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Original Article

Effectiveness of DM Smart Ludo Educational Media on Knowledge and Blood Sugar Control in T2DM Patients in the Working Area of North Polombangkeng Health Center, Takalar Regency

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ABSTRACT

This study aimed to assess the effectiveness of DM Smart Ludo educational gaming media on knowledge and blood sugar control in type 2 diabetes mellitus (T2DM) patients in the working area of the North Polombangkeng Health Center, Takalar Regency, Indonesia. The research employed a quantitative, pre-experimental one-group pre-post test design with 33 T2DM patients selected through accidental sampling. Data were collected using a standardized questionnaire for knowledge assessment and observation sheets coupled with blood glucose level measurements for evaluating blood sugar control. The Wilcoxon test was used for statistical analysis with a significance level of $p<0.05$. The results showed a significant improvement in knowledge after the intervention, with the average score increasing from 6.52 to 12.06 ($p=0.000$). Blood sugar control also improved significantly, with the average blood glucose level decreasing from 287.30 mg/dL before the intervention to 214.09 mg/dL in the fourth week post-intervention ($p=0.000$). The percentage of respondents with normal blood sugar levels increased from 12.1% pre-intervention to 57.6% in the fourth week. In conclusion, the DM Smart Ludo educational gaming media significantly improved knowledge and blood sugar control in T2DM patients, highlighting the potential of game-based interventions in diabetes management. Further research with larger sample sizes and longer durations is recommended to confirm these findings.

INTRODUCTION

Diabetes Mellitus, as defined by the World Health Organization (WHO), is a group of metabolic disorders characterized by hyperglycemia caused by defects in insulin secretion, insulin action, or both.[1] According to the World Health Organization (WHO), the number of T2DM patients in Indonesia is projected to increase from 8.4 million in 2000 to approximately 21.3 million by 2030. Similarly, the International Diabetes Federation (IDF) predicts that the number of diabetes patients in Indonesia will rise from 10.7 million in 2019 to 13.7 million by 2030.[2]

According to the International Diabetes Federation (IDF) Atlas, a large number of people worldwide between the ages of 20 and 79 have diabetes. In 2021, it was estimated that 10.5%, or 536.6 million people, were living with diabetes, and this figure is expected to increase to 12.2%, or 783.2 million people, by 2045. Diabetes is commonly found in men and women aged 75 to 79. Between 2021 and 2045, the prevalence of diabetes is expected to rise more significantly in middle-income countries (21.1%) compared to high-income (12.2%) and low-income countries (11.9%). Additionally, the prevalence is projected to be higher in urban areas (12.1%) compared to rural areas (8.3%).[3,4]

Among the seven regions of the world, the North Africa-Middle East and Western Pacific regions rank first and second in terms of the highest diabetes prevalence among people aged 20 to 79, with rates of 12.2% and 11.45%, respectively. Additionally, the IDF estimates the number of people with diabetes in the 20 to 79 age group across several countries and has identified ten countries with the highest mortality rates from diabetes[5]. According to the 2021 IDF report, China, India, Pakistan, and the United States rank in the top four with the highest number of diabetes cases, at 140.9 million, 74.2 million, 33 million, and 32.2 million, respectively. Indonesia ranks 5th with 19.5 million diabetes cases.[3]

The 2018 Basic Health Research (RISKESDAS) results showed that the prevalence of diabetes mellitus in Indonesia, based on doctor diagnoses for individuals over 15 years old, was 2%. This figure is higher than the 2013 RISKESDAS results, which recorded 1.5% in the same age group. However, the prevalence of diabetes mellitus based on blood sugar tests increased from 6.9% in 2013 to 8.5% in 2014 (according to the 2011 Perkeni Consensus, DM occurs in people over 15 years old), and to 10.9% in 2018 (according to the 2015 Perkeni Consensus, DM also occurs in people over 15 years old). Between 2013 and 2018, almost all provinces saw an increase in prevalence, except for East Nusa Tenggara. Several provinces with the highest increases in prevalence were DKI Jakarta (3.4%), North Sulawesi (2.6%), and East Kalimantan (3.1%). South Sulawesi ranked seventh in Indonesia with a DM prevalence of 1.3%.

