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Nutrition Management in Elderly with Diabetes Mellitus: Literature Review

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Abstract. Diabetes often occurs in the elderly who have become a great social burden. The effects of diabetes are weakness, cognitive dysfunction which is closely related to the aging mechanism. Nutritional management is one of the therapeutic diets as the cornerstone of diabetes treatment based on healthy and wise dietary guidelines. The purpose of this study was to determine the nutritional management of the elderly in diabetes mellitus. The research method used is a literature review and to select studies using the PRISMA Checklist protocol and PICOS format To determine the articles to be reviewed from Googlescholar and PubMed, 15 articles were found that met the criteria indicating that nutritional management in the elderly with diabetes mellitus must consider the quality of health (health status, activity, functional and psychological status), nutritional intake (vitamins, minerals, and fiber).), and changing eating habits by following a healthy diet.

Keyword: nutrition management; elderly; Diabetes Mellitus; literature review

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1. Introduction

Diabetes Mellitus is a disease caused by inadequate control of blood sugar levels. Diabetes mellitus has many subclassifications, including type 1, type 2, young adult-onset diabetes (MODY), gestational diabetes, neonatal diabetes, and steroid-induced diabetes (Sapra & Bhandari, 2021). The incidence in 2019 is estimated at 37.3 million or 11.3% of people in America suffer from diabetes mellitus and 1.9 million people have type 1 diabetes, including approximately 244,000 children and adolescents who are diagnosed or undiagnosed (ADA, 2018). Complications of diabetes often occur due to microvascular and macrovascular complications due to increased blood sugar levels, so dietary management is needed in order to prevent complications and a consequent increase in knowledge, attitudes and dietary practices leading to better disease control. (Khazrai et al., 2014). The elderly have two-thirds of the diabetes population by 2025 who are at risk of coexisting chronic conditions such as hypertension, dyslipidemia, and cardiovascular disease that affect nutritional needs. The problem of achieving and maintaining optimal body weight in elderly diabetics is not as easy as in other age groups (Rizvi, 2009). Diabetes in the elderly increases the risk of suboptimal nutrition, and malnutrition (Sanz-París & Lardiés-Sánchez, 2019). In Indonesia, the prevalence of diabetes mellitus is ranked 7th as a country with the highest number of around 10.7 million people (Lestari, 2021). The prevalence of diabetes at the age of 20-79 years globally in 2019 was 9.3 percent and in the North Sumatra region, 1.8 percent had been diagnosed with DM (Manao, 2021). Elderly with diabetes mellitus, often experience poor and irregular eating patterns that cause a very drastic drop in blood sugar levels. Low fluid intake in the elderly can also cause dehydration, and will result in the disease experienced. Nutritional and dietary assessments should be part of the elderly personal care plan (Hartono, 2021). The increase in prevalence due to being overweight in the elderly has an impact on insulin resistance and hyperglycemia which tends to require long treatment. Excess and underweight in diabetics can signal nutritional status that causes increased morbidity and mortality if nutritional guidelines are not adjusted to the needs of diabetic patients. diabetes can cause problems accompanied by changes in appetite, food delicacy, dietary restrictions, loneliness, and depression that can affect the type and amount of food consumed by diabetics (Rizvi, 2009). Nutritional problems experienced by people with diabetes mellitus can be overcome by performing nutritional management. Nutritional management is an integral component of nutritional therapy and diabetes self-management education (Marion et al., 2002). This is the nutritional management of the elderly with diabetes mellitus is a topic that will be carried out in this literature study. The purpose of this study is to determine the nutritional management of the elderly with diabetes mellitus based on several literature studies references.

2. Research Methods

a. Study protocol

The protocol in this study used the PRISMA statement (Moher et al., 2009) and the Joanna Briggs

Institute (JBI) Reviewer's Manual (JBI, 2020).

b. Inclusion and exclusion criteria

The inclusion and exclusion criteria in this study used the PICOS format (Bettany-Saltikov, 2010). This study included all quantitative studies related to the nutritional management of diabetes mellitus in the elderly. The approach in this systematic review looks at the extent to which the results of previous research differ and do not involve qualitative research because there is far from empirical evidence that would contradict each other. This is to avoid heterogeneity and complexity of integration.

