The Impact of Obesity on Periodontal Health Status in Adolescent Iraqi Students

Sarah Ihsan AL-KARAWI¹, Athraa Ali MAHMOOD¹, Ban Kareem HASSAN¹
¹- Periodontal Department, Dentistry College, Mustansiriya University, Baghdad-Iraq.

ABSTRACT

Objective: The aim of this study was to estimate the effect and association of obesity on the periodontal health status of middle school students. Materials and Methods: This study included 180 secondary school students aged 12-15 years from Baghdad City in the survey. BMI-for-age (body mass index for age) was utilized to detect overweight and obesity. Furthermore, periodontal screening records (PSR) index was performed to evaluate the oral hygiene and periodontal condition of the subjects. Chi-square tests and two-way ANOVA were used for statistical analyses. Results: A highly significant association of BMI-for-age with periodontal health (codes 0, 1, 2, and 3) was observed. The association of gender and periodontal health was highly significant in code 3, significant in codes 0 and 1, and not significant in code 2. Additionally, the ANOVA test revealed that the effects of gender and BMI-for-age on periodontal health were significant. In contrast, the effect of the interaction between gender and BMI-for-age on periodontal health was not significant. Conclusions: In adolescents, bad oral hygiene was correlated with extra body fat indicators. Therefore, oral health preventive schedules should take into consideration the relationship between periodontal condition and overweight/obesity in teenagers.

KEYWORDS

Obesity; Body mass index; Periodontal disease; Oral health status.

RESUMO

Objetivo: O objetivo deste estudo foi avaliar o efeito e a associação da obesidade no estado de saúde periodontal de estudantes do ensino médio. Materiais e Métodos: Este estudo incluiu 180 alunos do ensino médio com idades entre 12-15 anos da cidade de Bagdá. O IMC (Índice de massa corporal) foi utilizado para detectar sobrepeso e obesidade. Além disso, o índice de registro periodontal simplificado (RPS) foi realizado para avaliar a higiene oral e a condição periodontal dos indivíduos. Testes de qui-quadrado e ANOVA de dois fatores foram usados para análises estatísticas. Resultados: Foi observada uma relação altamente significante do IMC com a saúde periodontal (códigos 0, 1, 2 e 3). A relação de gênero e saúde periodontal foi altamente significante no código 3, significante nos códigos 0 e 1 e não significante no código 2. Além disso, o teste ANOVA revelou que a correlação do sexo e do IMC na saúde periodontal foram significantes. Em contraste, o efeito da interação entre gênero e IMC na saúde periodontal foi não significante. Conclusões: Em adolescentes, a má higiene bucal foi correlacionada com indicadores de gordura corporal extra. Portanto, as programações preventivas de saúde bucal devem levar em consideração a relação entre a condição periodontal e o sobrepeso / obesidade em adolescentes.

PALAVRAS-CHAVE

Obesidade; Índice de massa corporal; Doença periodontal; Condição de saúde bucal.
INTRODUCTION

The condition in which body fat is excessively stored and may unfavourably disturb overall health is known as obesity [1]. As the percentages of children and adolescents with high-fat build-up have considerably increased in developing countries, this condition is not limited to only those from advanced nations [2,3].

Obesity, identified by body mass index (BMI), is mutual in various places around the world. It is recognized as a chronic disease, which has multiple aetiologies: hereditary, ecological, socioeconomic, and behavioural influences together appear to be significantly involved [4,5]. Obesity complements mild inflammatory conditions and is estimated to be a predisposing factor for several chronic diseases, such as cardiovascular disease, diabetes, and possibly periodontal disease [6,7].

Similar to the mature populace, obesity in children is universally widespread; additionally, prevalence data demonstrate a growing trend worldwide [4,5]. However, this medical condition in adolescents is still incompletely understood due to the absence of equivalent demonstrative documents from diverse countries, as well as fluctuating measures for describing obesity [4].

Periodontal diseases commonly comprise many infectious and inflammatory conditions caused by the interaction between the host inflammatory response and supra- and subgingival biofilm growth along the tooth surfaces among children, as well as adolescents [8,9]. Periodontal diseases should be considered systemic conditions, meaning that they are both modulated by the body's systems and play a role as a risk factor for systemic disturbance [9]. Smoking, nutritional habits, diabetes mellitus, and psychological stress are risk factors that are commonly encountered, among others, for both periodontal disease and obesity [9].

Epidemiological studies indicate that gingivitis of varying severity is nearly a universal finding in children and adolescents [10]. One study performed in Greece showed a prevalence of gingivitis in adolescents of 73% in boys and 72% in girls [11]. The prevalence of periodontitis in adolescents was reported in surveys to be as high as 24% in the USA [12] and 7% in Australia [13].

