

Oral Health Knowledge, Attitudes, Behaviour and Oral Health Status of Chinese Diabetic Patients Aged 55 to 74 Years

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Objective: To understand the oral health knowledge, attitude, behaviour and oral health status of Chinese diabetic patients so as to facilitate the development of oral health education programmes for diabetic patients in China.

Method: A face-to-face questionnaire was conducted for 1,024 diabetic patients and 8,030 non-diabetic people aged 55 to 74 years old in order to understand their oral health knowledge, attitudes, and behaviour. Oral health examination was implemented including caries, gingival bleeding, dental calculus, periodontal attachment loss, etc. according to the Oral Health Surveys Basic Methods 5th Edition.

Results: Compared with non-diabetic patients, those with diabetes had more oral health knowledge and more positive attitudes. The proportion of people who formed toothbrushing habits was higher in diabetic patients, but that of regular scaling and flossing is as low as that in non-diabetic people. The detection rate of deep periodontal pockets in diabetic patients was higher than that in non-patients, while the caries situation was better than that in non-patients.

Conclusion: This study has shown that the oral health knowledge, attitude, behaviour and oral health status of the 55 to 64-year-old diabetic population are not optimistic. There is a great need for a systematic oral health education programme in China. The contradiction between a large number of diabetes patients and limited health resources requires us to give priority to the improvement of oral health behaviours, such as educating patients to develop toothbrushing and flossing habits.

Key words: China, diabetes, education programme, oral health
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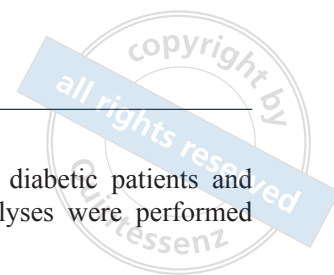
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Numerous epidemiological studies have found a high degree of association between diabetes mellitus (DM) and periodontal disease, and periodontal disease has even been proposed as the sixth complication of DM¹⁻³. Strengthening the oral health care of diabetic patients is an important part of the management of diabetic patients^{4,5}.

As the most populous country in the world, China has the largest number of people with diabetes. The prevalence of diabetes in China has been increasing since the 1970s⁶, and it increased rapidly from 2002 to 2013 among adults (2.6% to 10.9%)⁷. Moreover, the prevalence of prediabetes was 50.1%, implying that approximately 500 million Chinese adults may have had prediabetes⁸. Chinese diabetic patients will become a huge crowd in the future and diabetes will become one of the most serious public health problems in China. Diabetes mellitus can increase the risk for and severity of oral diseases especially periodontitis, and the oral status of diabetics affects glycaemic control and quality of life, thus diabetics should have better oral health awareness and behaviour than the general population.

The aim of the current study was to assess the prevalence of oral health knowledge, attitudes, behaviour and oral health status in diabetic patients aged 55 to 74 years, and to analyse the difference between diabetic patients and non-patients in order to better determine the practical needs of oral health care in diabetic patients in China and to provide a basis for preventive intervention and decision-making.

Materials and methods

This analysis is part of the 4th National Oral Health Survey conducted in 2015 to 2016. These surveys are carried out every 10 years. In all 31 provinces, autonomous regions and municipalities of the mainland of China, four counties (or districts) were randomly selected from each province, three townships (or street) were randomly selected from each county (or district), one village was randomly selected from each township (or street), 24 individuals aged 55 to 74 years were randomly selected from each village as the research object.

A face-to-face questionnaire was conducted with individuals aged 55 to 74 years old in order to understand their oral health knowledge, attitudes, and behaviours. Oral health examinations including caries, gingival bleeding, dental calculus, periodontal attachment loss, etc. was implemented according to *Oral Health Surveys Basic Methods 5th Edition*⁹.

T tests and Chi-tests were used to analyse the differences in oral health knowledge, attitudes, behaviour

and oral health status between diabetic patients and non-patients. All statistical analyses were performed using SAS 9.3.

Results

Among all 9,054 respondents, 1,024 reported that they were diagnosed with diabetes by professional medical institutions, including 473 males and 551 females, with an average age of 65.1 years. There were 614 people living in urban areas and 410 people living in rural areas. Meanwhile, 8,030 non-diabetic people of the same age were investigated.

There was no significant difference in age and gender composition between diabetic patients and non-diabetic people. However, there is a significant difference between the urban and rural composition of diabetic patients and those of non-diabetic people. That is, 60.0% of diabetic people live in urban and 40.0% live in rural areas. However, 49.5% of non-diabetic people live in urban and 50.5% live in rural areas (Table 1)

Oral health knowledge

The awareness of oral health knowledge in diabetic patients was showed in Table 2.

