Available on: *http://nursingjurnal.respati.ac.id/index.php/JKRY/index*
Jurnal Keperawatan Respati Yogyakarta, *10(2), May 2023, 140 - 146*

Influence Self Monitoring Blood Glucose (SMBG) and Diabetes Self Management Education (DSME) on the Stability of Blood Glucose Levels

Susanti [1,*], Difran Nobel Bistara [2]
[1] Department of Nursing, STIKES Adi Husada, Surabaya, East Java, Indonesia
[2] Department of Nursing, Faculty of Nursing and Midwifery, Universitas Nahdlatul Ulama Surabaya, Surabaya, Indonesia

Abstract

Diabetes Mellitus (DM) sufferers must do DM management behavior (self-management) to control their Blood glucose levels and prevent complications. To achieve optimal self-management behavior, one of the efforts made is SMBG and DSME. Self-Monitoring Blood Glucose (SMBG) is self-monitoring blood glucose using a glucometer. Diabetes Self-Management Education (DSME) is an ongoing process of facilitating the knowledge, skills, and abilities needed for diabetes self-care. This study contributes to analyzing the effect of Self-Monitoring Blood Glucose (SMBG) and Diabetes Self-Management Education (DSME) on the stability of Blood glucose levels. The research design used is quasi-experimental. The sample in this study amounted to 40 and was taken using the technique of simple random sampling. Stability of Blood glucose levels using a glucometer measuring instrument. Data analysis using test Wilcoxon Signed-rank. The results of statistical tests on SMBG showed a p-value (0.001), so it could be concluded that there was an effect of SMBG on the stability of Blood glucose levels. Statistical test results on DSME showed a p-value (0.000), so it can be concluded that there is an effect of DSME on the stability of Blood glucose levels. Adherence to structured SMBG allows sufferers to interpret results regarding their activity level and portion size. It motivates them to act on these results for better blood sugar results. DSME components taught to patients can increase patient knowledge and skills and improve patient care that is not correct.

Keywords: *Self-Monitoring Blood Glucose; Diabetes Self-Management Education; Blood Glucose Levels; Diabetes Mellitus*

Article info: *Sending on May 30, 2023; Revision on June 22, 2023; Accepted on July 17, 2023*

---

*) *Corresponding author: Susanti*
e-mail: susanti1303@gmail.com

1. Introduction

Diabetes Mellitus (DM) sufferers who cannot control their Blood glucose levels will potentially experience complications (Adu et al., 2019). Increased complications such as hyperglycemia and mortality in patients with type 2 DM occur if patients do not carry out DM management behavior (self-management) by the advice given by health workers. Therefore, it is necessary to have regularity toward healthy behavior from all aspects of DM self-management (Kusnanto et al., 2020). However, the reality that often occurs in the field is the lack of knowledge of DM sufferers about DM management behavior (self-management). The lack of monitoring of Blood glucose levels is often ignored by every person with diabetes mellitus, so it can be said that self-management and monitoring of Blood glucose levels in DM patients are still lacking. Not yet good (Zheng et al., 2019).

Under the initial survey of knowledge of DM management (self-management) behavior in people with diabetes mellitus in RW 02, Kelurahan Tanah Kali Kedinding, Kenjeran District, Surabaya, the results showed that eight people knew about DM management behaviour (self-management), only two people had less knowledge of DM management behaviour (self-management). According to the initial survey to monitor Blood glucose levels in people with diabetes mellitus in RW 02, Kelurahan Tanah Kali Kedinding, Kenjeran District, Surabaya, the results showed that nine people did not routinely monitor Blood glucose levels and only one person who regularly monitored Blood glucose levels.

An individual's ability to manage daily life, control and reduce the impact of the disease he suffers is known as self-management (Van Smoorenburg et al., 2019). Healthy self-management behaviors in DM patients include

following a healthy diet, increasing physical activity, using DM drugs and drugs in special circumstances safely and regularly, and monitoring Blood glucose levels (Nguyen et al., 2022). Diabetes Mellitus sufferers are at high risk of experiencing complications in the form of hypoglycemia, hyperglycemia, ketoacidosis, and neuropathy which increases the risk of gangrenous wounds that lead to amputation, retinopathy which has the potential to cause blindness, nephropathy, which can lead to kidney failure (Balaji et al., 2019).

