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Knowledge and Quality of Life in Type 2 Diabetes Mellitus Patients also its Related Factors

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ABSTRACT

Knowledge is important to control blood sugar and prevent complications, and subsequently have an impact on the quality of life (QOL) of type 2 diabetes mellitus (T2DM) patients as a response to their health. This study was aimed to determine the correlation between the level of knowledge and QOL in type 2 DM (T2DM) patients, as well as its related factors. This cross-sectional study was conducted in a Public Hospitals, Buleleng, Bali on September 2020. The inclusion criteria included T2DM outpatients aged ≥ 18-year-old, getting similar therapy for at least 3 months, filling out the questionnaire completely, being able to communicate well, and not in a pregnant/breastfeeding condition. Data were obtained by medical records, questionnaires DKQ-24 (knowledge) and EQ-5D-5L (QOL). The correlation between knowledge and QOL of T2DM patients and its related factors were analyzed using bivariate statistical tests. The findings of the 150 respondents showed that the majority of the patients were ≥ 60-year-old (53.3%), female (50.7%), first educational level (64%), not working (54%), low income (49.3%), >5 years of T2DM duration (44%), no complications (75.3%), taking 4-6 item medicines (66.7%), moderate knowledge level (70.7%) with QOL based on the utility score 0.892±0.154 and VAS 59.73±20.07. Statistical tests showed there was a significant correlation between knowledge and QOL based on utility value (p=0.01), but not with VAS value (p=0.165). These was reinforced by age which has a significant correlation with knowledge (p=0.042), also employment status and complications condition which have a significant correlation with QOL (p<0.05). Patients with a higher level of knowledge have a better QOL, despite different backgrounds.
Keywords: Type 2 diabetes mellitus; knowledge; quality of life; patient's characteristics

INTRODUCTION

The number of the patients if diabetes mellitus (DM) continues to increase both in developed and developing countries, and has become a global health problem in society[1]. In Indonesia, the number of people who suffer from DM is ranked 6th in the world (10.3 million people)[2]. Based on the results of *Indonesia's Sample Registration System* in 2018 conducted by Usman *et al.* (2019), in Indonesia, DM is the third largest cause of death after cerebrovascular disease and ischemic heart disease[3]. Especially in the province of Bali, based on the 2018 Basic Health Research Report (Laporan Riset Kesehatan Dasar), it was reported that the province of Bali had quite a lot of DM cases. The prevalence of DM in the province of Bali in the population aged ≥15-year-old based on a doctor's diagnosis had been increasing by 0.3% from 2015 to 2018. Every city/district in the province of Bali has DM sufferers, including Buleleng district. Buleleng is included in the top 5 regencies in Bali province with a percentage of DM cases, which is 1.23% of the total population of Bali province. In the health profile of Buleleng in 2017, in Singaraja City, DM had the 3rd most sufferers (1.549 cases) after acute respiratory infections and primary hypertension[4].

The information related to the high numbers of DM in Indonesia, especially in Bali, increases the need to know the level of patient knowledge of DM and DM management which can be significantly related to the patient's quality of life[5]. The knowledge of DM is very important for patients because it can affect the implementation of DM management in controlling blood sugar levels and preventing complications[6]. The lack of knowledge related to DM is still often an obstacle in controlling DM conditions, considering that this knowledge is related to decisions or helping DM sufferers overcome their problems in undergoing self-care activities such as physical exercise, diet, and a healthy lifestyle[7,8,9,10]. Not only that, a good knowledge about DM in DM patients is also reported to be

significantly related to other activities, namely in increasing the frequency of blood glucose checks and patient compliance which tends to be better in undergoing treatment, so that DM patients can control their blood sugar levels properly and are able to prevent complications. microvascular and macrovascular[11,12]. This in turn can have an impact on the better quality of life of the patients[13].

The quality of life in patients with type 2 diabetes is considered to be able to describe the patient's health condition in terms of physical, psychological, and social relationships. Optimally, the quality of life is the expected outcome after undergoing treatment and measuring other important parameters in controlling blood glucose levels and minimizing the occurrence of complications[14,15]. Solikin and Heriyadi (2020) also explained that the quality of life in DM patients appears as the individual's response to the DM condition they suffer, so an outlook is needed to improve the quality of life[16]. Therefore, in achieving a good quality of life, one of which is that patients can be influenced by knowledge related to DM[15]. A research by Thultheen *et al.* (2021) explained that the better the knowledge of type 2 DM patients have, the better their quality of life[17]. Based on the explanation above, the researchers are interested in knowing the relationship between the level of knowledge and the quality of life of type 2 DM patients at the Buleleng Regency General Hospital, then analyze the factors associated with both.

METHOD

This study is an observational study with a cross-sectional design conducted at a General Hospital (RSU) in Buleleng. The number of respondents involved in the study were 150 respondents who were obtained by purposive sampling technique, so that all members of the population were used as research samples. Inclusion criteria included outpatient type 2 DM with and without complications (complications occurred after the patient was diagnosed with type 2 DM), aged 18-year-old, underwent the same therapy for at least 3 months, and were willing to fill out the questionnaire completely (as evidenced by filling out the informed consent form). The exclusion criteria included the condition of the patient who was weak, unable to communicate well, and was pregnant and breastfeeding. The data collection was carried out for a period of 1 month, namely September 2020. This research has obtained a certificate of passing the ethical review from the Health Research Ethics Committee of Bina Usada Bali Health College with No. 011/EA/KEPK-BUB-2021.

