



ISSN: 0975-833X

Available online at <http://www.journalcra.com>

INTERNATIONAL JOURNAL
OF CURRENT RESEARCH

International Journal of Current Research
Vol. 14, Issue, 03, pp.21010-21013, March, 2022
DOI: <https://doi.org/10.24941/ijcr.43285.03.2022>

RESEARCH ARTICLE

ASSOCIATION BETWEEN BODY MASS INDEX AND DENTAL CARIES IN 19-59 YEARS AGE GROUP OF SUBURBAN POPULATION OF NORTH KOLKATA, WB

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ARTICLE INFO

Article History:

Received 24th December, 2021
Received in revised form
19th January, 2022
Accepted 24th February, 2022
Published online 30th March, 2022

Keywords:

Body Mass Index,
Dental Caries Prevalence,
DMFT.

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ABSTRACT

Background: Oral diseases, especially dental caries has high rate of prevalence in most developing countries. The primary cause of this condition is an imbalance between calorie intake and calorie consumption. Because dental caries is associated with poor dietary habits and inappropriate diets promote obesity, this study was conducted to find out whether Body Mass Index affects the prevalence of dental caries. **Methods:** Based on a pilot study, sample size calculation was performed. A total of 198 patients of 19-59 years age group attending the outpatient department of Conservative Dentistry & Endodontics were randomly selected for the study. Dental caries was scored using DMFT index. BMI was calculated according to the formula: $\text{weight (kg)/height}^2 \text{ (m}^2\text{)}$ **Results:** The DMFT index scores were relatively different among the different BMI groups, in which normal weight individuals revealed the highest value and underweight showed the lowest value and the differences were not statistically significant. **Conclusion:** Based on the results of this study, no statistically significant association between BMI and dental caries prevalence was found. For more conclusive results to be extrapolated to a larger population, further studies need to be conducted on higher sample size.

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Citation: Dr. Paromita Mazumdar, Dr. Tanmoy Saha, Dr. Sayantan Mukherjee and Dr. Santanu Sen Roy. "Association between Body Mass Index and dental caries in 19-59 years age group of suburban population of North Kolkata, WB", 2022. *International Journal of Current Research*, 14, (03), 21010-21013.

INTRODUCTION

Obesity and caries are both major concerns of public health and have disrupted lifestyle of children and adolescents worldwide (1, 2). Both adversely impacts on wellbeing of life and are responsible for major costs to the society (1, 3). The relationship between weight status and caries is largely investigated as health problems related to growth and development and with oral disease have common pathway through dietary behaviours (4-9). Body mass index is an anthropometric measurement which measures weight relative to the height.

Though it is often used to estimate the level of body fat in individuals, it provides an excellent indicator of obesity-related health risks such as cardiovascular diseases, musculoskeletal diseases and certain types of cancer like breast, prostate, liver, and colon cancer (10). Dental caries is a multifactorial disease affected by both modifiable risk factors like dietary factors, water fluoride levels, tooth brushing frequency, and nonmodifiable risk factors like socioeconomic status and previous caries experience. The focus now is shifted to modifiable factors, specifically diet, in the prevention of dental caries.

The world is witnessing an increasing number of overweight individuals due to the consumption of fast food and soft drinks accompanied by lack of physical activity and exercise (11). Prolonged exposure to carbohydrates can result in obesity. Excessive consumption of refined carbohydrates, especially sugar in its refined form, leads to higher risk of dental caries and being overweight and obese (12). An association between BMI and dental caries is assumed on this possibility. The Scientific Advisory Committee on Nutrition (London) reported such association of higher consumption of free sugars with dental caries. The consumption of sugar-sweetened beverages too leads to increase in BMI. The aim of this study is to assess the prevalence of dental caries, and to identify if there is any relationship between body mass index and dental caries in adult population of Panihati, Sodepur, West Bengal.

METHODOLOGY

Study design: Cross-sectional study was conducted to determine the association between body mass index and prevalence of dental caries. The *null hypothesis* postulated was that there is no difference in dental caries prevalence in the patients with varying body mass index.

Ethical Approval: The study was approved by the Institutional Review Board-IRB (Research Ethics Committee) at Guru Nanak Institute of Dental Science & Research, Kolkata. (IEC No: GNIDSR/IEC/19-22/27). Participation of each participant was voluntary and informed consent was obtained before commencement of the study. Patient information sheet was distributed to each subject.

