Analysis of Increasing Knowledge, Attitudes, and Behaviors for Type 2 Diabetes Complication Prevention

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Keywords	ABSTRACT
Diabetes Mellitus, Type 2, Knowledge, Attitudes, Behavior, Video Education Media, Modules.	*Diabetes mellitus is characterized by elevated blood sugar levels due to either a lack of insulin or decreased cellular sensitivity to insulin. Type 2 diabetes accounts for most (90%) of all diabetes cases. Diabetes mellitus is a significant contributor to mortality, mainly because it leads to complications such as atherosclerosis, coronary heart disease, and stroke. The research was designed as a quasi-experiment, employing a pre-test and post-test with a control group. The analysis included the use of Wilcoxon and Mann-Whitney tests. The sampling method used was purposive sampling, involving 100 participants. The results of the data analysis using the Wilcoxon test in the treatment group indicated a p-value of 0.000 (p<0.05) for the knowledge, attitude, and behavior variables. In the control group, a p-value of 0.002 (p<0.05) was observed for the knowledge variable, while p-values of 0.001 (p<0.05) were found for the attitude and behavior variables. These findings support the acceptance of the alternative hypothesis (Ha) and the rejection of the null hypothesis (H0), suggesting that the use of video media and modules positively impacts increasing knowledge, attitudes, and behaviors aimed at preventing complications. When examining the intervention group and control group using the Mann-Whitney Test, the p-value of 0.000 was less than 0.002, indicating that the use of video educational media in the intervention group significantly improved knowledge. Likewise, the statistical tests on attitudes in both groups revealed a p-value of 0.000, which was less than 0.001, signifying that video educational media significantly improved attitudes in the intervention group. Finally, the analysis of behavioral tests demonstrated a p-value of 0.000, which was less than 0.001 in both groups, highlighting the greater impact of video educational media in enhancing behavior. In conclusion, video educational media and modules effectively enhance knowledge, attitudes, and behavior in individuals with type 2 diabetes mellitus. However, video education is more influential in improving these aspects compared to other methods.*

INTRODUCTION

The global prevalence of diabetes mellitus is on the rise, and this trend is also evident in Indonesia. Worldwide, the number of individuals with diabetes mellitus currently stands at approximately 415 million, and it is projected to increase significantly, reaching an estimated 642 million (a 55% increase) by the year

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2040. According to data from the World Health Organization (WHO), Indonesia is expected to experience a notable surge in the number of people affected by diabetes, rising from 8.4 million in 2000 to approximately 21.3 million by 2030 (Perkeni, 2015). Additionally, the International Diabetes Federation (IDF) anticipates a substantial increase in diabetes mellitus cases among individuals aged 20-79 in Indonesia, projected to grow from 10 million in 2015 to 16.2 million by 2040. If these predictions hold, Indonesia will rank as the sixth-highest country globally in terms of diabetes mellitus cases by 2040 (Perkeni, 2015)

Based on 2013 Basic Health Research (Riskesdas) data, the prevalence of diabetes mellitus in people over 15 in Indonesia increased from 5.7% in 2017 to 6.9%. The prevalence of Diabetes Mellitus in Mataram City is 1.7%. Diabetes Mellitus was ranked 9th among the 10 most common diseases in NTB Community Health Centers in 2017 (NTB Provincial Health Profile, 2017). This predicate will persist until 2021 when non-communicable diseases such as stroke, hypertension, and diabetes mellitus are in the top 10 most common diseases. According to data on health service coverage for diabetes mellitus sufferers in sub-districts and community health centers in West Nusa Tenggara Province in 2020, there were 59,606 DM sufferers. Then, in 2021, there was an increase in DM sufferers, namely, there were 63,488 sufferers. Then, in Bima City, there were 3,523 sufferers.

The increase in the number of Diabetes Mellitus sufferers, most of whom are type 2 DM, is related to several factors such as obesity, hypertension, family history, age, genetic factors, smoking habits, consuming alcohol, availability of high-calorie foods, physical inactivity and lifestyle changes that cause diabetes (Fatimah, 2015). Diabetes mellitus is a high cause of death, especially due to complications of diabetes mellitus, which often cause atherosclerosis, coronary heart disease and stroke. Clients with diabetes mellitus have a 2-4 times higher risk of experiencing heart attacks and strokes. Apart from that, diabetes mellitus can develop, causing kidney failure, blindness, and amputation, so treatment needs to be done immediately.

Complications that frequently arise in individuals with diabetes include foot ulcers and wounds. Diabetic foot wounds encompass infections, ulcers, and deeper tissue damage that are associated with both neurological and vascular issues in the legs of those suffering from diabetes mellitus. These complications are primarily attributed to peripheral artery disease (PAD), a condition akin to coronary artery disease (which involves blockages in the arteries supplying blood to the heart muscle) and carotid artery disease (which pertains to blockages in the arteries leading to the brain). In the case of PAD, the arteries serving areas beyond the brain and heart, such as the neck, arms, and abdomen, are affected, with the legs and feet being the most afflicted regions. In PAD, fat deposits accumulate within the inner layers of the leg arteries, resulting in their narrowing. This constriction of the arteries hinders blood flow, and in severe cases, it can completely obstruct blood flow to the legs. This condition often leads to pain, particularly during physical activity like walking. Furthermore, it manifests with various other symptoms, such as slow-healing foot sores, a notable temperature disparity between one foot and the other, and the potential development of gangrene. These complications contribute to prolonged treatment durations, increased healthcare costs, elevated rates of disability, reduced quality of life, and a heightened risk of mortality.

In general, there are five principles for managing diabetes mellitus by the 2006 DM Management Consensus in Indonesia to improve the quality of life of DM patients. One is providing health education to prevent complications worsening the sufferer's condition. Type 2 DM disease can be prevented by increasing a person's knowledge, attitudes, and self-awareness in managing their lifestyle. Prevention can start with oneself. Saifunurmazah (2017) "explained that awareness is needed from within to prevent disease and prevent complications from the disease. "In preventing the mortality and morbidity of DM, self-care is very necessary. One of the most important aspects of self-care is self-awareness (self-awareness)".

