Original Article

Relationship Between Body Mass Index, Lipid Profile and Dental Caries

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Abstract

Background and Aim: Dental caries is the most common infectious, non-communicable, chronic disease worldwide. Obesity and overweight are major public health problems. Both dental caries and obesity have multi-factorial etiology. The aim of the present study was to determine the possible correlation between the body mass index (BMI), lipid profile and dental caries in two groups of high-school students with active caries (AC) and no caries (CF) in Hamadan, Iran.

Materials and Methods: In this case-control study, 118 high-school students between 15-19 years were divided into two groups of AC and CF. All clinical examinations were carried out by a single examiner. Blood samples were obtained from the antecubital vein. Lipid profile was assessed by the enzymatic method using an auto-analyzer. Data were analyzed using Stata.11 software. Statistical comparisons were made using Student's t-test and chi-square test.

Results: BMI was significantly lower in AC group than CF group (P=0.008). Males had higher BMI than females (P=0.056). CF group had significantly lower level of triglycerides (P=0.01), cholesterol (P=0.02) and low-density lipoprotein (LDL) (P=0.02) than AC group.

Conclusion: Our results showed that dental caries adversely affects the systemic growth pattern, and students with dental caries had lower BMI than others. Altered lipid profile had a higher frequency in AC group. Dental caries and obesity are both multi-factorial diseases; hence, well-designed epidemiologic studies on the same age group need to be performed in the future taking into account the socioeconomic and cultural factors.

Key Words: Body Mass Index, Lipids, Dental caries

➢ **Cite this article as:** Ahmadi-Motamayel F, Abdolsamadi H, Goodarzi MT, Jamshidi Z, Mahdavinezhad A. Relationship Between Body Mass Index, Lipid Profile and Dental Caries. J Islam Dent Assoc Iran. 2018; 30(3):106-112. DOI: 10.30699/JIsdreir.30.3.106

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Received: 29 May 2017
Accepted: 6 May 2018

[DOI: 10.30699/JIsdreir.30.3.106]

Introduction

Dental caries is the most common infectious, non-communicable, chronic disease worldwide [1,2]. Despite advances in science, it remains an important health problem particularly in developing countries and children with low socioeconomic status [3,4]. Dental caries can affect physical, mental and systemic health, quality of life and food intake [3,5]. Dental caries affects nearly two-thirds of children and adolescents between 5-17 years and its incidence is higher in poorer societies [6]. The prevalence of cavitated caries in the Iranian children was reported to be 61.1% [7]. The prevalence of dental caries was

reported to be 89.8% in Yasuj (Iran) and 79.7% in Ardabil (Iran) [8,9].

Obesity and overweight have also been major public health problems in the past 20 years [10,11]. The prevalence of obesity is increasing worldwide in all age groups and nationalities [10,12]. Obesity has many health risks such as metabolic syndrome, hypertension, hypercholesterolemia, insulin resistance, diabetes mellitus, impaired lung function [12], orthopedic problems [13], atherosclerosis [14], cancer and respiratory disorders [15].

Both dental caries and obesity have multifactorial etiology such as dietary habits and socio-demographic status [13,16,17]. There are many studies about the relationship of obesity and dental caries [13,15,16,18], although some studies showed no association in this respect [13,15]. However, the relationship between diet, obesity and dental caries remains controversial. Frisbee et al. [6] reported a negative correlation between dental health and obesity and a positive correlation between dental health and inflammatory markers. They concluded that preventive dental care plays an important role in general health of children. Bailleul-Forestier et al. [13] showed a significant correlation between body mass index (BMI) and decayed, missing and filled teeth (DMFT index). Participants with higher BMI had increased risk of caries [13]. In studies by Modéer et al, [15] and Willershausen et al, [19] obese and overweight participants had higher DMFT and carious surfaces.

Factors that cause obesity include sedentary lifestyle, decreased physical activity, diet and fast foods [12]. Diet and sugary foods strongly affect oral health, dental caries, obesity, bone loss and bone fracture [13]. Some studies showed a strong association between cardio-metabolic risk factors and dental caries [4]. One study showed a correlation between dental hygiene and systemic inflammation [6]. Frisbee et al. [6] showed a correlation between dental hygiene, preventive dental care, dental health, and systemic inflammatory markers such as cytokines, C-reactive protein and fasting lipid profile [total cholesterol, low density lipoprotein (LDL), high density lipoprotein (HDL) and triglycerides]. This association was not observed between the afore-mentioned factors and obesity. They concluded that preventive dentistry is very important in general health.

Many studies demonstrated the effect of local oral infection and preventive dentistry on systemic lipid profile, other inflammatory mediators and systemic health [6,19,20]. Studies have shown an association between DMFT, BMI and serum lipid profile [4,13]. In a previous study, obese adolescents had more carious lesions than the control group [13] and another study showed that the obese group had higher number of decayed surfaces [15]. In a study by Subramaniam et al, [21] salivary level of triglycerides had a significant association with dental caries.

