Tikrit Journal for Dental Sciences 12(2) (2024) 418-426
https://doi.org/10.25130/tjds.12.2.17

Tikrit Journal
for
Dental Sciences
https://tjds.tu.edu.iq
ISSN:2073-1213

Plaque Induced Gingivitis in Relation to Body Mass Index among School Children Aged 7-10 Years in Mosul City

Hadeel Abdullah Yaseen [(1) *]
Saher Sami Gasgoos[(2)]

[(1)] Ministry of Health, Salahdin Health Directorate, Tikrit, Iraq
[(2)] Department of Pedodontic, Orthodontic and Preventive Dentistry, College of Dentistry, University of Mosul, Iraq.

Keywords:
Gingivitis, Dental plaque, Body Mass Index, Schoolchildren.

Article Info.:

Article History:
Received: 23/9/2023
Received in revised form: 23/10/2023.
Accepted: 29/10/2023
Final Proofreading: 29/10/2023
Available Online: 1/12/2024

Citation: Yaseen HA, Gasgoos SS. Plaque Induced Gingivitis in Relation to Body Mass Index among School Children Aged 7-10 Years in Mosul City. Tikrit Journal for Dental Sciences 2024; 12(2): 418-426.
https://doi.org/10.25130/tjds.12.2.17

***Corresponding Author:**
Email:
hadeel.21dep31@student.uomosul.edu.iq

B.D.S., Ministry of Health, Salahdin Health Directorate, Tikrit, Iraq

Abstract

Aim and objective: The objective of this study was to examine the correlation between periodontal disorders and body mass index (BMI) in schoolchildren living in Mosul City. **Materials and methods:** The present study employed a cross-sectional design to investigate a sample of schoolchildren aged 7–10 years. The clinical indicators, including the plaque index (PI) and gingival index (GI), were assessed. After accounting for age, gender, height, and weight, the BMI-age percentiles were determined using the BMI Percentile Calculator for Children and Teens. Based on these calculations, children were grouped into underweight, normal weight, overweight, or obese groups, taking into account their age and sex. In the statistical analysis, The Kruskal-Wallis Test was applied to examine differences among categorical variables. **Results**: The mean results for PI (Plaque index) and GI (Gingival index) were shown to be greater in children with obesity. Furthermore, our analysis revealed that the variances between the weight groups for both PI and GI were shown to be statistically significant with a high level of confidence (p=0.000). **Conclusion:** The combination of obesity and oral health issues in children is influenced by shared risk factors, demanding a thorough, mixed strategy involving both medical and dental healthcare professionals.

Introduction:

Periodontal disease involves disease processes that affect the periodontium, which refers to the anatomical structures that provide support to the tooth. These structures include the gingival tissue, alveolar bone, cementum and periodontal ligament (1). The onset of the disease is characterized by the inflammation of the free gingival tissue without any associated clinical attachment loss. This initial stage, commonly referred to as gingivitis, occurs during the early phase of the disease. Gingivitis, distinguished by alterations in the microbial ecology of biofilms (2). Failure to accurately detect and effectively treat the condition may lead to its progression and subsequent impact on the associated periodontal structures. The condition that manifests in this subsequent stage is referred to as periodontitis, resulting in clinical attachment loss characterized by Resorption of alveolar bone and destruction of periodontal ligament. In the case that the disease remains misdiagnosed and untreated, it may finally lead to dental mobility and subsequent tooth loss. However, it is worth mentioning that not all instances of gingivitis will inevitably develop into periodontitis (3,4). According to World Dental Federation 2018, Severe periodontitis ranks as the sixth most widespread disease on a global scale, impacting approximately 11.2% or 743 million individuals (1,5). There are significant variations between the periodontium of the primary dentition and that of the permanent dentition. The clinical appearance of the periodontium in the primary dentition is characterized by a heightened vascularity, resulting in a redder look. The gingival tissues exhibit increased volume, a more rounded shape, and reduced stippling as a result of the presence of diastemata, which facilitate the eruption of teeth. The radiographic assessment reveals that the periodontal ligament space in primary dentition exhibits a little greater width compared to that observed in permanent teeth. periodontal ligament thickness varies between 0.24 mm and 0.15 mm between 11 years and 67 years respectively (6). The connective tissue remains consistent; yet, the junctional epithelium of the primary dentition has greater thickness, whereas the alveolar bone displays reduced calcification. In the pediatric population, the prevalence of gingivitis exceed that of periodontitis (7). Dental biofilm-induced gingivitis is the prevalent manifestation of gingivitis among children. The formation of dental biofilm triggers the host's immune response, leading to inflammation of the gingiva (8). The occurrence of gingivitis, characterized by gingival inflammation, in the absence of a substantial amount of dental biofilm, may suggest its association with systemic illnesses such as diabetes mellitus (9). In instances of severe periodontal illnesses, the enhancement of oral health habits alone is inadequate, necessitating the use of professional dental cleaning for eliminating of dental biofilm (9).

