Relationship between Body Mass Index and Periodontal Status among Patients Attending AIMST Dental Institute

Rajeev Arunachalam *, Panimholi A/P Palaniappan **, Oi Chai Ying**, Nu Fui Pin ** ,Vini Rajeev*

* Senior Lecturer, Faculty of Dentistry, Asian Institute of Medicine, Science and Technology (AIMST) University, Malaysia

**Undergraduate students, Faculty of Dentistry, Asian Institute of Medicine, Science and Technology (AIMST) University, Malaysia

Corresponding Author:

Rajeev Arunachalam, Faculty of Dentistry, Asian Institute of Medicine, Science and Technology (AIMST) University, Malaysia

Abstract

Introduction: The World Health Organization (WHO) defines overweight and obese as body mass index (BMI) greater than or equal to 25 and 30, respectively. More than one-third of the adult population 20 years and older are obese. Recently, increased interest in the link between obesity and oral health, has suggested that obesity is also associated with periodontitis.

Aims: The aim and objectives of this study was to determine if subjects with obesity have a higher chance of developing periodontal disease, using statistical analyses of the data collected in body mass index assessment and periodontal charting of patients attending AIMST Dental Institute, Malaysia.

Methods and Material: A cross-sectional study was conducted in Faculty of Dentistry, Asian Institute of Medicine, Science and Technology (AIMST) Dental Centre, Malaysia The study sample comprised of 50 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 full mouth periodontal charting. Statistical analysis was appropriately used to assess the relation between body mass index and periodontitis.

Results: Among the 50 samples, 8% are of underweight category, 34% are of normal weight category and 58% are of overweight category. These results show a significant percentage of periodontal patients fall under the overweight category. There were no significant differences between the obese class I, class II and class III and periodontal status. Subjects had an greater risk of developing periodontitis with each 1- kg/m2 increase in the body mass index, which shows

that an increased body mass index could be a possible risk factor for developing periodontitis among the adults aged 18 to 54 years.

Conclusions:

Our results reaffirm that increased BMI is positively correlated with periodontal disease prevalence. We hope this study will increase awareness among medical professionals so that there is increased patient education about the oral health risks of overweight and obesity, and that there is earlier recognition and treatment of periodontal disease in patients who are overweight and obese.

Keywords: Body mass index, Oral hygeine, obesity, periodontal diseases.

I.   Introduction

The World Health Organization (WHO) describes overweight and obese as body mass index (BMI) greater than or equal to 25 and 30, respectively[.1] More than one-third of the adult population 20 years and older are obese.[21] Increased BMI has been associated with inflammation in tissues throughout the body, which creates risk for chronic health problems. Similarly, periodontal disease is one of the world's most common chronic diseases with inflammatory condition that is widespread among the adult population. Periodontal disease is an inflammatory disease of the supporting tissues of the teeth caused by specific micro-organisms or groups of specific micro-organisms resulting in progressive destruction of the supporting structures leading to pocket formation, recession or both.

Lately, an amplified attentiveness in the link between obesity and oral health, has suggested that obesity is also linked with periodontitis.[2-4] An increased BMI is accompanying with an increase in the size and number of adipocytes.[1] Adipose tissue secretes hormones and cytokines that are very well involved in inflammatory processes proposing that similar pathways may be involved

in the pathophysiology of obesity, diabetes and periodontitis.[5]

Preventing periodontal disease is accomplished through valuation and revision of risk factors. A risk factor is a progression that is related with disease development. Prominently, association does not connect to causation, even though causation is normally implied. Risk factors are basically divided into those that are modifiable and those that are not. The non-modifiable risk factors are important in identifying those individuals at higher risk for development of periodontal disease, but do not necessarily affect treatment; conversely, if present, changing modifiable risk factors is the basis of any management strategy. There are a few well established modifiable risk factors for periodontitis and numerous others that are under active research. The most important and best defined modifiable risk factor is tobacco use and diabetes. Existing literature definitely shows an association between the two, but fulfillment of the Hill criteria is not entirely possible. Irrespective, adjusting these risk factors through tobacco use cessation and diabetic control are crucial steps in the treatment of these patient populations.