Monitoring Blood glucose levels is one of the self-management behaviors of diabetes mellitus. Monitoring Blood glucose levels can be done by self-monitoring blood Glucose (SMBG) (Despins & Wakefield, 2020). Self-monitoring blood Glucose aims to gather detailed information about blood glucose levels at multiple time points to maintain more constant glucose levels with more appropriate regimens. Self-monitoring blood Glucose works by asking the patient to do several glucose tests with a glucometer. Education is the beginning of managing diabetes mellitus to change patient behavior and lifestyle (Lambrinou et al., 2019). It is important to educate patients with type 2 diabetes mellitus as a step in controlling diabetes mellitus to increase patient knowledge and skills so that patients can manage diabetes mellitus independently and sustainably or what is known as Diabetes Self-Management Education (DSME) (Hailu et al., 2019). Accordingly, the contribution of this study is to aid in the analysis of the impact of diabetes self-management education (DSME) and self-monitoring blood glucose (SMBG) on the stability of blood glucose levels.

2. Method

The research design used quasi-experimental with type-pretest and posttest intervention by involving two treatment groups with different interventions. In this design, treatment group 1 was given the Self-Monitoring Blood Glucose (SMBG) intervention, and treatment group 2 was given the Diabetes Self-Management Education (DSME) intervention. In both groups, it started with a pre-test, and after the treatment was finished, a re-measurement (posttest) was held.

The population used in this study were Diabetes Mellitus sufferers in the RW 02 Kelurahan Tanah Kali Kedinding, Kenjeran District, Surabaya, East Java, Indonesia, totaling 42 people. This research uses techniques of simple random sampling. Each element is randomly selected by taking the available numbers to achieve sampling. A sample of 40 people was divided into two groups, namely treatment group 1 and treatment group 2, each containing 20 people. This research has been reviewed by the Ethics Committee under number 102/01/EC/II/2022

Independent variable self Monitoring Blood Glucose (SMBG) using a glucometer and independent variableDiabetes Self Management Education (DSME) using manualsDiabetes Self Management Education (DSME) includes diet management, physical activity, monitoring of Blood glucose levels, and pharmacological therapy. The dependent variable is the stability of Blood glucose levels using the observation sheet.

This research was conducted from March 13, 2022, until April 21, 2022, at RW 02, Tanah Kali Kedinding Village, Kenjeran District, Surabaya, East Java, Indonesia. The statistical test for treatment group 1 and treatment group 2 used a statistical test Wilcoxon signed rank test, namely the statistical test of comparison of two paired samples with ordinal scale variables using a degree of significance $p < 0.05$.

Research subjects have obligations regarding their professions, the law, and society under research ethics. Along with moral standards, before conducting the investigation, the researcher informed the respondents. To explain the research, the researcher got in touch with the responder. The explanations cover the following topics: study goals, research methods, advantages of the research, dangers and potential annoyances, data confidentiality, compensation for unforeseen events, and the researcher's accountability. After then, the researcher requested consent to participate in the study. Primary data was gathered, and respondents were requested to sign an informed consent form. After confirmation that all data is complete, the research goals will process and evaluate the data.

3. Results and Discussion

The results of research conducted on respondents obtained general data results in Table 1. The results of research conducted on respondents regarding the influence Self-Monitoring Blood Glucose (SMBG) and Diabetes Self-Management Education (DSME) on the stability of Blood glucose levels, the following results are obtained in Table 2.