Common periodontal disorders frequently observed in pediatric patients encompass:

1. Gingival diseases
2. Chronic periodontitis
3. Aggressive periodontitis
4. Periodontitis as a manifestation of systemic diseases
5. Necrotizing periodontal diseases
6. Periodontal abscess
7. Endo-perio lesions
8. Developmental or acquired conditions (10).

Aim of the study

- To find if there is a relation between BMI and plaque and gingivitis.

Materials and Methods

The present investigation used a cross-sectional design. A survey related to oral health was undertaken inside the borders

of Mosul city during the academic year of 2022-2023. The trial spanned a period of 6 to 12 months. A random sample of 300 youngsters, aged between 7 and 10 years old, were selected from primary schools located in Mosul city to partake in the survey. The participants were categorized into four distinct categories. The researchers got legal authorization from the educational authority in Mosul City to carry out the survey, as well as obtaining consent from the families of the participating kids. The study eliminated participants who had a documented medical history of systemic disorders that have the potential to impact their growth. Additionally, children with special needs who have mental and physical challenges were also missed from the study. The Body Mass Index (BMI) was computed by utilizing the measurements of body weight and height (expressed in kilograms per square meter) for each individual child. Weight was assessed using a calibrated weight scale, with the individual being barefoot and dressed in lightweight wear. The measurement of height was conducted using a height-measuring ruler that is placed in contact with the child's head while they are in a vertical standing position. The results were graphed on percentile curves specific to age and gender, as provided by the Centers for Disease Control and Prevention in figures 1 and 2. These results were then classified based on the BMI percentiles derived from the CDCP chart (11).

The plaques were assessed using the Plaque Index developed by Löe and Silness in 1964.(12)

The process of tooth selection and scoring.

A set of six teeth, specifically teeth numbered 16, 12, 24, 36, 32, and 44, have been chosen. The gingival edge of each tooth was assessed on four surfaces using a scoring system ranging from "0" to "3. Subsequently, the mean score was computed for each tooth, followed by the individual and group levels.

Scoring criteria:

0: Absence of plaque

1: The presence of a thin layer of plaque that is attached to the exposed gum line and the surrounding region of the tooth and is not visible to the naked eye. However, the identification of plaque may only be achieved through the utilization of a disclosing solution or by using a probe to traverse the surface of the tooth.

2: There is a visible buildup of deposits within the gingival pocket, along the gingival margin, and/or on the adjacent tooth surface, which is visible without the aid of magnification.

3: Excessive deposition of flexible substances within the gingival sulcus and/or on the tooth and gingival margin

The gingival index developed by Löe and Silness in 1963 was further refined by Löe in 1967.(13)

The process of tooth selection and scoring.

The teeth that have been assigned scores are as follows: 16, 12, 24, 36, 32, and 44. The test was conducted with a probe that lacked sharpness. Scoring was conducted on all four surfaces of the tooth in close proximity to the gingival border.

The criteria

0: There is an absence of inflammation.

1: The observed symptoms include mild inflammation, a minor alteration in color, a slight swelling, and no bleeding after a probe.

2: The observed symptoms include moderate inflammation, moderate glazing, redness, and bleeding after probing.

3: The observed symptoms include severe inflammation, characterized by prominent redness and hypertrophy, as well as ulceration and an increased capacity for spontaneous bleeding.

Statistical Analysis

The present study use statistical analysis techniques to examine and interpret the data collected. The data were subjected to analysis using the SPSS program (version 25), which encompassed the following components:

a) Descriptive statistics encompass several measures such as means, standard deviations, and frequencies, which provide a summary of the values observed for the variables under consideration.
b) The Kruskal-Wallis Test is employed to assess the differences in plaque index and gingival index among four distinct groups of children, namely underweight, normal weight, overweight, and obese.
c) The findings were deemed statistically significant at a significance level of $p < 0.05$.