Overconsumption of food and lack of physical activity have been shown to have a pivotal connection with obesity, but are not the only reasons for the obese condition.. Gender is one aspect that has been linked with obesity. Multiple studies provide evidence that women have a higher prevalence of obesity, and men have a higher prevalence of overweight, especially after the age of 50 years.[6][7] Several cross-sectional studies have documented increase in BMI with age.[6,8] A few longitudinal studies support the previously mentioned finding, with age 60 years cited.[9,- 11] .Flegal (1998) showed variations across ethnic groups in the prevalence of obesity. Genetic predisposition for obesity might be the reason for such variations especially when individuals are exposed to an affluent lifestyle.[1]

Adipose tissue play a major role in regulation of energy homeostasis and it secretes more than 50 biologically active substances, collectively termed adipokines. Adipokines such as the hormone-

like proteins: leptin and adiponectin, the classical pro-inflammatory cytokines: TNF-a and IL-6, and plasminogen activator inhibitor 1 (PAI-1) play a number of different biological roles. Certain cytokines secreted appear to be key regulators of the inflammatory response and are crucial for the progression of periodontitis. T cells that secrete such cytokines have an important function in periodontal inflammation. Diseased periodontal tissues initially show predominance of Th1-type cytokines, followed by a rise in Th2-type cytokines in later stages of periodontitis [12] Recent studies have also defined novel roles for Th17cells, which secrete IL-17, TNF-a, and granulocyte colony stimulating factor (G-CSF) [13]. The relationship between obesity and periodontal disease was published as early as 1977. An experimental ligature-induced periodontitis model was used in Zucker rats.[3] Greater alveolar bone resorption was seen in obese animals as compared with non-obese rats. Further, the response to bacterial plaque accumulation, periodontal inflammation and destruction was more severe in obese animals. [3] Models were constructed with low and high periodontitis as dependant variables and with BMI as categorical predictor variable.

Body weight adjusted for stature (Body Mass Index) has been commonly used in large-scale population surveys as a surrogate for body fat content.[14-15] Body mass index (BMI), also known as Quetelet's Index, is the most commonly used tool, the ratio defined as body weight (kg) divided by height squared (m^2). BMI has been shown to have strong correlation with body fatness, and weak correlation with height. [14, 16]

The present study attempted to investigate if there is an association between body composition, as determined by body mass index measurement, and periodontitis in adults.

II.   Materials and Methods

A cross-sectional study was conducted in Faculty of Dentistry, Asian Institute of Medicine, Science and Technology (AIMST) Dental Centre, Malaysia. The study sample comprised of 50 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 full mouth periodontal charting. Statistical analysis was appropriately used to assess the relation between body mass index and periodontitis.

Inclusion criteria:

•   Individual above the age of 18, below age 0f 80 and of both genders

•   Individual physically fit will be included in the study

•   Individual psychologically healthy will be included in the study

•   Individual with at least 6 teeth in one arch

•   Subject who meets the all the above criteria and gives consent to participate in the study

Exclusion criteria:

•   Children are not included, as pediatric manifestations of periodontal disease or diabetes are not within the scope of this research.

•   Completely edentulous (toothless) individuals will be excluded, as periodontal disease is not present in conjunction with full edentulism.

•   Pregnant and lactating mothers as their periodontal health will be affected by hormonal changes

•   Subjects physically, mentally, or legally incapacitated so that informed consent to treat cannot be obtained are not included.

Body Mass Index (BMI)

The BMI is a ratio of body weight to body height and was calculated based on reported height and weight measurements extracted. The weight measurement is measured in kilograms using weighing scale and the height is measured in meters using the height rod of the mechanical weight and height scale. The measured value is used in calculation of BMI. The standard formula used to calculate the BMI is shown as below,

Body Mass Index(BMI)= weight (kg)

Height (m2)

Where Kilogram (kg) is the weight and meter (m2) is the height squared.

The definition of obesity is based on BMI. Patients were then categorized into underweight, normal weight, overweight, or obese based on the World Health Organization criteria of BMI <18, <25, <30, and >30 respectively.[1]

Classification	BMI	Risk of comorbidities
Under weight	<18.50	Low (but risk of other clinical problems increased)
Normal range	18.50 – 24.99	Average
Overweight:	≥ 25.00	
Pre-obese	25.00 – 29.99	Increased
Obese class I	30.00 – 34.99	Moderate
Obese class II	35.00 – 39.99	Severe
Obese class III	≥ 40.00	Very severe
Adapted from the WHO, 2004.		

