APPLICATION OF DIABETES SELF-MANAGEMENT EDUCATION AND SUPPORT TO NUTRITIONAL STATUS, EATING HABITS AND GLYCEMIC CONTROL IN OUTPATIENTS WITH TYPE II DIABETES MELLITUS

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ABSTRACT

Education through self-management and support plays an important role in providing knowledge and instilling an awareness of the importance of healthy living. The purpose of this study was to determine the effect of Diabetes Self-Management Education and Support on eating habits, body weight, nutritional status, and glycemic control. The design of this study was quasi-experimental with the experimental design of the pre test post test without a control group. The number of samples was 60 patients who were taken by purposive sampling with predefined inclusion and exclusion criteria. Interventions were conducted 2 times a month for 6 months. From this study, it is known that for 6 months there was an increase in the consumption of vegetables, fruit, and milk (p<0,05), a significant decrease in the consumption of tubers and starches (p <0.05), while the consumption of rice and side dishes did not experience a significant change (p> 0, 05). Besides, there was a significant decrease in glycemic control (p <0.05) but there was no significant reduction in body weight and nutritional status (p> 0.05). The application of Diabetes Self-Management Education and Support for 6 months can influence glycemic control and change eating habits.

Keywords: eating habits, education, glycemic control, support, type II diabetes mellitus

INTRODUCTION

Diabetes Mellitus is a chronic disease whose prevalence continues to increase. Based on data from the International Diabetes Federation, in 2019 around 463 million adults (20–79 years) were diagnosed with diabetes and it is estimated that this will increase to 700 million by 2045 (International Diabetes Federation, 2019). The results of Basic Health Research (Riskesdas) in Indonesia reported that there was a significant increase in the prevalence of diabetes, from 6.9% in 2013 to 8.5% in 2018 (Riskesdas, 2018). Currently, Indonesia is in the sixth category with the highest number of people with diabetes aged 20–79 years in the world after China, India, the United States, Brazil, and Mexico (Kemenkes RI, 2018).

From 4 pillar form diabetes management, dietitian focus to pillar education and medical nutrition therapy (PERKENI, 2019). In general, the goal of managing medical nutritional therapy in diabetes mellitus patients is to promote and support a healthy diet so that they can achieve and maintain a normal weight, glycemic control, blood pressure, and normal blood lipids. Finally, the goal of medical nutritional therapy is to prevent macro vascular and microvascular comorbidities (Evert et al., 2019). Diabetes mellitus is a chronic disease that cannot be cured but can be controlled by increasing knowledge and self-control management (PERKENI, 2019).

The success of achieving a good outcome depends on the decisions made by the patient himself. The main objectives of self-management in type 2 diabetes mellitus patients are to facilitate the acquisition of knowledge and skills to modify diet and to support informed decision-making and self-care to improve clinical outcomes, health status, and quality of life (Burke et al., 2014). Therefore nutrition education that is centered on the needs of the patient is needed. Several studies have reported that comprehensive education can help patients understand themselves so that they can control sugar levels which is the main goal of intervention in type 2 diabetes mellitus patients (Kosti & Kanakari, 2012). Comprehensive

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education is education that does not only refer to increasing knowledge, but also increasing skills, abilities, and motivation for self-management. The educational interventions that are most frequently provided are nutritional counseling, promotion of physical activity, education on foot care, control of hypoglycemia and hyperglycemia, and medication (Agrimon & Street, 2016).

Some of the educational methods for diabetic patients that show the most results are counseling based on self-regulating psychological principles, which means that the goals and behavioral change actions are determined by the patient, the counselor only strengthens and accompanies. Therefore, education in diabetes mellitus patients cannot be done in a short time but must be studied in depth so that it can be seen which behavior needs modification so that the effect is real and can increase patient motivation to continue trying new behavior (Mulder et al., 2015). Counselors who work to help diabetes patients should be trained counselors so that they have knowledge and skills about handling diabetes patients from the aspects of medical, nutrition, medicine, and pedagogy, as well as communication so that it makes it easier for patients to manage themselves to overcome their problems. The role of this educator is to contribute to providing education individually and to drive behavior changes including eating behavior (Gvozdanović et al., 2019). Therefore, diabetes education with support in the form of assistance has been agreed to accelerate behavior change (Davies et al., 2018).