Results

The sample consists of 52 children classified as underweight, 97 children classified as having normal weight, 83 children classified as overweight, and 68 children classified as obese. The whole sample size comprised 162 boys and 138 girls. Distribution of the entire sample according to age, gender and BMI as seen in table (1). The proportion of male students, comprising 54% of the overall population, is higher than that of female students, which accounts for 46% of the whole population. The findings indicate that a significant proportion of the children, specifically 32.33%, were classified as having a normal weight. Additionally, 17.33% of the children were identified as underweight, while 27.66% were categorized as overweight. Furthermore, 22.66% of the children were classified as obese.

The average score and standard deviation for plaque across the underweight, normal weight, overweight and obesity groups, as determined through the use of the Kruskal-Wallis Test. The study observed that the average plaque value was much in the obesity group (0.4591±0.10931) compared to the normal group (0.4148±0.13949), the underweight group (0.3785±0.12705) and the overweight group (0.3230±.09735). This difference between groups was determined to be highly statistically significant (P=0.000) and as seen in table (2). The average score and standard deviation pertaining to gingivitis among the underweight, normal weight, overweight and obesity groups, as determined through the use of the Mann-Whitney Test. The study revealed that the average value of gingivitis was significantly higher in the obesity group (0.3346±0.10725) compared to the overweight group (0.2671±0.111), the normal weight group (0.2484±0.09831) and the underweight group (0.2345±0.08275). The differences between obesity and others groups were found to be highly statistically significant (P=0.000). While The others groups showed no significant differences between them ($P > 0.05$) as seen in table (3).

Discussion

Obesity, malnutrition, dental caries and periodontitis are significant global public health concerns. Previous studies have revealed a relationship between nutritional status and periodontal diseases (4,14). The behavioral habits of these diseases exhibit similarities to etiological circumstances (15). In our study we used guide for United States of America because there is no specific guide for Iraqi children of children in the middle east which might affect the accuracy of the results. The present investigation established a correlation between weight condition and the occurrence of gingivitis. The findings presented here are consistent with a recently published systematic review and meta-analysis which identified obesity as a significant risk factor for gingivitis in the pediatric and adolescent population (4). This finding reverses the results of other studies (16,17) that reported a lack of significant correlation between body weight and periodontal health. The observed disparities in the outcomes may

be attributed to variations in the methods employed for evaluating gingival health and the age distribution of the children included in the study. The results of this study align with a recent investigation conducted in the Arabian region (18), which determined that children who are fat have a higher susceptibility to gingival illnesses compared to children who have normal weight or are underweight. According to Ferreira *et al*. (19), it has been observed that oral bacteria have the potential to enhance hunger subsequent to weight gain, modify tissue insulin resistance by elevating proinflammatory cytokine levels, and diminish adiponectin levels, so interfering with its regulatory function in maintaining periodontal health.

Conclusion

This study is the first attempt to examine the correlation between body mass index (BMI) and oral health within the population of schoolchildren living in Mosul City, and it found that obese children exhibited higher mean scores in both PI and GI measurements. The oral health of children may be influenced by their dietary patterns and body mass index (BMI). The findings of our study offer significant