For the periodontal assessments, the comprehensive periodontal exams were extracted from the periodontal charts. Periodontal condition was determined by probing depth and clinical attachment loss. All measurements in the chart were taken by Aimst University dental students in their fourth and fifth year of dental school. The dental students' measurements were checked and approved by periodontal faculty.

Periodontal Charting
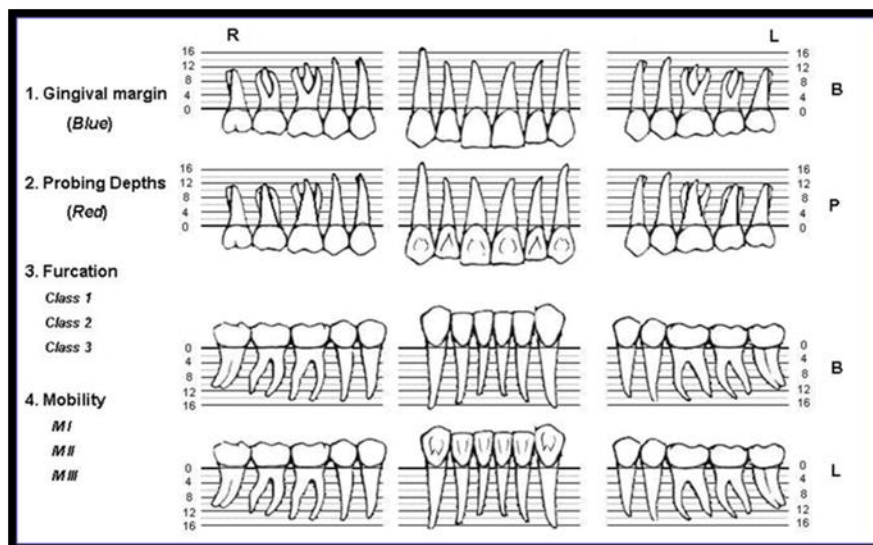
In periodontal charting, gingival margin level, periodontal pocket depth, furcation and mobility is assessed and recorded. Gingival margin and pocket depth is measured using calibrated probe, preferably William's periodontal probe. For each tooth, gingival margin and pocket depth is measured in 6 different surfaces, which includes mesiobuccal, buccal, distobuccal, mesiolingual, lingual and distoligual surfaces. Gingival margin is recorded in blue colour while the pocket depth is recorded in red. Both the value is added to obtain the measurement of clinical attachment loss. Clinical attachment loss of 6mm or more is considered as positive for periodontal disease.
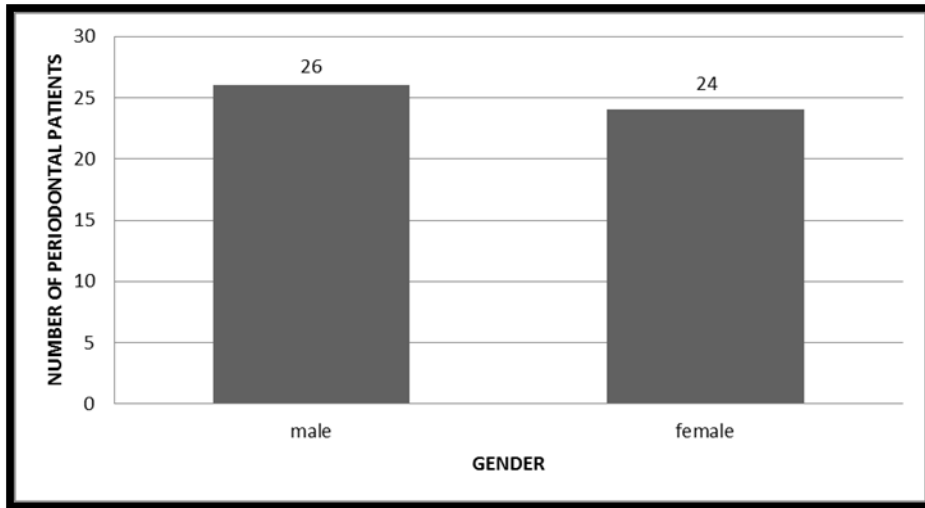
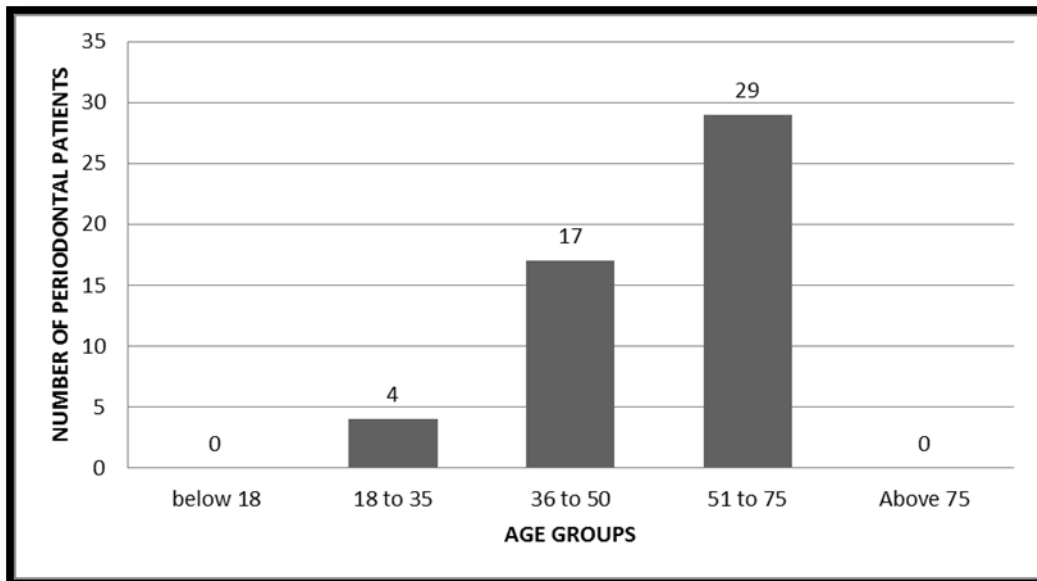### III.   Statistics and Results

