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# The impact of quality of life and oral hygiene in type 2 diabetes mellitus patients

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## Abstract

**Background**: 90-95% improvement which happens frequently and common cases is type 2 diabetes mellitus caused with increased blood glucose through degradation of insulin release by the pancreatic gland. Quality of sufferers life with type 2 diabetes mellitus isn't decided by general health but also by dental and oral health.

**Purpose**: To determine quality of life and oral hygiene conditions in sufferers against type 2 diabetes mellitus.

**Methods**: This research using literature study from several research journal databases published in 2015-2023. Literature search use a strategy with criteria of type 2 diabetes mellitus, oral hygiene, and quality of life utilize Pubmed, Google Scholar, Science Direct, and Elsevier databases with article title criteria discuss the relationship between influences quality of life and oral hygiene in sufferers against type 2 diabetes mellitus.

**Results**: There are respondents who have minimal knowledge about type 2 diabetes mellitus associated with dental and oral health in several studies. Majority of the female sufferers through type 2 diabetes mellitus. This disease related to the oral cavity causes pain and physical discomfort has negative effects on quality of life. Bacteria increase in the oral cavity and decrease saliva flow which causes xerostomia and decreases self-cleaning effect which can interfere with oral hygiene. Person with diabetes has higher effects of developing caries due to high levels of glucose in saliva.

**Conclusion**: It's important for diabetes mellitus sufferers to always maintain their health status and oral hygiene.

**Keywords:** Type 2 diabetes mellitus; Oral hygiene; Quality of life; Oral health; Oral illness

## 1. Introduction

The definition of health in accordance with the World Health Organization is a condition where not only apart from disease or disorder, but also with a balance between physical, physical, spiritual, mental and social well-being. Therefore, evaluating the measurement of quality of life related to health which includes three aspects of function, namely: physical, psychological (cognitive and emotional), and also social [1]. Quality of life is about daily life in a place with cultural relationships and assessment procedures related to life goals, desires, standards, etc [2]. Problems related to their quality of life are very broad, complex and multifactorial, including physical health. psychological status, and environmental social relations [3].

The health and quality of life in an individual isn't only determined by general health but is also determined by the health of his teeth and mouth. Dental and oral health has a very important role and is related to general health. Dental and oral health problems that are often encountered include periodontal disease which is correlated with various systemic diseases, for example diabetes mellitus [4].

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The International Diabetes Federation (IDF) organization has data that around 463 million people aged 20-79 years in the world were affected by diabetes mellitus in 2019, or a prevalence rate of 9.3% of the total population of the same age. Based on gender, the prevalence of diabetes in 2019 was 9% in women and 9.65% in men according to the IDF. According to Basic Health Research (RISKESDAS) in 2020, at the age of 65-79 years the prevalence of diabetes increases as the population ages to 19.9% or 111.2 million people. In 2030, this figure is predicted to continue to increase until it reaches 578 million and in 2045 there will be 700 million. With a prevalence of 11.3%, it ranks 3rd in Southeast Asia. There are 10.7 million people suffering from diabetes mellitus in Indonesia and is ranked 7th out of 10 countries [5].

Type 2 diabetes mellitus is the most general disease that occurs in 90-95% of cases, where the body experiences a decrease in insulin secretion and insulin resistance occurs by the pancreatic gland in adults [4]. In the last thirty years, in many countries the prevalence of type 2 diabetes has increased drastically at all income levels. So far, this type of diabetes has only been found in adults, but now type 2 diabetes is also affecting many children [6]. According to WHO, diabetes mellitus is a chronic metabolic disease that happens when the pancreas is unable to produce enough insulin. Diabetes mellitus is characterized by increased blood sugar levels which can cause damage to vital organs such as blood vessels, eyes, kidneys, nerves and heart. Oral health is general health that can influence systemic diseases. [7]

Poor oral hygiene causes a decrease in salivary secretion (hyposalivation) so that the soft tissue surface of the oral mucosa becomes dry (xerostomia). In patients with diabetes mellitus, Poor oral hygiene will result in a buildup of plaque so that the cleaning process from saliva decreases. Therefore, plaque sticks easily and can cause demineralization and injury to the enamel [8]. In addition to xerostomia, burning mouth sensation, impaired sense of taste and smell, increased caries activity, periodontal infections, tooth loss, halitosis, dysfunction of the TMJ or temporomandibular joints and bacterial and fungal infections will also increase [9, 10].

