

Description of knowledge, attitudes and practices to maintain oral hygiene as well as gingival index and plaque index in children suffering from type 1 diabetes mellitus

Fernando Rizky Ashifudin Pasha Mulyana ^{1,*}, Dini Setyowati ² and Gilang Rasuna Sabdho Wening ²

¹ Undergraduate Program, Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia.

² Department of Dental Public Health, Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia.

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Abstract

Background: Diabetes mellitus is a chronic disease whose incidence continues to increase throughout the world. Periodontal disease is a complication of diabetes. Poor periodontal health can lead to a variety of serious health problems. Therefore, this research is considered important to determine knowledge, attitudes and practices to maintain oral hygiene as well as gingival index and plaque index in children with type 1 diabetes mellitus.

Objectives: To determine the description of knowledge, attitudes and practices to maintain oral hygiene as well as gingival index and plaque index in children with type 1 diabetes mellitus.

Method: This research is a cross-sectional observational analytical study consisting of 32 respondents from children suffering from T1DM and members of IKADAR Malang. The instrument used was a questionnaire to measure knowledge, attitudes and practices regarding cleaning teeth and mouth; insulin injection compliance, diet, and physical activity. Hba1c to determine DMT-1 status. Gingival and plaque index.

Results and discussions: Respondents with controlled diabetes, good knowledge, attitudes and practices all had healthy gingiva and good PI, namely 3 (15.79%). respondents with regular insulin, good diet and low physical activity all had uncontrolled diabetes, namely 2 (7.14%).

Conclusion: The majority of respondents have uncontrolled diabetes, knowledge, attitudes, practices to maintain good oral hygiene, healthy gingiva, and good PI in one unit, namely 9. The majority of respondents have regular insulin injection compliance, moderate diet, low physical activity, and uncontrolled diabetes mellitus status in one unit, namely 17.

Keywords: Type-1 diabetes mellitus; Knowledge; ttitudes and practices to maintain oral hygiene independently; Insulin injection compliance; Diet; Physical activity; Gingival index and plaque index; Children

1. Introduction

Diabetes mellitus (DM) is a persistent condition with an increasing global incidence. Until 2018, the Indonesian Pediatrician Association (IDAI) reported that there were 1,220 cases of type 1 DM in children in Indonesia. The prevalence of type-1 DM in children and adolescents jumped significantly from 3.88 to 28.19 per 100 million population between 2000 and 2010. Analysis in 2003-2009 showed a higher proportion of type-1 DM in girls (60%) compared to

* Corresponding author: Fernando Rizky Ashifudin Pasha Mulyana

boys (28.6%) in the 10-14 year age group [1]. India recorded 15,900 new cases in the 0–14 year age group, which is the highest globally in incident cases in the 0–14 year and 0–19 year age groups [2].

Diabetes Mellitus (DM) is a systemic disease that manifests in the oral cavity. Uncontrolled diabetes disrupts white blood cells and immune cells such as neutrophils, monocytes and macrophages which function in the body's defense. This causes the body's ability to fight bacteria to decrease and sufferers become more susceptible to infection. In DM sufferers, there is an increase in the number of bacteria in the oral cavity, causing abnormalities in the periodontal tissue, including the gingiva. [3] Several previous studies stated that diabetes is a risk factor for the prevalence of gingivitis. In 1963 by Loe and Silness, the gingival index was introduced as a way to determine the health status of gingival tissue and to see inflammation of the gingiva [3]

Gingivitis is caused by microbial plaque deposits located in or near the gingival sulcus. Plaque is a thin layer that forms on the surface of the teeth due to poor oral hygiene. If not cleaned regularly, it can harden and form calculus. Since plaque harbors a large number of bacteria, inflammation can occur in the gingival tissue [4]. In 1968 Podshadley and Haley introduced the personal hygiene performance plaque index as a way to measure plaque on teeth.