The results of the study show that after being carried out Self Monitoring Blood Glucose (SMBG) once a week for a month, the researcher measured the Blood glucose level of the respondents after the intervention was given, and the results of the Blood glucose level in the normal category (80-199 mg/dL) which initially numbered seven people (35%) after the intervention became 18 people (90%), the hypoglycemia category (<80 mg/dL) which was initially two people (10%) after the intervention became one person (5%), and the hyperglycemia category (>200 mg/dL) which was

initially 11 people (55 %) after being given the intervention becomes one person (5%).

Table 1. Characteristics of respondents based on general data

Characteristics	Treatment Group 1		Treatment Group 2	
	F	P (%)	F	P (%)
Age				
Age 40-50 years	3	15%	2	10%
Age 51-60 years	11	55%	13	65%
Age 61-70 years	6	30%	5	25%
Total	20	100%	20	100%
Gender				
Man	2	10%	4	20%
Woman	18	90%	16	80%
Total	20	100%	20	100%
Education				
Elementary School	1	5%	5	25%
Junior High School	4	20%	11	55%
Senior High School	14	70%	4	20%
College	1	5%	0	0%
Total	20	100%	20	100%
Medication Routine				
Routine	13	65%	6	30%
Not a routine	7	35%	14	70%
Total	20	100%	20	100%
Long Suffered				
>5 years	11	55%	5	25%
<5 years	10	45%	15	75%
Total	20	100%	20	100%
Knowledge				
Good	16	80%	5	25%
Less	4	20%	15	75%
Total	20	100%	20	100%

Risk factors that affect diabetes mellitus are age, increased blood glucose levels in patients who are getting older due to insulin resistance due to changes in body composition, decreased activity, changes in eating patterns, and decreased neurohormonal function (Dal Canto et al., 2019). Another risk factor that affects diabetes mellitus is long-suffering. Patients with diabetes mellitus who have been sick for longer have much experience and get more information about diabetes self-management behavior so that it can be applied in life (Kjellsdotter et al., 2020). Another risk factor that affects diabetes mellitus is self-knowledge of diabetes management. Diabetes mellitus is a disease that requires independent treatment, so DM patients must have good knowledge to apply skills and attitudes to adapt to the daily management of DM (Gómez-Velasco et al., 2019).

Self-monitoring of blood glucose aims to collect detailed information about Blood glucose levels at certain times. According to the research by (Cuevas et al., 2022), researchers highlighted how SMBG offers rich and informative data that can stabilize Blood glucose levels accompanied by knowledge of DM sufferers about good blood sugar control. According to a study by (Romero-Castillo et al., 2022), a structured SMBG regimen combined with respondents with a good level of diabetes self-management education can be beneficial for patients in controlling their glycemic. Education plays an important role in the management of diabetes. The intervention group strictly adhered to diabetes control measures after the SMBG test. After six months of monitoring, the patient showed better changes in Blood glucose levels within the normal range. According to research by (Cuevas et al., 2022), Blood glucose levels in respondents experienced stability after being given the SMBG regimen. Respondents in their research had good diabetes management education, so, with good education, respondents could follow up on results by changing food portion sizes and physical activity levels.

Table 2. Characteristics of respondents based on blood glucose levels in treatment group 1 in patients with diabetes mellitus

Variable Blood glucose levels	Pre		Post	
	F	P(%)	F	P(%)
Normal	7	35%	18	90%
hypoglycemia	2	10%	1	5%
Hyperglycemia	11	55%	1	5%
Total	20	100%	20	100%
Test Wilcoxon Signed Rank Test	Results P value = 0.001			

Based on the research results, it is known that the results of the Wilcoxon Signed Rank Test obtained a P value = 0.001, which means that there is a significant effect between blood glucose levels after self Monitoring Blood Glucose (SMBG) and experiencing stability of blood glucose levels.

Self-monitoring of blood glucose is blood glucose monitoring carried out independently by the patient. Several benefits are obtained from having information about daily blood glucose for patients to choose and determine food intake and physical activity and adjust therapy, especially insulin doses (Ngoga et al., 2020). Based on research by (Wada et al., 2020), the superiority of SMBG in patients treated with SMBG frequency will increase the rapid adjustment of treatment by

the patients themselves. Based on the research results of (Ida et al., 2020), it has been shown that tight blood sugar control contributed to decreased blood glucose stability and improvement. This study reported that increased knowledge was a predictor of patient survival. This improvement resulted from more active patient participation in self-care management, better adherence to treatment protocols, and lower attrition rates than other interventions.