Study population: Panihati is a locality in suburban Kolkata having a population of 3.77 lakhs (2011 census data). Patients residing within the limits of Panihati Municipality and attending the outpatient department in conservative and endodontics department of Guru Nanak Institute of Dental Science & Research, Kolkata were randomly selected for the study.

Sample Size Calculation: P value <0.05 was considered to be significant for this study. Considering effect to be two-sided, value of Z_{α} was calculated to be 1.96. Power of study was assumed to be 90% and $Z_{1-\beta}$ = 1.28 was obtained. An effect size of 1.25 was considered to be statistically significant and applying the formula $n > 2(Z_{\alpha} + Z_{1-\beta})^2 \times SD^2/d^2$, $n = 39$ was derived. Total sample size of 198 subjects was considered for the study.

INCLUSION CRITERIA

Patients residing within the limits of Panihati Municipality, belonging to 19-59 years age group irrespective of gender were selected for the study.

EXCLUSION CRITERIA

Patients who did not consent to participate in the study following an initial briefing were excluded. Patients with developmental disorders of teeth, systemic diseases and mental disabilities were excluded from the study.

Clinical examination: The intraoral examination of the participated subjects was carried out in a dental chair under visible light using sterile disposable mouth mirrors and sterile

community periodontal index (CPI) probe to visually examine the caries on the occlusal, incisal, buccal and lingual surfaces. (according to Oral Health Survey; Basic Methods; WHO 1997). Type III oral examination was employed in this study. (13). The same person who clinically examined the subjects, recorded the values of DMFT.

CALCULATION OF BMI: BMI was measured to classify the obesity and overweight of study subjects (3). The height and weight of subjects were measured using calibrated digital scale. The recording was done by the same clinician who inspected the patient for dental caries. BMI was calculated according to the formula: weight (kg)/height² (m²) (14). Participants were divided into groups depending on their BMI according to WHO criteria into four groups: obese (BMI >30 kg/m²), overweight (BMI 25-30 kg/m²), normal weight (BMI 18.5-25 kg/m², or underweight (BMI <18.5 kg/m²).

STATISTICAL TOOLS

Categorical variables were expressed as number of patients and percentage of patients and compared across the groups using Pearson's Chi Square test for Independence of Attributes/ Fisher's Exact Test as appropriate. Continuous variables were expressed as Mean, Median and Standard Deviation and compared across the groups using Kruskal Wallis Test since the data did not follow normal distribution. The statistical software SPSS version 20 had been used for the analysis. An alpha level of 5% had been taken, i.e. if any p value is less than 0.05 it had been considered as significant.

OBSERVATION AND RESULTS

A total of 198 patients participated in the study out of which 113 were male and 85 were females; their BMI illustrated in table 1. The majority of participants (n=104) were of normal weight, while 21.7% (n=43) were overweight, and 17.7% out of them were obese (n=35). Underweight individuals constitute the minority of patients (n=16) (8.1%).

TABLE 1. Distribution of individuals according to BMI

BMI	Frequency	Percent
UNDER WEIGHT	16	8.1
NORMAL	104	52.5
OVER WEIGHT	43	21.7
OBESE	35	17.7
Total	198	100.0

As shown in Table 2, the mean values of DMFT in normal, obese and overweight were 8.49, 7.69 and 7.23 respectively while in underweight it was reported as 7.23. The DMFT index scores were relatively different among the different BMI groups, in which normal weight individuals revealed the highest value and underweight showed the lowest value and the differences were not statistically significant.

TABLE 2. Association between BMI and dental caries

BMI	DMFT		
	Mean	Median	Std. Deviation
UNDER WEIGHT	7.00	6.00	5.203
NORMAL	8.49	7.00	4.573
OVER WEIGHT	7.23	7.00	4.064
OBESE	7.69	6.00	4.632
p Value	0.268		
Significance	Not Significant		

The *null hypothesis* was thus rejected and an alternative hypothesis was postulated that there is difference in dental caries prevalence in the patients with varying body mass index.

DISCUSSION

What is already known on this topic: Changes to lifestyle and diet since the mid-1990s, for example due to increased affluence and access to high caloric carbohydrate-rich foods and drinks, may help account for the rising prevalence in dental caries and obesity since that time period (15,16) The relationship between BMI and dental caries is indecisive. A 2012 systematic review that included 48 papers assessed the potential relationship between BMI and dental caries in children and adolescents, found no association in 23 studies, while the remaining 25 studies found the opposite, making a decisive conclusion impossible (17). However, it is important to note that most of the previous studies that found a relationship between dental caries and BMI, either positive or negative, were conducted on children or adolescents aged less than 18 years. On the other hand, few studies were conducted to test this relationship among adult subjects. Moreover, a systematic review conducted in 2006 demonstrated that only one study with a high level of evidence showed a direct and significant association between dental caries and obesity (18).

