

Relationship Between Self-Care Behavior and Diabetes Self-Management Education in Type 2 Diabetes Mellitus Patients

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ABSTRACT

Introduction: Type 2 Diabetes Mellitus is caused by disruption of insulin secretion and insulin resistance. One aspect that plays an important role in the management of this disease is diabetes self-management education. Good self-care behavior will make diabetes management controlled and prevent complications and make the quality of life better. **Objectives:** The purpose of this study is to determine the relationship between self-care behavior and knowledge, patient motivation, family support, and self-efficacy on diabetes self-management education for type 2 Diabetes mellitus patients. **Methods:** The method used in this study was a quantitative approach: cross-sectional. The sample used was 115 patients with type 2 Diabetes mellitus in Sidrap Regency. The analytical method used is the Structural Equation Model (SEM). **Result:** The findings of the study showed that self-care behavior in patients with diabetes mellitus type 2 was influenced by knowledge factors by 89%, motivation factors by 82.8%, family support by 84.9%, and self-efficacy factors by 78.4%. Meanwhile, diabetes management of type 2 Diabetes mellitus patients was influenced by treatment factors by 75.5%, blood sugar control factors by 88.1%, dietary factors by 60.9%, physical activity factors by 87.3%, and foot care factors by 53,8%. The structural model of this study explains the variable care cell behavior with self-care management of 47.5%, so it can be seen that self-care behavior has a significant effect on DMSE in type 2 Diabetes mellitus patients (p -value= 0.001). **Discussion:** Therefore, the management of Diabetes mellitus must be more active in providing education to sufferers so that their knowledge or family members can increase and understand how to carry out diabetic management properly.

Keywords: *diabetes mellitus type 2; diabetes self-management education; self-care behavior*

ABSTRAK

Pendahuluan: Diabetes melitus tipe 2 disebabkan oleh terganggunya sekresi insulin dan resistensi insulin. Salah satu aspek yang memegang peranan penting dalam penatalaksanaan penyakit ini adalah diabetes self-management education. Perilaku self care yang baik akan membuat manajemen diabetes terkontrol dan mencegah terjadinya komplikasi dan membuat kualitas hidup menjadi lebih baik. **Tujuan:** Tujuan penelitian ini untuk mengetahui pengaruh perilaku self care serta besaran pengaruh dari pengetahuan, motivasi pasien, dukungan keluarga, dan efikasi diri terhadap diabetes self-management education pasien Diabetes mellitus tipe 2. **Metode:** Metode yang digunakan dalam penelitian ini adalah pendekatan kuantitatif yang menggunakan metode cross sectional. Sampel yang digunakan

sebanyak 115 pasien Diabetes mellitus tipe 2 di Kabupaten Sidrap. Metode analisis yang digunakan adalah Structural Equation Model (SEM) menggunakan Amos 2.0 dan SPSS 20 (IBM Corp). **Hasil:** Temuan penelitian menunjukkan bahwa perilaku self care pasien Diabetes mellitus tipe 2 dipengaruhi oleh faktor pengetahuan sebesar 89%, faktor motivasi sebesar 82,8%, dukungan keluarga sebesar 84,9%, dan faktor efikasi diri sebesar 78,4%. Sedangkan manajemen diabetes pasien Diabetes mellitus tipe 2 dipengaruhi oleh faktor pengobatan sebesar 75,5%, faktor pengontrolan gula darah sebesar 88,1%, faktor diet sebesar 60,9%, faktor aktivitas fisik sebesar 87,3%, dan faktor perawatan kaki 53,8%. Model struktural penelitian ini menjelaskan variabel perilaku self care dengan manajemen perawatan diri sebesar 47,5%, sehingga dapat diketahui bahwa perilaku perawatan diri berpengaruh signifikan terhadap DMSE pada pasien diabetes melitus tipe 2 (p -value= 0.001). **Diskusi:** Oleh karena itu, pihak pengelola penyakit diabetes mellitus harus lebih aktif memberikan edukasi kepada para penderita sehingga pengetahuan mereka atau anggota keluarga lebih meningkat dan memahami cara melakukan manajemen diabetik dengan baik.

