RESEARCH ARTICLE

Oral health-related quality of life in type 2 diabetic patients of Yogyakarta General Hospital

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ABSTRACT

Yogyakarta is a province in Indonesia with the highest prevalence (2.4%) of Diabetes Mellitus (DM). Around 90% of diabetic patients suffer from type 2 DM. Oral manifestations of DM may disturb oral functions which in turn influence oral health - related quality of life (OHRQo)L. This study aimed to evaluate the OHRQoL of type 2 DM outpatients in Yogyakarta General Hospital. The study subjects comprised 50 male outpatients and 32 female outpatients with type 2 DM (40-81 years old). Geriatric Oral Health Assessment Index (GOHAI) and Xerostomia Inventory were used to assess OHRQoL and xerostomia status, respectively. Intraoral examinations comprising periodontal tissue, oral hygiene (OH), coated tongue, and present teeth were performed. There were 49 (59.76%) subjects with low and 33 (40.24%) subjects with high score of GOHAI; 78 (95.12%) with and 4 (4.88%) without periodontal tissue defect; 79 (96.34%) with poor and 3 (3.66%) good OH; 17 (20.73%) with coated tongue >50% and 65 (79.27%) with coated tongue ≤50%; 34 (41.46%) with present teeth <20 and 48 (58.54%) with present teeth ≥20; and 39 (47.56%) with xerostomia and 43 (52.44%) with normal status. Only 'present teeth' had a significant contribution to the proportion of GOHAI status in type 2 DM patients in this study (p=0.032). Type 2 DM patients with ≥20 teeth had a more significant proportion of high GOHAI status compared to those with <20 teeth. The majority of type 2 DM outpatients of Yogyakarta General Hospital had poor OHRQoL as reflection of their oral condition that is partly contributed by patients with present teeth <20.

Keywords: GOHAI; OHRQoL; type 2 DM

INTRODUCTION

Oral health is an integral part of general health. Many systemic diseases manifest in oral cavity. On the other hand, oral diseases can adversely influence systemic diseases. Good oral health maintenance improves the systemic condition. One of the systemic diseases with a high prevalence is Diabetes mellitus (DM). Diabetes mellitus is a disorder of carbohydrate, lipid, and protein metabolism related with chronic deficient insulin secretion/action that causes hyperglycemia.[1] Diabetes mellitus becomes one of the world's health problems. Epidemiological data have projected that in 2030 worldwide, the number of diabetic patients will reach up to 552 million. Eighty percent of diabetic patients live in low to middle income countries. Indonesia ranks fourth in the world in terms of the prevalence of DM.[2] In 2018 there was 1.5% of Indonesian population aged ≥15 years suffering from DM. Amongst the provinces in Indonesia, Yogyakarta is the province with the highest prevalence of DM, reaching up to 2.4%.[3] The high prevalence is probably caused by lifestyle, lack of knowledge about health maintenance, low education level, no awareness of healthy dietary pattern, and lack of physical activity. Around 90% of diabetic patients suffer from type 2 DM.[4]

Patients with uncontrolled diabetes often demonstrate oral manifestations such as periodontal disease, xerostomia, burning mouth syndrome, and slow healing process; they are also more susceptible to oral viral/bacterial/fungal infection.[5,6] Xerostomia is one of the complaints experienced by diabetic patients. Xerostomia can be caused by hyposalivation (not always) due to salivary gland dysfunction. Xerostomia frequently occurs in 12.5% - 53.5% of diabetic patients.[7] Xerostomia with

hyposalivation contributes to many oral disorders that finally will decrease quality of life. Someone with hyposalivation is more susceptible to dental caries and periodontal disease since there is lack of self-cleaning in oral cavity.[8] Besides, someone may also have difficulty in eating, swallowing, and using denture since saliva is stickier. With a lack of saliva, someone is prone to traumatic lesion because of drier mucosa.[9] All these disturbances will influence oral functions and cause unsatisfying Oral Health-related Quality of Life (OHRQoL). Oral Health-related Quality of Life is defined as multidimensional conditions that reflect someone's comfort when eating, sleeping, or socializing with others. In other words, OHRQoL is satisfaction with oral health.[10]

So far, assessment of quality of life is more associated with general health rather than oral health. Based on the above explanation, this study aimed to investigate the OHRQoL in type 2 DM outpatients of Yogyakarta General Hospital. The information of the OHRQoL level is useful for planning better oral health management of type 2 DM patients that eventually improves their quality of life.

