Relationship of Body Mass Index with periodontal health status of green marble mine laborers in Kesariyaji, India

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Abstract: It is evident from literature that an increased body mass index (BMI) may be a potential risk factor for periodontitis. Association between BMI and periodontitis has been ascribed to unhealthy dietary patterns with insufficient micronutrients and excess sugar and fat content. The present study population has been plagued by unhealthy nutritional practices, hence the present study intended to assess the relation between BMI and periodontal status among green marble mine laborers of Kesariyaji, in the Udaipur district of Rajasthan, India. The study sample comprised of 513 subjects aged 18-54 years, drawn using the stratified cluster sampling procedure. BMI was calculated as the ratio of the subject's body weight (in kg) to the square of their height (in meters). Periodontal status was recorded using the Community Periodontal Index (CPI). Binary multiple logistic regression analysis was executed to assess the relation between body mass index and periodontitis. The dependent variable for logistic regression analysis was categorized into control group (scores 0 - 2 of the CPI) and periodontitis group (scores 3 and 4 of the CPI). The overall prevalence of periodontal disease was 98.2%. Caries status and mean number of teeth present deteriorated with the poor periodontal status. Subjects had an increased risk of periodontitis by 57% for each 1-kg/m^2 increase in the body mass index, which means that a higher body mass index could be a potential risk factor for periodontitis among the adults aged 18 to 54 years. In conclusion, evaluation of the body mass index could be used in periodontal risk assessment.

Descriptors: Periodontal diseases; Body mass index; Height by weight.

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Introduction

It is evident from the scientific literature that general health has a considerable impact on oral health and vice versa. Many mediators have been postulated for this relationship, namely infection, chronic inflammation, and genetic predisposition.[1]

Apart from these mediators, nutrition has been postulated as an alternative mediator.[2] The body mass index has always been considered a simple method for analysis of the nutritional status. The normal value for this index ranges from 20-25 kg/sq.m.[3] It is the value that better correlates with body fat.

Recently, studies have been conducted to assess the association of the body mass index and periodontitis. However, a study has even observed a significant association between caries frequency and the BMI,[4] whereas another study found no correlation between dental decay in obese and non-obese children.[5]

Sheiham *et al*.[6] (2002) has stated that "The nature of the relationship between BMI and oral health is clearly rather complex. A low BMI is easily explainable on the basis of there being real functional difficulties that can prevent normal eating in some cases. On the other hand, the association of poor oral health with obesity is likely to be associated with the quality of the diet."

Though no definite mechanism of association between BMI and periodontitis is identified, it has been ascribed to unhealthy dietary patterns with insufficient micronutrients and excess sugar and fat content. These dietary patterns could thus pose a risk both for periodontal disease and obesity.[7]

The present study population has been plagued by unhealthy nutritional practices and is thus a good sample to study the association of body mass index and periodontal status.

The present study intended to assess the relation between body mass index (BMI) and periodontal status among green marble mine laborers of Kesariyaji, India.

Material and Methods

The final sample size comprised of 513 subjects aged 18 to 54 years. The study area, Kesariyaji is located in the Udaipur district of Rajasthan, India and it is divided into four geographical zones: Masoron Ki Obri, Rushabhdev, Khandiovri and Kagdar Bhatiya. Stratified cluster sampling was implemented to collect the representative population.[8]

The sampling procedures and exclusion criterion have been discussed in detail in a previous paper.[9]

The height of the participants was measured in centimeters, using a hard ruler installed vertically and secured with a stable base, while weight was assessed in kilograms using a mechanical scale. The scale used was certified by the Controller of Legal Metrology (Weights & Measures), India.

The BMI was calculated as the ratio of the subject's body weight (in kg) to the square of their height (in meters). Based on the WHO criteria, four categories were defined: underweight (BMI < 18.5 kg/m^2), normal weight (BMI from 18.5 to 24.9 kg/m^2), overweight (BMI from 25 to 29.9 kg/m^2), and obese (BMI > 30 kg/m^2).

Oral examination was performed by a single examiner using a world health organization CPI periodontal probe. Periodontal status was recorded under five scores: score 0 (healthy), score 1 (bleeding), score 2 (calculus), score 3 (shallow periodontal pockets) and score 4 (deep periodontal pockets).[8] Caries assessment was done using the Decayed, Missing and Filled Teeth index (DMFT), which was recorded following the WHO criteria[10] for each subject.

Intra-examiner reliability for periodontal and DMFT assessment was analyzed by the weighted kappa statistic which was found to be 84.2% and 89.6% respectively.[11]

Ethical clearance for conducting the study was obtained from the Ethical Committee for Research, Darshan Dental College and Hospital.

The data was processed and analyzed using the statistical package for the social sciences (SPSS version 15.0). To facilitate the statistical analysis, the subjects were grouped into two categories based on CPI scores; individuals in the control group had a community periodontal index of 0–2, whereas those in the periodontitis group had a community periodontal index of 3–4.[12]

The Mann-Whitney U test was used to analyze

the significant differences between the two periodontal status categories in relation to age, BMI, DMFT and number of teeth present. Binary logistic regression analysis was performed to determine the relationship of BMI, age and DMFT. The dependent variable for the multiple logistic regression analysis was categorized into control group (scores 0 - 2 of the CPI) and periodontitis group (scores 3 and 4 of the CPI). All the independent variables were continuous and comprised of BMI, age and DMFT. Both adjusted and crude odds ratio were calculated for assessing the influence of various independent variables on the periodontal status with 95% confidence intervals. To analyze the adjusted odds ratio, the effect of each independent variable was assessed adjusting for all other variables in the model. A significance value of $p < 0.05$ was accepted as statistically significant.

