Jurnal Aisyah: Jurnal Ilmu Kesehatan

Volume 7, Issue 2, June 2022, p. 413–422
ISSN 2502-4825 (print), ISSN 2502-9495 (online)

Blood Sugar Levels Regulation in Diabetes Mellitus Type 2 Patients Through Diet Management

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ARTICLE INFO

Article history:

Received 11 December 2021
Accepted 21 April 2022
Published 10 June 2022

Keyword:

Blood sugar control
Diet management
Type 2 diabetes patients
Diet therapy

A B S T R A C T

Dietary compliance in diabetes mellitus (DM) patients plays an essential role in stabilizing blood glucose levels. In contrast, compliance develops a routine that helps patients follow a diet schedule. Family is one of the supporting factors to achieve the success of dietary compliance for DM patients. Family support is expected to help patients feel happy, raise their confidence in dealing with their illness and be eager to maintain their glucose levels. The method used in this literature review is a narrative review. The study to determine the appropriate interventions in regulating blood sugar in families with Type 2 Diabetes patients through diet management and which could be implemented within the family. The database used electronic data sources, namely PubMed, ScienceDirect and Sage Journal. In the article search results, there were ten journals as a result. The study results show that diet management in type 2 DM can reduce blood glucose levels. This intervention is considered effective in preventing and treating type 2 DM because it can help patients regulate their diet and daily nutritional intake. The recommended nutritional therapy of diabetic patients' dietary pattern includes a balanced nutritional calculation from carbohydrates, fruits, vegetables, whole grains, nuts, and low-fat milk is. Regulation of carbohydrate counts, total calories, carbohydrate exchange or experience-based estimation remains the primary strategy in achieving glycemic control.

Kata kunci:

Kontrol gula darah
Management diet
Pasien diabetes tipe 2
Therapi diet

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DOI: 10.30604/jika.v7i2.911

Pengaturan Kadar Gula Darah pada Penderita Diabetes Mellitus Tipe 2 Melalui Manajemen Diet

A B S T R A K

Kepatuhan diet pada penderita diabetes melitus sangat berperan penting untuk menstabilkan kadar glukosa darah, sedangkan kepatuhan itu sendiri merupakan suatu hal yang penting untuk dapat mengembangkan rutinitas yang membantu penderita diabetes melitus dalam mengikuti jadwal diet. Untuk mencapai keberhasilan penderita diabetes melitus dalam menjalankan kepatuhan diet, salah satunya dengan faktor pendukung yaitu keluarga, dengan adanya dukungan dari keluarga diharapkan penderita akan merasa senang karena dengan dukungan tersebut akan menimbulkan kepercayaan dirinya dalam menghadapi penyakitnya dan bersemangat untuk menjaga kadar glukosanya. Metode yang digunakan dalam penulisan literature review ini adalah narrative review. Tujuan penelitian untuk mengetahui intervensi yang applicable dalam mengatur gula darah pada keluarga dengan diabet Tipe 2 melalui manajemen diet dan dapat diimplementasikan dalam lingkup keluarga. Pencarian data menggunakan sumber data elektronik yaitu PubMed, Sciencedirect dan Sage Journal, kemudian ditemukan dari pencarian itu ada 10 jurnal. Manajemen diet pada penderita diabetes mellitus tipe 2 untuk menurunkan kadar gula dalam darah. Intervensi ini dipandang efektif sebagai pencegahan dan

pengobatan terhadap diabetes mellitus tipe 2 karena dapat membantu pasien untuk mengatur pola makan dan asupan nutrisi sehari - hari. Pola diet yang dilakukan mencakup perhitungan nutrisi yang seimbang berasal dari karbohidrat, buah-buahan, sayuran, biji-bijian, kacang- kacangan, dan susu rendah lemak dianjurkan dalam terapi gizi pasien diabetes. Pengaturan jumlah karbohidrat, total kalori, pertukaran jenis karbohidrat atau estimasi berbasis pengalaman, tetap menjadi strategi utama dalam mencapai kontrol glikemia.

