Turkish Online Journal of Qualitative Inquiry (TOJQI)
Volume 12, Issue 8 July 2021: 5715 – 5722

Research Article

# Evaluate Risk Markers For Periodontal Disease In Children With Type 1 Diabetes: A Systematic Review And Meta-Analysis

**Seyed Mohammad Monajem Zadeh[1], Marghana Elyaskhil[2*], Amirhossein Fathi[3], Seyedeh Mohadeseh Asadinejad[4]**

[1]General Dentist, Ahvaz, Iran.
[2]DDS, Dentistry Faculty, Kabul University of Medical Science, Kabul, Afghanistan.
[3]Assistant Professor, Department of Dental Prostheses, Dental Materials Research Center, Dental Sciences Research Institute, School of Dentistry, Isfahan University of Medical Sciences, Isfahan, Iran.
[4]Assistant Professor of Periodontology. Department of Periodontics, School of Dentistry. Isfahan University of Medical Sciences, Isfahan, Iran.

***Corresponding Author:** Marghana Elyaskhil, **Email:** marghana.e@gmail.com

**Abstract**

**Background and aim:** It is important to evaluate the characteristics of periodontitis in children with T1D and it should be checked properly so that in the future dentists can screen children with T1D for periodontal risk markers. Therefore the aim of current Systematic Review and Meta-Analysis study was evaluate risk markers for periodontal disease in children with type 1 diabetes.

**Method:** From the electronic databases, PubMed, Scopus, LILACS, Web of Science, EBSCO, LIVIVO, and Embase have been used to perform a systematic literature over the last ten years between 2011 and May 2021. For Data extraction, two reviewers blind and independently extracted data from abstract and full text of studies that included. Mean difference with 95% confidence interval (CI), fixed effect model and Inverse-variance method were calculated. The Meta analysis have been evaluated with the statistical software Stata/MP v.16 (The fastest version of Stata).

**Result:** 201 studies were selected to review the abstracts, the full text of 19 studies was reviewed. Finally, nine studies were selected. Mean difference of plaque index and Gingival index between children with type 1 diabetes and healthy children was (MD, 0.31 95% CI 0.24, 0.39. P=0.00) and (MD, 0.36 95% CI 0.28, 0.43. P=0.00) P =0.00), respectively.

**Conclusion:** The present Systematic Review and Meta-Analysis study showed that children with type 1 diabetes had higher plaque index, gingival index, bleeding on probing, and pocket depth than healthy children.

**Key words:** periodontal disease, children, type 1 diabetes, risk markers

# Evaluate Risk Markers For Periodontal Disease In Children With Type 1 Diabetes: A Systematic Review And Meta-Analysis

## Introduction

Type 1 diabetes is an autoimmune disorder in which the immune system attacks and destroys cells in the pancreas that produce insulin(1). Periodontal disease is common in adults with diabetes, and both conditions are associated with systemic inflammatory states (2). Periodontal disease is caused by dysbiosis of subgingival microbial communities that adversely affects the host immune system(3). Studies showed diabetes increases the risk of periodontal diseases, and biologically plausible mechanisms have been demonstrated in abundance. Less clear is the impact of periodontal diseases on glycemic control of diabetes and the mechanisms through which this occurs. Inflammatory periodontal diseases may increase insulin resistance in a way similar to obesity, thereby aggravating glycemic control(4). Almost more studies have been performed on the adult population with type 2 diabetes(5). Diabetes control is usually determined by an increase in glycated hemoglobin (HbA1c), a known risk factor for periodontitis(6). Studies have shown that the progression of periodontitis in people with diabetes is rapid and increasing(7). The risk markers for periodontal tissue inflammation include plaque, gingivitis and associated bleeding on probing (BOP), while periodontitis is clinically measured by pocket depth and clinical attachment loss(8). BOP is an indicator of tissue inflammatory response to bacterial pathogens(9). The plaque index (PI) used to measure the amount of plaque on the gingival margin, which is a risk factor for gingivitis(10). Gingival index used to determine the amount of gingivitis with gingival edema, erythema, bleeding, allergies(11). In a healthy mouth, the pocket depth is usually between 1 and 3 millimeters (mm). Pockets deeper than 4 mm may indicate periodontitis. Pockets deeper than 5 mm cannot be cleaned well. Take dental X-rays to check for bone loss in areas where your dentist observes deeper pocket depths(12). Children usually present with gingivitis and may be diagnosed in the early stages of periodontitis(13). There are few studies that have established a link between type 1 diabetes (T1D) in children and periodontal disease. It is important to evaluate the characteristics of periodontitis in children with T1D and it should be checked properly so that in the future dentists can screen children with T1D for periodontal risk markers. Therefore the aim of current Systematic Review and Meta-Analysis study was evaluate risk markers for periodontal disease in children with type 1 diabetes.