Kata kunci: diabetes mellitus tipe 2; diabetes self-management education; perilaku self care

INTRODUCTION

Diabetes Mellitus (DM) is one of the most common non-communicable diseases (Mosleh et al., 2017). DM is a metabolic disease that disrupts the insulin hormone, which functions to maintain the body's homeostasis by decreasing blood sugar levels (ADA, 2017; Salma et al., 2020). This disease can cause incomplete death as well as serious complications and disabilities (Shrivastva et al, 2020). In addition, this disease can increase blood sugar levels or hyperglycemia because the body lacks the hormone insulin (ADA, 2017). One of the most common types of DM disease in the world is DM type 2 (85-95%), a disease caused by disruption of insulin secretion and insulin resistance (Joyce & Jane, 2014).

DM of type 2 is a chronic disease and global health problem, affecting approximately 422 million people worldwide (Moura et al., 2019). The global diabetes prevalence in 2019 is estimated at 9.3% (463 million people), increasing to 10.2% (578 million) in 2030 and 10.9% (700 million) in 2045 (Saeedi et al., 2019). Global diabetes prevalence is around 5% for the 35-39 year age group, 10% for the 45-49 year age group, 15% for the 55-59 year age group, and close to 20% for the 65-69 year age group. Southeast Asian countries, such as Indonesia, Malaysia, Thailand, and Vietnam, have moved up the rankings in the last two decades. Due to its large population, China (88.5 million people with diabetes type 2), India (65.9 million), and the US (28.9 million) maintained the top position as the country with the

largest total number of individuals with this condition (Khan et al., 2020).

Based on the results of Basic Health Research (Riskesdas) in 2018, the prevalence of diabetes mellitus in Indonesia in 2013 was 6.9%, including TGT of 29.9% and GDP of 36.6%. In 2018, there was an increase of 10.9%, including TGT of 30.8% and GDP of 26.3%. The existence of diabetes mellitus based on age groups, namely, age 15-24 years (21.2%), age 25-34 years (27.2%), age 35-44 years (31.9%), and 45-54 years (32, 4%). South Sulawesi is one of the provinces in Indonesia with a prevalence of diabetes mellitus, reaching 1.2% in 2013 and an increase in 2018, reaching 1.8% (Kemenkes RI, 2018). The increasing number of Diabetes mellitus sufferers is evidence that Diabetes mellitus is a serious public health problem and needs to be a priority health problem in Indonesia.

The causes of Diabetes mellitus type 2 are unhealthy lifestyle, imbalance of dietary regulation, and lack of physical activity; this is influenced by self-care behavior (Widyoga, Saichudin, & Andiana, 2020). Factors that influence self-care behavior are factors from the patient himself, namely: knowledge, attitudes, motivation, family support, economy, and self-efficacy (Shrivastava et al., 2013). Other studies have stated that behavior greatly influences the self-care of DM patients (Karimi et al., 2017, Bintoro et al., 2019). Good self-care behavior has an essential role in diabetes management, especially in preventing diabetes complications

(ADA, 2017). This research is important because the main self-care behaviors that can prevent acute and chronic long-term complications related to diabetes include health eating, regular exercise, medication management, foot care, and adaptation to psychosocial challenges.