Based on the research of (Cuevas et al., 2022), discussion of SMBG data allows for making more informed decisions; as noted by various individuals, SMBG thus helps enable them to anticipate and prevent hypoglycemia and hyperglycemia. Continuous SMBG data has enabled them to understand better how diet and physical activity impact their blood glucose levels. Before proceeding to the next treatment, the standard SMBG regimen used in his study may be an option for treating target groups, particularly patients with type 2 DM who are not well controlled and do not have a current diagnosis. The success of managing type 2 diabetes mellitus needs to be improved by trying to accept, adapt to change, and build commitment to dealing with problems. Optimal health supports people with diabetes mellitus (Bistara et al., 2020).

The results of this study are the results of previous studies, which have described that Blood glucose levels are stable after being given SMBG. In the other treatment, groups were given diabetes Self Management Education (DSME) and experienced stability of Blood glucose levels. Adherence to structured SMBG allows sufferers to interpret results regarding their activity level and portion size. It motivates them to act on these results for better blood sugar results. The stability of Blood glucose levels after being given SMBG can occur if the respondent has good diabetes self-management knowledge. The knowledge can be applied in skills and attitudes to adjust to the daily management of DM so that the information obtained from this daily monitoring is used as data. They maintain constant blood glucose throughout the day by determining a more appropriate therapeutic regimen for the problem. Another factor is long-suffering; the longer DM sufferers will have more experience, get more information, and apply behavior more easily.

The results of the study show that after being carried out Diabetes Self-Management Education (DSME) for one month, the researchers measured the Blood glucose levels of the respondents after being given the intervention and obtained the results of normal Blood glucose levels (80-199 mg/dL), which initially numbered four people (20%) after being given the intervention, it became 19 people (99 %), the category of hypoglycemia (<80 mg/dL) which initially was one person (5%) after being given an intervention became absent, and the category of hyperglycemia (> 200 mg/dL) which was originally 15 people (75%) after being given an intervention became one people (5%).

Diabetes Mellitus is a disease that requires independent treatment, so DM patients must have good knowledge so that skills and attitudes can be applied to adjust to the daily management of DM (Gómez-Velasco et al., 2019). The general purpose of Diabetes Self-Management Education (DSME) is to support information in decision-making, behavior, self-care, problem-solving, and active collaboration with healthcare teams to improve clinical outcomes, health status, and quality of life (Hailu et al., 2019). Education provided through DSME can facilitate DM patients' knowledge, skills, and abilities in carrying out independent care. This is to research from (Powers et al., 2020), which suggests that providing interventions in the form of Diabetes Self-Management Education (DSME) education can increase patient and family awareness about the importance of holistic management of type 2 Diabetes Mellitus so that it becomes an attraction in implement the Diabetes Self-Management Education (DSME) intervention through various considerations to try and implement the intervention Diabetes Self-Management Education (DSME) as a whole.

Based on the description of Table 3 regarding the results of the SPSS test, it is known that the results of the Wilcoxon Signed Rank Test obtained a P value = 0.000, which means that there is a significant effect between blood glucose levels after diabetes Self Management Education (DSME) and experiencing stability of blood glucose levels.

Diabetes Self-Management Education (DSME) is an effective form of education given to DM patients because DSME administration can increase the patient's knowledge, attitudes, and behavior in self-care. DSME aims to support decision-making, self-care, problem-solving, and active collaboration with healthcare teams to improve clinical outcomes, health status, and quality of life (Uly et al., 2022). Providing information to patients is a stimulus that can increase knowledge, raising awareness to behave as expected. This is to the results of the study by (Kusnanto et al., 2019), which showed that there was an increase in the blood glucose levels of the respondents in the intervention group where during the pre-test, it was measured on the respondent's blood glucose and then given DSME and DM booklets periodically once a week for less more than four weeks with the result that there is a significant difference in blood glucose levels before and after.