Apart from that, Saifunurmazah (2017) "explained that self-awareness also has a direct relationship to behavior in carrying out management and self-care in diabetes mellitus patients to prevent complications."

The level of a person's self-awareness can be seen from their behavior. Pradika (2017) "states that blood sugar control behavior is influenced by knowledge." Other research shows that "low levels of knowledge impact preventing diabetes complications." This shows how big the influence of knowledge is on controlling a disease. "Knowledge itself is the result of human observation of something, not only observation but also assessment and testing that occurs systematically within humans." "Every person certainly has different knowledge and self-awareness. According to Fidianingsih et al. (2017), Prevention of diabetes mellitus can be done by including a healthy lifestyle, eating patterns that must be maintained and regular, physical activity, checking blood sugar levels regularly, and increasing knowledge or education with health education.

Health education is a comprehensive approach that combines education and intervention to facilitate positive behavioral and environmental changes to promote health. It can effectively utilize video media, which provides educational content about diabetes mellitus and its prevention through creative models, as highlighted (Sundari et al., 2019). Video media is preferred because it is considered more effective and easier to comprehend in health education (Susilaningsih & Salmiyati, 2017).

Utilizing video as a medium for health education has the potential to yield favorable outcomes in terms of understanding and motivation. It can lead to a better understanding of outcomes, falls within the "good" category, and can motivate individuals to grasp the information being presented. Video media is instrumental in enhancing motivation regarding the importance of maintaining good health and can effectively disseminate information and instruction related to health topics, including diabetes mellitus prevention. Research conducted by Susilaningsih (2017) indicates that health education using video media has a discernible impact. Prior to receiving health education through video media, individuals with diabetes often struggle with dietary compliance. However, after exposure to video education, diabetes mellitus patients exhibit improved dietary compliance, with a significant p-value of 0.016 (p < 0.05), demonstrating the effectiveness of this approach (Susilaningsih & Salmiyati, 2017).

Knowledge, attitudes, and conduct play crucial roles in influencing an individual's behavior transformation. Thus, an individual's awareness and positive outlook regarding diabetes mellitus and its prevention are vital and essential in molding their conduct to ward off diabetes mellitus (Sayekti, 2020).

This research is one of the preventive and promotive health efforts in the field of nursing and is expected to provide a basis and become material for consideration in nursing services so that it can guide nurses in completing assessments related to risk factors and preventive efforts in the management of patients with diabetes mellitus and preventing/minimizing its occurrence (Black & Hawks, 2014)

METHODS

This study adopts a quasi-experimental research design, incorporating a pre-test and post-test with a control group. This research aims to establish a cause-and-effect relationship between intervention and control groups (Nursalam, 2013). The intervention group received video-based educational materials, while the control group received module-based materials to prevent complications associated with type 2 diabetes mellitus.

The study's target population was approximately 1,895 individuals with type 2 diabetes mellitus in Bima City. The sample size for this study, focusing on type 2 diabetes mellitus patients, comprised 100 participants. The Lemeshow formula determined the sample size, which was employed due to the unknown or infinite population size. The Lemeshow formula is as follows:

Information:

n: Number of Samples
With: z-score at 95% confidence = 1,96
p: maximum estimate = 0.5
d: alpha (0,10) atau sampling error = 10%

So, the sample size is taken as follows:

$$n = \frac{With^2_{1-a/2}P(1-P)}{d^2}$$

$$n = \frac{1,96^2 \cdot 0,5\ (1 - 0,5)}{0,1^2}$$

$$n = \frac{3,8416 \cdot 0,25}{0,01}$$

n = 96.04 = 100 respondents

So, based on this formula, the n obtained is 96.04 = 100 respondents, so the researcher only takes data from a sample of at least 100 respondents. With the sampling technique, purposive *sampling* and the number of samples have been determined in proportion to the results of calculating the sample size in each group.

RESULTS

Frequency Distribution of Characteristics of Type 2 Diabetes Mellitus Respondents in Bima City in 2023

Table 1. Frequency distribution of respondent characteristics based on age, gender, highest level of education, eating habits, duration of illness, and history of drug consumption in Bima City in 2023

Variable	Intervention		Control	
	n	**%**	**n**	**%**
Age				
Late adulthood 36-45 years	8	16	12	24
Early old age 46-55 years	12	24	15	30
Late old age 56-65 years	25	50	20	40
Seniors 66 years and over	5	10	3	6
Gender				
Man	16	32	22	44
Woman	34	68	28	56
Last education				
No School	1	2	2	4
SD	3	6	4	8
JUNIOR HIGH SCHOOL	7	14	7	14
SMA	16	32	16	32
Diploma	20	40	20	40
Masters	3	6	1	2
Eating Habits Patterns				
Diet	12	24	16	32
Don't edit	38	76	34	68
Long illness				
<5 Years	12	24	13	26
>6 Years	38	76	37	74

Drug Consumption History				
DM	30	60	30	60
DM day HT	20	40	20	40

Source: Primary Data of Respondents in Bima City PKM in 2023

Based on the data presented in Table 1, out of the 100 respondents, with 50 in the intervention group and 50 in the control group, most respondents were in the late elderly age range of 56-65 years. In the intervention group, 25 people (50%) fell into this age category, while in the control group, 20 people (40%) were in the same age range. The gender distribution was predominantly female, with 34 people (68%) in the intervention group and 28 people (56%) in the control group being female. Nearly half of the respondents had a Diploma education, with 20 people (40%) in both the intervention and control groups. Regarding dietary habits, almost all respondents did not follow a specific diet, with 38 people (76%) in the intervention group and 34 people (68%) in the control group not adhering to any dietary regimen. The duration of illness for most respondents exceeded 6 years, with 38 people (76%) in the intervention group and 37 people (74%) in the control group having diabetes for more than 6 years. Furthermore, a significant proportion of respondents had a history of consuming diabetes mellitus medication, with 30 people (60%) in both the intervention and control groups. Additionally, almost half of the respondents in both groups had a history of consuming medication for both diabetes mellitus and hypertension.