To the best of our knowledge, no study has evaluated the association between BMI, lipid profile (triglycerides, cholesterol, LDL and HDL) and dental caries. Thus, the aim of the present study was to assess the correlation between BMI, lipid profile and dental caries in two groups of high-school students with active caries (AC) and no caries (CF) in Hamadan, Iran.

Materials and Methods

The protocol of this study was approved by Hamadan University of Medical Sciences, Hamadan, Iran (ethical approval code: 16/35/1531). In this case-control study, 118 students including 56 healthy high-school caries-free students (CF group; 28 females and 28 males) with an age range of 15-19 years and 62 high-school students with active caries (AC group; 35 females and 27 males) were randomly selected. The latter group had at least 5 tooth surfaces with active caries. Sample size was calculated according to a previous study [22] using the sample size calculation formula. Written informed consent was obtained from all participants. Blood samples were taken after ethics committee approval and obtaining informed consent. All participants were matched in terms of age and gender in the two groups and were all selected from one school to decrease the confounders and bias of the study. Those with a systemic disease, medication intake, smoking, periodontal disease and poor oral hygiene were excluded from the study.

All clinical examinations were carried out by a single examiner on a dental chair using a flash

[DOI: 10.30699/Jsdreir.30.3.106]

light, a dental mirror and an explorer. Caries detection was only based on clinical examination using a dental mirror and an explorer, and radiographic examination was not performed. The AC group had at least five tooth surfaces with clinically detectable carious lesions. The CF group did not have any carious lesion, filling or signs and symptoms of tooth hypersensitivity or proximal color change (DMFT=0). All participants had the same age range.

Next, 5 mL of blood was obtained from the antecubital vein of students by a trained nurse between 8:00 and 9:30 am. Tourniquet, cotton, 75% ethanol alcohol, disposable syringe and test tube containing anticoagulant agent (EDTA) were used for blood sampling. The blood samples were centrifuged at 3000 rpm for 10 minutes within 30 minutes of venipuncture.

Total cholesterol, HDL, LDL and triglycerides were measured by enzymatic method using an auto-analyzer (Hitachi Model 902, Hitachi Ltd., Japan) [4].

Anthropometric measurements including weight and height were made by a professional nutritionist with the subjects wearing light clothing and no shoes. Height was measured using a measuring rod and body weight was measured using a mechanical flat scale (Camry scale, 9313, China). BMI was calculated as the ratio of weight (kilograms) to the square of height (meters) according to the World Health Organization guidelines. Obesity for men and women was defined as BMI $\geq$30 kg/m^2 and overweight was defined as BMI between 25 and 29.9 kg/m^2 [23].

Statistical analysis

Data were analyzed using Stata.11 software. Statistical comparisons were made using Student's t-test and chi-square test. The values were expressed as mean ± standard deviation. A P value <0.05 was considered statistically significant.

Results

A total of 118 students between 15-19 years participated in this study; out of which, 31 patients (26%) were overweight, 19 were males and 12 were females. As shown in Table 1, chi-square test found a significant relationship between BMI and dental carie.

The results showed that BMI was significantly lower in AC group than CF group (P=0.008). There was also a difference between male and female groups (P=0.056) and males had higher weight than females (Table 1).

CF group had significantly lower level of triglycerides (P=0.01), cholesterol (P=0.02) and LDL (P=0.02) than AC group. HDL level was slightly higher in CF group but this difference was not statistically significant (P=0.72). Lipid profile did not show any statistically significant difference between males and females (Table 2).

The Pearson's correlation test showed a positive correlation between BMI with level of cholesterol (P=0.04), triglycerides (P=0.00) and LDL (P=0.09). HDL had an inverse correlation with BMI (P=0.12).

Discussion

The aim of the present study was to assess the correlation between BMI, lipid profile and dental caries. Our findings showed that BMI of AC group was significantly lower than that of CF group. CF students had better and healthier lipid profile than AC students.

Dental caries is the most common chronic oral disease in humans [24]. It affects people of all socioeconomic states, both genders, all races and age groups. Oral hygiene and saliva can affect the occurrence of dental caries [25].

Obesity has a correlation with body fat and many serious diseases. Nowadays, there are more than 300 million obese people worldwide and this rate is constantly increasing [26,27].

In this study, we assessed the correlation between BMI, lipid profile and dental caries and hypothesized that people with higher BMI and higher lipid profile would have more decayed teeth than others. Our results showed that dental caries adversely affects the systemic growth pattern. Similar to our results, other studies showed that caries was a negative predictor of body growth. Children with nursing caries have lower weight and quality of life. A significant association has been observed between dental caries, odontogenic infections and low weight [2,3].