Demographics

Race
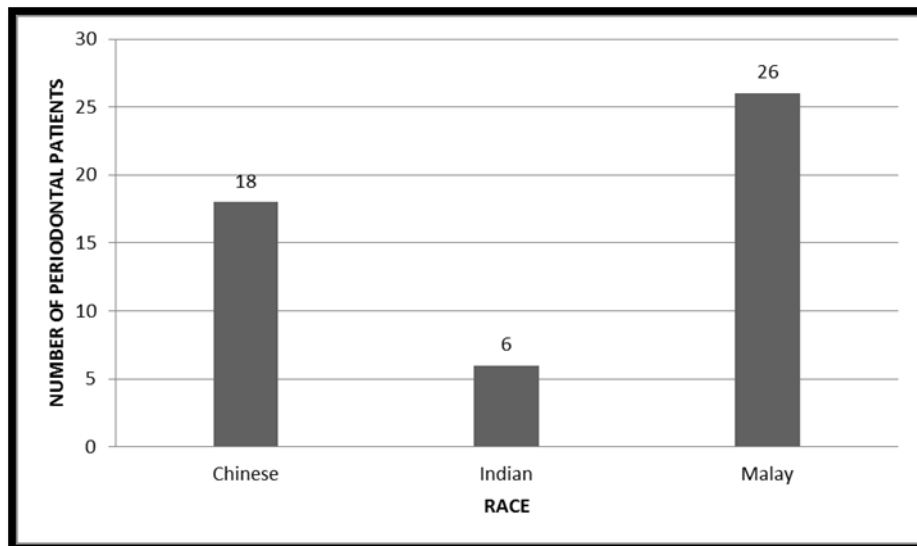
Gender

Age

The total number of study population among the targeted population composed of 50 patients with periodontal problems. There are almost equal numbers of male and female patients who are diagnosed with periodontal problems, which are 52% and 48% respectively. On the other hand, race wise there is a significant difference between Malay, Chinese and Indian patients. 52% of patients are Malays, while Chinese and Indian patients take up 36% and 12% respectively. This percentage is largely affected by the race distribution around the location of the research. When it comes to the age groups, no patient below 18 years old or above 75 years old were diagnosed with periodontal problems during the research. 8% were patients from 18 to 35 years old, 34% were patients from 36 to 50 years old and 58% were patients from 51 to 75 years old. This show a large number of patients are above 50 years old.
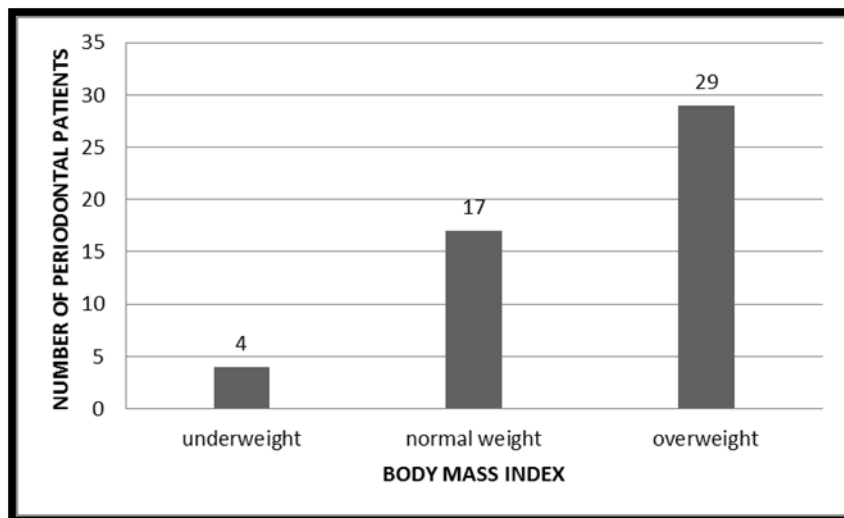

Figure 1: *Number of periodontal patients tabulated according to their BMI into underweight, normal weight and overweight patients.*