Apart from that, there are several other symptoms of oral diabetes mellitus, such as loss of gingival attachment, increased degree of tooth mobility, gingivitis and periodontitis, and xerostomia [11]. Therefore, people with type 2 diabetes mellitus have many oral health problems [12]. Oral manifestations in sufferers with type 2 diabetes mellitus can be prevented by maintaining oral hygiene from an early age.

## 2. Methods

The method used in the literature review is a comprehensive strategy, namely by searching for articles in research journal databases, national and international research results and searching on the internet. The research design uses literature studies published in 2016-2022. The literature search used a strategy with the keywords type 2 diabetes mellitus, oral hygiene, and quality of life. The keyword search used the Pubmed, Google scholar, Science Direct, and Elsevier databases with the criteria used, namely the title of the article discussing the effect of quality of life and oral hygiene in patients with type 2 diabetes mellitus. The studies excluded from this narrative review were (1) duplicate studies; (2) research published before December 2022 and after January 2016; (3) research with irrelevant titles or abstracts; (4) studies other than experimental studies; and (5) research that still has no clear discussion regarding the relationship between quality of life and oral hygiene conditions in people with type 2 diabetes mellitus. After screening, a total of 386 studies were obtained. Only 10 studies were included in this review after screening.

## 3. Results

Age is an unmodifiable risk factors of diabetes mellitus sufferers. Age may influence degenerative disease; there should be a decline in the practicality of the body's organs as a person age. For example, at ages 41–64 years a person would be at risk of 3.3 times more easily suffering from diabetes mellitus compared to the age of 25–40 years due to decreased endocrine function and capability of pancreatic β cells to manufacture insulin. In addition, the female sex has greater opportunities because of the increase in Body Mass Index (BMI). This happens due to premenstrual and postmenopausal syndrome practised by women because it is easy for the lipid distribution in the body to accumulate due to these hormonal processes so that they are riskier to suffer because of diabetes mellitus. BMI increase is closely connected with the development of insulin tolerance until inhibits glucose absorption to muscle, lipid cells that cause enhancement in blood glucose grade. [13]

The measurement basis for evaluating the life quality in sufferers with type 2 diabetes mellitus with complications closely related to the perception from their daily activities. Patients who have negative perceptions will experience depreciation which will impact quality of their life. [14]

**Table 1** Results of a review of research articles regarding the relationship between quality of life and oral hygiene conditions in people with type 2 diabetes mellitus