The application of self-management is one of the aspects that play an essential role in managing type 2 diabetes, including dietary regulation, physical activity/sports, monitoring blood sugar, compliance with medication consumption, and self/foot care (Hidayah, 2019). According to Kurniawan, Sari, and Aisyah (2020), out of 123 respondents, 62.6% had low self-management on blood sugar monitoring indicators. Meanwhile, a Chinese study showed a moderate category of self-management behavior in 50.4% of diabetes patients, and 33.6% had low self-management (Qi et al., 2021). Considering this, some patients do not still know about self-management in-depth and correctly. Various interventions to improve patients' self-management are carried out in the form of diabetes mellitus self-care and self-management education, but no optimal results have been obtained yet, and many people have not shown independence in managing their disease. The process of health education for individuals or families in managing Diabetes mellitus type 2 is provided by nurses to effectively improve clinical outcomes and quality of life for patients with the Diabetes Self-Management Education (DSME) method (McGowan, 2011). Another study states that DSME plays an important role in preventing the progression of neurovascular complications in DM patients with type 2, thereby helping to reduce the risk of diabetic foot injury (Indradewi et al., 2019). Therefore, the researcher wanted to know the effect of self-care behavior with diabetes self-management education in diabetes Mellitus patients type 2 in Sidrap District.

METHODS

Research Design

This type of research is an observational correlation with a cross-sectional approach,

conducted from March to May 2022 in Sidrap Regency. The variable used in this study was diabetes self-management education as the dependent variable, including diet regulation, physical activity/exercise, blood sugar monitoring, compliance with medication consumption, and self/foot care and the independent variable was self-care behavior, namely knowledge, motivation, family support, and self-efficacy.

Population and Sample

The sampling technique was determined using a consecutive sampling technique. The number of samples that were targeted in the research subjects, there were 115 who met the research criteria. The criteria for respondents who were used as subjects in this study were patients with type 2 diabetes Mellitus who underwent treatment and outpatients both in hospitals and in community health centers, able to communicate well, aged 35 to 60 years, and had blood glucose levels when they ranged from 71-380 mg/dL, and willing to be respondents. All participants agreed to the study protocol and provided written consent.

Instrument

This study focuses on knowing the correlation between self-care behavior and diabetes self-management education for DM patients with type 2 using a research instrument in the form of a questionnaire. This research questionnaire is divided into three parts, namely the first part is demographic data, the second part is the diabetic management questionnaire to measure self-management using the diabetes self-management questionnaire (DSMQ), including diet regulation, physical activity/exercise, blood sugar monitoring, compliance with medication consumption, and self/foot care (Schmitt et al., 2013) that has been tested for validity and reliability on the value of Alfa Cronbach's 0.805. The third part of the questionnaire about the self-care behavior of DM patients with type 2, namely knowledge, motivation, family support, and self-efficacy that, has been tested for validity and reliability on the value of Alfa Cronbach's 0.682.

Research Procedure

The research was conducted from 14 March 2022 to 20 May 2022, by distributing questionnaires to respondents with type 2 diabetes mellitus. All respondents who participated in this study were recruited from Empagae Health Center Sidenreng Rappang regency. Information directly from the respondent who agreed to participate filled the informed consent. Respondents were informed that the collected information would be kept confidential and that the questionnaire was anonymous. The researcher gave a sociodemographic questionnaire for attaining respondents' demographic data, a diabetic management questionnaire to measure self-management using the diabetes self-management questionnaire (DSMQ), and a questionnaire about the self-care behavior.

Data Analysis

The analysis test used is a linear regression test to determine the relationship between the variable self-care behavior and the diabetes self-management education variable for DM patients

with type 2 with a value and significance of <0.05, which is considered significant and looked at the structural model of research using the Structural Equation Model (SEM) with Amos 2.0 and SPSS 20 (IBM Corp).

Ethical Approval

This research has been approved by the Ethics Committee of STIKES Muhammadiyah Sidrap with Number 061/KEP/II.3.AU /F/2022 and takes into account the principles in the research process.

RESULTS

Table 1 shows that the majority of women who experience diabetes type 2 and more dominantly do not have complications such as hypertension and stroke. The average age of DM patients with type 2 is the pre-elderly age with an average length of suffering from diabetes with type 2 4 years 6 months. Meanwhile, the blood sugar value when they were still in the abnormal category with an average value of 253.8 mg/dL.