Research by Ahmazadeh et al. (2019) proves that intervention with BASNEF-Based Nutrition Education for 3 months can control eating habits. The composition of food intake as recommended, especially the adequate intake of vegetables (Dias & Imai, 2017), fruit, and milk (Eussen et al., 2016) can help control glycemic control (Wang et al., 2016). Besides, vegetables and fruits contain many antioxidants that can fight oxidative oxidation which affects the development of type 2 diabetes mellitus (Carter et al., 2013). Zareban et al., (2014) research showed that a 3-month self-care education program can significantly change the value of HbA1C (Zareban et al., 2014). Research conducted by Gvozdanovic et al. (2019) reports that education has the effect of increasing adherence to a diabetes diet and controlling blood sugar levels after one month of education with assistance. However, after 2 years, the patient returned to non-adherence and it turned out that the sugar levels were out of control again. Interventions in diabetic patients will be considered successful if they can change their eating habits and control HbA1C, to prevent complications from occurring. HbA1C is an indicator that describes the average blood glycemic rate for 3 months. So it is quite effective in evaluating diabetes interventions (American Diabetes Association, 2018).

Judging from these various backgrounds, the researchers wanted to know whether Diabetes Self-Management Education and Support during 6 months for diabetes sufferers could improve nutritional status, dietary habits, especially the fulfillment of carbohydrate, fat, protein, and fiber intake. and how is the effect on controlling blood sugar levels, both blood sugar levels at any time, 2 hours postprandial or HbA1C.

METHODS

The design of this research was Quasi-Experimental and the experimental design used was The Pretest-Post-test design without a control group. This data was taken from a study entitled "Macro Nutrient Intake, HbA1C Value and Blood Lipid Profiles in Outpatients with Type II Diabetes Mellitus Receiving Assistance for 6 months at RSUPN Dr. Cipto Mangunkusumo in 2017". The intervention in this study was self-management education and support. The intervention was given twice for 6 months, once in a month. The education provided consists of 12 topics, namely related to understanding and management during diabetes, medication, self-management, hypoglycemia, nutritional therapy, physical activity, complications of the disease, diabetic foot, handling when sick, diabetes mellitus during special conditions (travel, fasting, and diabetes). One educational topic is given for 30 minutes. Education Meanwhile, support is provided on 6 topics related to motivation and readiness for behavior change. Each 1 theme consists of 2 sessions for 45–60 minutes. Education and support are delivered by related health workers such as doctors, nurses, dietitians, and pharmacists specifically for diabetes.

A sample of 60 people were taken by purposive sampling with inclusion and exclusion criteria determined by the researcher. The inclusion criteria were having complete data in previous studies, HbA1C levels > 7.5%, and age 30–60 years. While the exclusion criteria were having comorbidities that affected memory, don't have a complete food record file, and incomplete blood biochemical data.

Anthropometric data on body weight and height have been carried out by previous researchers. Collecting weight data using digital scales and height data using a stadiometer. BMI is calculated as weight in kilograms divided by the square of the height in meters (kg/m^2) and is categorized into four groups according to the Asian-Pacific cut off points: 25 underweight (<18.5 kg/m^2), normal weight (18.5–22.9 kg/m^2), overweight (23–24.9 kg/m^2), and obese (≥25 kg/m^2).

Data on the frequency of consumption of foodstuffs were obtained through a 3×24 hours food record form. To obtain data on the frequency of foodstuffs, a food tally was carried out based on the data in the food record. Previously, when filling out the food record form, respondents had been given training on how to fill it out. Then the food record data is revalidated by dietitians through a 3×24 hours food recall. The nurses were collecting data on weight and height. Blood biochemical data collection, namely fasting blood glucose, blood glucose 2 hours postprandial, and HbA1C were carried out by a medical analyst. Intake data, body weight, and blood biochemistry were collected 3 times, namely before the intervention, three months after the intervention, and six months after the intervention. Method section driven from previous articles is allowed. The research period should be verified.

The data analysis used was Kolmogorov-Smirnov to find out which data was obtained either parametric or non-parametric. Data analysis using SPSS 17, to determine the changes that occur during the intervention used the paired-sample t-test if the data obtained is parametric and uses the Wilcoxon test if it can be obtained non-parametric. This research has passed the ethical review of FKUI-RSCM with number KET.1020/ UN2.F1 / ETIK / PPM.00.02 / 2019.

