Journal of Chemical Health Risks

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JCHR (2024) 14(1), 716-728 | ISSN:2251-6727

The Effect of Diabetes Mellitus Sport Application Education on Knowledge of Activities and Stability of Blood Glucose Levels in Diabetes Mellitus Patients

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(Received: 27 October 2023 Revised: 22 November Accepted: 26 December)

KEYWORDS

Diabetes Mellitus, Physical Activity, Educational Media

Abstract

Introduction: Diabetes mellitus (DM) is a chronic disease characterized by increased blood sugar levels (hyperglycemia) and glucose intolerance, which is caused by the pancreas not producing enough insulin or the body not being able to use the insulin it produces effectively. Disturbed insulin production can cause sugar to accumulate in the blood, which can cause various complications and the problem of unstable blood glucose levels often arises in diabetes mellitus. Method: Literature review was carried out based on issues, methodology, equations and research journals. Of the 6 studies used, each used the same research method, namely Quasi-experimental, with a pre and posttest research design with control design. Discussion: The "DM SPORT" application offers features that guide diabetes patients in engaging in physical activity Conclusion: Based on 6 studies, it was found that educational methods greatly influence knowledge of physical activity and blood glucose stability in diabetes patients.

1. INTRODUCTION

Diabetes mellitus (DM) is a chronic disease characterized by increased blood sugar levels (hyperglycemia) and glucose intolerance, resulting from insufficient insulin production by the pancreas or ineffective use of produced insulin by the body. Disturbed insulin production can lead to the accumulation of sugar in the blood, causing various complications. The problem of unstable blood glucose levels is common in diabetes mellitus (Yani, Nurhayani, 2022).

Instability of blood glucose levels is a prevalent issue in diabetes clients, characterized by variations where blood glucose levels deviate from the normal range due to hyperglycemia or hypoglycemia. Symptoms of hypoglycemia include drowsiness, dizziness, and impaired coordination, low glucose levels in the blood or urine, palpitations, hunger, shaking, decreased consciousness, strange behavior, difficulty speaking, and sweating. Hyperglycemia symptoms include palpitations, hunger, high glucose levels in the blood or urine, dry mouth, and increased thirst (SIKI DPP PPNI Working Group Team, 2017).

Fasil (2019) reports that uncontrolled blood sugar levels (hyperglycemia) are the primary cause of DM complications. Hyperglycemia, along with several other risk factors, increases the likelihood of DM complications (Yokobayashi et al., 2017; Zheng et al., 2018). The World Health Organization (WHO) emphasizes physical activity as the most effective tool for preventing DM complications and promoting disease management and a healthy lifestyle (WHO, 2016). Physical activity significantly improves the quality of life for DM sufferers and has economic benefits by preventing disability due to DM (Salas, Bubolz, & Caro, 2017). WHO recommends that DM sufferers engage in physical activity under the supervision of a doctor or other health professional, such as a physiotherapist, who understands health and the principles of physical exercise (WHO, 2018).

Physical activity, also known as sport, involves activities that engage the body's metabolism, requiring energy for muscle contractions and physiological functions (Chen et al., 2015). WHO explains that the effects of sport or physical exercise on the body depend on the intensity and duration of the activity. Recommended exercises for DM patients include aerobic activities like brisk walking,

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jogging, swimming, and cycling, as well as resistance training, such as weight lifting, which enhances muscle strength and size (WHO, 2020). Molecular mechanisms regulating muscle contraction and fibers are influenced by the hormonal system. DM sufferers should differentiate between resistance training and strength training, although there is a continuum between exercise modalities. Regular exercise causes chronic adaptations, increases heart capacity, affects metabolism, and reduces blood sugar levels (Duclos, Virally, & Dejager, 2018). Despite acute metabolic effects largely being insulin-independent, exercise improves muscle insulin sensitivity and is considered a key tool in preventing and treating metabolic disorders (Moghetti et al., 2016). Literature suggests that DM patients with low physical activity levels may experience intramuscular lipid accumulation, damaging muscle mitochondrial cells and leading to muscle weakness or sarcopenia. Lack of activity is also reported as a trigger for the development of diabetic peripheral neuropathy (DPN) (Tuttle et al., 2017).

