



## Occurrence of Gingivitis and Oral Hygiene in Individuals with Down Syndrome

Sabrina Amira<sup>1</sup>, Eva Fauziah<sup>2</sup>, Margaretha Suharsini<sup>3</sup>

<sup>1</sup>Undergraduate Program, Faculty of Dentistry, Universitas Indonesia, Jakarta, Indonesia.  0000-0001-9844-0773

<sup>2</sup>Department of Pediatric Dentistry, Faculty of Dentistry, Universitas Indonesia, Jakarta, Indonesia.  0000-0002-8785-5874

<sup>3</sup>Department of Pediatric Dentistry, Faculty of Dentistry, Universitas Indonesia, Jakarta, Indonesia.  0000-0001-9175-3531

Author to whom correspondence should be addressed: Dr. drg. Eva Fauziah, Sp.KGA(K), Department of Pediatric Dentistry, Faculty of Dentistry, Universitas Indonesia, Jalan Salemba Raya No.4, Jakarta Pusat, 10430, Indonesia. Phone: +62 8129440574. E-mail: [eva\\_dens@yahoo.com](mailto:eva_dens@yahoo.com).

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### Abstract

**Objective:** To determine the frequency distribution of gingivitis and oral hygiene in individuals with Down syndrome. **Material and Methods:** This study used a cross-sectional descriptive method and the subjects were 174 individuals with Down syndrome aged  $\geq 14$  years attending type C (intellectual disability) special needs schools in Jakarta. Gingivitis was measured using the gingival index, and oral hygiene was measured using the Simplified Oral Hygiene Index (OHI-S). The measurement of the two components of plaque and calculus was completed on six teeth on different surfaces, including the facial side of three maxillary teeth, the lingual side of the two posterior mandibular teeth, and the labial side of one anterior mandibular tooth. Descriptive statistics were used to calculate the absolute and relative frequencies. **Results:** 3.4% had no gingivitis, 47.2% had mild gingivitis, 40.8% had moderate gingivitis, and 8.6% had severe gingivitis. Regarding oral hygiene, 28.2% had good hygiene, 49.4% had fair, and 22.4% had poor hygiene. **Conclusion:** Individuals with Down syndrome had a frequency distribution of gingivitis mainly in the mild and moderate categories, and a majority of subjects had fair OHI-S.

**Keywords:** Oral Health; Gingival Diseases; Dental Plaque; Intellectual Disability.

## Introduction

Down syndrome is a genetic disorder that was first identified by John Langdon Down in 1866 [1]. It is caused by an extra chromosome 21 (trisomy 21) and occurs during the prenatal period during the organogenesis phase in the first trimester of pregnancy [2]. According to a recent study, the prevalence of individuals with Down syndrome is 8.72 per 10.000 population every year [1,2]. Riskesdas reported that in 2013, the prevalence of Indonesian children aged 24–59 months with disabilities, including Down syndrome, was 0.13% [3].

Individuals with Down syndrome generally have similar physical characteristics. According to the description by Down, these individuals have a flat and wide facial profile; rounded cheeks; slanted eyes with narrow palpebral fissures; thick and large lips; long, thick, and rough tongue; and a small nose [2].

One of the most frequently encountered oral diseases observed in Down syndrome is poor periodontal health or gingivitis in particular<sup>4</sup>, which is defined as inflammation of the gingiva caused by plaque retention on the surface of tooth structure, without the loss of attachment in the periodontal apparatus [4,5]. In assessing the severity of gingivitis, the Gingival Index by Loe and Sillness is usually employed [6].

In Down syndrome, there are two most influential factors affecting the health of periodontal tissues, particularly related to gingivitis; the first is systemic factors, such as neutrophil dysfunction, lymphocyte T dysfunction, increased inflammatory mediators, and hyperinnervation of the gingiva, and the second are local factors, such as poor oral hygiene, mouth breathing, tooth morphology, and plaque microflora composition [7].

Gingivitis has a positive correlation with oral hygiene [8]. Oral hygiene is measured in several ways, one of which is the Simplified Oral Hygiene Index (OHI-S), which measures the amount of plaque and calculus present on the representative tooth in each region of the mouth. The scores of plaque and calculus are then accumulated to determine the OHI-S value, which describes the oral hygiene status of that individual [9].

Although much research concerning gingivitis and oral hygiene has been performed in individuals with Down syndrome, such data are limited in Indonesians, particularly in Jakarta. Therefore, this investigation was conducted to determine the frequency distribution of gingivitis and OHI-S in individuals with Down syndrome aged  $\geq 14$  years in Jakarta.

## Material and Methods

### Study Design and Sample

This cross-sectional study evaluated 174 subjects with Down syndrome aged 14–53 years, recruited from 43 type C special needs schools in Jakarta, Indonesia.

