CHAPTER I

INTRODUCTION

1.1 Background

Dental caries and obesity are two health problems commonly found in school-aged children and remain a global concern, including in Indonesia. Dental caries can cause pain, chewing difficulties, and a reduced quality of life for children, while obesity is associated with various long-term health risks. Children aged 6–12 years are a vulnerable group because they are in a period of growth and development of permanent teeth, especially the first molars, so dental health and nutritional status at this age are crucial determinants of health in adulthood (Rafitha et al., 2019).

Body Mass Index (BMI) is the most commonly used anthropometric indicator for assessing nutritional status based on the ratio of weight to height. In children aged 6–12 years, BMI assessment cannot be equated with that of adults because the process of growth and development is still ongoing. Therefore, BMI in children is assessed based on BMI-for-age, expressed as a Z-score according to World Health Organization (WHO) standards, taking into account age and gender. Body Mass Index (BMI) is the most commonly used anthropometric indicator for assessing nutritional status based on the ratio of weight to height. In children aged 6–12 years, BMI assessment cannot be equated with that of adults because the growth and development process is still ongoing. Therefore, BMI in children is assessed based on BMI-for-age, which is expressed as a Z-score according to World Health Organization (WHO) standards, taking into account age and gender (Gupta et al., 2015).

Nutritional status problems in children, particularly overweight and obesity, have become a global health issue whose prevalence continues to increase, including in developing countries such as Indonesia. The increase in childhood obesity cases is closely related to lifestyle changes, such as increased consumption of foods high in energy, sugar, and fat, as well as decreased physical activity. This condition has the potential to cause various health effects, both short-term and long-term, including metabolic disorders, cardiovascular disease, and psychosocial problems (Sulistiadi et al., 2023).

In Indonesia, the prevalence of children with overweight and obesity has shown an upward trend from year to year. In South Sulawesi Province, the problem of overweight children of school age is still a concern, especially in urban areas. The consumption of fast food and sugary drinks, which are increasingly accessible to school-age children, has contributed to the increase in BMI values (Sulistiadi et al., 2023).

The DMF-T (Decayed, Missing, Filled Teeth) index is a commonly used indicator to assess caries experience in permanent teeth. Meanwhile, children's nutritional status can be assessed through the Body Mass Index (BMI), which is classified into the categories of underweight, normal, overweight, and obese. Several studies have shown that children with a high BMI tend to have higher DMF-T scores than children with a normal BMI. This is thought to be related to a diet high in sugar, frequent snacking, and suboptimal oral hygiene habits (Rarashifaa,et al., 2020).

Biologically, caries is a multifactorial disease influenced by the interaction between host, agent, substrate, and time. Children who are overweight or obese generally have a high intake of fermentable carbohydrates, which can increase the activity of cariogenic bacteria and acid production in the oral cavity. In addition, obesity is also associated with changes in the

composition and function of saliva, such as a decrease in buffer capacity, which can accelerate the process of enamel demineralization and increase the risk of caries (Rarashifaa,et al., 2020).

In Indonesia, the prevalence of dental caries in children is still relatively high. National data shows that most school-aged children experience caries with varying degrees of severity. In South Sulawesi Province, dental and oral health problems in children are also still commonly found, especially in urban areas such as Makassar City. In addition, the prevalence of children with overweight and obesity in South Sulawesi shows an increasing trend, in line with changes in lifestyle and consumption patterns among the population (Kementerian Kesehatan RI, 2018).

Dental caries is a significant oral health problem in Indonesia, with a national prevalence of 45-93% among primary school children based on the 2018 Riskesdas. In South Sulawesi Province, the situation is even more alarming, with a mean DMF-T of 1.4 for 12-year-olds and 6.0 for children over 12 years old, far above the national average of 0.91. The prevalence of active caries in this region reaches 37.8%, influenced by high sugar intake and poor oral hygiene, especially in poor urban areas such as Makassar (Kementerian Kesehatan RI, 2018).

1.2 Problem Formulation

What is the overview of BMI category and DMF-T score in children?

1.3 Research Objectives

The main objectives of this research is to know the overview of BMI category and DMF-T score in children.

1.4 Research Benefits

1. Theoretical Benefits
   This study is expected to contribute to the development of knowledge in pediatric dentistry and public health, particularly regarding the association between body mass index (BMI) categories and DMF-T scores in school-aged children. The findings of this study may serve as a scientific reference for future research related to the relationship between nutritional status and oral health in children.
2. Practical Benefits
   The results of this study are expected to provide an overview of the nutritional status and oral health conditions of children aged 6–12 years at SD Inpres Baraya 1, Makassar. This information may be used by healthcare professionals, especially dentists and school health personnel, as a basis for designing integrated promotive and preventive programs addressing both obesity and dental caries in children.
3. Policy Benefits
   This study is expected to serve as supporting evidence for schools and health authorities in developing or improving School Health Programs (UKS) by considering the relationship between nutritional status and oral health among children.
4. Social Benefits
   This study may contribute to improving children's quality of life. Decreased rates of obesity and dental caries are expected to reduce health problems that may negatively affect children's physical, social and psychological development.