DM sufferers need physical fitness to avoid DM complications. DM can lead to endothelial dysfunction (changes in endothelial function) in blood vessels, usually caused by high blood sugar levels (Sleath et al., 2016). Regular exercise adapts to the endothelium, thereby reducing DM complications. Maiorana et al. stated that exercise or physical activity can activate Nitric Oxide (NO) as a vasodilator of blood vessels, ensuring organs in the body receive sufficient oxygen and nutrients. For example, endurance exercise carried out for 7 consecutive days (Maiorana et al., 2019).

The American Association recommends aerobic exercise involving various muscle groups for DM sufferers, including gymnastics, cycling, jogging, swimming, walking, tai chi, yoga, balance training, flexibility training, resistance training, and strengthening exercises with or without weights, machines, pendulum load, or elastic rubber (Colberg et al., 2016). Exercise should be done 3-5 times a week, with a maximum of 150-175 minutes per week. However, type 2 DM sufferers are advised to stay active in light daily activities (Colberg et al., 2016).

There are several rules DM sufferers must adhere to when resting at home to avoid the development of DM complications, including reducing sedentary behavior, such as spending too much time watching TV or chatting with family or friends while consuming high glucose items like coffee, tea, and snacks. After sitting for 1 hour, it is recommended that sufferers spend at least 5-15 minutes engaging in light activities for 20-30 minutes, such as walking around the house. Type 2 DM sufferers are advised to remain active and carry out light daily activities, with breaks during the day for rest. The form of exercise can vary based on the different needs of each DM sufferer (Colberg et al., 2016).

For type 1 DM sufferers, there are no specific rules, as it depends on the glucose response, which differs from type 2 DM. In other words, DM patients are advised to exercise 3 times a week, once per session, while paying attention to individual conditions and responses (MacMillan et al., 2017). Examples of exercises include muscle endurance exercises such as push-ups, sit-ups, planks, and squats, performed based on patient tolerance, as well as jogging, cycling, swimming, and others.

Type 1 DM sufferers are highly susceptible to hypoglycemia due to daily insulin consumption. When planning to exercise, insulin medication should be taken 30-60 minutes before, with food intake limited to 10-15 grams of carbohydrates. This has been proven to reduce hypoglycemia by 25-75. If the sufferer wants to eat first, exercise should be done 30-60 minutes after eating. After completing exercise, 30-60 grams of carbohydrates can be consumed (Riddell & Milliken, 2019).

According to the World Health Organization (WHO) in 2021, approximately 422 million people worldwide suffer from diabetes, with the majority residing in low- and middle-income countries. Additionally, 1.5 million deaths are directly attributed to diabetes each year. The number and prevalence of diabetes have continued to increase in recent decades. Countries in the Arab-Northern Africa and West Pacific regions rank first with the highest prevalence of diabetes in individuals aged 20-79 years among the seven regions globally, namely 12.2% and 11.4%. The Southeast Asia region, where Indonesia is located, ranks third with a prevalence of 11.3%. The International Diabetes Federation (IDF) also predicts the number of diabetes sufferers aged 20-79 in several countries worldwide, identifying China, India, and America as the top three with 116 million, 77 million, and 31 million patients, respectively (Ministry of Health of the Republic of Indonesia, 2020).

Indonesia is ranked third among the ten countries with the highest number of sufferers, totaling 10.7 million in 2019. Indonesia is the sole Southeast Asian country on the list, suggesting a significant contribution to diabetes

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cases in Southeast Asia (InfoDatin, 2020). Almost all provinces in Indonesia showed an increase in diabetes cases from 2013 to 2018, except for East Nusa Tenggara province. The four provinces with the highest increase during this period were DI Yogyakarta, DKI Jakarta, North Sulawesi, and East Kalimantan. Some provinces had the highest increase of 0.9%, including Riau, DKI Jakarta, Banten, Gorontalo, and West Papua (Khairani, 2019).