Periodontal disease triggers a decrease in quality of life, thereby hampering routine activities. The impact on Oral Health-Related Quality of Life (OHRQoL) is enormous. Gingivitis is negatively correlated with comfort, especially in aspects such as pain, difficulty in brushing teeth, and wearing dentures [5]. Diabetes mellitus exacerbates periodontal disease, characterized by classic signs of inflammation—redness, swelling, pain, and localized temperature elevation. The severity of periodontal problems in diabetes patients is clearly visible through increased plaque index and gingival index [6]. Parameters that indicate periodontal disease in diabetes include fasting blood sugar levels ≥ 126 mg/dL, non-fasting blood sugar levels ≥ 200 mg/dL, and HbA1c levels $> 6.5\%$ [1].

This study aims to describe the gingival index and plaque index among children suffering from type 1 diabetes mellitus based on knowledge, attitudes, and independent oral and tooth cleaning practices. The main aim is to provide a more comprehensive understanding of the complex interpractices between knowledge, attitudes and self-cleaning practices and gingival index and plaque index in pediatric patients with type-1 diabetes mellitus. This aims to formulate recommendations for improving the standard of dental and oral health services tailored to children suffering from type 1 diabetes mellitus. In addition, this study aims to provide a basis for future research efforts that explore various factors that influence gingival index and plaque index in children suffering from type 1 diabetes mellitus, thereby contributing insight into strategies to improve dental and oral health in this demographic. The ultimate aspiration is that this research will produce major benefits for the wider field of public health, in particular addressing the unique challenges faced by children suffering from type 1 diabetes mellitus.

2. Material and methods

2.1. Research Design

This research uses observational analytics, using a cross-sectional research design to carefully examine the variables studied. This research approach allows systematic observation and analysis of data, offering valuable insights into relationships and patterns within specific parameters, essential for scientific investigation and hypothesis testing. The research was conducted within the IKADAR (Family Association for Diabetes Children and Adolescents) in Malang City in the period November to December 2023.

2.2. Population and Sample

The research population was all children with type 1 diabetes mellitus who were members of IKADAR (Association of Families of Childhood and Adolescent Diabetes Persons) in Malang City, totaling 32 people who were present during the research. The sample was the entire population—32 children and adolescents (6-16 years) with type 1 diabetes mellitus—who were willing to become research respondents, after providing informed consent. Total Sampling Method, which involves comprehensive sampling, is used for the selection process.

2.3. Research Tools

This research uses various instruments and resources, consisting of a research questionnaire distributed to research subjects, providing informed consent to participants, the use of the Microsoft Excel application, and a set of diagnostic tools.

2.4. Procedure

The initiation of this research included preparing and submitting a letter of research ethical feasibility to the Ethics Commission of the Faculty of Dentistry, Airlangga University, Surabaya. In addition, an informed consent document is developed for distribution to research subjects or respondents. At the same time, the instruments required for data collection, including diagnostic devices, were also carefully prepared. This research was carried out through systematic collection of subject data, which was achieved by compiling a comprehensive questionnaire. A clear explanation of the study procedures was provided to the subjects, along with a request for their voluntary participation, indicated by their agreement to the consent form. Furthermore, subjects who expressed their willingness to be actively involved continued to fill out the questionnaire and undergo the specified examination procedures. Careful preparation and clarity of these procedures are fundamental to maintaining ethical standards throughout the research process. The preparation stage continues until the establishment of ethical compliance as proven by the submission of a letter of research ethical feasibility to the Ethics Commission of the Faculty of Dentistry, Airlangga University, Surabaya. This step ensures that the design and implementation of the research complies with established ethical norms and principles. At the same time, an informed consent document is created, intended to be presented to potential research objects or respondents. This document serves as a transparent and informative tool, describing the nature of the research, potential risks and benefits, and the voluntary nature of participation. Upholding high ethical standards is paramount in obtaining voluntary and informed consent from participants.

