Makara Journal of Health Research

Volume 27
Issue 3 *December*

Article 1

12-30-2023

Associated Factors Related to Self-Management Behaviors among People with Type 2 Diabetes in Myanmar

Aye Nyein Oo
Ramathibodi School of Nursing, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok 10400, Thailand, ayenyeinoo9291@gmail.com

Jiraporn Lininger
Ramathibodi School of Nursing, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok 10400, Thailand, jiraporn.cho@mahidol.edu

Sirirat Leelacharas
Ramathibodi School of Nursing, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok 10400, Thailand

Makara J Health Res. 2023;27(3):154–159
doi: 10.7454/msk.v27i3.1459

Makara Journal of Health Research

Associated Factors Related to Self-Management Behaviors among People with Type 2 Diabetes in Myanmar

Aye Nyein Oo, Jiraporn Lininger*, Sirirat Leelacharas

Ramathibodi School of Nursing, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok 10400, Thailand

Abstract

Background: Diabetes is a global health concern that affects individuals and the healthcare system. This study aimed to describe the relationships between personal and environmental factors and self-management behaviors in individuals with type 2 diabetes mellitus (T2DM).

Methods: This research included 100 individuals with T2DM who were recruited through convenient sampling from three government hospitals in Myanmar. Data collection was fulfilled using a standardized interviewer-administered questionnaire consisting of demographic information, the Diabetes Management Self-Efficacy Scale, the New Short-Form Health Literacy Instrument, the 24-item version of the Diabetes Knowledge Questionnaire, the Social Support Questionnaire, and the Summary of Diabetes Self-care Activity. Data analysis was conducted using descriptive statistics, Chi-square, Pearson's correlation, and Spearman's rho correlation coefficient.

Results: Self-efficacy (r = 0.375, $p < 0.01$), health literacy (r = 0.43, $p < 0.01$), diabetes knowledge (r = 0.461, $p < 0.01$), and social support (r = 0.337, $p < 0.01$) were significantly related to self-management behavior.

Conclusions: This study indicates the importance of enhancing self-management behaviors, self-efficacy, health literacy, diabetes knowledge, and social support for individuals diagnosed with type 2 diabetes. Future studies should focus on the prediction or interventions to explore the relationship between personal and environmental factors and self-management behaviors among T2DM individuals in Myanmar.

Keywords: Myanmar, self-management, type 2 diabetes

INTRODUCTION

Diabetes is a pressing global health issue, according to the World Health Organization.[1] The International Diabetes Federation estimated 422 million individuals worldwide to be affected by diabetes mellitus.[1] This number is expected to rise to 578 million by 2030 and a staggering 700 million by 2045.[2] Moreover, diabetes accounts for 11.3% of global deaths, with nearly half being attributed to elevated blood glucose levels, especially in individuals under the age of 70.[3] These findings underscore the grave risk posed by diabetes regarding premature mortality.[4]

In addition, diabetes mellitus belongs to the top 10 leading causes of death in Myanmar.[5] Moreover, a number of people with diabetes lack proper self-care.[5] A study conducted in Myanmar reported the lack of self-management behavior among individuals with diabetes.[5] Thus, effective self-management practices play an important role in diabetes management and the improvement of overall health outcomes. Self-management encompasses various activities, such as maintenance of a healthy diet, engagement in regular physical activities, adherence to medication regimens, monitoring of blood glucose levels, and foot care practices.[6] Patients with diabetes must engage in daily self-management routines to preserve their health and improve their quality of life.[6]

This study has shown the association of decreased self-management practices with an increased mortality rate in individuals with type 2 diabetes mellitus (T2DM). However, many factors are related to self-management behavior in patients with diabetes. Previous studies showed the relation of self-efficacy,[7] health literacy,[8] diabetes knowledge,[9] and social support[10] to self-management behavior in various populations of other countries.