The prevalence of Diabetes Mellitus in South Tangerang City ranks first in the highest cases of diabetes mellitus in Banten Province, with 2,544 diabetes outpatients in South Tangerang City (Riskesdas, 2018). Proper treatment of Diabetes Mellitus is crucial. The management of Diabetes Mellitus can be categorized into five pillars: Education, dietary regulation, physical exercise, pharmacological intervention, and blood sugar checks (Haida, Putri, & Isfandiari, 2013).

Therefore, additional strategies are needed in the form of actions that focus on health problems, such as sports education for DM patients using the "DM Sport" media application, which is a key component of successful diabetes mellitus management. This action is highly appropriate for changing the patient's lifestyle in conducting activities and maintaining stable blood glucose.

The problem formulation in this literature is whether there is an educational effect of the "DM SPORT Application on Knowledge of Activities and Stability of Blood Glucose Levels in Diabetes Mellitus Patients in Tangerang."

The aim of this research is to determine the effect of education using the "DM SPORT Application" on Activity Knowledge and Stability of Blood Glucose Levels in Diabetes Mellitus Patients in Tangerang.

2. METHOD

2.1 Literature Search Strategy

2.1.1 Framework used (PICO)

Framework used Strategy used to search for journal articles using PICO.

1. Problem / population, the problem to be analyzed or population.
2. Intervention, actions taken or management actions for individual cases as well as explanations about management.
3. Comparison, the management used as a comparison.
4. Outcome, results or outcomes obtained in research.

2.1.2 Keywords used

Searching for articles or journals uses keywords and boolean operators (AND, OR NOT) which are used to specify the search, making it easier to determine which article or journal to use. The keywords used in this research are, "diabetes" AND "mellitus" AND "blood glucose stability" AND "sports" AND "application".

2.1.3 Database or search engine used

The data used in this research is secondary data obtained not from direct observation, but obtained from the results of research conducted by previous researchers. Secondary data sources obtained are selected articles or journals with data entered through Google Scholar and Scopus publications.

2.2 Inclusion and Exclusion Criteria.

Table 1. PICO format in literature review

Criteria	Inclusion	Exclusion
Population	DM patient	Apart from DM patients
Intervention	DM Sport	Apart from DM Sport
Comparison	-	-
Outcome	Improved knowledge and blood glucose stability	There was no improvement in knowledge and blood glucose stability
Study Design	one group pre and posttest design	-

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Publication Year	2018 – 2023	< 2018	
Language	English and Indonesian	Besides Language and Indonesian	English

2.3 Study Selection

Based on the results of literature searches through publications in the Google Scholar database and using predetermined keywords, researchers found 1500 journals that matched the keywords. The search results that have been obtained are then checked for identification of literature data via Google Scholar N1500 Data. Data selected based on inclusion and exclusion criteria n=6 Articles that can be downloaded n=1000 Data not in accordance with inclusion and exclusion criteria n=398, Cannot be downloaded n=102 Articles included in the literature study n=4. Meanwhile, the results of literature searches through publications in the Scopus database and using predetermined keywords, researchers found 280 journals that matched the keywords. The researcher then carried out a selection based on the inclusion and exclusion criteria, the researcher got 276 journals that did not meet the 4 inclusion and exclusion criteria and journals that fit the inclusion and exclusion criteria, then the journals could not be downloaded so the remaining 2 journals were taken, then the 2 journals that were included were taken into literature studies.