The data indicate that diabetes mellitus is one of the four non-communicable diseases responsible for 60% of deaths (South Sulawesi Health Office, 2020). Makassar City ranked first with 27,004 DM cases. According to information from the Takalar District Health Office (2022), the number of DM patients in the working areas of the following health centers was as follows: Pattalassang Health Center 21.7%, South Polombangkeng Health Center 5.3%, North Polombangkeng Health Center 18.8%, Ko'mara Health Center 4%, Mangarabombang Health Center 9.7%, Bulukunyi Health Center 11.4%, Mappakasunggu Health Center 3.7%, Pattopakang Health Center 5.2%, Sanrobone Health Center 2.9%, Bontomarannu Health Center 1.5%, Bontokassi Health Center 0.9%, Aeng Toa Health Center 2.2%, Galesong Health Center 5.5%, North Galesong Health Center 5.2%, Bontongape Health Center 1.3%, and Tana Keke Health Center 0.7%[6].

An increase in blood sugar levels caused by a decrease in insulin secretion by the pancreas leads to type 2 diabetes mellitus (T2DM).[5] If left untreated, it can lead to complications. T2DM can be prevented, slowed down, or delayed by controlling blood glucose levels through both pharmacological and non-pharmacological methods.[7]

Recent studies show that one of the main causes of the high number of T2DM cases is the lack of knowledge and education about the disease[8,9]. Effective management of diabetes is essential to prevent complications. One key aspect is blood sugar control, which is crucial for T2DM patients as it determines the appropriate medical treatment[10]. Patients are expected to understand diabetes mellitus through education and counseling.[11] Diabetes education can be provided to individuals with diabetes mellitus and their family members through face-to-face sessions, supported by materials or media such as leaflets. A study conducted by Ikhsan and Mulia Putra (2022), using a quasi-experimental design on DM patients aged 22-55 years, found significant results regarding knowledge of blood sugar control, indicating an effect after the intervention was given.[12]

Games can serve as a tool to help improve cognitive knowledge in the elderly. A study by Ayuni, Yenni, and Audiva (2022) using board games in a quasi-experimental design showed that the average cognitive function score before the intervention was 1.25, and after the intervention, it increased to 2.44. A p-value of 0.000 indicates a significant difference in cognitive function before and after the intervention[13]. A recent study in Indonesia by Uswatun Hasanah, Rica Wijayanti, and Metty Liesdiani (2020) showed that using Ludo games can help improve a person's knowledge. The study, using the Teams Games Tournament (TGT) method, was conducted on 10th-grade students with a quantitative descriptive approach. The results indicated a positive effect on increasing students' knowledge through learning methods using Ludo game media[14]. Furthermore, a study by Desna Kore, Rosita Wondal, and Rita Samad (2020), which conducted a literature review, found that using Ludo games as a learning method for children aged 5-6 years had a positive effect in helping to develop their cognitive abilities[15].

The Ludo game is well-designed and easy to understand. In this study, the Ludo game has been modified into the DM Smart Ludo game to improve knowledge and blood sugar control, specifically to enhance the cognitive knowledge of T2DM patients. The DM Smart Ludo game has been designed with content about the concept of diabetes mellitus embedded within the game, which will be examined in this study. However, previous research using Ludo games as a medium, especially for T2DM patients, is rare. Therefore, the researcher is interested in conducting a study using the DM Smart Ludo game to improve knowledge and blood sugar control in elderly individuals with diabetes mellitus.

