

Correlation Between Periodontal Pocket Depth And Periodontal Disease In Down Syndrome Considering Age, Sex, Nutrition, Toothbrushing

Naifatul Aulia Ahmad*, Nuryanni Dihin Utami**, Nydia Hanan***, Sinar Yani****, Listiyawati****

* Dental Medicine Education Program, Faculty of Dentistry, Mulawarman University

** Department of Periodontology, Faculty of Dentistry, Mulawarman University

*** Department of Pediatric Dentistry, Faculty of Dentistry, Mulawarman University

**** Department of Dental Sciences, Faculty of Dentistry, Mulawarman University

Correspondence: liaaulianaifatul@gmail.com

Received 15 January 2026; Revision 1st 22 February 2026, Accepted 25 February 2026; Published online 25 February 2026

Keywords:

Down Syndrome;
Periodontal Disease;
Periodontal Probing
Depth; Age;
Toothbrushing

ABSTRACT

Background: Down syndrome is a genetic disorder with a high prevalence of periodontal disease. Increased periodontal pocket depth is one of the important indicators in assessing periodontal tissue damage. Factors such as age, sex, nutritional status, and toothbrushing practice are thought to influence periodontal conditions in individuals with Down syndrome. This study aims to analyze the relationship between these factors and periodontal pocket depth values in individuals with Down syndrome.

Method: This study used an analytical observational design with a cross-sectional approach involving 40 respondents who met the inclusion criteria. Clinical examination of periodontal pocket depth was carried out using a WHO probe at six points of each tooth. Nutritional status data were obtained through body mass index (BMI) measurements, while toothbrushing practice and respondent characteristics were obtained through structured interviews. Data analysis included Spearman and Chi-square tests with a significance level of $p < 0,05$.

Result: The results showed a significant relationship between age ($p=0.000$; $r=0.646$) and toothbrushing practice ($p=0.008$; $r=0.412$) with periodontal pocket depth. Meanwhile, sex ($p=0.726$) and nutritional status ($p=0.679$) did not show a significant relationship with periodontal pocket depth in individuals with Down syndrome.

Conclusion: The results showed a significant relationship between age ($p=0.000$; $r=0.646$) and toothbrushing practice ($p=0.008$; $r=0.412$) with periodontal pocket depth. Meanwhile, sex ($p=0.726$) and nutritional status ($p=0.679$) did not show a significant relationship with periodontal pocket depth in individuals with Down syndrome

Copyright ©2022 National Research and Innovation Agency. This is an open access article under the CC BY-SA license (<https://creativecommons.org/licenses/by-sa/4.0/>).

DOI: <http://dx.doi.org/10.30659/medali.8.1.61-68>

MEDALI Jurnal: Media Dental Intelektual accredited as **Sinta 4 Journal**

(<https://sinta.kemdikbud.go.id/journals/profile/13665>)

2337-6937/ 2460-4151 ©2025 National Research and Innovation Agency

This is an open access article under the CC BY-SA license (<https://creativecommons.org/licenses/by-sa/4.0/>)

How to Cite: Ahmad et al. Correlation Between Periodontal Pocket Depth And Periodontal Disease In Down Syndrome Considering Age, Sex, Nutrition, Toothbrushing. MEDALI Jurnal: Media Dental Intelektual, v.8, n.1, p.61-68, February 2026.

INTRODUCTION

Down Syndrome is the most prevalent genetic developmental disorder, characterized by the presence of an extra copy of chromosome 21 (Trisomy 21). The global incidence is estimated to be approximately 1 in 1,000 live births^{1,2}. In Indonesia, data from Riset Kesehatan Dasar (Riskesdas) 2018 reported the percentage of children with Down Syndrome at 0.21%. According to Survei Kesehatan Indonesia (SKI) 2023 this figure rose to 0.26%, indicating an upward trend in prevalence^{3,4}. Individuals with Down Syndrome exhibit specific clinical characteristics, including immune system dysregulation. This condition triggers a pro-inflammatory state and results in a diminished immune response to infections⁵. These systemic alterations serve as a significant factor underlying the elevated prevalence of periodontal disease observed in this population⁶.