INTRODUCTION

Type 2 diabetes mellitus (T2DM) makes up approximately 90% of all diabetes cases. Type 2 diabetes mellitus is a hyperglycaemia disease caused by insulin ineffective by the body. Diabetes Mellitus (DM) type 2 is a metabolic disorder disease characterized by an increase in blood sugar due to a decrease in insulin secretion by pancreatic beta cells and/or impaired insulin function (insulin resistance) decreasing or within the normal range. Because insulin is always produced by pancreatic beta cells, type II diabetes mellitus is considered non-insulin-dependent diabetes mellitus (Fatimah, 2015).

In Diabetes Mellitus (DM) type 2 insulin response is reduced, and this is defined as insulin resistance. During this state, insulin is not effective in maintaining glucose homeostasis, which causes insulin production to decrease and results in T2DM (Goyal & Jialal, 20-21). According to *the World Health Organization* (WHO) states in people with diabetes mellitus there is an increase in blood glucose levels, blood glucose that is higher than the normal limit causes an additional 2.2 million deaths, by increasing the risk of cardiovascular disease and other diseases. 43% of these 3.7 million fatalities occurred before the age of 70 (WHO, 2016).

The International Diabetes Federation (IDF) estimates that one in 11 people aged 20 to 79 (415 million people) around the world had diabetes mellitus in 2015 (REF. 1). Estimates increase to 642 million by 2040, and the largest increase is for regions where the economy is shifting from low to middle income. However, these predictions are generally less representative of actual diabetes mellitus, particularly in regions in rapid epidemiological transition. The reasons for the growing epidemic of diabetes mellitus are varied, including an aging population, economic development, urbanization, unhealthy eating habits, and a sedentary lifestyle. More than 90 per cent of diabetes mellitus cases are type 2 diabetes mellitus (Zheng, Ley, & Hu, 2017).

Diabetes is a disease whose cases are increasing at this time (Bilous & Donelly, 2014). According to the Infodatin of the Indonesian Ministry of Health (2020), Indonesia is the 7th most affected country, accounting for 10.7 million people. Indonesia is the only country in Southeast Asia on the list, so it can be estimated that Indonesia's contribution to the prevalence of diabetes cases in Southeast Asia can be estimated (Kemenkes RI, 2020). This is a very important concern in controlling the risk of disease that will arise from type 2 diabetes mellitus, it is necessary to have proper management related to type 2 diabetes mellitus.

According to (PERKENI, 2019) diabetes management has several pillars, namely education, nutrition or dietary therapy, exercise and pharmacological therapy. Dietary determination is a key component of diabetes management. Factors that influence the glycemic level of foods are cooking methods, food preparation processes and types of foods and food composition (carbohydrates, fats and proteins). with carb types in the form of sugar, flour and fiber (Suciana, and all , 2019).

One of the problems with overcoming diabetes mellitus is nutritional therapy or diet. Dietary compliance among diabetics plays an important role in stabilizing blood sugar. while compliance itself is important in order to be able to develop a routine that helps people with diabetes mellitus to follow a diet program. If people with diabetes mellitus are not obedient to the implementation of a diet, it will affect uncontrolled levels of sugar. To achieve the success of people with diabetes mellitus in achieving dietary compliance, one of them is with a support factor, namely the family, with the support of the family. it is hoped that the patient will feel happy because with this support he will increase his confidence in treating his disease and desiring to maintain his glucose levels. According to research results from Nursihhah, M (2021) there is a significant relationship between diet compliance and glucose control. and also shows that patients who are out of compliance with the diet have 44,686 times. a greater risk of uncontrolled glucose levels compared to those on a diet..

The objective of this review is to identify applicable interventions, in the regulation of sugar roots in families with type 2 diabetes patients by food management and may be implemented within the family.

METHOD

The methodology used to write this document review is a narrative review. According to the guidelines of Rese, A., et al, (2017), this method is very favorable to the author in preparation due to general research questions to obtain an overview. This *review uses narrative review* guidelines according to Green et al., (2006) In El Haffar, et al (2020) that *Narrative review* includes a summary, and does not have a specific study method (Goodman, SN, et al, 2016). Selected articles are only summarized and examined because of time efficiency. Even though *narrative reviews* have shortcomings, the materials used must be valid, from trusted sources, because *narrative reviews are* based on research articles produced from reliable and valid sources.

