

Caries Dentis Risk in Hyperglycemic (Diabetes Mellitus) Patiens Base on Salivary Glucose, Oral Cavity Germ, Age and Gender

Research Article

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Abstract

Background: Diabetes sufferers are increasing from year to year both at regional and national levels. Diabetes Mellitus (DM) is a systemic disease that can cause damage to the oral cavity. The most prominent complaint about the condition of the oral cavity in DM sufferers is decreased saliva flow which causes dry mouth, which can reduce the effect of self-cleansing. So the increase in DM patients will have an impact on reducing the quality of life and increasing the use of dental and oral health services.

Objective: The research aims to determine the relationship between the occurrence of dental caries and DM (hyperglycemic), based on salivary glucose levels, oral cavity germ numbers, age and gender.

Method: Analytical observational research with a cross sectional approach was conducted at the Sebelas Maret University Academic Hospital. Diabetes mellitus patients are confirmed using HbA1c examination. Data was obtained using the CAMBRA (Caries Management by Risk Assesment) form was modified to determine pathological factors of dental caries (Variable 1), salivary glucose levels (Variable 2), oral germ numbers (Variable 3), age (Variable 4), and gender (Variable 5). Data analysis was calculated using the One Way Anova by SPSS for Window version 15.

Results: A total of 38 patients suffering from DM were collected with confirmed HbA1c>6. The results of the One Way Anova analysis showed no significant differences in the incidence of dental caries based on salivary glucose levels (p=0.344), oral germ numbers (p=0.153), and age. (p=0.558) and gender (p=0.170).

Conclusion: Dental caries risk can occur in all DM sufferers with hyperglycemic markers regardless of salivary glucose levels, oral germ numbers, age and gender.

Keywords: DM, Risk Factor, Dental Caries, CAMBRA.

Introduction

Caries is damage to tooth structure caused by an acidic atmosphere which is produced, among other things, from sugar (sucrose fermentation). The resulting acidic atmosphere causes loss of calcium

and phosphate from enamel and/or dentin, resulting in tooth decay. There are 9 out of 10 adults over the age of 20 who have caries [1]. The increased risk of dental caries in DM sufferers is still controversial, some say it is lower, the same, or higher [2]. Diabetes mellitus is



a metabolic disorder characterized by hyperglycemia that occurs due to impaired insulin secretion (T1D) or impaired insulin action (insulin resistance) (T2D), or both [3]. Diabetes sufferers are increasing from year to year both at regional and national levels. According to the International Diabetes Federation (2019), it is predicted that there will be an increase in DM cases in Indonesia from 10.7million in 2019 to 13.7million in 2030 [4, 5]. Diabetes Mellitus is a systemic disease that can impact the oral cavity [6]. In DM sufferers, it is reported that there will be an increase in the number of bacteria in the oral cavity, causing various kinds of lesions in the oral cavity [7].

The most prominent complaint about the condition of the mouth in DM sufferers is decreased saliva flow which is called dry mouth (Xerostomia). Decreased saliva flow can reduce the self-cleansing effect and increase salivary glucose levels and that can contribute to an increase in the prevalence of dental caries. In DM sufferers, poor oral hygiene will trigger the accumulation of debt, calculus and plaque, so that the self-cleansing effect of saliva on the tooth surface is reduced. Debris, calculus and plaque which easily adhere will cause demineralization and lesions on the enamel. Saliva with high glucose levels can increase bacterial growth resulting in increased acid production through the fermentation process, which then results in dental caries [8]. One way to measure caries risk is to use the Caries Management by Risk Assessment (CAMBRA) method, which is the identification of risk pathologic factors for each individual. The CAMBRA form consists of risk factor and protective factors. An imbalance of these two factors causes elevated of pathological factors which is dental caries (demineralization) [9].

Material and Method

The design of this research is observational analysis with a cross sectional approach, namely to see the relationship between the independent variable (DM) and the dependent variable (Dental Caries). The sampling location was at the UNS Academic Hospital's internal medicine clinic for the July-September period 2023. The variables in this study are: Independent variables: Dental Caries and Dependent variable: Saliva Glucose, Number of cariogenic bacteria in saliva, age and gender.

All patients had their HbA1c checked to determine that the patient was a DM sufferer with a score >6. Caries risk measurement is guided by Caries Management by Risk Assessment (CAMBRA). Assessment of dental caries is based on the International Caries Detection and Assessment System (ICDAS) (Variable1), saliva glucose content (Variable2), the number of pathogenic bacterial colonies using the Chair Side Test Kit method (Variable3), the age (Variable4) and gender of the patient (Variable5) were recorded. The following is the operational definition of this research.