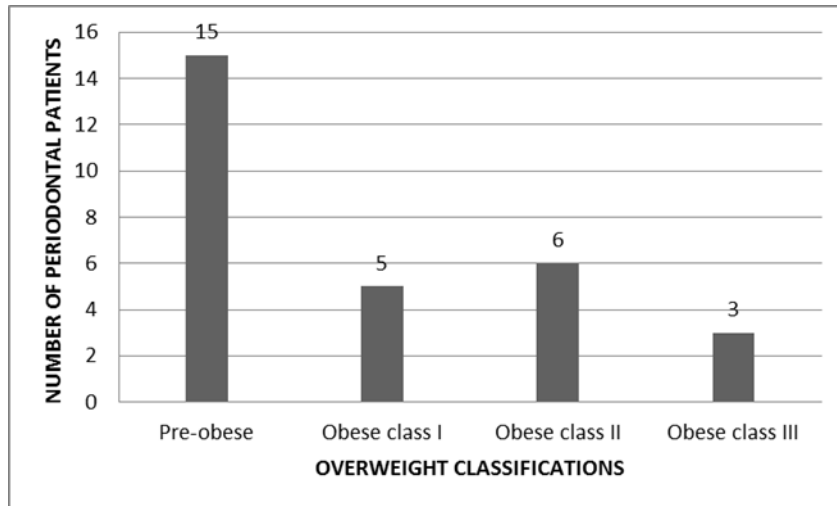
Figure 2: *Number of periodontal patients tabulated according to the classification of overweight*

BMI

IV.   Discussion

This study was conducted among the patients attending AIMST University dental clinic with positive periodontal findings to investigate the co-relation between the Body Mass Index (BMI) and the periodontal condition of the patient.

The periodontal chart taken by a single examiner was used in the study to select the samples. The measurements from the charting were extracted. Then the demographic details of the patients were recorded. Followed by that, the height and weight of the patients were measured and recorded. These details were used to calculate the Body Mass Index (BMI) of the patient. According to the BMI the samples were classified into underweight = BMI below 18.5, normal

range = BMI ranging from 18.5 to 24.9 and overweight = BMI above 25.0. The overweight category is further classified into pre-obese, obese class I, obese class II and obese class III with BMI of 25.0-29.9, 30.0-34.9, 35.0-39.9 and above 40.0 respectively.