With regard to ethical considerations, careful attention was directed to the methodological tools used for data collection. Diagnostic devices, which are important instruments in research, are carefully developed and calibrated to ensure accuracy and reliability in assessing relevant parameters. This strategic approach aims to increase the precision and validity of the data collected, thereby contributing to the overall strength of the research findings. The research implementation was opened with a systematic data collection approach. The creation of comprehensive questionnaires serves as an important means of collecting subject-specific data. Questionnaires, designed with precision, seek to extract relevant information that is important for research purposes. Next, the study procedures were articulated to the subjects, explaining the steps involved, and seeking their consent to participate. The emphasis on voluntary participation underscores the ethical considerations that are an integral part of the research process. After obtaining consent from willing participants, the next stage involves filling in the prescribed questionnaires and tests. Subjects are actively involved in providing the necessary information and undergoing prescribed diagnostic procedures. This phase not only ensures the acquisition of valuable data but also strengthens the ethical commitment to transparency, voluntary participation and well-being of research subjects.

3. Results

3.1. Respondent Characteristics

Table 1 Frequency distribution of sample characteristics.

Characteristics		N	Percentage (%)
Gender	Man	7	21.875%
	Woman	25	78.125%
Age	Children (5-11)	9	28.125%
	Adolescent (12-16)	23	81.875%
Child's BMI	Underweight	12	37.5%
	Normal	13	40.625%
	Overweight	3	9.375%
	Obesity	4	12.5%
Knowledge of Independent Teeth and Mouth Cleaning	Good	31	96.875%
	Enough	1	3.125%
	Poor	0	0%

Independent Teeth and Mouth Cleaning Attitude	Good	22	68.75%
	Enough	10	31.25%
	Poor	0	0%
Independent Teeth and Mouth Cleaning Practices	Good	20	62.5%
	Enough	12	37.5%
	Poor	0	0%
Type-1 Diabetes Mellitus Status	Controlled	4	12.5%
	Uncontrolled	28	87.5%
Injection Compliance	Obedient	20	62.5%
	Not Obey	12	37.5%
Dietary habit	Good	3	9.375%
	Enough	29	90.625%
	Poor	0	0%
Physical Activity	Good	0	0%
	Enough	2	6.25%
	Poor	30	93.75%
Gingival Index	Healthy Gingiva	29	90.625%
	Mild Gingivitis	3	9.375%
	Moderate Gingivitis	0	0%
	Severe gingivitis	0	0%
Plaque Index	Very Good	3	9.375%
	Good	20	62.5%
	Currently	8	25%
	Bad	1	3.125%

Table 1 presents a comprehensive overview of respondent demographics and various factors influencing periodontal health. Among the respondents, women emerged as the dominant gender, constituting 78.125% of the sample, indicating a noteworthy gender distribution. Teenagers dominated the age range, with 81.875% falling within this category. Body Mass Index (BMI) distribution revealed that 40.625% of respondents exhibited normal BMI values. Assessing the knowledge of maintaining independent dental and oral hygiene, an overwhelming majority, comprising 96.875%, fell into the 'good' category, reflecting a commendable understanding of oral health practices. Attitudes toward independent dental and oral hygiene were predominantly positive, with 68.75% exhibiting favorable attitudes. The majority of respondents demonstrated effective independent teeth and mouth cleaning activities, with 62.5% falling within the 'good' category. Regarding the status of type 1 diabetes mellitus, a significant portion, accounting for 87.5%, were identified as having uncontrolled diabetes status, underscoring potential challenges in glycemic control. Notably, 62.5% of respondents adhered to insulin injections, indicating a considerable compliance rate with this critical aspect of diabetes management. Dietary habits showcased a predominantly adequate category, encompassing 90.625% of respondents, highlighting a favorable dietary pattern. However, physical activity levels were predominantly categorized as 'less' for 93.75% of respondents, signaling potential areas for intervention to enhance overall health. Examination of gingival index revealed that 90.625% of respondents exhibited healthy gingiva, with only 9.275% displaying mild gingivitis. Similarly, the plaque index showcased a majority in the 'good' category, with 62.5% demonstrating effective plaque control.

