

Prevalence of Dental Anomalies in Children with Down Syndrome: A Cross-Sectional Study in Makassar City

Nahdah Zhafirah Syam^{*1}, Nurhaedah H. Galib B²

^{1,2}Departemen Kedokteran Gigi Anak, Fakultas Kedokteran Gigi, Universitas Hasanuddin, Indonesia
Email: ¹zhafirahsyam@gmail.com, ²nurhaedahgalib73@gmail.com

Abstract

Down syndrome is a chromosomal disorder that is often accompanied by intellectual delays and certain physical characteristics, including oral health problems. Children with Down syndrome often show distinctive orofacial characteristics, such as dental anomalies, with an incidence five times higher than the normal population. This study aims to evaluate the percentage prevalence of types of dental anomalies in children with Down syndrome in Makassar City. This study used a descriptive quantitative method with a cross-sectional approach to assess the prevalence of dental anomalies in 41 children with Down syndrome in eight special schools (SLB) in Makassar City aged 6-21 years using a purposive sampling technique. Data were analyzed in the form of frequency distribution and percentage. The results showed that in Makassar City, hypodontia as the most common anomaly (59.6%) occurred, followed by macrodontia (19.1%), microdontia (8.5%), supernumerary teeth (6.4%), fusion (2.1%), enamel hypocalcification (2.1%), and enamel hypoplasia (2.1%). Dental anomalies were more common in boys (63.8%) than girls (36.2%). This study highlights the importance of prevention and early treatment to reduce the risk of complications due to dental anomalies in children with Down syndrome.

Keywords: *Down Syndrome, Dental Anomalies, Prevalence, Oral Health*

1. INTRODUCTION

Based on data from the World Health Organization (WHO), there are an estimated 8 million people with Down syndrome worldwide. Specifically, there are 3,000-5,000 children per year born with chromosomal abnormalities (Rahmatunnisa et al., 2020). Globally, about one in 800 newborns experience this. In the United States, about 500 births a year suffer from Down syndrome, and more than 200,000 humans are affected (Bull, 2020). Based on Basic Health Research (Tim Riskesdas 2018, 2019) data from the Ministry of Health of the Republic of Indonesia in 2018, the number of Down syndrome cases in Indonesia in children aged 24-59 months reached 0.21%. Meanwhile, according to the records of the Indonesia Center for Biodiversity and Biotechnology (ICBB), there are 300,000 people with Down syndrome in Indonesia (Rahmatunnisa et al., 2020).

The term Down syndrome was first introduced by John Langdon Down in 1866 as a genetic disorder involving intellectual disability and physical abnormalities that vary between individuals (Bull, 2020). An extra chromosome causes Down syndrome in chromosome pair number 21, which makes the number of chromosomes in the patient 47 (Amanullah, 2022). This disorder affects cell metabolism and causes delays in physical and mental development, impacting the ability to maintain health, especially oral health. Children with Down syndrome are at high risk of various orofacial problems, including taurodontia, open bite, dental malformations, fissured tongue, malocclusion, caries, delayed tooth eruption, bruxism, and dental anomalies (Desingu et al., 2019).

Dental anomalies in children with Down syndrome occur with an incidence five times higher than the normal population, including abnormal changes in teeth that congenital or growth factors can cause (Yunus & Iman, 2020). Research by Hoda Fansa et al. (2019) showed that in the western region of Saudi Arabia, the prevalence of dental anomalies in patients with Down syndrome reached 94%, with macroglossia as the most common abnormality (Fansa et al., 2019). In Indonesia, a study by Luly Anggraini et al. (2019) reported that out of 174 subjects, 98.8% had microdontia, 80.9% hypodontia, and 70.8% enamel hypoplasia. Another study by Antonia M. Scott et al. (2023) using the scoping review method shows dental agenesis, including hypodontia, oligodontia, and anodontia, are the most common and frequently reported dental abnormalities in people with Down syndrome (Scott et al., 2023). These

anomalies can be categorized by number (hypodontia and supernumerary teeth), size (microdontia and macrodontia), shape (microdontia, talon cusp, fusion, gemination), and structure (enamel hypocalcification and enamel hypoplasia). Dental anomalies in children with Down syndrome impact their oral functions such as chewing, speaking, and swallowing, resulting in delayed tooth eruption and affecting the overall dental development process. The psychosocial impact also affects the self-confidence of Down syndrome children due to the aesthetic problems of their dental anomalies (Contaldo et al., 2021; Desingu et al., 2019). With early diagnosis, dental anomalies in children with Down syndrome can be planned for better long-term treatment, thus significantly improving their quality of life (Anggraini et al., 2019). One of the major cities in Indonesia with a significant population of children with Down syndrome is Makassar.