Electronic data sources in the search for articles using *PubMed,* Science direct *and Sage Journal*. The technique used to obtain appropriate literature with the PICO method. The *population* (P) in this study were families with type-2 diabetes mellitus, *intervention* (I) was in the form of

regulating blood sugar levels, *comparison* (C) was not carried out, and the *outcome* (O) was determined, namely diet management. The technique in searching the literature used the keywords in English "*Patients with diabetes type 2",* and "*Diet management or Diet Therapy", and "Glycemic Control".*

The process of searching for articles with the last 10 years of publication from 2011 to 2021, this is in order to get the latest information. The data obtained will be selected based on inclusion criteria, namely, the sample in the article is based on the analyzed article, namely the *applicable* intervention in regulating blood sugar levels in families with Type 2 DM patients through diet management, the articles obtained can be accessed for free (*full text*), and articles in English and the types of research are *Randomized Control Trial* and *Clinical Trial*. While the exclusion criteria are articles that are not relevant to the research topic. *Narrative review* includes a summary, critical review and does not use a specific method of study. The refore, the articles obtained are only summarized and critically reviewed for time efficiency.

RESULTS AND DISCUSSION

The articles obtained are selectedin order to get articles that are in accordance with the topic of literature study. The selection of articles is done by adjusting the inclusion and exclusion criteria that have been set.

The findings found 10 publications that met the criteria with the characteristics of research publications conducted in South Korea (n=1); China (n= 4); Japan (n= 3); Taiwan (n=1); Netherlands (n= 1). The sample population as a whole is in the population in earthquake-prone areas. The results of the identification of the type of *Study Design, Randomize Control Trial* (n=8; *Clinical Control Trial* (n=1); *Randomized Double Blind* (n=1). The type of intervention selected from the article was the type of education (n=1); Diet with meal replacement (n=4); Diet regulates food intake (n=4); Dinner consumption was divided (n=1), with a duration of intervention time, 3 months (n=3); 3-6 months (n=5); 6-9 months (n-1) and > 9 months (n=1). The research results from the selected articles are significant (n=9) and not significant (n=1).

The data found collected will be extracted into tables and then the data will be analyzed using the inductive method of content analysis where the publications obtained will be grouped into several sub-groups, and critically examined on the content of the publications that have patterns of relationships with the topic of discussion. From the content analysis, it was found that the main sub-categories were interventions that were *applicable* in regulating blood sugar levels in families with Type 2 DM patients through diet management.

The following is a flow chart for sorting articles obtained according to the topic of the literature study carried out.

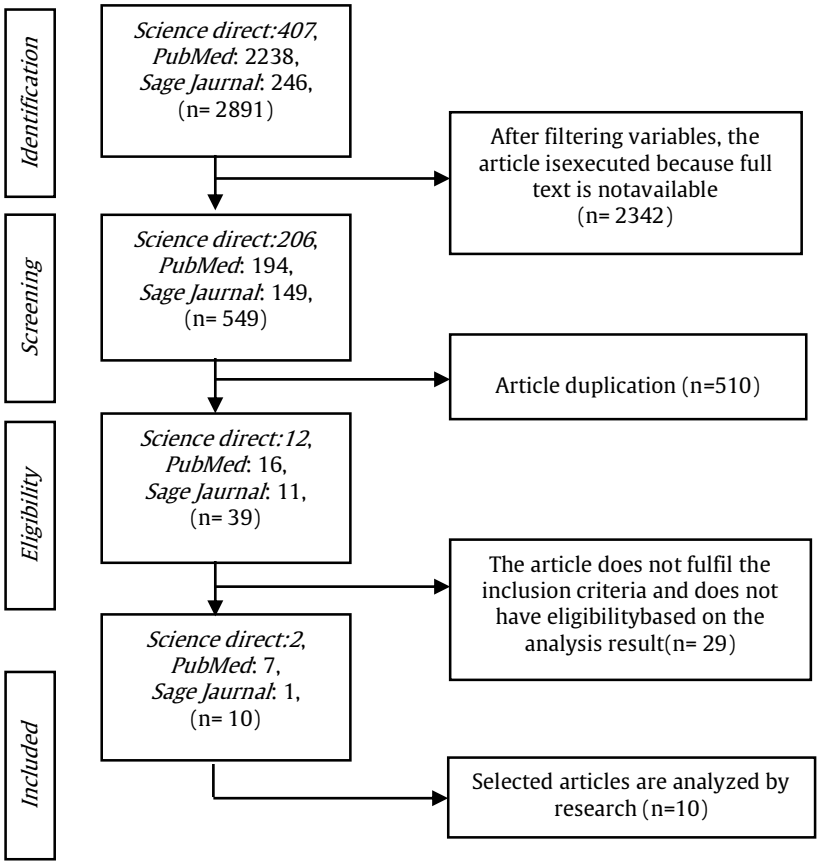

Chart 1. Flowchart of Article Selection Process

Table 1.
Applicable interventions in *regulating* blood sugar levels in families with Type 2 DM patients through diet management

