

# Title

Author

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## Abstract

**Background:** Dental caries is a multifactorial, infectious, and transmissible disease, which affects a high percentage of the population in all parts of the world. Dental caries is usually caused by frequent intake of fermentable sugars, which may lead to obesity and as a result association between dental caries and obesity has long been suspected.

**Objectives:** This study aims to assess the relationship between body mass index (BMI) and dental caries experience among the people of Maredumilli of East godavari district of Andhra Pradesh

**Materials and Methods:** A cross-sectional study was conducted among the people of Maredumilli of East godavari district of Andhra Pradesh to assess the relationship between body mass index (BMI) and dental caries experience. Obesity was recorded by measuring the BMI. Dental caries experience was recorded using the World Health Organization's recommended "decayed missing and filled teeth (DMFT)" method.

**Results:** The overall prevalence of dental caries was 96.3% and the average BMI of study participants was 25.29±5.05. The mean DMFT scores among the obese (11.08) group was high when compared to the overweight, normal and underweight and the least DMFT scores was seen among the normal and underweight and the difference was statistically significant with  $p < 0.001^*$ . females has more DMFT and BMI when compared with males. there is significant positive correlation between the BMI and DMFT

**Conclusion:** the DMFT score was more among the obese people when compared with the normal and underweight people

**Keywords:** BMI, Dental caries, Adult population

Date of Submission: 18-04-2026

Date of Acceptance: 28-04-2026

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## I. Introduction

The World Health Organization (WHO) defines health as a condition of physical, mental, and social well-being rather than the absence of disease or infirmity<sup>1</sup>. Body mass index (BMI) is a simple index of weight for height and is commonly used to classify overweight and obesity in adults. Body Mass Index (BMI) is divided into four categories according to Asian classification: Underweight (<18.5 kg/m<sup>2</sup>), normal weight (18.5–22.9 kg/m<sup>2</sup>), overweight (23–24.9 kg/m<sup>2</sup>) and Obese (≥25–29.9 kg/m<sup>2</sup>).<sup>2</sup> Since 1975, the global rate of obesity has nearly tripled. In 2016, over 1.9 billion people aged 18 and older were overweight (39% of the total). Over 650 million of these were obese (13% of the total).<sup>3</sup> Most of the world's population live in countries where overweight and obese kill more people than underweight.<sup>4</sup>

Obesity is defined as a condition of abnormal and excessive fat accumulation in adipose tissue to the extent that health may be adversely affected.<sup>5</sup> It is a global epidemic, and the World Health Organization (WHO) estimates that it is the fifth leading cause of mortality worldwide.<sup>6,7</sup> Obesity rates have doubled within the last 20 years in many developing and developed countries.<sup>8</sup> Moreover, it is a risk factor for many diseases such as type 2 diabetes, hypertension, hyperlipidemia, cerebrovascular diseases and certain types of cancers.<sup>9-12</sup> The rapid cultural and social changes that have occurred in the Gulf region since the discovery of oil and the subsequent economic boom of the 70s and 80s have been associated with an alarming increase in obesity.<sup>13-17</sup>

Diet plays an important role in the increased prevalence of obesity due to the higher consumption of foods rich in fat and carbohydrates. Apart from that lack of physical activity, increasing sedentary lifestyles and dietary changes are other factors that are strongly associated with the development of obesity. Moreover, individuals who are obese often are exposed to an unhealthy diet that focuses heavily on sugar as well as sweet foods and drinks.<sup>18</sup>

Such a diet pattern promotes both obese conditions and the development of tooth decay.<sup>19</sup> Thus, obesity can be associated with dental caries, through greater availability of cariogenic factors, modulated by oral hygiene habits. Given the causal relationship between refined carbohydrates and dental caries, it is appropriate to hypothesize that being overweight might also be a marker for dental caries among the population.<sup>20</sup>

Dental caries is a multifactorial, infectious, and transmissible disease, which affects a high percentage of the population in all parts of the world.<sup>21</sup> In recent times, the prevalence of caries has increased in developing nations due to an array of factors, such as intake of sugary foods, low socioeconomic status, exposure to fluorides, ethnicity, age, the limited access to oral health services, and other lifestyle factors.<sup>22</sup> The results of previously conducted studies have shown that change in dietary patterns among the population is contributing to obesity and

also acts as a risk factor for the development of dental caries by acting biologically plausible