## Methods

### *Search strategy*

From the electronic databases, PubMed, Scopus, LILACS, Web of Science, EBSCO, LIVIVO, and Embase have been used to perform a systematic literature over the last ten years between 2011 and May 2021. The reason for choosing studies in the last ten years is to be able to provide sufficient evidence in this area and use newer studies. Therefore, a software program (Endnote X8) has been utilized for managing the electronic titles.

Searches were performed with mesh terms:

((("Periodontal Diseases"[Mesh] OR "Periodontal Pocket"[Mesh] OR "Periodontal Attachment Loss"[Mesh] OR "Periodontal Prosthesis"[Mesh] OR “Periodontal Index"[Mesh]) AND "Diabetes Mellitus, Type 1"[Mesh]) AND "Dental Plaque Index"[Mesh]) AND (“Child"[Mesh] OR "Adult Children"[Mesh] OR "Dental Care for Children"[Mesh] OR “Only Child"[Mesh] ).

This systematic review has been conducted on the basis of the key consideration of the PRISMA Statement–Perfumed Reporting Items for the Systematic Review and Meta-analysis(14), and PICO strategy (Table1).

### *Selection criteria*

*Inclusion criteria:* cross-sectional studies; Children with T1D compared with healthy group; in English. In vitro studies, case studies, case reports and reviews were excluded from the study.

Table1. PICO strategy

| PECO strategy | Description |
|---|---|
| P | Population: Children with type 1 diabetes |
| I | Intervention: periodontal risk markers |
| C | Comparison: healthy children |
| O | Outcome: PI, GI, BOP, PD and CAL |

***Study selection, Data Extraction and method of analysis***

Joanna Briggs Institute scale (15, 16) used to assessed quality of the case-control studies, with guidelines for assessing the risk of bias of cross-sectional studies.

For Data extraction, two reviewers blind and independently extracted data from abstract and full text of studies that included. Prior to the screening, kappa statistics was carried out in order to verify the agreement level between the reviewers. The kappa values were higher than 0.80.

Mean difference with 95% confidence interval (CI), fixed effect model and Inverse-variance method were calculated. Random effects were used to deal with potential heterogeneity and $I^2$ showed heterogeneity. $I^2$ values above 50% signified moderate-to-high heterogeneity. The Meta analysis have been evaluated with the statistical software Stata/MP v.16 (The fastest version of Stata).

**Results**

According to the purpose of the study, in the initial search with keywords, 248 articles were found. In the first step of selecting studies 201 studies were selected to review the abstracts. Then, studies that did not meet the inclusion criteria were excluded from the study (182 article). In the second step, the full text of 19 studies was reviewed. Finally, nine studies were selected (Figure1).