Table 1. Characteristics of Respondent (n=60)

Characteristics	n	%
Gender		
Men	20	33.3
Women	40	66.7
Aged Group		
30–35 years	2	3.3
36–45 years	4	6.7
46–55 years	20	43.3
56–65 years	34	46.7
Profession		
Work	20	33.3
Housewife	40	66.7
Nutritional Status		
Underweight	2	3.3
Normal Weight	16	26.7
Overweight	10	16.7
Obesity	32	53.3

RESULTS AND DISCUSSIONS

Respondent Characteristics

Table 1 shows that most of the respondents were female (66.7%) with the largest ages ranging from 56–65 years (46.7%). Most of the respondents did not work or work as housewives (66.7%). Based on the nutritional status with the calculation of BMI according to the Asia Pacific classification, it appears that most of the respondents fall into the obesity category (53.3%), followed by good nutrition (26.7%), overweight (16.7%) and the lowest is malnutrition (3.3%).

Bodyweight and Nutritional Status during the Diabetes Self-Management Education and Support Application

Table 2 shows that there was a decrease in body weight and nutritional status during education and mentoring for 3 months and 6 months but it was not statistically significant (P> 0.05). The table shows that the average body weight of the respondents at 3 months was 69.01 ± 15.579 kg. likewise in the second 3 months the average body weight of the respondents was 68.811 ± 0.284 kg and after 6 months of education and assistance obtained an average body weight was 68.471 ± 0.600 kg.

The relationship with nutritional status as shown in table 2 shows that in the first 3 months

Table 2. Body weight and Nutritional Status during the Diabetes Self-Management Education and Support application

Variabel	Mean ± SD	p-value
Weight (kg)		
1–3 Months	69.071 ± 15.579	0.426
3–6 Months	68.811 ± 14.284	0.417
1–6 Months	68.471 ± 13.615	0.251
BMI		
1–3 Months	28.0236 ± 5.862	0.44
3–6 Months	27.923 ± 5.333	0.459
1–6 Months	27.800 ± 5.142	0.283

*) Statistical test paired sample t test, significant p <0.05

the average BMI of respondents was 28.0236 ± 5.862 kg / cm2. In the second 3 months the average BMI of the respondents was 27.923 ± 5.333 and after education and mentoring for 6 months the average BMI of the respondents was 27.800 ± 5.142.

The results of this study revealed 53.3% of the participation of type II diabetes mellitus patients in RSCM had obese nutritional status. This prevalence is still lower when compared to the results of Fajarini's (2019) study which revealed that there were 63.9% of Prolanis type II diabetes mellitus patients at the Jatinegara Health Center, East Jakarta (Fajarini & Sartika. 2019). Even in the world, more than 90% of diabetic patients have obese nutritional status (Bramante et al., 2017). The most common co-diabetes disease is obesity (Garvey et al., 2016). So it needs extra handling so that there is no increase in the risk of other comorbidities such as cardiovascular disease, hypertension, and kidney disease (American Diabetes Association, 2018).

Glycemic Control during the Diabetes Self-Management Education and Support Application

In table 3, it appears that education and mentoring of 60 type II diabetes mellitus patients for 6 months has a real effect on reducing blood sugar levels but has not been able to normalize blood sugar levels both fasting blood sugar, blood sugar 2 hours postprandial, and HBA1C values. The average fasting blood sugar levels up to 6 months of intervention were 156.415±55.657 mg/dL, blood sugar 2 hours postprandial was

Tabel 3. Glycemic control during the Diabetes Self-Management Education and Support application

Variabel	Mean ± SD	p-value
Fasting Blood Glucose		
1–3 Months	183.735 ± 67.563	0.190
3–6 Months	158.452 ± 72.292	0.856
1–6 Months	156.415 ± 55.657	0.031*
Glucose 2 Hours PP		
1–3 Months	242.717 ± 91.459	0.102
3–6 Months	218.603 ± 101.870	0.138
1–6 Months	192.717 ± 103.962	0.008*
HbA1C		
1–3 Months	9.379 ± 1.638	0.000*
3–6 Months	7.969 ± 1.638	0.045*
1–6 Months	8.362 ± 1.960	0.000*

*) Statistical test paired sample t test. significant p <0.05

192.717±103.962 mg/dL, and HbA1C was 8.362±1.960 mg/dL.

