Metabolic Control Status Related to Quality of Life in Children with Type 1 Diabetes Mellitus at Dr. M. Djamil General Hospital Padang

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A B S T R A C T

Background. Type 1 Diabetes Mellitus (T1DM) is a chronic autoimmune disease requiring lifelong treatment. Good metabolic control could maintain an optimal quality of life. HbA1C is a reliable parameter of metabolic control. Poor metabolic control results in decreased quality of life for T1DM. This study aims to evaluate the relationship between metabolic control status and quality of life in children with T1DM at Dr. M. Djamil General Hospital Padang. **Methods:** This cross-sectional study on 52 T1DM children aged 8–16 years using consecutive sampling methods at the pediatric endocrinology outpatient clinic, Dr. M. Djamil General Hospital Padang, from April-September 2021. HbA1C was calculated using the High-Performance Liquid Chromatography (HPLC) method and classified into good and poor control. Quality of life was assessed using PedsQl 4.0 and classified as impaired and unimpaired. The Chi-square test was used for data analysis. The P-value of <0.05 was considered statistically significant. **Results:** The majority of respondents were girls (57.7%), and most of them had good nutritional status (73.1%). The mean age at diagnosis was 11.21±2.57 years, and they had suffered from T1DM for 2.21±1.28 years. A family history of diabetes was found in 57.7% of respondents. Complications found were hypoglycemia (19.2%) and diabetic ketoacidosis (50%). Poor metabolic control was found in 78.8% of respondents. Quality of life was impaired in 40.4% of respondents, especially in school functions. This study found that respondents with impaired quality of life had poor metabolic status (p<0.034). **Conclusion**: T1DM patients with poor metabolic control status have impaired quality of life.

1. Introduction

Type 1 diabetes mellitus (T1DM) is an autoimmune disease commonly found in children, adolescents, and young adults. The incidence of T1DM is found in 5-10% of all cases of diabetes. The incidence of T1DM in the United States is estimated at around 1.24 million people and is expected to increase to 5 million by 2050. The prevalence of T1DM in children increased by 21% between 2001 and 2009.[1] The Indonesian Pediatrician Association (IDAI) 2018 reported the incidence of T1DM cases in Indonesia is 1220 children. The incidence of effects. Good metabolic control could lead to optimal

T1DM increased to 28.19 per 100 million population in 2010.[2]

T1DM is a disease that requires complex treatment to achieve good metabolic control. The complexity of managing T1DM can be overwhelming, especially for uncomplicated patients, children who may feel abnormal or different from their peers, given the need for self-care activities that interfere with their daily life.[3] Quality of life and T1DM have an overall relationship, especially for psychological, physical, and therapeutic quality of life. Metabolic control is an attempt to achieve

blood glucose levels close to normal or normal and does not cause hypoglycemia.

Good metabolic control can reduce the risk of acute and chronic complications of T1DM, resulting in an increase in the quality of life in children with T1DM,[4,5] This study aimed to evaluate the relationship between metabolic control status and quality of life in children with T1DM at Dr. M. Djamil General Hospital Padang.

2. Methods

This was a cross-sectional study conducted on 52 pediatric patients with T1DM in the polyclinic of Dr. M. Djamil General Hospital Padang from April 2021 to September 2021, by consecutive sampling method.

The inclusion criteria were patients with T1DM aged 8 to 17 years old who agreed to participate in this study. Meanwhile, the exclusion criteria were diabetic children with cerebral palsy, mental retardation, and impaired kidney or liver function. Metabolic control was assessed by the level of Glycated hemoglobin (HbA1C). HbA1C levels were measured by High – The performance Liquid Chromatography (HPLC) method and were classified into good (< 8% at age 6-12 years, <7,5% at age 13-19 years), and poor (≥8% at age 6-12 years, ≥7,5% on age 13-19 years) metabolic control. The quality of life assessment was carried out using the PedsQl questionnaire and classified as impaired (score <70) and unimpaired (score ≥70)

Statistical analysis was performed using the IBM SPSS Statistics software. Categorical data were analyzed using the Chi-square test. The P-value of < 0.05 was considered significant.