The precise mechanism underlying the progression of periodontal disease has not been confirmed until recently; in addition, diverse reasons, such as amplified production of pro-inflammatory cytokines, have been theorized to participate in periodontal pathophysiology [14].

In the literature, there have been few comprehensive studies concerning periodontal diseases' association with obesity in young individuals. One of the chief communal health apprehensions is obesity in adolescents, and due to its universal spread and severe outcomes, it can be defined as a pandemic [15].

In 1977, an association between obesity and periodontal diseases was initially stated due to the establishment of periodontium fluctuations in overweight rats [16]. Obesity could be directly connected with periodontitis in humans, as indicated by cross-sectional studies [17,18].

A systematic review by Khan et al., 2018 showed evidence to suggest that obesity is associated with periodontitis in both adolescents and young adults [19]. Another systematic review by Martens et al. in 2017 stated that “The available evidence suggests a significantly positive association between periodontal disease and obesity in children” [20].

The interface of obesity and periodontal conditions was postulated in medical records, for instance, variations in host defence modifications, compromised glucose tolerance, and increased reaction to psychological stress with the production of pro-inflammatory cytokines [21].
In preceding years, periodontal disease and obesity have been thoroughly investigated in adults. However, studies exploring this rapport in children and teenagers are limited. Currently, the relationship between oral condition and obesity is not closely established in children and adolescents compared to adults based on the body of systematic knowledge generated from previous studies [22].

Given this gap in knowledge, this study aimed to evaluate and understand the association and effect of overweight/obesity as defined by BMI-for-age on periodontal health as measured by the periodontal screening records (PSR) index among Iraqi school adolescent students of both genders.

**MATERIAL AND METHODS**

In 2018 at the Centre of Baghdad, Iraq, this cross-sectional research was conducted and included (n = 180) and excluded (n = 60) adolescents (12-15) years old from both genders, grade 1-2 of high school education from public schools that were arbitrarily assigned.

Written consent was obtained from the students' parents for agreement and publishing data, and approval for their use was acquired from the local ethical research committee (protocol 1014. 27-Jun-2018).

This study was intended as a comparative observational analysis of oral and periodontal conditions in overweight and obese adolescents compared to average-weight subjects. The investigational group constituted overweight and obese individuals, while the control group was comprised of healthy average weight individuals.

Students with chromosomal diseases or major medical situations or who were taking medications that produce gingival enlargement were excluded. Moreover, data was collected from all subjects, including sex, age, and smoking habits. Participants were restricted to non-smokers because smoking is intensely interconnected with both systemic health and periodontal disease equally [23].

Students were interviewed at their schools, and structured questionnaires were used to collect information. Both clinical and oral examinations were recorded.

Based on BMI-for-age, the groups were designated by values that depended on BMI for each age and gender, describing overweight adolescents and utilizing obesity confines [24].

**Auxological Records:**

The auxological information gathered by a sole detective included the following:

- Age
- Weight (kg) of the student dressed
- Height (m) of the student recorded using a measuring tape

Calculation of BMI was indicative of total body adiposity. BMI was calculated as follows: \[\text{BMI} = \frac{\text{weight (kg)}}{\text{height (m)}^2}\].

**BMI-for-Age**

BMI-for-age \([(\text{weight in kilograms})/(\text{height in metres})^2]\) percentiles, produced and utilized as a growth and nutrition reference by WHO, relied on gender- and particular age weight-for-height charts of individuals from 5-19 years [24]. Consistent with these tables, ‘healthy’ was recognized as 5% < BMI-for-age < 85%, ‘overweight’ as 85% ≤ BMI-for-age < 95%, and obese as BMI-for-age ≥ 95% [25]. The underweight/undernutrition school students in which BMI-for-age ≤ 5th percentile [26] were omitted from investigation of additional records to relate non-fat and obese. When assessing visits, all information was gathered from individuals, and if they fit the inclusion criteria, they were requested to participate in this study.
Clinical Examinations

Clinical examinations measured students’ periodontal status using the PSR index. Examinations were performed in classes from each school via professionally trained periodontists and under domain circumstances. Subjects sat in a chair with a lengthy backrest, and the inspector was standing anterior to the chair using disposable mirrors, along with WHO periodontal probes. The inspector documented the matching PSR index according to WHO standards. The PSR has five classifications, as shown in Table I [27].