Inclusion criteria for participants were those diagnosed with Down syndrome, those aged  $\geq 14$  years, and those able to cooperate during assessment and data collection. The age of 14 was chosen to ensure that individuals were in their permanent dentition, considering the lag of 2–3 years in teeth development that may occur in individuals with Down syndrome [10]. The exclusion

criterion was the presence of systemic conditions, such as type 2 diabetes, cardiovascular disease, and osteoporosis.

The severity of gingivitis can be clinically measured by probing the gingival sulcus and scoring gingival inflammation based on the gingival index (GI). The scoring criteria are given in Table 1 [11,12].

**Table 1. Gingival score criteria.**

Score	Description
0	Normal gingiva.
1	Mild gingivitis. There is slight discoloration and edema. No bleeding on probing.
2	Moderate inflammation. There is a reddish color, edema, glazing on the gingiva as well as bleeding on probing.
3	Severe inflammation. There is a reddish color with pronounced edema, ulceration, and a tendency for spontaneous bleeding.

Once the score for each tooth was determined, the scores were averaged to determine the GI of each individual. Then, the resulting score was assessed with the index description as shown as follows: 0: Free of gingivitis; 0.1–1.0: Mild gingivitis; 1.1–2.0: Moderate gingivitis; 2.1–3.0: Severe gingivitis.

The oral hygiene status was measured using the Simplified Oral Hygiene Index (OHI-S). The index measurement assessed the amount of plaque and calculus on the tooth surface. To facilitate visualization of plaque retention on the tooth surface, a disclosing solution was used.

The measurement of the two components of plaque and calculus was completed on six teeth on different surfaces, including the facial side of three maxillary teeth, the lingual side of the two posterior mandibular teeth, and the labial side of one anterior mandibular tooth. Score determination for plaque and calculus score was determined according to the criteria presented in Table 2. The Simplified Oral Hygiene Index results were as follows: 0–1.2: Good; 1.3–3.0: Fair; and 3.1–6.0: Poor.

**Table 2. Plaque and calculus criteria.**

Variables	Score	Description
Plaque Index		
	0	Absence of plaque, debris, or stain.
	1	Subtle plaque covering no more than one-third of the tooth surface or an extrinsic stain without debris covering the tooth surface.
	2	Subtle plaque covering more than one-third of the tooth surface but not more than two-third.
	3	Subtle plaque covering more than two-third of the tooth surface.
Calculus Index		
	0	No calculus
	1	Supragingival calculus covering not more than one-third of the tooth surface.
	2	Supragingival calculus covering more than one-third of the tooth surface but not more than two-third, or a speck of calculus on the subgingival portion along the cervical area of the tooth, or both.
	3	Supragingival calculus covering two-thirds of the tooth surface, or a line of subgingival calculus along the cervical area of the tooth, or both.

Plaque Index = Accumulated plaque scores on all surfaces/the number of surfaces  
 Calculus Index = (buccal score + lingual score)/the number of surfaces;  
 Simplified Oral Hygiene Index (OHI-S) = Plaque Index + Calculus Index.

Clinical assessments were performed by residents of the Pediatric Dentistry program at the Faculty of Dentistry, Universitas Indonesia. The gingival index and OHI-S scores were recorded by the operator's assistant.

#### Data Analysis

Data were analyzed using Microsoft Excel (Microsoft Corp., USA). Descriptive statistics were used to calculate the absolute and relative frequencies.

#### Ethical Aspects

Ethical approval for this research has been granted by the Ethical Committee of Faculty of Dentistry, Universitas Indonesia. Parents of these subjects gave written informed consent to participate in this study.

#### Results

The majority of subjects have mild or moderate gingivitis, while only a very small amount is free of gingivitis. Half of the subjects have fair OHI-S, while the rest is evenly distributed between the good and poor OHI-S category (Table 3).

**Table 3. Frequency distribution of gingivitis and OHI-S.**

Variables	N	%	Mean
Gingivitis Index			
No Gingivitis	6	3.4	0.0
Mild Gingivitis	82	47.2	0.71
Moderate Gingivitis	71	40.8	1.63
Severe Gingivitis	15	8.6	2.83
OHI-S			
Good	49	28.2	0.85
Fair	86	49.4	2.06
Poor	39	22.4	4.40

Table 4 shows the frequency distribution of gingivitis and OHI-S in individuals with Down syndrome based on the age of subjects. It can be seen that the ability to keep good oral hygiene in individuals with Down syndrome tends to increase as the age progresses, especially in older individuals of age 33-53.