The design of this study adopts the research of Pratama *et al*. (2019) and Yuwindry *et al*. (2016), which looked at the relationship between knowledge and quality of life of type 2 DM patients and the factors that influence it. However, this study did not look at patient compliance as a potential intermediate factor in improving the patient's quality of life[18,19]. The research instrument used was a data collection sheet to collect the data from medical records, such as treatment history, complications, and duration of suffering from type 2 diabetes. In addition, questionnaires were also used, which consisted of the Diabetes Knowledge Questionnaire 24 (DKQ-24)[20] to measure knowledge, as well as the European Quality of Life Five Dimension Five Level Scale (EQ-5D-5L) with Indonesian value set conversions to measure quality of life. based on utility value[21]. Both questionnaires have met the validity and reliability tests based on previous studies. The DKQ-24 questionnaire has an Individual Content Validity Index (I-CVI) value of 0.95 and Cronbach's value of 0.71 (>0.60)[20]. The Indonesian version of the EQ-5D questionnaire had a correlation value of > 0.30 based on the Pearson Product Moment and a Cronbanch's value of 0.718 (> 0.60)[22].

The assessment of the DKQ-24 questionnaire is based on the answer choices such as "yes", "no", and "don't know" from the 24 questions asked to respondents. The assessment was carried out based on the number of items correctly answered by the

respondent. The correct answer is given a value of 1, while the wrong answer or do not know is given a value of 0. The level of knowledge is said to be "high" if it is in the range of scores of 17-24, "medium" in the range of 10-16, and "low" if it is in the range of 0-9[23]. The assessment on the EQ-5D-5L questionnaire is divided into two, namely in the first part based on the 5 dimensions and the level of each of these dimensions. The value of each level is then converted based on the Indonesian value set, then combined to determine the utility value of each respondent. The utility values are in the range 0 to 1. A zero value of "0" indicates the worst condition, while a value of one "1" indicates the best health status. The second part of the EQ-5D-5L questionnaire is a Visual Analog Scale (VAS) score which is a scale in the form of a straight line of 10 cm (or 100 mm) long, with a verbal description at each end in the range 0 to 100 (0 describes the worst health status, while 100 describes the best health status when filling out the questionnaire)[24].

The descriptive analysis was used to describe the characteristics of the respondents involved in this study, such as social demographics, level of knowledge and quality of life, which are shown through the percentage (%) of frequency and mean±standard deviation (SD). The relationship between knowledge and quality of life (utility value and VAS) was analyzed by statistical test of Pearson's rank correlation (parametric data on ratio-ratio scale) with statistical software. Other statistical tests consisting of non-parametric correlation tests, namely Spearman's rho test (ordinal-ratio data), Kendall's tau b/c test (ordinal-ordinal scale data), Chi-square test (tabulation BXK>2 and nominal-scale ordinal data), or the comparative test Kruskal-Wallis H test (nominal-ordinal scale data) which did not meet the requirements of the Chi-square test (tabulation BxK>2) was used to analyze the relationship between respondent characteristics with the compliance and the quality of life.

RESULT AND DISCUSSION

Overview of Patient Characteristics

The characteristics of the respondents in this study were mostly aged 60 years (53.3%), female (50.7%), first education level (SD-SMP) (64%). A research by Hamida *et al.* (2019) which measured the quality of life of DM and hypertension patients, the majority of DM sufferers are women[25]. Patients with type 2 diabetes also have different age levels, patients >45-year-old have the potential to develop type 2 DM and most of them are found to have macro vascular complications that can develop progressively[26]. The education level of type 2 DM patients is low (elementary-middle school). Education can contribute to the behavior of individuals to choose and make better decisions. Therefore, the higher the education level of the patient, the more it is expected for them to be able to control the DM condition that is being experienced, as well as to prevent the risk of DM[10]. However, the education here refers not only to a formal form, but also to an informal form, such as a family that supports type 2 DM patients positively, to also prevent complications[27]. The majority of type 2 DM patients do not work and have low income because the patient's age is >60-year-old, therefore working is not possible due to a decrease in body functional conditions that affect physical, psychological, social relations, and physical activity[28].

The longest duration of illness felt > 5 years (44%) by type 2 DM patients with various types of complications and the drugs they received (Table I). A total of 24.0% of patients experienced complications, of which macrovascular complications (58.3%) were more common in type 2 DM patients than microvascular complications (50.0%), but the majority of respondents had no complications (76.0%). Type 2 DM patients tend to have a weak immune system condition, therefore DM patients are more susceptible to various types of infections, and there is a high possibility of chronic complications (microvascular and macrovascular), given the relationship with the nature of DM disease and low glycemic

Table I. The Characteristics of DM Type 2 Patients

Characteristic	n (150)	%
Age		
< 60-year-old	70	46.7
≥ 60-year-old	80	53.3
Sex		
Male	74	49.3
Female	76	50.7
Education Level		
No education	12	8.0
Elementary to Middle School Level	96	64.0
High School Level	23	15.3
Higher education	19	12.7
Labor status		
No Labor	81	54.0
Have Labor	69	46.0
Income		
< Rp 1.000.000	74	49.3
Rp 1.000.000-2.000.000	46	30.7
> Rp 2.000.000	30	20.0
Length of having disease		
< 3-year-old	30	20.0
3-5 years	54	36.0
> 5-year-old	66	44.0
Total of Drug Item		
1-3 drugs	47	31.3
4-6 drugs	100	66.7
> 6 drugs	3	2.0
Complication		
No Complication	114	76.0
With Complication	36	24.0
Microvascular Complication	18	50.0
Diabetic nephropathy	14	77.8
Diabetic neuropathy	4	22.2
Macrovascular Complication	21	58.3
CHD	18	85.7
Stroke	3	14.3

control[29]. The effect of long suffering from DM is estimated to contribute to the occurrence of complications, but if DM patients lead a healthy lifestyle, the risk of complications can be prevented[30]. The other major characteristics of type 2 DM patients, namely receiving 4-6 drug items (66.7%) were related to their DM condition. Research by Poluan *et al.* (2020) explained that type 2 DM patients were dominantly treated with ≥5 types of drugs per day. This was followed by the condition of complications that the patients had also experienced. The treatment received was, in addition to controlling blood sugar levels, also used to control some of the complications experienced in patients with type 2 DM[31]. Research by Pratama *et al.* (2019) stated that type 2 DM patients with fewer drugs indicated

Table II. Knowledge Level of DM Type 2 Patients

Variable	Category	n	%	Average ± Elementary School (*Sekolah Dasar*/SD)
Knowledge	Low (0-8)	10	6.7	
	Moderate (9-16)	106	70.7	14.1± 3.1
	High (17-24)	34	22.7	
Total		150	100.0	

Description: DM, Diabetes Melitus; SD, Standard of Deviation

a low number of complications and/or co-morbidities that they experienced[18].