Table I - Periodontal Screening and Recording Index

| Code | Bleeding on Probing (BOP) | Calculus/Defective Margins | Probing Depth (PD) |
|------|--------------------------|---------------------------|-------------------|
| 4    | Whether 3 or 4, defined as PD. However, it may exceed if PD represent false pocket without BOP or calculus | More than 5.5 | |
| 3    | Yes                      | Yes                       | 5.5               |
| 2    | Yes                      | Yes                       | Less than 3.5     |
| 1    | Yes                      | None                      | Less than 3.5     |
| 0    | None                     | None                      | Less than 3.5     |
| x    | Edentulous Sextant       |                           |                   |

The mouth is divided into sextants, and six places on every tooth are examined. However, the worst result observed is recorded for the sextant. The WHO periodontal probe was utilized for periodontal estimation [28]. Incompletely erupted teeth and retained roots were excluded.

Statistical Analysis

Data were analysed using SPSS version 24, and statistical descriptions were performed by frequency and percent. The chi-square test was used to assess the association of BMI-for-age and gender with periodontal health (codes 0, 1, 2 and 3). Incompletely erupted teeth and retained roots were excluded.

RESULTS

Descriptive statistics in Table II show the frequency and percentage of each code and allocation of the sample to different study groups for both genders (male and female) and for all weight classes (healthy, overweight, and obese). The frequency of code 0 was higher in the male group (112) than in the female group (13). Code 1 in the male group was 259 and was 272 in the female group. For code 2, frequencies in the male group and female group were 142 and 206, respectively. In addition, for code 3, the frequency of the male group was 28, and that of the female group was 48. None of the study subjects showed any manifestations for code 4, so code 4 was omitted from the results. The frequency and percentage of each code and allocation of the sample to different study groups, depending on the BMI-for-Age (healthy, overweight, and obese), were for code 0 (healthy 40, overweight 49, and obese 36). Code 1 was healthy (150), overweight (199), and obese (182). For code 2, frequencies were healthy (140), overweight (103), and obese (105). In addition, for code 3, frequencies were healthy 28, overweight 9, and obese 39.

Additionally, the chi-square test in Table II revealed a highly significant association between BMI-for-age and periodontal health (codes 0, 1, 2 and 3) at a p-value = 0.000. The association between gender and periodontal health was highly significant in code 3 (p-value = 0.000), significant in codes 0 and 1 (p-value = 0.032 and 0.031, respectively), and insignificant in code 2 (p-value = 0.520).
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Table II - Descriptive Statistics (Frequency and Percentage of Each Code for Both Genders) & Association of Periodontal Health Status with Gender & BMI-for-Age

| Variables | Code 0 Frequency (%) | p-value | Code 1 Frequency (%) | p-value | Code 2 Frequency (%) | p-value | Code 3 Frequency (%) | p-value |
|-----------|----------------------|---------|----------------------|---------|----------------------|---------|----------------------|---------|
| Gender    |                      |         |                      |         |                      |         |                      |         |
| Male      | 112 (89.6)           | 0.032*  | 259 (48.8)           | 0.031*  | 142 (40.8)           | 0.520   | 28 (36.8)            | 0.000** |
| Female    | 13 (10.4)            |         | 272 (51.2)           |         | 206 (59.2)           |         | 48 (63.2)            |         |
| BMI-For-Age |            |         |                      |         |                      |         |                      |         |
| Healthy   | 40 (32)              |         | 150 (28.2)           |         | 140 (40.2)           |         | 28 (36.8)            |         |
| Overweight | 49 (39.2)           | 0.000** | 199 (37.5)           | 0.000** | 103 (29.6)           | 0.000** | 9 (11.8)             | 0.000** |
| Obese     | 36 (28.8)            |         | 182 (34.3)           |         | 105 (30.2)           |         | 39 (51.3)            |         |

p-value of chi-square test, *Significant at P-value ≤ 0.05, **Highly significant at P value < 0.001, BMI for Age: Body Mass Index for Age, %: Percentage

In subsequent statistical analysis, Table III, two-way ANOVA for the study group showed that the effect of gender on periodontal health status was highly significant at p-value (0.000), and the effect of BMI-for-age on periodontal health status was significant at p-value (0.043). In contrast, the effect of the interaction between gender and BMI-for-age on periodontal health status was insignificant (p-value = 0.235).

Table III - The effect of gender and BMI-for-age on periodontal health status

| Variables | Periodontal Health Status (PSR Index Mean) | f | p   |
|-----------|--------------------------------------------|---|-----|
| Gender    |                                            | 15.223 | 0.000** |
| BMI-for-age |                                        | 3.207  | 0.043* |
| Gender*BMI-for-age |                                | 1.459  | 0.235 |

f: f value of two-way ANOVA, *Significant at P-value ≤ 0.05, **Highly significant at P value < 0.001

DISCUSSION

Periodontal diseases are multifactorial infective and inflammatory diseases characterized by the existence of supra- and subgingival plaque, which provoke an inflammatory host reaction [9,29].