Table 1. Characteristics of Respondents (n=115)

Characteristics	Mean±SD	n (%)
Gender, n (%)		
Male	-	43 (37.4)
Female	-	72 (62.6)
Disease Complications, n (%)		
No complications	-	63 (54.8)
There are complications	-	52 (45.2)
Ages, Years (±Up to)	50.5±8.39	-
Long-suffering from DM, years (±Up to)	4.6±3.40	-
Blood sugar while, mg/dL (±Up to)	253.8±43.86	-

Table 2. Results of Data Test Analysis (Validity and Reliability) Variables of Self Care Behavior and DMSE (n=115).

Variable	Standardized Loading	CR.	p*	Description
Self-Care Behavior → Knowledge	0.042	12.723	0.0001	Valid and Reliable
Self-Care Behavior → Motivation	0.080	11.689	0.0001	Valid and Reliable
Self-Care Behavior → Family Support	0.079	12.644	0.0001	Valid and Reliable
Self-Care Behavior → Self Efficacy	0.039	13.613	0.0001	Valid and Reliable
DMSE → Treatment	0.398	4.555	0.0001	Valid and Reliable
DMSE → Blood sugar control	0.438	5.142	0.0001	Valid and Reliable
DMSE → Diet	0.275	4.004	0.0001	Valid and Reliable
DMSE → Physical activity	0.400	5.153	0.0001	Valid and Reliable
DMSE → Footcare	0.094	5.153	0.0001	Valid and Reliable

The data in Table 2 shows that all indicators, or in this case the factors that build the variable self-care behavior and DMSE, can be accepted or declared valid and reliable because the test results show that all p values on each indicator are below the value of 0.05 (≤ 0.05) and the CR value on each indicator that builds self-care behavior and DMSE is above 0.07 (≥ 0.07). Another provision that also states that the indicators forming the variable self-care behavior and DMSE are declared valid and reliable is that all the loading factor values (standardized loading) are above 0.03 (> 0.03). So that all indicators are accepted and declared capable of measuring the variable self-care behavior and DMSE so that they will be included in the next full model test.

Self-care behavior variables are formed by four factors, namely knowledge, motivation, family support, and self-efficacy. From the four factors of the self-care behavior variable, information was obtained that all factors had a significant relationship with the formation of the patient's self-care behavior variable, and it was known that the knowledge factor was the most related factor or played a role in the formation of the patient's self-care behavior variable with p-value (0.0001) and the estimated value of the effect

is 0.890. So real and strong knowledge plays a role in forming self-care behavior variables (table 3).

In table 4, it can be seen that self-care behavior has a significant effect on DMSE of type 2 Diabetes mellitus patients. To see the percentage of the effect is $R^2 = 0.475$, meaning that self-care behavior effect on DMSE by 47.5%, while the remaining 52.5% is the influence of other variables not studied. The overall model validation value can be seen from the goodness of fit value obtained by 0.569 (which tends to be moderate), so this value indicates a good fit between the model and the theory used, namely the theory of Orem.

The DMSE variable is formed by five factors: medication, blood sugar control, diet, physical activity, and foot care. From the five factors of the DMSE variable, information is obtained that all factors have a significant relationship with the formation of the patient's DMSE variable, and it is known that the blood sugar controlling factor is the most related factor or plays a role in the formation of the patient's DMSE variable with p-value (0.0001) and the estimated effect value is 0.981. So controlling blood sugar significantly and strongly plays a role in forming the DMSE variable.