Makassar City is the capital city of South Sulawesi, and it pays great attention to its people's health and education conditions. This applies to all groups, including children with Down syndrome. Makassar City Regional Regulation No.6 of 2013 states that children with disabilities receive protection in the care of parents, guardians, or any other party responsible for their care from discrimination, exploitation, neglect, cruelty, violence, abuse, injustice, and other mistreatment (Yani et al., 2023). The presence of this regulation guarantees the realization of equal rights and opportunities for persons with disabilities. This is also evidenced by a sizable special needs school in Makassar City, where they can obtain education and training to improve their standard of living in general. Based on the above information, the frequency distribution of the prevalence of dental anomalies can be used as representative data in Makassar City to determine public policy in the community. Therefore, this study aims to evaluate the prevalence of dental anomalies in Down syndrome children in Makassar City and identify the dominant types of abnormalities.

2. RESEARCH METHODS

This study uses descriptive research with quantitative methods through a cross-sectional approach to evaluate the prevalence of dental anomalies in children with Down syndrome in Makassar City. The cross-sectional method allows data collection at one point in time to describe the prevalence of dental anomalies in the study subject group so that the results can be used to provide relevant epidemiological information. The subjects of this study were children with Down syndrome who attended eight Special Education (SPED) Schools in Makassar City using a purposive sampling technique. These special education schools consisted of SLB Negeri 1 Makassar (16 people), SLB-C YPPLB Makassar (2 people), SLB Negeri 2 Makassar (5 people), SLB Reskiani Mangga Tiga (2 people), SLB Hudaya Hasyim (1 person), SLB Arnadya Makassar (4 people), SLB YPAC (5 people), and SLB Katolik Rajawali (6 people). So, those with Down syndrome are involved in this study per the sample criteria.

The inclusion criteria in this study were children with Down syndrome who were cooperative, aged 6-21 years, willing to participate, and had obtained permission from guardians or parents to be examined. Exclusion criteria included children with mental retardation other than Down syndrome, such as Autism Spectrum Disorder (ASD), Prader-Wili syndrome, and Klinefelter syndrome. Other criteria included undergoing orthodontic treatment and therapies that affect tooth development. To reduce the possibility of bias due to the absence or non-cooperation of children with Down syndrome in the clinical examination, it was necessary to schedule the examination on several different days to provide time flexibility and allow children unable to attend to still participate.

This study was approved by The Health Research Committee with number of 0010/PL.09/KEPK FKG-RSGM UNHAS/2024. The information collected in this study was the type of dental anomaly in the form of a number (hypodontia and supernumerary teeth), size (microdontia and macrodontia), structure (enamel hypodontia and enamel hypo calcification), and shape (fusion and gemination). Clinical examination in determining dental abnormalities uses a pocket probe to identify the size of teeth viewed from the mesiodistal side of the labial surface; oral diagnostic tools consisting of an explorer, sonde, and mirror are used to check the position of teeth that grow out of place, overlapping teeth, or teeth that do not grow properly; and visual clinical observations. Dental abnormalities in children with Down syndrome are compared with normal tooth size tables to determine the type of anomaly experienced.

The data of this study were compiled in a Microsoft Office Excel spreadsheet (Microsoft Corporation, Redmond, WA, USA) and percentage analysis using IBM SPSS Statistics version 25 (IBM Corporation, Armonk, NY, USA) to calculate descriptive statistical data in determining the absolute prevalence of dental anomalies in Down syndrome children.

3. RESULTS AND DISCUSSION

3.1. Results

This study consisted of 47 subjects aged 5-25 with an average age of 12-16. Of the 47 children with Down syndrome, 41 agreed to participate in the study, consisting of 25 boys and 16 girls. Based on age group, vulnerable (5-11 years) included 17 people (41.5%), early adolescents (12-16 years) included 19 people (46.3%), and late adolescents (17-25 years) included 5 people (12.2%). Dental anomalies in children with Down syndrome were more common in males 61% than females with 39% of the total 41 samples (table 1).