Frequency Distribution of Knowledge, Attitudes and Behavior, Before and After Giving Modules and Videos to Respondents with Type 2 Diabetes Mellitus in Bima City in 2023

Table 2. Frequency distribution of knowledge, attitudes, and behavior, before and after being given modules and videos to respondents with type 2 diabetes mellitus in Bima City in 202

Variable	Intervention				Δ Mean	Control				Δ Mean
	Pre Test		Post Test			Pre Test		Post Test		
	n	%	n	%		n	%	n	%	
Knowledge Mean ± SD	4.68 ± 1.168		8.98 ± 1.378		4.3	4.66 ± 1.171		6.86 ± 1.578		2.2
Height	0	0	44	88		0	0	26	52	
Currently	31	62	6	12		30	60	20	40	
Low	19	38	0	0		20	40	4	8	
Attitude Mean ± SD	27.54 ± 5.195		44.36 ± 8.007		16.82	27.54 ± 5.195		40.52 ± 9.163		12.98
Good	0	0	34	68		0	0	32	64	
Enough	32	64	16	32		32	64	17	34	
Less	18	36	0	0		18	36	1	2	
Behavior Mean ± SD	27.54 ± 5.195		44.36 ± 8.007		16.82	27.40 ± 5.264		37.34 ± 7.102		9.94
Good	0	0	34	68		0	0	33	66	
Enough	32	64	16	32		32	64	17	34	
Less	18	36	0	0		18	36	0	0	

Source: Primary Data of Respondents in Bima City PKM in 2023

Based on Table 2, it was found that most of the respondents' pre-test knowledge before being given educational media was in the medium category, namely 31 people (62%) in the group intervention with an

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average pre-test score of 4.68 with a standard deviation of 1.168 and as many as 30 people (60%) in the control group with an average pre-test score of 4.66 with a standard deviation of 1.171. Then, after being given educational media, a post-test was carried out. Almost all respondents' knowledge was in the high category, with 44 people (88%) in the group intervention with an average post-test score of 8.98 with a standard deviation of 1,378 and as many as 26 people (52%) in the control group with an average post-test score of 6.86 with a standard deviation of 1,578.

In the attitude variable before being given educational media, most respondents were in the sufficient category, 32 people (64%) in the group intervention with an average pre-test score of 27.54 with a standard deviation of 5,195 and as many as 32 people (64%) in the control group with an average pre-test score of 27.54 with a standard deviation of 5,195. Then, after being given educational media, a post-test was carried out. Most of the respondents' attitudes were in a good category, with 34 people (68%) in the group intervention with an average post-test score of 44.36 with a standard deviation of 8.007 and as many as 32 people (64%) with an average post-test score of 40.52 with a standard deviation of 9.163 in the control group.

Regarding the behavioral variable before receiving educational media, most respondents were categorized as having sufficient behavior. In the intervention group, 32 people (64%) had a pre-test score with an average of 27.54 and a standard deviation of 5.195. Similarly, in the control group, 32 people (64%) exhibited sufficient behavior with an average pre-test score of 27.40 and a standard deviation 5.264. Following the administration of educational media and conducting a post-test, there was a significant improvement in most of the respondents' behavior, which shifted to the good category. In the intervention group, 34 people (68%) demonstrated good behavior, with an average post-test score of 44.36 and a standard deviation of 8.007. Likewise, in the control group, 33 people (66%) displayed good behavior, with an average post-test score of 37.34 and a standard deviation of 7.102.

Analysis of Differences in Average Values of Knowledge, Attitudes, and Behavior Before and After Being Given Type 2 Diabetes Mellitus Modules and Videos in Bima City in 2023

Table 3. Analysis of differences in average values of knowledge, attitudes, and behavior before and after being given modules and videos to respondents with type 2 diabetes mellitus in Bima City in 2023

Group	Intervention		Control		*p* value
	pre-test	post-test	pre-test	post-test	
Knowledge	0.000		0.002		0.000
Attitude	0.000		0.001		0.02
Behavior	0.000		0.001		0.000

The statistical test results using the Wilcoxon test revealed a significant change in the knowledge, attitude, and behavior variables in both the intervention and control groups. The intervention group's p-value was 0.000 (p<0.05) for the knowledge, attitude, and behavior variables. This indicates a statistically significant increase after the administration of educational media in the form of videos. These results support the acceptance of the alternative hypothesis (Ha), signifying that providing education through video media has a positive impact on enhancing knowledge, attitudes, and behavior aimed at preventing complications from type 2 diabetes mellitus in Bima City in 2023.

In the control group, the p-values were 0.002 (p<0.05) for the knowledge variable, 0.001 (p<0.05) for the attitude variable, and 0.001 (p<0.05) for the behavioral variable. These results also support the acceptance of the alternative hypothesis (Ha), indicating that providing education using module media has a significant influence on increasing knowledge, attitudes, and behavior in the context of preventing complications from type 2 diabetes mellitus in Bima City in 2023.

An examination of variations in the mean values of knowledge, attitudes, and behavior before and after the provision of educational media was carried out in both the intervention and control groups. This analysis employed the Mann-Whitney Test, yielding p-values of 0.000 (less than 0.05) for knowledge, 0.02 (less than 0.05) for attitude, and 0.000 (less than 0.05) for behavior. Consequently, it can be deduced that there are substantial disparities in the mean levels of knowledge, attitudes, and behavior between the intervention and control groups.

The outcomes of the statistical knowledge tests in both the intervention and control groups yielded a p-value of 0.000, which is less than 0.002, indicating that providing video educational media to the intervention group had a more substantial impact on enhancing knowledge. Similarly, the statistical tests for attitudes in both the intervention and control groups resulted in a p-value of 0.000, which is less than 0.001, signifying that the use of video educational media with the intervention group had a more significant effect on improving respondents' attitudes. Additionally, the statistical tests for behavior in the intervention and control groups produced a p-value of 0.000, which is less than 0.001, demonstrating that providing video educational media to the intervention group had a more pronounced effect on improving behavior.