Periodontal health issues, particularly gingivitis and periodontitis, are highly prevalent and frequently manifest among individuals with Down Syndrome⁷. Studies indicate a remarkably high prevalence of gingivitis among children with Down Syndrome; specifically, only 3.4% were found to be gingivitis-free, while 40.8% presented with moderate gingivitis, and 8.6% exhibited severe gingivitis⁸. Furthermore, periodontitis has been reported in 59% of children with Down Syndrome, this figure substantially higher than the prevalence observed in healthy children, which ranges from 0.84% to 26.9%^{7,9}.

The factors contributing to poor periodontal health in individuals with Down Syndrome are categorized into two primary groups: systemic factors and local factors.⁸ Systemic factors encompass neutrophil and T-lymphocyte dysfunction, elevated levels of inflammatory mediators, and gingival hyperinnervation. Meanwhile, local factors involve poor oral hygiene,

mouth breathing, abnormal tooth morphology, and a distinct plaque microflora composition⁸.

Previous studies have also highlighted variations in the severity of periodontal disease based on demographic factors^{10,11,15}. Alveolar bone loss is initially observable around the age of 16, 92% of individuals under 16 years of age already exhibit signs of bone loss¹². The prevalence of periodontitis among individuals with Down Syndrome under the age of 30 ranges from 58% to 96%, with a generally higher incidence observed in males compared to females^{13,10}.

In addition to age and sex, nutritional status plays a pivotal role in periodontal health. Individuals with Down Syndrome are predisposed to obesity due to excessive caloric intake and lower energy requirements resulting from hypotonia, which can exacerbate systemic inflammation and periodontal complications^{11,14}. Specific oral habits, such as bruxism and mouth breathing, alongside suboptimal tooth brushing practices, further aggravate the periodontal condition¹⁵. The severity of periodontal disease in this population can be objectively assessed through the measurement of periodontal pocket depth¹⁶. The increased pocket depth serves as a critical indicator of deteriorating periodontal tissue health¹⁸.

Based on the aforementioned background, this study aims to comprehensively analyze the correlation between periodontal pocket depth and the incidence of periodontal disease among individuals with Down Syndrome, focusing on four specific factors: age, sex, nutritional status, and tooth brushing practices. The findings of this research are expected to provide deeper scientific insights into these risk factors, subsequently serving as a foundation for developing more effective prevention and management strategies for periodontal disease in the Down Syndrome population.

METHOD

This study employed an analytical observational design with a cross-sectional approach, conducted in Samarinda City. The primary objective was to analyze the correlation between periodontal pocket depth and periodontal disease based on age, sex, nutritional status, and tooth brushing practices among individuals with Down Syndrome. The research population comprised all individuals with Down Syndrome within the study area. Samples were selected using a purposive sampling technique, ensuring subjects met specific inclusion and exclusion criteria. Prior to data collection, informed consent was obtained from all subjects and their legal guardians. This study received ethical clearance from the Health Research Ethics Committee of the Faculty of Medicine, Mulawarman University.

The dependent variable of this study was periodontal pocket depth, which was measured at the six Ramfjord index teeth (16, 12, 24, 36, 32, 44) using a WHO probe. These measurements served as the basis for classifying the subjects' periodontal status. The independent variables included age, sex, nutritional status, and tooth brushing practices. Nutritional status was assessed by calculating the Body Mass Index (BMI) based on the subjects' weight and height. Data regarding tooth brushing practices were obtained through standardized

questionnaires completed by the subjects' guardians or caregivers. Data were analyzed using Microsoft Excel and SPSS software. Descriptive analysis was employed to present the subjects' characteristics. Subsequently, inferential statistical tests, specifically the Chi-Square test and Logistic Regression (or Spearman's correlation), were applied to examine the relationships between variables, with the level of significance set at $p < 0,05$.

RESULT

Based on the frequency distribution in Table 1, the measurements of periodontal pocket depth revealed that the majority of respondents were categorized as having gingivitis, totaling 25 individuals (62.5%). 10 respondents (25%) were in the normal category, while 5 individuals (12.5%) were categorized as having periodontitis. These findings indicate that most respondents had experienced gingival tissue inflammation. This condition may be influenced by various factors, including oral hygiene, tooth brushing practices, and the nutritional status of the respondents. Furthermore, the presence of respondents in the periodontitis category suggests that a subset of the population has already progressed to more advanced periodontal tissue destruction.