Our tabulated data shows that among the 50 samples, 8% are of underweight category, 34% are of normal weight category and 58% are of overweight category. These results show a significant percentage of periodontal patients fall under the overweight category. To be more specific, a huge number of samples come from the pre-obese classification. This shows compared to underweight and normal weight patients, the overweight patients are more prone to periodontal diseases. Therefore, there is a positive co-relation between the Body Mass Index and the results support our hypotheses.

However, in this study there are no highly significant differences between the obese class I, class II and class III. This might be due to demographic factors and also the group of patients attending the institute for dental treatment. Thus, other survey and studies are recommended to be conducted on respondents from other living area or ethnic other than those attending the AIMST Dental Institute to study the type of overweight patients with the majority relevance to periodontal problems.

The main limitation of the study is that systemic health status was self-reported by patients. These were not routinely examined at patient visits, but rather reported by the patients. Patients might not be aware of their latent systemic diseases progress, or were not willing to reveal their

ongoing systemic disease. Other limitations to this study includes the inability to account for the possible confounding variables of socioeconomic status and precise smoking status (pack years) because these were not recorded in the patient's periodontal charts. Not only do confounding variables make analysis difficult to interpret, but also the fact that some variables (i.e. physical health status) were self-reported may introduce an inherent bias in the study. Also, the retrospective study design meant that we were dependent on periodontal measurements taken by a diverse group of dental students. Patients who were already edentulous were excluded from the study due to the lack of baseline data and clinical attachment loss levels. This is a limitation in the study because the loss of all of their teeth might be due to severe periodontitis, which if it were the case would exclude a large number of the most severely diseased population.

This study investigated the association between body mass index and periodontal disease. Specifically this research attempted to determine whether obese individuals (assessed by variable BMI) are at greater risk of developing periodontal disease (assessed by probing depth and mean clinical attachment loss). BMI and periodontal charting of patients (n=50) obtained from the Dental Institute, Aimst University were analysed. Review of the literature regarding periodontal disease, obesity, and the relationships linking these two conditions together was made.

Due to the variability and complexity of the associated parameters, further investigation is necessary to elicit and clarify whether such association exists beyond reasonable doubt. Further understanding of how obesity is linked to periodontal disease, along with more well-designed prospective studies, is necessary to clarify how such relationships between periodontal health and systemic health exist. Prevention is key for both chronic conditions. Health-care providers should continue to underscore for their patients the importance of reaching and maintaining a healthy

weight, following the dietary and nutritional recommendations, and having regular oral health examinations and screenings for signs of periodontal disease.

While we have shown the association between BMI and periodontal disease, the next important step is to explore causation, which may be best done using Hill's criteria. First, the strength and consistency of the association has been established in our study and in multiple prior studies. Second, we have considered many alternate explanations of the association by accounting for confounding variables in our study (age, sex, ethnicity, tobacco use, and diabetes). Third, it is fully plausible that obesity is not just associated with periodontitis, but that it actually predisposes to its development. Fourth, establishing temporality would be possible if a longitudinal study were to show that obese people have a higher incidence, not just prevalence, of periodontitis. Clinical experience suggests that that would be the case and future research could easily explore this idea. Overall, the idea that obesity is at least a contributing or predisposing factor to the development of periodontitis is coherent.

V.   Conclusion

Our results reaffirm that increased BMI is positively correlated with periodontal disease prevalence. We hope this study will increase awareness among medical professionals so that there is increased patient education about the oral health risks of overweight and obesity, and that there is earlier recognition and treatment of periodontal disease in patients who are overweight and obese.

The changes taken to reduce the prevalence of obesity should occur at both a dentist and a patient level. Patient level changes occur at every visit to a dental health professional. Dentists and dental

hygienists are well suited to effect change through patient education. Weight loss education and reinforcement through motivational interviewing techniques have been shown to be effective in reducing patient weight. At each patient visit simple questions about patient weight loss goals and reminders that obesity is associated with periodontal disease should become a part of treatment planning.