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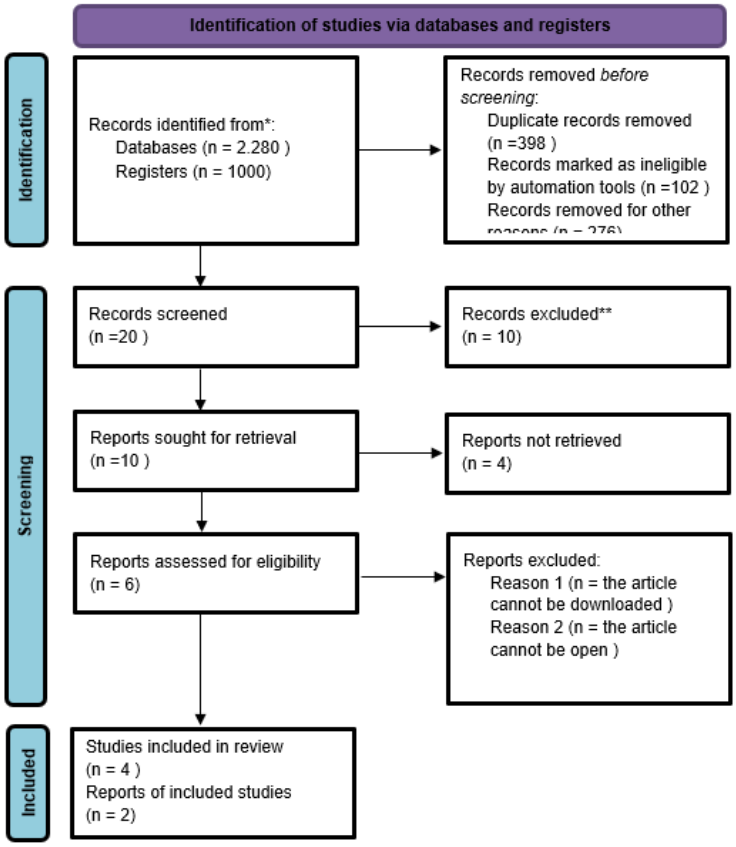

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

2.4 Critically review the selected journals

Table 1. Literature Search Results

No.	Title, Author Name, Year	Types of Research	Population/Number of Samples	Results
1.	**A sports and health application for patients with type 1 diabetes mellitus -An end-user survey on expectations and requirements (Roman Holze et,.al 2022)**	The type of research conducted is a quantitative survey	167 respondent.	The main features/aspects identified as "somewhat important" or "very important" by over 75% of respondents are: 1. Data security (96.4%) 2. Further integration of health data (e.g., heart rate, step count, calories) from other installed applications on their smartphones (92.2%) 3. Automatic import of glucose data from other applications (91.6%) 4. Individual target settings (87.4%) 5. Alerts about abnormal glucose levels (82.6%) 6. Alerts about other abnormal health data (81.4%)

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				7. Journaling function (81.4%) 8. Daily diary function (80.8%) 9. Information about exercise sessions post-workout (80.8%) 10. Displaying/processing additional fitness variables (such as heart rate, step count, etc.) from wearable health-related devices (77.8%).
2.	**Peningkatan Pengetahuan Tentang Cara Melakukan Olahraga yang Aman Bagi Penderita Diabetes Melitus (Dwi&Arif, 2022)**	The type of analytical research that is quasi-experimental in nature is the one-group pre-test-post-test design, with sample selection conducted through purposive sampling.	60 respondent	There is an increase in the percentage of participants in the counseling session who scored above 80 or fell into the "very understanding" category in answering the questionnaire, rising from 13.3% to 38.4%. Meanwhile, participants with a knowledge level categorized as "not understanding" decreased from 78.3% to 38.4%.
3.	**MyDi application: Towards automatic activity annotation of young patients with Type 1 diabetes (Lucia, Moccia et.al, 2019)**	No information provided	Adolescents with T1DM	This work presents the MyDi framework that integrates the MyDi smartphone application with the VGG16 CNN to support young adults with diabetes in automating the annotation process of activities. Therefore, this system does not require patients to keep daily glycemic records but directly classifies their activities based on images. Encouraging results were achieved for the considered dataset and two classes (i.e., food and exercise).
4.	**Knowledge of dm sufferers about physical activity at the Binjai pepper garden health center (Simanullang, Detty et.al, 2023).**	Quasi-experimental, with a pre-and post-test design incorporating a control group. .	30 respondent	The results of this study indicate that among diabetes mellitus patients at Kebun Lada Binjai Health Center, 5 individuals (16.7%) have good knowledge, 15 individuals (50.0%) have moderate knowledge, and 10 individuals (33.3%) have poor knowledge. The conclusion of this study is that the majority of diabetes mellitus patients have moderate knowledge, with 15 individuals (50.0%).
5.	**The Influence of Diabetes Exercise on Blood Sugar Levels in Type 2 Diabetes Mellitus Patients (Dahlan, Rini et.al, 2023).**	One Group Pretest Posttest Design Method, with Cross Sectional Approach	37 respondent	The research results indicate that the blood sugar levels before performing diabetes exercise, for 30 respondents (81.0%), had a mean value of 203.03 with a standard deviation of 42.094. After diabetes exercise, for 15 respondents (40.5%), the mean blood sugar level was 178.92 with a standard deviation of 33.446. The Paired Sample t-test

