# VALIDATION AND RELIABILITY OF A GUIDED QUESTIONNAIRE (GQ) FOR TYPE 1 DIABETES MELLITUS (T1DM) CHILDREN AND PARENTS ON PERIODONTAL DISEASE (PD)

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***Abstract***

The prevalence of PD is notably high in individuals with T1DM. Despite this, there is a limited availability of research on the utilization of questionnaires to evaluate self-perceived PD, patient knowledge, and their perception of PD in T1DM patients. Therefore, our objective was to establish validity and reliability of a bilingual (English-Malay) version of the guided questionnaire (GQ) to be used among pediatric T1DM patients attending Universiti Teknologi MARA (UiTM) Sungai Buloh campus and the Universiti Malaya (UM). This questionnaire focused on self-reported periodontal disease (PD), assessing their knowledge, and understanding of the bidirectional relationship between PD and T1DM. The dual-language GQ was adapted from the Self-Reported Questionnaire Malay Modified (SRQMM) to suit the targeted participants. Content validation was carried out among five field experts, and face validation was done among pediatric patients in Dental Faculty UiTM. Reliability testing was administered in T1DM patients attending UiTM and UM. The structure and words of the component in GQ were modified to ensure that it was appropriate for the participants. The item-level Content Validity Index (I-CVI) turned out to be valid with an average of 0.98. The subjective measurement of face validation showed satisfactory results after the second revision. Reliability concerning Cronbach's alpha (α) values was computed relying on all 21 items, which were acceptable at about 0.777, 0.644, 0.780 in the self-perceived PD assessment domain, knowledge domain and perception domain, respectively. Hence, the adapted dual language paediatrics version of the GQ is a reliable and valid tool for assessing self-perceived PD, knowledge, and perception in T1DM patients on PD and it can be effectively utilized by non-dental healthcare personnel.

***Keywords***: Periodontal Disease, Surveys and Questionnaires, Type 1 Diabetes Mellitus, Guided Questionnaire

## *Introduction*

Diabetes mellitus (DM) is a significant risk factor for periodontitis, with periodontal disease (PD) ranking as the fifth most complication (1-4). While most of the evidence focuses on the impact of type 2 diabetes mellitus (T2DM), characterized by insulin insensitivity, it is important to note that a similar effect, although less extensively studied, is observed in type 1 diabetes mellitus (T1DM), which results from insulin insufficiency (5). PD is observed to occur twice as frequently in individuals with DM compared to

those without the condition. Furthermore, poor glycaemic control is associated with a substantially faster and more severe destruction of periodontal alveolar bone, with individuals in this category facing an 11-fold higher risk (6).

The relationship between these two conditions is bidirectional and well-supported by research (7-12). Additionally, it is worth noting that periodontitis can have a negative impact on glycaemic control, while severe periodontitis is considered a risk factor that can compromise the management of diabetes (10).

Diabetes Mellitus (DM) exerts a significant impact on the periodontium, with hyperglycemia playing a pivotal role in the development of associated complications. Elevated glucose levels within microvascular target cells, especially capillary endothelial cells in the periodontal tissues, trigger the generation of reactive oxygen species (ROS) within mitochondria (13). These biochemical events activate four prominent pathogenic pathways: the polyol pathway, the advanced glycation end-products (AGEs) and their corresponding receptor (RAGE) pathway, the protein kinase C (PKC) pathway, and the hexosamine pathway (13).

Together, these pathways contribute to the establishment of a pro-inflammatory environment within susceptible areas of the periodontium. This inflammatory state is further exacerbated by compromised immune responses, making individuals with diabetes more susceptible to periodontal diseases. Additionally, diabetes induces the thickening of the vascular basement membrane, which impairs the migration of leukocytes, reduces collagen synthesis, and alters the behaviour of polymorphonuclear leukocytes (PMN) (14). As a result of these alterations, there is continuous production of matrix metalloproteinases (MMPs) and reactive oxygen species (ROS), further intensifying the degradation of the periodontal tissues.

In the context of the impact of Periodontal Disease (PD) on Diabetes Mellitus (DM), it is important to recognise that the pathogenic bacteria associated with PD can spread through two routes: indirectly, within immune cells that have engulfed them, or directly into the bloodstream (15, 16). This dissemination of pathogenic bacteria, especially *Porphyromonas gingivalis*, can have detrimental effects on insulin sensitivity through various pathogenic mechanisms. Moreover, it can disrupt the balance of the gut microbiota, ultimately leading to a compromised host immune system and insulin resistance (15).

Furthermore, it is crucial to acknowledge that the destruction of local oral epithelial tissue by PD pathogens can stimulate the release of local inflammatory mediators from the periodontal pocket into the systemic circulation. This process can promote the recruitment of immune cells to distant sites within the body, potentially intensifying systemic inflammation and leading to insulin resistance (15).

Monitoring PD in the population typically involves expensive resources and resource-intensive clinical examinations. Consequently, the ability to oversee the disease on a population scale is limited, especially among high-risk groups such as those with T1DM (17). One cost-effective method for screening periodontal disease is the use of self-reported PD through Guided Questionnaire (GQ). This approach allows for estimating the prevalence of periodontitis at local, state, and national levels, where clinical examinations may not be feasible (18). GQ is also a valuable tool for healthcare professionals to conduct large-scale, cost-effective screenings for patients at high risk of periodontitis and its associated systemic conditions (17). Moreover, employing a validated and reliable GQ could assist paediatric endocrinologists in identifying PD in patients with T1DM who undergo regular quarterly diabetes check-ups. When a positive screening result using the GQ suggests the presence of PD, it can prompt timely referrals to oral health specialists (12, 19).

In the year 2003, the Centre for Disease Control and Prevention (CDC), in collaboration with the American Academy of Periodontology (AAP), recommended the use of a validated Self-Reported Questionnaire (SRQ) to estimate the prevalence of PD and establish screening criteria for the population in the United States of America (USA) (17). The CDC's validated SRQ comprises eight questions and can be administered to individuals at risk of PD. The responses to these questions may indicate the presence of PD in the patient, prompting the need for a dental referral for immediate evaluation and appropriate intervention by qualified personnel.