Furthermore, obese patients may need more intense periodontal treatment and screening. By being aware of the increased prevalence of periodontitis in obese patients, dentists can be more sensitive in looking for early signs of clinical attachment loss. More frequent formal hygiene appointments and patient hygiene education could be instituted for obese patients with early signs. Thus, we hope the results of our study have contributed in increasing the awareness on association between BMI and periodontal issues.

References

1.   World Health Organization. Obesity: Preventing and managing the global epidemic. Geneva: World Health Organization 2000 (WHO Technical Report Series 894).

2.   Grossi SG, Genco RJ, Machtei EE, Ho AW, Koch G, Dunford R, Zambon JJ, Hausmann E. Assessment of risk for periodontal disease. II. Risk indicators for alveolar bone loss. J Periodontol. 1995 Jan;66(1):23-9

3.   Perlstein MI, Bissada NF. Influence of obesity and hypertension on the severity of periodontitis in rats. Oral Surg Oral Med Oral Pathol 1977;43:707-719.

4.   Saito T, Shimazzaki Y, Tzuzuki and Ohshima. Relationship between upper body obesity and periodontitis. J of Dent Res 2001; 80: 1631-1636.

5.　　Lissner L. Heitmann BL. Dietary fat and obesity: evidence from epidemiology. Eur J Clin Nutr 1995;49:79-90.

6.　　Flegal KM. Carroll MD. Kuczmarski RJ. Johnson CL. Overweight and obesity in the United States: prevalence and trends, 1960-1994. Int J Obes Relat Metab Disord 1998;22:39-47.

7.　　Stam-Moraga MC. Kolanowski J. Dramaix M. De Backer G. Kornitzer MD. Sociodemographic and nutritional determinants of obesity in Belgium. Int J Obes Relat Metab Disord 1999;23:S1-9.

8.　　Boyle CA. Dobson AJ. Egger G. Magnus P. Can the increasing weight of Australians be explained by the decreasing prevalence of cigarette smoking? Int J Obes Relat Metab Disord 1994; 18:55-60.

9.　　Williamson DF. Kahn HS. Remington PL. Anda RF. The 10-year incidence of overweight and major weight gain in US adults. Arch Intern Med 1990;150:665-72.

10.　　Lewis CE. Smith DE. Wallace DD. Williams OD. Bild DE. Jacobs DR. Seven-year trends in body weight and associations with lifestyle and behavioral characteristics in black and white young adults: the CARDIA Study. Am J Public Health 1997;87:635-42.

11.　　Guo SS. Zeller C. Chumlea WC. Siervogel RM. Aging, body composition, and lifestyle: the Fels Longitudinal Study. Am J Clin Nutr 1999;70:405-11.

12.　　Gaffen SL, Hajishengallis G. A new inflammatory cytokine on the block: re-thinking periodontal disease and the Th1/Th2 paradigm in the context of Th17 cells and IL-17. J Dent Res 2008;87:817—28.

13.　　Kamio N, Akifusa S, Yamaguchi N, Nonaka K, Yamashita Y. Antiinflammatory activity of a globular adiponectin function on RAW 264 cells stimulated by lipopolysaccharide from Aggregatibacter actinomycetemcomitans. FEMS Immunol Med Microbiol 2009;56:241—7.

14.   Revicki DA. Israel RG. Relationship between body mass indices and measures of body adiposity. Am J Public Health 1986;76:992-4.

15.   Gray DS. Fujioka K. Use of relative weight and body mass index for the determination of adiposity. J Clin Epidemiol 1991;44:545-50.

16.   Keys A. Fidanza F. Karvonen MJ. Kimura N. Taylor HL. Indices of relative weight and obesity. J Chronic Dis 1971;25:329-43.

AUTHORS

1. Rajeev Arunachalam, MDS, AIMST University, Malaysia. rajeevarun80@gmail.com

2. PanimholiA/P Palaniappan, BDS, AIMST University, Malaysia. pani0703.pp@gmail.com

3. Oi Chai Ying, BDS, AIMST University, Malaysia. cyingoi.ocy@gmail.com

4. Nu Fui Pin, BDS, AIMST University, Malaysia   nufuipin@gmail.com

5. Vini Rajeev, MDS, AIMST University, Malaysia. vinirajeev09@gmail.com

Correspondence Author– Dr. Rajeev Arunachalam, rajeevarun80@gmail.com, 0164055204