Table 1 Inclusion and exclusion criteria using the PICOS format

Criteria	Inclusion	Exclusion
Population	Elderly or older people	Non- Elderly or older people (e.g. newborn baby, toodler, and infant).
Interventions/ Phenomenon of interest	Nutrition management for elderly with diabetes mellitus	Not nutrition management for elderly with diabetes mellitus
Comparators	Standard practice, alternative intervention, and no comparator	No limitations
Outcomes	Outcome for nutrition management with diabetes mellitus for elderly	No limitations
Study design and publication types	Published, peer-reviewed, systematic review of quantitative studies, randomized clinical trials, quasiexperimental studies and observational studies	Qualitative studies, case studies and single expert opinion
Publication years	From January 2018 – January 2022	Not from 2018- January 2022
Language	In English	Not in English

c. Search strategy

This systematic data goes through a three-stage process in identifying relevant articles (JBI, 2020). The first phase is electronic databases (PubMed, Proquest, Google Schoolar) used to determine keywords that match the title and abstract. The second stage performs a specific search using keywords to identify potentially relevant articles. The last stage, manual search from the

list of research references by identifying articles published from January 2018 to January 2022.

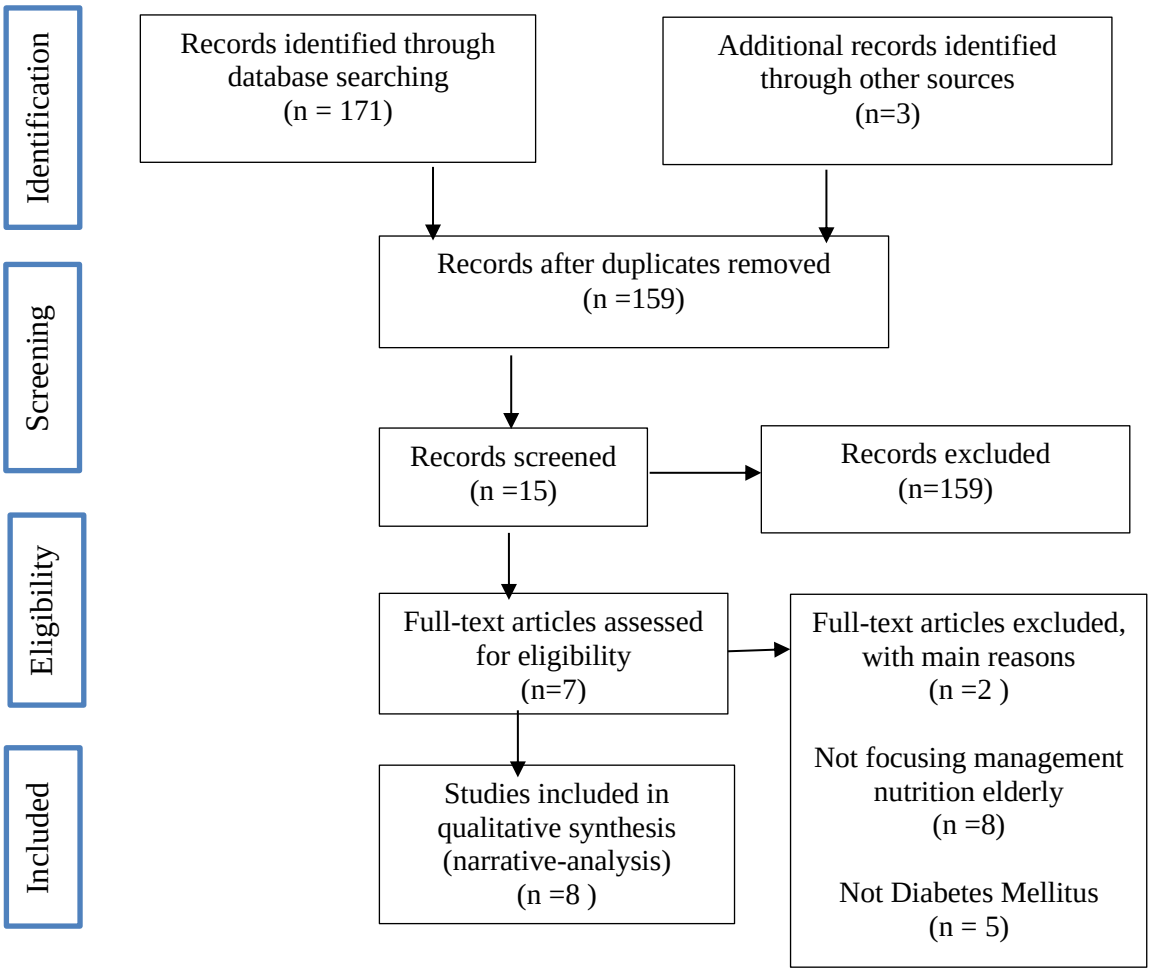

FIGURE 1. PRISMA flow diagram (Moher et al., 2009)

d. Study screening and selection

A search study using keywords namely nutrition management, elderly with diabetes mellitus found 18700 articles in a Google Scholar search. However, no selection has been made according to the inclusion criteria, namely articles resulting from peer reviews, systematic reviews of quantitative studies, randomized clinical trials, quasi-experimental studies and observational studies. After the selection, it was found that 15 articles that met the inclusion criteria from 171 manually selected articles that looked at keywords.

e. Critical assessment

This article's critical assessment uses PICO analysis which looks at the research objectives, research design, and results that have been compiled specifically looking at the keywords of the article to be reviewed.

f. Extraction and synthesis of data

The data was synthesized using a structured data extraction table (JBI, 2020) consisting of the

author's name, year, study design, method and results.

3. Research Results

The 15 (fifteen) articles reviewed are presented in the following table:

Table 2 Articles reviewed

No	Author	Title	Design & Sample	Intervention	Result
1	Sesti, G., Antonelli Incalzi, R., Bonora, E., Consoli, A., Giaccari, A., Maggi, S., Paolisso, G., Purrello, F., Vendemiale, G., & Ferrara, N. (2018) PMCID: PMC7693664 PMID: 33139628 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7693664/	Management of diabetes in older adults. (Sesti et al., 2018)	Peer-Review Sample Older Adults with Diabetes	Pharmacological treatment should be carefully determined and monitored taking into account the patient's cognition, side effects of the drugs given and physical activity and nutritional evaluation of the elderly with diabetes.	The main strategies in people with diabetes mellitus are: - Considering needs, possibilities and risks when carrying out treatment - Perform a comprehensive geriatric assessment to explore social status and support in activities of daily living - Drug-dependent hyperglycemic therapy HbA1c goals must be in accordance with the rules - Monitor RCT indications - Close monitoring and adjustment of hypoglycemic therapy is required.
2	Silvana Linhares de Carvalho, Marilia Araripe Ferreira, Juliana Mineu Pereiira Medeiros, Anne Caroline Ferreira Queiroga, Tatiana Reboucas Moreira, Francisca Diana da Silva Negreiros.(2018) Doi: http://dx.doi.org/10.1590/0034-7167-2017-0064 Proquest: https://www.proquest.com/docview/2052774269/2FF659E325174A63PQ/1?accountid=50257	Conversation map: an educational strategy in the care of elderly people with diabetes mellitus (Carvalho et al., 2018)	A descriptive qualitative study, an experience report, was conducted at a dedicated outpatient clinic for diabetics in Fortaleza, Ceara Brasil. Total sample of 72 users who participated in this study	The patients are pre-selected at two different moments: 1. The patient's medical record is reviewed the day before the consultation with the endocrinologist 2. Screening of films on the day of consultation, in which patients with a certain degree of decompensation or the	Participants talk about issues that were not discussed in private consultations and are able to see for themselves through other people's stories, thereby realizing that they are not alone and that others are experiencing the same difficulties. Through empathy and the stories of others, participants build knowledge and practice for everyday life. Final Considerations: Conversation maps enable professionals to empower patients with diabetes, promote self-care and ensure better control of disease, to prevent or delay the