MATERIALS AND METHODS

This study was a cross-sectional survey that recruited 82 type 2 DM outpatients, consisting of 50 male and 32 female patients (40-81 years old) of Yogyakarta General Hospital in Yogyakarta who were admitted in August to October 2017. Ethic approval for doing this study was obtained from the Research Ethic Committee of Faculty of Dentistry Universitas Gadjah Mada (No. 001100/KKEP/FKG-UGM/EC/2017). All the subjects did not require any special assistance for their daily activities. The subjects who agreed to participate in this research had filled out an Informed Consent.

The study on oral health-related quality of life and xerostomia status was conducted by interview according to the questionnaire of Geriatric Oral Health Assessment Index (GOHAI)[11] and Xerostomia Inventory (XI)[12] upon the submission of the written informed consent. A validated and reliable Indonesian GOHAI (unpublished) was used to assess the OHRQoL in this study. Geriatric Oral Health Assessment Index is a 12-item questionnaire to evaluate the three dimensions of OHRQoL, i.e., physical function, psychosocial function, and pain/discomfort. It consists of 6-point Likert scale from 0 (never) to 5 (always). The subjects were asked to rate on the 6-point Likert scale based on their experiences in the past three months. The GOHAI score was classified as low (≤50), moderate (51-56), and high (57-60), whereby a higher score indicates a better OHRQoL. Xerostomia status was assessed using a validated Indonesian XI Questionnaire (unpublished) that consists of 11 items and a 5-point Likert scale from 0 (never) to 4 (always).[13] the subjects were asked to rate on the 5-point Likert scale based on their experiences in the past three months, in which the answer of 'fairly often' and 'very often' indicate xerostomia.[14]

The intraoral examinations were performed by two trained dentists under adequate lighting with artificial lights. The examinations consisted of periodontal tissue, oral hygiene, coated tongue, and present teeth. Russel's Periodontal Index using WHO periodontal probe with a round tip of 0.5 mm diameter was used to determine the periodontal tissue status. The examination of Greene and Vermillion's Oral Hygiene Index-Simplified (OHI-S) with aid of no. 5 explorer was used to evaluate the oral hygiene status. Shimizu's Coated Tongue Index (CTI)[15] was applied to determine the coated tongue for each subject. Principally, the dorsal surface of the tongue was divided into 9 areas in which each area was scored according to the following classification, i.e., score 0: tongue coating not visible, score 1: tongue coating thin, papillae of tongue visible, score 2: tongue coating very thick, papillae of tongue not visible, so the total score was between 0-18. Then, the CTI percentage was calculated by dividing the obtained total score by 18. The number of present teeth was obtained by clinically counting the rest of the teeth found in the oral cavity, including teeth with at least a half of crown and mobile teeth, however radix/radices was/were not included.

Diabetes Mellitus status was determined based on fasting blood sugar ≥126 mg/dL or 2 h

postprandial blood sugar ≥200 mg/dL or random plasma sugar ≥200 mg/dL accompanied by polyphagia, polydipsia, polyuria, and unexplained weight loss. According to the consensus of The Indonesian Society of Endocrinology or *Perkumpulan Endokrinologi Indonesia (Perkeni)* that was adopted from the American Diabetes Association (ADA), controlled DM was determined when the fasting blood sugar was 80-130 mg/dL or 2h postprandial blood sugar was <180 mg/dL. Uncontrolled DM was determined if the fasting blood sugar was >130 mg/dL or 2h post prandial blood sugar was ≥180 mg/dL.[16]

The percentage of intraoral parameters, GOHAI score, and xerostomia status were analyzed, descriptively. Then, the subjects' characteristics were described based on GOHAI status using Chi Square test. For the data analysis, periodontal status was classified into 'no periodontal defect' if the Russel's Periodontal Index was <1.0 and classified into 'having periodontal defect' if the Russel's Periodontal Index was >1.0. Oral hygiene status was classified into 'not poor' if OHI-S was ≤1.2 and classified into 'poor' if OHI-S was >1.2. The GOHAI score was classified into 'high' if the score was >50 and 'low' if the score was ≤50. The frequency and percentage of each GOHAI item was descriptively analyzed as well.

RESULTS

The age range of the 82 subjects of this study was between 40 to 81 years with the average 63.41 ± 7.72 years. The duration of DM less than 5 years was detected in 26 subjects and that more than 5 years was detected in 56 subjects.

