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# Weight status related to Dental Caries in Children Attending Pediatric Clinics at the College of Dentistry, Uruk University

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**Abstract** Dental caries (often referred to as tooth decay) represents a major health issue for children worldwide. It stands as one of the most common chronic diseases in pediatric demographics, impacting millions of youngsters annually. Body mass index is an anthropometric measurement which measures weight relative to the height, The relationship between weight loss and tooth decay has become a controversial health issue in various countries, diet among overweight or obesity children may be a common risk factor for overweight children and dental caries.This study aims to investigate and analyse the relationship between weight status and dental caries in children. This cross-sectional comparative study was carried out at the pediatric clinic located in the College of Dentistry (Uruk University, Iraq) from April 2023 to June 2023. It involved a sample of 100 children ranging in age from 4 to 14 years, categorized into four distinct groups: underweight, overweight, at-risk weight and healthy weight, with 25 children in each group. The Body Mass Index was calculated; however, dental caries were assessed using the decayed, missing and filled surfaces (dmfs/DMFS) index, in accordance with WHO criteria. The study revealed that there were no difference in mean value of tooth decay across the four weight categories. However, noticeable disparities in body mass index (BMI) were evident among the groups (p = 0.000). In the group, a negative relationship between BMI and dmfs was identified; on the other hand, a positive connection was observed between BMI and DMFS in the underweight group. weight status influences dental caries in children. Underweight children showed a trend of higher caries in primary teeth, while at risk weight children exhibited fewer caries in permanent teeth. Weight status affects caries differently depending on weight categories. This suggests that both low and high weight may impact tooth development and susceptibility to caries through different factors.

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**Keywords:** *Dental caries, Nutrition, Pediatric, BMI, DMFS, dmfs.*

## 1. INTRODUCTION

Tooth decay (commonly referred to as caries) represents a significant health issue that affects children worldwide. This condition is not merely a temporary problem; rather, it is a chronic issue that impacts young individuals annually. Early onset of cavities can result in pain and infections (which are detrimental) and can potentially affect a child's overall health and happiness. The development of tooth decay involves a complex interaction between various factors: eating habits, hygiene and the presence of cavity-causing bacteria. [1], [2]. The unhealthy lifestyles include excessive consumption of sugar and high fat diet, Studies have argued that dental caries is correlated with increasing weight, which was attributed to sugar consumption, Other studies argued that dental caries negatively impacts children's growth, practically in low income countries and communities . Direct effects of dental caries, associated pain and inflammation impact children's ability to eat and result in poor dietary intake that contributes to stagnation of weight and height gain [3], [4]. On the other hand, there is evidence that being malnourished, underweight or stunting might affect the development of dental cavities , nutritional transitions in children and the patterns of obesity, under nutrition and dental caries occurring simultaneously among children provide a good opportunity for assessing this bidirectional association[1], [5]. The association between oral health status and weight of patients is a subject of controversy. This debate is partially attributed to the nature of the published studies as population sampling has focused on schoolchildren. Consumption of soft drinks and fast food together with minimal activity and exercise is contributing to an increase in the number of people who are overweight around the world. High sugar intake, for example sugar-containing snacks and soft drinks, is reported to be more common in children/adolescents who are overweight and obesity compared to those of normal weight. Frequent sugar intake is also a recognized risk factor for dental caries. Thus, diet among overweight or obesity children may be a common risk factor for overweight children and dental caries [6], [7]. Tooth loss

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and caries may also be associated with both obesity and weakness. Weight loss can be seen in children who have difficulty feeding due to early tooth loss and painful teeth. Severe dental caries can reduce the action of eating and thus cause weight loss [8].

**Objectives**

The primary objective of this research is to explore and comprehend the relationship between children's weight status and tooth decay.

## 2. MATERIAL AND METHODS

This cross-sectional and compartive study was carried out at Pediatric Clinic College of Dentistry/Uruk University in Iraq, spanning from April 2023 to June 2023. The research involved 100 children, aged from 4 to 14 years, who were categorized into four groups: 25 children classified as underweight, 25 identified as overweight, 25 deemed at-risk weight and 25 who were healthy.