The knowledge of type 2 DM patients undergoing outpatient treatment at the General Hospital in Buleleng was mostly at a moderate level of knowledge based on knowledge measurement using the DKQ-24 questionnaire (Table II). At this level of knowledge, the highest score obtained was 14 points from a range of 9-16. Most patients answered correctly ("yes") with the most dominant (98.7%%) on questions related to whether eating too much sugar can cause DM. The most incorrect answers to the questions ("no" or "don't know") were answered by respondents related to DM symptoms, namely frequent urination and feeling thirsty (86.0%). From these incorrect answers, concern related to the respondent's lack of knowledge about the symptoms of diabetes arises. The symptoms of type 2 DM usually develop gradually, for DM conditions are often not diagnosed at the beginning of its occurrence. People who are at risk of developing this disease are recommended to undergo routine examinations and have knowledge related to the various symptoms that appear whether in the pre-diabetes or in DM stage, especially when it has occurred long enough, in order to prevent a progressive increase in the severity of DM[32]. Therefore, to control type 2 DM effectively, it is important for patients to have good and correct knowledge regarding the disease[33]. This is also a concern for health workers to be able to provide further education regarding DM and its therapy[18].

The quality of life is one of the important outcomes used to evaluate the effect of chronic disease management, such as DM[24]. In this study, the quality of life of patients with type 2 DM was measured by the EQ-5D-5L questionnaire through utility values and VAS. The utility value was calculated by calculating the index value with the value set that had been determined by Purba *et al.* (2017) [21]. Table III shows that type 2 DM patients have a quality of life with a mean utility value of 0.892 ± 0.154. The results of this study are in line with the research conducted by Hamida *et al*. (2019) which showed that type 2 DM patients reported having a mean utility value of > 0.800 with a minimum number of respondents at the level 5[25]. The difference in utility values in type 2 DM patients does not occur in only in the regions of Indonesia, but is also shown in several other Asian countries such as Thailand, China, Hong Kong, India, Bangladesh, Iran, respectively 0.801[34]; 0.939[35]; 0.840[36]; 0.803[37]; 0.620[38]; 0.770 and 0.720[39]. In addition, the results of the second quality of life measurement based on the VAS for type 2 DM patients in this study tended to be low, namely 59.73±20.07 with only 11.33% of respondents having a VAS value >80, which can be interpreted that the respondent had a fairly disturbed health status when filling out the questionnaire, such as in terms of pain and not being able to move freely because of the complications they had[40]. A research by Golicki *et al.* (2015) showed that in Poland, the mean of the VAS value was also low in type 2 DM patients, and decreased with age (VAS scores were 68.2 at 32–44-year-old and 50.2 at >65-year-old)[41]. Likewise, in the research of Mateo *et al.* (2015) in Spain and Abedini *et al.* (2020) in Birjand had shown a VAS mean value

Table III. Overview of L Quality of Life Dimensions, Utility Values, and EQ-VAS Based on the EQ-5D-5L Questionnaire in Type 2 DM Patients

Dimension	Level (%)					Average ± Elementary School (*Sekolah Dasar*/SD)
	1	2	3	4	5	
***Mobility* (MO)**	65.3	24.0	9.3	0.7	0.7	
***Self-Care* (SC)**	81.3	13.3	4.0	0.7	0.7	
***Usual Activity* (UA)**	68.7	23.3	6.7	0.7	0.7	
***Pain/ Discomfort* (PD)**	62.7	28.7	7.3	0.7	0.7	
***Anxiety/Depression* (AD)**	81.3	14.0	2.7	1.3	0.7	
Utility Value						0,892 ± 0,154
EQ-VAS						59.73± 20.07

Description: level 1, not disturbing; level 2, a little disturbing; level 3, quite disturbing; level 4, very disturbing; level 5, extremely disturbing; DM, diabetes mellitus; SD, standard deviation; EQ-5D-5L, European Quality of Life Five Dimension Five Level Scale; EQ-VAS, European Quality of Life-Visual Analog Scale; DM, Diabetes Mellitus.

of 61.11±20.51[42] and 65.22±9.32[29], respectively. The difference in results on quality of life both in utility and VAS values among the existing studies is caused by differences in the time and frequency of measurement, number, sociodemographic characteristics, and clinical conditions of the respondents which are influenced by the quality of DM treatment they were undergoing, and the availability of the system and access to health services. Then, the way the respondents responded when answering the questionnaire could also provide variations in utility value results, such as face-to-face interviews which are considered more effective than postal surveys, because respondents can be met more easily and can answer questions more optimistically[29,38]. Another cause is the use of different value sets, such as Indonesia EQ-5D-5L value set[21] used in this study, while a similar study conducted by *Zare et al.* (2020) in type 2 DM patients in Iran used the United Kingdom (UK) EQ-5D-5L value set[39].