(Awang Ahmad et al., 2020) suggested that patient and family education using booklets changed DM self-care knowledge. The results of

the process of administering the Diabetes Self-Management Education (DSME) program have been shown to affect a decrease in blood glucose levels in patients with type 2 diabetes mellitus. Where when providing education, respondents are given knowledge about their disease, taught how to prevent the severity of their disease, then invited to plan the management of their disease to encourage the willingness of respondents to take proper self-care and prevention measures (Uly et al., 2022). This is consistent with the research of (Zheng et al., 2019), which showed an effect of a diabetes self-management education program on reducing blood glucose levels in type 2 DM patients. Respondents who experienced decreased sugar levels were because the respondents were very cooperative and serious in following and listening as the DSME materials were explained. Patient education in managing diabetes mellitus is one of the important pillars for optimizing medical therapy. If education is effective, self-management and increased adherence to health worker recommendations will be carried out (Bistara et al., 2022).

Table 3. Characteristics of respondents based on blood glucose levels in treatment group 2 in patients with diabetes mellitus

Variable Blood glucose levels	Pre		Post	
	F	P(%)	F	P(%)
Normal	4	20%	19	95%
Hypoglycemia	1	5%	0	0%
Hyperglycemia	15	75%	1	5%
Total	20	100%	20	100%
Test Wilcoxon Signed Rank Test	Results P value = 0.000			

Based on the research of (Cuevas et al., 2022) results described above, DSME can reduce Blood glucose levels through self-care. In the other treatment groups given self, Monitoring Blood Glucose (SMBG) also stabilizes Blood glucose levels. The decrease could be caused by several factors, including the respondents who knew briefly about the monitoring that had to be carried out, they did not know about proper nutritional arrangements, they did not know the types of exercise recommended for diabetics, and the pharmacological therapy of diabetes. So, this study shows that the DSME intervention and administration of DM booklets were able to restrain the rate of increase in glucose levels in DM 2 patients. By administering DSME to DM patients in this study, patients obtained information about DM self-care. The patient's knowledge, skills, and psychological status have increased, so the patient begins to treat his illness independently. The DSME components taught during DSME administration to DM patients in this study were basic knowledge about DM, nutrition/diet management, exercise or physical exercise, foot care, pharmacological therapy, and monitoring of Blood glucose levels. Apart from that, family-based DM care management is also needed (Rakhmawati, D., Ramadlan, M., & Ridwan, M. 2022).

4. Conclusion and Suggestions

The stability of Blood glucose levels after being given SMBG can occur if the respondent has good diabetes self-management knowledge. The process of administering the Diabetes Self-Management Education (DSME) program has been shown to affect a decrease in blood glucose levels in patients with type 2 diabetes mellitus. Based on the results of this study, it is recommended that nurses, when providing education to clients, provide complete information about their disease, teach them how to prevent the severity of their disease, then invite them to plan the management of their disease.

5. Acknowledgments

Thank you to all respondents and to those who have helped in completing this research until the compilation of this manuscript. Thank you to the University of Nahdlaltul Ulama Surabaya and STIKES Adi Husada for providing much encouragement and support so that this research can be carried out and to all those who helped a lot. May God bestow grace and convenience for all of us.

6. References

Adu, M. D., Malabu, U. H., Malau-Aduli, A. E. O., & Malau-Aduli, B. S. (2019). Enablers and barriers to effective diabetes self-management: A multi-national investigation. *PloS One*, *14*(6), e0217771. https://doi.org/10.1371/journal.pone.0217771.

Awang Ahmad, N. A., Sallehuddin, M. A. A., Teo, Y. C., & Abdul Rahman, H. (2020). Self-Care Management of Patients with diabetes: nurses' perspectives. *Journal of Diabetes & Metabolic Disorders*, *19*, 1537–1542. https://doi.org/10.1007/s40200-020-00688-w.