CHAPTER II

LITERATURE REVIEW

2.1 Children

The definition of "children" based on academic journals and research commonly refers to human beings below the age of 18 years. This age-based definition is widely recognized internationally, for example by the United Nations Convention on the Rights of the Child (UNCRC), which defines a child as a person under 18 years old without a specified minimum age, sometimes leading to cultural variations in interpretation. Besides the numerical age criterion, contemporary sociology and social sciences emphasize that childhood is a social and cultural construct, meaning the experience and understanding of being a child differ by social, cultural, and historical contexts. Thus, children are seen not only as minors but as active social beings with capacity and agency within their social environments (Lansdown G, Vaghri Z.2022).

Age classifications within childhood vary in research, often distinguishing stages such as infancy, toddlerhood, early and late childhood, and adolescence, where each stage has differential developmental and social characteristics. For instance, some classifications define children as those between about 4 and 12 years old, with adolescence starting around 10 to 13 years old and extending to 18 or beyond, depending on context (Lansdown G, Vaghri Z.2022).

Children's characteristics based on academic journals include physical, emotional, cognitive, and social developmental traits that evolve with age and growth stages. Physically, children develop motor skills ranging from gross motor control to fine motor coordination, improving hand-eye coordination and requiring activities that engage large muscle groups. Emotionally, children exhibit attachment to caregivers, high curiosity, various emotional expressions, and a balance between dependence and growing independence. Cognitively, they rapidly acquire language skills, have limited attention spans, learn best through hands-on experiences with concrete objects, and gradually develop abstract thinking abilities. Socially, children enjoy interacting and playing with peers, participate in group activities, and imitate learned behaviors (Lansdown G, Vaghri Z.2022).

2.2 DMF-T Score

The DMF-T Index (Decayed, Missing due to caries, Filled-Teeth) is a WHO standard measurement tool for assessing lifetime caries experience in the permanent teeth of individuals or populations. The D component records teeth with cavities (decay) in the enamel/dentin/pulp, M for teeth that have been extracted due to caries, and F for teeth/surfaces that have been restored with permanent fillings in good condition. The total DMF-T score is obtained by adding

D + M + F per individual, where each tooth is counted only once even if multiple surfaces are involved (Dewi et al., 2017).

The DMFT score for an individual will range from 0 to 28. A score of 0 means no teeth are decayed, missing, or filled. A score of 28 means that all teeth are affected. If a tooth or surface is both restored and decayed, it is quantified as decayed. The DMFS score for an individual will range from 0 to 128, as anterior teeth have 4 surfaces and molars and premolars have 5 surfaces. Missing or crowned teeth pose a problem to the DMFS; controversy exists regarding how many surfaces should be counted as missing or restored in such teeth. Assigning the maximum value of surfaces may overestimate the caries experience of the individual; similarly, giving a lower value may underestimate the scope of the problem. The 1939 revision of the DMF recommends assigning 3 surfaces to missing and crowned teeth, as three is the most common number of dental surfaces affected by caries in extracted teeth (Budisak P, Brizuela M.2023).

The DMF-T index is widely used in dental and oral health surveys because it is simple, practical, and recommended by the World Health Organization (WHO) as a standard tool in dental caries epidemiology research.

2.2.1 DMF-T Index Components

1. Decayed (D)
   This is the number of permanent teeth with active caries that have not yet been treated. Teeth with caries that have been filled but still have active caries lesions are still included in category D.
2. Missing (M)
   This is the number of permanent teeth that are missing or have been extracted due to caries. Teeth that are missing due to other causes, such as trauma, congenital abnormalities, or orthodontic treatment, are not included in this component.
3. Filled (F)
   This is the number of permanent teeth that have been treated with fillings due to caries and show no signs of active caries.

2.2.2 DMF-T Classification Criteria

DMF-T Category	Interpretation
0–1.1	Very low
1.2–2.6	Low
2.7–4.4	Moderate
4.5–6.5	High
>6.5	Very high

The DMF-T score is used to describe the level of permanent tooth caries experience in individuals or populations. The interpretation of DMF-T scores is based on the mean DMF-T value, which is then classified into different categories of caries severity.

1. **Very Low (0–1.1)**
   This category indicates a very low level of dental caries. Children in this category generally have healthy permanent teeth with little or no caries experience. This condition reflects good oral hygiene practices and adequate exposure to protective factors such as fluoride.

2. **Low (1.2–2.6)**

The low category indicates a limited experience of permanent tooth caries. Although caries severity is still considered mild, preventive and promotive measures are necessary to prevent further progression of dental caries.

3. **Moderate (2.7–4.4)**
   The moderate category reflects a noticeable level of caries experience in permanent teeth. Children in this category may require dental treatment and enhanced oral health education to control further caries development.