The dominance of the answers on each dimension is at level 1 (>60%) (Table III). However, there were still type II DM patients in this study who were in the severe category (levels 4 and/or 5) in each dimension (<2%). Such respondents were generally respondents who had a long-term history of DM and experienced quite severe complications and had an uncontrolled lifestyle which ultimately affected the patient's quality of life[25,43]. Then, most of the respondents were not disturbed by their activities because these patients had a controlled lifestyle and sugar levels. A research Hamida *et al.* (2019) is in line with this study for as many as 98% of DM patients at Palu City Health Center did not find it difficult to carry out self-care. However, generally, the average type 2 DM patients had poor quality in the dimension of mobility, namely the patient's ability to walk or move, as well as experiencing anxiety/depression[25]. In addition, studies in other countries in patients with type 2 DM, such as in Bangladesh and India also showed the same constraints[44,37]. Anxiety/depression that can come from feelings of pain/discomfort experienced by patients with type 2 diabetes is associated with lower metabolic outcomes and the large number of drugs received due to the patient's complications. If a person experiences anxiety/depression, there is an increase in the release of the hormone cortisol which can directly increase blood sugar levels. In addition, when a person is diagnosed with type 2 DM, the individual feels stressed that

this disease might require a series of unwanted lifestyle changes, causing the individual to lose control over their health, and ultimately causing complications related to type 2 DM, such as diabetic retinopathy, neuropathy, sexual dysfunction, and macrovascular complications[45].

The Relationship between Knowledge with Quality of Life

Based on the variation in the level of knowledge and quality of life of type 2 DM patients in this study, it can be seen that there is a relationship between the two (Table IV). Based on statistical tests, it is clear that the level of knowledge has a significant relationship with the quality of life based on the utility value ($p<0.05$) with a positive correlation direction and the closeness of the relationship (r value) of 0.317. That is, the higher the patient's knowledge, the higher the patient's quality of life (utility value), but the closeness value is in the weak category[46]. In line with the research conducted in Indonesia by Amelia (2015) and Yuwindry *et al.* (2016), each of the patients with type 2 DM in one of the hospitals in Medan and Yogyakarta stated that the patients' level of knowledge had an effect on their quality of life[29,47]. A research by Al_aboudi *et al.* (2016) revealed that DM patients need to have knowledge to achieve better glycemic control to improve the quality of life[24]. DM patients with a higher level of knowledge may have positive attitudes and practices in managing their disease. This is shown through high self-awareness related to health, hence the patients try to change their lifestyle to a healthier direction, then adhere to the therapy they are undergoing, and ultimately have an impact on controlling blood sugar levels and low HbA1c values, so as to reduce the incidence of DM complications and increase the utility value which leads to a better quality of life[18,33,47,48]. The quality of life of type 2 DM patients is significantly influenced by the patient's knowledge, and the quality of life can be further improved along with high adherence to DM therapy[19].

This study did not show a significant relationship between knowledge and the VAS value ($p>0.05$). This is caused by the existence of different perceptions between individuals. For example, the perception of pain felt by each individual varies depending on the condition of the body between individuals at that time. Each patient with another may have the same clinical diagnosis, but the quantification of the severity of the pain they feel may differ, in which some patients may be able to tolerate a higher level of pain and continue with daily life and activities, but some others may not be able to accept the pain so that they immediately seek and undergo treatment with the aim of reducing the severity of the pain. Based on Klimek *et al*. (2017), VAS can document the characteristics and classification of severity of symptoms related to the patient's disease, patients can freely express themselves and the results of VAS measurements can be used to carry out a series of disease control efforts quickly (statistically measurable and reproducible). In addition, VAS can also be used in routine patient history and to monitor the course of chronic disease. However, this VAS measurement is still considered to have a negative effect in the study. For instance, it may give biased results if the questions asked are not clear or the patient feels ambivalent (has two opposite feelings, one side feels afraid, but on the other side feels hopeful)[50].

Relationship of Patient Characteristics with Knowledge and Quality of Life

In this study, it can be underlined that age is significantly correlated with knowledge ($p<0.05$) (Table V). Type 2 DM patients in the age group 60-year-old had a lower mean of knowledge than type 2 DM patients in the <60-year-old age group. A research by Fenwick *et al.* (2013) stated that the age characteristics of type 2 DM patients affect knowledge, it appears that older type 2 DM patients tend to have low knowledge of their disease ($p < 0.001$)[7]. Lee *et al.* (2012) in their research revealed that age is an important factor in the knowledge of type 2 DM patients[51].

Table IV. The Relationship between Knowledge with Quality of Life

Knowledge (n= 150)	Quality of Life					
	Utility Value			VAS		
	Average ± Elementary School (*Sekolah Dasar*/SD)	*p-value*	*r-value*	Average ± Elementary School (*Sekolah Dasar*/SD)	*p-value*	*r-value*
Low	0.776± 0.169			60.00± 26.247		
Medium	0.880± 0.163	0,000[a]*	0.317	60.95± 20.025	0,837[a]	0.017
High	0.964± 0.067			55.29± 18.130		

Description: (*) = significance (p<0,05); ([a]) = *Pearson's rank correlation test*

Nasihah and Sifia (2013) stated that the older a person gets, the better the level of knowledge and the maturity of thinking[52]. If type 2 DM patients have good knowledge as they get older, it may affect their self-efficacy and attitudes, such as changing their lifestyle for the better so that they can improve glycemic control and have an impact on a better quality of life[24]. Related to other patient characteristics such as gender, education level, employment status, income, duration of illness, number of drug items received, and complications, they do not contribute to patient knowledge (p<0.05).

On quality of life, the results of this study highlight that employment status has a significant relationship with utility values (p<0.05) with a correlation coefficient (r) of -0.075 (Table V). That is, if a person works, their quality of life is higher, yet the closeness of the relationship is still very low. This can be seen from the patients who work and do not work have a high utility value (> 0.850), which indicates an almost perfect health condition. However, the utility value of type 2 DM patients who work is higher than those who do not work. Type 2 DM patients who are still able to work tend to have a regular income and the higher the income level, the easier it will be to meet their personal and family needs in carrying out a healthy lifestyle, such as consuming healthy food and exercising regularly. It is important to remember that this income must be managed properly to be able to meet the needs of a healthy life[10]. A research by Stojanović *et al.* (2018) and Basu *et al*. (2021) explained that DM patients who do not work tend to have a lower quality of life due to depression. The depression is related to DM condition and the complications they experience as well as with the medical expenses[53,54]. Reinforced by research Norström *et al.* (2019) in Sweden who have explained that someone who does not work has a strong correlation with low quality of life which shows a loss in the Quality Adjusted Life Year (QALY) value of 10%. The effect on QALY is mainly due to an increase in depression or anxiety problems in someone who does not work[55].

