

## Diabetes Mellitus Type 2 and Oral Health in Context to Thailand: An Updated Overview

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### Abstract

At present, the prevalence of diabetes is increasing markedly not only in developed countries, but also in middle- and low-income countries. Diabetes is a major cause of blindness, kidney failure, heart attacks, stroke and lower limb amputation. Poorly controlled diabetes is associated with gingivitis, periodontal diseases, and alveolar bone loss.

The objective of this review articles is to presents an updated overview diabetes and the results of different studies in Thailand regarding diabetes and its relation to oral health. Articles were searched from ScienceDirect, Pubmed, Scopus and Google Scholar typing the words “diabetes”, “oral health”, and “Thailand”. By application of inclusion criteria, articles were selected and included in this review. This reviews article which will help to improve the oral health care of the patients with diabetes.

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### Introduction

Diabetes mellitus (DM) comprises a group of genetically and clinically heterogeneous metabolic disorders characterized by hyperglycemia that results from a defective insulin secretion and/or activity.<sup>1,2</sup> There are 3 types of diabetes: a) type 1, which results from an absolute insulin deficiency; b) type 2, which is the result of insulin resistance and an insulin secretory defect; and c) gestational, a condition of abnormal glucose tolerance during pregnancy. In this article, we considered only DM type 2 which is a group of disorders characterized by increased blood glucose level and abnormalities of carbohydrate, fat and protein metabolism. Globally, including Thailand, there has been increasing prevalence of DM. Over the past decade, diabetes prevalence has risen faster in low- and middle-income countries than in high-income countries.<sup>3</sup> This reflects an increase in associated risk factors such as being overweight or obese. It a major cause of blindness, kidney

failure, heart attacks, stroke and lower limb amputation.<sup>4</sup> Healthy diet, regular physical activity, maintaining a normal body weight and avoiding tobacco use are ways to prevent or delay the onset of type 2 diabetes. It can be treated and its consequences avoided or delayed with diet, physical activity, medication and regular screening and treatment for complications. In this review article, articles were searched from ScienceDirect, Pubmed, Scopus and Google Scholar typing the words “diabetes”, “oral health”, and “Thailand”. By application of inclusion criteria, articles were selected and included in this review. This reviews article which will help to improve the oral health care of the patients with diabetes.

### Prevalence of diabetes

Globally, recent data in 2014, indicates that an estimated 422 million adults were having with diabetes.<sup>3</sup> The global prevalence of DM has doubled since 1980, rising from 4.7% to 8.5%. It caused 1.5 million deaths in 2012 from diabetes.<sup>3</sup> In Thailand, the diabetes prevalence rate has risen dramatically in recent years, from just 2.3% in 1991 to 6.9% in 2009.

Currently, diabetes is no longer a disease of predominantly only rich nations and the prevalence of diabetes is steadily increasing markedly in the world's middle- and low-income countries.<sup>4</sup> Higher blood glucose than optimal caused an additional 2.2 million deaths, by

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increasing the risks of cardiovascular and other diseases. 43% of these 3.7 million deaths occur before the age of 70 years.<sup>4</sup>

The percentage of deaths from high sugar level or diabetes prior to age 70 is higher in low- and middle-income countries than in high-income countries.

#### **Associated factors of diabetes**

A number of oral diseases and disorders have been associated with diabetes. In a study in Thai subjects, it was found that age, gender, education, oral hygiene status, smoking, and diabetes are significantly associated with periodontal disease severity.<sup>5</sup>

Type 2 diabetes is a dietary habit and lifestyle-associated disease, and given the magnitude of the problem in Thailand, it is important to develop preventive dietary interventions. Traditional Southeast Asian diets are composed of 70-80% carbohydrates, mostly from cereals mainly rice. However, urbanization have resulted in a nutritional transition characterized by a shift away from traditional diets towards an industrialized diet that includes both processed western foods as well as traditional foods with more added sugars and fat.<sup>6</sup> This transition in conjunction with reduced physical activity has contributed to a rapid increase in the prevalence of overweight and obesity in Asia.<sup>7</sup>