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				resulted in a p-value of 0.00, and the alternative hypothesis (H1) is accepted. The study concludes that diabetes exercise has a significant effect on reducing blood sugar levels in type 2 diabetes mellitus patients.
6.	**The Influence of Walking Physical Activity on Type 2 Diabetes Mellitus Patients on Blood Sugar Stability (Sri,Jumiarsih et.al, 2022).**	Quasi-experiment, with a pre-and post-test design incorporating a control group.	10 respondent	The research results indicate that there is a change in blood sugar levels in all diabetes patients who were subjects after the treatment. Based on the Wilcoxon test, it is proven that the alternative hypothesis (Ha) is accepted, indicating that walking physical activity significantly affects the blood sugar stability of individuals with diabetes mellitus.

2.5 Critical Appraisal

2.5.1 Journal: "A sports and health application for patients with type 1 diabetes mellitus - An end-user survey on expectations and requirements" (Holze et al., 2022):

1. Is it clear in the study what is the ‘cause’ and what is the ‘effect’?

Yes. This study addresses user expectations and requirements for health and exercise applications for type 1 diabetes patients.

2. Were the participants included in any comparisons similar?

Yes. Participants had similar expectations and requirements for health and exercise applications.

3. Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?

Yes. All participants discussed health and exercise apps but did not receive direct intervention.

4. Was there a control group?

No. This study was more exploratory and did not involve a control group.

5. Were there multiple measurements of the outcome both pre and post the intervention/exposure?

Not applicable, as this is a user opinion survey.

6. Was follow-up complete, and if not, were differences between groups in terms of their follow-up adequately described and analyzed?

Not applicable, as this is a user opinion survey.

7. Were the outcomes of participants included in any comparisons measured in the same way?

Yes. The survey was administered in a consistent manner to all participants.

8. Were outcomes measured in a reliable way?

Yes. Surveys are conducted systematically and reliably to measure user expectations and requirements.

9. Was appropriate statistical analysis used?

Not applicable, as this is a survey and not experimental research.

2.5.2 Journal: "Increasing Knowledge About How to Exercise Safely for Diabetes Mellitus Sufferers" (Dwi & Arif, 2022):

1. Is it clear in the study what is the ‘cause’ and what is the ‘effect’?

Yes. This research focuses on increasing participants' knowledge about how to do exercise safely.

2. Were the participants included in any comparisons similar?

Yes. Participants had similar characteristics before and after the intervention.

3. Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?

Yes. All participants received the same intervention in the form of increasing knowledge.

4. Was there a control group?

No. This study is more descriptive and does not involve a control group.

5. Were there multiple measurements of the outcome both pre and post the intervention/exposure?

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Yes. Participants' knowledge was measured before and after the intervention.
6. Was follow-up complete, and if not, were differences between groups in terms of their follow-up adequately described and analyzed?
Not applicable, as this was a cross-sectional study without a control group.
7. Were the outcomes of participants included in any comparisons measured in the same way?
Yes. Participants' knowledge was measured in a consistent manner.
8. Were outcomes measured in a reliable way?
Yes. Knowledge measurement is carried out using reliable methods.
9. Was appropriate statistical analysis used?