From Table 1, it is clear that the majority of the subjects had low GOHAI score, indicating low OHRQoL. Poor oral hygiene was detected in almost all the subjects (96.34%) along with periodontal defect (95.12%). However, no periodontal defect was characterized by the presence of gingivitis or relatively normal periodontal tissue. Here, the periodontal defect was demonstrated by early up to advanced periodontal tissue damage. Coated tongue was determined by white-yellowish layer on the dorsal surface of the tongue as accumulation of oral debris, shedding of tongue epithelium or tongue microorganism. If the intraoral examination was attributed to GOHAI status, so the results are depicted in Table 2.

From Table 2, only 'present teeth' had a significant contribution to the proportion of the GOHAI status in type 2 DM patients in this study (p=0.032). Type 2 DM patients with ≥20 teeth had a more significant proportion of high GOHAI status compared to those with <20 teeth.

From Table 3, the 12 items in the GOHAI instrument were already negatively directed. Therefore, answer 'always' indicated the lowest score and answer 'never' indicated the highest score. The higher the score, the better the OHRQoL. It appears that most of the answers given by the subjects was 'never'. According to the three dimensions of GOHAI instrument, 'having trouble in biting/chewing' of the physical function dimension (bold) was experienced more significantly compared to the other three items. On the other hand, 'being unable to eat comfortably' of the pain and discomfort dimension (bold) was felt more significantly compared to the other two items. Likewise, 'being unhappy with the teeth/gums/dentures' of the

Table 1. Summary of intraoral parameter, GOHAI score, and xerostomia status in 82 subjects

Examined conditions	Yes (%)	No (%)
Periodontal defect	78 (95.12%)	4 (4.88%)
Poor oral hygiene	79 (96.34%)	3 (3.66%)
>50% coated tongue	17 (20.73%)	65 (79.27%)
<20 present teeth	34 (41.46%)	48 (58.54%)
Xerostomia	39 (47.56%)	43 (52.44%)
Low GOHAI score	49 (59.76%)	33 (40.24%)

Table 2. Description of subjects based on GOHAI status

No	Variable	GOHAI n (%)		p-value[*)]
		High	Low	
1	Age			0.087
	<60	14 (42.4)	12 (24.5)	
	≥60	19 (57.6)	37 (75.5)	
2	Gender			0.386
	Male	22 (66.7)	28 (57.1)	
	Female	11 (33.3)	21 (42.9)	
3	Duration of DM			0.479
	≤5 y	9 (27.3)	17 (34.7)	
	>5 y	24 (72.7)	32 (65.3)	
4	Fasting blood sugar			0.965
	80 – 130 mg/dL	17 (51.5)	25 (51)	
	>130 mg/dL	16 (48.5)	24 (49)	
5	2 h postprandial blood sugar			0.822
	<180	17 (51.5)	24 (49)	
	≥180	16 (48.5)	25 (51)	
6	Periodontal status			0.092
	<1	0 (0)	4 (8.2)	
	≥1	33 (100)	45 (91.8)	
7	CTI			0.306
	≤50	28 (84.8)	37 (75.5)	
	>50	5 (15.2)	12 (24.5)	
8	OHI-S			0.148
	≤1.2	0 (0)	3 (6.1)	
	>1.2	33 (100)	46 (93.9)	
9	Present teeth			0.032
	<20	9 (27.3)	25 (51)	
	≥20	24 (72.7)	24 (49)	
10	Xerostomia status			0.891
	Normal	17 (51.5)	26 (53.1)	
	Xerostomia	16 (48.5)	23 (46.9)	

DM, Diabetes mellitus; CTI, coated tongue index; OHI-S, oral hygiene index – simplified *) Chi Square test

psychosocial impact dimension (bold) was experienced more significantly compared to the other four items. Due to the average frequency and percentage for each dimension, it could not be concluded since the subjects' answers extremely varied.

DISCUSSION

The majority of the subjects (59.76%) had low OHRQoL. This result reflected a relatively poor oral health condition of the majority of type 2 DM outpatients at Yogyakarta General Hospital. It seems that periodontal defect and poor oral hygiene were two oral health problems contributing to the poor oral health condition (Table 1).