In addition to working status, the characteristics of respondents related to complicated conditions indicate a significant relationship with quality of life based on utility values (p=0.033; r=-0.174), where type 2 DM patients without complications tend to have better utility values than type 2 DM patients with complications (Table V). These results are supported by the research of Jacob *et al.* (2021) who, in their literature study, concluded that the presence of complications had an impact on the low utility value of type 2 DM patients[15]. A research by Pham *et al.* (2020) in a population of type 2 DM patients in Vietnam explained that the condition of complications experienced by DM patients, namely related to microvascular complications such as nephropathy and

Table V. Relationship of Patient Characteristics with Knowledge and Quality of Life

Patient Characteristics (n= 150)	Knowledge			EQ-5D-5L Utility Value		
	Average ± Elementary School (*Sekolah Dasar*/SD)	*p. value*	*r value*	Average ± Elementary School (*Sekolah Dasar*/SD)	*p. value*	*r value*
Age						
< 60-year-old	14.77± 3.06	0,042[a]*	NA	0.905± 0.145	0,196[e]	-0.106
≥ 60-year-old	13.58± 3.04			0.881± 0.160		
Sex						
Male	14.20± 2.94	0,429[a]	NA	0.911± 0.125	0,363[a]	-0.075
Female	13.32± 3.26			0.870± 0.175		
Education Level						
No education	15.21± 2.23	0,657[b]	0.025	0.885± 0.188		
Elementary - Middle School	13.67± 3.27			0.891± 0.147	0,939[e]	0.006
High School/Public High School	15.09± 2.00			0.864± 0.186		
Higher Education	14.68± 3.50			0.939± 0.109		
Labor status						
No Labor	13.98± 2.98	0,299[b]	0.085	0.861± 0.173	0,007[e*]	-0.220
Have Labor	14.32± 3.27			0.929± 0.117		
Income						
< Rp 1.000.000	13.97± 2.98			0.864± 0.170		
Rp 1.000.000-2.000.000	14.17± 3.12	0,377[c]	0.070	0.924± 0.119	0,051[e]	0.160
> Rp 2.000.000	14.47± 3.40			0.911± 0.151		
Length of having disease						
< 3-year-old	14.50± 3.51			0.935± 0.117		
3-5 years	13.74± 2.99	0,162[d]	NA	0.871± 0.168	0,109[e]	-0.131
> 5-year-old	14.29± 3.00			0.889± 0.154		
Total of Drug Item						
1-3 drugs	14.11± 3.11			0.895± 0.144		
4-6 drugs	14.13± 3.15	0,817[d]	NA	0.895± 0.155	0,609[e]	-0.042
> 6 drugs	14.67± 0.58			0.721± 0.195		
Complication						
No Complication	13.86± 3.21	0,947[a]	NA	0.910± 0.135	0,033[e*]	-0.174
With Complication	14.72± 3.15			0.838± 0.194		

Description: (*)= significance (p value <0,05); ([a])=*Chi-square test;* ([b])=*Kendall's tau-c test*; ([c])=*Kendall's tau-b test*; ([d])= *Kruskall-Walis H test*; ([e])=*Spearman's rho test;* ([f])= patient might suffer complications >1 category (microvascular and macrovascular); NA= *not applicable*

retinopathy, affect the patient's low quality of life, mainly from social and emotional functions, although these complications tend not to affect physical status significantly, but it has made the patient worried about the effect of these complications on their daily life and social relationships. Meanwhile, macrovascular complications in DM patients, such as heart disease, can cause mental problems (anxiety/depression) in addition to a

decrease in physical function, considering that patients with these complications have the potential to experience premature death which is much higher than nephropathy or retinopathy[53,56]. Therefore, prevention and control of complications is an important target to shape the quality of life of DM patients in a better direction.

Patient characteristics other than age, employment status, and condition of complications show no significant relationship to knowledge and/or quality of life based on utility values ($p>0.05$). This may be caused by other environmental factors of the patient, such as family support. According to Karmila and Herawati (2018), families can help in reducing ignorance and also non-compliance with DM therapy, such as implementing a diet in type 2 DM patients, and being able to improve self-management of DM patients, so they can have good knowledge and can improve their quality of life. Family support consisting of instrumental support, information, appreciation, and emotional support is a factor that can support an increase in a person's health[57]. However, it should be noted that within the family itself there are different support interactions, including supportive interactions including encouraging family communication and collaboration in managing diet, medication, and checking blood glucose. In addition, there are also non-supportive interactions, namely the feelings of visible irritation, fussy behavior, and refusal to share the burden of life between family members and the family members suffering from DM. The perspectives within the family must be understood and handled properly because family members are interdependent and influenced by each other, which may influence the patient's condition[58]. Another factor is the role of health workers in providing communication, information, and education (IEC) related to DM. Interventions from health workers who are targeted to DM patients can change inappropriate behavior, in terms of knowledge, attitudes, and actions, as well as patient beliefs in managing their disease[59]. A research by Karaoui *et al.* (2018) stated that DM patients tend to be diligent in exercising after receiving recommendations from health workers as part of the DM management. Health workers are highly recommended to undergo special and periodic training in communicating with patients, and empowering patients to be able to manage their illness independently through knowledge transfer and counseling about treatment and appropriate lifestyle changes[60]. In addition, current technological advances, such as the internet, are very helpful in finding sources of information related to DM and can be used as a virtual space to increase the interaction between the health workers and DM patients so that it can lead to a good level of knowledge and quality of life for the patients[61].