Discussion

A. Characteristics of respondents with type 2 diabetes mellitus in Bima City

1. Age

The findings in Table 1 indicate that a significant proportion of the respondents fall within the late elderly age category of 56-65. In the intervention group, 25 individuals (50%) belong to this age range, while in the control group, 20 individuals (40%) are within the same age bracket. This trend aligns with research by Riyambodo (2017), which observed a predominant age range of 51-60 years. Similarly, Fitriana et al.'s 2019 study reported a higher concentration of individuals aged 56-65, marked by a decline in physiological function and reduced information absorption capacity (Notoatmodjo, 2007). Furthermore, Khasanah and Fitri's 2019 research highlights that most participants were 53-58 years old. It is important to note that age is closely linked to elevated blood sugar levels, with an increasing age corresponding to a higher prevalence of diabetes mellitus and glucose disorders. Consequently, individuals with diabetes mellitus must take measures to maintain normal blood sugar levels, as indicated by Safitri in 2017.

Increasing age causes a person to be at risk of increasing the incidence of diabetes mellitus. People who are aged 55 years and over are associated with the occurrence of diabetes because, in old age, physiological body functions decrease due to a decrease in insulin secretion or resistance so that the body's ability to control high blood glucose functions. Less than optimal (Suryono, 2007). This is what was stated by Smeltzer Suzane C (2002), who stated that at age > 45 years, the function of the body's organs decreases. This is due to the reduced activity of pancreatic beta cells to produce insulin. DM in old age tends to increase because DM in old age is multifactorial and is influenced by extrinsic and intrinsic factors. Age is an independent factor in its influence on changes in the body's tolerance to glucose. Generally, 90% of diabetes patients in the elderly include type II diabetes and are >45 years old (Gustiyani, 2006). Damayanti explained that the risk factor for developing type II DM is age over 30 years. This is due to anatomical, physiological, and biochemical decline (Damayanti, 2015)**.**

2. Gender

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In the research, a significant proportion of the respondents were female, with 34 individuals (68%) in the intervention group and 28 individuals (56%) in the control group falling into this category. This pattern is consistent with a study by Kunaryanti in 2018, which also noted a predominant presence of females. Similarly, the research conducted by Musdalifah and Setiyo Nugroho (2020) supports the idea that the female gender is the most prevalent without establishing a direct link between gender and the occurrence of diabetes mellitus. Another study by Ukat et al. (2018) reveals that most respondents are women. The increased risk of diabetes among women is attributed to their greater susceptibility to changes in body mass index, as highlighted by Trisnawati (2018). Furthermore, the occurrence of diabetes mellitus in women is influenced by factors such as menstrual cycle syndrome (premenstrual syndrome) and post-menopausal changes, which can lead to a higher accumulation of body fat due to hormonal processes, thereby increasing the susceptibility of women to diabetes mellitus.

3. Last education

Roughly 50% of the respondents held a Diploma degree, with 20 individuals (40%) in the intervention and control groups falling into this educational category. This observation corresponds with the outcomes of Hunt's study in 2012, which identified most respondents having a higher education background at 57.9%, followed by secondary education at 32.2%, and the lowest percentage having primary education at 9.9%. Similarly, Wilson's research in 2012 reported that the largest educational background among respondents was higher education, accounting for 66.2%, while 23.1% had a secondary education, and only 1.5% had primary education. These findings are consistent with the results of Yin's 2005 study, which concluded no correlation between education and self-management behavior. Additionally, the studies conducted by Wattanakul in 2012 and Adwan & Najjar in 2013 both revealed p-values greater than 0.05, indicating that there are no significant differences in self-management behavior related to diabetes mellitus (DM) among respondents with primary, secondary, or tertiary educational backgrounds.

According to researchers, education does not directly influence management behavior in treating type 2 DM but influences knowledge first. However, education is also an important factor that type 2 DM patients need to have because, as stated by Lukoschek (2003, in Yin, 2005), DM patients who have a high level of education are better able to absorb the information provided by health workers if they receive education on diabetes mellitus management. Meanwhile, DM patients with a low level of education have a limited ability to understand the health information provided, which, in the end, can become an obstacle for DM patients to obtain the necessary knowledge regarding diabetes and diabetes management. This is also in accordance with the respondent data in this study, where the largest number of respondents with a good level of knowledge are respondents with a high level of education. Therefore, it can be concluded that education is not directly related to management behavior for treating type 2 DM because DM patients, whether they have high or low education, can both implement self-management behavior if they both receive education regarding diabetes management. Apart from receiving education, DM patients must also increase their self-efficacy to encourage them to implement self-management behavior for type 2 diabetes mellitus.

4. Eating Habits Patterns

Practically all the respondents, constituting 38 individuals (76%) in the intervention group and 34 individuals (68%) in the control group, did not adhere to any specific dietary regimen. A similar trend was observed among both smokers, with 38 individuals (84.4%) reporting non-dietary eating habits, and non-smokers, with 47 individuals (85.5%) also displaying no inclination toward dieting. Adopting modern dietary patterns characterized by high-fat, high-sugar, and preservative-laden

instant foods is often associated with individuals leading stressful lifestyles. This condition is frequently linked to contemporary lifestyle practices, including reduced physical activity, dietary choices, obesity, smoking habits, and genetic factors (Lotfy et al., 2017).

5. Long illness

The duration of illness for almost all respondents was >6 years (more than 6 years), 38 people (76%) in the intervention group and 37 people (74%) in the control group. Almost all smoking respondents had a long history of suffering >6 years (more than 6 years), as many as 38 people (84.4%), and almost all non-smoking respondents >6 years (more than 6 years), as many as 42 people (76.4%). Suffering from DM for a long time will further increase complications in the form of damage to blood vessels throughout the body, thus further aggravating the disruption of the function of vital organs. Over a long period, glucose levels in the blood will damage the walls of the capillaries, which are directly connected to the nerves. Suffering from type 2 DM for a long time causes complications. The specific causes and pathogenesis of each type of complication are still being investigated, but increased blood glucose levels play a role in the process of neuropathic disorders, microvascular complications and as a risk factor for macrovascular complications. Along with the complications that occur, the longer the duration of suffering from DM, the higher the incidence of complications experienced by sufferers. Over a long period, glucose levels in the blood will damage the walls of the capillaries, which are directly connected to the nerves (Brunner & Suddarth, 2008).