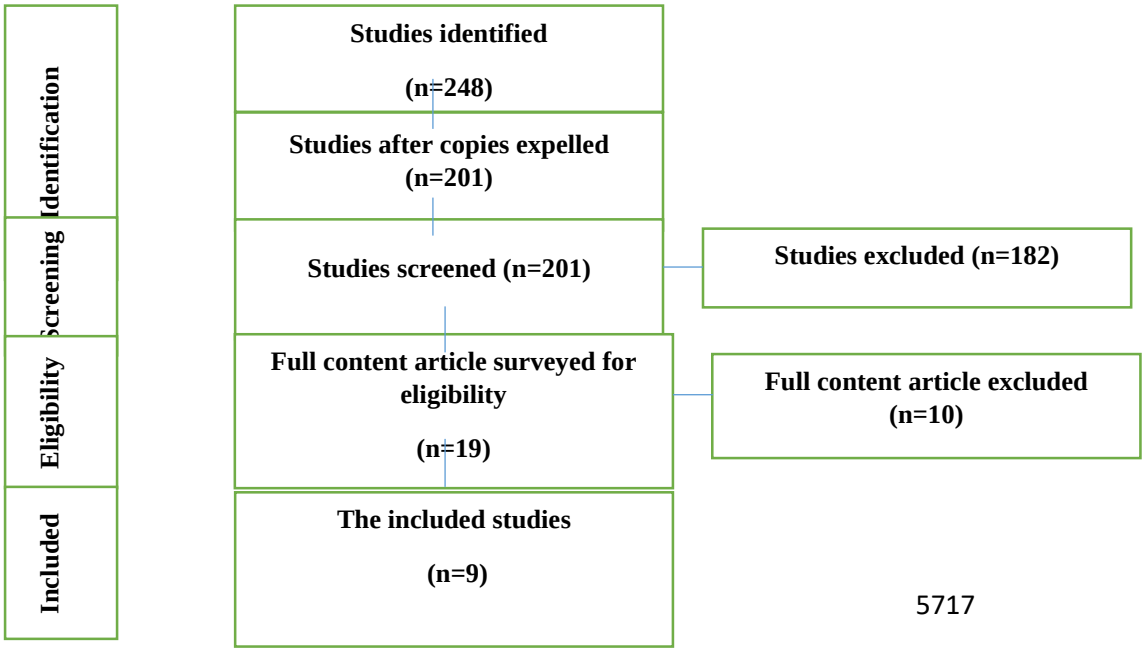

**Figure 1. Study Attrition**

***Characteristics***

Nine studies have been included in present article. The number of children in intervention group and control group was 584 and 385, respectively (Table2). The mean of Plaque index, gingival index, bleeding on probing and Pocket depth reported in table 2.

***Bias assessment***

According to Joanna Briggs Institute scale all studies had high quality or low risk of bias.

**Table2. Studies selected for systematic review and meta-analysis.**

| Study. Years | Sample size | | Plaque index (mean) | | Gingival index (mean) | | Bleeding on probing (mean) | | Pocket depth (mean) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | In-group | Control | In-group | control | In-group | Control | In-group | Control | In-group | Control |
| Coelho et al.,2018 (17) | 36 | 36 | 52.03 | 38.25 | NR | NR | 35.66 | 26.3 | NR | NR |
| Duque et al.,2017 (18) | 24 | 27 | 24.7 | 32 | 17.6 | 19.1 | NR | NR | 1.48 | 1.41 |
| Ismail et al.,2017 (19) | 32 | 32 | 0.76 | 0.46 | 0.58 | 0.62 | 0.2 | .16 | NR | NR |
| Sridharan et al.,2017 (20) | 10 | 10 | 0.72 | 0.56 | 0.69 | 0.35 | NR | NR | 2.64 | 2.41 |
| Singh-Hüsgen et al.,2016 (21) | 200 | 38 | 1.05 | 0.79 | NR | NR | 0.3 | .17 | NR | NR |
| Rafatjou et al.,2016 (22) | 80 | 80 | 21.38 | 46.57 | 0.45 | 0.26 | NR | NR | NR | NR |
| Olczak-Kowalczyk et al.,2015 (23) | 35 | 29 | 1.8 | 0.53 | 0.47 | 0.24 | NR | NR | NR | NR |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Al-Khabbaz et al.,2013 (24) | 95 | 61 | 1.02 | 1.3 | 1.9 | 0.9 | 0.4 | 0.1 | NR | NR |
| Gujjar et al.,2011 (25) | 72 | 72 | 1.35 | 1.11 | 1.79 | 0.58 | NR | NR | NR | NR |

In-group: Intervention group; NR: not reported

***Plaque index (PI)***

Mean difference of PI between children with type 1 diabetes and healthy children was 0.31 (MD, 0.31 95% CI 0.24, 0.39. P=0.00) among nine studies and heterogeneity found ($I^2$=94.51%; P =0.00); there was significant difference between two groups (p<0.01) (Figure2).

***Gingival index (GI)***

Mean difference of GI between children with type 1 diabetes and healthy children was 0.36 (MD, 0.36 95% CI 0.28, 0.43. P=0.00) among seven studies and heterogeneity found ($I^2$=95.39%; P =0.00); there was significant difference between two groups (p<0.01) (Figure3).