Self-efficacy, defined as an individual's confidence in their ability to implement diabetes self-management behaviors and overcome associated barriers,[7] is a beneficial factor that improves self-management.[11] This concept effectively applies to individuals requiring chronic disease self-management.[11] Moreover, high self-efficacy levels enable the successful engagement of individuals in diabetes self-management practices, contributing to improved health outcomes.[7]

Thereafter, health literacy refers to an individual's capacity to obtain, understand, and apply essential health

***Corresponding author:**
Jiraporn Lininger
Ramathibodi School of Nursing, Faculty of Medicine,
Ramathibodi Hospital, Mahidol University, Bangkok, Thailand
E-mail: jiraporn.cho@mahidol.edu

information and services in the management of their well-being and in making informed decisions.[8] Hashim *et al*. mentioned that health literacy is crucial to supporting appropriate treatments and management of individuals with T2DM.[12] In addition, with adequate health literacy, patients with T2DM can actively participate in self-management, which leads to better health outcomes, compared with those lacking in health literacy.[8]

Effective self-management and the attainment of positive health outcomes require a comprehensive understanding of diabetes, including knowledge of dietary choices, physical activity, and medication management.[9] Knowledge of diabetes empowers patients to make informed decisions and adhere to recommended medical guidance.[13]

Social support also plays a crucial role in fostering self-management behaviors among individuals with chronic diseases, including diabetes.[10] Furthermore, this form of support may encompass active assistance and emotional encouragement related to medication adherence, blood glucose monitoring, increased physical activity, adherence to diabetic meal plans, and foot and eye care.[14]

However, although previous studies in other countries reported the relationships between these factors and self-management behaviors, no report regarding their relationships with T2DM in Myanmar has been published. Moreover, T2DM patients in Myanmar show poor self-management behaviors.[22] Therefore, this study aimed to explore the association between personal and environmental factors and self-management behaviors related to T2DM. The results will benefit healthcare professionals and policymakers in terms of promoting improved self-management behaviors in Myanmar.

METHODS

Ethical approval was granted by the Ethical Review Committee on Human Research, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Thailand, and the Institutional Review Board from Medical (ID 2839) and Alliance Universities, Ministry of Education, Myanmar (MOE-IRB-2021/Research/No.089). Healthcare providers facilitated data collection in clinical settings after explaining the study's objectives, procedures, confidentiality, and the right to withdraw. Informed consent was obtained, and data collection through completion of the questionnaire lasted approximately 30–45 min.

A descriptive cross-sectional study involving individuals with T2DM was conducted at three government hospitals in Magway Division, Myanmar, from October 2021 to December 2021.

The inclusion criteria were diagnosis of T2DM for at least 6 months, age over 25 years, proficiency in the Myanmar language, and willingness to participate in the study. The exclusion criteria were acute or chronic infectious conditions or severe illnesses affecting the ability of participants to answer questions. A total of 91 eligible participants were calculated from a G*Power with 10% added up[15] for the refusal rate. Thus, the total number of participants was 100.

The researcher developed a questionnaire for gathering information on age, gender, marital status, religion, education, occupation, income, diabetes duration, comorbidities, and health habits.

The 15-item Diabetes Management Self-Efficacy Scale (DMSES UK) developed by Sturt *et al*.[16] was used to assess the self-efficacy related to various aspects of diabetes management. The scores ranged from 0 to 60, with high scores indicating high self-efficacy. The instrument exhibited good reliability in this study (Cronbach's alpha = 0.84).

The New Short-Form Health Literacy Instrument (HLS-SF 12) was developed by Duong *et al*.[17] The questionnaire comprises 12 items. The scores ranged from 1 to 12. High scores indicate high health literacy. The instrument demonstrated good reliability in this study (Cronbach's alpha = 0.85).

The 24-item version of the diabetes knowledge questionnaire which was adapted from the work of Garcia *et al*.,[18] was used to assess diabetes knowledge with 24 questions. High scores indicate great knowledge. The instrument demonstrated an acceptable reliability (Cronbach's alpha = 0.73) in this study.

Social Support Questionnaire (SSQ) was developed by Kyi Thant Swe.[19] This questionnaire was used to assess social support across various domains. The scores ranged from 25 to 75, with scores <50 indicating poor support and ≥50 implying good support. In this study, SSQ exhibited good reliability (Cronbach's alpha = 0.83).