6. History of Diabetes Mellitus Medication Consumption

Most respondents had a history of consuming diabetes mellitus medication, 30 people (60%) in the intervention group and control group and almost half of them had a history of consuming diabetes mellitus and hypertension medication in the control group and intervention group. History of consumption of diabetes mellitus medication: Most of the respondents were smokers, 25 people (55.6%), and some took diabetes mellitus and hypertension medicines. Then, among non-smoker respondents, most respondents took diabetes medicines, 30 people (54.5%), and some took diabetes mellitus medicines. And hypertension as many as 25 people (45.5%). Taking medication as one of the 5 pillars of controlling type 2 DM can be applied as an effort to prevent complications and improve quality of life. Management of the 5 pillars of DM control includes diet, pharmacological treatment, physical exercise, education, and monitoring blood sugar levels (Suciana et al., 2019)

B. **Knowledge, attitudes, and behavior before and after being given video media and modules to type 2 diabetes mellitus patients in Bima City.**

The respondents' knowledge increased, with a mean value of 8.98 in the intervention group, reflecting a difference of 4.3. A similar increase was observed in the control group, with a mean value of 6.86, representing a difference of 2.2. These mean values indicate that the intervention group, which received education through video media, had a higher increase in knowledge than the control group, which received education through module media. This finding aligns with the research conducted by Larassati and Rumintang (2020) which demonstrated an enhancement in respondents' knowledge after receiving intervention via video media, particularly concerning the impact of teenage pregnancy. These results are consistent with the findings of Puspita et al. (2019), indicating that video media effectively increases knowledge among mothers in preventing febrile seizures in toddlers. Similarly, the research conducted by Jayanti et al. in 2019 illustrates the positive influence of providing health education through audiovisual means on knowledge levels. Likewise, Meliyanti's study (2021)reveals a significant increase in knowledge after providing video education to students at Gatotsubroto Elementary School, highlighting the effectiveness of video media as an educational tool.

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Knowledge is the outcome of acquiring information and typically follows the sensory perception of specific objects. The process of sensing is facilitated through the five human senses, which include sight, hearing, smell, taste, and touch (Notoatmodjo, 2007). Enhancing knowledge through video media proves more effective due to its engaging and non-monotonous nature. Video media is not limited to visual content alone; it also incorporates audio-visual elements, ensuring the audience remains engaged without getting easily bored (Ardyanto, 2020). The combination of visuals and explanatory content makes the information more comprehensible, ultimately leading to an improved increase in the knowledge of the respondents (Nurfita, 2018).

The respondents' attitudes displayed an improvement, with a mean value of 44.36 in the intervention group, reflecting a difference of 16.82, while in the control group, there was also an increase, with a mean value of 40.52, indicating a difference of 12.98. This mean value comparison reveals that the intervention group, which received education through video media, exhibited a higher increase in attitudes than the control group, which received education through module media. This study aligns with research conducted by Rita Irma and her colleagues in 2018, which explored the impact of nutrition education on the attitudes of individuals with diabetes mellitus. Their statistical analysis showed a significant influence of counseling on the attitudes of individuals with DM, as denoted by a p-value of 0.001. This study's observed positive attitude improvement can be attributed to providing information through audio-visual media during nutritional education.

Furthermore, Purnamasari's (2017) research suggests that knowledge can shape attitudes, where the respondent's knowledge post-intervention plays a key role. A solid knowledge foundation leads respondents to form positive attitudes, encouraging them to stay healthy or manage their medical condition. Ayu's 2014 study is consistent with this notion, demonstrating the influence of nutrition education on increasing knowledge and altering attitudes in individuals with type 2 diabetes mellitus, as indicated by a p-value of 0.000. It is worth noting that while education did not affect blood sugar control in type 2 diabetes mellitus patients (p-value = 1.000), it did result in increased knowledge and more positive attitudes in patients with well-controlled blood sugar levels after nutrition education. In a similar vein, research conducted by Goyena (2013) highlights the positive impact of counseling and the provision of audio-visual media on knowledge and attitudes in both control and intervention groups, revealing significant differences (knowledge: $p=0.01$; $\alpha=0.05$; attitude: $p=0.036$; $\alpha=0.05$). Adrianto's research (2019) also indicates an increase in attitudes by 1.9% and a 21.9% improvement in balanced nutrition practices, with p-values for attitudes and practices before and after intervention being less than 0.05.

The behavior of the respondents exhibited an improvement, with a mean value of 44.36 in the intervention group, indicating a difference of 16.82. There was also an increase in the control group, with a mean value of 37.34, representing a difference of 9.94. This comparison of mean values reveals that the intervention group, which received education through video media, demonstrated a more substantial increase in behavior than the control group, which received education through module media. These findings are consistent with the research conducted by Alqahtani (2020), which highlighted a lack of desirable behavior among respondents concerning diabetes mellitus. Additionally, Susilaningsih's study (2017) demonstrated the impact of providing health education through video media. Prior to receiving health education through video media, individuals with diabetes did not adhere to dietary recommendations. However, after receiving video education, individuals with diabetes mellitus began complying with dietary guidelines, with a significant value of 0.016 (p < 0.05), signifying a positive change in their behavior (Susilaningsih & Salmiyati, 2017).

Factors that cause behavior in individuals are a person's knowledge and attitude regarding what has been done. Individual knowledge and behavior changes start from the compliance stage, identification and then internalization. Initially, an individual obeys the recommendations or instructions of health workers without awareness of acting and often carries out instructions because of punishment, but if they receive rewards or rewards, they will comply with the recommendations, but it is still temporary (Suharto et al., 2020). One of the media for health education is video media. Video media is a medium that is easy to understand, modern and interesting, where this media is easily accepted. Educational media with video has its advantages, namely being able to display moving images, has its uniqueness that other learning media do not have, the story concept is packaged as the main point in learning and material that is long and difficult to convey orally can be presented in the form of films and videos. easy to understand (Handayani & MARNIATI, 2018).