After the intervention in 60 participating type II diabetes mellitus patients, it is known that education and mentoring carried out for 6 months in the hospital can improve blood glucose in the body. Three parameters of blood glucose dropped significantly (p <0.05) after 6 months of education and assistance, namely fasting blood glucose (p = 0.031), blood glucose 2 hours postprandial (p = 0.008) and HbA1C (p = 0.000). However. the education and assistance carried out could not affect the body weight and nutritional status of the participating type II diabetes mellitus patients (p> 0.05).

Diabetes is a chronic disease that cannot be cured but can be controlled by increasing knowledge and self-control management (PERKENI, 2019). In this study, knowledge, and self-control were enhanced through education and mentoring. Education is one of the 4 pillars of diabetes management which functions to increase patient knowledge so that patients can carry out monitoring of their health at home. To strengthen the results of this education, assistance is provided. Mentoring is a self-empowerment that aims to build self-confidence, reduce stress, and encourage oneself to make changes (Gardiarini et al., 2017). So that the changes that occur are the patient's own decisions and awareness without coercion from others. Several studies have proven that mentoring

can improve the glycemic load of diabetes patients. Diana's research (2015) proves that mentoring given to type 2 diabetes mellitus patients can change habits and can significantly reduce HbA1C levels (Gardiarini et al., 2017). Marizeh (2015) revealed that the assistance provided by health workers is effective in improving the quality of life of elderly women (Jahromi et al., 2015).

This study revealed that the combination of education and mentoring that was carried out twice a month for 6 months could significantly reduce blood glucose levels, both fasting blood glucose. GD2PP and HbA1C, but had not been able to control body weight and nutritional status. The 6 months of mentoring time is still considered insufficient, even though the results of glycemic control have decreased significantly, but the values of each glycemic control are still above normal. Zhang and Chu's (2018) research results also state that the results of systematic education consist of nine components namely giving color booklets, motivational videos, eating plate rules, group chat, proper medication rules, doctor visits, lifestyle intervention and education and 2 years of self-control management decreased 0.67% HbA1C but did not significantly reduce the patient's BMI (Zhang & Chu, 2018). Research by Ahmazadeh et al. (2019) proved that intervention with BASNEF-Based Nutrition Education for 3 months was able to control blood glucose levels and was able to increase the intake of vegetables, fruit, and milk (Ahmadzadeh et al., 2019).

Eating Habits during the Diabetes Self-Management Education and Support Application

From Table 4, the description of the frequency of food consumption above, it is known that most patients still consume rice with an average frequency of up to 6 months of intervention, namely 2.57 ± 0.586 times a day. Not only rice consumption, but the patients also consumed several types of staple foods such as noodles (0.10 ± 0.305 times), tubers (0.10 ± 0.305 times), and bread and flour (0.17 ± 0.379 times).

Based on the results of the paired sample t-test, it was found that there was no significant change in rice consumption during the 6 months of the intervention. However, there was a significant

Table 4. Eating Habits during the Diabetes Self-Management Education and Support Application