Table 3. Test Results of Regression Weight (n=115)

Variable	Estimate	p*	Description
Self Care Behavior ← Knowledge	0.890	0.0001	Significant
Self Care Behavior ← Motivation	0.828	0.0001	Significant
Self Care Behavior ← Family Support	0.849	0.0001	Significant
Self Care Behavior ← Self Efficacy	0.784	0.0001	Significant
DMSE ← Treatment	0.755	0.0001	Significant
DMSE ← Blood sugar control	0.881	0.0001	Significant
DMSE ← Diet	0.609	0.0001	Significant
DMSE ← Physical activity	0.873	0.0001	Significant
DMSE ← Footcare	0.538	0.0001	Significant

Table 4: Test Results of Research Hypotheses (n=115)

Relationship Between Variables	Estimate	SE	R ²	t	p*
Self-Care Behavior → DMSE	0.569	0.196	0.475	2.900	0.0001

DISCUSSION

In this study, researchers have succeeded in developing components of self-care behavior for DM patients with type 2: knowledge, motivation,

family support, and self-efficacy for diabetes self-management education (DMSE). A DM patient has good self-care behavior if he has good knowledge about diabetes and its management, has a positive

attitude, gets positive support from family and people around him, has a strong motivation to recover, and has good self-efficacy. The results of this study have proven what components form self-care behavior and how strong the relationship is with DMSE. The implementation of self-care behavior towards DMSE can play an essential role in managing diabetes type 2, including dietary regulation, physical activity/sports, monitoring blood sugar, compliance with medication consumption, and self/foot care (Hidayah, 2019).

Improving self-care behaviors is the first step in helping patients better control their disease. It highlights the importance of understanding the factors that influence self-care behavior in diabetic patients and requires the design and strengthening of interventions related to self-care behaviors. Also, it helps caregivers to treat illnesses better and reduce complications. According to the American Association of Diabetes (ADA), people with diabetes need to adopt self-care behaviors to improve their quality of life because it is an indicator of diabetes control outcomes while reducing complications related to their disease (Hsu, Lee and Wang, 2018).

According to behavioral theory, self-care behavior in diabetes is an evolutionary process of developing knowledge or awareness by studying survival with the natural complexities of diabetes in a social context. The theory of self-care behavior makes patients have to change their lifestyle to a healthier lifestyle, including diet, physical activity, blood glucose monitoring, and medication adherence with the help and close monitoring of nurses so that it can be carried out properly (Oluma *et al.*, 2020). Patients with diabetes mellitus who carry out self-care continuously will shape their way of life in preventing, recognizing, and managing their disease so that with the hope that good and sustainable self-care behavior will have a positive impact, namely improving one's welfare. The degree of well-being is due to taking the right treatment according to their condition (Noviyanti, Suryanto and Rahman, 2021). Therefore, good self-care behavior can contribute to patients in managing diabetes, especially in preventing

diabetes complications through diabetes self-management education.

Previous research stated that social support with patient self-care behavior showed a significant relationship so that diabetes self-management education would be more effective for DM patients with type 2 (Mohebi *et al.*, 2018). One behavioral intervention that can be applied to DM patients is the Diabetes Self Management Education (DSME) program (Mikhael *et al.*, 2020). DSME is an ongoing process to facilitate DM patients' knowledge, skills, and ability to carry out self-care (Hailu *et al.*, 2019). Other studies have shown that DMSE affects knowledge and self-care behavior.

The educational process seems to play a decisive role in patients' self-care capability due to its effects on their knowledge level and attitude. Self-care for diabetes is one of the critical problems in controlling it, and self-care educational programs can positively affect patients' ability to control diabetes. Educating people with diabetes is as important and valuable as medications, exercise, and diet because treatment will be effective when the patient knows the nature of his or her illness well and takes positive steps to cope with it. If we consider diet, exercise, and medicines to be the three main pillars of diabetes, its fourth pillar will certainly be education. The variable of self-care behavior in this study was formed by 4 factors, namely knowledge, motivation, family support, and self-efficacy. From the 4 factors of the self-care behavior variable, information was obtained that all factors had a significant relationship with the formation of the patient's self-care behavior variable, and it was known that the knowledge factor was the most related factor or played a role in the formation of the patient's self-care behavior variable with a p-value (0.001) and the estimated value of the effect is 0.890. So, real and strong knowledge plays a role in shaping self-care behavior variables.