No	Title and Researcher	Research Design	Sample	Intervention	Variables and Instruments	Results
1	*Effects of Fasting-Mimicking Diet and Specific Meal Replacement Foods on Blood Glucose Control in Patients with Type 2 Diabetes: A Randomized Controlled Trial* (Fang Tang, Xuan Lin, 2020)	*Randomized Controlled Trial*	100 randomly selected patients with type 2 diabetes	50 patients each for the test group (with low-energy meal replacements during a fasting mimicking diet) and control group (with certain meal replacements given normal adult doses)	Dependent Variable: *Meal Replacement Foods* Independent Variables: - Fasting *plasma glucose* (FPG) - (2-*hour postprandial glucose (*2hPG)) - HbA1c Research Instrument: Observation	Fasting blood glucose indicator, 2 h postprandial venous blood glucose, P < 0:05); Observational indicators after 4 months which included body mass index, waist circumference, blood lipids (triglycerides, cholesterol, and low-density lipoprotein), and blood pressure were all lower than the control group, and high-density lipoprotein levels were all higher than the control group (all P < 0:05). The two groups of fasting blood glucose, 2 hours postprandial blood glucose, and blood pressure had a relatively stable decreasing trend, but the experimental group experienced a more significant decrease. In conclusion, diets such as fasting and certain meal replacements are effective in reducing body weight and improving metabolic syndrome in patients with type 2 diabetes.
2	*Effectiveness of the Beyond Good Intentions Program on Improving Dietary Quality Among People with Type 2 Diabetes Mellitus* (Laura A. van der Velde, Jessica C. Kiefte-de Jong, Guy E. Rutten, Rimke C. Vos. 2021)	Randomized Controlled Trial (RCT)	108 patients with Type 2 Diabetes Mellitus	Divided into two groups, namely intervention (56 people) and control (52 people) By analyzing the effectiveness of the BGI program to improve the quality of diet in patients with type 2 diabetes mellitus	Dependent Variable blood glucose level Independent Variables: Good Beyond Program Research instrument: - Diabetes specific dietary guidelines - Crystal food habits questionnaire (FHQ) (18) - Dutch Fat Consumption Questionnaire (FCQ - The dietary quality score (DQS) - Descriptive statistics	- There was an increase in the DQS score in the intervention k group as much as 0.71 compared to the control group after being given the intervention (p = 0.028) - In the individual component there was a significant increase in fruit consumption in the intervention group (p = 0.033) - There was an increase in consumption of fruit and nuts after the intervention but it was not significant
3	*A randomized controlled trial of 130 g/day low-carbohydrate*	Open-label method. randomized	66 T2DM patients with HbA1c >7.5% Outpatient	Investigating the efficacy and safety of 130 g/day LCD for patients with uncontrolled T2DM	Patients received a questionnaire at the end of the study about adherence to nutritional therapy	This study shows that 130 g/day LCD (low-*carbohydrate diet*) for 6 months is more effective and safer than CRD