The difference between this research and previous studies is that most studies using Ludo games as a medium have been conducted with children, adolescents, and young adults. Studies involving elderly individuals, particularly those with diabetes mellitus, are rare or have seldom focused on this group. Based on the theories and prevalence mentioned above, this study aims to determine the effectiveness of the DM Smart Ludo educational gaming media on knowledge and blood sugar control in T2DM patients in the working area of North Polombangkeng Health Center, Takalar Regency.

METHODS

The research employed a quantitative, pre-experimental one-group pre-post test design to explore the impact of DM Smart Ludo Gaming media on the knowledge and blood sugar control of T2DM patients. This design identifies cause-and-effect relationships by observing changes before and after an intervention within the same group of subjects. Data collection involved multiple-choice questionnaires for knowledge assessment and observation sheets coupled with blood glucose level (GDS) measurements for evaluating blood sugar control.[16,17]

The population consisted of all T2DM patients treated at the North Polombangkeng Health Center, with a sample size of 33 respondents selected through accidental sampling. While this sampling method offers convenience, its limitations, such as potential biases and lack of representativeness, should be noted. It was chosen in this study due to the availability of respondents at the research site. Addressing these limitations with justification strengthens the study's methodology.[18]

Validation and reliability of the instruments used (questionnaires and GDS measurements) were not described, leaving potential gaps in assessing the consistency and accuracy of the results. Future studies should ensure these tools are validated and reliable to enhance the credibility of the findings. Additionally, the statistical analysis was conducted using the Wilcoxon test, chosen for its appropriateness in analyzing paired non-parametric data, which aligns with the study’s design. Providing more details on the rationale for selecting this test would offer greater clarity on its suitability for the research objectives.

RESULTS

The focus of the study was in the working area of the North Polombangkeng Health Center in Takalar Regency, conducted from June to July 2023, with a total of 33 respondents. Data collection was carried out through the completion of questionnaires. The description begins with a univariate analysis to describe the respondents' characteristics, while the bivariate analysis examines the relationship between the dependent and independent variables.

Table 1. Characteristics of Respondents in the North Polombangkeng Health Center Work Area

Respondent characteristics	n	%
Age		
45-50 Years	10	30.0
51-60 Years	16	48.5
61-65 Years	17	21.2
Gender		
Male	4	12.1
Female	29	87.9
Education		
Did not finish elementary school	4	12.1
Elementary school	7	21.2
Junior high school	11	33.3
High school	11	33.3
Occupation		
Not Working	1	3.0
Farmer	2	6.1
Self-Employed	3	9.1
Housewife	27	81.8
DM History		
Yes	14	42.2
No	19	57.6
Duration of DM Suffering		
< 5 Years	17	51.5
≥ 5 Years	16	48.5

Based on Table 1 above, it shows that out of 33 respondents, 10 respondents (30.3%) were aged 45-50, 16 respondents (48.5%) were aged 51-60, and 7 respondents (21.2%) were aged 61-65. In terms of gender, 29 respondents (87.9%) were female, and 4 respondents (12.1%) were male. For education, the majority of respondents had a junior high school (SMP) and high school (SMA) education, with 11 respondents (33.3%) in each category. The majority of respondents worked as housewives (IRT), accounting for 27 respondents (81.8%). Most respondents had no family history of T2DM, with 19 respondents (57.6%), while 17 respondents (51.6%) had been suffering from diabetes for less than 5 years, and 16 respondents (48.5%) had been suffering for more than 5 years.

Table 2. Frequency distribution of respondents based on pre- and post-intervention knowledge of type 2 diabetes mellitus

Group	Knowledge					
	Good		not enough		Total	
	n	%	n	%	n	%
Pre Intervention	2	6.1	31	93.9	33	100
Post Intervention	30	90.9	3	9.1	33	100

Out of the 33 survey respondents, as shown in Table 5.2, there was an increase in good knowledge after the intervention, with 30 respondents (90.9%) demonstrating good knowledge, compared to only 2 respondents (6.1%) before the intervention.