Table 1. Demographic profile of Down syndrome children with dental anomalies

	Category	Frequency	Percentage
Age	Vulnerable age (5-11 years)	17	41.5%
	Early adolescents age (12-16 years)	9	46.3%
	Late adolescents age (17-25 years)	5	12.2%
Gender	Male	25	61%
	Female	16	39%

Table 2. Frequency distribution of samples based on dental anomalies in children with Down syndrome in Makassar city

Dental anomalies	Male (m)		Female (f)		Total	
	n	%	n	%	N	%
Hypodontia	17	60.7%	11	39.3%	28	59.6%
Supernumerary teeth	2	66.7%	1	33.3%	3	6.4%
Macrodonia	5	55.6%	4	44.4%	9	19.1%
Microdonia	4	100%	0	0.00%	4	8.5%
Fusion	1	100%	0	0.00%	1	2.1%
Gemination	0	0.00%	0	0.00%	0	0.00%
Hutchinson's teeth	0	0.00%	0	0.00%	0	0.00%
Mulberry Molar	0	0.00%	0	0.00%	0	0.00%
Email hypoplasia	0	0.00%	1	100%	1	2.1%
Email hypocalcification	1	100%	0	0.00%	1	2.1%
Total	30	63.8%	17	36.2%	47	100.00%

Table 2 showed that hypodontia was the most common dental abnormality in the study sample, affecting 28 subjects with a prevalence of 57.14%. Macrodonia was observed in 9 subjects, with a prevalence of 19.1%, while microdonia affected four subjects (8.5%). Supernumerary teeth were identified in 3 subjects, representing a prevalence of 6.4%. Fusion abnormalities, enamel hypoplasia, and enamel hypocalcification had the same prevalence of 2.01% (Figure 1). No cases of gemination, Hutchinson teeth, or mulberry molars were observed in the sample. Based on gender, hypodontia was the most common anomaly, with a higher number of cases in males (18 subjects) compared to females (14 subjects). Supernumerary teeth ranked second, with an almost equal distribution between males and females. Other anomalies, such as macrodonia and microdonia, were relatively rare and distributed almost evenly between genders. Meanwhile, fusion abnormalities, enamel hypoplasia, and enamel hypocalcification were found in very low numbers, with fewer than five cases each and no significant

gender difference. These findings suggested that gender may influence the prevalence of certain dental anomalies, particularly hypodontia (Figure 2).

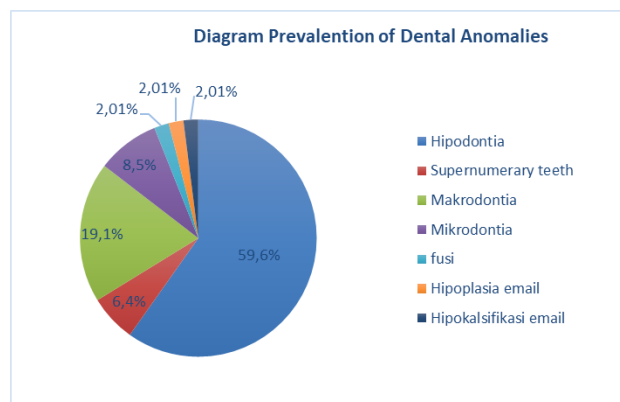


Figure 1. frequency distribution diagram of dental anomalies

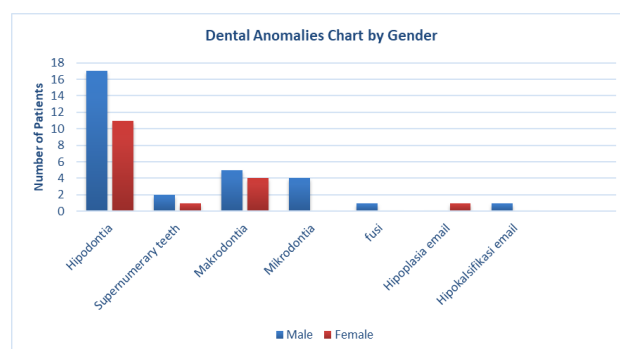


Figure 2. Diagram of dental anomalies by gender

3.2. Discussion

Down syndrome, or trisomy 21, is a chromosomal disorder characterized by increased genetic material on chromosome 21 and occurs in about 1 in 600 to 1 in 2000 births worldwide. One of the most significant risk factors for Down syndrome is maternal age older than 35 years at delivery. People with Down syndrome usually experience delays in cognitive, physical, and motor development. They are prone to various health problems, including dental and oral disorders affecting soft and hard tissues (Yani et al., 2023). Dental anomalies are common in children with Down syndrome, with an incidence five times higher than the normal population, and are associated with slow growth rates and reduced cell numbers (Desingu et al., 2019; Fansa et al., 2019). These abnormalities hinder the maintenance of oral hygiene and increase periodontal problems, caries risk, and psychosocial impact on the child (Contaldo et al., 2021; Najmuddin et al., 2024). Therefore, comprehensive dental care and early intervention are needed to reduce the negative impact and improve oral health in children with Down syndrome (Popoola et al., 2017; Sarkisyan et al., 2024).