Sophia et al. (20) proposed the use of clinical symptoms and signs of PD in conjunction with the SRQ to assess PD among patients with DM. Additionally, Han et al. (21) contributed to this field by validating a Malay-translated Self-Reported Questionnaire (SRQ-M) among patients in Kuantan, Malaysia. In this context, a positive screening was defined when three or more items indicated the likelihood of PD (21). Subsequently, the SRQ-M underwent further modifications and became the Malay-modified Self-Reported Questionnaire (SRQ-MM), which exhibited improved reliability (22). Upon concluding the study, the author confirmed that the SRQ-MM serves as a dependable screening tool for detecting PD in patients with DM. Furthermore, the SRQ-MM demonstrated satisfactory sensitivity in identifying individuals at risk for periodontal disease (22).

However, to the best of the author's knowledge, this research represents the inaugural study conducted in Malaysia, specifically focusing on the pediatric population affected by T1DM. Furthermore, it is pioneering in its approach as it involves interviews with children and their parents within a paediatric endocrine clinic setting. As a result, the primary objectives of this study aimed to assess the validity and reliability of adapted GQ within the selected Malaysian population of T1DM patients and their parents.

The use of this instrument serves the important purpose of increasing awareness among both patients and parents regarding the heightened susceptibility to periodontal

disease in individuals with T1DM. It underscores the bidirectional impact of this relationship, highlighting the significance of early detection and management of PD in this population.

## *Materials and Method*

This research constituted a cross-sectional study conducted as part of a clinical doctorate study. This pilot study involved several stages, including adaptation and content validation by experts in the relevant field, as well as face validation among dental patients who were in good health. Subsequently, field testing was carried out to assess reliability, which included an analysis of internal consistency using Cronbach's alpha.

For participants under the age of 16, a structured interview was administered to the parent(s) or caregiver(s). In the case of individuals aged 16 and older, the structured interview was directly conducted with the participants themselves.

### *Study design and participants*

This cross-sectional study was conducted from November 2021 to March 2022, focusing on individuals diagnosed with T1DM and their parents. Ethical approval was obtained from the ethical committees of Universiti Teknologi MARA (UiTM) (REC/07/2020(MR/169) and University of Malaya (UM) (DF RD2018/0110 (L). The study population for the pilot study consisted of:

1) Adaptation of SRQMM from Han (22) : three experts in different fields and one language expert

2) Content validation of adapted questionnaire (GQ): experts in paediatric dental, periodontology and paediatric endocrinology

3) Face validation : fit and healthy dental patient under the age of 18, attending the dental clinic UiTM, Sungai Buloh

4) Relialibility test : T1DM patients under the age of 18, identified from the Paediatric Endocrine Centre at the University Malaya Medical Centre (UMMC) and UiTM. Parents of these patients were contacted verbally and provided with information about the research.

Comprehensive information sheets accompanied by informative pamphlets were provided and discussed with both the participants and their guardians. Data collection began with obtaining written informed consent from the parents or guardians, along with obtaining assent from the children and adolescents themselves who were participating in the study. Subsequently, structured interviews were conducted with the patients at their respective healthcare centres.

In the reliability test, inclusion criteria encompassed all children and adolescents with T1DM, who were below 18 years of age, and proficient in either English and/or Bahasa Melayu for effective communication. Exclusion criteria were defined to exclude individuals undergoing active orthodontic treatment, those who had taken antibiotics within the last three months, individuals using medications known to potentially affect periodontal health (e.g., drugs associated with gingival alterations such as calcium channel blockers like nifedipine and amlodipine, anticonvulsant drugs like phenytoin and sodium valproate, and immunosuppressants like cyclosporin and tacrolimus), and those who declined to participate in the study.

### ***Study instrument:*** *SRQs-MM*

The SRQs-MM assessed three key domains:

1. **PD Status:** This domain focused on the self-perceived PD status of participants. It consisted of 14 items, including eight items related to patients' baseline characteristics (A2.1- A2.8) and six items on symptoms of PD (A2.9.1-A2.9.6 ). All questionnaires in this domain were designed to have dichotomous answers (Yes/No), except for item A2.2, which had a response (Bad/Fair/Good).

2. **Knowledge**: The second domain assessed participants's knowledge regarding PD. It contained four items with dichotomous response options (Yes/No).

3. **Perception**: The third domain focused on participants's perception of PD status. It included three items measured on a 5-point Likert scale, allowing participants to express their level of agreement (strongly agree/agree/neutral/do not agree/strongly do not agree).

Please note that the study instrument, SRQs-MM, was designed to collect data in these three distinct domains to comprehensively assess the participants' understanding and perception of PD.

### *Adaptation*

The questionnaire items underwent a thorough adaptation process involving the input of three experts from different fields and a language expert. These experts assessed and refined the items to ensure they aligned with the intended construct, provided clear instructions, and addressed linguistic aspects to make them suitable for the targeted participants.

### *Content validation*

Five experts participated in the content validation process. This panel of experts included three professionals with expertise in dentistry, with one specialising in periodontology and the other two in paediatric dentistry. Additionally, two paediatric endocrinologists were part of this expert panel. Their collective review focused on the original 21 items, assessing their relevance to the intended construct for specific assessment purposes within the local context.

To gauge the content's validity, the experts employed the Item-level Content Validity Index (I-CVI) as a measuring tool. The I0-CVI was calculated by dividing the number of experts who rated each item as either 3 ('relevant') or 4 ('highly relevant') by the total number of experts who participated in the rating process. Items that resulted in an I-CVI of 0.78 or lower were identified for potential revision or removal from the questionnaire (23).

### *Face validation*

For face validation of the adapted questionnaire, participants who met the inclusion criteria, including those under 18 years old, attending the dental clinic, and providing consent, were selected. It is important to note that the questionnaire was administered as a guided interview. During this process, participants were asked to provide feedback on several aspects, including the time taken to complete the questionnaire, the syntax, the grammar, clarity of the questions' meaning, relevance, appropriateness of the questions, and the layout, presentation, and organization of the questionnaire. The results obtained were then subjected to discussion among experts, leading to subsequent adjustments and refinements. These adjustments primarily focused on minor corrections and fine-tuning to enhance the questionnaire's overall quality and user-friendliness.

### *Reliability test*

In the reliability test, a total of twenty T1DM (n = 20) who were under 18 years old, along with their parent(s) or caregiver(s), were invited to participate in the pilot study from two different healthcare centres. Based on the results and recommendations from this sample, the suitability and precision of the questionnaires were evaluated. The findings were then examined in collaboration with the expert panel to ensure the questionnaires provided accurate and reliable estimates for the intended purposes.