The limitations of this study are obtaining the number of samples, as well as the access and the time of data collection during the COVID-19 pandemic. These limitations contributed to the variation in the results. Therefore, there are several variables that were not specifically included in the research criteria, such as the type of DM therapy used, the frequency of checking glucose levels and clinical outcomes related to other DM diseases, marital status, family support, frequency or last time receiving education about the disease and DM therapy from health workers, the internet, or other sources of information that have the potential to be a confounding variable or give biased results in research. In addition, the researcher only took data at one time and did not use a control group, therefore an analysis of opportunities such as the relative risk (RR) of patient characteristics in influencing knowledge and quality of life could not be carried out. Researchers also did not measure adherence as another outcome of the study that might increase the estimated value of the patients' quality of life.

CONCLUSION

The majority of type 2 DM patients had knowledge in the moderate category (70.7%) with a quality of life based on a mean utility

value of 0.892±0.154 and a mean VAS of 59.73±20.07. The knowledge of type 2 DM patients was significantly related to their quality of life (p=0.01; r=0.276). Patient characteristics, such as age, employment status, and complications were significantly related to the level of knowledge and quality of life of patients with type 2 DM (p<0.05). Respondents with a higher level of knowledge have a better quality of life. Therefore, in order to maintain and encourage knowledge and better quality of life, it is necessary to support families and health workers to provide further education and assistance to type 2 DM patients in understanding DM disease and its therapy.

REFERENCES

1. World Health Organization. *Global Report on Diabetes*. World Health Organization; 2016:21-31.
2. International Diabetes Federation. *IDF Diabetes Atlas Eighth Edition 2017*. International Diabetes Federation; 2017:40-49.
3. Usman Y, Iriawan RW, Rosita T, *et al*. Indonesia's sample registration system in 2018: A work in progress. *J Popul Soc Stud*. 2018;27(1):39-52.
4. Dinas Kesehatan Kabupaten Buleleng. *Profil Kesehatan Kabupaten Buleleng Tahun 2017*. Dinas Kesehatan Kabupaten Buleleng; 2017:9.
5. Yusiana MA, Wahyuningsih A, Mahanani S. Senam diabetes melitus menurunkan kadar gula darah puasa pada pasien diabetes melitus tipe II. *Jurnal Penelitian Keperawatan*. 2015;1(1):11-20.
6. Chen L, Pei JH, Kuang J, *et al*. Effect of lifestyle intervention in patients with type 2 diabetes: a meta-analysis. *Metabolism*. 2015;64(2):338-347.
7. Fenwick EK, Xie J, Rees G, Finger RP, Lamoureux EL. Factors associated with knowledge of diabetes in patients with type 2 diabetes using the diabetes knowledge test validated with Rasch analysis. *PLoS One*. 2013;8(12):8-14.
8. Bukhsh A, Khan TM, Sarfraz Nawaz M, Sajjad Ahmed H, Chan KG, Goh BH. Association of diabetes knowledge with glycemic control and self-care practices among Pakistani people with type 2 diabetes mellitus. *Diabetes Metab Syndr Obes*. 2019;12:1409-1417.
9. Abouammoh NA, Alshamrani MA. Knowledge about Diabetes and Glycemic Control among Diabetic Patients in Saudi Arabia. *J Diabetes Res*. 2020;2020:1239735.
10. Gustawi IA, Norviatin D, Alibasyah RW. Gustawi IA, Norviatin D, Alibasyah RW. Pengaruh Tingkat Pengetahuan tentang Diabetes Melitus (DM) Tipe 2 dan Sosial Ekonomi Terhadap Gaya Hidup Penderita DM Tipe 2 di Puskesmas Jalan Kembang Kota Cirebon. *Tunas Med J Kedokt dan Kesehat*. 2020;6(2):103-107.
11. Gonzalez-Barcala FJ, de la Fuente-Cid R, Tafalla M, Nuevo J, Caamano-Isorna F. Factors associated with health-related quality of life in adults with asthma. A cross-sectional study. *Multidisciplinary Respiratory Medicine*. 2012; 7(1):32-42.
12. Kueh YC, Morris T, Borkoles E, Shee H. Modelling of diabetes knowledge, attitudes, self-management, and quality of life: a cross-sectional study with an Australian sample. *Health Qual Life Outcomes*. 2015;13:129-130.
13. Rumana NA, Sitoayu L, Sapang M. Korelasi kadar gula darah puasa terhadap kualitas hidup pasien diabetes melitus tipe 2 di Puskesmas Jakarta Barat tahun 2018. *Indonesian of Health Information Management Journal*. 2018;6(2):41-45.
14. Nurdin F. Persepsi Penyakit dan Perawatan Diri dengan Kualitas Hidup Diabetes Mellitus Type 2. *J Keperawatan Silampari*. 2021;4(2):566-575.
15. Yakub AS, Ekowatiningsih D, Heriansyah, Mustafa M. Studi Literatur Kualitas Hidup Penderita Diabetes