The total awareness rate of oral health knowledge in diabetic patients was 64.9%. Specifically, most diabetic patients (81.1%) knew that “oral health can influence the progress of diabetes”. More than two-thirds (69.5%) of diabetics knew that “bacteria can cause dental caries” and 72.3% knew that “bacteria are a major cause of gingivitis”. Awareness of knowledge related to gingival bleeding was relatively low, only 55.8% and 45.7% knew that “it is abnormal” for gums to bleed when brushing your teeth” and “brushing can prevent gum bleeding”, respectively.

Compared with non-diabetic people, the awareness rate of oral health knowledge in diabetic people was higher ($\chi^2 = 9.2836$, $P = 0.0023$). This is mainly due to that awareness rates of diabetic people in rural areas is significantly higher than that of non-diabetic people ($\chi^2 = 31.6096$, $P < 0.0001$), while there was no difference in urban areas ($\chi^2 = 2.3716$, $P = 0.1236$).

Oral health attitudes

Oral health attitudes in diabetic patients are shown in Table 3.

Eighty percent (80.0%) of diabetics had a positive attitude towards oral health care. But more than half of the people (54.4%) with diabetes mistakenly believe

Table 1 Characteristics of diabetic people and non-diabetic population.

		Diabetic population	Non-diabetic population	
Number		1024	8030	
Gender	Male	46.2%	50.3%	
	Female	53.8%	48.7%	
Mean age (years)		65.1	64.3	
Area	Urban	60.0%	49.5%	**
	Rural	40.0%	50.5%	

** $P < 0.01$

Table 2 Oral health knowledge in diabetics aged 55 to 74, China, 2015 to 2016 (%).

	Diabetic population			Non-diabetic population			
	All	Urban	Rural	All	Urban	Rural	
Total	64.9	68.6	59.3	59.9	67.2	52.8	**
It is abnormal for gums to bleed when brushing your teeth	55.8	59.9	49.5	49.1	56.9	41.5	***
Bacteria is a major cause of gingivitis	72.3	75.9	66.8	66.5	75.4	57.7	***
Brushing can prevent gum bleeding	45.7	49.2	40.5	41.6	47.3	36.1	*
Bacteria can cause dental caries	69.5	73.3	63.9	64.6	72.8	56.5	**
Oral health can influence the progress of diabetes	81.1	84.5	75.9	77.7	83.4	72	*

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

Table 3 Oral health attitudes in diabetics aged 55 to 74, China, 2015 to 2016 (%).

	Diabetic population			Non-diabetic population			
	All	Urban	Rural	All	Urban	Rural	
Total	80.0	81.7	77.4	77.1	82.6	71.8	*
Oral health is important for individuals	92.9	95.3	89.3	90.7	94.9	86.6	*
Regular oral examination is necessary	82.3	84.0	79.8	78.9	84.7	73.2	*
Dental health is innate and has little to do with human self-care	54.4	55.0	53.4	51.6	58.2	45.2	
Dental prophylaxis on your own	90.3	92.5	87.1	87.2	92.5	82.1	**

* $P < 0.05$; ** $P < 0.01$

that “dental health is innate and has little to do with human self-care”.

The proportion of diabetic people with a positive attitude to oral care is higher than in non-diabetic people ($\chi^2 = 4.3159$, $P = 0.0378$). More concretely, there is no difference in attitude between urban diabetic and non-diabetic people ($\chi^2 = 1.4767$, $P = 0.2243$), while diabetic people in rural areas have a more positive attitude than those who do not have diabetes ($\chi^2 = 29.1621$, $P < 0.0001$).

Oral health behaviour

The oral health behaviour status in diabetic patients is shown in Table 4.

A little more than one third (36.1%) of diabetic patients brushed their teeth twice a day and 23.4% patients visited the dentist once a year. The proportion in urban areas was higher than that in rural areas ($\chi^2 = 35.9235$, $P < 0.0001$) ($\chi^2 = 6.6236$, $P = 0.0101$). Only 2.8% and 2.7% of patients had regular scaling and used floss, respectively. There was no difference between those living in urban and rural areas (regular scaling: $\chi^2 = 1.4309$, $P = 0.2316$; floss: $\chi^2 = 2.1062$, $P = 0.1467$).

The proportion of people who brushed their teeth every morning and evening was significantly higher in diabetic patients than in people who did not have diabetes ($\chi^2 = 18.1836$, $P < 0.001$) and they also visited the dentist more often ($\chi^2 = 7.2871$, $P = 0.0069$), but the proportion of regular scaling and flossing in diabetes patients was as low as in non-diabetic people ($\chi^2 = 0.0007$, $P = 0.9792$) ($\chi^2 = 3.1018$, $P = 0.0782$). There was no significant difference in the above four oral health behaviours between people with and without diabetes in urban areas. In rural areas, the proportion of people that brush their teeth each morning and evening was higher than for non-diabetic patients ($\chi^2 = 22.358$, $P < 0.0001$). There was no difference between them regarding the other three behaviours.