C. **Analyzing knowledge, attitudes, and behavior before and after being given video media and modules to type 2 diabetes mellitus patients in Bima City**

The statistical test results indicate that the mean knowledge rank of respondents in the intervention group was 8.98, while in the control group, it was 6.86, resulting in a mean rank difference of 2.1. The non-parametric Wilcoxon signed-rank test yielded a p-value of 0.000 for the intervention group and a p-value of 0.002 for the control group. Similarly, the results of the statistical tests demonstrate a difference in knowledge scores before and after health promotion through video media, as confirmed by the non-parametric Mann-Whitney test with a p-value of 0.000. These findings conclude that video media exerts a more significant influence on increasing knowledge related to type 2 diabetes mellitus than module media. This observation aligns with the explanation provided by Notoatmodjo (2007), emphasizing that the audiovisual education strategy stimulates both auditory and visual senses during the educational process, enhancing the effectiveness of learning. This conclusion is consistent with Anifah's research (2020), which identified differences in the knowledge levels of teenagers before and after exposure to video media. Likewise, Lasmini and her colleagues (2021) demonstrated the impact of providing education through video media on increasing knowledge about family planning among women of reproductive age. Additionally, Mulyani and Fitriana's (2020) study highlighted the positive effects of video-based education on mothers' knowledge of choking incidents in toddlers.

Knowledge can be obtained from what is seen, heard, or given by teachers to increase knowledge, for example, by providing health education using various media such as videos, films, and others. Knowledge results from " knowing " where people see and hear certain objects, such as a video. Someone will increase their knowledge after seeing and listening to it (Fuad et al., 2017).

Knowledge is necessary to control and reduce the impacts caused by diabetes mellitus (Sundari et al., 2019). Knowledge of the therapeutic management of type 2 DM patients' needs to be managed in 5 pillars: education, meal planning, physical activity, pharmacological therapy, and checking blood sugar levels (Suciana et al., 2019). Knowledge of therapeutic management is an important tool to help treat patients, so the more people are aware of this, the better they will be in treating DM.
Health promotion media is a means or effort to display the information message that the communicator wants to convey, whether through print, electronic media (television, radio, computer, etc.) or outdoor media so that the target can increase knowledge, which is ultimately expected to change behavior towards which is positive for knowledge (Notoatmodjo, 2007).

Video media counseling can provide the audience with a more realistic learning model because the audience can play an active role in learning. Besides, learning using video can make learning easier because it is accompanied by live visuals so that what they see can be captured well (Hardianti, 2017).

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Extension using video media can be more interesting because it can overcome the limitations of instructors. Video is included in audio-visual media because it presents the actual situation, and the information presented has a very big effect (Lasmini, 2021).

The statistical test results mean the attitude rank of respondents in the intervention group was 44.36, while in the control group, it was 40.52, with a difference in mean rank of 3.84. Test results non-parametric Wilcoxon signed rank earned value p=0.000 intervention group and value p=0.001 control group. Likewise, statistical test results show differences in attitude scores before and after health promotion through video media and testing nonparametric Mann-Whitney (p=0.02). The results of this study are not in line with research conducted by Machmud (2019), which revealed that most of the respondents' attitudes regarding the prevention of diabetes mellitus were in the poor category. Attitude can be a predisposition to behave and act. Factors that cause behavior in individuals are a person's knowledge and attitude regarding what has been done. Individual knowledge and behavior changes start from the compliance stage, identification, and internalization. Initially, an individual obeys the recommendations or instructions of health workers without awareness of acting and often carries out instructions because of punishment. However, if they receive rewards or rewards, they will comply with the recommendations, but it is still temporary (Suharto et al., 2020). According to Azwar (2012), one factor influencing attitudes is the mass media in newspapers, radio, or other communication media. News that should be factual and conveyed objectively influences consumer attitudes.

Attitude is a collection of symptoms or syndromes in response to a stimulus or Objects, thus, involve thoughts, feelings, attention, and other psychological symptoms (Wawan & Dewi, 2016). Attitudes can also influence a person's disease-prevention behavior because an increase in attitude is proportional to changes in a person's behavior, which is improving (Notoatmodjo, 2007). Attitudes are formed through the willingness to accept someone's words, respond to messages with active participation, and provide judgment and readiness to act. Attitudes are formed through the willingness to accept someone's words, respond to messages with active participation, and provide judgment and readiness to act (Perry, 2009). Pratama's research (PRATAMA, 2016) stated that DM sufferers who were given health education had a good attitude, followed by a moderate attitude and, finally, a bad attitude.

The outcomes of the statistical tests reveal that the mean rank of respondent behavior in the intervention group stood at 44.36. In contrast, in the control group, it was 37.34, resulting in a mean rank difference of 6.88. The non-parametric Wilcoxon signed-rank test produced a p-value of 0.000 for the intervention group and a p-value of 0.001 for the control group. Similarly, the results of the statistical tests demonstrate a difference in knowledge scores before and after health promotion through video media, as evidenced by the non-parametric Mann-Whitney test with a p-value of 0.000. Knowledge, attitudes, and behavior are critical factors influencing an individual's actions. Therefore, a person's knowledge and favorable attitude toward diabetes mellitus and its prevention play a pivotal and necessary role in shaping an individual's behavior when it comes to preventing diabetes mellitus. (Sayekti, 2020).

Behavior is the result of experience and the process of interaction with the environment, This manifests in knowledge, attitudes, and actions until a state of balance between driving and restraining forces. Behavior a person can change if there is an imbalance between the two forces in someone. Health education effectively influences a person's behavior because it is based on social psychology, mass communication, and marketing to develop and convey prevention materials and messages to avoid disease (Bensley & Fisher, 2003).

Audiovisual is a medium that stimulates two senses, namely the senses of sight and hearing, so that it can maximize the reception of information and provide information more quickly because it can be directly seen, heard and repeated, making respondents more enthusiastic about obtaining information (Simbolon et al., 2021). The method of providing education through audiovisual is very interesting because it is easy to access, there are interesting pictures, the explanations given are clear, and the duration of the video is short. The way to provide videos to respondents is to send them individually, not in groups or focus on sending them to one respondent and not sending them through groups, which will result in the information provided being drowned out or not being conveyed properly. Apart from that, audiovisual media is very interesting, easy to access anytime and anywhere, and it displays writing, images, sound and even videos about how to care for your feet every day. So that it is easier for respondents to obtain information about managing diabetes mellitus; moreover, from the information provided, respondents can change their behavior by maintaining a good diet, controlling blood sugar regularly, and doing daily physical activity. This research aligns with Habibah's (2019) research, which states that there is a significant influence on improvements in care behavior in DM patients using audiovisual media before and after being given DSME.