### *Statistical analysis*

The descriptive and analytical statistics of the collected data were conducted using the IBM Statistical Package for the Social Sciences (IBM SPSS, Chicago, IL) Version 20.0. The descriptive data analysis uses a frequency table that includes categorical and nominal variables, such as number of participant, gender, race and all diabetic parameters. Cronbach's Alpha is often implemented as a reliability test, and the 0.6–0.7 range indicates an acceptable level of reliability (24).

## *Results*

Table 1 provides an overview of the participant numbers in each phase of face validation and reliability testing. The sociodemographic characteristics of T1DM patients in the reliability test are presented in Table 2. Among the participants, males outnumbered females, and children under 16 constituted the majority. Most T1DM patients were newly diagnosed (less than 5 years) and had uncontrolled diabetes. Additionally, a higher proportion had a healthy body mass index.

**Table 1:** The number of patients categorized by age in each phase

| Phase | Below 16 years old (n) | 16 years old and above (n) |
|---|---|---|
| Face Validation round one | 7 | 3 |
| Face validation round two | 8 | 2 |
| Reliability test | 15 | 5 |

**Table 2:** Sociodemographic characteristics of patients with Type 1 Diabetes (T1DM) in a reliability test

| Variables | n | (%) |
|---|---|---|
| **Sex** | | |
| Male | 14 | (70) |
| Female | 6 | (30) |
| **Age** | | |
| <16 years | 15 | (75) |
| 16-17 years | 5 | (5) |
| **Race** | | |
| Malay | 8 | (40) |
| Chinese | 4 | (20) |
| Indian | 8 | (40) |
| Duration of diabetes | | |
| <5 years | 10 | (50) |
| 5-10 years | 7 | (35) |
| >10 years | 3 | (15) |
| HbA1c (39) | | |
| Controlled | 3 | (8.0) |
| Uncontrolled | 17 | (92.0) |
| BMI (40) | | |
| Underweight | 1 | (5) |
| Healthy weight | 12 | (60) |
| Overweight | 6 | (30) |
| Obesity | 1 | (5) |

BMI = Body Mass Index
HbA1c = Hemoglobin A1c

Table 3 presents the original SRQ-MM by Han (22). The adaptation of the questionnaire into both languages is shown in Table 4. This adaptation involved changing certain terms to layman terms, such as replacing "PD" with "gum disease", and "DM" with "high blood sugar" (25, 26). Item A2.2 simplified into answers from the previous three options. The structure of item no. A2.9.2, "gums are swollen," was modified to "swelling gum" to align it to the previous question, "bleeding when brushings."

**Table 3**: The SRQMM originally by Han, 2018

| | | |
|---|---|---|
| Participants'' perception on PD screening using self-reported questionnaires at medical clinic.<br>Data collection method & Timing: Face to face interview after answering Q –A2 (PD screening using SRQ)<br><br>Soal selidik yang diisikan Sendiri untuk Penilaian Penyakit Gusi Kaedah kutipan & masa: Data akan dipungut setelah mengambil Q-A 1 oleh Tadbir sendiri kaedah(Sila bulatkan pilihan jawapan anda) | | |
| A2.1 | Do you think you have gum disease?<br>Adakah anda rasa anda menghidap penyakit gusi? | 1.Yes 2. No<br>1. Ya 2. Tidak |
| A2.2 | Overall, how would you rate the health of your teeth and gums?<br>Secara keseluruhan, bagaimana anda menilai kesihatan gigi dan gusi anda | 1.Good 2. Fair 3. Bad<br>1.Baik 2. Sederhana 3. Tidak baik |
| A2.3 | Have you ever had treatment for gum disease, such as Scaling and Root Planing (SRP), sometimes called "deep cleaning"?<br>Pernahkah anda mendapat rawatan untuk penyakit gusi, seperti cuci karang gigi dan perancangan akar, kadang-kadang dikenali sebagai "pembersihan gigi dalam"? | 1.Yes 2. No<br>1. Ya 2. Tidak |
| A2.4 | Have you ever had teeth become loose on their own without injury?<br>Pernahkah gigi anda menjadi longgar sendiri tanpa sebarang kecederaan? | 1.Yes 2. No<br>1. Ya 2. Tidak |
| A2.5 | Have you ever been told by a dental professional that you have gum disease?<br>Adakah anda pernah diberitahu oleh doktor gigi yang anda menghidap penyakit gusi? | 1.Yes 2. No<br>1. Ya 2. Tidak |
| A2.6 | During the past 3 months, have you noticed that "your gum" doesn't look good?<br>Sepanjang tempoh 3 bulan yang lepas, adakah anda menyedari gusi anda tidak sihat? | 1.Yes 2. No<br>1.Ya 2. Tidak |
| A2.7 | Did you use "dental floss" or "other devices" to clean between your teeth in the last 7 days?<br>Adakah anda menggunakan "floss" gigi atau "alat yang lain" untuk membersih celah gigi anda dalam tempoh 7 hari yang lepas? | 1.Yes 2. No<br>If Yes,<br>How many times?<br>___ times per day<br>1. Ya 2. Tidak<br>Jika Ya, berapa kali.<br>..... x sehari |

**Table 3**: The SRQMM originally by Han, 2018 (continued)

| | | |
|---|---|---|
| A2.8 | Did you use mouthwash or other dental rinses for treating "dental problems" in the last 7 days?<br>Adakah anda menggunakan "floss" gigi atau "alat yang lain" untuk membersih celah gigi anda dalam tempoh 7 hari yang lepas? | 1. Yes 2. No<br>If Yes,<br>How many times?<br>____ times per day |
| | Do you have the following symptoms*<br>Adakah anda mempunyai gejala seperti berikut | |
| A2.9.1 | Bleeding when brushing, flossing, or eating food<br>Pendarahan ketika memberus gigi, menggunakan flos atau semasa makan | 1.Yes 2. No<br>1. Ya 2. Tidak |
| A2.9.2 | Gums are swollen, red, or painful for no apparent reason<br>Gusi bengkak, merah atau sakit tanpa sebab | 1.Yes 2. No<br>1. Ya 2. Tidak |
| A2.9.3 | Teeth look longer, and the smile appear more "toothy"<br>Gigi kelihatan lebih panjang dan senyuman yang kelihatan lebih "toothy" | 1.Yes 2. No<br>1.Ya 2. Tidak |
| A2.9.4 | Bad breath/halitosis/a foul odour mouth<br>Nafas berbau/mulut berbau/ mulut bau busuk | 1.Yes 2. No<br>1.Ya 2. Tidak |
| A2.9.5 | Loosening or shifting of the teeth in the affected area<br>Gigi longgar atau teranjak dalam kawasan yang terjejas | 1. Yes 2. No<br>1. Ya 2. Tidak |
| A2.9.6 | Pus oozing from between the teeth<br>Nanah meleleh di antara gigi | 1.Yes 2. No<br>1.Ya 2. Tidak |
| Participants'' perception on PD screening using self-reported questionnaires at medical clinic<br>Data collection method & Timing: Face to face interview after answering Q –A2 (PD screening using SRQ)<br><br>Persepsi Peserta mengenai pemeriksaan PD menggunakan soal selidik yang dijawab sendiri di klinik perubatan<br>Kaedah pengumpulan data & masa: ditadbir sendiri selepas menjawab Q – A2<br>(PD saringan menggunakan SRQ) | | |
| A3.1 | Do you know that DM is related to Periodontal disease?<br>(Please Circle one answer )<br><br>Adakah anda tahu bahawa DM berkait dengan penyakit gusi?<br>(Sila bulatkan satu jawapan) | 1.Yes 2. No<br>1.Ya 2. Tidak |