No	Author	Title	Design & Sample	Intervention	Result
				presence of complications are sought.	onset of associated complications.
3	Tamura, Y., Omura, T., Toyoshima, K., & Araki, A. (2020) PMID 33139628 PMCID: PMC7693664	Nutrition management in older adults with diabetes: A review on the importance of shifting prevention strategies from metabolic syndrome to frailty (Tamura et al., 2020)	The study in this study was peer-reviewed in the elderly with diabetes mellitus	1. Obesity: Setting an Appropriate BMI Range 2. Metabolic Syndrome 3. Sarcopenic Obesity 4. Changes in Body Weight	There are no clear standards for changing the diet strategy of people with diabetes. This is highly considered for those aged over 75 years, because they have the potential to have weakness or sarcopenia, malnutrition and require prevention, social support, exercise and control of blood sugar levels.
4	Chen, T. L., Feng, Y. H., Kao, S. L., Lu, J. W., & Loh, C. H. (2022)	Impact of integrated health care on elderly population: A systematic review of Taiwan's experience. (T. L. Chen et al., 2022)	Systematic review, elderly	This study reviewed 34 studies with a total of 838,026 subjects studied. The study involved 11 sub themes, namely diabetes, chronic kidney disease, hepatitis C, fractures, cancer, dementia, atrial fibrillation, COPD, mechanical ventilation, terminal illness, outpatients and community-dwelling patients.	The implementation of integrated health care could not only provide benefits on survival, self-care ability, health quality, physical, and functional rehabilitation outcomes, but also significantly reduce medical utilization and expenditures.
5	Ji-Yeon Choi, Jieun Shin, Seunghui Baek PMID 3491887 PMCID: PMC8483364	Gender-based comparison of factors affecting regular exercise of patients with Non-insulin Dependent Diabetes	A total of 1,432 patients with NIDDM were recruited using raw data from the Korea Health and Nutrition	The Korea National Health and Nutrition Survey	General characteristics, behavior and health conditions, NIDDM patients in Korea are less physically active. In addition, patients with higher educational attainment, higher income, and higher subjective health conditions had higher odds ratios for regular

No	Author	Title	Design & Sample	Intervention	Result
		Mellitus (NIDDM) based on the 7th Korea National Health and Nutrition Examinati on Survey (KNHANE S) (Shin, 2019)	Survey conducted between 2016 and 2018. SAS 9.4 was adopted for data analysis, and distributio nal differences were measured by multi-nominal logistic regression and the Rao-Scott x2 statistic to identify factors that affect the patient's routine physical activity, the analysis of which provides only association s.		exercise. Meanwhile, the ratio was lower for smokers and those who were stressed.
6	Raveendran, A. V., & Misra, A. (2021) PMCID: PMC8317446 PMID 34384972	Post COVID-19 Syndrome ("Long COVID") and Diabetes: Challenges in Diagnosis and Manageme nt. *Diabetes and Metabolic Syndrome:*	Sistematic Review, elderly	This research study reviews several articles related to "Post COVID-19 Syndrome and diabetes mellitus in PubMed and Google Scholar.	Elderly with a history of diabetes mellitus will affect the pathophysiological mechanism of Covid-19 and can worsen tachycardia, sarcopenia and microvascular dysfunction in the elderly.
7	James, P. T., Ali, Z., Armitage, A. E., Bonell, A., Cerami, C., Drakesmith, H., Jobe, M., Jones, K. S., Liew, Z., Moore, S. E., Morales-Berstein, F.,	The Role of Nutrition in COVID-19 Susceptibil ity and Severity of	Systematic review on the elderly	This study collects information related to 13 nutritional components and their potential	High doses of micronutrient supplements will prevent severe illness and speed up recovery. In addition, there is strong evidence that prevention of obesity