	diet in Q10 type 2 diabetes with poor glycemic control (Sato, J., Kanazawa, A., Hatae, C., Makita, S., Komiya, K., Shimizu, T., ... & Watada, H. 2017)	controlled study	Juntendo University Hospital	and a history of nutritional therapy repeat from CRD		(*calorie restricted diet*) for patients with T2DM who cannot control blood sugar levels. which is good despite repeated CRD. At the end of the 6-month intervention, changes in energy intake were significantly lower (14, range 449 to 177 kcal/day) in the CRD group (calorie *restricted diet*) compared to the LCD group (low-*carbohydrate diet*) (406, 587 to 44 kcal/day, $p < 0.01$). With regard to different food components, changes carbohydrates by 3 (54 to 30) g/day in the CRD. group and 87 (116 to 40) g/day in the LCD group ($p < 0.01$)
4	*Divided consumption of late – night - dinner improves glycemic excursions in patients with type 2 diabetes:* (Saeko Imai A, Shizuo Kajiyama, Yoshitaka Hashimoto, Chikako Yamane, Takashi Miyawaki, Neiko Ozasa, Muhei Tanaka, Michiaki Fukui . 2017).	Randomized cross-over clinical trial	16 patients Outpatients at the Kajiyama Clinic, Kyoto, Japan with type 2 diabetes who had not worked night shifts in the past 2 years and who had not crossed time zones in the past 6 months were randomly assigned to a cross-over study.	Exploring the acute effects of late night eating and divided dinners on postprandial glucose levels in patients with type 2 diabetes	Independent Variables: Divided consumption of late night dinner Dependent Variable: - Peak additional glucose (IGP) after dinner - IAUC glucose - Mean glycemic course amplitude (MAGE) Instrument: - Glucose monitor (CGM, iPro2, Medtronic Japan, Tokyo) - SMBG, Sanwa Kagaku Kenkyusyo, Aichi, Japan)	That shared dinner significantly reduced the IAUC of 2300 to 0800 hours (142 ± 60 mmol/L - min, $p < 0.01$), post-dinner IGP (3.75 ± 0.58 mmol/L, $p < 0.01$), and MAGE (5.33 ± 0.41 mmol/L, $p < 0.01$) compared with D21. D21 showed significantly higher values of the additional area under the curve (IAUC) for glucose 2300 to 0800 hours (644 ± 156 vs. 147 ± 63 mmol/L - min, $p < 0.01$, mean ± standard error mean) and increase in additional glucose (IGP) after dinner (6.78 ± 0.79 vs. 3.09 ± 0.62 mmol/L, $p < 0.01$) compared to D18.
5	*Effect of a Brown Rice Based Vegan Diet and Conventional Diabetic Diet on Glycemic Control of Patients with Type 2 Diabetes* (Yu-Mi Lee, Se-A Kim, In-Kyu Lee, Jung-Guk Kim, Keun-Gyu Park, Ji-Yun Jeong, JaeHan Jeon, Ji-Yeon Shin, Duk-Hee Lee . 2016)	A 12-week randomized clinical trial	Participants diagnosed with type 2 DM were randomly assigned	Assigned to follow a vegan diet (n = 46) or a conventional diet recommended by the 2011 Korean Diabetes Association (n = 47) for 12 weeks. HbA1c levels were measured at weeks 0, 4, and 12, and the primary study end point was the change in HbA1c levels over 12 weeks.	Independent Variables: Vegan diet and conventional diet Dependent Variable: Glucose level Instrument: - ADVIA 240 analyzer (fasting blood sugar) - COBAS Integra 800 (HbA1C) - Weighing, measuring height, waist circumference, and blood pressure (Week 0,4,12)	The mean HbA1c levels at weeks 0, 4, and 12 were 7.7%, 7.2%, and 7.1% in the vegan group, and 7.4%, 7.2%, and 7.2% respectively. in the conventional group. Although both groups showed a significant decrease in HbA1C levels, the decrease was greater in the vegan group than in the conventional group (-0.5% vs. -0.2%; p-for-interaction = 0.017). Considering participants with high adherence levels, the difference in the reduced HbA1c level of the groups was found