However, xerostomia was also complained by 47.56% of the subjects. Scully (2003) explained that many medications are xerogenic such as antihypertensive drugs.[17] In this study, hypertension might become one of the diabetic complications in which 25 of the 82 (30.49%) subjects suffered from hypertension. As stated previously, xerostomia is frequently found in

Table 3. Frequency and percentage of each GOHAI item

In the past three months	Always	Very often	Often	Sometimes	Seldom	Never
Physical function						
Limiting the kinds or amounts of food	8 (9.76%)	4 (4.88%)	5 (6.10%)	17 (20.73%)	8 (9.76%)	40 (48.78%)
Having trouble in biting/chewing	13 (15.85%)	6 (7.32%)	13 (15.85%)	15 (18.29%)	9 (10.98%)	26 (31.71%)
Feeling uncomfortable in swallowing	8 (9.76%)	4 (4.88%)	5 (6.10%)	9 (10.98%)	5 (6.10%)	51 (62.20%)
Being unable to speak clearly	1 (1.22%)	1 (1.22%)	1 (1.22%)	10 (12.20%)	9 (10.98%)	60 (73.17%)
Average frequency and percentage for physical function per scale	7.5 (9.15%)	3.75 (4.57%)	6 (7.32%)	12.75 (15.55%)	7.75 (9.45%)	44.25 (53.96%)
Pain and discomfort						
Being unable to eat comfortably	3 (3.66%)	2 (2.44%)	12 (14.63%)	18 (21.95%)	7 (8.54%)	40 (48.78%)
Consuming analgesic	1 (1.22%)	2 (2.44%)	4 (4.88%)	15 (18.29%)	9 (10.98%)	51 (62.20%)
Having teeth/gums sensitive to hot, cold, or sweet	1 (1.22%)	1 (1.22%)	11 (13.41%)	16 (19.51%)	7 (8.54%)	46 (56.10%)
Average frequency and percentage for pain and discomfort per scale	1.67 (2.03%)	1.67 (2.03%)	9 (10.98%)	16.33 (19.92%)	7.67 (9.35%)	45.67 (55.69%)
Psychosocial impact						
Limiting contact with people because of teeth/dentures	0 (0.00%)	0 (0.00%)	1 (1.22%)	9 (10.98%)	13 (15.85%)	59 (71.95%)
Being unhappy with the teeth/gums/dentures	5 (6.10%)	6 (7.32%)	23 (28.05%)	13 (15.85%)	5 (6.10%)	30 (36.59%)
Feeling worried because of the teeth/gums/dentures	2 (2.44%)	0 (0.00%)	3 (3.66%)	25 (30.49%)	9 (10.98%)	43 (52.44%)
Feeling nervous because of the teeth/gums/dentures	1 (1.22%)	0 (0.00%)	0 (0.00%)	7 (8.54%)	14 (17.07%)	60 (73.17%)
Feeling uncomfortable when eating in front of people because of teeth/dentures	3 (3.66%)	2 (2.44%)	4 (4.88%)	14 (17.07%)	10 (12.20%)	49 (59.76%)
Average frequency and percentage for psychosocial impact per scale	2.2 (2.68%)	1.6 (1.95%)	6.20 (7.56%)	13.6 (16.59%)	10.2 (12.44%)	48.2 (58.78%)

patients with uncontrolled diabetes.[18,19] In this study, 41 subjects were detected to have postprandial blood glucose higher than 179 mg/dL, making them classified as patients with uncontrolled diabetes. Xerostomia suffered by the subjects was likely to be contributed by their uncontrolled DM and the side effect of taking antihypertensive medication.[20] This study supported a study by Lima et al. that 59 of 120 diabetic patients aged 65-91 years reported moderate to severe xerostomia.[21] Xerostomia

can be accompanied either with or without hyposalivation. Hyposalivation in diabetic patients can be contributed by multiple factors such as the changes in the parenchyma of the salivary gland, glycosuria or polyuria, and diabetic complications such as neuropathy and angiopathy.[22]

From the assessment of periodontal tissue status, it is clear that 95.12% of the subjects experienced periodontal tissue destruction. As has been known, periodontal disease is the oral complication most commonly found in diabetic patients. Even periodontal disease has been proposed as the sixth complication of DM and periodontitis as a possible early sign of diabetes mellitus. There is a vice-versa relationship between periodontal disease and DM. Epidemiological data verify that diabetes is a major risk factor for periodontal disease and susceptibility to periodontitis increases almost three times in patients with diabetes.[23]