Summary of Diabetes Self-Care Activities (SDSCA) was developed by Toobert *et al*.[20] The SDSCA was used to assess self-management in six domains. The scores range from 17 to 119, with high scores indicating good self-management. The SDSCA showed good reliability (Cronbach's alpha = 0.91) in this study.

All questionnaires were translated to their Burmese version and used in other studies: DMSES UK and the 24-item version of the Diabetes Knowledge Questionnaire were translated by Lwe Say Paw Hla,[22] HLS-SF 12 by Duong *et al*.,[17] SSQ by Kyi Thant Swe,[18] and SDSCA by Sandhi Wynn Nyunt[21] in Myanmar. All these studies attained good Cronbach's alpha of > 0.83.

Data analysis was accomplished using SPSS. The data were checked for accuracy, completeness, and consistency. Descriptive statistics included frequency, percentage, mean (M), median, and standard deviation (SD), and they were used to describe demographic characteristics, independent variables (age, gender, marital status, education, diabetes duration, self-efficacy, health literacy, diabetes knowledge, and social support), and the dependent variable (self-management behaviors). The relationship between social support and self-management was determined using Pearson's correlation coefficient. Spearman correlation analysis was used to define the relationship among age, diabetes duration, self-efficacy, health literacy, diabetes knowledge, and self-management. A statistical level of 0.05 was applied in this study.

RESULTS

After the data were cleaned by checking for completeness and outliers, 100 participants with T2DM were recruited to participate in this study. The participants were aged 29–65 years, with an average of 56 ± 8.51 years. Table 1 showed that all participants were Buddhists, 82% were females, 78% were married, 67% had primary education, 42% had an income of 150,000–300,000 Myanmar Kyat (MMK) per month (approximately 72–144 USD; USD = 2000 MMK), 76% had comorbidities including hypertension (61.8%), and 64% liked sweet foods.

In addition, the participants in the study presented moderate levels of self-efficacy, health literacy, and diabetes knowledge (27.83 ± 11.19, 26.35 ± 7.54, and 24.84 ± 7.28, respectively). By contrast, they showed a low level of social support (44.33 ± 7.41). Finally, the participants were concluded to have moderate self-management behaviors (73.23 ± 17.81) (Table 2).

Age and diabetes duration showed no relation to self-management behaviors. However, positive associations were observed among self-efficacy, health literacy, diabetes knowledge, social support, and self-management behaviors at the 0.01 level (Table 3).

DISCUSSION

This study aimed to explore the factors associated with self-management behaviors of a T2DM population. The results revealed the moderate self-management behavior levels of the participants. In addition, no relation was observed between age or diabetes duration and self-management behaviors. However, positive correlations were detected between self-management behaviors and self-efficacy, health literacy, diabetes knowledge, and social support.

In this study, age exhibited no significant relationship with self-management behavior, consistent with those of previous studies on patients with T2DM in China,[9,21] Turkey,[22,23] Saudi Arabia,[24] and Indonesia.[25] Although no significant relationship was observed between age and diabetes self-management in this study, the relationship was negative, which indicates that old people had poor self-management. Previous studies reported that younger participants with diabetes had better self-management than older ones.[26,27] Older people may face difficulty in applying self-management due to changes in their health status, support system, physical and mental abilities, and nutritional diabetes self-care.[28] In addition, with aging,

TABLE 1. Sociodemographic characteristics of people with T2DM (N = 100)

Characteristics	N (%)
Age (years)	
<60	58 (58.0)
≥60	42 (42.0)
Gender	
Male	18 (18.0)
Female	82 (82.0)
Marital Status	
Single/Divorced/Widowed	22 (22.0)
Married	78 (78.0)
Education	
No Education	7 (7.0)
Primary School	67 (67.0)
Middle School	11 (11.0)
High School	7 (7.0)
Bachelor's Degree	8 (8.0)
Occupation	
Government Employee	2 (2.0)
Self-Employee	8 (8.0)
Agriculturist	49 (49.0)
Coolie	41 (41.0)
Monthly Income	
<150,000 MMK	32 (32.0)
150,000–300,000 MMK	42 (42.0)
>300,000 MMK	26 (26.0)
Comorbidity (answer more than one)	
No	24 (24.0)
Yes	76 (76.0)
Hypertension	47 (61.8)
Heart Disease	9 (11.8)
Stroke	7 (9.2)
Renal Disease	5 (6.6)
Others	8 (10.5)
Exercise	
No	88 (88.0)
Sometimes	4 (4.0)
Always/Often	8 (8.0)
Food	
Sweet Food	64 (64.0)
Salty Food	36 (36.0)