2.5.3 Journal: "MyDi application: Towards automatic activity annotation of young patients with Type 1 diabetes" (Lucia, Moccia et al., 2019):
1. Is it clear in the study what is the 'cause' and what is the 'effect'?
Yes. This study focuses on developing the MyDi application for automating activity annotation in type 1 diabetes patients.
2. Were the participants included in any comparisons similar?
Yes. Participants have similar characteristics in the context of MyDi application development.
3. Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?
Yes. Participants received similar care as type 1 diabetes patients, but the focus of the study 4. was more on technology development.
4. Was there a control group?
No. This study is more exploratory and technological development in nature, not an experiment with a control group.
5. Were there multiple measurements of the outcome both pre and post the intervention/exposure?
Not applicable because this is a technology development study.
6. Was follow-up complete, and if not, were differences between groups in terms of their follow-up adequately described and analyzed?
Not applicable as this is a technology development study without a control group.
7. Were the outcomes of participants included in any comparisons measured in the same way?
Yes. Despite the focus on technological development, activity measurement is carried out uniformly.
8. Were outcomes measured in a reliable way?
Yes. Activity measurement uses technology and methods that are considered reliable.
9. Was appropriate statistical analysis used?
Not applicable as this is a technology development study without specific statistical analysis.

2.5.4 Journal: "Knowledge of DM sufferers about physical activity at the Binjai Pepper Garden Community Health Center" (Simanullang, Detty et al., 2023):
1. Is it clear in the study what is the 'cause' and what is the 'effect'?
Yes. This study evaluated diabetes sufferers' knowledge about physical activity.
2. Were the participants included in any comparisons similar?
Yes. Participants had similar characteristics as diabetes sufferers at the Kebun Lada Binjai Health Center.
3. Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?
Yes. Participants received similar care as diabetics at community health centers.
4. Was there a control group?
No. This study is more descriptive and does not involve a control group.
5. Were there multiple measurements of the outcome both pre and post the intervention/exposure?
Not applicable, as this was a cross-sectional study without a control group.
6. Was follow-up complete, and if not, were differences between groups in terms of their follow-up adequately described and analyzed?
Not applicable, as this was a cross-sectional study without a control group.
7. Were the outcomes of participants included in any comparisons measured in the same way?
Yes. Knowledge of diabetes sufferers was measured uniformly.
8. Were outcomes measured in a reliable way?
Yes. Knowledge measurement is carried out using methods that are considered reliable.
9. Was appropriate statistical analysis used?

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No. The statistical analysis used is limited to descriptive data presentation.

2.5.5 Journal: "The effect of diabetes exercise on blood sugar levels in patients with type 2 diabetes mellitus" (Dahlan, Rini et al., 2023):

1. Is it clear in the study what is the 'cause' and what is the 'effect'?

Yes. This study evaluated the effect of diabetes exercise on reducing blood sugar levels in patients with type 2 diabetes mellitus.

2. Were the participants included in any comparisons similar?

Yes. Participants had similar characteristics as people with type 2 diabetes mellitus.

3. Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?

Yes. Participants engaged in a diabetes exercise program but did not receive different additional treatments or interventions.

4. Was there a control group?

Yes. This study involved a control group who were not involved in the diabetes exercise program.

5. Were there multiple measurements of the outcome both pre and post the intervention/exposure?

Yes. Blood sugar levels were measured before and after diabetes exercise.

6. Was follow-up complete, and if not, were differences between groups in terms of their follow-up adequately described and analyzed?

Not entirely clear. This study did not provide detailed information on the completeness of follow-up.

7. Were the outcomes of participants included in any comparisons measured in the same way?

Yes. Blood sugar levels are measured using a uniform method.

8. Were outcomes measured in a reliable way?

Yes. Blood sugar levels are measured using methods that are considered reliable.