Balaji, R., Duraisamy, R., & Kumar, M. P. (2019). Complications of diabetes mellitus: A review. *Drug Invention Today*, *12*(1). https://web.p.ebscohost.com/abstract?direct=true&profile=ehost&scope=site&authtype.

Bistara, D. N., Wardani, E. M., Susanti, S., Putro, A., Santoso, R., Hakim, A., Fasya, Z., & Andini, A. (2022). *The effect of discharge planning on the stability of Blood glucose levels in type 2 diabetes mellitus patients*.

11(3), 1180–1184. https://doi.org/10.15562/bmj.v11i3.3537.

Bistara, D. N., Rusdianingseh, Susanti, S., Wardani, E. M., Septianingrum, Y., Ainiyah, N., Fitriasari, A., Noventi, I., & HASINA, S. N. U. R. (2020). Acceptance and commitment therapy (ACT) on increasing the compliance of management diabetes mellitus type 2. *International Journal of Psychosocial Rehabilitation*, *24*(9), 942–946. http://repository.unusa.ac.id/6260/.

Cuevas, H., Heitkemper, E., & Haque, B. (2022). Relationships among perception of cognitive function, diabetes self-management, and glucose variability in older adults: a mixed methods study. *Research in Gerontological Nursing*, *15*(4), 203–212. https://doi.org/10.3928/19404921-20220609-02.

Dal Canto, E., Ceriello, A., Rydén, L., Ferrini, M., Hansen, T. B., Schnell, O., Standl, E., & Beulens, J. W. J. (2019). Diabetes as a cardiovascular risk factor: An overview of global trends of macro and micro vascular complications. *European Journal of Preventive Cardiology*, *26*(2_suppl), 25–32. https://doi.org/10.1177/2047487319878371.

Despins, L. A., & Wakefield, B. J. (2020). Making sense of blood glucose data and self-management in individuals with type 2 diabetes mellitus: A qualitative study. *Journal of Clinical Nursing*, *29*(13–14), 2572–2588. https://doi.org/10.1111/jocn.15280.

Gómez-Velasco, D. V, Almeda-Valdes, P., Martagón, A. J., Galán-Ramírez, G. A., & Aguilar-Salinas, C. A. (2019). Empowerment of patients with type 2 diabetes: current perspectives. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy*, 1311–1321. https://doi.org/10.2147/DMSO.S174910.

Hailu, F. B., Moen, A., & Hjortdahl, P. (2019). Diabetes self-management education (DSME)–Effect on knowledge, self-care behavior, and self-efficacy among type 2 diabetes patients in Ethiopia: A controlled clinical trial. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy*, 2489–2499. https://doi.org/10.2147/DMSO.S223123.

Ida, S., Kaneko, R., Imataka, K., Okubo, K., Shirakura, Y., Azuma, K., Hujiwara, R., Takahashi, H., & Murata, K. (2020). Effects of flash glucose monitoring on dietary variety, physical activity, and self-care behaviors in patients with diabetes. *Journal of Diabetes Research*. https://doi.org/10.1155/2020/9463648.

Kjellsdotter, A., Berglund, M., Jebens, E., Kvick, J., & Andersson, S. (2020). To take charge of one's life-group-based education for patients with type 2 diabetes in primary care-a lifeworld approach. *International Journal of Qualitative Studies on Health and Well-Being*, *15*(1), 1726856. https://doi.org/10.1080/17482631.2020.1726856.

Kusnanto, K., Arifin, H., & Widyawati, I. Y. (2020). A qualitative study exploring diabetes resilience among adults with regulated type 2 diabetes mellitus. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, *14*(6), 1681–1687. https://doi.org/10.1016/j.dsx.2020.08.035.

Kusnanto, Widyanata, K. A. J., Suprajitno, & Arifin, H. (2019). DM-calendar app as a diabetes self-management education on adult type 2 diabetes mellitus: a randomized controlled trial. *Journal of Diabetes & Metabolic Disorders*, *18*, 557–563. https://doi.org/10.1007/s40200-019-00468-1.