Dentition status

Table 5 presents the dentition status for diabetic patients in this study. Almost all (97.3%) of the diabetic population suffered from dental caries. Each person had an average of 10.77 incidences of dental caries, including 2.51 decayed teeth, 7.66 missing teeth and 0.63 filled teeth. There were 0.73 root caries per capita, including 0.65 decayed root caries and 0.07 filled root caries. There was no difference between patients in urban areas and those living in rural locations except for the the num-

ber of filled teeth. Compared with rural diabetic patients, the number of filled teeth in urban diabetes patients was higher ($t = 2.870$, $P = 0.004$).

Compared with non-diabetic people, the number of caries (DT) in diabetic people was lower ($t = 3.556$, $P = 0.000$). Diabetic people have lower DT both in urban ($t = 2.263$, $P = 0.024$) and rural areas ($t = 2.013$, $P = 0.044$).

Compared with non-diabetic people, the number of root caries (DRoot) incidences in diabetic people was lower ($t = 2.001$, $P = 0.046$). However, regardless of where they lived no significant difference was found between those with diabetes and those without.

The number of filled teeth (FT) was higher ($t = 2.870$, $P = 0.004$) in diabetic people. Diabetic people in rural areas have a higher FT than non-diabetic people ($t = 2.663$, $P = 0.008$), while there was no difference between the two groups in urban areas.

There was also no difference in the prevalence rate of caries, missing teeth (MT), decayed missing and filled teeth (DMFT), filled root caries (FRoot), and decayed and filled root caries (DFroot), in both urban and rural areas.

Periodontal health

Regarding periodontal health status, 86% of diabetic patients were detected to have gingival bleeding and dental calculus was detected in 92.3%. Almost 70% (69.4%) of diabetics had periodontal pockets and 17.0% of those were deep. Periodontal attachment loss was detected in 71.4% of diabetic patients. There was no significant difference in all indicators between urban and rural areas (Table 6).

Compared with non-diabetic patients, the prevalence of deep periodontal pockets in diabetic people was higher than that of non-diabetics ($\chi^2 = 4.0933$, $P = 0.0431$). There was no difference of periodontal pocket prevalence between diabetic and non-diabetic people in urban areas ($\chi^2 = 0.18$, $P = 0.895$), but the prevalence of deep periodontal pockets in diabetic patients was significantly higher than that of non-diabetic people in rural areas ($\chi^2 = 7.113$, $P = 0.008$). There was no difference in all other periodontal indicators between the two groups, regardless of location.

Discussion

Our study found that oral health-related behaviours among diabetic patients had improved since 2010. The prevalence of dental attendance (23.4%) in the past 1

Table 4 Oral health behaviour in diabetics aged 55 to 74, China, 2015 to 2016 (%).

	Diabetic population			Non-diabetic population			
	All	Urban	Rural	All	Urban	Rural	
Brush teeth every morning and evening	36.1	43.5	25.1	29.6	41.5	18.0	***
Use of dental floss	2.7	3.4	1.7	1.9	2.7	1.0	
Dental visits at least once a year	23.4	26.2	19.3	19.8	23.7	16.0	**
Teeth cleaning at least once a year	2.8	3.4	2.0	2.9	4.0	1.8	

** $P < 0.01$; *** $P < 0.001$

Table 5 Dentition status in diabetics aged 55 to 74, China, 2015-2016 (%).

	Diabetic population			Non-diabetic population			
	All	Urban	Rural	All	Urban	Rural	
Prevalence rate of caries (%)	97.3	97.9	96.3	96.7	96.7	96.7	
Decayed teeth (DT)	2.51	2.31	2.81	2.93	2.62	3.24	***
Missing teeth (MT)	7.63	7.77	7.44	7.57	7.15	7.99	
Filled teeth (FT)	0.63	0.72	0.48	0.48	0.68	0.28	**
Decayed, missing and filled teeth (DMFT)	10.77	10.8	10.73	10.98	10.44	11.51	
Decayed root caries (DRoot)	0.65	0.60	0.73	0.75	0.71	0.78	*
Filled root caries (FRoot)	0.07	0.09	0.04	0.07	0.12	0.03	
Decayed and filled root caries (DFroot)	0.73	0.70	0.77	0.82	0.82	0.81	

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

Table 6 Prevalence of periodontal unhealthy health in diabetics aged 55 to 74, China, 2015 to 2016 (%).