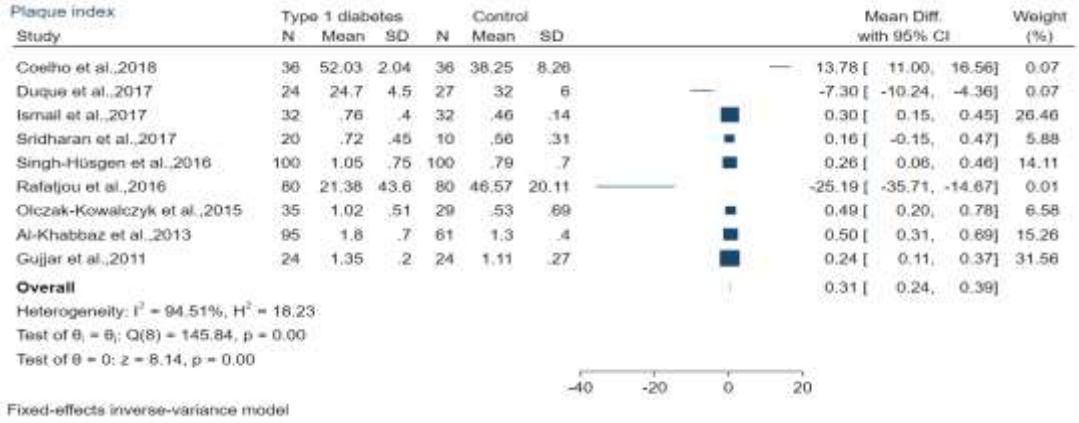


**Figure2. Forest plot showed mean difference of Plaque index between test and control group**

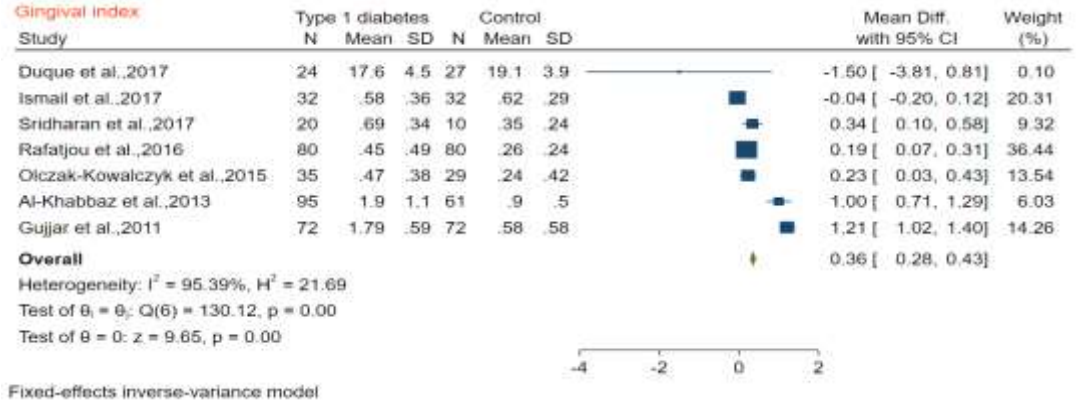


**Figure3. Forest plot showed mean difference of gingival index between test and control group**

***Bleeding on probing (BOP)***

Mean difference of BOP between children with type 1 diabetes and healthy children was 0.15 (MD, 0.15 95% CI 0.10, 0.20; P=0.00) among four studies and heterogeneity found ($I^2$=85.19%; P =0.00); there was significant difference between two groups (p<0.01) (Figure4).

***Pocket depth (PD)***

Mean difference of PD between children with type 1 diabetes and healthy children was 0.2 (MD, 0.2 95% CI 0.10, 0.31; P=0.00) among two studies and heterogeneity found ($I^2$=12.10%; P =0.29); there was significant difference between two groups (p<0.01) (Figure5).