Table 3. Frequency Distribution of Respondents Based on Pre- and Post-Intervention Blood Sugar Control in Type 2 Diabetes Mellitus

Group	Blood Sugar Value					
	Normal		Abnormal		Total	
	n	%	n	%	n	%
Pre Intervention	4	12.1	29	87.9	33	100
Post Sunday Intervention 1	14	42.4	19	57.6	33	100
Post Sunday Intervention 2	17	51.5	16	48.5	33	100
Post Sunday Intervention 3	20	60.6	13	39.4	33	100
Post Sunday Intervention 4	19	57.6	14	42.4	33	100

Based on Table 3, it can be seen that out of 33 respondents, 4 (12.1%) had normal blood sugar levels before the intervention. After the first week of the intervention, the number of respondents with normal blood sugar levels increased to 14 (42.4%). In the second week, the number of respondents with normal blood sugar levels further increased to 17 (51.5%). In the third week, 20 respondents (60.6%) had normal blood sugar levels, and in the fourth week, the number slightly decreased to 19 (57.6%).

Table 4. Blood Sugar Control Status After Smart Ludo Gaming DM Intervention

Blood Sugar Value	n	%
Post Intervention Week 1		
Increase	13	39.4
Decrease	20	60.6
Post Intervention Week 2		
Increase	11	33.3
Decrease	22	66.7
Post Intervention Week 3		
Increase	16	48.5
Decrease	17	51.5
Post Intervention Week 4		
Increase	9	27.3
Decrease	24	72.7

Based on Table 4, it can be seen that out of 33 respondents, the status of blood sugar levels (GDS) after the intervention showed an increase in 13 respondents (39.4%) and a decrease in 20 respondents (60.6%) during the first week. In the second week, 11 respondents (33.3%) experienced an increase in GDS, while 22 respondents (66.7%) experienced a decrease. In the third week, 16 respondents (48.5%) showed an increase in GDS, and 17 respondents (51.5%) showed a decrease. In the fourth week, 9 respondents (27.3%) experienced an increase in GDS, while 24 respondents (72.7%) experienced a decrease.

Table 5. Analysis of the Differences in Providing Smart DM Ludo Gaming Educational Media on Knowledge

Knowledge	n	Mean	Std. Deviation	Std. Error Mean
Pre Intervention	33	6.52	1.679	0.292
Post Intervention	33	12.06	1.749	0.304

Based on Table 5, out of 33 respondents observed during the pre-intervention phase, the average (mean) of good knowledge before the intervention was 6.52, with 2 respondents demonstrating good knowledge. There was an increase in good knowledge after the intervention using the Ludo Smart DM game, with an average post-intervention knowledge score of 12.06 from 30 respondents.

Table 6. Analysis of the influence of providing educational media for smart DM Ludo Gaming on knowledge

Knowledge	n	Mean	Std. Deviation	Std. Error Mean	ρ. Value
Pre-Post Intervention	33	5.545	1.543	0.269	0,000

*Uji Wilcoxon

The results of the Wilcoxon test analysis show that the average difference between pre-intervention and post-intervention was 5.545. This indicates an increase in knowledge after the intervention, where the value of ρ = 0.000 < α = 0.05, meaning there is a significant effect of the Ludo Smart DM game education on the knowledge of patients with type 2 diabetes (DMT2) in the Polombang Utara Health Center area, Takalar Regency.