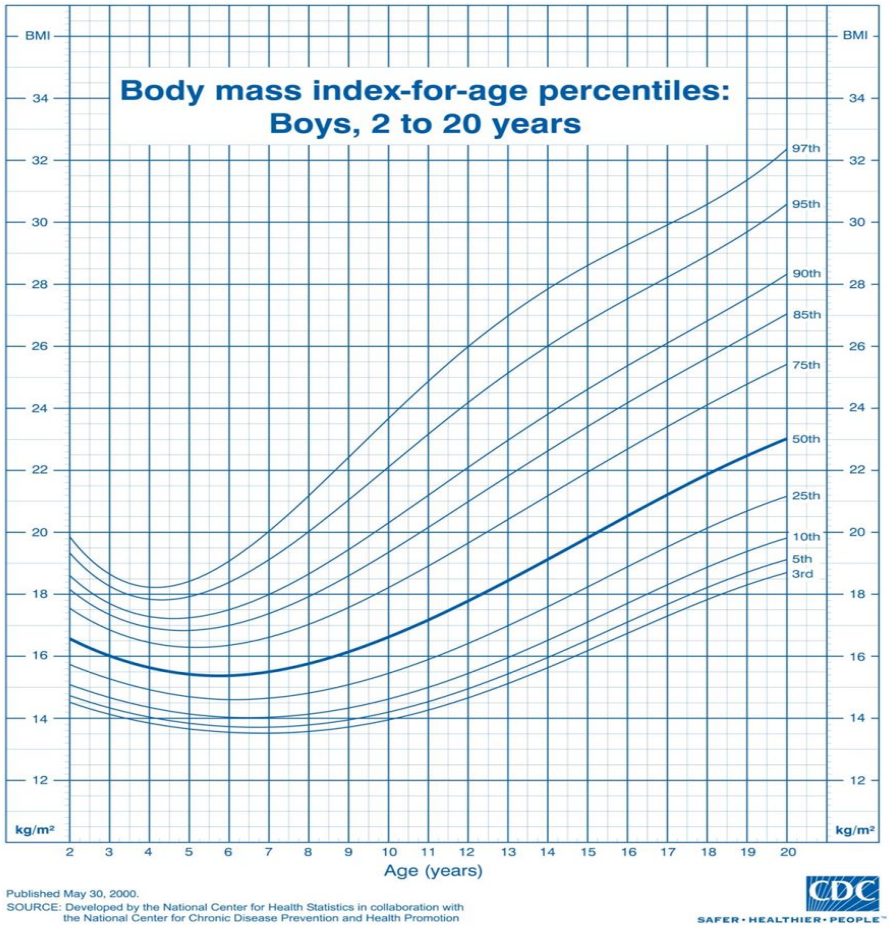

Figure 1: percentile curves specific to age and gender provided by the Centers for Disease Control and Prevention for boys.

Figure 2: percentile curves specific to age and gender provided by the Centers for Disease Control and Prevention for girls.

Table 1: presents the demographical distribution of the study sample.

Age	gender	Examined Children		Underweight		Normal Weight		Overweight		Obesity	
		No.	%	No.	%	No.	%	No.	%	No.	%
7 years	Boys	45	15	10	19.2	11	11.3	6	7.2	18	26.5
	Girls	28	9.33	6	11.5	7	7.2	5	6	10	14.7
	Total	73	24.33	16	5.33	18	6	11	3.66	28	9.33
8 years	Boys	36	12	6	11.5	8	8.2	16	19.3	6	8.8
	Girls	41	13.66	11	21.2	8	8.2	12	14.5	10	14.7
	Total	77	25.66	17	5.66	16	5.33	28	9.33	16	5.33
9 years	Boys	41	13.66	3	5.8	21	21.6	7	8.4	10	14.7
	Girls	41	13.66	4	7.7	10	10.3	22	26.5	5	7.4
	Total	82	27.33	7	2.33	31	10.33	29	9.66	15	5
10 years	Boys	40	13.33	8	15.4	22	22.7	5	6	5	7.4
	Girls	28	9.33	4	7.7	10	10.3	10	12	4	5.9
	Total	68	22.66	12	4	32	10.66	15	5	9	3
Total	Boys	162	54	27	9	62	20.66	34	11.33	39	13
	Girls	138	46	25	8.33	35	11.66	49	16.33	29	9.66
	Total	300	100	52	17.33	97	32.33	83	27.66	68	22.66

Table 2: presents a comparative analysis of the average plaque values among the four groups.

Plaque					
Group	No.	Mean ±Std. Deviation	Kruskal Wallis Test		*P*- value
			Mean Rank	Chi-Square	
Under	52	0.3785±0.12705	146.97	44.155	0.000
Normal	97	0.4148±0.13949	171.58		
Over	83	0.3230±.09735	110.74		
Obesity	68	0.4591±0.10931	202.73		

Table 3 : presents a comparative analysis of the average gingivitis values among the four groups.

Gingivitis					
Group	No.	Mean ±Std. Deviation	Mann-Whitney Test		*P*- value
			Mean Rank	Test value	
Normal	97	0.2484±0.09831	63.82	1438.000	0.000
Obesity	68	0.3346±0.10725	110.35		
Normal	97	0.2484±0.09831	84.43	3436.500	0.072
Over	83	0.2671±0.111	97.60		
Normal	97	0.2484±0.09831	73.77	2402.500	0.607
Under	52	0.2345±0.08275	77.30		
Obesity	68	0.3346±0.10725	92.16	1723.000	0.000
Over	83	0.2671±0.111	62.76		
Obesity	68	0.3346±0.10725	72.83	929.500	0.000
Under	52	0.2345±0.08275	44.38		
Over	83	0.2671±0.111	70.57	1944.500	0.307
Under	52	0.2345±0.08275	63.89		