Audiovisual media can be conveyed well and is influenced by educational factors where most of the respondents' education in the treatment group is high school and diploma/graduate, 63%. Education plays a very important role in the acceptance of educational videos provided where education is directly proportional to knowledge, and respondents can absorb the information provided through audiovisual video media and improve the self-care behavior of diabetes mellitus patients. A person's behavior based on knowledge will be sustainable, but if a behavior is not based on knowledge, then the behavior will only be temporary. However, sometimes knowledge only sometimes guarantees the behavior carried out by someone. Experiences and influences from the external environment will strengthen a person's behavior (Notoatmodjo, 2005). The creation of the application of a behavior requires motivation within the individual. A person who knows must also be motivated because motivation will influence changes in a person's behavior (Koma & Suwarno, 2021).

CONCLUSION

This study comprised two groups, namely the intervention group and the control group, with similar characteristics regarding age, gender, education, dietary habits, duration of illness, and previous history of diabetes mellitus medication. Before receiving educational materials, the respondents' knowledge, attitudes, and behaviors in both groups were relatively alike. After providing educational materials, respondents' knowledge in the intervention group exhibited a significant improvement, with most of them reaching a high level of knowledge. Similarly, the attitudes and behaviors of respondents in the intervention group also showed significant enhancements, with most of them demonstrating favorable attitudes and behaviors. Statistical analysis results indicate notable knowledge, attitudes, and behavior disparities between the intervention and control groups after administering educational materials. Using video-based educational materials proved more effective in augmenting knowledge, attitudes, and behavior than the control group. Consequently, it can be inferred that video-based educational materials positively impact respondents' knowledge, attitudes, and behaviors concerning diabetes mellitus.

REFERENCES

Adrianto, H. P. (2019). *Pengaruh Penyuluhan Gizi Dengan Media Audio Visual Terhadap Perubahan Pengetahuan, Sikap, Dan Praktik Gizi Seimbang Pada Wanita Usia Subur Pra Nikah Di Kua Wilayah Kota Pariaman Tahun 2019* .

Rusmini[1], Edy Suyanto[2], Nurwahidah[3], Ratih Putri Maharani[4]

Alqahtani, M., Almutairi, F., Albasseet, A., Cureus, K. A.-, & 2020, undefined. (2020). Knowledge, attitude, and practice of diabetes mellitus among the saudi population in Riyadh, Saudi Arabia: a quantitative study. *Cureus.ComM Alqahtani, FE Almutairi, AO Albasseet, KE AlmutairiCureus, 2020•cureus.Com*. https://doi.org/10.7759/cureus.6601

Anifah, F. (2020). Pengaruh Pendidikan Kesehatan Melalui Media Vidio Terhadap Pengetahuan Tentang Anemia Pada Remaja Putri. *Jurnal Keperawatan Muhammadiyah*, *5*(1). https://doi.org/10.30651/JKM.V5I1.6335

Ardyanto, W. (2020). *Review Literatur: Pengaruh Penggunaan Media Audio Visual Terhadap Pengetahuan Gizi Pada Penderita Diabetes Mellitus Tipe Ii*. http://eprints.poltekkesjogja.ac.id/3297/

Black, J. M., & Hawks, J. H. (2014). *Keperawatan medikal bedah: manajemen klinis untuk hasil yang diharapkan*. Elsevier (Singapore).

Brunner, L. S., & Suddarth, D. S. (2008). *Textbook of Medical-surgical Nursing: Brunner and Suddarth's*. Lippincott Williams & Wilkins.

dan Perry, P. (2009). Buku Ajar Fundamental Keperawatan: Konsep, proses, dan praktik. *Jakarta: EGC*.

Habibah, U., Ezdha, A. U. A., Harmaini, F., & Fitri, D. E. (2019). Pengaruh Diabetes Self Management Education (Dsme) Dengan Metode Audiovisual Terhadap Self Care Behavior Pasien Diabetes Melitus. *HEALTH CARE : JURNAL KESEHATAN*, *8*(2), 23–28. https://doi.org/10.36763/HEALTHCARE.V8I2.53

Handayani, S., & MARNIATI, M. (2018). *Penerapan Media Video Pembelajaran Pada Kompetensi Dasar Membuat Pola Dasar Rok Secara Konstruksi Di Kelas X Tata Busana 3 Smk Negeri 6*. https://ejournal.unesa.ac.id/index.php/jurnal-tata-busana/article/view/23588/21563

Larasanti, P. A., & Rumintang, B. I. (2020). Pengaruh Pendidikan Kesehatan Menggunakan Media Video Terhadap Peningkatan Pengetahuan Remaja Putri Mengenai Dampak Kehamilan Usia Remaja Di Smpn 1 Lingsar Tahun 2018. *Jurnal Midwifery Update (MU)*, *1*(2), 21–29.

Lasmini, L. (2021). *Pengaruh Penerapan Edukasi Alat Kontrasepsi Melalui Video Terhadap Tingkat Pengetahuan Wus Tentang Kb Di Desa Jlopo Kecamatan Grogol Kabupaten Sukoharjo*.

Machmud, Y., Ahmad, A., Keperawatan, H. P.-M., & 2019, undefined. (n.d.). Pengaruh pendidikan kesehatan terhadap pengetahuan dan sikap pencegahan diabetes melitus pada siswa kelas x di SMK Negeri 10 Makassar. *Neliti.ComY Machmud, AK Ahmad, HPPP PutriMedia Keperawatan, 2019•neliti.Com*. https://doi.org/10.32382/jmk.v10i2.1317

Meliyanti, M. (2021). Pengaruh Edukasi Video Terhadap Tingkat Pengetahuan Bahaya Tidak Sarapan Pagi Pada Siswa Sekolah Dasar SDN Gatot Subroto Kota Bandung. *Jurnal Sehat Masada*, *15*(1), 156–161.