Pathological Factors (Dental caries risk)

Caries risk assessment based on the evidence-based CAMBRA approach in the context of preventing and treating dental caries in the early stages. The principle of imbalance in the occurrence of pathologic factor of dental caries is based on protective factors, and risk factor in the Cambra method, so that it will determine whether the caries process will continue, stop or even reverse (remineralization occurs). Measuring tools: Questionnaires and measurement results of caries indicators based on risk factors and protective factors. Measuring method: Distribution of questionnaires directly to respondents, the questionnaire is given once and measurements or assessments are carried out on risk factors, protective and pathological factors.

The results of these measurements are analyzed to obtain the severity level results:

- a. It is called low (score 1) if the cumulative number of risk factors is <the number of protective factors, and there are no indicator pathological factors.
- b. It is called moderate (score 2) if the cumulative number of risk factors => the number of protective factors and there are no pathological factor indicators.
- c. It is called high (score 3) if the result of the number of cumulative risk factors > the number of protective factors, there is at least one pathological indicator without xerostomia.
- d. It is called extreme (score 4) if the cumulative number of risk factors > the number of protective factors, there is at least one pathological indicator with xerostomia.

Salivary Flow Rate

The weight of saliva obtained in a certain unit of time. The respondent spits in a tube or small pot for 5minutes. Measuring tools: Saliva weight. How to measure: Calculate the weight of saliva: (weight of the tube/pot containing saliva – weight of the empty tube/pot). Measuring results: The results of measuring attitudes are an ordinal scale with the following criteria

- a) Saliva weight results (> 1g/minute): Normal saliva rate criteria
- b) Saliva weight results (1-0.7g/minute): Low saliva rate criteria
- c) Saliva weight results (<0.7g/minute: Criteria for xerostomia/dry mouth

Number Of Cariogenic Bacteria

Cariogenic bacteria that cause dental caries are from the group Streptococcus and Staphylococcus. Analysis using the Chair Side Test Kit method (CRT bacteria, Ivoclar vivadent) or other methods available in the laboratory.

Measuring equipment: Chair-side test kit.

Measuring method: Cariogenic bacteria in saliva (Staphylococcus and Streptococcus). The number of bacteria was measured based on colony forming units per millimeter of saliva (CFU/mL).

Measuring results:

- i. It is called low if the bacterial count value is <105 CFU/mL
- ii. It is called high if the bacterial count value => 105 CFU/mL

Salivary Glucose

Carry out salivary glucose analysis using the colorimetric oxidase method. Measurements were carried out in the biomedical laboratory of FK UNS. Measuring equipment: Spectrophotometer. Measuring method: Salivary glucose concentration is measured using a standard curve (regression equation: concentration + absorption/0.0162 mg/dL, R2= 0.998). The collected data was analyzed using SPSS for Window version 15. One Way Anova test to determine differences between groups in the occurrence of dental caries based on salivary sugar levels, germ numbers, age and gender.

Result

38 samples of diabetes mellitus sufferers were collected as presented in table 1.

For data analysis used ONE WAY ANOVA from SPSS for Window version 15 showed in table 2.



Table 1: The collected data of dental caries as a independent variable (VAR0001), For dependent variable are salivary sugar levels (VAR0002), Germ numbers (VAR0003), age (VAR0004) and gender (VAR0005).

No	Dental Caries Risk	Glukose Saliva	Angka Kuman	Age	Gender
	Var. 4	Var. 2	Var. 3	Var. 1	Var. 5
1	5	3	4	2	6
1	1	49.599	59	63	1
2	1	39.26	51	68	1
3	1	10.33	75	59	1
4	1	41.32	20	68	1
5	1	12.4	76	72	1
6	1	12.4	78	61	2
7	1	22.73	910	67	2
8	1	56.78	673	52	1
9	2	66.12	502	71	1
10	2	1.3	421	54	2
11	2	16.53	546	62	2
12	3	33.06	187	24	2
13	3	67.87	417	53	2
14	3	18.6	178	34	1
15	3	35.12	155	35	1
16	3	66.12	362	42	1
17	3	47.52	142	62	1
18	3	88.81	313	45	2
19	3	4.3	336	85	1
20	3	1.33	367	77	1
21	3	41.32	545	63	1
22	3	2.07	285	73	1
23	3	99.17	381	74	1
24	3	12.4	912	60	1
25	3	86.23	562	65	1
26	3	26.86	540	61	1
23	3	64.05	653	66	2
27	3	46.56	733	47	1
28	3	78.51	487	65	1
29	3	78.23	470	61	1
30	3	18.6	154	63	1
31	3	20.66	827	65	1
32	3	31.12	142	70	1
33	3	20.66	480	60	2
34	3	24.6	535	54	1
35	3	70.25	93	48	1
36	3	77.24	848	61	1
37	3	89.56	610	63	1
38	3	10.33	352	66	1