**Sample Size**

The sample size calculation was performed using G*Power version 3.1.9.7 for a one-way ANOVA with four groups, targeting 85% power, and a 5% significance level. Based on a medium effect size, the total sample size required was 100 participants, 25 participants per group.

Ethical approval (Project No. 234006) was secured from the scientific committee at Uruk University's College of Dentistry. The weight was recorded via an electronic digital scale and rounded to the closest 1 kg. The BMI was calculated by dividing the weight in kilogrammes by the square of the height in meters. The Body Mass Index (BMI) was classified into four categories: underweight (BMI < 18.5), normal weight (BMI 18.5–24.9), overweight (BMI 25–30), and at-risk weight (BMI > 30) [9].

**Inclusion Criteria**

Selection of cases based on the followings:

1. They were already diagnosed with dental caries.
2. Cooperative child.
3. age range 4 to 14 years

**Exclusion Criteria**

1. Children known by their medical history that they suffering from any systemic disease which could influence the severity of dental caries or the occurrence of periodontal diseases, such as periodentitits and gingivitis.
2. Un cooperative child.
3. Children who their parents refuse their participation in the study.

**Oral Examination:**

The clinical examination and evaluation of the oral health of each participant was performed under standardized condition described in the oral health survey of the WHO (2013). During examination, a suitable comfortable chair was used with noticing that it supports the head of the child [10].

Dental caries experience was recorded according to the decayed, missing, filled index (dmfs/ DMFS) according to the criteria of WHO (2013)[10] using a CPI probe.

**Statistical analysis**

The data analysis was conducted using SPSS Ver. 26.0 and Excel 2019. The data from the current study underwent thorough testing for normality to determine whether it followed a parametric or non-parametric distribution. Consequently, Chi-Square tests, LSD (Least Significant Difference) and Pearson Correlation analyses were conducted. Level of significance as: Not significant P>0.05, Significant P<0.05.

## 3. RESULTS

Using the Shapiro-Wilk test, the data was found to follow a normal distribution. The age distribution of children across weight categories (healthy, underweight, overweight, and at-risk weight) was analyzed using Chi-Square tests and is presented in Figure 1.

The mean ages are 9.44, 8.36, 9.20, and 8.68 years, respectively. With age range is 4 to 14 years which affect the BMI categorization, with statistical analysis non-significant differences ( p= 0.298) between groups.

The proportions of females (27.6%, 24.1%, 22.4%, 25.9%) and males (21.4%, 26.2%, 28.6%, 23.8%) are similar in each group using Chi-Square tests, with a total count of 58 females and 42 males with a non-significant difference (p =0.844) in gender distribution among the groups. As demonstrated in Figure 2.


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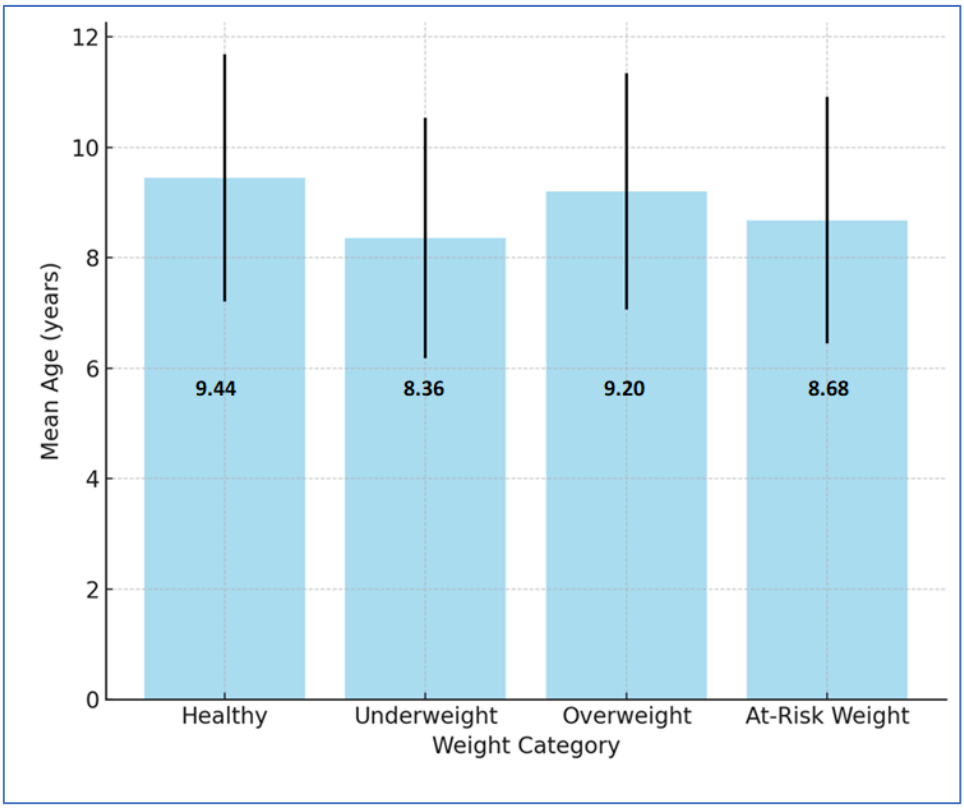