**Table 3**: The SRQMM originally by Han, 2018 (continued)

| | | |
|---|---|---|
| A3.2 | Do you know that periodontal disease screening can be done using self-reported questionnaires (Before this survey)? (Please Circle one answer )<br><br>Adakah anda tahu bahawa saringan penyakit gusi boleh dilakukan dengan menggunakan soal selidik yang dijawab sendiri? (Sebelum Kajian ini)<br>(Sila bulatkan satu jawapan) | 1.Yes 2. No<br>1.Ya 2. Tidak |
| A3.3 | Did you do dental check-up within last 1 (ONE) year? (Please Circle one answer)<br><br>Adakah anda melakukan pemeriksaan gigi dalam tempoh 1 tahun yang lalu? (Sila bulatkan satu jawapan) | 1.Yes 2. No<br>1.Ya 2. Tidak |
| A3.4 | Have you ever done Periodontal Disease screening using self-reported questionnaires at medical clinics (Before this survey)? (Please Circle one answer<br>Adakah anda pernah melakukan pemeriksaan bagi penyakit gusi dengan menggunakan soal selidik (yang dijawab sendiri) di klinik perubatan? Sebelum Kajian ini)(Sila bulatkan satu jawapan) | 1.Yes 2. No<br>1.Ya 2. Tidak |
| A3.5 | Do you agree to do Periodontal Diseases screening using self-reported questionnaires at medical clinics?<br>(Please Circle one answer)<br><br>Adakah anda bersetuju untuk melakukan saringan Penyakit gusi menggunakan borang soal selidik yang dijawab sendiri di klinik perubatan?<br>(Sila bulatkan satu jawapan) | 1.Strongly disagreed<br>1. Sangat tidak bersetuju<br><br>2. Disagreed<br>2. Tidak bersetuju<br><br>3. No comment<br>3. Tiada komen<br><br>4. Agreed<br>4 Setuju<br>5. Strongly agreed<br>5. Sangat bersetuju |
| A3.6 | Do you agree that Periodontal Disease effects on glycemic control of DM patients?<br>(Please Circle one answer)<br>Adakah anda bersetuju bahawa Penyakit gusi memberi kesan terhadap kawalan gula pesakit DM?<br>(Sila bulatkan satu jawapan) | 1.Strongly disagreed<br>1. Sangat tidak bersetuju<br><br>2. Disagreed<br>2. Tidak bersetuju<br><br>3. No comment<br>3. Tiada komen<br><br>4. Agreed<br>4 Setuju<br>5. Strongly agreed<br>5. Sangat bersetuju |

**Table 3**: The SRQMM originally by Han, 2018 (continued)

| | | |
|---|---|---|
| A3.7 | Do you agree that you will get benefit from screening Periodontal Diseases for your general health especially diabetes<br>(Please Circle one answer)<br>Adakah anda bersetuju bahawa anda akan mendapat manfaat dari saringan penyakit Periodontal bagi Kesihatan umum anda terutama penyakit kencing manis<br>(Sila bulatkan satu jawapan) | 1.Strongly disagreed<br>1. Sangat tidak bersetuju<br><br>2. Disagreed<br>2. Tidak bersetuju<br><br>3. No comment<br>3. Tiada komen<br><br>4. Agreed<br>4 Setuju<br>5. Strongly agreed<br>5. Sangat bersetuju |

**Table 4**: The adapted English and Malay version

| **English** | |
|---|---|
| **SRQMM** | **GQ** |
| Gum Disease Assessment | |
| Self-reported questionnaire for periodontal assessment | Questionnaires for gum disease assessment |
| Data will be collected after taking Q-A1 through the self-administered method | Data will be collected after taking QA1 through a face-to-face meeting and structured interview with the participant/parents |
| Options for answers in A2.2: Good, fair, bad | Bad or good |
| A2.9.2:<br>Gums are swollen, red, or painful for no apparent reason | Swelling, red, or painful gums for no apparent reason |
| Knowledge | |
| "Participants' perception on PD screening using self-reported questionnaires at the Medical Clinic" | "Participant knowledge and perceptions on gum disease screening at the Paediatric Clinic" |
| Data collection method and Timing: Face-to-face interview after answering QA2 (PD screening using SRQ) | Timing and collection method: Data will be collected after taking QA2 in a face-to-face meeting and structured interview with participants/parents |
| A3.1:<br>Do you know that DM is related to Periodontal disease? | Do you know that high blood sugar is related to gum disease? |
| A3.2:<br>Do you know that periodontal disease screening can be done using self-reported questionnaires? | Do you know that gum disease screening can be done using self-reported questionnaires? |