| Author and Title | Subject | Method | Results |
|---|---|---|---|
| Risdiana & Aidina [13]<br><br>The Oral Health Status, Salivary Flow Rate and pH in Diabetic Patients | In the last 3 months, 57 diabetes mellitus patients regularly visited the Kasihan 1 Bantul Health Center, Yogyakarta. | This research used is descriptive quantitative method with a cross sectional research design | Some diabetes mellitus sufferers have unhealthy dental and oral health status, acidic saliva pH, and low saliva flow rate. |
| Santoso et al [14]<br><br>Correlation Amongst Quality of Life and Sufferers Perceptions of Type 2 Diabetes Mellitus with Complications | There are 51 patients diagnosed type 2 diabetes mellitus at the Internal Medicine Polyclinic at PKU Muhammadiyah Hospital Bantul | This type of research used is observational analytical method with a cross sectional approach using a questionnaire | Complications are influenced by the level of education and perception of the disease on the quality of life type 2 diabetes mellitus sufferers. |
| Khalifa et al [15]<br><br>Oral health status and oral health-related quality of life among patients with type 2 diabetes mellitus in the United Arab Emirates: a matched case-control study | There are 168 patients (84 diabetic patients and 84 non-diabetic patients as control group) at Sharjah University General Hospital and Sharjah University Hospital, United Arab Emirates | This study uses analytic observational data by filling out a short questionnaire | If periodontal disease occurs more frequently, it will influence the quality of life of diabetes mellitus which is related to oral health. |
| Sousa et al [16]<br><br>Evaluation of oral health-related quality of life in individuals with type 2 diabetes mellitus | There were 302 male and female sufferers with type 2 diabetes mellitus in the Primary Care Unit of the Family Health Program, Municipality of Pombal, Paraíba, Brazil | This type of cross-sectional research was carried out by answering questionnaires. Apart from that, data analysis includes descriptive statistics, bivariate analysis and logistic regression | Xerostomia, wearing dentures and periodontitis are risk factors for negative impacts on quality of life correlated to oral health and socio-economic status. |
| Ravindranath [17]<br><br>Association of Oral Health Status and Oral Health-Related Quality of Life among Adult Patients with Type 2 Diabetes Mellitus: A cross-sectional study | A total of 350 diabetes patients (193 male and 157 female) aged 30-60 years | The type of this research is cross-sectional research carried out withal a questionnaire to collect information | There is a relationship between dental and oral health state and quality of life in type 2 diabetes mellitus patients |
| Kinanthi & Santoso [8]<br><br>Differences in Oral Cavity Conditions in Uncontrolled and Controlled Type 2 Diabetes Mellitus Patients | Sampling was carried out by consecutive sampling with the large sample formula, 16 samples for each group were obtained from the medical records of Dr. Kariadi Semarang. Inclusion criteria were uncontrolled and controlled type 2 | This research is an observational analytical study with a cross sectional comparative research approach | The mean oral hygiene index in the controlled type 2 DM category was 1,78 ± 0,74 which was included in the moderate category, while in the uncontrolled type 2 DM category it was 3,40 ± 0,90 which was included in the |

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| | diabetes mellitus patients aged 30-60 years, not pregnant, not suffering from systemic diseases. Exclusion criteria were patients with uncontrolled and controlled Diabetes Mellitus type 2 withdrew and were not willing to fill out an informed consent form to become research subjects. | | poor groups with *a p* value <0,05 |
| Lestari *et al* [18] The Correlation between the rate of dental and oral health knowledge and the health status of periodontal tissue in diabetes sufferers type 2 mellitus at Manembo-nembo Bitung Hospital | The population in this study were people with T2DM who underwent outpatient care at the Manembo-nembo Hospital in Bitung with a population of 184 patients. | This sampling method is purposive sampling with a total sample of 65 respondents. Data collection was obtained through questionnaires and periodontal status examination | Almost all respondents (87.70%) did not know that diabetes mellitus could exacerbate inflammation in the gums and 84.62% did not know that DMT2 could affect dental and oral health. The results of examination of the health status of the periodontal tissues showed that almost all respondents (83.08%) had periodontal gingivitis status. |
| Putri *et al* [19] Differences in Oral Hygiene Index and Quality of Life Related to Oral Health in Sufferers with Type 2 Diabetes Mellitus and Non-Diabetes Mellitus | This research was conducted at the Internal Medicine Outpatient Installation at Diponegoro National Hospital with a total sample of 42 patients.The research criteria were: female and male patients, with age range of 18-60 years, had medical records of blood glucose levels <180 mg/dl (specifically for T2DM patients). The study exclusion criteria were patients who wore dentures, had malignancy, trismus, or systemic disease | This research used is analytical observational method with a cross sectional research design | The difference in the mean OHIS index was analysed using the unpaired t test while the difference in the mean OHIS index was analysed using the Mann Whitney test. Both tests showed a p value <0,05; showing there was an important diversity amongst OHIS and OHIP-14 indices in the T2DM patient category compared with the non-DM patient category. |
| Fansurna *et al* [20] The Relevance among Blood Glucose Rate in Sufferers Against Type 2 Diabetes Mellitus and Cases of Loose Teeth at Pengaron Health Center, Banjar Regency | The research sample was type 2 diabetes mellitus who visited the Pengaron Health Center, Banjar district, 36 people aged 20 years or more were taken. | The type of research used is analytical observational research with a cross sectional research design | This age range from 41-60 years, namely 19 people (52,8%), had the most T2DM, then the age range of 20-40 years, namely 8 people (22,2%) and the age range > 60 years, namely 9 people (25,0%) least T2DM patients. It is known that the highest range of blood sugar levels in T2DM patients was ≥200 mg/dL in 34 people (94,45%) then <200 mg/dL in 2 people (5,55%). It is known that the minimum Periodontal |