**Table 4. Frequency distribution of gingivitis and OHI-S based on the age of subjects.**

Age (Years)	N	GI (Mean)	Category	OHI-S (Mean)	Classification
14	21	1.43	Moderate	1.96	Fair
15	25	1.48	Moderate	2.57	Fair
16	28	1.20	Moderate	2.05	Fair
17	24	1.32	Moderate	2.37	Fair
18	14	1.26	Moderate	2.53	Fair
19	15	1.26	Moderate	4.22	Poor
20	6	2.11	Severe	3.48	Poor

21	8	1.19	Moderate	1.80	Fair
22	8	1.22	Moderate	2.00	Fair
23	4	0.66	Mild	1.22	Fair
24	1	1.83	Moderate	4.00	Poor
25	2	1.23	Moderate	0.99	Good
26	2	0.89	Mild	3.10	Poor
29	1	2.67	Severe	4.20	Poor
32	3	1.87	Moderate	4.44	Poor
33	2	0.73	Mild	1.75	Fair
38	1	1.00	Mild	3.00	Fair
39	1	0.43	Mild	2.00	Fair
41	1	0.50	Mild	1.50	Fair
53	1	0.30	Mild	0.70	Good

## Discussion

This study aimed to determine the frequency distribution of gingivitis and OHI-S in individuals with Down syndrome aged  $\geq 14$  years attending special needs school type C in Jakarta. The GI and OHI-S scores were chosen because they are both relatively straightforward, quick to score, and have been validated [11].

The vast majority of patients in our study (96.6%) had some level of gingivitis, which is explained by the microflora composition in the subgingiva of individuals with Down syndrome compared with that in healthy individuals [13]. Alternately, host response in these individuals is dysfunctional, which predisposes these patients to gingival conditions [12]. Previous research showed that patients with Down syndrome have a higher GI than healthy controls, with a mean standard of 0.9 in Down syndrome and 0.7 in healthy individuals, with a significant difference between the two groups. This indicates a more severe level of gingivitis in individuals with Down syndrome compared to healthy subjects and subjects with other developmental disorders [14,15].

Similar results were found in a previous study conducted in Temanggung, Central Java, which found gingivitis in all subjects [16]. Systemic disorders in individuals with Down syndrome can generally manifest as oral conditions, particularly in the periodontal tissues. For example, lymphocyte T-cells and neutrophil cells are dysfunctional in Down syndrome, which subsequently exacerbates gingival inflammation response [11,18].

In our study, the majority of subjects (88%) were in the mild and moderate gingivitis category, which is consistent with the finding in a previous study conducted in Mexico that compared a Down syndrome group with a sex- and age-matched healthy control group and found that the Down syndrome group had more severe and extensive gingivitis (94.4%) than the control group (89.9%) [10]. It is possible that the higher prevalence of gingivitis in Down syndrome reflects reduced motor ability, which would be a challenge to maintain dental hygiene or reduced access to dental treatments for special needs population [10].

However, a study conducted in Yemen indicated a different result finding that moderate gingivitis has the highest prevalence (47.5%), compared with the prevalence of mild (28.7%) and severe (23.8%) gingivitis, in Down syndrome. This might be explained by different demographic

characteristics and divergent socioeconomic states [19]. In contrast, the Temanggung study concluded that 100% of the subjects had mild gingivitis [16]. The difference shown in the Temanggung study compared to the Yemen study might be explained by the dental check-up program that is routinely conducted every two months for the enrolled subjects, resulting in a better oral condition for these individuals.

The majority of individuals in our study (49.4%) had a fair OHI-S, which is not consistent with data from a previous study conducted in Nigeria where 40% of individuals with Down syndrome had poor OHI-S. This may be caused by a developmental disability, combined with reduced motor functions such as muscle hypotonus and weak arm joints in Down syndrome. Therefore, these patients need assistance in maintaining their oral hygiene [20,21].

This result differs from a study conducted in Mexico that showed no significant difference in OHI-S of individuals with Down syndrome and that of healthy individuals. This study stated that both groups had fair OHI-S [10].

Oral hygiene in Down syndrome highly depends on the support roles of parents and caregivers. Our finding of relatively mild OHI-S in patients aged 33–53 years suggests that relatively mature patients can maintain their oral hygiene. This result differs from the study conducted in Nigeria, which found that increased age was associated with higher OHI-S scores. This may be explained by the culture of independence that caregivers promote because they believe that they can take care of themselves [21].

To improve the oral health conditions of individuals with Down syndrome, an intensive educational approach needs to be applied to caregivers and special needs teachers because they have daily and direct interactions with these disabled individuals. Also, parents and caregivers should be provided with information regarding the most effective and appropriate approach to deal with the oral health of these individuals. Generally, individuals with Down syndrome can be trained if their disability is mild to moderate, suggesting that repetitive teaching and habit forming can help in to improve their oral hygiene.

## Conclusion

The majority of individuals with Down syndrome are present with the condition of mild gingivitis and fair oral hygiene. We believe the importance of a preventive approach in regards to the maintenance of oral hygiene is critical to be taught to the caregivers. In addition, the oral condition of individuals with Down syndrome should be monitored closely with a routine dental check-up.

**Authors' Contributions:** SA designed the study, performed the data collection, data analysis and interpretation and wrote the manuscript. EF and MS designed the study, performed the data analysis and interpretation, wrote and reviewed the manuscript. All authors declare that they contributed to critical review of intellectual content and approval of the final version to be published.

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**Conflict of Interest:** The authors declare no conflicts of interest.

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