**Table 4**: The adapted English and Malay version (continued)

| | |
|---|---|
| A3.4:<br>Have you ever done periodontal disease screening using self-reported questionnaires at Medical Clinics? | Have you ever done gum disease screening using self-reported questionnaires at Paediatric Clinics? |
| Perception | |
| A3.5:<br>Do you agree to do periodontal diseases screening using self-reported questionnaires at Medical Clinics | Do you agree to undergo gum disease screening using self-reported questionnaires at Paediatric Clinics |
| A3.6:<br>Do you agree to do periodontal disease screening using self-reported questionnaires at Medical Clinics? | Do you agree that gum disease affects the glycaemic control of patients with diabetes mellitus? |
| A3.7:<br>Do you agree that you will benefit from screening periodontal diseases for your general health, especially diabetes? | Do you agree that you will benefit from gum disease screening for your general health, especially high blood sugar? |
| Malay Version | |
| SRQMM | GQ |
| Gum Disease Assessment | |
| Soal selidik yang diisikan sendiri untuk penilaian penyakit gusi | Soal selidik untuk penilaian penyakit gusi |
| Diisikan sendiri kaedah tadbir sendiri | Temu bual secara bersemuka dan berstruktur dengan pesakit/ibubapa |
| A2.3:<br>Pernahkan anda mendapatkan rawatan untuk penyakit gusi, seperti cuci karang gigi dan perancangan akar, atau dikenali sebagai 'pembersihan gigi dalam'? | Pernahkan anda mendapatkan rawatan untuk penyakit gusi, seperti cuci karang gigi dan pengetaman akar, atau dikenali sebagai 'pembersihan gigi dalam'? |
| A2.9.1:<br>Pendarahan ketika memberus gigi, menggunakan flos, atau semasa makan | Pendarahan ketika pemberusan gigi, penggunaan flos, atau semasa makan? |
| A2.9.2:<br>Gusi bengkak, merah, atau sakit tanpa sebab | Bengkak gusi, kemerahan pada gusi, atau sakit gusi tanpa sebab |
| A2.9.5:<br>Gigi longgar atau teranjak dalam kawasan terjejas | Kelonggaran gigi atau teranjak dalam kawasan terjejas |
| A2.9.6:<br>Nanah meleleh di antara gigi | Lelehan nanah di antara gigi |

**Table 4**: The adapted English and Malay version (continued)

| Knowledge | |
|---|---|
| Persepsi peserta mengenai pemeriksaan PD menggunakan soal selidik yang dijawab sendiri di Klinik Perubatan) | Pengetahuan dan persepsi peserta mengenai pemeriksaan penyakit gusi di Klinik Kanak-Kanak |
| Kaedah pengumpulan data dan masa: ditadbir sendiri selepas menjawab Q – A2 (PD saringan menggunakan SRQ | Kaedah pengumpulan data dan masa: temu bual secara bersemuka dan berstruktur dengan pesakit/ibubapa selepas menjawab QA2 |
| A3.1:<br>Adakah anda tahu bahawa DM berkait dengan penyakit gusi? | Adakah anda tahu bahawa kandungan gula yang tinggi dalam darah berkait dengan penyakit gusi? |
| A3.4:<br>Klinik Perubatan | Klinik Kanak-Kanak |
| Perception | |
| A3.5:<br>Adakah anda bersetuju untuk melakukan saringan penyakit gusi menggunakan borang soal selidik yang dijawab sendiri di Klinik Perubatan? | Adakah anda bersetuju untuk menjalani saringan penyakit gusi menggunakan borang soal selidik yang dijawab sendiri di Klinik Kanak-Kanak? |
| A3.6:<br>Adakah anda bersetuju bahawa penyakit gusi memberi kesan terhadap kawalan gula pesakit DM? | Adakah anda bersetuju bahawa penyakit gusi memberi kesan terhadap kawalan gula pesakit DM? |
| A3.7:<br>Adakah anda bersetuju bahawa anda akan mendapat manfaat dari saringan penyakit periodontal bagi kesihatan umum anda, terutama penyakit kencing manis? | Adakah anda bersetuju bahawa anda akan mendapat manfaat dari saringan penyakit gusi bagi kesihatan umum anda, terutama jika gula tinggi dalam darah? |

In the Malay language version, the phrase "memberus gigi" was changed to "pemberusan gigi" in items A2.9.1 to correct the grammatical corrections based on *Dewan Bahasa dan Pustaka (DPB)* 4th edition (27, 28). "Gigi longgar" in Item A2.9.5, was altered to "Kelonggaran gigi," which is more commonly used (29). "Nanah meleleh di antara gigi" in A2.9.6, was amended to "Lelehan nanah di antara gigi," refering to "cairan" (28). Item A2.9.2 was change from "Gusi bengkak" to "Bengkak gusi as the latter was used more frequent (30). "Perancangan akar" in item A2.3 was modified to "Pengetaman akar" based on "ringkasan Bahasa mudah" in Cochrane review (31). Several other suitable word replacements were made, such as changing "pesakit DM" to "pesakit kencing manis" and "periodontal" to "gusi," along with refining the description of the DM condition "(gula) adalah tinggi di dalam darah" (32-34). Similar changes applied in A3.1, A3.6, and A3.7.

The I-CVI from five experts indicated a high level of relevance, with a score of 0.98, as shown in Table 5. The overall I-CVIs ranged from 0.80 to 1.0. Face validation yielded satisfactory results after the questionnaire underwent another round of revision (Table 6). Face validation was measured subjectively. Consequently, item A2.3, " scaling and root planing, sometimes called "deep cleaning"? " was changed to the more common term "scaling on the upper or lower gum", and it received more positive feedback (35).