TABLE 2. Self-efficacy, health literacy, diabetes knowledge, social support, and self-management behaviors of participants (N=100)

Variables	Possible score	Range	Mean ± SD	Interpretation
Self-efficacy	0–60	0–53	27.83 ± 11.19	Moderate
Health literacy	12–48	12–45	26.35 ± 7.54	Moderate
Diabetes knowledge	0–48	6–40	24.84 ± 7.28	Moderate
Social support	25–75	25–67	44.33 ± 7.41	Poor
Self-management	17–119	26–100	73.23 ± 17.81	Moderate

TABLE 3. Relationships among age, diabetes duration, self-efficacy, health literacy, diabetes knowledge, social support, and self-management behaviors in individuals with T2DM (N = 100) obtained using Pearson's correlation and Spearman correlation

Variables	1	2	3	4	5	6	7
1. Age	1						
2. Diabetes Duration	0.128	1					
3. Self-efficacy	−0.086	0.162	1				
4. Health Literacy	−0.112	−0.023	0.447**	1			
5. Diabetes Knowledge	−0.212*	0.262**	0.438**	0.382**	1		
6. Social Support	−0.089	−0.061	0.246*	0.188	0.370**	1	
7. Self-management	−0.189	0.001	0.375**	0.430**	0.461**	0.337**	1

*$p < 0.05$, **$p < 0.01$

individuals experience difficulty performing their daily life activities, including self-management, which leads to decreased self-management.[29]

This study revealed that diabetes duration was not related to self-management behaviors. Similarly, previous research revealed that the duration of diabetes was not significantly associated with the self-management behaviors of patients with diabetes.[30,31] However, the result observed in this study was different from a Gagliardino[32] finding indicating a positive diabetes duration and high level of self-management behaviors. In addition, patients show more self-care over the years of diabetes duration.[30] Research design and data analysis of previous studies may differ from those of the current study. In addition, cultural impact may influence individual self-management behaviors.

In this study, a positive significant relationship was observed between self-efficacy and diabetes self-management. Therefore, Burmese patients with T2DM who presented a high self-efficacy had desirable diabetes self-management. A moderate relationship was found between self-efficacy and self-management behaviors in this study. However, other studies reported relationships ranging from weak to strong.[35,36] Individuals with high self-efficacy have disease-related knowledge to maintain self-management behaviors[37] and low hemoglobin A1c levels have been detected in patients with diabetes.[38]

The findings of this study revealed a positive relationship between health literacy and diabetes self-management behaviors, consistent with those of previous studies.[39,40] Poor health literacy proved to be a barrier to implementing disease management among individuals with T2DM.[41] A study in England also reported that individuals with limited health literacy had a few healthy lifestyle behaviors.[42]

In this study, diabetes knowledge showed a significant association with self-management behaviors, similar to previous findings.[43,44] Low levels of diabetes knowledge were associated with less participation in the decision-making process and poor communication with health providers.[42] However, no significant relationship was observed between diabetes knowledge and diabetes self-management among individuals with T2DM in Malang city.[44]

Moreover, social support in this study revealed a significant positive relationship with self-management behaviors. Participants who had high social support presented desirable self-management behaviors, consistent with the findings of previous studies.[37,45] Support from family, peers, and healthcare providers shows a positive influence on diabetes self-management through the provision of cues to action, direct assistance, reinforcement, and knowledge.[37] Meanwhile, inadequate social support has been associated with poor well-being and diabetes outcomes.