Table 1. Distribution and Frequency of Periodontal Pocket Depth among Individuals with Down Syndrome

Periodontal Pocket Depth	Frequency (n)	Percentage (%)
Normal	10	25%
Gingivitis	25	62,5%
Periodontitis	5	12,5%
Total	40	100%

Furthermore, Table 2 presents the correlation analysis conducted on the 40 individuals

with Down Syndrome who served as research subjects. Spearman's correlation analysis revealed

a highly significant statistical relationship between the subjects' age and their periodontal pocket depth values. The age distribution within this variable comprised 15 children, 19 early adolescents, 4 late adolescents, and 2 young adults. The analysis yielded a correlation coefficient of 0.646 between age and the periodontal status categories (normal, gingivitis, and periodontitis). This indicates a

positive relationship with a strong correlation strength. The obtained p-value of 0.000 ($p < 0.05$) confirms that this relationship is statistically significant at a 99% confidence level. These findings conclusively demonstrate that as the age of individuals with Down Syndrome increases, there is a corresponding tendency for periodontal pocket depth to increase.

Table 2. Spearman's Correlation Analysis between Age and Periodontal Pocket Depth

Variable 1	Variable 2	Correlation Coefficient (r)	Sig. (p-value)	Total Subject (n)	Interpretation
Age	Periodontal Pocket Depth	0,646	0,000	40	Positive, strong, and significant correlation

Based on the Chi-Square test results in Table 3, which included 40 respondents equally distributed by sex (20 males and 20 females), the Pearson Chi-Square value was $p = 0.726$. This indicates that there is no significant relationship between sex and periodontal pocket depth. Furthermore, the Likelihood Ratio ($p = 0.725$) and Linear-by-Linear Association ($p = 0.435$) values further support the absence of a meaningful association. These findings suggest that variations in periodontal pocket depth among individuals with Down Syndrome are not influenced by sex, implying that males and females have a relatively equal probability of exhibiting specific periodontal pocket depths

Table 3. Chi-Square Test Results for the Sex Variable

Statistical Test	p-value	Interpretation
<i>Pearson Chi-Square</i>	0,726	Not significant
<i>Likelihood Ratio</i>	0,725	Not significant
<i>Linear-by-Linear Association</i>	0,435	Not significant
Total	40	-

The Spearman's correlation analysis in Table 4 indicates that nutritional status categorized into three groups consisting of 9 malnourished, 16 normal-weight, and 15 overnourished respondents has no significant relationship with periodontal pocket depth among the 40 individuals with Down Syndrome. The Spearman correlation coefficient (-0.067) with a p-value of 0.679 ($p > 0.05$) indicates an extremely weak and non-significant negative correlation. These results suggest that variations in nutritional status do not contribute to differences in periodontal pocket depth, implying that other factors beyond nutritional status likely exert a more substantial influence

Table 4. Hasil Uji Spearman Variabel Status Gizi

Variable	Correlation Coefficient (r)	Sig. (p-value)	Interpretation
Nutritional Status and Periodontal Pocket Depth	-0,067	0,679	Weak, negative, and non-significant correlation

The Spearman's correlation analysis in Table 5 demonstrates that tooth brushing practices categorized into three groups consisting of 14 respondents with poor patterns, 22 with fair patterns, and 4 with good patterns have a significant relationship with periodontal pocket depth among the 40 individuals with Down Syndrome. The correlation coefficient 0.412 with a p-value of 0.008 $p < 0.01$ indicates a positive relationship of moderate strength, suggesting that poorer tooth brushing practices are associated with increased periodontal pocket depth. The significant p-value at a 99% confidence level confirms that this relationship is statistically meaningful. Consequently, tooth brushing practices contribute significantly to the condition of periodontal pocket depth in individuals with Down Syndrome.