9. Was appropriate statistical analysis used?

Yes. Statistical analysis, such as the paired sample t-test, was used to evaluate differences before and after intervention.

6. Journal: "The Effect of Walking Physical Activity in People with Type 2 Diabetes Mellitus on Blood Sugar Stability" (Sri, Juniarsih et al., 2022):

1. Is it clear in the study what is the 'cause' and what is the 'effect'?

Yes. This study evaluated the effect of walking physical activity on the stability of blood sugar in people with type 2 diabetes mellitus.

2. Were the participants included in any comparisons similar?

Yes. Participants had similar characteristics as people with type 2 diabetes mellitus.

3. Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?

Yes. Participants engaged in the physical activity of walking but did not receive any additional treatment or intervention.

4. Was there a control group?

Yes. This study involved a control group who did not engage in the physical activity of walking.

5. Were there multiple measurements of the outcome both pre and post the intervention/exposure?

Yes. Blood sugar levels were measured before and after treatment.

6. Was follow-up complete, and if not, were differences between groups in terms of their follow-up adequately described and analyzed?

Yes. This study involved Wilcoxon analysis to evaluate changes in blood sugar levels after treatment.

7. Were the outcomes of participants included in any comparisons measured in the same way?

Yes. Blood sugar levels are measured using a uniform method.

8. Were outcomes measured in a reliable way?

Yes. Blood sugar levels are measured using methods that are considered reliable.

9. Was appropriate statistical analysis used?

Yes. Statistical analysis, such as the Wilcoxon test, is used to evaluate changes in blood sugar levels after treatment.

3. RESULTS

3.1 Education on the "DM SPORT" Application as a Guide to Physical Activity

The "DM SPORT" application (Holze et al., 2022) offers features that guide diabetes patients in engaging in physical activity. Individual target setting, diary function, and information about exercise sessions can help patients understand and undergo diabetes exercise in a targeted manner.

3.2 Increasing Knowledge through Education

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Education through the "DM SPORT" application (Dwi & Arif, 2022) has been proven to increase participants' knowledge about safe sports. Improved knowledge can provide a stronger basis for patients in adopting and implementing a diabetes exercise program correctly.

3.3 Utilization of Technology for Activity Monitoring

Technology integration, such as the MyDi application (Lucia, Moccia et al., 2019), can help automate monitoring of diabetes patient activities. This monitoring provides accurate information about activity patterns, including the effects of exercise, which can help patients and healthcare professionals optimize diabetes management.

3.4 Effect of Diabetes Exercise on Blood Sugar Levels

Findings from research by Dahlan et al. (2023) show that diabetes exercise has a positive impact on reducing blood sugar levels in type 2 DM patients. Physical activity during exercise increases glucose use by muscles, helping to control blood sugar levels.

3.5 The Effect of Walking Physical Activity on Blood Sugar Stability

Journal by Sri, Jumiarsih et al. (2022) provides additional support by showing that physical activity in the form of walking has a significant effect on the stability of blood sugar in people with diabetes mellitus. This confirms that exercise such as walking can be an integral part of diabetes management.

3.6 Community Health Center Education to Increase Knowledge

Research by Simanullang et al. (2023) indicated that education at community health centers contributed to increasing knowledge of diabetes sufferers about physical activity. Such education can provide a strong foundation for patients to engage in diabetes exercise as part of their diabetes management routine.

Based on the results of previous research findings, a deep understanding can be gained that diabetes exercise is not just physical activity but is an integral component of a holistic diabetes management approach. Strong support comes from various aspects, including application education, technology integration, and knowledge gained through outreach programs at community health centers. All of this together forms a solid foundation, providing a platform to motivate, guide, and improve the quality of life of diabetes patients through the adoption and practice of exercise as an effective strategy to manage and improve their blood glucose stability.

a) Education Application "DM SPORT"
   The "DM SPORT" application provides tools that not only provide information but also help patients plan and involve themselves in a targeted diabetes exercise program. Features such as individual target setting and the diary function provide much-needed guidance.
b) Technology Integration in Activity Monitoring
   Technology integration, such as the MyDi application, reflects the trend of progress in monitoring diabetes patient activity. Automatic information about physical activity provides more accurate and reliable data, providing a better understanding of the impact of exercise on blood glucose stability.
c) Knowledge from the Extension Program at the Community Health Center
   Extension programs at community health centers, as recorded in research by Simanullang et al. (2023), increase diabetes patients' knowledge about physical activity. This creates the necessary foundation to encourage active participation in diabetes exercise, along with increasing understanding of its benefits.