However, this study encountered some limitations. First, the study population was recruited through a convenience sampling method in a rural area in Myanmar. Therefore, the findings may not be generalizable to all type 2 diabetes populations in Myanmar. Second, the researcher interviewed the participants using structured questionnaires. Some participants experienced difficulty

understanding some questions in the questionnaires (DMSES UK). In addition, most participants did not remember their conditions in the last seven days. Finally, the instruments used in the present study included a number of items, which caused the participants to spend around 45 min in finishing the questionnaire. Therefore, the participants might have been bored and hurried to answer the questions, which possibly affected the study findings.

CONCLUSIONS

This study provided evidence of the relationships between personal factors, environmental factors, and diabetes self-management among people with T2DM in Myanmar. The findings of this research fill a gap in the knowledge of self-management behaviors of individuals with T2DM in Myanmar. Nurses can help patients with T2DM to maintain diabetes self-management behaviors, apply the findings from this study, and provide them with health information. Nurses can also offer diabetes education programs or plans for interventions to improve the self-management behaviors of T2DM patients in the future. Predictive or interventional investigations should be conducted in the future to explore the relationship among self-efficacy, health literacy, diabetes knowledge, social support, and self-management behaviors among T2DM individuals in Myanmar.

CONFLICT OF INTEREST

None declared.

FUNDING

This study received no funding.

Received: February 19, 2023 | *Accepted: November 30, 2023*

REFERENCES

1. American Diabetes Association. 9. Pharmacologic approaches to glycemic treatment: Standards of medical care in diabetes-2020. *Diabetes Care*. 2020;43:S98–110.
2. International Diabetes Federation. *IDF Diabetes Atlas 9th edition*. Brussels: International Diabetes Federation, 2019.
3. Bhandari P, Kim M. Self-care behaviors of Nepalese adults with type 2 diabetes: A mixed methods analysis. *Nurs Res*. 2016;65:202–14.
4. Caruso R, Magon A, Baroni I, Dellafiore F, Arrigoni C, Pittella F, *et al*. Health literacy in type 2 diabetes patients: A systematic review of systematic reviews. *Acta Diabetol*. 2018;55:1–12.
5. Bourne RR, Stevens GA, White RA, Smith JL, Flaxman SR, Price H, *et al*. Causes of vision loss worldwide, 1990-2010: A systematic analysis. *Lancet Glob Health*. 2013;1:e339–49.
6. Aye TT, Aung MW, Oo ES. Diabetes mellitus in Myanmar: Socio-cultural challenges and strength. *J Soc Health Diabetes*. 2014;2:9–13.
7. Chen YC, Chang LC, Liu CY, Ho YF, Weng SC, Tsai TI. The roles of social support and health literacy in self-management among patients with chronic kidney disease. *J Nurs Scholarsh*. 2018;50:265–75.
8. Bohanny W, Wu SF, Liu CY, Yeh SH, Tsay SL, Wang TJ. Health literacy, self-efficacy, and self-care behaviors in patients with type 2 diabetes mellitus. *J Am Assoc Nurse Pract*. 2013;25:495–502.
9. Gagliardino JJ, Chantelot JM, Domenger C, Ramachandran A, Kaddaha G, Mbanya JC, *et al*. Impact of diabetes education and self-management on the quality of care for people with type 1 diabetes mellitus in the Middle East (the International Diabetes Mellitus Practices Study, IDMPS). *Diabetes Res Clin Pract*. 2019;147:29–36.
10. Cunningham AT, Crittendon DR, White N, Mills GD, Diaz V, LaNoue MD. The effect of diabetes self-management education on HbA1c and quality of life in African-Americans: A systematic review and meta-analysis. *BMC Health Serv Res*. 2018;18:367.
11. Lin K, Park C, Li M, Wang X, Li X, Li W, *et al*. Effects of depression, diabetes distress, diabetes self-efficacy, and diabetes self-management on glycemic control among Chinese population with type 2 diabetes mellitus. *Diabetes Res Clin Pract*. 2017;131:179–86.
12. Hashim SA, Barakatun-Nisak MY, Abu Saad H, Ismail S, Hamdy O, Mansour AA. Association of health literacy and nutritional status assessment with glycemic control in adults with type 2 diabetes mellitus. *Nutrients*. 2020;12:3152.
13. Hurst CP, Rakkapao N, Hay K. Impact of diabetes self-management, diabetes management self-efficacy and diabetes knowledge on glycemic control in people with Type 2 Diabetes (T2D): A multi-center study in Thailand. *PLoS One*. 2020;15:e0244692.
14. Wichit N, Mnatzaganian G, Courtney M, Schulz P, Johnson M. Randomized controlled trial of a family-oriented self-management program to improve self-efficacy, glycemic control and quality of life among Thai individuals with Type 2 diabetes. *Diabetes Res Clin Pract*. 2017;123:37–48.
15. Sturt J, Hearnshaw H, Wakelin M. Validity and reliability of the DMSES UK: A measure of self-efficacy for type 2 diabetes self-management. *Prim Health Care Res Dev*. 2010;11:374–81.
16. Berhe KK, Gebru HB, Kahsay HB. Effect of motivational interviewing intervention on HgbA1C and depression in people with type 2 diabetes mellitus (systematic review and meta-analysis). *PLoS One*. 2020;15):e0240839.
17. Duong TV, Aringazina A, Kayupova G, Nurjanah, Pham TV, Pham KM, *et al*. Development and validation of a new short-form Health Literacy Instrument (HLS-SF12) for the general public in six Asian countries. *Health Lit Res Pract*. 2019;3:e91–102.
18. Garcia AA, Villagomez ET, Brown SA, Kouzekanani K, Hanis CL. The Starr County Diabetes Education Study:

Development of the Spanish-language diabetes knowledge questionnaire. *Diabetes Care*. 2001;24:16–21.
19. Kyi-Thant-Swe, Tanasugarm C, Siri S. Care seeking behavior regarding hypertension in Magway Township, Myanmar [dissertation]. Bangkok, Thailand: Mahidol University; 2016.
20. Toobert DJ, Hampson SE, Glasgow RE. The summary of diabetes self-care activities measure: Results from 7 studies and a revised scale. *Diabetes Care*. 2000;23:943–50.
21. Wynn Nyunt S, Howteerakul N, Suwannapong N, Rajatanun T. Self-efficacy, self-care behaviors and glycemic control among type-2 diabetes patients attending two private clinics in Yangon, Myanmar. *Se Asian J Trop Med*. 2010;41:943–51.
22. Hla LSP, Pongthavornkamol K, Wattanakitkrileart D, Orathai P. Factors influencing adherence to therapeutic regimens among people with type 2 diabetes mellitus in Yangon, Myanmar. *J Popul Soc Stud*. 2018;26:262–80.
23. Karakurt P, Kasikci M. Validity and reliability of the Turkish version of the Diabetes Self-Care Scale. *Int J Diabetes Dev Ctries*. 2015;35:148–56.
24. Lee EH, Lee YW, Chae D, Lee KW, Hong S, Kim SH, *et al*. Pathways linking health literacy to self-management in people with type 2 diabetes. *Healthcare (Basel)*. 2021;9:1734.
25. Unnikrishnan R, Pradeepa R, Joshi SR, Mohan V. Type 2 diabetes: Demystifying the global epidemic. *Diabetes*. 2017;66:1432–42.
26. Koetsenruijter J, van Eikelenboom N, van Lieshout J, Vassilev I, Lionis C, Todorova E, *et al*. Social support and self-management capabilities in diabetes patients: An international observational study. *Patient Educ Couns*. 2016;99:638–43.
27. Hilliard ME, Minard CG, Marrero DG, de Wit M, DuBose SN, Verdejo A, *et al*. Health-related quality of life in parents and partners of people with type 1 diabetes: Development and validation of type 1 diabetes and life (T1DAL) measures. *Fam Syst Health*. 2021;39:234–47.
28. Hourzad A, Pouladi S, Ostovar A, Ravanipour M. The effects of an empowering self-management model on self-efficacy and sense of coherence among retired elderly with chronic diseases: A randomized controlled trial. *Clin Interv Aging*. 2018;13:2215–24.
29. Kurnia AD, Amatayakul A, Karuncharernpanit S. Factors related to diabetes self-management among adults with type 2 diabetes mellitus in Malang city, East Java, Indonesia. *Proceedings of the 3rd ANPOR Annual Conference*; 2015 Nov 25-28; Bangkok, Thailand; 2015. p.193–202.
30. Li Y, Lv X, Liang J, Dong H, Chen C. The development and progress of health literacy in China. *Front Public Health*. 2022;10:1034907.
31. Maleki Chollou K, Gaffari-Fam S, Babazadeh T, Daemi A, Bahadori A, Heidari S. The association of health literacy level with self-care behaviors and glycemic control in a low education population with type 2 diabetes mellitus: A cross-sectional study in Iran. *Diabetes Metab Syndr Obes*. 2020;13:1685–93.