No	Author	Title	Design & Sample	Intervention	Result
	Nabwera, H. M., Nadjm, B., Pasricha, S. R., Scheelbeek, P., Silver, M. J., Teh, M. R., & Prentice, A. M. (2021). PMCID: PMC8194602 PMID 33982105	Disease: A Systematic Review (James et al., 2021)		interactions with people with COVID-19, obesity, protein energy malnutrition, anemia, vitamins A, C, D, and E; PUFAs; iron; selenium, zinc, antioxidants; and nutritional support.	and type 2 diabetes will reduce the risk of serious COVID-19 outcomes.
8	Chika Horikawa, Rei Aida, Shiro Tanaka, Chiemi Kamada, Sachiko Tanaka, Yukio Yoshimura, Remi Kodera, Kazuya Fujihara, Ryo Kawasaki, Tatsumi Moriya, Hidetoshi Yamashita, Hideki Ito, Hirohito Sone, dan Atsushi Araki Pubmed: https://pubmed.ncbi.nlm.nih.gov/33670045/ DOI: 10.3390/nu13020689 PMID: 33670045 PMCID: PMC7926689	Sodium Intake and Incidence of Diabetes Complications in Elderly Patients with Type 2 Diabetes – Analysis of Data from the Japanese Elderly Diabetes Intervention Study (Horikawa et al., 2021)	This study investigated the association between sodium intake and diabetes complications in a national cohort of elderly Japanese patients with type 2 diabetes mellitus aged 65-85 years. From the data of 912 respondents regarding food intake at the beginning, it was analyzed and assessed by the frequency of the food questionnaire based on food groups.	Sodium Intake and Incidence of Diabetes Complications in Elderly Patients	The primary outcome was time to diabetic retinopathy, manifest nephropathy, cardiovascular disease (CVD) from all causes of death over six years. Researchers found that the average sodium intake in the quartiles ranged from 2.5 grams to 5.9 grams/day. After adjustment for confounders, no significant association was observed between the quartiles of sodium intake and the incidence of diabetes complications and mortality except for a significant trend for an increased risk of diabetic retinopathy (P=0.039), among patients whose vegetable intake was less than a mean of 368.7 grams. The hazard ratios (HR) for diabetic retinopathy in patients in the second, third, and fourth quartile were 0.87 (95% CL, 031–2.41), 2.61(1.00–6.83) and 3.70. (1.37-10.02), respectively. The findings suggest that sodium intake is high.
9	Chen, R., & Chen, G. (2022). https://doi.org/10.1016/j.jfutfo.2022.06.001 https://www.sciencedirect.com/science/arti	Personalized nutrition for people with diabetes	Systematic review, elderly	Reviewing several articles related to diabetes nutrition	Blood glucose levels change in response to the same standard of food in different people. This suggests that interactions of diet,