By bringing these approaches together, patients not only have a better understanding of the importance of exercise in diabetes management but also have practical tools (via apps) and technological support to help them engage effectively. Therefore, exercise is not just a physical routine but part of a comprehensive lifestyle change, supporting increased blood glucose stability and overall well-being in diabetes patients.

4. DISCUSSION

Setting strict criteria for methods greatly influences the number of articles obtained. Determining the articles to be taken was initially done by entering all the words contained in the literature review and then searching using Google Scholar and Scopus. After seeing that the number of articles obtained was limited, the criteria for selecting articles were then specific to the last 5 years.

Because the results obtained are still too many to determine, then the results obtained after being specified in the last 5 years are taken and analyzed which ones meet the inclusion criteria and can be used as articles that will be used by referring to articles related to the influence of the use of educational media on Diet knowledge and blood glucose stability in diabetes mellitus patients. After lowering the criteria in the form of research methods, finally, there were 6 articles.

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First article:
The research results show that the key features/aspects identified as “somewhat important”/”very important” by over 75% of respondents were: data security (96.4%), further integration of health data (e.g., heart rate, number of steps, calories) from other apps already installed on their smartphone (92.2%), automatic import of glucose data from other apps (91.6%), setting individual targets (87.4%), alerts about abnormal glucose levels (82.6%), alerts about other abnormal health data (81.4%), diary function (81.4%), diary function (80.8%), information about the session workout after workout (80.8%), and displays/processes further fitness variables (such as heart rate, count steps, etc.) from other health-related wearable device systems (77.8%).
Second article:
The research results show that there is an increase in the percentage of counseling participants who get a score in answering questions in the questionnaire, increasing from 13.3% with a score above 80 or the very understand category. Participants with a level of knowledge in the "don't understand" category decreased from 78.3% to 38.4%.
Third article:
The research results present the MyDi framework that combines the MyDi smartphone application with the VGG16 CNN to support young adults with diabetes in automating the activity annotation process. Therefore, this system does not force patients to keep a glycemic diary but directly classifies their activities based on the images. Encouraging results were achieved for the data set and the two classes considered (i.e., food and exercise).
Fourth article:
The research results show that 5 people (16.7%) had good knowledge of DM sufferers at Kebun Lada Binjai Community Health Center, 15 people had sufficient knowledge (50.0%), 10 people had poor knowledge (33.3%). The conclusion of this research is that the majority of DM sufferers have sufficient knowledge, 15 people (50.0%).
Fifth article:
The results of the research show that the blood sugar level before doing diabetes exercise was 30 respondents (81.0%), the mean value was 203.03 with a standard deviation of 42,094, and the blood sugar level after diabetes exercise was 15 respondents (40.5%), the mean value was 178.92 with a standard deviation of 33,446. The results of the Paired sample t-test obtained value p value = 0.00. H1 is accepted. Research concludes that diabetes exercise is very influential in reducing blood sugar levels in type 2 DM patients.
Sixth article:
The results of the research showed that there was a change in blood sugar levels in all people with diabetes who were subjects after treatment. Based on the Wilcoxon test, it is proven that Ha is acceptable, which indicates that the physical activity of walking has a significant effect on the stability of blood sugar in people with diabetes mellitus.

CONCLUSION

The results of this literature review show that educational media for diabetes patients influences the level of knowledge, and physical activity can stabilize blood glucose levels. This is proven by the general research results stating that educational media can increase knowledge, and physical activity can stabilize glucose levels.

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