						to be greater (-0.9% vs -0.3%).
6	*The Effect of Low-Carbohydrate Diet on Glycemic Control in Patients with Type 2 Diabetes Mellitus.* (Li-Li Wang, Qi Wang, Yong Hong, Omorogieva Ojo, Qing Jiang, Yun-Ying Hou, Yu-Hua Huang, Xiao-Hua Wang. 2018)	Randomized Controlled Trial (RCT)	Patients older than 18 years, have been diagnosed with DMT2 sample 56	LCD group (n=28) LFD group (n=28) Researchers then let them record details of their diet and leave it to the researchers to calculate the caloric value of the food. Based on this, researchers will explore the effect of two diets DM LCD *(Low Carbohydrate Diet)* and LFD *(Low Fat Diet)* on hyperglycemia.	Independent Variable Low-Carbohydrate Diet Dependent Variable: Glycemic control in patients with diabetes mellitus type 2 Instruments: - HbA1c . measurement - Perform anthropometric measurements of body mass index (BMI), weight, and height - Observations regarding the recording of the respondent's deen	There was a greater decrease in HbA1c levels in the LCD group (-0.63% vs. -0.31%, P < 0.05). The insulin dose and fasting blood glucose (FBG) at the third month were lower than at baseline in both groups. Compared with baseline values, body mass index (BMI) and total cholesterol (TC) in the LCD group decreased significantly at the third month (P < 0.05); however, there was no statistically significant difference in the LFD. group
7	*Short and Long Term Effects of Wholegrain Oat Intake on Weight Management and Glucolipid Metabolism in Overweight Type 2 Diabetics* (Xue Li, Xiaxia Cai, Xiaotao Ma, Lulu Jing, Jiaojiao Gu, Lei Bao, Jun Li, Meihong Xu, Zhaofeng Zhang, Yong Li, 2016).	Randomized Control Trials.	Consisting of 445 adult patients with T2DM, in the end only 298 subjects met the criteria of being overweight with a body mass index 24 kg/m2 in China.	Participants were randomly allocated to 4 groups with different interventions. first the usual care group (n=60) did not receive the intervention, the second diet group (n=79) received a low-fat and high-fiber diet, the third the 50g-oat group (n=80) and the fourth the 100g-oat group (n=79) receive a healthy diet with the same cereal	Variables and continuous were analyzed by Chi-square test or sample t-test by looking at the response to changes in the intervention on anthropometric, blood glycemic and lipid variables that had been determined at the beginning and end of the intervention.	There were significant differences in changes in FPG (fasting plasma glucose), PPG (postprandial plasma glucose), HbA1c (glycosylated hemoglobin), HOMA-IR (assessment of insulin resistance homeostasis model), TC (total cholesterol), TG (total triglycerides), and LDL-c (low density lipoprotein cholesterol) was observed in 4 groups. In the healthy diet group and the 50 g-oat group there was a greater decrease in PPG (MD): -1.04 mmol/L: 95% CI: - 2.03, -0.05) and TC (MD: - 0, 24 mmol/L; 95% CI: -0.47, -0.01; the 100 g-oat group had a greater reduction (MD: -0.33 mmol/L; 95% CI: -0.56, -0.10) and LDL-c (MD: -0.2 2 mmol/L; 95% CI: -0.41, 0.03) After the intervention duration was increased to 1 year, the effect on weight loss was greater , this shows that consuming oats in the short and long term has a significant effect in reducing body weight, blood lipids and controlling hyperglycemia.
8	*A Randomized Controlled Trial to*	Randomized Controlled Trial	The participants were recruited	Randomly allocated to the Peanuts group (n = 17) and 15 to the	Researchers included nuts or almonds in a low-carbohydrate	A low-carbohydrate diet, both peanuts and almonds, can increase