No	Author	Title	Design & Sample	Intervention	Result
	cle/pii/S2772566922000416	and at risk of diabetes has begun (R. Chen & Chen, 2022)			genome, gut microbiome, gut transit time, insulin sensitivity, cultural, social, and economic factors must be considered to achieve dietary interventions through nutritional integration.
10	Guilherme Pena, Beatrice Kuang, Prue Cowled, Stuart Howell, Joseph Dawson, Ross Philpot, dan Robert Fitridge Pubmed: https://pubmed.ncbi.nlm.nih.gov/31871826/ PMID: 31871826 PMCID: PMC6918841 DOI: 10.1089/wound.2019.0973	Micronutrient Status in Diabetic Patients with Foot Ulcers (Pena et al., 2020)	Approach: A prospective cohort study of diabetic patients with foot ulcers seen in multidisciplinary foot clinics throughout Adelaide or admitted to the Vascular Surgery Unit at Royal Adelaide Hospital between February 2017 and September 2018. A total of 131 patients were included in the study. Serum plasma levels of vitamins A, C, D, and E, copper, zinc, and ferritin were measured. Demographic and clinical data, including BMI,	These studies have shown that micronutrient deficiencies, especially vitamin D, vitamin C, zinc, and vitamin A, are common in diabetic patients with foot ulcers.	The most common nutritional deficiency is vitamin D. affected 55.7% of patients. Suboptimal vitamin C levels affected 73% of patients, consisting of marginal levels at 22.2% and deficiency rates at 50.8%. Zinc deficiency, vitamin A deficiency, and low ferritin levels were found in 26.9%, 10.9%, and 5.9% of patients, respectively. There is no correlation between BMI, grip strength, duration of diabetes, HbA1c, or smoking status with micronutrient deficiencies. Increased severity of diabetic foot disease was associated with lower vitamin C levels ($p = 0.02$).

No	Author	Title	Design & Sample	Intervention	Result
			smoking status, diabetes duration, HbA1c, and WIfI score, were obtained.		
11	Satoru Yamada, Yusuke Kabeya, Hiroshi Noto Pubmed: https://pubmed.ncbi.nlm.nih.gov/30104491/ PMID 20104491 PMCID PMC6116111 DOI: 10.3390/nu10081080	Dietary Approaches Patients with Diabetes: A Systematic Review (Naito et al., 2019)	This study was conducted by searching the MEDLINE, EMBASE and Japan Medical Abstracts Society (JAMAS) databases from baseline to 30 June 2017 identifying studies related to dietary or energy restriction. Exclusion criteria applied in this study: 1) non-Japanese data, 2) non-diabetic patient data, 3) other dietary approaches, 4) unpublished data (including abstracts presented in scientific form only, and 5) studies not suitable for case evaluations and	This study identified related dietary restrictions in people with diabetes mellitus.	286 articles were identified related to dietary energy restriction, which the majority of respondents were with type 2 DM. There were no articles describing side effects of energy restriction. Five articles were excluded from the systematic review because (a) counseling, (b) feeding, and (c) periodization were evaluated under the same level of energy restriction in the three studies; one study assessed the effects of very strict energy restriction during hospitalization (1000 kcal/day); while others did not evaluate the energy restricted diet. After excluding these five studies, the remaining two randomized controlled trials (RCTs) were assessed in our systematic review. The two selected articles were fairly homogeneous in terms of the degree of energy restriction. Both studies adopted a carbohydrate restriction diet as a control group. The sample sizes in these two studies were 24 and 66.

No	Author	Title	Design & Sample	Intervention	Result
			reports. Validity and Quality Assessment based on random sequencing, allocation concealment, blinding of participants, personnel, and assessors; incomplete result data; selective reporting of results; and other sources of bias, according to the recommendations of the Medical Information Service Distribution Network.		
12	Laura Adam, Colleen O'Connor, Alicia C. Garcia Pubmed: https://pubmed.ncbi.nlm.nih.gov/29449096/ PMID 29449096 DOI 10.1016/j.jcjd.2017.11.003	Evaluating the Impact of Diabetes Self-Management Education Methods on Knowledge, Attitude, and Behavior of Patients with Type 2 Diabetes (Evert et al., 2019)	This study used a random method in determining the sample and found 21 respondents who fit the criteria.	The intervention was carried out using a pretest and post-test questionnaire that compared before and after the education session.	Results: Significant differences in changes in knowledge and attitudes scores were observed from primary/early education and after 3 months. Both groups experienced a significant reduction in A1C levels from baseline to 3 months thereafter. The focus groups revealed similar themes for both groups, such as the benefits of early education, the need for lifestyle behavior change and feelings about social support.
13	Emily Burch, Lauren Ball, Mari Somerville, Lauren T Williams PubMed:	Dietary intake by food group of individuals	This study reviews 4 electronic data sources	After screening 13,662 publications, 11 studies	Patients with type 2 diabetes do not follow the recommended food groups as recommended; fruits,