Obesity is considered as a serious health problem in Thailand.<sup>8</sup> Increased intake of sugars and sweet foods is seen as a major factor contributing to excess weight and obesity.<sup>9</sup> A National Health Examination Survey done in 2009 showed that the prevalence of overweight (BMI 23-24.9 kg/m<sup>2</sup>) was 17.5%, obesity class I (BMI 25-29.9 kg/m<sup>2</sup>) was 26.0%, and obesity class II (BMI ≥30 kg/m<sup>2</sup>) was 9.0%.<sup>10</sup> The BMI was increased by an average of 0.95 kg/m<sup>2</sup> from 1991 to 2009, one of the highest rates of increase in Southeast Asia. The average increase in BMI per decade was higher in women and (0.9 kg/m<sup>2</sup>) than men (0.8 kg/m<sup>2</sup>). Another nationwide study in Thailand, Papier *et al.*<sup>11</sup> assessed the sugar-sweetened beverage (SSB) intake and the risk of developing DM type 2 in Thai adults. They found that women consuming SSBs ≥once per day were associated with increased DM incidence at the 8-year follow-up. The obesity was found to mediate ~23% of the total association between SSB intake in 2005

and DM risk in 2013. Hence, they suggested that targeting SSB consumption can help prevent a national rise in the incidence of DM.

Data on diabetes from the National Health Examination Survey (NHES) in Thailand in 2004<sup>12</sup> showed that the prevalence of DM type 2 impaired fasting glucose (IFG) and diabetes was 10.6 and 7.5%, respectively. Of all diabetes diagnoses, 35.4% were not previously diagnosed, and the proportion was higher in men than in women (47.3 vs. 23.4%,  $P < 0.05$ ). However, in substantial proportions of individuals with diabetes these concomitants were still controlled sub optimally. Another nationwide study about the health status of diabetes type 2 patients about their know-how, behavior and perception about health care was re-assessed.<sup>13</sup>

Laboratory results revealed that in average 70% of the patients had been over nourished, over 50% had abnormal cholesterol-, over 55% had high triglyceride levels and 51% had high density lipid values below 45 mg/dl. Sixty percent of patients had glycated hemoglobin (HbA1c) levels over 7%.

A study by Eknithiset *et al.*<sup>14</sup> explored factors associated with knowledge, perception, and practice toward self-care among elderly DM type 2 patients aged 50–70 years in 3 clinics of primary healthcare at Taladnoi, Horathep, and Khokyai, Saraburi, Thailand. About ¼ of the participants were housewives, 15.2% government employee and 12.1% were farmer. Participants suffering from diabetes for 1-5 years were 48.5%. Among the diabetic patients, 51.5% reported to have family history of diabetes.

Choowattanapakorn *et al.*<sup>15</sup> investigated the factors affecting the quality of life of older persons with diabetes where they measure the characteristic, quality of life, resilience and selfcare. They determined resilience, personal characteristics, self-care behavior and demographic factors were predictive of quality of life among older diabetics. They suggested that the health care professionals need to be aware of individual differences among older diabetics towards promoting better quality of life.

#### **Diabetes and its oral signs**

People with diabetes are at greater risk for oral health problems than others. Also, diabetes with tobacco use presents a greater risk for oral health concerns.<sup>16</sup> Diabetes can cause many complications which includes, nerve

damage, heart disease, stroke, kidney disease, and even blindness.



**Figure 1.** Gingivitis in patient with diabetes type 2.

Another common health complication of poorly controlled diabetes is gingivitis (Fig. 1), periodontal diseases, and alveolar bone loss (Fig 2).<sup>17</sup> There is relationship of effects of poorly controlled glycemic control on periodontal disease.<sup>18</sup> Several mechanisms have been proposed to explain the increased susceptibility to periodontal diseases, including alterations in host response, subgingival microflora, collagen metabolism, vascularity, gingival crevicular fluid and heredity patterns. Multiple pathophysiological mechanisms (compromised neutrophil function, decreased phagocytosis and leukotaxis) also have been implicated in the increased alveolar bone loss found in patients with diabetes.<sup>19,20</sup> Diabetes affects your ability to fight off bacteria that can cause gum infections.