	Compare the Effect of Peanuts and Almonds on the Cardio-Metabolic and Inflammatory Parameters in Patients with Type 2 Diabetes Mellitus (Yun-Ying Hou , Omorogieva Ojo , Li-Li Wang , Qi Wang , Qing Jiang , Xin-Yu Shao , Xiao-Hua Wang . 2018)		from the diabetes club and from the Endocrine Division of the First Affiliated Hospital of Soochow University. 32 T2DM patients were recruited and met several inclusion criteria	Almonds group (n = 15) in a parallel design. This study was a prospective, randomized controlled trial (RCT).	diet (LCD), which is a dietary strategy that refers to a carbohydrate intake of between 30–200 g/day or calories from carbohydrates/total calories <45%, supplemented by fat or protein. The reduced staple food/food was replaced by consumption of peanuts 60 g/day for men and 50 g/day for women in the Peanut group.25], and 55 g/day almonds for men and 45g/day for women in the group. Almonds. Peanuts and almonds (unsalted and with skins intact, and free) are prepared in a vacuum pack, according to the daily amount. The patients were instructed to consume nuts between meals or with breakfast, or when hungry. For those whose fasting plasma glucose is higher than normal (>6.1 mmol/L), nuts should be consumed before 10:00 am. The patients were instructed to consume 50% nuts before bed if there was a risk of developing nighttime hypoglycemia. The duration of the intervention was three months for both groups.	fasting blood glucose and 2-hour postprandial blood glucose in patients with T2DM. The effects of almonds on improving long-term glycemic control need to be confirmed with more studies.
9	*One year follow-up after a randomized controlled trial of a 130 g/day low-carbohydrate diet in patients with type 2 diabetes mellitus and poor glycemic control* (Sato, J., Kanazawa, A., Hatae, C., Makita, S., Komiya, K., Shimizu, T., ... & Watada, H. 2017)	Randomized Controlled Trial	In the RCT, we recruited 66 patients with T2DM from the Juntendo University Hospital Outpatient Clinic.	The dietary intervention was carried out over a 6-month RCT period. For CRD patients, the target total caloric intake is calculated by multiplying the ideal body weight by 28 kcal/kg, according to the Japan Diabetes Society guidelines. [14] Total caloric intake consists of 50-60% carbohydrates, 1.0-1.2 g/kg protein, and the remainder as fat.	- Super Nutrient Calculation System analysis software, Healthy Maker Pro 501 Series (Mushroomsoft, Okayama, Japan) - Diabetes Treatment Satisfaction Questionnaire (DTSQ)	One year after the dietary intervention intervention, the effect of LCD on reductions in HbA1c and BMI was not sustained compared with CRD. However, combining the two groups, significant increases in HbA1c and BMI from baseline were observed. Although excess LCD disappeared 1 year after intensive intervention. Demonstrated that well-designed nutritional therapy programs, both CRD and LCD, were equally effective in increasing HbA1c for at least 1 year.
10	*Therapeutic effects of soluble dietary fiber*	Randomized, double-blind trial	A total of 120 patients at Xinqiao	Grouped according to treatment and randomly divided into the	Investigating the effect of Dietary Fiber on glycemic control and	After one month of treatment, systolic pressure and HDL, LDL and

consumption on type 2 diabetes mellitus (Chunye Chen, Yuan Zeng, Jing Xu, Hongting Zheng, Jun Liu, Rong Fan, Wenyi Zhu, Lijia Yuan, Yu Qin, Shihui Chen, Yong Zhou, Ying Wu, Jing Wan, Mantian Mi, and Jian Wang. 2016)	Hospital of the Third Military Medical University (Chongqing, China), who had been diagnosed with DM2 [based on 2010 ADA criteria] for 6 months	following three groups using a random number table (40 subjects/group): i) Control; ii) low dose (10DF); and iii) grouphigh dose (20DF). After one month of treatment, 37 patients remained in the control group, 3 patients discontinued for personal reasons and 40 patients remained in the 10DF and 20DF groups, respectively. Patients in the control group received only MNT, and patients in the 10DF and 20 DF groups were given 10 and 20 g of soluble DF daily, respectively.	plasma lipid concentrations in patients with DM2	apo B levels were significantly increased in the 20DF group compared to before treatment (P<0.05). In addition, the values of body weight, BMI and hip circumference increased significantly in the control and 10DF groups (P<0.05), and waist circumference was significantly reduced in the 10DF group (P<0.05) compared to before treatment. Fasting insulin, 2-hour blood glucose and Lpa levels, and insulin resistance index, , were significantly increased in all three groups compared to before treatment (P<0.05). Furthermore, fasting blood glucose, insulin 2 hours, fasting C peptide, C peptide 2 hours, GA and TG levels were significantly increased in the DF group (P<0.05), compared to the control group, where there was no significant increase for the observed.

Based on 10 articles that have been reviewed, there are three interventions that are *applicable* to be applied in Indonesia, namely a low-carbohydrate diet, a vegan diet, and restriction of eating late at night. A low-carbohydrate diet is suitable to be applied in Indonesia because Indonesian people are familiar with this diet method and many nutritionists have implemented it. In addition, in implementing a low-carbohydrate diet, the consumption of white rice intake is replaced with ingredients such as brown or black rice, cassava, wheat, and potatoes. Some of these substitute food ingredients are not difficult to find in Indonesia and can be processed into various types of food in their presentation. The results of the journal analysis state that replacing and limiting carbohydrate intake can help control glucose levels in patients with type 2 diabetes mellitus and can prevent hyperglycemia. However, the implementation of a low-carbohydrate diet has its own challenges, namely efforts to change the habitual behavior of Indonesians who always eat with white rice, if they don't eat rice, they don't feel like they have eaten. Therefore, in implementing this low-carbohydrate diet intervention, it is necessary to always be monitored by health workers and assisted by the family so that it runs optimally.