**Table 5:** Item in GQ: Content validity using I-CVI

| Heading | Items in GQ | I-CVI |
|---|---|---|
| Gum disease assessment (Self-perception) | A 2.1<br>Adakah anda rasa anda menghidap penyakit gusi?<br>Do you think you have gum disease? | 1.00 |
| | A 2.2<br>Secara keseluruhan, bagaimana anda menilai kesihatan gigi dan gusi anda?<br>Overall, how do you rate your teeth and gum health? | 1.00 |
| | A 2.3<br>Pernahkan anda mendapat rawatan untuk penyakit gusi, seperti cuci karang gigi dan pengetaman akar, atau dikenali sebagai 'pembersihan gigi dalam'?<br>Have you ever had gum treatment for gum disease, such as scaling and root planing, sometimes called "deep cleaning"? | 1.00 |
| | A 2.4<br>Pernahkah anda mengalami kelonggaran gigi tanpa sebarang kecederaan?<br>Have you ever had loose teeth without injury? | 1.00 |
| | A 2.5<br>Adakah anda pernah diberitahu doktor gigi bahawa anda menghidap penyakit gusi?<br>Have you ever been told by a dental professional that you have gum disease? | 1.00 |
| | A 2.6<br>Sepanjang tempoh 3 bulan yang lepas, adakah anda menyedari gusi anda tidak sihat?<br>During the past 3 months, have you ever noticed that your gum doesn't look good? | 1.00 |
| | A 2.7<br>Adakah anda menggunakan 'floss gigi' atau 'alat yang lain' untuk pembersihan gigi anda dalam tempoh 7 hari yang lepas?<br>Did you use dental floss or 'other devices' for tooth cleaning in the last 7 days? | 1.00 |
| | A 2.8<br>Adakah anda menggunakan ubat kumur atau lain-lain produk untuk rawatan masalah gigi dan gusi dalam tempoh 7 hari yang lepas?<br>Did you use mouthwash or other dental rinses for 'dental problems' treatment in the last 7 days? | 1.00 |
| Self-perception based on symptoms | A 2.9.1<br>Pendarahan ketika pemberusan gigi, penggunaan flos, atau semasa makan?<br>Bleeding when brushing, flossing, or eating food? | 1.00 |
| | A 2.9.2<br>Bengkak gusi, kemerahan pada gusi, atau sakit gusi tanpa sebab?<br>Swelling, red, or painful gums for no apparent reason? | 1.00 |
| | A 2.9.3<br>Gigi kelihatan lebih panjang dan senyuman yang kelihatan lebih 'toothy'<br>Teeth look longer, and the smile appears more 'toothy' | 0.80 |
| | A 2.9.4<br>Nafas berbau/mulut berbau/ mulut bau busuk<br>Bad breath/halitosis/a foul mouth odour | 1.00 |
| | A 2.9.5<br>Kelonggaran gigi atau teranjak dalam kawasan yang terjejas<br>Loosening or shifting of teeth in the affected area | 1.00 |
| | A 2.9.6<br>Lelehan nanah di antara gigi<br>Pus oozing between the teeth | 0.80 |
| Knowledge | A 3.1<br>Adakah anda tahu bahawa kandungan gula yang tinggi dalam darah berkait dengan penyakit gusi?<br>(Sila bulatkan satu jawapan)<br>Do you know high blood sugar is related to gum disease? (Please circle one answer) | 1.00 |

**Table 5:** Item in GQ: Content validity using I-CVI (continued)

| Heading | Items in GQ | I-CVI |
|---|---|---|
| | A 3.2<br>Adakah anda tahu bahawa saringan penyakit gusi boleh dilakukan dengan menggunakan soal selidik yang dijawab sendiri? (Sebelum kajian ini)?<br>(Sila bulatkan satu jawapan)<br>Do you know that gum disease screening can be done using self-reported questionnaires? (Before this survey)? (Please circle one answer) | 1.00 |
| | A 3.3<br>Adakah anda melakukan pemeriksaan gigi dalam tempoh 1 tahun yang lalu?<br>(Sila bulatkan satu jawapan)<br>Did you do a dental check-up within a year ago? (Please circle one answer) | 1.00 |
| | A 3.4<br>Adakah anda pernah melakukan pemeriksaan bagi penyakit gusi menggunakan soal selidik (yang dijawab sendiri) di Klinik Kanak-Kanak?<br>(Sila bulatkan satu jawapan)<br>Have you ever done gum disease screening using self-reported questionnaires at Paediatric Clinics?<br>(Please circle one answer) | 1.00 |
| Perception | A 3.5<br>Adakah anda bersetuju untuk menjalani saringan penyakit gusi menggunakan borang soal selidik yang dijawab sendiri di Klinik Kanak-Kanak?<br>(Sila bulatkan satu jawapan)<br>Do you agree to undergo gum disease screening using self-reported questionnaires at Paediatric Clinics?<br>(Please circle one answer) | 1.00 |
| | A 3.6<br>Adakah anda setuju bahawa penyakit gusi memberi kesan terhadap kawalan gula pesakit kencing manis?<br>(Sila bulatkan satu jawapan)<br>Do you agree that gum disease affects the glycaemic control of patients with diabetes mellitus?<br>(Please circle one answer) | 1.00 |
| | A 3.7<br>Adakah anda bersetuju bahawa anda akan mendapat manfaat dari saringan penyakit gusi bagi kesihatan umum anda, terutama jika gula tinggi dalam darah?<br>(Sila bulatkan satu jawapan)<br>Do you agree that you will benefit from gum disease screening for your general health, especially high blood sugar? (Please circle one answer) | 1.00 |

I-CVI = Item-Level Content Validity Index, Averaging method (I-CVI/ave) = 0.98; the average proportion of items judged relevant across the five experts: 0.98

**Table 6:** The revision made in face validation.

| **Face Validation round 1** |
|---|
| **English** |
| Have you ever had treatment for gum disease, such as scaling and root planing, sometimes called 'deep cleaning'? |
| **Malay** |
| Pernahkah anda mendapat rawatan untuk penyakit gusi, seperti cuci karang gigi dan perancangan akar, kadang-kadang dikenali sebagai 'pembersihan gigi dalam'? |
| **Face validation round 2** |
| **English** |
| Have you ever had gum treatment for gum disease, such as scaling on the upper or lower gum? |
| **Malay** |
| Pernahkan anda mendapat rawatan untuk penyakit gusi, seperti cuci karang gigi sama ada gusi atas atau gusi bawah? |

In the reliability test, Cronbach's alpha (α) values were calculated for 21 items and were found to be acceptable, approximately 0.777, 0.644, 0.780 in the PD assessment domain, knowledge domain and perception domain, respectively (Table 7). Two items, A2.3 (CITC = -0.050) and A2.9.3 (-0.05), showed negative corrected item total correlations (CITC).

## *Discussion*

In this study, the previous mode of the self-administered questionnaire was altered to face-to-face interviews to better suit the study population. Face-to-face interviews are associated with higher response rates, significantly reduce the required time for data collection, enable more effective communication for precise questioning and information gathering, and result in virtually no instances of missing data (36).

**Table 7:** Reliability analysis

| Domain | Item | Mean | (SD) | CITC | Cronbach's alpha (α) |
|---|---|---|---|---|---|
| PD assessment | A2.1 | 0.20 | (0.41) | 0.766 | 0.777 |
| | A2.2 | 0.20 | (0.41) | 0.312 | |
| | A2.3 | 0.05 | (0.22) | -0.050 | |
| | A2.4 | 0.05 | (0.22) | 0.532 | |
| | A2.5 | 0.05 | (0.22) | 0.532 | |
| | A2.6 | 0.10 | (0.31) | 0.448 | |
| | A2.7 | 0.05 | (0.22) | 0.061 | |
| | A2.8 | 0.10 | (0.31) | 0.016 | |
| | A2.9.1 | 1.35 | (0.49) | 0.660 | |
| | A2.9.2 | 1.15 | (0.37) | 0.687 | |
| | A2.9.3 | 1.05 | (0.22) | -0.050 | |
| | A2.9.4 | 1.10 | (0.31) | 0.737 | |
| | A2.9.5 | 1.05 | (0.22) | 0.532 | |
| | A2.9.6 | 1.15 | (0.32) | 0.575 | |
| Knowledge | A3.1 | 0.35 | (0.49) | 0.288 | 0.644 |
| | A3.2 | 0.15 | (0.37) | 0.560 | |
| | A3.3 | 0.20 | (0.41) | 0.435 | |
| | A3.4 | 0.05 | (0.22) | 0.586 | |
| Perception | A3.5 | 3.80 | (0.70) | 0.778 | 0.780 |
| | A3.6 | 3.50 | (0.89) | 0.468 | |
| | A3.7 | 3.80 | (0.77) | 0.656 | |