Dental caries is usually caused by frequent intake of fermentable sugars, which may lead to obesity and as a result association between dental caries and obesity has long been suspected.<sup>23-26</sup> The main goal in understanding this association is to measure the possible confounding variables that include the diet, income, age, oral hygiene habits, and use of fluoridated water in a standardized manner.<sup>27</sup> It has been suggested that the intake of sugar-sweetened beverages and frequent consumption of high caloric diet that is associated with weight gain and leads to obesity.<sup>28</sup> 62% adults in Bagdad<sup>29</sup> and 63.4% in India<sup>30</sup> are affected with the dental caries. Bafti et al.<sup>31</sup> reported an inverse relationship of association between underweight and a higher mean decayed, missing, filled teeth (DMFT). de Jong-Lenters et al., in his study, reported that there are more carious lesions in overweight children.<sup>32</sup> Bernabé et al. reported that there is a greater risk of dental caries in adults who regularly consumed sugar sweetened drinks.<sup>33</sup> The results of systematic review conducted by Hooley et al.<sup>34</sup> reported that there is still significant differences to the existence and nature of an association between dental caries and BMI. A study conducted by Alswat et al.<sup>35</sup> reported positive correlation between dental caries and BMI in adults.

Studies reported in the literature, mainly assessed the relationship between obesity and dental caries among schoolchildren, with seemingly scanty information on the general population. Hence, the present cross-sectional study aimed to assess the relationship between BMI and dental caries among the adult patients of maredumaili mandal of East Godavari district, Andhrapradesh .

## II. Methodology

A descriptive cross-sectional study was carried out between the months of March 2025 and August 2025, to study dental caries experience in relation to body mass index among the people East Godavari district of Andhra Pradesh

**Source Of Data:** The source of data was primary in nature and it was obtained from a survey, clinical examination.

**Study Setting:** The study was conducted in people aged 15 years and above of 10 randomly selected villages of East Godavari district, Andhra Pradesh.

**Study Population:** The survey was carried out among people aged 15 years and above of 10 randomly selected villages of East Godavari district, Andhra Pradesh

### Inclusion Criteria:

- Subjects with the age range between 15 to 65
- Subjects who are present at the time of survey.
- Subjects who are willing for oral examination

### Exclusion Criteria:

- Subjects who are not available at the time of study.
- Subjects who are not willing or uncooperative to participate in the study.
- Subjects who did not give consent to the examination.

### Ethical Clearance:

The ethical clearance was obtained from the institutional review board of Peoples Dental College, Bhopal, Madhya Pradesh

### Study Variables:

Independent variable:

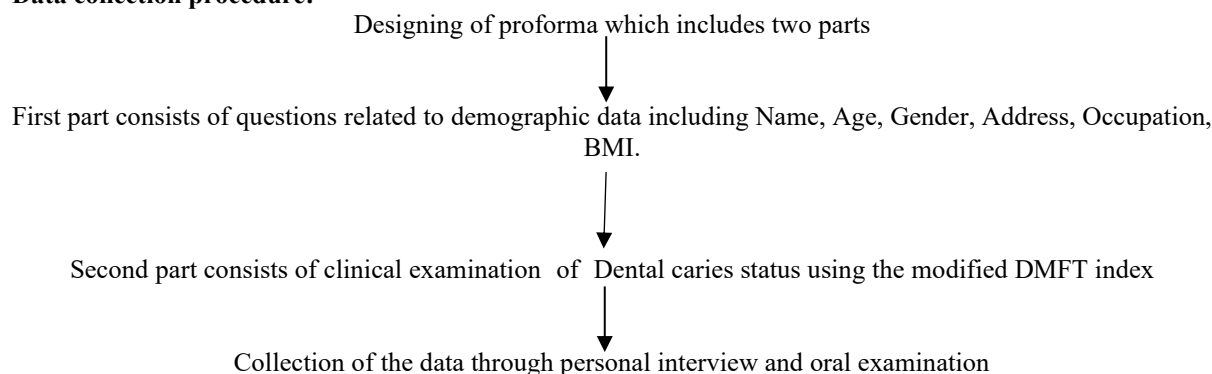
- Age Group
- Gender
- Body Mass Index

Dependent variable:

- Dental caries

### Apparatus And Materials:

Mouth mirrors, Explorers, tweezers, CPI probes, cotton holders, Savlon, Sterilized cotton, Disposable gloves, Disposable glasses, Specially designed proforma, stationary, weighing machine and measuring tape

**Data collection procedure:****Training And Calibration:**

Before starting the study, multiple sessions of training for the assessment of clinical parameter was performed with a calibrated professional in the Department of public health dentistry, Peoples dental college.

**Sample Size:**

The sample size was estimated based on prevalence of dental caries reported in the previous studies<sup>11</sup>. The formula used for the estimation of the sample size was

$$n = \frac{4 \times p \times q}{L^2}$$

n = Sample size  
p = Prevalence (70 / 100 = 0.70)  
q = 1 - p (1 - 0.70 = 0.30)  
L = 3.5

$$n = \frac{4 \times 0.70 \times 0.30}{(3.5)^2}$$

N = 685

After substitution of the values the sample size was arrived at 685, which was rounded off to 700.