In a previous study [28], dental treatment did not cause any significant improvement in BMI within 3 years, but other studies showed a significant improvement in weight, general body growth and

[DOI: 10.30699/Jsdreir.30.3.106]

Table 1. Relationship Between BMI groups and dental caries using chi-square test

BMI Group	Underweight	Normal	Overweight	Total	P-value
Male	4	32	19	55	0.056
Female	12	39	12	63	
Caries free	2	36	18	56	0.008
Active caries	14	35	13	62	
Total	16	71	31	118	

Table 2. Comparison of triglycerides, cholesterol, LDL and HDL in males and females and active caries and caries free groups

Variable	TG Mean ± SD	p value	Cholesterol Mean ± SD	p value	LDL Mean ± SD	p value	HDL Mean ± SD	p value
Male	160.80±37.68	0.5	184.69±27.26	0.79	106.04±20.47	0.29	46.44±9.71	0.19
Female	165.93±39.48		183.12±32.52		101.30±25.53		48.70±8.05	
Caries free	154.02±35.58	0.01	177.07±30.59	0.02	98.33±23.03	0.02	47.90±8.40	0.72
Active caries	171.40±39.38		189.78±28.19		108.26±22.40		47.28±9.50	

TG: Triglycerides

quality of life of patients after 6 months [2,3,29]. In spite of our results, other studies have shown high level of dental caries in obese people [13,15,18,19,30] and a positive association has been reported among dental caries, dental hygiene, overweight, obesity and BMI [6,12,31-33]. Another study observed a weak correlation between caries prevalence and overweight in Swedish children [34]. BMI percentile was not correlated with DMFT score or number of carious teeth in another study [35]. Some others found no association between obesity, BMI, DMFT and dental caries [7,35-37]. However, one systematic review concluded that only one study with high level of evidence showed direct association between obesity and dental caries [18]. This controversy could be explained by different study groups, study design, role of many other factors in dental caries and obesity. Many factors play a role in dental caries such as family income, education and body weight [38]. Different results have been observed in studies according to the age of study populations; thus, studies with the same age range of participants should be compared [39].

1-The matrix of mature enamel has 60% proteins and 40% lipids. The matrix and pellicle lipids have been found to prevent enamel demineralization by retarding the influx of lactic-acid [40]. Caries prevalence is also associated with body fat percentage [41]. A significant association has been noted between dental caries and cardiovascular risk factors [4]. Thus, body fat may not relate to enamel matrix lipid.

Our results showed a statistically significant difference in LDL and triglycerides between the AC and CF groups and they were higher in AC group than the CF group. Thus, it seems that subjects with lipid abnormality and high lipid profile have higher susceptibility for dental caries. HDL level was lower in AC group but this difference was not statistically significant. In our study, the serum lipid profile was higher in AC

[DOI: 10.30699/Jsdreir.30.3.106]

group; thus, it may have no association with lipid level of dental matrix and plaque.

Górski et al, [20] also showed a positive association between oral local inflammatory processes and LDL level. Thus, preventive dental care is very important in systemic health [6]. Kelishadi et al. [4] evaluated the association of cardio-metabolic risk factors and dental caries. They reported significant differences in DMFS, BMI and lipid profile between the patients with cardio-metabolic risk factors and healthy control groups. Ylöstalo et al, [42] also confirmed associations between gingivitis, dental caries and tooth loss with angina pectoris. Another study demonstrated a significant association between salivary cholesterol and triglycerides with dental caries [21]. Obese people usually have dietary habits such as high sugar intake, and higher rate of dental caries, but our study results did not confirm this hypothesis. This may be explained by presence of toothache in AC group, low food consumption, sleeping habits, physiological processes, reduced quality of life, infectious status of dental caries, effect on general health of students, socio-demographic factors, environmental factors in different regions of the country, different preventive fluoride programs and odontogenic infections, which may result in cytokine release and its subsequent impact on growth [2]. Based on the results of this study, dental caries was a negative predictor of weight gain. Other studies need to be done in the future on larger sample sizes and different age groups.

To improve oral and physical health of children, raising awareness on dental caries, education of parents, physicians, nutritionists and pediatric dentists, easy access to oral health services, prevention and timely intervention and treatment of dental caries in children as well as lifestyle changes seem necessary.

Conclusion

Our results showed that dental caries affects systemic growth pattern and students with dental caries had lower BMI than others. Abnormal serum lipid profile had a higher frequency in AC group. Both dental caries and obesity have multifactorial etiology; thus, epidemiological studies with larger sample size are needed in the future.

Acknowledgement

This study was supported by a research grant from the Dental School, Hamadan University of Medical Sciences, Hamadan, Iran. The authors would like to thank the Vice Chancellor for Research and Technology of Hamadan University of Medical Sciences.

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[DOI: 10.30699/Jsdreir.30.3.106]

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[DOI: 10.30699/Jsdreir.30.3.106]