**Figure 2.** Periodontitis and alveolar bone loss in patient with diabetes type 2.

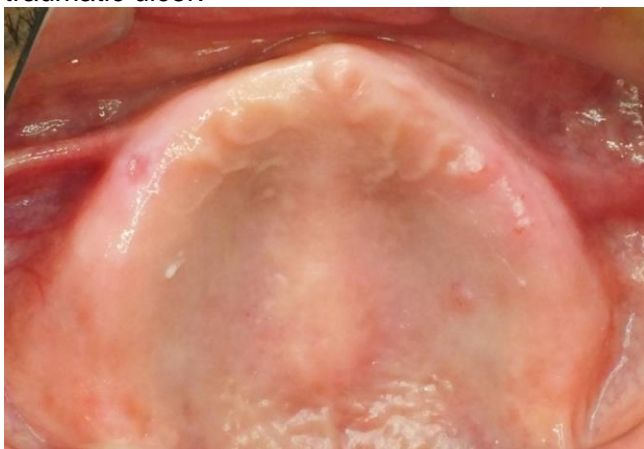
Ramli *et al.*<sup>21</sup> found that diabetic patients are more prone to periodontal destruction and tooth loss and mentioned that the patients are at a higher risk of developing dental caries. But

there has been no proper clarification of association relationship between diabetes and dental caries.<sup>17</sup> It is important to note that patients with diabetes are susceptible to oral sensory, periodontal and salivary disorders, which could increase their risk of developing new and recurrent dental caries. Hintao *et al.*<sup>22</sup> studied the effect of type 2 diabetes on coronal and root surface caries and to investigate some factors associated with coronal and root surface caries in Thai subjects. Diabetic patients compared with non-diabetic subjects had a higher prevalence of root surface caries (40.0% versus 18.5%;  $P=0.001$ ), a higher number of decayed/filled root surfaces ( $1.2 \pm 0.2$  versus  $0.5 \pm 0.1$ ;  $P < 0.01$ ) and a higher percentage of generalized periodontitis (98.1% versus 87.4%;  $P < 0.01$ ). The factors associated with root surface caries included type 2 DM, a low saliva buffer capacity, more missing teeth, and existing coronal caries; whereas wearing removable dentures, more missing teeth, a high number of lactobacilli, and a low saliva buffer capacity were associated with coronal caries. They concluded that diabetes is a significant risk factor for root surface (Fig. 3), but not for coronal caries. Periodontal disease should be treated early in type 2 diabetic subjects to reduce the risk of subsequent root surface caries.



**Figure 3.** Root caries on lower teeth in patients with diabetes type 2.

Additionally, people with diabetes are likely to have a dry mouth and poor salivary gland dysfunctions.<sup>23,24</sup> The cause is unknown, but may be related to polyuria or to alterations in the basement membranes of salivary glands.<sup>25</sup> In addition, severe glycemic control is associated with increased risk for mouth ulcers (Fig. 4), lichen planus, soreness, and dental infections.<sup>26</sup> Furthermore, diabetes is also associated with increased risk for thrush, a type of severe *Candida* infection.<sup>27</sup> Another complications of the diabetes is delayed wound healing in oral traumatic ulcer.<sup>28</sup>