***Figure 1:*** *Demographic data of age*

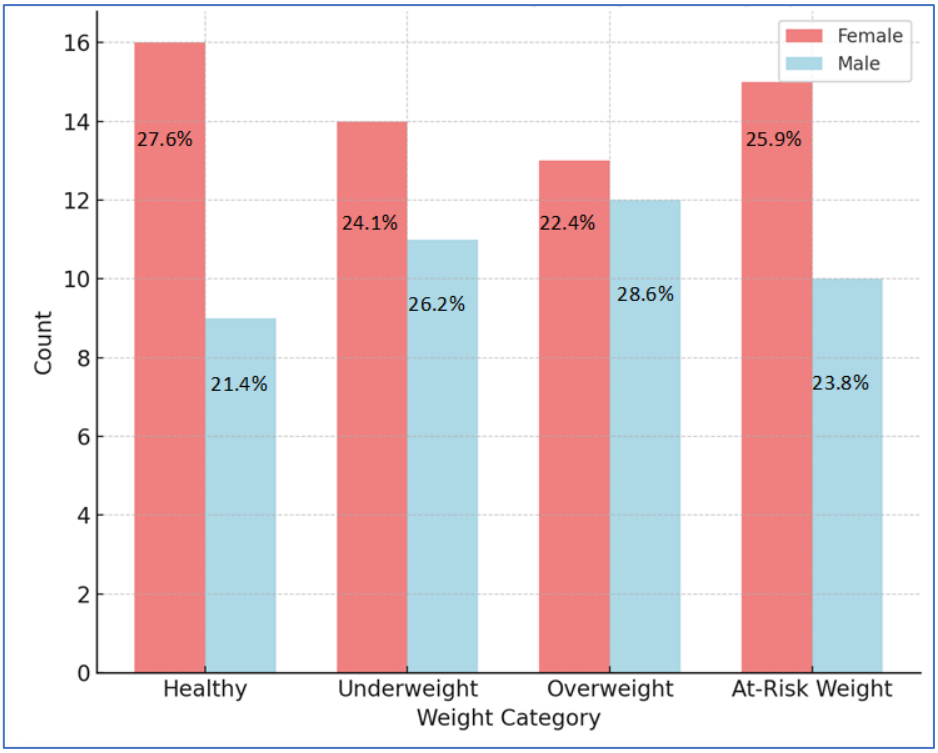


***Figure 2:*** *Demographic data of gender*

Table 1 illustrates the caries experience in primary teeth among four weight groups: healthy, underweight, overweight, and at-risk weight. The mean decayed, missing, and filled surfaces (dmfs) scores are 6.72, 12.04, 8.04, and 6.28, respectively. The statistical analysis shows no significant differences in caries experience across the groups, with F-values of 2.290 (p = 0.083) for decayed surfaces, 0.099 (p = 0.961) for missing surfaces, 0.670 (p = 0.573) for filled surfaces, 1.915 (p = 0.132)



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for dmfs, and 2.422 (p = 0.071) for decayed, missing, and filled teeth (dmft).