Main findings of this study: The present study found no statistically significant relationship between dental caries and body mass index. People with normal BMI had the highest mean DMFT whereas underweight patients had lowest DMFT. But patients with obesity had more caries than both underweight and overweight subjects. Few studies conducted by Kumar (2017) (19), Gupta, *et al.* (20), Begum *et al.* (21), Alves *et al.* (22), and Shakya *et al.* (23) showed no association between body weight and dental caries, which might be attributed to the fact that both obesity and dental caries are multifactorial in etiology and various genetic and environmental factors have an impact on them. Changes in dietary pattern like increased consumption of soft drinks, fast food, sticky food and refined sugars have led to significant dietary changes among populations, and are considered to be common risk factors for obesity as well as dental caries. Given the strong evidence supporting the association of dental caries with irregular dietary patterns and quality and the fact that abnormal dietary intake has been linked to the development of obesity at a young age, a link between dental caries and body weight is biologically plausible (24). Caries is higher in obese subjects due to increased intake and prolonged exposure to carbohydrates in various dietary forms. The possible reason could be due to high family income that has led to easy access to high caloric food (fast foods and junk foods) and less physical activity. Another biological mechanism that could link obesity and caries is the reduced stimulated saliva flow that has been found among obese teenagers when compared to their healthy peers (25) However, other authors reported that excessive consumption of fatty foods has less influence on the development of caries than diets rich in sugar, which could be somewhat responsible for the lack of association between obesity and the presence of caries observed in some studies like this study (26). The use of longitudinal data including information on various points of time is important because obesity in early life often leads individuals to change their habits to reduce body weight, resulting in a change in BMI scores.

However, the scores for caries by means of DMF can remain high because this index considers caries throughout the individuals' lives (26). Another factor which can affect the relationship between weight status and caries is the method used to assess weight status. BMI cannot differentiate between fat, muscle or bone mass (5). However, the evidence of a relationship between obesity and caries is also not consistent when different measures of obesity (e.g. waist circumference, skinfold thickness) or more accurate laboratory methods of body composition assessment (e.g. Dual-energy X-ray Absorptiometry-DXA, air displacement plethysmography) are used (4,5,27,28). Further studies using different indicators of obesity in different age groups, as well as more accurate methods of assessment may well provide more accurate insights into the real nature of the relationship between obesity and caries. However, whether such studies can be justified is debatable, as their conduct would be extremely expensive.

The method of assessing and diagnosing dental caries is also an important factor. This study used visual examination of decay, which meant it estimated the level of caries in the population differently from those that used radiographs which have a different diagnostic accuracy. Differences in the methods used to assess caries may therefore have distorted the effect size of a relationship between BMI and caries with other studies (29).

Another consideration is the population's access to oral health services and the use of fluorinated substances. This study did not consider the various confounding variables like socioeconomic factors, dietary pattern, and oral hygiene practice which could have played a major role in the establishment of a relationship. These factors are considered as potential effect modifiers that may lead to a weak or negative association between obesity and caries (30). Similar studies conducted by Ambarkova and Gracija(31) Alkarimi, *et al.* (32) Sudhakar *et al.*,(33) and Kopycka-Kedzierawski, *et al.* (34) showed a negative association between obesity and dental caries which are in sharp contrast in results with this study. Whereas the studies conducted by Chopra *et al.*, (35) Costacurta, *et al.* (27) Parkar and Chokshi,(36) and Trikaliotis *et al.* (37) reported a positive association between body weight and dental caries. The relationship between BMI and dental caries is thus indecisive.

Conclusion

There was no positive association found between BMI and dental caries. Subjects with normal weight were most susceptible to dental caries. Obese individuals had more score of dental caries than overweight and underweight subjects.

Limitations

The cross-sectional nature prevented the discovery of any cause and effect relationship between the variables. Another limitation was lack of information on the nutritional behaviour of subjects. Limitations include small sample size and data collection isolated to a single centre.

Further directions

Larger studies with a multicentre approach are needed, as are studies with an intervention approach in order to establish causality. There is need to identify associations and evaluate the weight of each variable as possible risk factors that may

have a correlation if a larger sample size was to be considered. Well-designed and appropriately powered longitudinal studies examining the relation between different measures of obesity and caries at different life stages are needed. The impact of confounders and effect modifiers should also be thoroughly examined in future studies

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