3. Results

There were 52 subjects with T1DM. The mean age of the subjects was 13.44 ± 2.58 years, the mean age of the subjects at diagnosis was 11.21 ± 2.57 years, and the mean years suffered from diabetes mellitus was about 2.21 ± 1.28 years. Less than half of the respondents were boys, of which 73.1% of the respondents had good nutritional status. Less than half of the subjects had a family history of diabetes mellitus (42.3%). Half of the subjects had experienced diabetic ketoacidosis (50%), and 19.2% had hypoglycemia in the last one month. Patient characteristics are listed in table 1.

Table 2 shows the metabolic control status of the subjects, 78.8% of the subjects had poor metabolic control status. Table 3 shows the quality of life of T1DM children, where 40.4% of the subjects had an impaired quality of life. The quality of life per domain can be seen in table 4 where the lowest mean of the measured quality of life is the school functioning, with an average of 59.71 and a standard deviation of 14.56, while the other domains have a better mean value (emotional functioning 75.38, physical functioning 80.82, and social functioning 81.55).

The relationship between metabolic control status and quality of life is shown in table 5. Children with poor metabolic control status have more impaired quality of life (48.8%) than children with good metabolic control (9.1%). Based on the results of statistical analysis using the chi-square test, the study shows that there is a relationship between metabolic control status and quality of life for T1DM children (p<0.05).

Table 1. Patient characteristics

Characteristics	f (%)	Mean±SD
Age (years)		13,44±2,58
Age at diagnosis (years)		11,21±2,57
Length of time known to have T1DM (years)		2,21±1,28
Gender Boys Girls	22 (42,3) 30 (57,7)	
Nutritional status Underweight Normal Overweight	5 (9,6) 38 (73,1) 9 (17,3)	
The child's educational status Elementary school Junior high school Senior high school	19 (36,5) 18 (34) 15 (28,8)	
Family history of diabetes Mellitus Yes None	22 (42,3) 30 (57,7)	
HbA1C (%)		10,40±3,02

Complications
  Hypoglycemia
   Yes
   None
  Diabetic ketoacidosis
   Yes
   None
	10 (19,2)
	42 (80,7)
	26 (50)
	26 (50)	

Table 2. The metabolic control status of the subjects (T1DM children)

Metabolic control status	f (%)
Poor	41 (78,8)
Good	11 (21,2)

Table 3. The quality of life of the subjects (T1DM children)

The quality of life	f (%)
Impaired	21 (40,4)
Unimpaired	31 (59,6)

Table 4. The quality of life per domain in the subjects (T1DM children)

The domain of the quality of life	Mean	Standard Deviation	Minimum - Maximum Value
Physical Functioning	80,82	17,48	21,88-100
Emotional Functioning	75,38	16,02	35-100
Social Functioning	81,55	15,57	40-100
School Functioning	59,71	14,56	20-90

Table 5. The Relationship between metabolic control status with the quality of life in children with T1DM

Metabolic control status	The quality of life status		Total (f/%)	p-value
	Impaired (f/%)	Unimpaired (f/%)		
Poor	20 (48,8)	21 (51,2)	41 (100,0)	0,034
Good	1 (9,1)	10 (90,9)	11 (100,0)	
Total	**21 (40,4)**	**31 (59,6)**	**52 (100,0)**	

4. Discussion

In this study, respondents with type 1 DM were in the age range of 9-17 years, of which half of the respondents (57.7%) were girls. A 2017 study by Fox et al. reported that the incidence of T1DM in children and adolescents in Canada significantly increased at the age of 10-14 years.[6] The study of Fischer et al. found that the incidence of diabetes had a mean age of 12.77 years.[7] The Murillo study found that girls were more likely to suffer from T1DM (52.9%) with a mean age of 13.4 years.[8] IDAI data for 2003-2009 showed that in the age group of 10-14 years, the proportion of girls with type 1 DM (60%) is higher than that of boys (28.6 %).[9,10]

Most of the patients in this study (73.1%) had good nutritional status. Abbasi's study on 1318 T1DM cases aged 2 to 15 years showed no significant relationship between the incidence of obesity or overweight with T1DM. Maffeis et al. conducted a study assessing the incidence of underweight and overweight or obesity in children and adolescents with T1DM. A total of 23,026 children with T1DM participated in this study. The results of this study are the same as previous studies, where most of the samples showed normal weight.[11,12]

The development of T1DM is increased in individuals who have a family history of T1DM. According to the American Diabetes Association (ADA), patients with T1DM are recommended to have family members screened. Individuals with a first-degree family history of T1DM have an 88% to 90% chance of developing T1DM. Simmons et al. screened for T1DM in 478 children aged 1 to 18 years who attended a medical examination. Most of the sample in this study reported having no first-degree family history of T1DM (87.7%). A positive test result for T1DM antibodies was found in 2.8% of cases.[13] In this study, it was found that 57.7% of cases did not have a family history of diabetes.