3.2. Cross Tabulation

3.2.1. Cross tabulation between diabetes mellitus status, knowledge, attitudes, and practices to maintain oral hygiene with gingival index and plaque index

Table 2 Cross tabulation between diabetes mellitus status, knowledge, attitudes, and practices to maintain oral hygiene with gingival index and plaque index

	Healthy gingiva			Mild gingivitis			Grand Total
	Plaque Index			Plaque Index			
	Very good	Good	Moderate	Very good	Good	Bad	
Controlled diabetes	0 (0%)	4 (21.05%)	0 (0%)	0 (0%)	0 (0%)	0	4 (12,5%)
Good knowledge	0 (0%)	4 (21.05%)	0 (0%)	0 (0%)	0 (0%)	0	4 (12,5%)
Good attitude	0 (0%)	4 (21.05%)	0 (0%)	0 (0%)	0 (0%)	0	4 (12,5%)
Good practice	0 (0%)	3 (15.79%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	3 (9,38%)
Moderate practice	0 (0%)	1 (5.26%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (3,13%)
Uncontrolled diabetes	2 (100%)	15 (78.95%)	8 (100%)	1 (100%)	1 (100%)	1 (100%)	28 (87,5%)
Good knowledge	2 (100%)	14 (75.68%)	8 (100%)	1 (100%)	1 (100%)	1 (100%)	27 (84,38%)
Good attitude	2 (100%)	10 (52.63%)	4 (50%)	1 (100%)	1 (100%)	0 (0%)	18 (56,25%)
Good practice	2 (100%)	9 (47.37%)	3 (37.5%)	0 (0%)	0 (0%)	0 (0%)	14 (43,75%)
Moderate practice	0 (0%)	1 (5.26%)	1 (12.5%)	1 (100%)	1 (100%)	0 (0%)	4 (12,5%)
Moderate attitude	0 (0%)	4 (21.05%)	4 (50%)	0 (0%)	0 (0%)	1 (100%)	9 (28,13%)
Good practice	0 (0%)	0 (0%)	3 (37.5%)	0 (0%)	0 (0%)	0 (0%)	3 (9,34%)
Moderate practice	0 (0%)	4 (21.05%)	1 (12.5%)	0 (0%)	0 (0%)	1 (100%)	6 (18,75%)
Moderate knowledge	0 (0%)	1 (5.26%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (3,13%)
Moderate attitude	0 (0%)	1 (5.26%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (3,13%)
Moderate practice	0 (0%)	1 (5.26%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (3,13%)
Grand Total	2 (100%)	19 (100%)	8 (100%)	1 (100%)	1 (100%)	1 (100%)	32 (100%)

Table 2 shows the relationship between diabetes mellitus status, knowledge, attitudes and practices of maintaining oral hygiene with gingival index and plaque index. The results showed that respondents with controlled diabetes, good knowledge, attitudes and practices all had healthy gingiva and good PI, namely 3 (15.79%), while respondents with moderate practice all had healthy gingiva and good PI, namely 1 (5.26%). Of respondents with uncontrolled diabetes who have good knowledge, attitudes and practices, the majority have healthy gingiva and good PI, namely 9 (47.37%), while respondents with moderate practice have balanced results between healthy gingiva, good PI; healthy gingiva, moderate PI; Mild gingivitis, very good PI; and mild gingivitis, good PI. Respondents with uncontrolled diabetes who had good knowledge, moderate attitudes and good practices all had healthy gingiva and moderate PI, namely 3 (37.5%), while the majority of those who had moderate practice had healthy gingiva and good PI, namely 4 (21.05%). For respondents with uncontrolled diabetes who had moderate knowledge, attitudes and practices, all of them had healthy gingiva and good PI, namely 1 (5.26%).

3.2.2. Cross tabulation between insulin injection compliance, diet and physical activity with diabetes mellitus status

Table 3 Cross tabulation between insulin injection compliance, diet and physical activity with diabetes mellitus status

	Diabetes status		Grand Total
	Controlled	Uncontrolled	
Regular insulin	1 (25%)	19 (67.86%)	20 (62.5%)
Good diet	0 (0%)	2 (7.14%)	2 (6.25%)
Low physical activity	0 (0%)	2 (7.14%)	2 (6.25%)
Moderate diet	1 (25%)	17 (60.17%)	18 (56.25%)
Low physical activity	1 (25%)	17 (60.71%)	18 (56.25%)
Irregular insulin	3 (75%)	9 (32.14%)	12 (37.5%)
Good diet	0 (0%)	1 (3.57%)	1 (3.13%)
Low physical activity	0 (0%)	1 (3.57%)	1 (3.13%)
Moderate diet	3 (75%)	8 (28.57%)	11 (34.38%)
Low physical activity	3 (75%)	6 (21.42%)	9 (28.13%)
Moderate physical activity	0 (0%)	2 (7.14%)	2 (6.25%)
Grand Total	4 (100%)	28 (100%)	32 (100%)