Table 7. Analysis of the Differences in Providing Smart DM Ludo Gaming Educational Media on Blood Sugar Control

Blood Sugar Value	n	Mean	Std. Deviation	Std. Error Mean
Pre Intervention	33	287.30	95.206	16.573
Post Week 1 Intervention	33	248.70	86.331	15.028
Post Week 2 Intervention	33	215.33	62.735	10.921
Post Week 3 Intervention	33	215.18	58.924	10.257
Post Week 4 Intervention	33	214.09	80.583	14.028

Based on Table 7, out of 33 respondents observed before the intervention, the average (mean) blood sugar level before the intervention was 287.30. After the first week of the intervention, the average blood sugar level was 248.70, indicating a decrease in GDS in 20 respondents. In the second week, the average blood sugar level after the intervention was 215.33, showing a decrease in GDS in 22 respondents. In the third week, the average blood sugar level was 215.18, indicating a decrease in GDS in 17 respondents. Finally, in the fourth week, the average blood sugar level was 214.09, reflecting a decrease in GDS in 24 respondents after the intervention with the Ludo Smart DM game.

Table 8. Analysis of the effect of providing Smart Ludo Gaming DM Educational Media on Blood Sugar Control

Blood Sugar Value	n	Mean	Std. Deviation	Std. Error Mean	ρ. Value
Pre-Post Intervention	33	73.212	95.575	16.638	0,000

*Uji Wilcoxon

The results of the Wilcoxon test analysis show that the average difference between pre-intervention and post-intervention was 73.212. This indicates a decrease in blood sugar levels (GDS) after the intervention, where the value of ρ = 0.000 < α = 0.05, meaning there is a significant effect of

the Ludo Smart DM game education on blood sugar control in patients with type 2 diabetes (DMT2) in the Polombang Utara Health Center area, Takalar Regency.

DISCUSSION

Knowledge

This study demonstrates that the method used to improve knowledge is through gameplay, where the game chosen as the educational medium is Ludo, aimed at increasing the knowledge of T2DM patients. The analysis of the data regarding the differences before and after the intervention with the DM Smart Ludo Educational Game shows that out of 33 respondents, the average (mean) knowledge score before the intervention was 6.52, with 2 respondents having good knowledge, while the average score after the intervention increased to 12.06, with 30 respondents having good knowledge. This indicates a significant improvement in knowledge between the pre- and post-intervention phases with the DM Smart Ludo Game.

The results of the Wilcoxon test analysis show that the average difference between the pre-intervention and post-intervention scores was 5.545. This indicates an increase in knowledge after the intervention, with a p-value of $0.000 < \alpha = 0.05$, meaning that there is a significant effect of the DM Smart Ludo Educational Game on the knowledge of T2DM patients in the working area of the North Polombangkeng Health Center, Takalar Regency. The term "health education" is used to describe an educational process designed to achieve health-related goals, encompassing various types of education. One of the five pillars of diabetes mellitus management is education, which also influences how well patients maintain their blood sugar levels within normal limits.[12]

According to Nursalam (2016), knowledge is the result of "knowing," which occurs after a person perceives a particular object. The human senses carry out perception through the five senses: smell, taste, hearing, sight, and touch.[16] Most of human knowledge is acquired through education, the experiences of others, the media, and the surrounding environment. Knowledge refers to the outcome of understanding gained by a person after perceiving a particular object through their senses.[19]

The discussion above aligns with the findings of the research, where providing education has the potential to increase a person's knowledge. The intervention of the Ludo Smart DM educational media was effective in improving respondents' knowledge for their health. Respondents' knowledge increased after being given the Ludo Smart DM game intervention.

The data above explains that playing Ludo can enhance a person's knowledge. This study is consistent with previous research (Rosita Wondal, Rita Samad, 2020; Ni'mah, Astuti, and Isnanto, 2022) which showed that playing Ludo as a means of improving knowledge is indeed correlated.[15,20]

The findings of this study are similar to those conducted by Wulanyani (2018); Martina and Redjeki (2019); and Indarwati (2019), where health education using the simulation game method influenced the improvement of patients' cognitive knowledge about health, their attitudes, and actions in managing diabetes. The purpose of this method is to assess the implementation of actions to control blood sugar in type 2 diabetes (DMT2) patients. It was found that using the game-playing method as an educational intervention significantly increased knowledge. Although health lectures also improved knowledge, the increase was not as significant as with the simulation game and game-playing methods.[21,22,23]

Thus, the researcher believes that playing Ludo plays a significant role in increasing knowledge. This is evidenced by the research findings, which show a significant impact after the implementation of the Ludo Smart DM educational media on the knowledge of type 2 diabetes (DMT2) patients in the Polombangkeng Utara Health Center area, Takalar Regency, with a value of ($\rho = 0.000$) $\leq \alpha$ 0.05.