| | | | Disease Index in DMT2 is 1.00 and the maximum is 4.40, obtaining an average of 3.3431. |
|---|---|---|---|
| Octavia *et al* [21]<br><br>Correlation among Oral Hygiene and Glycemic State withal Periodontal Parameters of Type 2 Diabetes Mellitus Patients | A total of 164 subjects were diagnosed with DMT2. Subjects which fulfills the inclusive and exclusive criteria totaled 69 persons consist of 32 persons with controlled DM and 37 persons withal uncontrolled DM. | Sampling was done by purposive sampling method | Results from the significance tests show that there are significant differences in the PBI scores among the three OH categories (p<0,05). This outcome of the significance tests show that there is no important diversity<br>amongst OH-index categories and glycemic status (p>0,05). |

Periodontal diseases are more general and serious in diabetes mellitus sufferers than in healthy people. Diabetic have a longer time period of periodontal diseases (>7 years old). This is related to the enhanced inflammatory response in the periodontal tissue, because of an abnormal host response in diabetic sufferers. The entry from periodontal microorganisms and their virulence element into circulation has roles in increasing the acute stage and biomarkers of oxidative stress. [15]

A literature reports that individuals with poor oral hygiene habits and infrequent visits to the dentist have a greater chance of having poor oral health status, which could have negative effects on quality of life because it may affect speech, use of dentures and food intake. However, an insignificant relationship is found in between edentulism and life quality considering the number or location of missing teeth [16]. Diabetes mellitus patients who lose their teeth will have the highest negative affect on their life quality due to the functional and aesthetic effects of edentulism. In addition, a powerful relationship was discovered between periodontitis and life quality in diabetes mellitus patients. Periodontal diseases are a very general oral hygiene state visible to diabetes patients which is also linked to oral health-related of their life quality. In addition, wearers of partial dentures have a higher effect on oral health-related of their life quality than wearers of full dentures. Because dentures have a lower masticatory efficiency than natural teeth. Thus, this lesson is important that the oral hygiene state of diabetics is correlated with their oral hygiene. [17]

Outcome showed that the index from oral hygiene in controlled and uncontrolled DM patients was quite high. The mean oral hygiene index in uncontrolled type 2 DM patients was 3.40 which was included in the bad criteria while those in controlled type 2 DM patients were included in the moderate criteria, namely 1.78. While the results of the caries index with the Decay Missing Filled-Teeth (DMF-T) assessment found that sufferers type 2 diabetes mellitus uncontrolled and controlled had a very high DMF-T category, namely ≥ 4.5. However, the average caries index in uncontrolled type 2 DM patients was higher than controlled type 2 DM patients, namely 14.63, while in controlled type 2 DM patients it was 10.94 although statistically there was no significant difference. [8]

In this study, respondents had minimal knowledge regarding DMT2 and its relationship to oral health. This will affect the behaviour of respondents in maintaining healthy teeth and mouth. Conditions with periodontal gingivitis status may be related to respondents' lack of science regarding technique or how brush your teeth, tooth brushing frequency, and period of brushing your teeth, which can affect the formation of plaque on the tooth surface. Dental and oral hygiene that is not maintained causes a layer of plaque to stick to the surface of the teeth and over time it hardens or forms tartar (calculus).[18]