Variable	Mean ± SD	p-value
Rice		
1–3 Months	2.33 ± 0.661	1.000
3–6 Months	2.33 ± 0.711	0.129
1–6 Months	2.57 ± 0.568	0.147
Noodle		
1–3 Months	0.17 ± 0.461	0.573
3–6 Months	0.10 ± 0.403	1.000
1–6 Months	0.10 ± 0.305	0.536
Tubers		
1–3 Months	0.37 ± 0.615	0.255
3–6 Months	0.23 ± 0.504	0.211
1–6 Months	0.10 ± 0.305	0.030*
Bread and Flour		
1–3 Months	0.53 ± 0.860	0.630
3–6 Months	0.43 ± 0.774	0.043*
1–6 Months	0.17 ± 0.379	0.019*
Chicken		
1–3 Months	0.60 ± 0.724	0.610
3–6 Months	0.50 ± 0.682	1.000
1–6 Months	0.50 ± 0.777	0.669
Fish		
1–3 Months	0.77 ± 0.774	0.526
3–6 Months	0.63 ± 0.809	0.326
1–6 Months	0.80 ± 0.761	0.851
Eggs		
1–3 Months	0.53 ± 0.776	0.264
3–6 Months	0.73 ± 0.907	0.639
1–6 Months	0.63 ± 0.850	0.541
Tofu		
1–3 Months	0.60 ± 0.675	0.344
3–6 Months	0.43 ± 0.568	1.000
1–6 Months	0.43 ± 0.626	0.305
Tempeh		
1–3 Months	0.77 ± 0.817	0.555
3–6 Months	0.63 ± 0.928	0.310
1–6 Months	0.90 ± 0.885	0.573
Vegetables		
1–3 Months	1.17 ± 0.699	0.031*
3–6 Months	1.57 ± 0.858	0.002*
1–6 Months	2.13 ± 0.681	0.000*
Fruits		
1–3 Months	0.90± 0.885	0.662
3–6 Months	1.00 ± 0.947	0.004*
1–6 Months	1.63 ± 1.066	0.000*
Milk		
1–3 Months	0.10 ±0.305	0.255
3–6 Months	0.23 ± 0.504	0.231
1–6 Months	0.40 ± 0.563	0.010*

decrease ($p < 0.05$) in the consumption of tubers ($p = 0.030$), bread and flour ($p = 0.019$).

From Table 4 it is known that the consumption of protein intake is very diverse namely, there are chickens with an average consumption of 0.50 ± 0.777 times during the intervention. Fish 0.80 ± 0 .761 times. eggs 0.63 ± 0.850 times, tofu 0.43 ± 0.626 times, and tempeh 0.90 ± 0.885 times. In general, the protein food group experienced an increase during the 6 months of the intervention, but the increase in consumption was not significant ($p > 0.05$).

From table 4 it can be seen that the average frequency of vegetable consumption during the 6 months of the intervention was 2.13 ± 0.681 time, the fruit was 1.63 ± 1.0667 and milk was 0.40 ± 0.563. Vegetable consumption increased significantly ($p < 0.05$) each month during the intervention. Followed by fruit and milk consumption, there was a significant increase in the third and sixth months ($p < 0.05$).

This study also proved that education in type 2 diabetes mellitus patients was able to control the consumption of staple foods such as flour, bread, and tubers and was able to increase consumption of vegetables, fruit, and milk. The increased consumption of vegetables, fruit, and milk are very beneficial for type II diabetes mellitus patients in controlling glycemic control. The fiber content that can be obtained from vegetables and fruit is known to reduce the death rate of people with diabetes. Several studies stated that consumption of fiber 50 grams/ day can reduce HbA1C 0.2–0.3%. However, it has not been determined that the reduction in HbA1C is solely from fiber (Evert et al., 2013).

CONCLUSION

The intervention given in the form of education and mentoring for 6 months was able to significantly reduce glycemic control, both fasting blood glucose, 2 hours postprandial glucose, and HbA1C. As well as being able to change eating habits, namely by increasing the consumption of vegetables, fruit and milk significantly and reducing the consumption of tubers, flour and bread. However, these interventions have not been able to reduce the patient's body weight and body mass index. Therefore, researchers suggest adding physical activity interventions as one of the pillars of diabetes control in an effort to reduce patient weight and control glycemic control to normal.

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REFERENCE

Ahmadzadeh, N., Shojaeizadeh, D., Sum, S., & Hajian, K. (2019). Effect of BASNEF - based education on nutritional behaviors among elderly people and Mini Nutritional Assesment on nutritional status ini eldery with T2DM. *Journal Education Health Promotion*, *8*(94). Retrieved from https://pubmed.ncbi.nlm.nih.gov/31143811/

American Diabetes Association. (2018). Glycemic Targets: Standards of Medical Care in Diabetes 2018. *Diabetes Care 2018*, *41*(1), S55–S64. Retrieved from https://care.diabetesjournals.org/content/41/Supplement_1/S55

Bramante, C. T., Lee, C. J., & Gudzune, K. A. (2017). Treatment of Obesity in Patients With Diabetes. *Diabetes Spectrum*, *30*(4), 237–243. https://doi.org/10.2337/ds17-0030 Retrieved from https://spectrum.diabetesjournals.org/content/30/4/237