References

1. Gasner NS, Schure RS. Periodontal Disease. StatPearls [Internet]. 2022 Jan.
2. Suresh S, Mahendra J. Multifactorial relationship of obesity and periodontal disease. Journal of Clinical and Diagnostic Research: JCDR. 2014 Apr 15;8(4):ZE01-3.
3. Chapple IL, Bouchard P, Cagetti MG, Campus G, Carra MC, Cocco F, Nibali L, Hujoel P, Laine ML, Lingstrom P, Manton DJ. Interaction of lifestyle, behaviour or systemic diseases with dental caries and periodontal diseases: consensus report of group 2 of the joint EFP/ORCA workshop on the boundaries between caries and periodontal diseases. Journal of Clinical Periodontology. 2017;44(S18):S39-51.
4. Martens L, De Smet S, Yusof MY, Rajasekharan S. Association between overweight/obesity and periodontal disease in children and adolescents: a systematic review and meta-analysis. European Archives of Paediatric Dentistry. 2017 Feb 25;18(2):69-82.
5. Tonetti MS, Jepsen S, Jin L, Otomo-Corgel J. Impact of the global burden of periodontal diseases on health, nutrition and wellbeing of mankind: A call for global action. Journal of clinical periodontology. 2017 May;44(5):456-62.
6. Vikram NR, Kumar KS, Nagachandran KS, Hashir YM. Apical stress distribution on maxillary central incisor during various orthodontic tooth movements by varying cemental and two different periodontal ligament thicknesses: a FEM study. Indian journal of dental research. 2012 Mar 1;23(2):213.
7. Sjödin B, Haubek D. Periodontal conditions. Pediatric Dentistry: A Clinical Approach, 3rd ed.; Wiley-Blackwell: Hoboken, NJ, USA. 2017 Jan 4:174-92.
8. Oh TJ, Eber R, Wang HL. Periodontal diseases in the child and adolescent. Journal of clinical periodontology. 2002 May;29(5):400-10.
9. Madiba TK, Bhayat A. Periodontal disease-risk factors and treatment options. South African Dental Journal. 2018 Oct;73(9):571-5.
10. Peeran SW, Ramalingam K. Essentials of periodontics & oral implantology. Saranraj JPS Publication. 2021.
11. Centers for Disease Control and Prevention (CDC. Vital signs: obesity among low-income, preschool-aged children--United States, 2008-2011. MMWR. Morbidity and mortality weekly report. 2013 Aug 9;62(31):629-34.
12. Silness J, Löe H. Periodontal disease in pregnancy II. Correlation between oral hygiene and periodontal condition. Acta odontologica scandinavica. 1964 Jan 1;22(1):121-35.
13. Löe H. The gingival index, the plaque index and the retention index systems. The Journal of Periodontology. 1967 Nov;38(6):610-6.
14. Nascimento GG, Leite FR, Do LG, Peres KG, Correa MB, Demarco FF, Peres MA. Is weight gain associated with the incidence of periodontitis? A systematic review and meta-analysis. Journal of clinical periodontology. 2015 Jun;42(6):495-505.
15. Cinar AB, Murtomaa H. Interrelation between obesity, oral health and life-style factors among Turkish school children. Clinical oral investigations. 2011 Apr;15:177-84.
16. Majeed AM, Al Dahan ZA. Oral health status in relation to nutritional status among institutionalized and non-institutionalized orphans in Baghdad city. Journal of Baghdad College of Dentistry. 2017 Dec 15;29(4):102-9.
17. Jafar ZJ, Aldafaai RR, Radhi NJ. Oral Health Status in Relation to Anthropometric Measurements in a Group of Iraqi Children. Journal of Research in Medical and Dental Science. 2022 Jan;10(1):104-9.
18. Thomas JT, Thomas T, Ahmed M, Kannan S K, Abdullah Z, Alghamdi SA, Joseph B. Prevalence of periodontal disease among obese young adult population in Saudi Arabia—a cross-sectional study. Medicina. 2020 Apr 24;56(4):197.
19. Ferreira RD, Correa MG, Magno MB, Almeida AP, Fagundes NC, Rosing CK, Maia LC, Lima RR. Physical activity reduces the prevalence of periodontal disease: Systematic review and meta-analysis. Frontiers in physiology. 2019 Mar 21;10:234.