This study involved 41 children with Down syndrome in 8 special schools in Makassar City who were willing to be examined and met the inclusion criteria. Table 1 shows that the age group with the most dental abnormalities in early adolescence was 12-16 years old, as many as 19 people (46.3%). This study is almost similar to research conducted in Brazil by Siqueira et al., 2011 (de Siqueira Mellara DDS et al., 2011). However, many studies have different age groups with a wider age range, such as research conducted by Anggraini et al., 2019 (14 to 53.2 years), Cuoghi et al., 2016 (7 to 42 years) (Anggraini et al., 2019; Cuoghi et al., 2016).

The number of Down syndrome boys studied was 25 people, while Down syndrome girls were 16 people. Based on Table 2, the prevalence of dental abnormalities in Down syndrome children in boys (61%) and girls (39%). This is by research conducted by Anggraini et al. (2019), which states that

specifically, boys with Down syndrome tend to experience dental abnormalities 2.85 times more than girls with Down syndrome (Anggraini et al., 2019). Research conducted by Fansa et al. (2019) also strengthens this study, which was conducted in the western part of Saudi Arabia, showing that males tend to have dental abnormalities, namely 60%, compared to females 40% (Fansa et al., 2019). Research shows that boys with Down syndrome are more likely to have dental abnormalities compared to girls.

The cause of this difference is not fully understood, but several genetic, hormonal, and social factors may play a role. Based on genetic factors, Down syndrome is more common in males than females due to sex chromosome differences (males have one X chromosome and one Y chromosome, while females have two X chromosomes). This difference affects the response to the genetic mutations that cause Down syndrome. This results from a disruption of meiosis in the father that affects the sex chromosomes or, during fertilization, the accessibility of sperm carrying the larger Y chromosome to the ovaries. As a result, boys with Down syndrome are born with a larger Y chromosome in the ovary (Terapi et al., 2022). Hormonal factors such as androgens that differ between males and females can also affect tooth development. Higher androgen hormones in males may affect tooth growth and development differently, although the exact mechanism still needs further investigation (Contaldo et al., 2021). Social factors affecting the oral health of children with Down syndrome give rise to the gender stigma that mothers of girls with Down syndrome are often more aware of and encourage their children to maintain dental health, which in turn affects their dental care routines. Girls are more likely to show concern for aesthetic factors such as smile and tooth condition. At the same time, boys often require additional encouragement from family or caregivers to participate in dental care actively (Brosnan et al., 2021).

In Figure 1, the results showed that hypodontia had the highest prevalence of dental anomalies, followed by macrodontia, microdontia, supernumerary teeth, fusion, enamel hypocalcification, and enamel hypoplasia. Table 2 shows the number of anomalies, namely hypodontia and supernumerary teeth, with a prevalence of 59.6% and 6.4%, respectively. There were 28 individuals with hypodontia (59.6%), with males showing a higher prevalence (60.7%) than females (39.3%). This result aligns with a study conducted by Siqueira et al., 2011, which found that hypodontia had the highest prevalence (35.4%) (de Siqueira Mellara DDS et al., 2011). The high prevalence of hypodontia in Down syndrome patients is predicted to be related to impaired neural development or abnormal development of chondral elements at the time of initiation of permanent tooth buds starting from the 10th week of fetal development. Changes in the peripheral nervous system in patients with Down syndrome include fewer peripheral nerve branches or nerves that do not grow at the same rate as the normal population. This supports the statement that hypodontia is more common in patients with Down syndrome than in the normal population (Anggraini et al., 2019; Sekerci et al., 2014). In contrast, some studies show that dental anomalies other than hypodontia are in the highest order, such as a study conducted by Anggraini et al. (2019), which reported that microdontia had the highest prevalence in Indonesia (98.8%) followed by hypodontia (80.9%) with males occurring more (25.3%) than females (22.4%). Another study by Cuoghi et al. (2016) in Brazil reported hypodontia in 16.19% of 105 subjects, with the incidence more common in males (Cuoghi et al., 2016).