Melitus Tipe 2. *J Media Keperawatan*. 2021;12(1):165-168.
16. Solikin S, Heriyadi MR. Hubungan Self Management Dengan Kualitas Hidup Pasien Diabetes Melitus Di Puskesmas Landasan Ulin. *Din Kesehat J Kebidanan Dan Keperawatan*. 2020;11(1):432-439.
17. Thultheen I, Mansour AMH, Zandeeq W. Knowledge, Attitude and Quality of Life among Type 2 Diabetic Patients in Palestine. *Medico-Legal Updat*. 2021;21(1):355-359.
18. Pratama IPY, Andayani TM, Kristina SA. Knowledge, Adherence, and Quality of Life Among Type 2 Diabetes Mellitus Patients. *International Research Journal of Pharmacy*. 2019;10(4):52-55.
19. Yuwindry I, Wiedyaningsih C, Widodo GP. Pengaruh Pengetahuan Terhadap Kualitas Hidup dengan Kepatuhan Penggunaan Obat Sebagai Variabel Antara Pada Pasien DM. *J Manaj dan Pelayanan Farm*. 2016;6(4):249-254.
20. Qamar M, Iqubal RRM, Farrukh J, *et al*. Validation of diabetes knowledge quistionnaire among Malaysian adult diabetic patients. *Universitas Indonesia Conferences, Asian Federation for Pharmaceutical Sciences*. 2019;5(2):216-224.
21. Purba FD, Hunfeld JAM, Iskandarsyah A, *et al*. The Indonesian EQ-5D-5L Value Set. *PharmacoEconomics*. 2017;35(11):1153-1165.
22. Sari A, Lestari NY, Perwitasari DA. Validasi ST European Quality of Life-5 Dimensions (EQ-5D) Versi Indonesia Pada Pasien Hipertensi di Puskesmas Kota Gede II Yogyakarta. *Pharmaciana*. 2015;5(2):131-138.
23. Larasati AL, Andayani TM, Kristina SA. Hubungan Tingkat Pengetahuan Terhadap Outcome Klinik Pasien Diabetes Melitus Tipe 2. *J Manaj dan Pelayanan Farm.* 2019;9(2):101-108.
24. Al-Aboudi IS, Hassali MA, Shafie AA. Knowledge, attitudes, and quality of life of type 2 diabetes patients in Riyadh, Saudi Arabia. *J Pharm Bioallied Sci*. 2016;8(3):195-202.
25. Hamida N, Ulfa M, Haris RNH, Endarti D, Wiedyaningsih C. Pengukuran Kualitas Hidup Pasien Program Pengelolaan Penyakit Kronis (Prolanis) di Puskesmas Menggunakan Instrumen EQ-5D-5L. *Majalah Farmaseutik*. 2019;15(2):67-74.
26. Yuhelma, Hasneli Y, Nauli FA. Identifikasi dan analisis komplikasi makrovaskuler dan mikrovaskuler pada pasien diabetes melitus. *J Online Mahasiswa Fakultas Keperawatan*. 2014;2(1):569– 579.
27. Farida L, Purwaningsih P, Rosalina. Peran Informal Keluarga Dalam Pengendalian Kadar Glukosa Darah Pada Penderita Diabetes Melitus. *J Ilmu Keperawatan Komunitas.* 2018;1(1):5-17.
28. Anggraini D, Andani TZ. Kualitas Hidupn Pasien Pasca-Percutaneous Coronary Intervention (PCI). *J Keperawatan Komperhensif (Comprehensive Nursing Journal)*. 2018;4(2):98-105.
29. Abedini MR, Bijari B, Miri Z, Shakhs Emampour F, Abbasi A. The quality of life of the patients with diabetes type 2 using EQ-5D-5 L in Birjand. *Health Qual Life Outcomes*. 2020;18(1):18-27.
30. Lathifah NL. Hubungan Durasi Penyakit dan Kadar Gula Darah dengan Keluhan Subyektif Penderita Diabetes Melitus. *J Berkala Epidemiologi*. 2017;5(2):231-239.
31. Poluan OA, Wiyono WI, Yamlean PVY. Identifikasi Potensi Interaksi Obat pada Pasien Diabetes Melitus Tipe 2 Rawat Inap di Rumah Sakit Gunung Maria Tomohon Periode Januari-Mei 2018. *Pharmacon, Jurnal Ilmiah Farmasi*. 2020;9(1):38-46.
32. Widodo FY. Pemantauan Penderita Diabetes Melitus. *J Ilmiah Kedokteran*. 2014;3(2):55-69.
33. Le NK, Turnbull N, Van Dam C, Khiewkhern S, Thiabrithi S. Impact of

knowledge, attitude, and practices of Type 2 diabetic patients: A study in the locality in Vietnam. *J Educ Health Promot*. 2021;10:72.