**Sampling Methodology:**

Maredumilli is a manda in Eastgodavari district of andhrapradesh, this maredumilli mandal comprises of 70 villages and the total population in maredumilli was 19507 of which 10166 were males and 9341 were females. Out of 70 villages, 10 villages were randomly selected and from each village 70 people aged 15 years and above were selected randomly and were examined.

**Statistical analysis:**

Statistical analysis was performed using appropriate statistical tests and SPSS software programme version 22. Independent t test was used to check the association between gender, BMI and dental caries. Anova test followed by posthoc tukey was used to test the dental caries among the different BMI categories and pearson correlation test was used to check correlation between the BMI and dental caries .

**III. Results**

A total of 700 participants were examined in the study of which 403 were females and 297 were males. The overall prevalence of dental caries was 96.3% and the average BMI of study participants was 25.29±5.05

Table 1: Demographic details

Demographics		
Gender	Females	403(57.6)
	Males	297(42.4)
Age		40.1±15.2

Table 1 shows the demographic details of the study population the females participants accounted for 57.6% and male participants accounted for 42.4%. the females participants were more when compared with males

Table 2: gender wise comparison of BMI and DMFT

Parameter	Gender	Mean $\pm$ SD	tvalue	pvalue
BMI	Females	25.8 $\pm$ 5.55	2.4	0.017*
	Males	24.1 $\pm$ 4.36		
DMFT	Females	9.9 $\pm$ 4.5	7.26	<0.001*
	Males	7.52 $\pm$ 4.01		

Independent t test  $p < 0.05$ \* significant

Table 2 shows the gender wise comparison of BMI and DMFT among the study population

The mean BMI values among the females and males in the study population was 25.8 $\pm$ 5.55 and 24.1 $\pm$ 4.36 respectively and the difference was statistically significant with  $p = 0.017$ \*. the females showed more mean BMI when compared with males

The mean DMFT values among the Females and males in the study population was 9.9 $\pm$ 4.5 and 7.52 $\pm$ 4.01 respectively and the difference was statistically significant with  $p < 0.001$ \*. the females showed more mean DMFT when compared with males

Figure:

Table 3: comparison of BMI levels among the males and females

BMI	Females	Males	$\chi^2$ value	pvalue
Obese	85(21.1)	38(12.8)	9.35	0.03*
Over weight	94(23.3)	83(27.9)		
Normal	196(48.6)	159(53.5)		
Underweight	28(6.9)	17(5.7)		

Chisquare test  $p < 0.05$ \* significant

Table 3 shows the distribution of males and females according to the BMI. 21.1 % of the females and 12.8% of the males were obese, 23.3% of females and 27.9% of males were overweight. 53.5% of males and 48.6% of the females were normal weight

Table 4: comparison of DMFT among various BMI groups

BMI	mean DMFT	SD	f value	pvalue
Obese	11.08	4.13	21.1	<0.001*
Over weight	9.73	4.27		
Normal	7.85	4.32		
Underweight	7.89	4.65		

Oneway anova  $p < 0.05$ \* significant

The mean DMFT scores among the obese (11.08) group was high when compared to the overweight, normal and underweight and the least DMFT scores was seen among the normal and underweight and the difference was statistically significant with  $p = < 0.001$

Table 5: multiple comparison using posthoc tukey

BMI	Obese	overweight	Normal	Underweight
Obese	Mean difference	—	1.35	3.23
	pvalue	—	0.038*	<.001*
overweight	Mean difference	—	1.88	1.8456
	pvalue	—	<.001*	0.050*
Normal	Mean difference	—	—	-0.0382
	pvalue	—	—	1.000(NS)
Underweight	Mean difference	—	—	—
	pvalue	—	—	—

Post hoc tukey  $p < 0.05$ \* significant

Table shows the multiple comparisons using posthoc tukey statistically significant difference in DMFT scores obese – overweight, obese – normal, obese – underweight, overweight – normal and overweight – underweight

Table 6: correlation between the BMI and dMFT

Pearson correlation	DMFT	
BMI	Pearson's r	0.247
	df	698
	p-value	<.001

Table 6 shows the correlation between BMI and dental caries, positive correlation with r value 0.247 was seen between the two variable and the correlation was statistically significant with  $p=0.001^*$

#### IV. Discussion

Obesity is a global public health issue in the 21st century. The rates of obesity are rising daily in both developed and developing countries. WHO reported an increase of 10–30% in the prevalence of obesity between the years 1980–1990 according to the results of the MONICA (monitoring trends and determinants in cardiovascular disease) study, which was conducted in six different sites in Asia, Africa and Europe for a duration of 12 years. Between 1980 and 2008, the prevalence of obesity doubled in the world. In 2008, 10% of males and 14% of females became obese (BMI  $30 \text{ kg/m}^2$ ), although the rates were 5% for males and 8% for females in 1980. In 2008, approximately 205 million males and 297 million females over the age of 20 became obese, which accounts for more than half a billion adults all over the world. In Australia, one in four children and two in three adults are either obese or overweight<sup>37</sup>