The functions of immune cells in diabetic patients are altered and impaired, thus hindering the bacterial killing in periodontal pocket and significantly exacerbating periodontal tissue destruction. A high glucose concentration in gingival crevicular fluid may inhibit the wound healing capacity of fibroblasts in periodontal tissue by preventing collagen turnover and may reduce the resistance of periodontal tissue to bacterial attack.[24] On the other hand, there is emerging evidence to support that periodontal inflammation can lead to poor glycemic control.[25,26]

The oral hygiene examination demonstrated that 96.34% of the subjects had poor oral hygiene. Poor oral hygiene might result from bad self-cleaning because of lack of saliva. Someone with poor oral hygiene is prone to dental caries and periodontal disease. Untreated dental caries and periodontal disease are the major etiology of tooth loss. In this study, around 41.46% of the subjects only had remaining teeth less than 20. Besides, poor oral hygiene could be contributed by higher coated tongue index. In this study, coated tongue more than 50% was encountered in around 20% of the subjects. Coated tongue is an accumulation of death cells, food debris, or protein on the dorsal surface of the tongue. Coated tongue may contribute to the occurrence of dental caries, periodontal disease, and halitosis (bad breath).[27]

The GOHAI instrument to evaluate the three dimensions of OHRQoL is comprised of: (i) physical function including eating, speech, and swallowing; (ii) pain or discomfort including the use of medication to relieve pain or discomfort from the mouth and history of tooth or gum sensitivity; (iii) psychosocial function including worry, concern about oral health, dissatisfaction with appearance, self-awareness about oral health, and disengagement from social life because of mouth problems.[28] From the above oral findings, it could develop a cascade phenomenon in the oral cavity, i.e., xerostomia that can limit self-cleaning and discomfort or pain of oral mucosa since it is more susceptible to irritation or trauma.[29] Furthermore, xerostomia leads to difficulty in mastication and swallowing because there is inadequate saliva blended with food, so food boluses could not be formed properly.[30] In addition to that, decrease in self-cleaning could cause someone to be more prone to periodontal disease. Of course, periodontal disease generates pain or discomfort which in turn could give rise to tooth loss unless properly treated. Tooth loss results in mastication impairment and pain/discomfort, thus causing disengagement from social activities.

In this research, only 'present teeth' had a significant contribution for the proportion of the GOHAI status in type 2 DM patients in this study (p=0.032). The subjects with <20 teeth had a more significant proportion of low GOHAI status compared to those with ≥20 teeth. Therefore, the fact that the majority of the subjects had low OHRQoL in this study might be contributed significantly by more tooth loss, since tooth loss is the last consequence of a cascade phenomenon in the oral cavity (xerostomia, poor oral hygiene, and periodontal disease). Finally, all these conditions will deteriorate someone's OHRQoL since they would cause pain/discomfort and reduce physical and psychosocial functions.

According to the three dimensions of the GOHAI instrument, 'having trouble in biting/chewing' of the physical function dimension was experienced more significantly compared to the other three items. Similarly, a complaint of 'being unable to eat comfortably' of the pain and discomfort dimension (bold) was felt more significantly compared to the other two items. Both complaints might be partly contributed by periodontal defect and the number of remaining teeth of <20 because these two conditions significantly influence mastication capability which in turn brings a 'psychological impact in the form of 'being unhappy with the teeth/gums" that was experienced more significantly compared to the other four items.

The assessment of quality of life (QoL) is difficult and very subjective because it relies on someone's satisfaction with oral function and it is full of life values.[10,31] Many factors may influence QoL assessment such as education level, social condition, culture, and practices in a place where QoL is implemented and evaluated. In addition, the assessment also depends on life values which are different for each person[31,32,33] since QoL assessment is related with the goals, expectations, standards, and concerns of a person's life.[33] Therefore, although the 34 subjects in this study had present teeth <20 or 78 subjects had periodontal defect, not all of those subjects had low GOHAI score (Table 2). From this result, it seems that the oral health care was still unsatisfying in type 2 DM outpatients of Yogyakarta General Hospital. This condition could be reflected from the low OHRQoL. It is very important to raise awareness of the fact that oral health and systemic health cannot be separated and they are interplay.

CONCLUSION

The majority of type 2 DM outpatients of Yogyakarta General Hospital had poor OHRQoL as reflection of their oral condition that is partly contributed by subjects with present teeth less than twenty.

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