Note:

SD = Standard deviation
CITC = Corrected item-total correlation
Acceptable value = 0.6–0.7, Very good ≥ 8 (24)

In the adaptation process, efforts were made to replace the jargon words with more layman-friendly terms. For instance, "periodontal disease" was changed to "gum disease", and restructuring was done to make questions easier to understand and align with previous questions. For example, "swelling gum" was used instead of "gums are swollen". Additionally, standardisation was implemented to provide simple dichotomous answers in all self-perceived periodontal disease questions. This not only allows for straightforward cross-analysis but also reduces bias in response selection if a moderate option is maintained in A2.2. Misinterpretations were also addressed, such as changing "root planning" to "root planing" in A2.3, as these two terms sound similar but carry different meanings.

In the Malay language version, similar adjustments were made to use layman terms, such as changing "periodontal" to "gusi", and the structure of words was modified to be more pleasing to the ear. For example "memberus gigi" was changed to "pemberusan gigi".

The average I-CVI for this study was 0.98, which is considered good. None of the items for these three domains had an I-CVI of 0.78 or lower, which would have indicated a need for revision (23). Following the face validation, more common terms were used. For example, "supragingival", which refers to above the gum line, indicates treatment of superficial scaling, while "deep scaling" is confined to subgingival, meaning below the gum line (37, 38). Regarding reliability, a range of 0.6–0.7 presents an acceptable reliability level. A value of 0.8 or greater signifies a very good level, and there is no need to adjust the measuring tools when the value exceeds 0.7 (24). However, as previous studies recorded high sensitivity (98.8%) and accuracy (71%), these items were retained (22).

Surveillance of periodontal disease (PD) in the general population often involves resource-intensive and costly clinically-based periodontal examinations. Alternatively, the use of Guided Questionnaires (GQ) can be considered. Several studies have reported moderate to high accuracy and effectiveness in using GQ compared to clinical examinations (2, 18). This suggests that GQ have the potential to be a valuable tool for raising awareness, facilitating early detection, and predicting the onset of the disease. Furthermore, establishing a connection between periodontitis and diabetes mellitus (DM) is crucial for the management of both conditions. Consequently, a validated and reliable GQ could serve as a key tool in initiating early referrals from non-dental healthcare settings. This, in turn, would significantly contribute to the prevention and early treatment of periodontal disease.

In our study, we faced certain challenges. Firstly, due to the limited number of available T1DM patients for the study, we conducted face validation in a group of healthy and physically fit children. This substitution was necessitated by the scarcity of T1DM participants. Secondly, another challenge we encountered pertained to potential inaccuracies is historical data. These inaccuracies could introduce recall bias into our study since historical data relies on individuals' memories and their ability to recall past events accurately.

## *Conclusion*

The GQ demonstrates both acceptable reliability and excellent validity, establishing it as a suitable screening tool for Malaysian T1DM patients and their parents. This tool can be effectively administered by non-dental healthcare professionals. Furthermore, it serves as a valuable resource in situations where conducting a comprehensive oral examination is not feasible. An additional advantage lies in its potential to raise awareness about the mutual relationship between T1DM and the risk of periodontal disease among T1DM patients. This underscores the significance of oral health with this patient population.

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## Competing interest

The authors declare that they have no competing interests.

## Ethical clearance

Ethical approval for the current study was granted by the UiTM Research Ethics Committee (REC), dated 29th July 2020, REC/07/2020, 29th June 2020, REC/07/2020 (MR/169), and the Medical Ethics Committee, Faculty of Dentistry, UM dated 29th June 2020 DF RD2018/0110 (L).