Lambrinou, E., Hansen, T. B., & Beulens, J. W. J. (2019). Lifestyle factors, self-management and patient empowerment in diabetes care. *European Journal of Preventive Cardiology*, *26*(2_suppl), 55–63. https://doi.org/10.1177/2047487319885455.

Ngoga, G., Dusabeyezu, S., Hedt-Gauthier, B. L., Ngamije, P., Habiyaremye, M., Harerimana, E., Ndayisaba, G., Rusangwa, C., Niyonsenga, S. P., & Bavuma, C. M. (2020). Implementation of blood glucose self-monitoring among insulin-dependent patients with type 2 diabetes in three rural districts in Rwanda: 6 months open randomised controlled trial. *BMJ Open*, *10*(7), e036202. https://doi.org/10.1136/bmjopen-2019-036202.

Nguyen, V. B., Thi, K. H. P., Nguyen, T. X., Pham, N. T. L., Nguyen, V. V. H., & Van Le, C. (2022). Diabetes self-management and its associated factors among patients with diabetes in central Vietnam: A cross-sectional study. *Plos One*, *17*(7), e0270901. https://doi.org/10.1371/journal.pone.0270901.

Powers, M. A., et al., (2020). Diabetes self-management education and support in adults with type 2 diabetes: a consensus report of the American Diabetes Association, the Association of Diabetes Care & Education Specialists, the Academy of Nutrition and Dietetics, the American Academy of Family Physicians, the American Academy of PAs, the American Association of Nurse

Practitioners, and the American Pharmacists Association. *Diabetes Care*, *43*(7), 1636–1649. https://doi.org/10.2337/dci20-0023.

Rakhmawati, D., Ramadlan, M., & Ridwan, M. (2022). Family nursing care in family with diabetes mellitus with a focus of inaffectiveness management of type 2 diabetes mellitus diet in banjarnegara district. *Jurnal Keperawatan Respati Yogyakarta*, *9*(3), 195 - 198. http://dx.doi.org/10.35842/jkry.v9i3.623.

Romero-Castillo, R., Pabón-Carrasco, M., Jiménez-Picón, N., & Ponce-Blandón, J. A. (2022). Effects of Nursing Diabetes Self-Management Education on Glycemic Control and Self-Care in Type 1 Diabetes: Study Protocol. *International Journal of Environmental Research and Public Health*, *19*(9), 5079. https://doi.org/10.3390/ijerph19095079.

Uly, N., Fadli, F., & Iskandar, R. (2022). Relationship between Self-Care Behavior and Diabetes Self-Management Education in Patients with Diabetes Mellitus Type 2. *Open Access Macedonian Journal of Medical Sciences*, *10*(E), 1648–1651. https://doi.org/10.3889/oamjms.2022.10879.

Van Smoorenburg, A. N., Hertroijs, D. F. L., Dekkers, T., Elissen, A. M. J., & Melles, M. (2019). Patients' perspective on self-management: type 2 diabetes in daily life. *BMC Health Services Research*, *19*(1), 1–8. https://doi.org/10.1186/s12913-019-4384-7.

Wada, E., Onoue, T., Kobayashi, T., Handa, T., Hayase, A., Ito, M., Furukawa, M., Okuji, T., Okada, N., & Iwama, S. (2020). Flash glucose monitoring helps achieve better glycemic control than conventional self-monitoring of blood glucose in non-insulin-treated type 2 diabetes: a randomized controlled trial. *BMJ Open Diabetes Research and Care*, *8*(1), e001115. https://doi.org/10.1136/bmjdrc-2019-001115.

Zheng, F., Liu, S., Liu, Y., & Deng, L. (2019). Effects of an outpatient diabetes self-management education on patients with type 2 diabetes in China: a randomized controlled trial. *Journal of Diabetes Research*, *2019*. https://doi.org/10.1155/2019/1073131.