Mulyani, I., & Fitriana, N. F. (2020). Pengaruh Pemberian Edukasi Menggunakan Audio Visual (Video) pada Ibu terhadap Pengetahuan Penanganan Tersedak Balita. *Jurnal Keperawatan Muhammadiyah Bengkulu*, *8*(2), 87–93. https://doi.org/10.36085/JKMU.V8I2.885

Musdalifah, M., & Nugroho, P. S. (2020). Hubungan Jenis Kelamin dan Tingkat Ekonomi dengan Kejadian Diabetes Melitus di Wilayah Kerja Puskesmas Palaran Kota Samarinda Tahun 2019. *Borneo Studies and Research*, *1*(2), 1238–1242.

Notoatmodjo, S. (2005). *Metodologi penelitian kesehatan*.

Notoatmodjo, S. (2007). Promosi kesehatan dan ilmu perilaku. *Jakarta: Rineka Cipta*, *20*.

Nursalam, S. (2013). Metodologi penelitian ilmu keperawatan pendekatan praktis. *Jakarta: Salemba Medika*.

Perkeni, P. I.-Pb. (2015). Pengelolaan dan pencegahan diabetes melitus tipe 2 di Indonesia. *Academia.EduPE IndonesiaPb. Perkeni, 2015•academia.Edu*. https://www.academia.edu/download/56766833/DM_Perkeni.pdf

PRATAMA, P. (2016). Pengaruh Pendidikan Kesehatan Terhadap Pengetahuan Dan Sikap Pasien Tentang Pengelolaan Diet Diabetes Mellitus. *Core.Ac.UkPA PRATAMAcore.Ac.Uk*. https://core.ac.uk/download/pdf/148613673.pdf

Puspita, R. I., Maghfirah, S., & Sari, R. M. (2019). Penyuluhan Kesehatan Menggunakan Media Video Terhadap Pengetahuan Ibu Dalam Pencegahan Kejang Demam Balita di Dukuh Ngembel Desa Baosan Lor Kecamatan Ngrayun Kabupaten Ponorogo. *Health Sciences Journal*, *3*(1), 23. https://doi.org/10.24269/HSJ.V3I1.220

Sayekti, I. (2020). *Pengaruh pendidikan kesehatan dengan media video terhadap pengetahuan, sikap, dan perilaku pencegahan diabetes mellitus di Desa Mangunsoko Kecamatan*. http://eprintslib.ummgl.ac.id/1643/

Simbolon, P., … S. S.-J. I., & 2021, undefined. (2021). Pendidikan Kesehatan Pencegahan Diabetes Melitus pada Masyarakat Tanjung Anom. *Myjurnal.Poltekkes-Kdi.Ac.Id*, *1*(2), 2021. https://doi.org/10.36990/jippm.v1i2.407

Suciana, F., Daryani, D., … M. M.-J. I. P., & 2019, undefined. (2019). Penatalaksanaan 5 pilar pengendalian dm terhadap kualitas hidup pasien DM tipe 2. *Journal.Stikeskendal.Ac.IdF Suciana, D Daryani, M Marwanti, D ArifiantoJurnal Ilmiah Permas: Jurnal Ilmiah STIKES Kendal, 2019•journal.Stikeskendal.Ac.Id*.
http://journal.stikeskendal.ac.id/index.php/PSKM/article/view/587

Suharto, S., Gurning, F. P., Pratama, M. Y., & Suprayitno, E. (2020). Implementasi kebijakan penanggulangan HIV/AIDS di Puskesmas Teladan. *Jurnal Riset Hesti Medan Akper Kesdam I/BB Medan*, *4*(2), 131–136.

Sundari, P., Asmoro, C., Keperawatan, H. A.-J., & 2019, undefined. (2019). Hubungan tingkat pengetahuan dan diabetes self-management dengan tingkat stres pasien diabetes melitus yang menjalani diet. *Repository.Unair.Ac.Id*, *22*(1), 31–42. https://doi.org/10.7454/jki.v22i1.780

Susilaningsih, T., & Salmiyati, S. (2017). *Pengaruh Pendidikan Kesehatan dengan Media Video terhadap Tingkat Kepatuhan Diet pada Penderita Diabetes Mellitus di Puskesmas Gamping 1 Sleman*. http://digilib.unisayogya.ac.id/2616/

Trisnadewi. (2018). Gambaran Pengetahuan Pasien Diabetes Mellitus (Dm) Dan Keluarga Tentang Manajemen Dm Tipe 2. *Balimedikajurnal.Com*. https://www.balimedikajurnal.com/index.php/bmj/article/view/33

Ukat, Z. M. Y., Yuliwar, R., & Dewi, N. (2018). Hubungan antara Tingkat Pengetahuan dengan Gaya Hidup pada Penderita Diabetes Mellitus di Wilayah Kerja Puskesmas Kendalsari Kelurahan Tulusrejo Kecamatan Lowokwaru Malang. *Nursing News: Jurnal Ilmiah Keperawatan*, *3*(3).

Umiyarni Purnamasari, D., Dardjito, E., Studi Ilmu Gizi FIKES Unsoed, P., Kesehatan Masyarakat FIKES Unsoed, J., & Studi Pendidikan Jasmani dan Kesehatan Rekreasi FIKES Unsoed, P. (2017). Perilaku gizi seimbang anak sekolah diperbaiki dengan edukasi gizi anak dan orangtua. *Jos.Unsoed.IdDU Purnamasari, E Dardjito, K KusnandarJurnal Gizi Dan Pangan Soedirman, 2017•jos.Unsoed.Ac.Id*, *1*, 1–9. http://jos.unsoed.ac.id/index.php/jgps/article/view/318

Wawan, A., & Dewi, M. (2016). Teori dan Pengukuran Pengetahuan, Sikap, dan Perilaku Manusia (Yogyakarta: Nuha Medika) p 132. 6. *Acknowledgement Authors Wishing to Acknowledge*.

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