	Diabetic population			Non-diabetic population			
	All	Urban	Rural	All	Urban	Rural	
Gingival bleeding	86.0	85.2	87.3	85.5	84.9	86.1	
Dental calculus	92.3	92.2	92.4	93.6	93.9	93.3	
Periodontal pocket	69.4	69.2	69.8	66.7	67.3	66.2	
Deep periodontal pocket	17.0	16.3	18.0	14.7	16.1	13.3	*
Loss of periodontal attachment	71.4	69.2	74.6	72.1	70.7	73.4	

* $P < 0.05$

year in our study was higher compared with that in 2010 (11.9%)¹⁰. And the rate of brushing teeth twice a day had also slightly increased from 33.1% in 2010¹⁰ to 36.1%.

This study showed that the awareness rate of oral health knowledge of diabetic patients was higher than that of non-diabetic patients. Some oral health behaviours, such as toothbrushing and regular dental examination, were also better those recorded for non-diabetic patients. In addition, patients with diabetes had fewer decayed teeth and more filled teeth. It seemed that the oral health behaviour and condition of diabetics was better than that of non-diabetic patients. Possible explanations may be that the relationship between diabetes and periodontal disease has been a great concern to diabetic patients as well as doctors and that some effective programmes on management of oral health among diabetic patients could improve oral health knowledge, attitudes and behaviour¹¹. However, there is still a large gap between the recommendation standards and the actual levels of other developed countries¹²⁻¹⁴.

One noticeable finding of our study was that patients with diabetes had a worse periodontal status compared with those without diabetes, especially when it comes to deep periodontal pockets. Previous literature has demonstrated the effect of diabetes on periodontal disease¹⁵; deep periodontal pockets could be used in epidemiological surveys as a relatively reliable indicator of periodontal disease among diabetics, and dental practitioners must attach importance to deep periodontal pockets when managing patients with periodontitis and diabetes.

Based on the two-way relationship between diabetes and periodontal disease, oral health management among diabetic patients had been given worldwide attention.

In recent years, the Chinese government has paid closer attention to the health management of diabetic patients, and has carried out health education programmes such as the prevention of diabetic complications^{16,17}. This research mostly focused on complications such as retinopathy, nephropathy, and peripheral neuropathy^{18,19}, but few studies have focused on oral health management in diabetic patients, and there had not been a national level project on oral health management for diabetic patients in China. This phenomenon not only exists in China, but also in many countries all over the world. Even for diabetes health education professionals, only 79% of their vocational training had featured oral health education²⁰. China urgently needs a national oral health education programme for patients with diabetes, and health professionals should take the opportunity to educate patients with diabetes about the complications (e.g. periodontitis and oral candidiasis)

of diabetes²¹ and educate patients to change their lifestyle (e.g. flossing)²².

In China, the diabetic population is huge, while medical resources are relatively limited. Therefore, we must adopt cost-effective methods of educating diabetic patients and strive to achieve maximum results with minimal investment. We should encourage self-management role of the patients with diabetes and educate them to focus on oral health-related behaviour, such as regular brushing and flossing. At the same time, regular oral examinations and effective treatment of periodontal disease must be carried out to control blood sugar levels.

An interesting discovery in this research was that there was not much difference in oral knowledge, attitude and behaviour between urban diabetic and non-diabetic patients. However, in rural areas, patients have higher knowledge awareness, a more positive attitude, better toothbrushing behaviour and less dental caries, but they are in a worse periodontal condition than non-diabetic people. This appears contradictory and reminds us that periodontal disease cannot be completely controlled through good oral hygiene alone. Special attention should be paid to improving the accessibility of oral medical care for diabetic people living in rural areas, and this should be accompanied by oral health education.

Conclusion

The oral health knowledge, attitude, behaviour and oral health status of 55 to 64-year-old members of the Chinese diabetic population are not optimistic. We must pay full attention to the oral health education of diabetic patients, guide them to develop good oral hygiene behaviour and improve oral health in general for people with diabetes.

Conflicts of interest

The authors reported no conflicts of interest related to this study.

Author contribution

Drs Chun Xiao WANG, Li Li MA, Yan SI and Zhi Xin LI, designed and directed the study; Drs Chun Xiao WANG, Li Li MA, drafted the manuscript; Drs Chun Xiao WANG, Yang YANG, Meng Ru XU analysed the data; Drs Xing WANG, Xi Ping FENG, Bao Jun TAI, De Yu HU, Huan Cai LIN, Bo WANG, Shu Guo ZHENG, Xue Nan LIU, Wen Sheng RONG, Wei Jian WANG, Yan

SI, Chun Xiao WANG made the survey plan, trained the investigators, designed and supervised the survey. All authors have read and approved the final manuscript for submission.

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