**Figure 4.** Dryness and oral ulcer in upper edentulous arch in patient with diabetes type 2.

Chomkhakhai *et al.*<sup>29</sup> studied the prevalence of oral manifestations, xerostomia, hyposalivation and level of oral microflora in 369 Thai patients with metabolic syndrome (MS) and to determine if there is any association between MS and these oral health components. They found that dental caries was found in at least one tooth and periodontitis were found in 184 (49.9%) and 192 (52.0%) patients, respectively. Oral mucosal manifestations were found in 203 patients (55.0%). The most prevalent manifestation was fissured tongue (41.5%), followed by denture stomatitis (9.2%) and depapillated tongue (3.0%). Dry mucosa was depicted in 203 patients (55.0%). Xerostomia was revealed in 157 patients (42.5%) while hyposalivation was detected in 202 patients (54.7%). 24% of patients had high *Candida* level. Significant association was found between *Candida* level and hyposalivation and also hyposalivation, xerostomia and dry mucosa. Hence, approx. half of the patients with metabolic syndrome presented with dental caries, periodontitis, dry mouth, oral mucosal changes

and approx. 1/4 had high *Candida* level. In addition, resistin and adiponectin are adipokines that secreted from adipose tissue that postulated opposing functions in insulin resistance and inflammation.<sup>30</sup> Resistin level was lower in type 2 DM and the adiponectin level was increased in deep pocket.

#### Oral health management and diabetes

Dentists must be aware of the sign and symptoms of DM and various methods of treating effectively the oral complications of diabetes mellitus.<sup>17</sup> The patients with diabetes does require more interventional therapy and rigorous follow-up. In addition, regular communication with physicians is needed and greater attention is to be taken for prevention. Dental treatment in patients with diabetes, especially with a history of poor glycemic control require more frequent recall visits and require attention.

The blood sugar levels for the adults living with type 2 diabetes can be controlled by controlling diet, maintaining regular exercise, and complying with medication.<sup>31</sup> A study by Eknithiset *et al.*<sup>14</sup> found that the knowledge, perception, and practice about type 2 diabetes mellitus among patient were significantly poor. Hence, proper knowledge regarding the blood sugar levels and sugars in the diet is a first step for planning cost-effective and targeted actions. Similarly, another study done by Suksathan and Prabsangob<sup>32</sup> in Rachburi Province which described the health literacy and self-care behavior, and their association with diabetes showed that the elderly with diabetic had inadequate health literacy may be because of their old age, low education and low income.

In older Thai, the chewing ability and nutritional status was also related.<sup>33</sup> Those with few teeth present and a low number of functional teeth had poor chewing ability; this decreased chewing ability was associated with lower nutritional status. Their findings emphasize the need for an increased consciousness among dental and nutritional professionals about the importance of good oral health for the maintenance of proper nutritional status in older people.

In addition, proper care of teeth with regular brushing, flossing, and dentist's visits helps to maintain optimal oral health. Treatments for oral health conditions related to diabetes depend on the condition and its severity, such as

periodontal disease can be treated with scaling and root planning with or without use of antibiotics. Regular dental check-up is necessary for the patients with diabetes. The diabetic patients should be made aware that following the suggestions to prevent side effects of the disease and trying to stay healthy despite suffering from the disease will significantly improve their quality of life.<sup>34</sup>

Recently, nonsurgical periodontal treatment together with Low Level Laser Therapy (LLLT) is associated with improved clinical parameters and decreased levels of high sensitive C-Reactive Protein (hs-CRP) and Hemoglobin A1c (HbA1c) in normal weight patients with type 2 DM, but it needs large scale and long-term study.<sup>35</sup>

### Conclusions

The prevalence of diabetes mellitus type 2 is increasing globally including Thailand. Effective management of diabetes patients requires an understanding of the disease. The blood sugar levels can be controlled by controlling diet, maintaining regular exercise, and complying with medication. It showed that there is lack of knowledge and perception of diabetes in Thailand. Proper knowledge regarding diabetes, blood sugar levels and sugars in the diet is a first step for planning cost-effective. The goal of the oral health care and treatment for patients with diabetes should aim to control the blood sugar level, provide safe and effective dental care, and improve oral health conditions to enhance the overall quality of life for patients.

### Declaration of Interest

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