***Table 1:*** *Descriptive and statistical test of caries experience of primary teeth among groups*

| groups | | ds | ms | fs | dmfs | dmft |
|---|---|---|---|---|---|---|
| Healthy | Mean | 7.00 | .84 | .88 | 6.72 | 2.84 |
| | ±SD | 7.377 | 2.211 | 2.728 | 6.295 | 3.902 |
| under | Mean | 11.16 | 1.16 | .52 | 12.04 | 5.72 |
| | ±SD | 11.560 | 3.555 | 1.358 | 12.009 | 5.443 |
| over w | Mean | 8.36 | 1.16 | .24 | 8.04 | 4.40 |
| | ±SD | 8.435 | 2.749 | .723 | 9.985 | 4.509 |
| at risk | Mean | 4.68 | .88 | .80 | 6.28 | 2.84 |
| | ±SD | 7.793 | 2.369 | 1.683 | 8.687 | 3.826 |
| F | | 2.290 | .099 | .670 | 1.915 | 2.422 |
| p.value | | .083 | .961 | .573 | .132 | .071 |

Regarding caries experience in permanent teeth across four weight groups: healthy, underweight, overweight, and at-risk weight is observed in Table 2.

The mean decayed, missing, and filled surfaces (DMFS) scores are 4.32, 3.96, 4.48, and 2.68, respectively. With a non-significant difference in caries experience among the groups, with F-values of 1.122 (p = 0.344) for decayed surfaces, 0.724 (p = 0.540) for missing surfaces, 0.453 (p = 0.715) for filled surfaces, 0.607 (p = 0.612) for DMFS, and 1.156 (p = 0.331) for decayed, missing, and filled teeth (DMFT).

***Table 2:*** *Descriptive and statistical test of caries experience of permanent teeth among groups*

| groups | | DS | MS | FS | DMFS | DMFT |
|---|---|---|---|---|---|---|
| healthy | Mean | 3.40 | .68 | .76 | 4.32 | 3.24 |
| | ±SD | 4.123 | 1.574 | 1.332 | 4.732 | 4.216 |
| under | Mean | 4.60 | .20 | .56 | 3.96 | 1.96 |
| | ±SD | 6.461 | 1.000 | 2.022 | 5.381 | 2.282 |
| over w | Mean | 2.88 | 1.12 | .44 | 4.48 | 2.64 |
| | ±SD | 3.100 | 5.600 | .961 | 6.850 | 2.515 |
| at risk | Mean | 2.40 | .00 | .32 | 2.68 | 1.92 |
| | ±SD | 3.379 | .000 | .988 | 3.375 | 2.178 |
| F | | 1.122 | 0.724 | 0.453 | 0.607 | 1.156 |
| p.value | | 0.344 | 0.540 | 0.715 | 0.612 | 0.331 |

The Body Mass Index (BMI) mean value according to weight-status categories. The mean BMI values are 17.0, 16.0, 22.1, and 24.7, respectively. Statistical analysis reveals significant differences in BMI among the groups (p= 0.001). As illustrated in Table 3.



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***Table 3:*** *Descriptive and statistical test of BMI among groups*

| BMI | | | | | |
|---|---|---|---|---|---|
| groups | N | Mean | ±SD | F | p.value |
| healthy | 25 | 17.0 | 2.2 | 6.89 | 0.001 HS |
| under | 25 | 16.0 | 5.0 | | |
| over w | 25 | 22.1 | 14.7 | | |
| at risk | 25 | 24.7 | 1.4 | | |
| Total | 100 | 19.9 | 8.6 | | |

Table 4 shows multiple comparisons of BMI between the four weight groups: healthy, underweight, overweight, and at-risk weight. Significant differences are found between several pairs: healthy vs. overweight (-5.12480, p = 0.024), healthy vs. at-risk (-7.70040, p = 0.001), underweight vs. overweight (-6.08920, p = 0.007), and underweight vs. at-risk (-8.66480, p = 0.000).

No significant differences are found between healthy vs. underweight, overweight vs. at-risk, and at-risk vs. overweight (p>0.05).