CONCLUSION

This study proves that diabetes self-management education is influenced by the self-

care behavior of DM patients with type 2. The structural model produced in this study can explain more than half of the self-care behavior variables compared to other variables not studied. The knowledge factor is the most related factor or plays a role in forming self-care behavior variables for DM patients with type 2. This means that the greater the patient's knowledge, the better the self-care behavior and self-care management for type 2 DM patients will be. Therefore, the management of Diabetes mellitus must be more active in providing education to sufferers so that their knowledge or family members can increase and understand how to do diabetes management properly.

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REFERENCES

- American Diabetes Association. (2017). Classification and diagnosis of diabetes. *Diabetes Care*, 40 (1), 11–24. <https://doi.org/10.2337/dc17-S005>.
- Bintoro, T., Putra, M. M., Made, N., & Yunica, D. (2019). Illness Perception, Motivation, And Self-Care Behavior In Diabetic Patients. In *The 5th International Conference on Public Health*. Solo, Indonesia: ICPH., February 13-14, 2019, 236-244 <https://doi.org/doi.org/10.26911/theicph.2019.02.46>.
- 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*, 12(4), 2489–2499. <https://doi.org/10.2147/DMSO.S223123>.
- Hidayah, M. (2019). The Relationship between Self-Management Behaviour and Blood Glucose Level in Diabetes mellitus Type 2 Patient in Pucang Sewu Health Center, Surabaya. *Amerta Nutrition*, 3(3), 176–182. <https://doi.org/10.2473/amnt.v3i3.2019.176-182>.
- Hsu, H. C., Lee, Y. J. and Wang, R. H. (2018). Influencing Pathways to Quality of Life and HbA1c in Patients With Diabetes: A Longitudinal Study That Inform Evidence-Based Practice. *Worldviews on Evidence-Based Nursing*, 15(2), 104–112. doi: 10.1111/wvn.12275.
- Inradewi, D. P., Prihandhani, A. S., & Ngurah, A. K. (2019). Hubungan manajemen diabetes dengan kejadian luka kaki pada pasien diabetes melitus tipe 2. *Journal Community of Publishing in Nursing*, 8(1), 73–78. Retrieved from <https://ojs.unud.ac.id/index.php/coping/article/view/59604/34611>.
- Joyce, B., & Jane, H. (2014). *Keperawatan Medikal Bedah: Manajemen Klinis untuk Hasil yang Diharapkan* (8th ed.). Singapore: Elsevier (Singapore) Pte Ltd.
- Karimi, F., Abedini, S., & Mohseni, S. (2017). Self-care behavior of type 2 Diabetes mellitus patients in Bandar Abbas in 2015. *Electronic Physician*, 9(11), 5863–5867. <https://doi.org/10.19082/5863>
- Kemenkes. RI. (2018). *Hasil Utama Riset Kesehatan Dasar Tahun 2018*. Jakarta: Badan Penelitian dan Pengembangan Kesehatan.
- Khan, M. A. B., Hashim, M. J., King, J. K., Govender, R. D., Mustafa, H., & Al Kaabi, J. (2020). Epidemiology of Type 2 Diabetes - Global Burden of Disease and Forecasted Trends. *Journal of Epidemiology and Global Health*, 10(1), 107–111. <https://doi.org/10.2991/jegh.k.191028.001>.
- McGowan, P. (2011). The efficacy of diabetes patient education and self-management education in type 2 diabetes. *Canadian Journal of Diabetes*, 35(1), 46–53. [https://doi.org/10.1016/S1499-2671\(11\)51008-1](https://doi.org/10.1016/S1499-2671(11)51008-1).
- Mikhael, E. M., Hassali, M. A. and Hussain, S. A. (2020). Effectiveness of diabetes self-management educational programs for type