Blood Sugar Control

This study shows that the method used to help control blood glucose levels is a game-playing method, where the game used as an educational medium is Ludo, aimed at controlling blood glucose in type 2 diabetes (DMT2) patients. The data on respondents' blood sugar control shows that out of 33 respondents, 4 (12.1%) had normal blood sugar levels before the intervention. After the first week of the intervention, the number of respondents with normal blood sugar levels increased to 14 (42.4%). In the second week, 17 respondents (51.5%) had normal blood sugar levels, in the third week, this increased to 20 respondents (60.6%), and in the fourth week, 19 respondents (57.6%) maintained normal blood sugar levels.

The data on blood sugar control status indicates that out of 33 respondents, 13 respondents (39.4%) experienced an increase in GDS in the first week after the intervention, while 20 respondents (60.6%) saw a decrease. In the second week, 11 respondents (33.3%) experienced an increase in GDS, and 22 respondents (66.7%) experienced a decrease. In the third week, 16 respondents (48.5%) experienced an increase, while 17 respondents (51.5%) experienced a decrease. In the fourth week, 9 respondents (27.3%) saw an increase, while 24 respondents (72.7%) experienced a decrease.

The analysis of the effect of the Ludo Smart DM educational media on blood sugar control showed that the average blood sugar level of the 33 respondents before the intervention was 287.30. After the first week of the intervention, the average blood sugar level decreased to 248.70, indicating a decrease in GDS in 20 respondents. In the second week, the average blood sugar level decreased further to 215.33, with a decrease in GDS in 22 respondents. In the third week, the average blood sugar level was 215.18, showing a decrease in 17 respondents, and in the fourth week, the average blood sugar level was 214.09, indicating a decrease in GDS in 24 respondents after the Ludo Smart DM game intervention.

The results of the Wilcoxon test analysis show that the average difference between pre-intervention and post-intervention was 73.212. This indicates a decrease in GDS after the intervention, with a value of $\rho = 0.000 < \alpha = 0.05$, meaning there is a significant effect of the Ludo Smart DM game education on blood sugar control in type 2 diabetes (DMT2) patients in the Polombang Utara Health Center area, Takalar Regency.

Thus, the ability of respondents to understand the importance of blood sugar control through the Ludo Smart DM game was supported by a weekly program for one month, which contributed to the reduction in blood glucose levels.

Blood glucose control in diabetic patients (DM) is known as blood sugar control, which should be performed at least once every three months after the initial visit or regularly each month until blood sugar levels are controlled. Failure to properly control blood sugar can lead to chronic hyperglycemia.[24,25]

Monitoring blood glucose levels in patients allows them to be more compliant in controlling their blood sugar levels. Compliance is a key component in managing blood glucose levels. The compliance of type 2 diabetes (DMT2) patients is defined as the extent to which their behavior aligns with treatment recommendations, such as following a diet, taking medications, and maintaining a lifestyle as advised by their doctor.[26,27]

This research is in line with previous studies by Martos-Cabrera, María Begoña, María José, Nora Suleiman, Emilio Mota et al. (2020), Wahyuni, Prayitno, and Wibowo (2019), Achmad Ali Fikri, Syamsul Arifin (2022), and Rosita, Rita Samad (2020), as well as Zainuddin et al. (2023), where, after the intervention in the form of education, there was an increase in knowledge and glycemic control. This indicates that using game-based methods can help control blood glucose levels.[28,1,25,15,29] The application of games and gamification in this study can be an effective instrument for health education and chronic disease management, as it is motivating and enjoyable, making the learning process and disease management more efficient for type 2 diabetes (DMT2) patients in the working area of Polombangkeng Utara Health Center, Takalar Regency.

