Chen, C. (2021). The effectiveness of peer support on self-efficacy and self-management in people with type 2 diabetes: A meta-analysis. *Patient Education Counseling, 104*(4), 760-769.

Lin, K., Park, C., Li, M., Wang, X., Li, X., Li, W., & Quinn, L. (2017). Effects of depression, diabetes distress, diabetes self-efficacy, and diabetes self-management on glycemic control among Chinese population with type 2 diabetes mellitus. *Diabetes Research Clinical Practice, 131*, 179-186.

Liu, H. L., Zhao, Y. Z., Zhou, P., Xia, Q. H., & Jiang, Y. (2018). Self-management behavior and its influencing factors in type 2 diabetic patients with poor glycemic control in community of Changning District,Shanghai. *Shanghai Journal of Preventive Medicine, 30*(06), 497-503. https://doi.org/10.19428/j.cnki.sjpm.2018.18760

Liu, Y., & Sun, X. (2020). Analysis of influencing factors of disease cognition level in rural type 2 diabetic patients. *China's Rural Health Service Management*. https://doi.org/CNKI:SUN:ZNWS.0.2020-05-016

Lorig, K. R., & Holman, H. R. (2003). Self-management education: History, definition, outcomes, and mechanisms. *Annals of Behavioral Medicine, 26*(1), 1-7.

Mohammed, M. A., & Sharew, N. T. (2019). Adherence to dietary recommendation and associated factors among diabetic patients in Ethiopian teaching hospitals. *The Pan African Medical Journal, 33*, 260.

Onofrei, L.-M., Puiu, M., Chirita-Emandi, A., & Serban, C. L. (2024). A comprehensive analysis concerning eating behavior associated with chronic diseases among Romanian community nurses. *Frontiers in Public Health, 12*, 1368069.

Papatheodorou, K., Banach, M., Bekiari, E., Rizzo, M., & Edmonds, M. J. J. o. d. r. (2018). Complications of diabetes 2017. *Journal of diabetes research, 2018*, 3086167. https://doi.org/10.1155/2018/3086167

Paragas Jr, E. D., & Barcelo, T. I. (2019). Effects of message - framed informational videos on diabetes management knowledge and self - efficacy. *International Journal of Nursing Practice, 25*(4), e12737.

Peiru, Z. (2021). Study on dietary behavior compliance and influencing factors in patients with type 2 diabetes aged 60-75 years. *Journal of Shanxi Health Vocational College, 31*(3), 2.

Pender, N. J., Murdaugh, C. L., & Parsons, M. A. (2011). *Health promotion in nursing practice*. Pearson.

Putra, K. W. R., Toonsiri, C., & Junprasert, S. (2015). Factors influencing eating behaviors among type 2 diabetes mellitus patients in Sidoarjo Sub-district, East Java, Indonesia. *Thai Pharmaceutical and Health Science Journal, 10*(2), 39-48.

Putra, K. W. R., Toonsiri, C., & Junprasert, S. (2016). Self-efficacy, psychological stress, family support, and eating behavior on type 2 diabetes mellitus. *Belitung Nursing Journal, 2*(1), 3-7.

Ruijie, L., Zhijin, L., Yan, H., Linmei, W., & Jingjing, Z. (2024). Potential profile analysis and influencing factors of dietary behavior compliance in type 2 diabetic patients. *Journal of Nurses Training, 39*(13). https://doi.org/10.16821/j.cnki.hsjx.2024.13.013

Sami, W., Alabdulwahhab, K. M., Ab Hamid, M. R., Alasbali, T. A., Alwadani, F. A., & Ahmad, M. S. (2020). Dietary knowledge among adults with type 2 diabetes—kingdom of Saudi Arabia. *International Journal of Environmental Research Public Health, 17*(3), 858.

Sari, L. A., Astuti, A., & Merdekawati, D. (2021). Knowledge and self-efficacy towards eating behaviors by people living with diabetes mellitus. *KnE Life Sciences*, 288-298.

Speight, J., & Bradley, C. (2001). The ADKnowl: Identifying knowledge deficits in diabetes care. *Diabetic medicine, 18*(8), 626-633.

Sun, H., Saeedi, P., Karuranga, S., Pinkepank, M., Ogurtsova, K., Duncan, B. B., . . . Mbanya, J. C. (2022). IDF diabetes atlas: Global, regional and country-level diabetes prevalence estimates for 2021 and projections for 2045. *Diabetes Res Clin Pract, 183*, 109119.

Sun, S. (2010). *Study on the status and influencing factors of self-management in diabetic patients*. Peking: Peking Union Medical College, China.

Williams, B. W., Kessler, H. A., & Williams, M. V. (2014). Relationship among practice change, motivation, and self-efficacy. *Journal of Continuing Education in the Health Professions, 34*, S5-S10.

Xuejiao, C., Yun, Y., Yannan, C., Nana, Z., Qiuyan, F., & Yue, Z. (2024). Status and influencing factors of diet management in young and middle-aged diabetic patients with poor glycemic control. *International Journal of Nursing Practice, 15*, 2697-2701. https://doi.org/10.3760/cma.j.cn221370-20230818-00629

Yan, Z., Jin, H., Bei, L., Ying, W., Wei, L., & Huiling, H. (2019). Association of diabetic knowledge with health care support and empowerment in type 2 diabetic patients. *Journal of Nursing, 8*, 4. https://doi.org/CNKI:SUN:HLXZ.0.2019-08-013

Zhao, Q., Hou, S., Liang, Y., Zhao, J., & Wang, L. (2017). Development and validity of dietary behavior compliance measurement scale for type 2 diabetes patients. *Journal of Nursing Training, 17*, 32. https://doi.org/10.3870/j.issn.1001-4152.2017.102

Zhu. (2021). Guidelines for the Prevention and Treatment of Type 2 Diabetes in China (2020 Edition) (Part 1). *Chinese Journal of Practical Internal Medicine, 41*(8), 28. https://doi.org/10.19538/j.nk2021080106

Zhu, W. (2010). *The sinicization of the knowledge inventory for diabetes patients and the investigation on the diabetic population in the third class a hospital in Hangzhou Zhejiang University*. China: Hangzhou Zhejiang University.