- 2 Diabetes mellitus patients in middle east countries: A systematic review. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy*, 13(3), 117–138. doi: 10.2147/DMSO.S232958.
- Mohebi, S., Parham, M., Sharifirad, G., & Gharlipour, Z. (2018). Relationship between perceived social support and self-care behavior in type 2 diabetics: A cross-sectional study. *Journal of Education and Health Promotion*, 7(48), 1–6. <https://doi.org/10.4103/jehp.jehp>.
- Mosleh, R. S. A., Jarrar, Y. B., Zyoud, S., & Morisky, D. E. (2017). Factors related to diabetes self-care management behaviors among patients with type II diabetes in Palestine. *Journal of Applied Pharmaceutical Science*, 7(12), 102–109. <https://doi.org/10.7324/JAPS.2017.71214>.
- Moura, N. D. S., Lopes, B. B., Teixeira, J. J. D., Oria, M. O. B., Vieira, N. F. C., & Guedes, M. V. C. (2019). Literacy in health and self-care in people with type 2 diabetes mellitus. *Revista Brasileira de Enfermagem*, 72(3), 700–706. <https://doi.org/10.1590/0034-7167-2018-0291>
- Noviyanti, L. W., Suryanto, S. and Rahman, R. T. (2021). Peningkatan Perilaku Perawatan Diri Pasien melalui Diabetes Self Management Education and Support. *Media Karya Kesehatan*, 4(1), 67–77. Available at: <https://journal.unpad.ac.id/mkk/article/view/30747>.
- Oluma, A. *et al.* (2020). Predictors of adherence to self-care behavior among patients with diabetes at public hospitals in West Ethiopia. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy*, 13(1), 3277–3288. doi: 10.2147/DMSO.S266589.
- Saeedi, P., Petersohn, I., Salpea, P., Malanda, B., Karuranga, S., Unwin, N., Williams, R. (2019). Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas, 9th edition. *Diabetes Research and Clinical Practice*, 157, 107843. <https://doi.org/10.1016/j.diabres.2019.107843>.
- Salma, N., Fadli, F., & Fattah, A. H. (2020). Hubungan Kepatuhan Diet dengan Kadar Gula Darah Puasa pada Pasien Diabetes mellitus Tipe 2. *Jurnal Media Keperawatan*, 11(1), 102–107. <https://doi.org/10.32382/jmk.v11i1.1512>.
- Schmitt, A., Gahr, A., Hermanns, N., Kulzer, B., Huber, J., & Haak, T. (2013). The Diabetes Self-Management Questionnaire (DSMQ): development and evaluation of an instrument to assess diabetes self-care activities associated with glycaemic control. *Journal Health and Quality of Life Outcomes*, 11(138), 1–14. <https://doi.org/10.1186/1477-7525-11-138>.
- Shrivastava, S. R. B. L., Shrivastava, P. S., & Ramasamy, J. (2013). Role of self-care in management of diabetes mellitus. *Journal of Diabetes and Metabolic Disorders*, 12(14), 1–5. <https://doi.org/10.1186/2251-6581-12-14>.
- Shrivastva, A., Phadnis, S., Rao N, K., & Gore, M. (2020). A study on knowledge and self-care practices about Diabetes mellitus among patients with type 2 Diabetes mellitus attending selected tertiary healthcare facilities in coastal Karnataka. *Clinical Epidemiology and Global Health*, 8(3), 689–692. <https://doi.org/10.1016/j.cegh.2020.01.003>.
- Widyoga, R. C., Saichudin, & Andiana, O. (2020). Hubungan Tingkat Pengetahuan tentang Penyakit Diabetes Melitus pada Penderita terhadap Pengaturan Pola Makan dan Physical Activity. *Journal Sport Science and Health*, 2(2), 152–161. Retrieved from <http://journal2.um.ac.id/index.php/jfik/article/view/11393>.