Burke, S. D., Sherr, D., & Lipman, R. D. (2014). Partnering with diabetes educators to improve patient outcomes. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy*, *7*, 45–53. Retrieved from https://www.dovepress.com/partnering-with-diabetes-educators-to-improve-patient-outcomes-peer-reviewed-article-DMSO

Carter, P., Gray, L. J., Talbot, D., Morris, D. H., Khunti, K., & Davies, M. J. (2013). Fruit and vegetable intake and the association with glucose parameters: A cross-sectional analysis of the Let's Prevent Diabetes Study. *European Journal of Clinical Nutrition*, *67*(1), 12–17. Retrieved from https://www.nature.com/articles/ejcn2012174

Davies, M. J., Alessio, D. A. D., Fradkin, J., Kernan, W. N., Mathieu, C., & Mingrone, G. (2018). Management of Hyperglycemia in Type 2 Diabetes, 2018. A Consensus Report by the American Diabetes Association

(ADA) and theEuropeanAssociation for the Study of Diabetes (EASD). *Diabetes Care*, *2012*(4), 1–33. Retrieved from https://care.diabetesjournals.org/content/41/12/2669

Dias, J., & Imai, S. (2017). Vegetables Consumption and its Benefits on Diabetes. *Journal of Nutritional Therapeutics*, *6*(1), 1–10. Retrieved from https://www.lifescienceglobal.com/journals/journal-of-nutritional-therapeutics/volume-6-number-1/87-abstract/jnt/1134-abstract-vegetables-consumption-and-its-benefits-on-diabetes

Eussen, S. J. P. M., Van Dongen, M. C. J. M., Wijckmans, N., Den Biggelaar, L., Oude Elferink, S. J. W. H., Singh-Povel, C. M., … Dagnelie, P. C. (2016). Consumption of dairy foods in relation to impaired glucose metabolism and type 2 diabetes mellitus: The Maastricht Study. *British Journal of Nutrition*, *115*(8), 1453–1461. Retrieved from https://www.cambridge.org/core/journals/british-journal-of-nutrition/article/consumption-of-dairy-foods-in-relation-to-impaired-glucose-metabolism-and-type-2-diabetes-mellitus-the-maastricht-study/FCB37A7652AFF33A8BD97E595BAB82A4

Evert, A. B., Boucher, J. L., Cypress, M., Dunbar, S. A., Franz, M. J., Mayer-Davis, E. J., Neumiller, J. J., Nwankwo, R., Verdi, C. L., Urbanski, P., & Yancy, W. S. (2013). Nutrition therapy recommendations for the management of adults with diabetes. *Diabetes Care*, *36*(11), 3821–3842. Retrieved from https://care.diabetesjournals.org/content/36/11/3821

Evert, A. B., Dennison, M., Gardner, C. D., Timothy Garvey, W., Karen Lau, K. H., MacLeod, J., Mitri, J., Pereira, R. F., Rawlings, K., Robinson, S., Saslow, L., Uelmen, S., Urbanski, P. B., & Yancy, W. S. (2019). Nutrition therapy for adults with diabetes or prediabetes: A consensus report. *Diabetes Care*, *42*(5), 731–754. 4 Retrieved from https://care.diabetesjournals.org/content/42/5/731

Fajarini, I. A., & Sartika, R. A. D. (2019). Obesity as a common type-2 diabetes comorbidity: Eating behaviors and other determinants in Jakarta, Indonesia. *Kesmas*, *13*(4), 157–163. Retrieved from https://journal.fkm.ui.ac.id/kesmas/article/view/2483

Gardiarini, P., Sudargo, T., & Pramantara, I. D. P. (2017). Kualitas Diet, Sosio-Demografi, dan Dukungan Keluarga Hubungannya dengan Pengendalian Gula Darah pada Penderita Diabetes Mellitus Tipe 2 di Rumah Sakit Kanujoso Sjatiwibowo (RSKD), Balikpapan. *Journal of the Indonesia Nutrion Association*, *40*(2), 89–100. Retrieved from https://persagi.org/ejournal/index.php/Gizi_Indon/article/view/237