34. Thaweethamcharoen T, Noparatayaporn P, Sritippayawan S, Aiyasanon N. Comparison of EQ-5D-5L, VAS, and SF-6D in Thai Patients on Peritoneal Dialysis. *Value Heal Reg Issues*. 2019;18:59-64.
35. Lu Y, Wang N, Chen Y, *et al*. Health-related quality of life in type-2 diabetes patients: A cross-sectional study in East China. *BMC Endocr Disord*. 2017;17(1):1-7.
36. Wong EL yi, Xu RH, Cheung AW ling. Measurement of health-related quality of life in patients with diabetes mellitus using EQ-5D-5L in Hong Kong, China. *Qual Life Res*. 2020;29(7):1913-1921.
37. Parik P, Patel V. Health-related quality of life of patients with type 2 diabetes mellitus at a tertiary care hospital in India using Eq 5D 5L. *Indian J Endocrinol Metab*. 2019;23(4):407-411.
38. Barua L, Faruque M, Chowdhury HA, Banik PC, Ali L. Health-related quality of life and its predictors among the type 2 diabetes population of Bangladesh: A nation-wide cross-sectional study. *J Diabetes Investig*. 2021;12(2):277-285.
39. Zare F, Ameri H, Madadizadeh F, Reza Aghaei M. Health-related quality of life and its associated factors in patients with type 2 diabetes mellitus. *SAGE Open Med*. 2020;8:2050312120965314.
40. Alsuwayt S, Almesned M, Alhajri S, Alomari N, Alhadlaq R, Alotaibi A. Quality of life among type II diabetic patients attending the primary health centers of King Saud Medical City in Riyadh, Saudi Arabia. *J Family Med Prim Care*. 2021;10:3040-6.
41. Golicki D, Dudzińska M, Zwolak A, Tarach JS. Quality of life in patients with type 2 diabetes in Poland - Comparison with the general population using the EQ-5D questionnaire. *Adv Clin Exp Med*. 2015;24(1):139-146.
42. Mateo DC, Gordillo MAG, Olivares PR, Adsuar JC. Normative values of EQ-5D-5L for diabetes patients from Spain. *Nutr Hosp*. 2015;32(4):1595-1602.
43. Fajriansyah, Lestari K, Iskandarsyah A, Puspitasari IM. Pengukuran Kualitas Hidup Pasien Program Pengelolaan Penyakit Kronis Diabetes Melitus Tipe 2 di Puskesmas Tamalanrea Makassar. *Majalah Farmasetika*. 2019;4 (1):225-232.
44. Safita N, Islam SMS, Chow CK, *et al*. The impact of type 2 diabetes on health related quality of life in Bangladesh: Results from a matched study comparing treated cases with non-diabetic controls. *Health Qual Life Outcomes*. 2016;14(1):1-9.
45. Bickett A, Tapp H. Anxiety and diabetes: Innovative approaches to management in primary care. *Exp Biol Med*. 2016;241(15):1724-1731.
46. Notoadmojo, S. Metode Penelitian. Jakarta: Rineka Cipta. 2018, dalam Pratiwi Y, Anggiani F. Hubungan Edukasi Terhadap Peningkatan Pengetahuan Masyarakat Pada Penggunaan Antibiotik Di Kecamatan Jekulo Kabupaten Kudus. Cendekia J Pharm. 2020;4(2):149-155.
47. Amelia R. The Correlation Between Level of Diabetic Patients' Knowledge with Quality of Life in Patients with Type 2 Diabetes Mellitus at Haji Adam Malik Hospital Medan. *5th Annu Int Conf Syiah Kuala Univ (AIC Unsyiah) 2015*. Published online 2015:313-318.
48. Amelia R, Lelo A, Lindarto D, Mutiara E. Quality of life and glycemic profile of type 2 diabetes mellitus patients of Indonesian: A descriptive study. *IOP Conf Ser Earth Environ Sci*. 2018;125(1):1-6.
49. Delgado DA, Lambert BS, Boutris N, *et al*. Validation of Digital Visual Analog Scale Pain Scoring With a Traditional Paper-based Visual Analog Scale in

Adults. *J Am Acad Orthop Surg Glob Res Rev*. 2018;2(3):e088.

50. Klimek L, Bergmann KC, Biedermann T, *et al*. Visual analogue scales (VAS): Measuring instruments for the documentation of symptoms and therapy monitoring in cases of allergic rhinitis in everyday health care: Position Paper of the German Society of Allergology (AeDA) and the German Society of Allergy and Clinical Immunology (DGAKI), ENT Section, in collaboration with the working group on Clinical Immunology, Allergology and Environmental Medicine of the German Society of Otorhinolaryngology, Head and Neck Surgery (DGHNOKHC). *Allergo J Int*. 2017;26(1):16-2.
51. Lee WJ, Song K-H, Noh JH, Choi YJ, Jo M-W. Health-Related Quality of Life Using the EuroQol 5D Questionnaire in Korean Patients with Type 2 Diabetes. *J Korean Med Sci*. 2012;27(3):255-260.
52. Nasihah M, Sifia LB. Hubungan antara Pengetahuan dan Pendidikan dengan Pelaksanaan Deteksi Dini Kanker Servik Melalui IVA. *J Midpro*. 2013;2(1): 20-36.
53. Stojanović M, Cvetanović G, Anđelković-Apostolović M, Stojanović D, Rančić N. Impact of socio-demographic characteristics and long-term complications on quality of life in patients with diabetes mellitus. *Cent Eur J Public Health*. 2018;26(2):104-110.
54. Basu G, nandi D, Biswas S, Roy SK. Quality of Life and Depression among Diabetic Patients Attending The Lifestyle Clinic of a Teaching Hospital, West Bengal. *J Family Med Prim Care.* 2021;10(1):321-326.
55. Norström F, Waenerlund A-K, Lindholm L, Nygren R, Sahlén K-G, Brydsten A. Does unemployment contribute to poorer health-related quality of life among Swedish adults? *BMC Public Health*. 2019;19(1):457-468.
56. Pham TB, Nguyen TT, Truong HT, *et al*. Effects of Diabetic Complications on Health-Related Quality of Life Impairment in Vietnamese Patients with Type 2 Diabetes. *J Diabetes Res*. 2020;2020:4360804.
57. Karmila L, Herawati DR. Dukungan Keluarga dengan Kepatuhan Minum Obat pada Pasien Gangguan Jiwa di Wilayah Kerja Puskesmas Banjarbaru. Fakultas Kedokteran Unversitas lambung Banjarbaru. *J Dunia Keperawatan*. 2018;4(2):88-92.
58. Bennich BB, Røder ME, Overgaard D, Egerod I, Munch L, Knop FK, Vilsbøll T, Konradsen H. Supportive and Non-Supportive Interactions in Families with a Type 2 Diabetes Patient: an Integrative Review. *Diabetology and Metabolic Syndrome*. 2017;9(1):55-59.
59. Jackson IL, Adibe MO, Okonta MJ, Ukwe C V. Knowledge of self-care among type 2 diabetes patients in two states of Nigeria. *Pharm Pract*. 2014;12(3):404-414.
60. Karaoui LR, Deeb ME, Nasser L, Hallit S. Knowledge and practice of patients with diabetes mellitus in Lebanon: a cross-sectional study. *BMC Public Health*. 2018;18(1):525-534.

Cántaro K, Jara JA, Taboada M, Mayta-Tristán P. Association between information sources and level of knowledge about diabetes in patients with type 2 diabetes. *Endocrinol y Nutr (English Ed)*. 2016;63(5):202-211.