In the prevalence of supernumerary teeth, there were three individuals (6.4%) in males, 66.7%, and females, 33.3%. This study is in line with studies in some countries, such as Turkey, which showed a prevalence of 9% for supernumerary teeth, while agenesis of permanent teeth was found in 29% of subjects. However, studies in Malaysia and Sudan only recorded hypodontia without reporting cases of supernumerary teeth, with a prevalence of hypodontia of 50% and 54.9%, respectively (Anggraini et al., 2019; Urzúa et al., 2020). An additional study by Fansa et al. found supernumerary teeth in 10% of individuals, indicating variations in prevalence across different populations (Fansa et al., 2019).

Dental anomalies based on size showed that the prevalence of dental anomalies in Down syndrome children with macrodontia, according to Table 2, was nine (19.1%), with five boys (55.6%) and four girls (44.4%). These percentages show that although macrodontia is found in both sexes, the condition is more common in boys. However, the prevalence of macrodontia varied across studies, with one study reporting a prevalence of 16.19%, while another reported microdontia at 2.04% (Desingu et al., 2019).

According to the study, microdontia was only found in four boys. This is related to studies conducted by Fansa et al. (2019) and Cuoghi et al. (2016), which showed that, on average, males

experienced microdontia more often than females. However, previous studies, including those by Kumasaka et al. (2013), Lomholt et al. (2014), and Sekerci et al. (2014), did not find statistically significant differences between genders for anomalies such as microdontia, taurodontia and macrodontia. This result is also corroborated by the findings of Siquera et al. (2015), who reported a prevalence of microdontia of 9.4%, close to the results of this study (Anggraini et al., 2019; Sekerci et al., 2014).

Dental deformities in children with Down syndrome include fusion, the union between dentin and enamel of two or more teeth that originally grew separately ((Singh et al., 2017). This study found fusion in one boy (2.04%). This finding aligns with Desingu et al. (2019), who reported a fusion prevalence of 2.04%, and Anggraini et al. (2019), who noted that the prevalence of dental fusion in children with Down syndrome in Indonesia reached 2.30% ((Desingu et al., 2019). During embryogenesis, or the histodifferentiation and morphodifferentiation phases, progenitor cells can differentiate into specific cell types. Thus, lower mitotic activity of dental progenitor cells results in dental anomalies in the form of fusion found in people with Down syndrome (Anggraini et al., 2019).

In addition, 2.1% of children with Down syndrome have dental structural abnormalities in the form of enamel hypoplasia and enamel hypocalcification. Anggraini et al. (2019) reported a prevalence of enamel hypocalcification of 4.2% and enamel hypoplasia of 70.8% in children in Indonesia, while Fansa et al. (2019) recorded a prevalence of enamel hypoplasia of 38% and enamel hypocalcification of 26% in Saudi Arabia. (Anggraini et al., 2019) Enamel hypocalcification is caused by reduced enamel matrix and opacity in the enamel layer, while enamel hypoplasia is related to the decreased quality of enamel maturation (Fansa et al., 2019). Abnormal blood supply to the embryonic jaw can also affect tissue growth, causing degeneration of odontoblasts responsible for dentin formation and disruption of ameloblasts that affect enamel production. While not many studies address tooth discoloration in children with Down syndrome, this study found three subjects with tooth discoloration, both intrinsic (related to tooth development) and extrinsic (occurring on the tooth surface). The spectrum of tooth colors identified included black, brown, blue, green, gray, orange, pink, red, and yellow (Anggraini et al., 2019).

This study provides information related to basic data for further research related to dental anomalies in children with Down syndrome in Makassar City. Thus, it can help in prevention and early treatment that leads to more effective interventions to avoid complications that may arise due to dental abnormalities that occur in children with Down syndrome. The main weakness of this study is that further research still needs to be done on the genetic mechanisms and environmental factors underlying the occurrence of dental abnormalities in children with Down syndrome due to limited resources. So, further analysis is still needed on this matter.

4. CONCLUSION

Children with Down syndrome tend to have more dental anomalies than children without the condition. In Makassar City, the prevalence of dental anomalies in children with Down syndrome shows that hypodontia (59.6%) is the most common abnormality, and this condition is more common in boys than girls. These dental anomalies not only impact oral function but can also affect the psychosocial aspects of the child. Therefore, early diagnosis is essential to plan long-term treatment to improve their quality of life significantly. Further research is needed to examine the genetic and environmental factors that influence the prevalence of dental anomalies in children with Down syndrome.

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