The next intervention is a *vegan* diet, this diet is *applicable* to be applied in Indonesia because it is already familiar. Indonesian people consume more foods that contain plant-based foods such as fresh vegetables and fruits compared to meat and fish. This diet has the advantage that the body's glucose intake can be controlled very well because the *vegan diet* uses healthy natural ingredients. However, the application of this diet needs good monitoring and management from nutritionists because if it is done carelessly, it can risk experiencing malnutrition which can cause macro and microvascular complications in people with type 2 Diabetes Mellitus.

The next intervention is the restriction of dinner, this intervention is appropriate to be applied in Indonesia because eating late at night is not recommended so that this action also needs to be applied to patients with type 2 diabetes mellitus. According to research in the Journal of Clinical Endocrinology & Metabolism, eating too late contributes to weight gain, and increase the risk of diabetes which is higher because it can trigger hyperglycemia. Dinner hours that are not recommended for patients with type 2 diabetes mellitus are at 23.00-08.00, because at that time mean plasma glucose (IGP) and IAUC values were higher than with dinner at 18.00. The setting of dinner hours can be applied as a high-carbohydrate diet and a diet high in protein, fat and fiber -containing foods are consumed at 21.00 so that patients can easily receive the beneficial effects of their lifestyle. This diet will be quite difficult to apply to families with irregular eating patterns, namely the time to eat is done without restrictions. Therefore, it is necessary to make the habit of limiting eating late at night by changing their behavior slowly.

Based on the results of the analysis and discussion, it was found that overall discussing dietary management in patients with type 2 diabetes mellitus, low carbohydrate (Junko Sato, et, all, 2016), vegan diet (Lee, et, all, 2016), and restriction of late-night eating (Saeko Imai A., et al., 2017). The low-carbohydrate diet intervention in the article (Junko Sato, et, all, 2016) was carried out by limiting carbohydrate intake to 130g/day and replacing food ingredients with brown, brown, or black rice, potatoes, and wheat. The vegan diet intervention in the article (Lee et al., 2016) families and patients can be given education about dietary guidelines, cooking methods, counseling, discussions, and reminding patients to write down the types of daily food consumption according to the vegan diet guidelines. Families can also report to the nurse about the results of the HbA1C blood glucose count during the diet to evaluate its effectiveness in patients. The dietary intervention in the article (Saeko Imai A., et al., 2017) was carried out by limiting eating too late at night by limiting the patient's eating before 18.00 WIB in order to prevent hyperglycemia.

The interventions found can be integrated into family nursing practice. The role of the family in helping family members with type 2 diabetes mellitus to maintain food intake and stable blood glucose levels. Family members participate in receiving education about recommended dietary management through counseling and monitoring food intake by helping prepare processed types of low-carbohydrate foods in the home environment. Therefore, diet management is an intervention that can be applied in family nursing practice, because the role of each family member can help optimize the health condition of a family through improving nutrition and controlling food intake in people with type 2 diabetes mellitus to prevent hyperglycemia.

CONCLUSIONS AND SUGGESTIONS

Based on the results *of a literature review,* it shows that dietary management in patients with type 2 diabetes mellitus can reduce blood glucose levels. This intervention is considered effective as a prevention and treatment of type 2 diabetes mellitus because it can help patients to regulate their diet and daily nutritional intake. The dietary pattern carried out includes a balanced nutritional calculation between carbohydrates, fruits, vegetables, whole grains, nuts, and low-fat milk which is recommended nutritional therapy for diabetic patients. Regulation of the amount of carbohydrates, total calories, switching types of carbohydrates or based on experience, remains the main strategy in achieving glycemic control.

This literature review is also expected to help health workers, especially in the nursing field, to develop and determine appropriate interventions in providing care for patients with Type 2 DM. This literature review uses international research journal articles with proven and trusted credibility. So it is hoped that it can be a reference for regulation of the stability of blood glucose levels in patients with Type 2 DM through diet management.

Funding Statement

The author does not receive funding support from any organization for the submitted work, the funding is done independently.

Conflict of Interest Statement

The authors state that there is no potential conflict frominterests in connection with writing and publicationthis article.

Reviewer's Suggestion

The authors leave it entirely to the manager to review our articles, and the results of the reviewers are submitted back to us if they must be corrected according to the reviewer team's input.

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