No	Author	Title	Design & Sample	Intervention	Result
	https://pubmed.ncbi.nlm.nih.gov/29329777/ PMID 29329777	with type 2 diabetes mellitus: A systematic review (Burch et al., 2018)	namely MEDLINE, EMBASE, CINAHL and Web of Sciences with samples over the age of 18 years with five main food groups (fruits, vegetables, dairy, grains and meat/meat alternatives).	were included. All research data are cross-sectional.	vegetables, milk and grains.
14	Erika Leung, Supakanya Wongrakpanich, Medha N Munshi (2018) PMID 30140140 PMCID: PMC6092888	Diabetes Management in the Elderly (Leung et al., 2018)	Sistematik review for older people	Reviews of some articles	Counseling to avoid carbohydrate consumption which aims to reduce blood glucose levels and perform sports activities taking into account the patient's physical ability, for example 5-10 minutes or two to three times a day doing leisurely walks.
15	Vincenzo Bellizzi, Patrizia Calella, Julia Nava Hernandez, Veronica Figueroa Gonzalez, Silvia Moran Lira, Serena Torraca, Rocio Urbina Arronte, Pietro Cirillo, Roberto Minutolo, Rafael A Montufar Cardenas PubMed: https://pubmed.ncbi.nlm.nih.gov/29743031/ PMID: 29743031 PMCID: PMC5944089	Safety and effectiveness of low-protein diet supplemented with ketoacids in diabetic patients with chronic kidney disease (Bellizzi et al., 2018)	Prospective study in CKD patients with DM and without DM	This study provides the metabolic and nutritional effects of a low protein (0.5-0.6 g/kg/day), normal energy (30-35 kcal/kg/day) diet supplemented with miracle keto acids (LPD-KA) prospectively. .	In diabetic patients with CKD having a low protein diet supplemented with keto acids will increase uremia and diabetes leading to sudden weight loss.

4. Research Discussion

The main strategies in Diabetes Mellitus:

1. Considering the needs, risks and treatment of people with DM

2. Conduct a comprehensive assessment
3. Monitoring indications for drug and food administration (Sesti et al., 2018)
4. Maintaining health quality (self-care ability, physical and functional status (T. L. Chen et al., 2022)

Nutrition Management For Type 1 And Type 2 Diabetes Mellitus Patients

The average sodium ranges from 2.5 grams to 5.9 grams / day in the intake of vegetables that are safe for consumption in people with Diabetes Mellitus (Horikawa et al., 2021). Adequate fiber intake will cause a feeling of fullness for longer, thereby delaying hunger (Paruntu et al., 2018). Patients with diabetes mellitus need nutritional recommendations that will meet the needs of vitamins, minerals, magnesium, sodium, and iron (Burch et al., 2018; Pena et al., 2020).

Diabetics also provide counseling related to indications and complications of the disease they are suffering from and avoid psychological problems (James et al., 2021; Leung et al., 2018; Naito et al., 2019). Lifestyle changes will affect the behavior and mood of people with diabetes mellitus (García-Molina et al., 2020). Nutrition performed on patients must be individualized by considering eating habits, metabolism, physical activity, and the presence of comorbidities (Tumiwa & Langi, 2013). During the Covid-19 pandemic, nutritional needs are a top priority for comorbidities such as diabetes mellitus (James et al., 2021; Raveendran & Misra, 2021). Several studies say that over the age of 40, DM patients should maintain a healthy lifestyle that can prevent complications of diabetes due to high blood sugar levels. (Masruroh, 2018).

5. Conclusion and Future Research

The conclusion of this article is that nutritional management in diabetes mellitus requires social support that will change the behavior of the patient to pay attention to the intake of nutrients, vitamins, minerals and reduce carbohydrate levels in providing daily food.

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