Table 3 shows the relationship between insulin injection compliance, diet and physical activity with diabetes mellitus status. The results showed that respondents with regular insulin, good diet and low physical activity all had uncontrolled diabetes, namely 2 (7.14%), while for those who had a moderate diet and low physical activity the majority had uncontrolled diabetes, namely 17 (60.71%). Respondents with irregular insulin, good diet and low physical activity all had uncontrolled diabetes, namely 1 (3.57%). Meanwhile, for moderate diet and low physical activity, the majority had uncontrolled diabetes, namely 6 (21.42%), and for those who have moderate physical activity, all of them have uncontrolled diabetes, namely 2 (7.14%).

4. Discussion

This research was conducted from November to December 2023 in the IKADAR (Family Association of Child and Adolescent Diabetes Sufferers) Malang City involving 32 children aged 6 to 16 years with type 1 diabetes mellitus. Respondents underwent a comprehensive assessment through a questionnaire that discussed knowledge, attitudes, and practices regarding self-cleaning of teeth and mouth, insulin injection compliance, diet, and physical activity. In addition, respondents had completed the last HbA1c test and underwent gingival index and plaque examination. Children with diabetes mellitus face increased susceptibility to periodontal disease, as they age. Given the potential complications associated with type 1 diabetes mellitus, including those related to dental and oral health, appropriate prevention and treatment strategies are needed [7]. The practice of self-cleaning your teeth and mouth is very important in preventing periodontal disease, which has a major impact on dental and oral health. Inadequate oral hygiene practices play an important role in triggering and advancing periodontal disease. Improper oral hygiene techniques contribute to

the accumulation of bacteria and plaque on the teeth, culminating in gingivitis. This correlation exists in the literature, underscoring that an increase in dental plaque is directly related to an increase in the severity and prevalence of periodontal disease [8]. Many factors contribute to the onset or exacerbation of gingivitis, including plaque accumulation, calculus (tartar), and systemic or overall body health conditions. Chronic gingivitis is a common chronic inflammatory condition, and over the past four to five decades, our understanding of the pathogenesis of this common condition has expanded significantly. The clear role of bacterial plaque in initiating gingival inflammation was first demonstrated in experimental studies of gingivitis in the 1960s [9]. In this context, referring to the theory put forward by Rahayu et al. (2014), individuals who demonstrated increased knowledge, positive attitudes, and appropriate practices towards oral hygiene also demonstrated improved periodontal health status. Cognitive skills, or knowledge, are important domains that influence individual behavior. A person's understanding of dental health greatly determines the health status of their teeth and mouth in the future, although knowledge alone is not enough; This must be balanced with the right attitudes and practices. Knowledge about dental health is the basis for behavior, which in turn influences a person's behavior in maintaining oral hygiene. Attitude, as a tendency that has not yet been translated into concrete action, is an integral part. Health practices act as an important factor that influences a person's health status, which is a concrete manifestation of knowledge and positive attitudes. Knowledge alone is not enough if it is not translated into real action. The tendency to adopt or abandon health-promoting behaviors stems from knowledge. Individuals who have good information will be better prepared to take appropriate action in dealing with their illness, as revealed in Tambunan et al.'s research. (2015). This study showed that respondents with controlled diabetes mellitus showed lower levels of periodontal disease compared to respondents with uncontrolled diabetes mellitus. Individuals with uncontrolled diabetes mellitus face increased susceptibility to periodontal disease due to the adverse effects of uncontrolled diabetes on white blood cells, making teeth more vulnerable and leading to gingival infections [10].