***Table 4:*** *Multiple comparisons between groups among BMI*

| Groups combination | Mean Difference | p.value |
|---|---|---|
| Healthy Vs. under | 0.96 | 0.666 NS |
| Healthy Vs. over w | -5.13* | 0.024 S |
| Healthy Vs. at risk | -7.70* | 0.001 S |
| Under Vs. over w | -6.09* | 0.007 S |
| Under Vs. at risk | -8.67* | 0.000 S |
| over w Vs. at risk | -2.58 | 0.251 NS |
| at risk Vs. over w | 2.58 | 0.251 NS |

**. The mean difference is significant at the 0.05 level.*

Table 5 shows the correlation between BMI and caries experience in primary teeth among four weight groups: healthy, underweight, overweight, and at-risk weight. For the healthy group, BMI negatively correlates with decayed surfaces (ds) (r = -0.555, p = 0.004) and dmfs (r = -0.432, p = 0.031). The underweight group shows no significant correlations. In the overweight group, BMI negatively correlates with dmfs (r = -0.142, p = 0.500), but it is not significant. The at-risk weight group shows no significant correlations.

***Table 5:*** *Correlation between BMI and caries experience of primary teeth*

| BMI | Healthy | | underweight | | overweight | | at-risk weight | |
|---|---|---|---|---|---|---|---|---|
| | r | p | r | p | r | p | r | p |
| ds | -.555** | .004 | -.172 | .410 | -.254 | .220 | .124 | .555 |
| ms | -.162 | .439 | -.324 | .115 | -.098 | .641 | -.132 | .528 |
| fs | -.256 | .217 | .088 | .677 | -.049 | .817 | -.151 | .470 |
| dmfs | -.432* | .031 | -.319 | .120 | -.142 | .500 | .036 | .866 |
| dmft | -.303 | .140 | -.199 | .341 | -.275 | .184 | -.009 | .966 |
| | | | | | | | | |

The correlation between BMI and caries experience in permanent teeth across four weight groups: healthy, underweight, overweight, and at-risk weight observed in Table 6. In the healthy group, BMI shows a significant positive correlation with decayed surfaces (DS) (r = 0.434, p = 0.030), DMFS (r = 0.476, p = 0.016), and DMFT (r = 0.471, p = 0.018). In the underweight group, BMI also positively correlates with DS (r = 0.430, p = 0.032) and DMFS (r = 0.426, p = 0.034). In contrast, the overweight and at-risk weight groups show no significant correlations between BMI and any caries experience metrics.



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***Table 6:*** *Correlation between BMI and caries experience of permanent teeth*

| BMI | Healthy | | underweight | | overweight | | at-risk weight | |
|---|---|---|---|---|---|---|---|---|
| | r | p | r | p | r | p | r | p |
| DS | .434* | .030 | .430* | .032 | -.105 | .619 | -.066 | .754 |
| MS | .265 | .201 | .078 | .709 | -.058 | .783 | -- | -- |
| FS | -.011 | .957 | .047 | .823 | -.130 | .537 | -.255 | .219 |
| DMFS | .476* | .016 | .426* | .034 | -.100 | .634 | -.159 | .448 |
| DMFT | .471* | .018 | .178 | .396 | -.102 | .628 | -.163 | .435 |
| | | | | | | | | |

## 4. DISCUSSION

Childhood obesity is a fast escalating and significant global public health issue [11], [12], [13]. The likelihood of obesity continuing into adulthood is greater in cases of more severe overweight and obesity. Therefore, the most alarming rise in childhood obesity occurs among those at the highest end of the BMI range [14], [15], [16], [17]. While there has been a significant rise in childhood overweight and obesity in recent decades, the prevalence of dental caries, a chronic illness, has shown a notable decline in most Western nations over the last 20 years [18]. The correlation between dental caries and childhood/adolescent overweight/obesity has attracted increasing attention. However, the findings of earlier research have not provided solid evidence [19], [20]. Childhood and teenage overweight/obesity and caries are both complex disorders that occur together in many communities [21]. The correlation between dental caries and obesity is not a causative relationship, but rather a coexistence that may occur in a community due to the clustering of shared contributing variables. The factors that contribute to this phenomenon (which are quite complex) include genetics, socioeconomic status, cultural influences and sugar consumption. Environmental factors also play a role, however, lifestyle choices are particularly significant. Although these elements interconnect, their individual impacts can vary greatly. Because of this, understanding the nuances is essential for a comprehensive analysis [22], [23]. The challenge in exploring the connection lies in quantifying various confounding factors or variables that may alter the impact. This is particularly complex because, although some variables are easily measurable, others remain elusive. However, understanding these elements is crucial; it can significantly influence the overall findings. But, one must consider that the interplay of these variables may also introduce unexpected results, complicating the analysis [24].