Garvey, W. T., Mechanick, J. I., Brett, E. M., Garber, A. J., Hurley, D. L., Jastreboff, A. M., Nadolsky, K., Pessah-Pollack, R., & Plodkowski, R. (2016). American association of clinical endocrinologists and American college of endocrinology comprehensive clinical practice guidelines for medical care of patients with obesity. *Endocrine Practice*, *22*(July), 1–203. Retrieved from https://www.endocrinepractice.org/article/S1530-891X(20)44630-0/fulltext

Gvozdanović, Z., Farčić, N., Placento, H., Lovrić, R., Dujmić, Ž., Jurić, A., Miškić, B., & Prlić, N. (2019). Diet education as a success factor of glycemia regulation in diabetes patients: A prospective study. *International Journal of Environmental Research and Public Health*, *16*(20), 1–10. Retrieved from https://www.mdpi.com/1660-4601/16/20/4003

Hilman Agrimon, O., & Street, J. (2016). Developing Comprehensive Diabetes Education Materials for Structured Patient Education Programs in Primary Care Setting. *International Journal of Public Health Science (IJPHS)*, *5*(1), 16. Retrieved from http://ijphs.iaescore.com/index.php/IJPHS/article/view/4758

International Diabetes Federation. (2019). IDF Diabetes Atlas. In *9th Edition*. International Diabetes Federation, 2019. Retrieved from https://www.idf.org/e-library/welcome/copyright-permission.html

Kargar Jahromi, M., Ramezanli, S., & Taheri, L. (2015). Effectiveness of diabetes self-management education on quality of life in diabetic elderly females. *Global Journal of Health Science*, *7*(1), 10–15. Retrieved from http://www.ccsenet.org/journal/index.php/gjhs/article/view/37675

Kemenkes RI. (2018). Cegah, cegah, cegah : Suara Dunia Perangi Diabetes. In *Biro Komunikasi dan Pelayanan Masyarakat*. Retrieved from http://www.depkes.go.id/article/view/18121200001/prevent-prevent-and-prevent-the-voice-of-the-world-fight-diabetes.html

Kosti, M., & Kanakari, M. (2012). Education and diabetes mellitus. *Health Science Journal*, *6*(4), 654–662. Retrieved from https://www.researchgate.net/publication/288764054_

Education_and_diabetes_mellitus

Mulder, B. C., Lokhorst, A. M., Rutten, G. E. H. M., & van Woerkum, C. M. J. (2015). Effective Nurse Communication With Type 2 Diabetes Patients: A Review. *Western Journal of Nursing Research*, *37*(8), 1100–1131. 531077 Retrieved from https://journals.sagepub.com/doi/10.1177/0193945914531077

PERKENI. (2019). Pedoman pengelolaan dan pencegahan diabetes mellitus tipe 2 dewasa di Indonesia 2019. In *PB. PERKENI*. Retrieved from https://pbperkeni.or.id/wp-content/uploads/2020/07/Pedoman-Pengelolaan-DM-Tipe-2-Dewasa-di-Indonesia-eBook-PDF-1.pdf

Riskesdas, 2018. (2018). *Hasil utama riskesdas 2018*. Retrieved from https://kesmas.kemkes.go.id/assets/upload/dir_519d41d8cd98f00/files/Hasil-riskesdas-2018_1274.pdf

Wang, P. Y., Fang, J. C., Gao, Z. H., Zhang, C., & Xie, S. Y. (2016). Higher intake of fruits, vegetables or their fiber reduces the risk of type 2 diabetes: A meta-analysis. *Journal of Diabetes Investigation*, *7*(1), 56–69. Retrieved from https://onlinelibrary.wiley.com/doi/10.1111/jdi.12376

Zareban, I., Karimy, M., Niknami, S., Haidarnia, A., & Rakhahani, F. (2014). The Effect of Self-care Education Program on Reducong HbA1c Leves in Patients with Type 2 Diabetes. *Journal of Education and Health Promotion*, *3*(123). Retrieved from http://ncbi.nlm.nih.gov/pmc/articles/PMC4275624

Zhang, Y., & Chu, L. (2018). Effectiveness of Systematic Health Education Model for Type 2 Diabetes Patients. *International Journal of Endocrinology*, *2018*. Retrieved from https://www.hindawi.com/journals/ije/2018/6530607/.