The lesson show it there are valuable distinction in OHIP-14 among T2DM sufferer and non-DM sufferer (7,14 vs 2,24; p <0,001), i.e. T2DM patients showed a worse mean OHIP-14 than non DM patients. Differences in life quality index associated with oral health among T2DM patients and non-DM patients possibly related by an increased risk of various oral health problems in patients with DM such as xerostomia, increased accumulation of plaque and calculus, candidiasis, periodontitis, periapical abscess, and burning mouth syndrome. . In this study, the average OHIP-14 value of T2DM patients was still in the good category, although the average OHIP-14 value was worse than non-DM patients. [19]

The results of this research are different because the study subjects who were examined had lost a lot of teeth but still had tooth indexes for Periodontal Disease Index (PDI) examinations, and also there were some research subjects who used artificial teeth so that the average value obtained to see tooth mobility with the Periodontal Disease Index (PDI) criteria, a mean of 3.3431 was obtained, a value which included severe gingivitis but had not caused tooth mobility and loss of attachment of periodontal fibers or loss of attachment. If this severe gingivitis is not treated quickly, it will continue to get worse, extending from the gums to the bone under the teeth, causing wider damage to the periodontal tissue. [20]

Mean distribution of scores Distribution of Plaque (PI), Calculus (CI), Gingival Bleeding (PBI), Oral Hygiene Index (OH-index), Pocket Depth (PD), Gingival Recession (GR), and Clinical Attachment Loss (CAL) in controlled DM group are lower than the uncontrolled DM group. To find out whether there is a significant difference between each variable, a significance test was done. This outcome shows that there is no important diversity among the CI, PI and OH-index scores (independent t-test; $p > 0,05$) GR, PD, CAL (Mann-Whitney test; $p > 0,05$) between the diabetic group controlled and uncontrolled. However, there is a significant difference among the PBI rate of the both groups ($p < 0.05$). [21]

## 4. Discussions

The study conducted by Risdiana and Aidina shows that the majority of diabetic patients have > 4 cavities and decay teeth. Most patients with diabetes mellitus are discovered to have plaque or calculus over most of the area of their oral cavity, dry mouth and sticky mucosa, and halitosis. Whereas, some research has also confirmed those same findings: diabetes mellitus patients feel dry mouth due to low salivary flow rate. [13]

According to a study by Santoso *et al.,* high educational level is associated with step-up in degrees of quality of life quality. Patients to type 2 diabetic who are highly knowledgeable have a better perception of their disease. Patients with sufficient knowledge will have a concern for changing their life habits towards a healthier and meaningful and quality life. [14]

The study conducted by Khalifa *et al.,* also has the same connection with the study by Risdiana and Aidina, where diabetes mellitus is significantly more common in women. In addition, Diabetic patients may be more likely to experience it and notice other healthcare problems related towards their diabetes than to their oral health. [13,15]

In a research carried out by Sousa *et al.,* it was also revealed that the majority of the female sex suffered from type 2 diabetes mellitus. In this research, problems related to the oral cavity with its potential causes physical discomfort and pain has the biggest negative effects on characteristics of their life among nearly half of the population with type 2 diabetes mellitus. [16] Research by Ravindranath shows that the correlation among diabetic and periodontal diseases are two-way, withal periodontitis as a changer of glycemic related to control. Then, losing a tooth is a significant problem between people with diabetic, and many other studies support these findings. Therefore, having a diabetic patient with oral problems that can potentially cause soreness and physical discomfort has the biggest negative affect on quality of their life. [17]

In a study conducted by Sekar and Oedijani, it was shown that chronic type 2 DM poor patients' blood glucose trip supervisor suffered from worse caries compared to patients whose blood glucose was well controlled. DM sufferers there are enhanced in bacterial numbers in the oral cavity and decline salivary flow which causes dry mouth (xerostomia). There may be an increase in saliva glucose and a decline in the self cleansing effect which contributes to worsening oral hygiene. A person with diabetes has higher risk for progression caries because of the high level of glucose in the saliva. [8]