This research is supported by an international study conducted by Koivisto and Malik (2021), which used the gamification method with elderly participants. In their study, out of 12 respondents, 10 showed positive results, meaning the respondents were able to manage their diabetes through a combination of learning and playing[30]. The findings of the study by Koohmareh, Karandish, and Hadianfard (2021) also support this research. In their study, using a mobile game method with diabetes mellitus patients, there was an improvement in glycemic index control after the intervention. The patients became more capable of managing which foods to avoid. This indicates the effectiveness of providing education through mobile game media.[31]

Overall, studies on game interventions for the elderly show that older adults can benefit from gamification and game-based interventions, particularly in the health sector. However, due to methodological limitations and the small number of available studies, further research is needed in this area.[30]

A person's motivation is influenced by their needs, particularly physiological needs. Health education aims to increase the desire to control blood sugar levels in type 2 diabetes patients by informing them about their physiological needs, including ideal physical conditions and blood sugar control despite having diabetes. This awareness will drive an increase in motivation.[10]

The research demonstrates the development of an educational medium called "Ludo Smart DM Game," which can be used by individuals with type 2 diabetes. Additionally, this study provides a simple communication system. Compared to other media, Ludo Smart DM Game is more effective in increasing knowledge and controlling blood sugar levels. Previous researchers have mostly used leaflets, booklets, pocket books, and similar media. Therefore, I became interested in using the Ludo Smart DM Game as the novelty of my research. It has been proven that this medium attracted the elderly, leading to improved knowledge and reduced blood sugar levels. This is evident from the effectiveness of the intervention I conducted with 33 DMT2 patients, who participated in the intervention using the Ludo Smart DM educational media.

The aim of this study was to determine the impact of the Ludo Smart DM Game on changes in blood sugar control among DMT2 patients in the working area of the Polombangkeng Utara Health Center, Takalar Regency. The results, using statistical testing with a p-value of 0.000 < α 0.05, show a significant effect of the Ludo Smart DM game instructions on changes in blood sugar control in patients. Based on the researcher's assumption, before the intervention, 4 respondents had blood glucose levels above the normal limit. After the one-month intervention with 33 respondents, 19 respondents had blood glucose levels below the normal limit. Although not all were within the normal range, the average blood glucose levels of the respondents showed improvement, with 24 respondents experiencing a decrease in blood sugar levels after the intervention and 9 respondents showing an increase. This may be due to poorly regulated eating habits, busy work schedules, or reliance on traditional treatments rather than understanding how to properly control blood sugar levels for diabetes mellitus patients.

CONCLUSION

This study concludes that the DM Smart Ludo Gaming educational media significantly improved the knowledge and blood sugar control of T2DM patients in the working area of the North Polombangkeng Health Center, Takalar Regency. Before the intervention, only 6.1% of respondents had good knowledge, which increased to 90.9% post-intervention. Similarly, only 12.1% of respondents had normal blood sugar control before the intervention, rising to 87.9% afterward. Statistical analysis using the Wilcoxon test confirmed the significant impact of the educational media on both knowledge ($p = 0.000 < \alpha = 0.05$) and blood sugar control ($p = 0.000 < \alpha = 0.05$). These findings highlight the effectiveness of game-based educational tools in enhancing patient outcomes. Healthcare professionals are encouraged to optimize T2DM patient education and monitoring by providing suitable health facilities and utilizing tools like the DM Smart Ludo Educational Game to enhance learning and reduce T2DM cases in North Polombangkeng, Takalar. Future researchers

should broaden the scope, duration, and sample size of studies to test the broader applicability of game-based interventions. This study offers valuable insights for nursing care development, educational references, and community applications as a non-pharmacological approach to managing blood sugar levels.

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