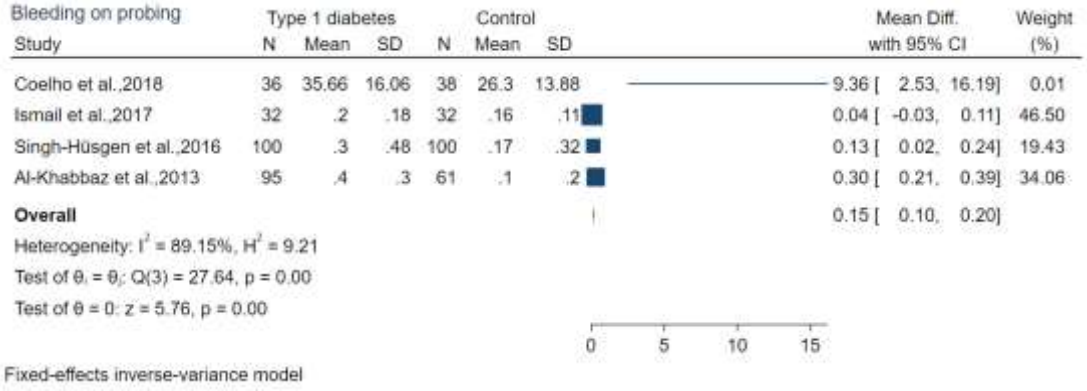


**Figure4. Forest plot showed mean difference of Bleeding on probing between test and control group**

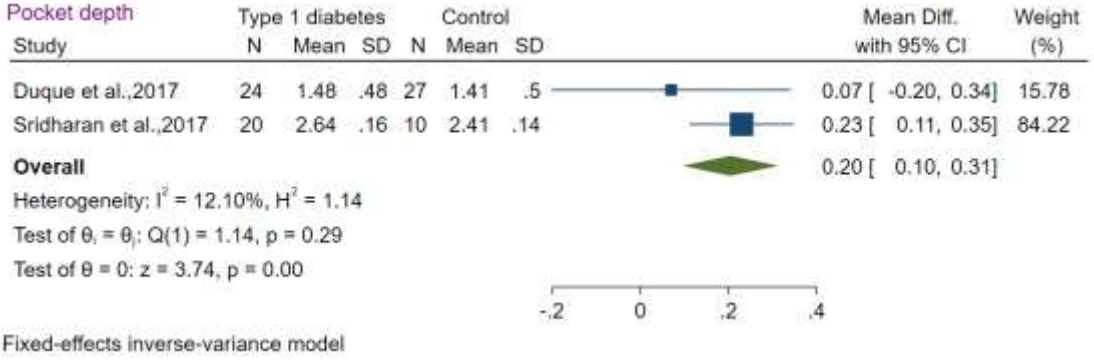


**Figure4. Forest plot showed mean difference of Pocket depth between test and control group**

**Discussion**

The aim of current Systematic Review and Meta-Analysis was evaluate risk markers for periodontal disease in children with type 1 diabetes. Meta-analysis showed the mean of plaque index, gingival index, bleeding on probing, pocket depth was significantly higher in children with type 1 diabetes compared to the healthy group. The heterogeneity between the studies was very high, only in the case of the Pocket depth study the heterogeneity was low, which can be attributed to the fact that only two studies were evaluated; As a result, further studies with similar working methods and results can help to achieve sufficient evidence. The studies that were reviewed in the present study were cross-sectional, it is better to do RCT studies in this field to

provide better results by comparing. Also among the factors that confuse periodontitis in people with diabetes were the duration of the disease, how to control blood sugar levels, salivary interleukin levels and how to observe personal oral hygiene. One study examined the factors associated with periodontitis in children with T1D(24). In the present study, studies from the last ten years have been used, older studies in this field have used the previous IDDM classification. Large-scale longitudinal studies, including prospective cohort studies, are needed to assess the temporal relationship between T1D and periodontitis and to identify potential pathways. In studies, there was a variety of risk markers including periodontal disease as well as participants' characteristics such as age, blood sugar control level and duration of diabetes, which are limitations for the present study.

## Conclusion

The present Systematic Review and Meta-Analysis study showed that children with type 1 diabetes had higher plaque index, gingival index, bleeding on probing, and pocket depth than healthy children. Early diagnosis and intervention by a dentist can prevent irreversible damage to periodontal tissue. Further research into the progression of periodontal disease in children and adolescents with T1D is essential to ensure optimal oral health for this group of people at risk.