According to a study by Lestari *et al.,* people with diabetic are very susceptible to your teeth and oral health problems, this is due to the high glucose content in the gingival fluids and blood which can change the microflora environment in the mouth, including qualitative changes in bacteria which affect the severity of dental health and mouth. In addition, the impact of diabetes in the mouth in the form of reduced amount of saliva in the mouth so that the mouth becomes dry (xerostomia) is a risk factor for periodontal disease due to lack of self-cleansing effect due to reduced saliva. [18]

In a research carried out by Putri *et al.,* the difference in oral hygiene index could be caused by an increased risk of poorer oral hygiene in patients with DM. Increased sugar levels in gingival crevicular fluid and saliva can be a stimulus for increased growth of fungal and bacterial colonies such as Mutans streptococci and Lactobacilli in the oral cavity which further increases the risk of DM patients developing caries. In addition, microvascular complications of diabetic in peripheral neuropathy form can cause salivary dysfunction which results in xerostomia, which is a risk factor for plaque formation on the teeth. [19]

According to the study of Fansurna *et al.,* diabetes mellitus which is accompanied by several changes in the periodontium has the potential and role in the occurrence of chronic periodontitis resulting in tooth mobility. The cause of loose teeth is not only systemic factors, there are other factors that influence it. The causes of loose teeth in adults besides systemic factors (uncontrolled diabetes mellitus) there are local factors, namely subgingival calculus and trauma. Although other factors can affect the periodontal tissue, the main cause of periodontal case is microorganism that collect on dental surface (bacterial plaque and its products) and form colonies, some systemic disorders can adversely affect the periodontal tissue, but systemic factors alone without The presence of bacterial plaque cannot trigger periodontitis. [20]

A research carried out by Octavia *et al.,* found that mouth hygiene habits varied. This can be seen from the frequency of brushing teeth, using dental floss, mouthwash, and brushing the tongue. This can affect the level of oral hygiene of each subject. Maintaining ideal oral hygiene consists of check yourself with a dentist at least once a year (including visits for teeth and oral problems), brushing your teeth at least 2 times a day, using interdental cleaners such as dental floss every day, and not eating more than one food cariogenic in a day. In this study, researchers compared the OH-index between controlled and uncontrolled glycemic groups and found that there is no important diversity amongst OH-index categories, even if there was a difference in the mean clinical OH index score. [21]

## 5. Conclusion

Based on several studies from the various literature above, it can be concluded that poor oral hygiene status and infrequent visits to the dentist have a poor health status, thus negatively impacting on characteristics of their life. Cleanliness of oral hygiene conditions is correlated to quality of their life associated with oral hygiene in sufferers of type 2 diabetes mellitus, especially functional restrictions, physical illness, and psychological inconvenience.

## Compliance with ethical standards

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The authors assert that there are no conflicts of interest related to the publication of this document.

## References

[1]     World Health Organization 2023 [Internet]. New York;2023 [cited 2023 Apr 5]. Available form : https://www.who.int/about/governance/constitution

[2]     World Health Organization 2023 [Internet]. New York;2023 [cited 2023 Apr 5]. Available form : https://www.who.int/tools/whoqol

[3]     Delwien EJ, Sandjaya. Factors that Influence the Quality of Life of the Karubaga Community District Sub District Tolikara Provinsi Papua. National Journal of Health Sciences (JNIK) LP2M Unhas. 2018;1(1):1-16

[4]     Dinda AI, Janti R, Amaliya A. Oral hygiene in people with type 1 Diabetes Mellitus. Unpad Dental Journal. 2017Apr;29(1):41-49

[5]     Pusdatin 2020 [Internet]. Jakarta;2020 [cited 2020]. Available from : https://www.kemkes.go.id/downloads/resources/download/pusdatin/infodatin/Infodatin%202020%20Diab etes%20Melitus.pdf

[6]     World Health Organization 2023 [Internet]. New York; 2023 [cited 2023 Apr 5]. Available from : https://www.who.int/health-topics/diabetes#tab=tab_1          https://www.who.int/news-room/fact-sheets/detail/diabetes

[7]     Dewi A, Nunuk P, Lisdrianto H, Fimma N. Oral health-related quality of life in type 2 diabetic patients of Yogyakarta General Hospital. Majalah Kedokteran Gigi Indonesia. 2022;7(1):1

[8] Kinanthi Ps, Santoso O. Differences in the Condition of the Oral Cavity of Uncontrolled and Controlled Type 2 Diabetes Sufferers. Diponegoro Medical Journal. 2018;7(2):396-405. Https://Doi.Org/10.14710/Dmj.V7i2.20668.