This study found that 78.8% of the study subjects had poor metabolic control. Al-Agha's study found that 66% of the samples had poor glycemic control with HbA1C levels above 9%.[14] Furthermore, Al Zahrani's study in Saudi Arabia found the average HbA1C level was 9.67±1.93, and only 26% had HbA1C levels of 8%.[15] The Dumrisilp study in Thailand also found that 75% of the sample had poor glycemic control. This does not appear to be affected by age, gender, puberty, and duration of diabetes.[16]

Targeted therapy for T1DM requires monitoring of blood glucose and proper use of insulin. The process of care and treatment needed by the children with T1DM is influenced by the process of growth and development, cognitive development, and psychosocial condition of the children. Thus, this process will affect the quality of life of children and adolescents with T1DM. Khemakhem et al. conducted a study on 48 T1DM patients with the aim of measuring the quality of life of children and adolescents with T1DM and found that the average patient had a good quality of life with a mean score of 80.52.[17] Meanwhile, in this study, 59.6% of T1DM children have an unimpaired quality of life.

The quality of life in school functioning of children with T1DM was found to be impaired, with a mean of 59.71 in this study. Samardzi et al. reported that children with T1DM experienced a lower quality of life. Quality of life scores of T1DM patients was significantly lower in psychosocial health and school functioning (p=0.008).[18] Roman et al. reported lower school performance in children with T1DM than in the general population. As many as 10.5% of patients with T1DM reported dropping out of the education system. Mental health problems were also seen in children with T1DM, i.e., 65% adjustment disorder, 50% anxiety disorder, and 20% depression.[19]

This study showed a significant relationship between metabolic control status and quality of life in T1DM children (p=0.034). A higher rate of impaired quality of life status was found in the group of children with poor metabolic control status (48.8%) compared to the group of children with good metabolic control status (9.1%). Schiller et al. conducted a study assessing the association of HbA1C with quality of life in children with T1DM and found that higher HbA1C levels were associated with lower quality of life in patients, especially in school and peer settings. When HbA1C is high in the early years, there is a lower quality of life in the next 4 years, which can affect the patient's life and is associated with depression.[20] Samardzi et al. also reported an association between metabolic control and quality of life in children with T1DM. Feelings of

less anxiety and better perceptions of health are associated with lower HbA1C levels.[18]

Anderson et al. conducted a cross-sectional study consisting of 5,887 T1DM patients. This study reported a significant relationship between quality of life scores and HbA1C levels. Quality of life with a good score is associated with low HbA1C levels. Management of good quality of life such as dietary intake, more frequent daily blood glucose monitoring, and physical activity of at least 30 minutes for more than a day in a week will improve the quality of life and metabolic control of T1DM patients.[21] Murillo et al., reported the association of quality of life with metabolic control of T1DM patients. T1DM children who showed the low quality of life scores were associated with poor metabolic control (HbA1C > 7.5%). Patients with good metabolic control will have their quality of life scores improved.[8]

Mozillo et al. reported that a high quality of life was significantly associated with lower HbA1C levels ($p=0.005$).[22] A study of 161 children with T1DM reported an association of family function with metabolic control. A good family function is associated with low HbA1C levels.[23] Wagner et al. showed different results in which no differences in quality of life were found between diabetic children and healthy children. This may be related to positive thinking, high motivation, good adaptation, and family support to ensure that the children have a good quality of life.[24]

Because this study is a cross-sectional study, data sampling is only done once. To determine what caused the lowest quality of life in the school function, we need to measure the school performance and need to measure the association with the social, economic, and education of the parents.

5. Conclusion

Impaired quality of life was found in children with type 1 diabetes mellitus with poor metabolic control at Dr. M Djamil General Hospital Padang and had a significant relationship between metabolic control status and quality of life for children with T1DM ($p<0.05$).

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