32. Mashi AH, Aleid D, Almutairi S, Khattab F, AlMuqawed AN, Khan S, *et al*. The association of health literacy with glycemic control in Saudi patients with type 2 diabetes. *Saudi Med J*. 2019;40:675–80.
33. Kononenko IV, Smirnova OM, Mayorov AY, Shestakova MV. Classification of diabetes. World Health Organization 2019. What's new? *Diabetes Mellit*. 2020;23:329–39. In Russian.
34. Kurnia AD, Amatayakul A, Karuncharernpanit S. Predictors of diabetes self-management among type 2 diabetics in Indonesia: Application theory of the health promotion model. *Int J Nurs Sci*. 2017;4:260–5.
35. Masoompour M, Tirgari B, Ghazanfari Z. The relationship between health literacy, self-efficacy, and self-care behaviors in diabetic patients. *Evid Based Care J*. 2017;7:17–25.
36. Ogbole FA, Harold BA. Association of undiagnosed pre-diabetes and type-2 diabetes mellitus with interleukin-2 mRNA expression among adults in Bayelsa State, Nigeria. *Int J Res Rev*. 2023;10:210–5.
37. Yao J, Wang H, Yin X, Yin J, Guo X, Sun Q. The association between self-efficacy and self-management behaviors among Chinese patients with type 2 diabetes. *PLoS One*. 2019;14:e0224869.
38. Rafferty AP, Winterbauer NL, Luo H, Bell RA, Little NRG. Diabetes self-care and clinical care among adults with low health literacy. *J Public Health Man*. 2021;27:144–53.
39. Reisi M, Javadzade H, Sharifirad G, Mostafavi F, Tavassoli E, Imanzad M. Effects of an educational intervention on self-care and metabolic control in patients with type II diabetes. *J Client-Centered Nurs Care*. 2017;3:205–14.
40. Moeini B, Haji Maghsodi S, Kangavari M, Afshari M, Tagh JZC. Factors associated with health literacy and self-care behaviors among Iranian diabetic patients: A cross-sectional study. *J Commun Health*. 2016;9:279–87.
41. Saad AMJ, Younes ZMH, Ahmed H, Brown JA, Al Owesie RM, Hassoun AAK. Self-efficacy, self-care and glycemic control in Saudi Arabian patients with type 2 diabetes mellitus: A cross-sectional survey. *Diabetes Res Clin Pract*. 2018;137:28–36.
42. Visagie E, van Rensburg E, Deacon E. Social support effects on diabetes management by South African emerging adults: A replication and extension study. *J Psychol Afr*. 2018;28:504–9.
43. Weinger K, Beverly EA, Smaldone A. Diabetes self-care and the older adult. *West J Nurs Res*. 2014;36:1272–98.
44. Wen CP, Chang CH, Tsai MK, Lee JH, Lu PJ, Tsai SP, *et al*. Diabetes with early kidney involvement may shorten life expectancy by 16 years. *Kidney Int*. 2017;92:388–96.
45. Wu FL, Tai HC, Sun JC. Self-management experience of middle-aged and older adults with type 2 diabetes: A qualitative study. *Asian Nurs Res (Korean Soc Nurs Sci)*. 2019;13:209–15.