## References

1. Roep BO, Thomaidou S, van Tienhoven R, Zaldumbide A. Type 1 diabetes mellitus as a disease of the β-cell (do not blame the immune system?). Nature Reviews Endocrinology. 2021;17(3):150-61.
2. Marchetti E, Monaco A, Procaccini L, Mummolo S, Gatto R, Tetè S, et al. Periodontal disease: the influence of metabolic syndrome. Nutrition & metabolism. 2012;9(1):1-13.
3. Sedghi L, DiMassa V, Harrington A, Lynch SV, Kapila YL. The oral microbiome: Role of key organisms and complex networks in oral health and disease. Periodontology 2000. 2021;87(1):107-31.
4. Mealey BL, Oates TW. Diabetes mellitus and periodontal diseases. Journal of periodontology. 2006;77(8):1289-303.
5. Graves DT, Ding Z, Yang Y. The impact of diabetes on periodontal diseases. Periodontology 2000. 2020;82(1):214-24.
6. Rapone B, Ferrara E, Corsalini M, Converti I, Grassi FR, Santacroce L, et al. The effect of gaseous ozone therapy in conjunction with periodontal treatment on glycated hemoglobin level in subjects with Type 2 diabetes mellitus: An unmasked randomized controlled trial. International journal of environmental research and public health. 2020;17(15):5467.
7. Preshaw PM, Bissett SM. Periodontitis and diabetes. British dental journal. 2019;227(7):577-84.
8. Genco RJ, Borgnakke WS. Diabetes as a potential risk for periodontitis: association studies. Periodontology 2000. 2020;83(1):40-5.
9. Checchi L, Montevecchi M, Checchi V, Zappulla F. The relationship between bleeding on probing and subgingival deposits. An endoscopical evaluation. The Open Dentistry Journal. 2009;3:154.
10. Woźniewicz M, Nowaczyk PM, Kurhańska-Flisykowska A, Wyganowska-Świątkowska M, Lasik-Kurdyś M, Walkowiak J, et al. Consumption of cranberry functional beverage reduces gingival index and plaque index in patients with gingivitis. Nutrition Research. 2018;58:36-45.
11. Thomas V, Uppoor AS, Pralhad S, Naik DG, Kushtagi P. Towards a common etiopathogenesis: Periodontal disease and endometriosis. Journal of human reproductive sciences. 2018;11(3):269.
12. Donos N. The periodontal pocket. Periodontology 2000. 2018;76(1):7-15.

13. Stenberg Jr WV. Periodontal problems in children and adolescents. Pediatric Dentistry: Elsevier; 2019. p. 371-8. e1.
14. Moher D, Liberati A, Tetzlaff J, Altman DG, Altman D, Antes G, et al. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement (Chinese edition). Journal of Chinese Integrative Medicine. 2009;7(9):889-96.
15. Aromataris E, Munn Z. Joanna Briggs Institute reviewer's manual. The Joanna Briggs Institute. 2017;2017(1).
16. Moola S, Munn Z, Tufanaru C, Aromataris E, Sears K, Sfetcu R, et al. Joanna Briggs Institute Reviewer's Manual The Joanna Briggs Institute. Aromataris E MZ, ed Systematic reviews of etiology and risk. 2017.
17. Coelho ASEdC, Carneiro AS, Pereira VF, Paula AP, Macedo AP, Carrilho EVP. Oral health of Portuguese children with type 1 diabetes: a multiparametric evaluation. Journal of Clinical Pediatric Dentistry. 2018;42(3):231-5.
18. Duque C, João MFD, Camargo GAdCG, Teixeira GS, Machado TS, Azevedo RdS, et al. Microbiological, lipid and immunological profiles in children with gingivitis and type 1 diabetes mellitus. Journal of Applied Oral Science. 2017;25:217-26.
19. Ismail AF, McGrath CP, Yiu CK. Oral health status of children with type 1 diabetes: a comparative study. Journal of Pediatric Endocrinology and Metabolism. 2017;30(11):1155-9.
20. Sridharan S, Sravani P, Satyanarayan A, Kiran K, Shetty V. Salivary alkaline phosphatase as a noninvasive marker for periodontal disease in children with uncontrolled type 1 diabetes mellitus. Journal of Clinical Pediatric Dentistry. 2017;41(1):70-4.
21. Singh-Hüsgen P, Meissner T, Bizhang M, Henrich B, Raab WH. Investigation of the oral status and microorganisms in children with phenylketonuria and type 1 diabetes. Clinical oral investigations. 2016;20(4):841-7.
22. Rafatjou R, Razavi Z, Tayebi S, Khalili M, Farhadian M. Dental health status and hygiene in children and adolescents with type 1 diabetes mellitus. Journal of research in health sciences. 2016;16(3):122.
23. Olczak-Kowalczyk D, Pyrżak B, Dąbkowska M, Pańczyk-Tomaszewska M, Miszkurka G, Rogozińska I, et al. Candida spp. and gingivitis in children with nephrotic syndrome or type 1 diabetes. BMC Oral Health. 2015;15(1):1-9.
24. Al-Khabbaz AK, Al-Shammari KF, Hasan A, Abdul-Rasoul M. Periodontal health of children with type 1 diabetes mellitus in Kuwait: a case-control study. Medical Principles and Practice. 2013;22(2):144-9.
25. Gujjar KR, Khadija H, Suleiman MO, Amith H. Gingival health status of 2-to 15-year-old Benghazi children with type-I diabetes mellitus. Journal of Dentistry for Children. 2011;78(2):96-101.