4. **High (4.5–6.5)**
   The high category indicates a significant level of dental caries, with many permanent teeth affected by decay, tooth loss due to caries, or restorations. This condition suggests a high risk of oral health problems and the need for more intensive dental care and preventive interventions.

5. **Very High (>6.5)**
   The very high category represents a severe level of dental caries experience. Children in this category carry a heavy caries burden that may negatively affect mastication, aesthetics, and overall quality of life, thus requiring comprehensive and continuous dental management.

2.3 BMI Category

Body Mass Index (BMI) is a simple anthropometric indicator for categorizing nutritional status based on weight (kg) squared by height (m^2), which is highly relevant for children aged 6-12 years in studies associating it with DMF-T scores. In elementary school children, adult BMI cutoffs are not used; instead, BMI-for-age Z-scores or percentiles according to the CDC/WHO curve are used to capture growth dynamics (International Journal of Dental Medicine.2025).

BMI is calculated using the following formula :

$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height (m)}^2}$$

BMI is widely used by health professionals to assess whether a person is underweight, normal weight, overweight, or obese. In addition to being easy to use, BMI also relatively reflects body fat percentage, although it is not a direct measure of body fat (WHO Growth and Obesity.2007).

2.3.1 The Role of BMI

BMI for age is an important screening tool for identifying children's nutritional status, especially underweight, overweight, and obesity. In children, BMI is not only used for individual assessment, but also to monitor population health trends and nutrition-related disease risks. This measurement is important because excess or insufficient nutrition in childhood can have long-term health consequences, including metabolic disorders, growth disorders, and chronic diseases in adulthood (Ali et al., 2023).

2.3.2 Classification

Classification of BMI (Body Mass Index) is used to assess an individual's nutritional status based on the relationship between weight and height. BMI is a simple and widely used indicator globally due to its ease of calculation, non-invasive nature, and

applicability across adult age groups. Although BMI does not directly measure body fat, its classification helps identify whether a person falls into the categories of underweight, normal weight, overweight, or obese. Understanding BMI classification is important for early detection of health risks and for planning prevention and management strategies related to obesity (Apata et al., 2023).

Table 2. 1 Classification of BMI

Classification	BMI Range (kg/m²)	Description
Underweight	< 18.5	Low body weight
Normal weight	18.5 – 24.9	Healthy weight range
Overweight	25.0 – 29.9	Increased body weight
Obesity Class I	30.0 – 34.9	Moderate obesity
Obesity Class II	35.0 – 39.9	Severe obesity
Obesity Class III	≥ 40	Extreme or morbid obesity

This classification is widely accepted by the World Health Organization (WHO) and National Institutes of Health (NIH) and used globally for clinical and epidemiological purposes. The terms "preobesity" or "overweight" are sometimes used interchangeably for BMI between 25 and 29.9.

Assessment of children's nutritional status using the BMI-for-Age Z-Score (BAZ) is carried out by comparing the Body Mass Index value to the WHO growth curve based on age and sex. Children are categorized as overweight if they have a Z-Score value of more than +1 SD, which is equivalent to a BMI of 25 kg/m² at age 19. Meanwhile, children with a Z-Score value of more than +2 SD are categorized as obese, which is equivalent to a BMI of 30 kg/m² at age 19. Meanwhile, children with a Z-Score value of less than -2 SD are categorized as thinness, and a value of less than -3 SD indicates severe thinness. This classification helps in identifying children's nutritional status more accurately according to their growth age.

It is important to note that BMI is an indirect measure of fatness and does not distinguish between fat mass and muscle mass. Therefore, other clinical assessments such as waist circumference may be used alongside BMI to better assess health risks related to obesity (Busebee B, Ghusn W, Cifuentes L, Acosta A.2023).

2.4 Theoretical Framework

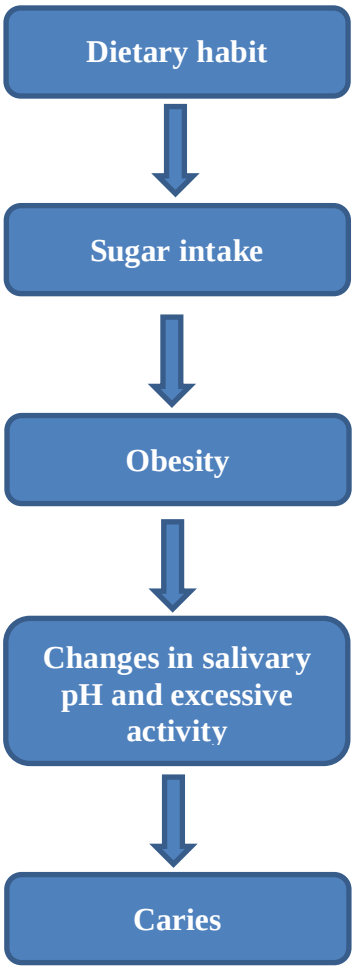

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Figure 2.1 Theoretical Framework