The present investigation presents the results concerning caries experience in primary (baby) teeth and permanent teeth across various weight categories: healthy, underweight, overweight and at-risk weight. The findings indicate that, although there are distinctions in the mean dmfs and DMFS scores among these weight groups, these disparities are not statistically significant. Specifically, the underweight group exhibited an average dmfs score of 12.04, while the at-risk weight group demonstrated an average DMFS score of 2.68. This result could be unexpected, as one might presume that the overweight or at-risk groups would experience a higher incidence of cavities due to dietary patterns frequently associated with these populations. However, the lack of significant variations implies that body weight alone may not substantially influence the development of cavities in either primary or permanent teeth. Furthermore, the relationship between weight and dental decay is complex, potentially involving both biological and behavioral factors. Because aspects such as diet quality, oral hygiene practices and socioeconomic status can affect both body weight and oral health, this complexity warrants further investigation.

In agreement with Naidoo, (2013) [25], Underweight children may have dietary restrictions that could increase sugar intake from certain foods, resulting in higher caries experience. Conversely, overweight children might have access to higher quantities of sugary snacks, but their overall diet could be more balanced, mitigating the risk of caries [25].

The link between obesity and dental caries in this study aligns with other clinical studies conducted by Willershausen et al. (2007), Alm et al. (2008), Gerdin et al. (2008), and Modéer et al. (2010), [26], [27], [28], [29], although conflicting results are presented by [21], [30], [31]. In contrast, Marshall et al. (2007) caries and obesity coexists in children of low socioeconomic status [32], [36], [39].

One potential reason for varying findings on the link between dental caries and obesity is that researchers sometimes fail to account for factors that may influence the results, such as sociodemographic variables. Furthermore, the correlation between obesity and dental caries is likely to be weak and might fluctuate over time and across various locations owing to variations in preventative fluoride programs targeted at children [28].

The findings indicate significant differences in BMI between several pairs of weight groups.



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The nutritional intake of individuals (within each weight group) is likely to differ significantly: healthy individuals may consume a balanced diet rich in fruits, vegetables and whole grains. However, overweight and at-risk individuals may have higher caloric intake from processed foods (and sugary beverages) because of their dietary choices. Although the differences are notable, this disparity in nutrition can impact overall health [33], [34], [37], [40].

Furthermore, physical activity serves as a crucial determinant of BMI. Healthy (and underweight) individuals might engage in more frequent physical activity; however, overweight and at-risk individuals tend to adopt more sedentary lifestyles, which contributes to elevated BMI values [35], [38].

Moreover, individual metabolic rates can (also) significantly impact BMI. Genetic predispositions, hormonal balances and various metabolic factors influence how the body stores fat and utilizes energy. This leads to noticeable differences in BMI among different weight groups, although the interplay of these factors can be complex.

An inherent limitation of this research is the inability to analyze the extent of preventive treatment provided to patients. The variables "not daily tooth-brushing in the evening or morning" did not introduce any additional factors that might have influenced the association between obesity and dental caries.

The usage of fluoride in toothpaste during the tooth-brushing technique is crucial because to its notable anticaries impact. Nevertheless, it is important to consider the possibility that there may be variations in preventive treatment across the groups, which might potentially impact the magnitude of the association between obesity and dental caries. This research did not find any correlation between caries experience, measured in terms of dmft and DMFT, and weight groups. According to present data, it is more suitable to utilise decaying surface as the outcome variable. The length of obesity in the participants was not recorded, which may potentially be significant when considering the relationship between obesity and dental caries, in addition to the degree of obesity.

## 5. CONCLUSION

The study revealed that weight status influences dental caries in children. Underweight children showed a trend of higher caries in primary teeth, while at risk weight children exhibited fewer caries in permanent teeth. Significant correlations were found, indicating that BMI affects caries differently depending on weight categories and tooth type. This suggests that both low and high BMI may impact tooth development and susceptibility to caries through other different factors.

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