Caries severity and prevalence are significantly affected by several factors including age, educational background, socioeconomic status, genetic susceptibility, fluoride percentage in drinking water, and level of dental awareness. BMI is also one factor that affects the dental caries. Consequently, study of caries-related factors is complex. These variables explain the inequality in the dental caries scale among various studies. The severity of dental caries worldwide ranges greatly, from less than 5 to more than 20 (DMFT index).<sup>38</sup> Dental caries has now become a public health problem regardless of age. Though dental caries has been found to affect young children, it also tracks across adolescence, adulthood, and into later life persisting as a chronic and progressive condition. Majority of the epidemiological studies done in India have been conducted mainly on children rather than adults<sup>39</sup>. This descriptive cross-sectional study had been conducted in the community among adults encompassing 10 villages of maredumilli area of East Godavari district of Andhra Pradesh.

In the present study, we evaluated the association between obesity and caries experience (DMFT) in a representative sample of patients belong to the 10 villages of Maredumilli area of east Godavari district. The prevalence of dental caries at 96% in this study was found to be much higher compared to studies conducted in other parts of the country by Duraiswamy et al in Rajasthan<sup>38</sup>, Binod Kumar Patro in Delhi<sup>40</sup> Alswat et al<sup>35</sup>, Anju Khapung et al among Nepal population<sup>39</sup>

In the present study the BMI of males was less when compared with the female population and Most of the population in males and females belong to the normal range BMI and this was in accordance with the study done by Kumar Raja et al in Chennai<sup>40</sup> Idrees M et al<sup>41</sup> Akarsu S et al<sup>37</sup> in Turkish population and the results of the study was contradictory to the study done by Alswat et al<sup>35</sup>

In this study, mean DMFT was observed to be less in males than females. A possible reason could be lifestyle patterns of both the genders, leading to changes in dietary patterns. This was similar to the studies done by Kumar Raja et al in Chennai<sup>40</sup>

In the current study, it was found that the prevalence of decayed among overweight participants was high thereby suggesting a significant association between BMI scores and caries prevalence. These findings were similar to the study conducted by Hamasha et al<sup>42</sup> in Saudi Arabia. A person's oral health deteriorates when their BMI score rises beyond the normal category. However, it was in conflict with the study conducted by Swaminathan et al<sup>43</sup>, which suggested that having a higher BMI did not have any detrimental effect on a person's oral health.

The mean DMFT among the obese was high followed by the overweight and normal weight this result was in accordance to the study done by Akarsu S et al in Turkish population<sup>37</sup>, this was contradictory to the study done by Idrees M et al<sup>41</sup> where underweight showed more DMFT when compared to the other categories,

Khaled Alswat et al<sup>44</sup> conducted a study on a group of 385 individuals with a mean age of 28.39 years and reported that 55.3% of individuals were obese or overweight and DMFT index was 6.55. They observed a significantly positive correlation between the BMI and DMFT index. Verma et al<sup>45</sup> conducted a study on 1125 adults aged between 25 and 44 years and reported that 21.2% were either overweight or obese and that DMFT index was 4.39 and 5.53 in the overweight and obese individuals, respectively. They also reported a significantly positive correlation between the BMI and DMFT index. These findings were similar to our study where there is significant positive correlation between BMI and DMFT was observed. These findings were contradictory to the studies done by Kantovitz KR<sup>45</sup> and Kim YS<sup>46</sup> et al where there is no correlation between the BMI and dental caries was seen.

#### V. Limitations:

One of the main limitations of the study includes the small sample size and data collection being confined to a single center of east Godavari district. So the results could not be generalised

## VI. Recommendations:

Studies with a large sample and multicenter approach are needed in the future. Indeed, this study had a cross-sectional design, which limits the ability to identify causality. Therefore, a longitudinal design is needed in the future to explore cause and effect relationships in this regard. Since obesity and dental caries share some common multifactorial etiologies, further studies are needed to explore the possible confounding factors influencing this association. Necessary steps should be taken by the health professionals, to arrange frequent dental examinations among the vulnerable groups and data should be collected in this regard so that policy-makers can formulate effective preventive strategies to prevent obesity as well as dental caries among the population

## VII. Conclusion

The study concludes that the overall prevalence was high in the study population ie 95.3. Females has more DMFT and BMI when compared to the males and the difference was statistically significant and the people with the obese BMI has more DMFT when compared with the other categories of BMI and the difference in the DMFT among the BMI categories was statistically significant

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