Diabetes status is influenced by various factors, including compliance with insulin injections, diet, and physical activity. Insulin, an important hormone that facilitates the entry of glucose into cells for energy utilization, becomes important in diabetes, where insufficient insulin production or impaired utilization leads to increased blood sugar levels. Therefore, insulin injections are mandatory to regulate blood sugar. Adherence to insulin injections plays an important role in diabetes control, correlating with improved blood sugar management, thereby preventing or delaying complications. On the other hand, non-compliance can cause uncontrolled blood sugar fluctuations, thus having a negative impact on health. Implementing a wise diet is a fundamental strategy in controlling blood sugar in diabetes mellitus patients. For effective diet management, the 3J method—the right kind, the right amount, and the right schedule—is recommended, with an emphasis on consuming a diverse and healthy diet. Success in adhering to the prescribed diet depends on the behavior of diabetes mellitus sufferers. In addition, including physical activity is in line with Saryono's (2011) theory, which recognizes lack of physical activity as a risk factor for diabetes mellitus. Physical exercise benefits individuals with T1DM, improving glycemic control, cardiovascular function, blood lipid profile, and psychological well-being [11].

In this investigation, examination of knowledge, attitudes, and practices related to autonomous oral hygiene indicated that the majority of respondents demonstrated commendable proficiency in these areas. Remarkably, this ability is in line with the large number of respondents who have healthy gingiva and good plaque index status. In contrast, the majority of respondents showed uncontrolled diabetes status, this was due to the prevalence of low levels of physical activity and a diet that was categorized as adequate, although compliance with insulin injections remained consistent. In the cross tabulation analysis between diabetes status, knowledge, attitudes, and practices to maintain oral hygiene with gingival index and plaque index, it was found that for respondents with controlled diabetes, knowledge, attitudes, and practices to clean their teeth were in the good category, all of them had healthy gingiva and good PI, namely as many as 3. Meanwhile, respondents with uncontrolled diabetes, knowledge, attitudes and practices in the medium category all also had healthy gingiva and good PI, namely 1. In this cross tabulation, the most respondents were in the categories of uncontrolled diabetes, knowledge, attitudes and good practices. and have healthy gingiva and good pi, namely 9 people. In the cross tabulation analysis between insulin injection compliance, diet, and physical activity with diabetes status, the results were obtained where respondents with regular insulin had good diet. Low physical activity is all in the uncontrolled diabetes category. Meanwhile, the majority of respondents with irregular insulin, moderate eating patterns, and low physical activity had uncontrolled diabetes status. And the majority of respondents in this cross tabulation were on regular insulin, moderate eating patterns, and low physical activity and had uncontrolled diabetes status, namely 17 people.

After examining a cross tabulation analysis that compared diabetes status, knowledge, attitudes and practices in maintaining oral hygiene with the gingival index and plaque index, the majority of respondents had healthy gingiva and plaque index in the good category. This phenomenon is caused by the majority of respondents having good knowledge, attitudes and practices related to dental and oral hygiene independently. Each facet recorded a frequency exceeding 60% in the good category. It is important to know certain obstacles in this research, especially the lack of complete data

regarding knowledge, attitudes and practices to maintain dental hygiene. Interestingly, there were no respondents who fell into the poor category, the number of samples obtained for this research was still relatively small, namely only 32 respondents.

5. Conclusion

Comprehensive insights gained from all stages of this research resulted in the following cohesive conclusions. First, participant demographics consisted mainly of adolescent girls aged between 12 and 16 years, who had a normal BMI. Second, the majority of respondents demonstrated extraordinary proficiency in cleaning their teeth and mouth independently, and demonstrated commendable knowledge, attitudes and practices. Third, the general conditions experienced by respondents were uncontrolled diabetes, compliance with insulin injections, adequate diet, and lack of physical activity. Fourth, the majority of respondents showed a healthy gingival index, good plaque index. Fifth, the majority of respondents have uncontrolled diabetes status, knowledge, attitudes, practices to maintain good oral hygiene, have healthy gingiva, and good PI in one unit. Sixth, the majority of respondents have regular insulin compliance, a moderate diet, low physical activity, and uncontrolled diabetes status in one unit.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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