[9] Wenche SB, Patricia FA, Carol S, Anca J. Is there a relationship between oral health and diabetic neuropathy?. Current diabetes reports. 2015;15(11):93

[10] Ngairangba, S, B S, Doddabasavaiah BN. Oral lesions and periodontal status in diabetics and non-diabetics: A hospital based study. Journal of oral and maxillofacial pathology. 2022;26(3):419

[11] Aris AK, Meitika WW, Maulina T, Dian NAI, Anindita L. Laporan Kasus: Xerostomia pada Penderita Diabetes Mellitus Tipe 2. Jurnal Kedokteran Gigi Unej. 2020;17(1):33-36

[12] Emad A, Y A. Oral health problems among patients with type 2 diabetes attending UNRWA health centres in Gaza governorates: a cross-sectional study. The Lancet. 2022;399(1):S20

[13] Risdiana N, Aidina U. The oral health status, salivary flow rate and ph in diabetic patients. Proceedings of the International Conference on Sustainable Innovation on Health Sciences and Nursing (ICOSI-HSN 2022). 2022;248–57. doi:10.2991/978-94-6463-070-1_30

[14] Santoso SB, Perwitasari DA, Faridah IN, Kaptein AA. Relationship between quality of life and patient perception about type 2 diabetes mellitus and complications. Pharmaciana. 2017;7(1):33. doi:10.12928/pharmaciana.v7i1.4699

[15] Khalifa N, Rahman B, Gaintantzopoulou MD, Amad SA, Awad MM. Oral Health Status and oral health-related quality of life among patients with type 2 diabetes mellitus in the United Arab Emirates: A matched case-control study. 2020; doi:10.21203/rs.2.23221/v1

[16] Sousa RV, Pinho RC, Vajgel B de, Paiva SM, Cimões R. Evaluation of oral health-related quality of life in individuals with type 2 diabetes mellitus. Brazilian Journal of Oral Sciences. 2019;18. doi:10.20396/bjos.v18i0.8655466

[17] Ravindranath N, Raju R. Association of Oral Health Status and oral health-related quality of life among adult patients with type 2 diabetes mellitus: A cross-sectional study. Journal of Indian Association of Public Health Dentistry. 2020;18(4):290. doi:10.4103/jiaphd.jiaphd_31_20

[18] Lestari DP, Wowor VNS, Tambunan E. The relationship between the level of dental and oral health knowledge and the health status of periodontal tissue in people with type 2 diabetes mellitus at Manembo-Nembo Bitung Hospital. e-GIGI. 2016;4(2). doi:10.35790/eg.4.2.2016.13926

[19] Putri FA, Pramudo SG, Kusuma IA, Nasia AA. Differences in Oral Hygiene Index and Quality of Life Related to Oral Cavity Health in Type 2 Diabetes Mellitus and Non-Diabetes Mellitus Patients. e-GiGi. 2021;9(1). doi:10.35790/eg.9.1.2021.32632

[20] Fansurna A, Utami NK. Relationship between blood sugar levels in patients with TYPE 2 diabetes mellitus and cases of loose teeth at the Pengaron Community Health Center, Banjar Regency. An-Nadaa: Journal of Public Health. 2020;7(2):127. doi:10.31602/ann.v7i2.3925

[21] Octavia M. Association between Oral Hygiene and glycemic control status with periodontal parameter in type-2 diabetes mellitus. Damianus Journal of Medicine. 2022;21(2):113–26. doi:10.25170/djm.v21i2.3300