Table 2: Data analysis with ONE WAY ANOVA of dental caries risk (VAR0001), salivary sugar levels (VAR0002), germ numbers (VAR0003), age (VAR0004) and gender (VAR0005).

		Sum of Squares	DF	Mean Square	F	Sig.
VAR00002	Between Groups	1828.318	2	914.159	1.101	.344
	Within Groups	29894.916	36	830.414		
	Total	31723.235	38			
VAR00003	Between Groups	248337.053	2	124168.527	1.981	.153
	Within Groups	2255918.024	36	62664.39		
	Total	2504255.077	38			
VAR00004	Between Groups	180.379	2	90.190	.592	.558
	Within Groups	5480.595	36	152.239		
	Total	5660.974	38			
VAR00005	Between Groups	.649	2	.325	1.863	.170
	Within Groups	6.274	36	.174		
	Total	6.923	38			

Discussion

Research that determine the relationship between diabetes and dental caries among US adults participating done in 2011-2018 but National Health and Nutrition Examination Survey (NHANES) concluded that Diabetes had associated with a higher caries score and a greater risk for dental caries among US adults [2]. Another study was conducted to find the strength of association between dental caries in patients with T2DM in A case-control study conducted among 35-44-year-old patients with T2DM reporting to various hospitals and controls who met the inclusion criteria. Dental caries status were recorded using the WHO criteria, 2013. The result are no such association was found between dental caries and T2DM [10].

It could conceivably be hypothesized that a link exists between an altered microbiota due to local hyperglycemia and the increased risk of caries in diabetes mellitus (DM). In most studies, the relative abundance of acidogenic and aciduric bacteria was higher in diabetics when compared to their normoglycaemic controls. Whilst the evidence certainty was very low, there was a consistent Proteobacteria depletion and Firmicutes enrichment in T2D. Tannerella/T. forsythia was enriched in T2D saliva, but the certainty is low. Further well-designed cohorts are needed to clarify the distribution of acid-associated microorganisms in the saliva of adults with T2D and how this can be clinically manifested was clear [11].

Type-2 diabetes (T2DM) is a global epidemic. Among various complications of T2DM, dental caries is one of its preventable complications. Many study to investigate the association between salivary factors and the growth of cariogenic bacteria in the saliva of T2DM patients. In conclusion, salivary factors play important roles in controlling the salivary status of cariogenic bacteria. Thus, an adequate oral health and proper glycemic control could help in abolishing the caries risk and its complications [12]. Regarding past epidemiological studies, there has been disagreement over whether type 1 diabetes (T1DM) is one of the risk factors for dental caries. Its indicate that T1DM has causal involvement in the genesis of dental caries. There-

fore, periodic reinforcement of oral hygiene instructions must be added to the management and early multidisciplinary intervention of T1DM patients, especially among adolescents and teenagers, who are more susceptible to T1DM [13].

In systematic review was to evaluate current evidence to prevent and manage dental caries in patients with type 2 diabetes mellitus (T2DM) done by following method Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, the Participants, Intervention, Comparison, Outcomes and Study Design (PICOS) strategy was used to formulate a structured search: systematic search of PubMed, Cochrane Library, MEDLINE via Ovid, EMBASE, Scopus, Web of Science, and Lilacs without any date limit and/or language restrictions. The summarize is that the current randomized controlled clinical trials demonstrated that regular extensive oral health education using interdental cleaning aids, mouthwash, moistening gel, and saliva substitutes including lactoperoxidase, lysozyme, glucose oxidase, and lactoferrin could control oral inflammation and contribute to the management of dental caries in patients with T2DM [14].

Conclusion

Dental caries risk can occur as a result of suffering from DM with classic markers of hyperglycemia without distinguishing between salivary glucose levels, oral germ numbers, age and gender.

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