Results

Table 1 presents the general profile of the study population. The youngest age group (18-24 years) contributed for one third of the sample size while there were fewer subjects who belonged to the oldest age group (45-54 years).

The overall prevalence of periodontal disease was 98.2%. CPI scores 1 and 2 (bleeding and calculus) were more widespread among the study population whereas deep periodontal pockets were presented by 1.8% of the subjects.

None of the subjects were obese while more than half of the subjects (67.6%) belonged to the 18.5-24.9 BMI group.

Mean subject characteristics with periodontal status are illustrated in Table 2. There was a significant difference for age between the groups, with the mean age of the periodontitis group being approximately 3 years older than that of the control group. A similar trend was noticed for the BMI with subjects belonging to the periodontits group presenting greater BMI. Caries status and mean number of teeth present deteriorated with the poor periodontal status.

Logistic regression analyses revealed that subjects had an increased risk of periodontitis by 57% for each 1-kg/m^2 increase in body mass index (adjusted odds ratio, 1.57; 95% confidence interval, 1.22–2.01). Moreover, though the risk of periodontis increased with the increase in age, its influence was not significant (Table 3).

Discussion

Previous data suggest that periodontal disease prevalence is greater among obese people, and studies have proposed that an increased body mass index

Table 1 - General profile of the study population.

Characteristics	Percentage of subjects
Age (years)	
18-24	33.3
25-34	31.6
35-44	26.3
45-54	8.8
Periodontal status	
CPI score 0	1.8
CPI score 1	45.6
CPI score 2	36.8
CPI score 3	14.0
CPI score 4	1.8
Body mass index (kg/m^2)	
< 18.5 (underweight)	21.8
18.5-24.9 (normal weight)	67.6
25.0-29.9 (overweight)	10.5
≥ 30.0 (obese)	0.0

Table 2 - Characteristics of subjects by periodontal status.

Characteristics	CPI scores 0-2 (n = 432)	CPI scores 3-4 (n = 81)	P
Age	30.35 ± 9.62	33.78 ± 7.54	0.0001
Body mass index (kg/m^2)	20.84 ± 2.83	24.23 ± 3.44	0.004
DMFT	2.44 ± 2.83	3.21 ± 2.92	0.002
Number of teeth present	28.47 ± 0.34	25.82 ± 0.46	0.001

Mann Whitney U test.

Table 3 - Crude and adjusted odds ratio and 95% confidence interval (CI) of body mass index (BMI) and age as independent variables and presence of periodontal pockets as dependent variable (CPI ≥ 3 = 1, CPI ≤ 2= 0).

	Crude Odds ratio (95% CI)	P	Adjusted Odds ratio (95% CI)	P value
Age	1.96 (1.88-2.04)	0.324	1.93 (1.86-2.01)	0.118
Body mass index	1.52 (1.19-1.94)	0.001	1.57 (1.22-2.01)	0.0001

may be a potential risk factor for periodontitis.

Past studies[7,13,14] have included either young or old subjects and data from those studies on both the young and adult individuals had suggested that periodontal status deteriorates with BMI. The present study used a wide range of age, with the youngest individuals being 18 years of age and the oldest being 54 years of age.

However, the present study is not devoid of limitations, as the periodontal status was assessed using the Community periodontal index, which does not include all the teeth and does not measure attachment loss.

The overall prevalence of periodontal disease was 98.2% whereas this prevalence is 89.6% among the general population of India belonging to the 35-44 years age group.[15] The higher prevalence of periodontal disease among the present study population can be attributed to a multitude of reasons like poor oral hygiene practices, poor living conditions and low access to dental health services. However, the widespread prevalence of bleeding and calculus is in accordance with previous studies.[16-18]

None of the subjects were obese while more than half of the subjects (67.6%) belonged to the 18.5-24.9 BMI group. Moreover, the mean DMFT was greater in the periodontitis group when compared to the control group. This could be attributed to the influence of oral hygiene practices on both the diseases. Individuals who maintain good oral hygiene practices tend to be free from periodontal disease as well as decayed teeth.

It was observed that the subjects with higher BMI and age had an increased risk for periodontal disease.

The influence of age on periodontal disease is consistent with previous literature. Miyazaki *et al.*[18] (1991) used the CPITN to assess the periodontal profiles of adults and found that the periodontal disease increased with the increase in age.

The present study population had an increased risk of periodontitis by 57% for each 1-kg/m^2 increase in body mass index while the risk of periodontitis increased by 16% among young Japanese adults aged 18-24 years.[13] This difference in risk might be due to the difference in age composition. Moreover, it is evident that the body mass index increases with age.[19]

Al-Zahrani *et al.*[7] (2003) assessed the association of BMI and periodontal disease among adults aged 18-34 years and observed that the prevalence of periodontitis was 76% higher among obese individuals. Furthermore, Reeves *et al.*[14] (2006) studied the association of body weight and waist size with chronic periodontitis among individuals aged 17-21 years and reported that weight significantly influenced the periodontal status.

Another study showed obese females to be 2.1 times more likely to have periodontitis than normal weight females. The risk increased to 3.4 times when the analysis was restricted to non-smokers.[20]

Conclusions

A higher body mass index could be a potential risk factor for periodontitis among adults aged 18 to 24 years. Thus, the evaluation of body mass index could be used in periodontal risk assessment. Longitudinal studies with a larger sample size are required to confirm the association of body mass index and periodontal disease.

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