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## References

1. Löe H. Periodontal disease. The sixth complication of diabetes mellitus. Diabetes Care. 1993; 16(1):329-34.
2. Abidin ZZ, Noor E, Zaini AA, Azizi NZ, Soelar SA, Mohamad Shahrizad M, et al. Type 1 Diabetes Mellitus (T1DM) patients' self-perception of periodontal diseases. Preprint at https://www.researchgate.net/publication/364599252_Type_1_Diabetes_Mellitus_T1DM_patients'_self-perception_of_periodontal_diseases (2022). Accessed 10 May 2022.
3. Nordin NN, Vaithilingam RD, Saub R, Nasir NH, Mohd Asari AS, Bashah B, et al. Awareness, knowledge, attitudes and practices on the management of diabetes mellitus patients with periodontitis amongst Malaysian primary care practitioners. Malays Fam Physician. 2021; 16(3):44-55.
4. Nazir G, Amin J. Diabetes mellitus and periodontal diseases: A two way relationship. Int. J. Dent. 2021; 6(2):43-56.
5. Albandar JM, Susin C, Hughes FJ. Manifestations of systemic diseases and conditions that affect the periodontal attachment apparatus: Case definitions and diagnostic considerations. J Periodontol. 2018; 89 Suppl 1:S183-s203.
6. Liao D-M, Chen C. Oral Health of Diabetic Patients. Int. J. Integr. Med. Res. 2023; 10(01):17-21.
7. Siddiqi A, Zafar S. The Two-Way Link Between Diabetes Mellitus and Periodontal Disease: Medical-Healthcare Professionals' Clinical Practice. Biomed. J. Sci. Tech. Res. 2022; 44:32793.
8. Grossi SG, Genco RJ. Periodontal disease and diabetes mellitus: a two-way relationship. Ann Periodontol. 1998; 3(1):51-61.
9. Mealey BL. Periodontal disease and diabetes. A two-way street. J Am Dent Assoc. 2006; 137 Suppl:26s-31s.
10. Preshaw PM, Alba AL, Herrera D, Jepsen S, Konstantinidis A, Makrilakis K, et al. Periodontitis and diabetes: a two-way relationship. Diabetologia. 2012; 55(1):21-31.
11. Taylor GW. Bidirectional interrelationships between diabetes and periodontal diseases: an epidemiologic perspective. Ann Periodontol. 2001; 6(1):99-112.
12. Casanova L, Hughes FJ, Preshaw PM. Diabetes and periodontal disease: a two-way relationship. Br Dent J. 2014; 217(8):433-7.
13. Verhulst MJL, Loos BG, Gerdes VEA, Teeuw WJ. Evaluating All Potential Oral Complications of Diabetes Mellitus. Front Endocrinol (Lausanne). 2019; 10:56.
14. Potra Cicalau GI, Babeș P, Domocoș D, Pogan M. The assessment of two-way relationship between periodontal diseases and diabetes mellitus. Acta Stomatologica Marisiensis Journal. 2021; 4(1): 1-7
15. Barutta F, Bellini S, Durazzo M, Gruden G. Novel Insight into the Mechanisms of the Bidirectional Relationship between Diabetes and Periodontitis. Biomedicines. 2022; 10(1):178.
16. Paul O, Arora P, Mayer M, Chatterjee S. Inflammation in Periodontal Disease: Possible Link to Vascular Disease. Front Physiol. 2020; 11:609614.
17. Eke PI, Genco RJ. CDC Periodontal Disease Surveillance Project: background, objectives, and progress report. J Periodontol. 2007; 78(7 Suppl):1366-1371.
18. Montero E, La Rosa M, Montanya E, Calle-Pascual AL, Genco RJ, Sanz M, et al. Validation of self-reported measures of periodontitis in a Spanish Population. J Periodontal Res. 2020; 55(3):400-9.
19. Fisher E, Lazar L, Shalitin S, Yackobovitch-Gavan M, de Vries L, Oron T, et al. Association between Glycemic Control and Clinic Attendance in Emerging Adults with Type 1 Diabetes: A Tertiary Center Experience. J. Diabetes Res. 2018; 2018:9572817.
20. Sophia C, William CH, George LK, Robert JG. Periodontal disease- its impact on diabetes and glycemic control. 2010. Available at: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://aadi.joslin.org/en/Education%20Materials/99.PeriodontalDisease-ItsImpactOnDiabetesAndGlycemicControl-EN.pdf. Accessed 10 May 2022
21. Han TM, Ismail R, Yaacob M, Md Aris MA, Osman IF, Thuraiappah M, et al. Validation of self-reported questionnaries to screen periodontal disease among diabetes patients: a study at selected health centers in Kuantan. Malays. Fam. Physician. 2016; 11:9.
22. Han TM. Effectiveness of medical-dental coordinated care for diabetes patients with periodontal disease at selected public primary care clinic in Kuantan, Pahang. (Doctoral Dissertation). 2018.
23. Polit D, Beck C, Owen S. Is the CVI an acceptable indicator of content validity? Appraisal and recommendations. Res. Nurs. Health. 2007; 30:459-67.
24. Ursachi G, Zait A, Horodnic I. How Reliable are Measurement Scales? External Factors with Indirect

Influence on Reliability Estimators. Procedia Econ. Financ. 2015; 20:679-86.
25. What is gum disease? J. Am. Dent. Assoc. 2011; 142(1):111.
26. Common terms. American Diabetes Association. 2022. Available from: https://diabetes.org/resources/students/common-terms. Accessed 2 Oct 2022.
27. (n.d.) M-W. Toothbrushing. In Merriam-Webster.com dictionary. 2022. Available at: https://www.merriam-webster.com/dictionary/toothbrushing. Accessed 2 Oct 2022.
28. Kamus dewan: Edisi keempat (4th ed.) [Internet]. Dewan Bahasa dan Pustaka. 2005. Accessed 2 Oct 2022.
29. Nazer.B. Penstabilan Gigi: Ministry of Health Malaysia.2014 [updated 3.7.2014]. Available from: http://www.myhealth.gov.my/penstabilan-gigi/. Accessed 10 May 2022.
30. Staf Mhe. Bengkak Gusi & Gigi – Punca, Tanda & Rawatan. 2022 [updated 29.8.2022]. Available at: https://tips-kesihatan.com/bengkak-gusi-gigi-punca-tanda-rawatan/#. Accessed 10 May 2022.
31. Eberhard J, Jepsen S, Jervøe-Storm PM, Needleman I, Worthington HV. Full-mouth treatment modalities (within 24 hours) for chronic periodontitis in adults. Cochrane Database Syst. Rev. 2015 Apr 17; 2015(4):CD004622.
32. Kurangkan Pengambilan Gula. Oral health division.2019. Available at: https://ohd.moh.gov.my/images/bahan_pendidikan/Kurangkan-Gula.pdf. Accessed 14 Dec 2022
33. Penyakit gusi. Oral Health Division, Malaysia. 2019. Available at: https://ohd.moh.gov.my/images/bahan_pendidikan/tahappenyakitgusi.png. Accessed 14 Dec 2022.
34. Fuziah MZ. Kencing Manis (Diabetes Mellitus). 2012. Available at: http://www.myhealth.gov.my/kencing-manis/. Accessed 23 Dec 2022.
35. Rachel RE. Gum Disease: Symptoms and Treatment Atlanta: WebMD. 2022. Available at: https://www.webmd.com/oral-health/features/gums-problems-gingivitis. Accessed 23 Dec 2022.
36. Kabir SM. Methods of data collection.In : Jahur et al (editors).Basic Guidelines for Research: An Introductory Approach for All Disciplines.Bangladesh: Book Zone Publication; 2016. p.201-75.
37. Costalonga M, Herzberg MC. The oral microbiome and the immunobiology of periodontal disease and caries. Immunol Lett. 2014; 162(2 Pt A):22-38.
38. Gasner NS, RS S. Periodontal Disease. StatPearls. Treasure Island (FL): StatPearls Publishing. 2023. Available at: https://www.ncbi.nlm.nih.gov/books/NBK554590/. Accessed 14 Dec 2022.
39. DiMeglio LA, Acerini CL, Codner E, Craig ME, Hofer SE, Pillay K, et al. ISPAD Clinical Practice Consensus Guidelines 2018: Glycemic control targets and glucose monitoring for children, adolescents, and young adults with diabetes. Pediatr Diabetes. 2018; 19 Suppl 27:105-114.
40. (CDC) Centre for Disease Control and Prevention: Individual Growth Charts. 2017. Available at: http://www.cdc.gov/growthcharts/charts.htm. Accessed 5 May 2022.