As previously described by many reports, among children and adolescents, gingivitis is the most predominant illness. The rapport of obesity with oral hygiene in adolescents has been inconclusive until now. While in adults, there is a pure connotation between these two factors [30].

Our results indicate a significant association between BMI-for-age and periodontal health status, which is represented by codes 0, 1, 2, and 3. Similar findings for the effect of obesity on periodontal health in adolescents have been reported by “Modeer et al. 2011 and Irigoyen-Camacho et al. 2014” [31,32].

The overall outcomes indicate a confirmed effect and association of overweight and obesity on the incidence of periodontal disease. This effect could be due to an altered reaction to microbial defy, as obesity is known to induce exaggerated inflammatory conditions or affect periodontal disease status [33]; consequently, obesity might have detrimental effects on host reactions by modifying T-cell and macrophage function [34].

Obesity is accompanied by secretion of pro-inflammatory cytokine, adipokines, and other bioactive materials that might lead to amplified inflammation of the gingiva and/or destruction of the periodontium related to periodontal disease [32,35,36].

The adolescent periodontal condition can be potentially affected by increased adiposity throughout childhood via various mechanisms. Otherwise, adiposity serves as an indicator of a harmful lifestyle that result in periodontal
disease [18,37]. Additionally, obesity initiates an immune response by producing chronic inflammatory conditions [17, 38].

The complicated system of cytokines and further mediators implicated in obesity might be nourished by chronic inflammation of periodontal disease. The formerly disturbed inflammatory cytokine network in the gingival crevice causes advanced damage in the periodontium, which is aggravated by specific inflammatory markers liberated from fatty tissue. Adipose tissue is a dynamic endocrine structure that discharges plentiful cytokines and adipokines [39,40].

The affirmative interconnection concerning obesity and gingival bleeding as formerly present among young adults is possibly clarified by all of these potential mechanisms [37,41]. Gingival bleeding is a pathological marker of periodontal diseases [42]. This interconnection indicates that these overweight and obese teenagers could be increased risk for chronic systemic inflammation. Even in an early lifetime, inflammatory reaction disturbances can affect periodontal tissues [37].

Hence, the hypothesis proposed that the combined effect of metabolic and inflammatory outlines along with ignored behaviour concerning oral health in addition to over-all health personnel carefulness might have a vital part in the link of weight state with periodontal condition [43,44].

In this study, we found a significant association of gender with periodontal health status (codes 0, 1, and 3) and a highly significant effect of gender on periodontal condition. Some studies, “AlJehani, 2014; Genco and Borgnakke, 2013” [45,46], have shown that males are greater risk for periodontitis than females, while others, “Laine, 2002” [47], propose that females may sometimes be more susceptible to the advancement of periodontitis as a result of hormonal variations that augment gingival inflammation.

Although the effect of gender on periodontal health status was highly significant and the effect of BMI-for-age on periodontal health status was significant, the effect of the interaction between gender and BMI-for-age on periodontal health status was insignificant. Therefore, future cross-sectional and longitudinal studies with a larger number of participants will be essential to understand the nature, magnitude, and mechanism by which obesity affects periodontal disease in adolescents.

Additionally, the consequence of commonly ignored behaviours concerning oral illness avoidance, including personnel sanitation techniques, nutritional information, and routine oral prevention visits, should be kept in mind [43].

Since periodontal disease and obesity are preventable pandemics, proper information and education about their adverse effects should be systemically introduced as part of general health classes given to students of this age to encourage them to adopt healthy lifestyles.

In this study, students with periodontal health problems (codes 1, 2 & 3) were informed of the importance of oral hygiene measures, the proper technique for brushing, and the need for surface debridement (codes 2 & 3). Additionally, overweight/obese adolescents were advised to visit a nutritional specialist for information on a proper and healthy diet.

CONCLUSIONS

The outcomes of this study emphasize the negative influence of obesity on gingival tissue health in young individuals and the need to regularly evaluate BMI-for-age to intercept the negative effect of obesity/overweight on oral and general health.

Additionally, on a clinical level, the relationship between paediatricians and dentists...
should be encouraged to achieve the best outcome for adolescent health.

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Athraa Ali Mahmood
(Corresponding address)
Periodontal Department, Dentistry College, Mustansiriyah University, Baghdad, Iraq.
Email: athrauali@gmail.com

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