Table 5. Spearman's Correlation Results for the Tooth brushing practices Variable

Variable	Corelation Coefficient (r)	Sig. (p-value)	Interpretation
Tooth brushing practices and Periodontal Pocket Depth	0,412	0,008	Moderate, positive, significant correlation

DISCUSSION

The study of 40 individuals with Down Syndrome who met the inclusion criteria specifically those aged 6–35 years who consented to participate yielded crucial findings regarding the factors influencing periodontal pocket depth. Spearman's correlation analysis revealed a correlation coefficient of 0.646 between age and periodontal pocket depth, indicating a strong positive relationship. The p-value of 0.000 ($p < 0.05$) confirms that this relationship is statistically

significant. By categorizing respondents into four age groups (children, early adolescents, late adolescents, and young adults), these findings underscore that advancing age is closely associated with the deterioration of periodontal status. This relationship is elucidated by the unique biological and immunological characteristics of individuals with Down Syndrome. As age increases, there is an accumulation of innate risk factors, such as impaired neutrophil function, chemotaxis deficiency, T-cell and B-cell abnormalities, and alterations in connective tissue structure, all of which accelerate the progression of periodontal disease even at a young age. This is consistent with the reports by Ghaith et al.¹⁸ indicating that individuals with Down Syndrome exhibit significantly higher Calculus Index (CI) values compared to the general population. This phenomenon is partially attributed to salivary calcium levels, which tend to increase with age. This progressive condition is further reinforced by the findings of Porovic et al.¹⁹ who reported that although some children with Down Syndrome maintain good oral hygiene, calculus and gingivitis remain highly prevalent, indicating the dominance of innate biological factors. Periodontal pockets have even been observed in 36% of children with Down Syndrome under the age of six. Taken together, this evidence reinforces that advancing age is a robust determinant of periodontal disease in Down Syndrome, occurring not only due to environmental exposure but also because of the innate progressivity associated with Trisomy 21

Conversely, this study utilized a balanced sample of 20 males and 20 females, with the Chi-square test yielding a p-value of 0.726. This result indicates that there is no significant difference between sexes regarding periodontal conditions. This relatively equal susceptibility suggests that sex is not a primary determinant in this population.

Although some literature, such as Roba et al²⁰ and López & Hernández²¹, reporting a higher prevalence in males, which is often attributed to oral hygiene behaviors, the findings of this study are consistent with the studies by Goud et al²⁰.dan Elrefadi et al²². which found no significant association between sex and periodontal status. Boukhalfa et al²³. further support these results, emphasizing that sex is not a determinant factor because oral hygiene behaviors in the Down Syndrome group are more heavily influenced by parental or caregiver supervision and motor skill limitations.

Furthermore, the results of Spearman's correlation analysis between nutritional status (classified by BMI) and periodontal condition yielded a p-value of 0.679, indicating the absence of a meaningful relationship. Physiologically, nutritional status has the potential to influence periodontal tissues through inflammatory mechanisms. However, in Down Syndrome, this influence appears less dominant. Due to specific feeding patterns, such as soft textures and high calorie intake often chosen by parents. These findings are reinforced by Elrefadi et al²². who reported no significant association between oral hygiene and nutritional factors, despite the high prevalence of obesity resulting from low energy expenditure and limited physical activity. Research by Makieh et al²⁸ also demonstrated that nutritional status parameters do not correlate with the prevalence of periodontal disease. This reinforces the argument that innate biological factors in Down Syndrome, such as immune impairment, connective tissue anomalies, and motor limitations exert a far greater influence on the development of periodontal disease than variations in nutritional status itself.

Lastly, tooth brushing practices categorized as poor, fair, and good based on scores obtained

from validated interview questionnaires, showed a significant relationship with periodontal disease ($p = 0.008$) through Spearman's correlation analysis. Inadequate tooth brushing practices represent the most significant modifiable risk factor. Motor skill limitations and sensory control issues in children with Down Syndrome exacerbate the situation, leading to progressive and cumulative plaque accumulation, which is further accelerated by an innate susceptibility to gingival inflammation. These findings are consistent with the report by Stein et al²⁴.and Kayacı dan Gezgin²⁵. regarding inadequate tooth brushing practice frequency and duration. Parental limitations in assisting their children, as emphasized by Putri et al²⁶ and Betty et al²⁷ represent a major barrier. Therefore, the findings of this study underscore tooth brushing practices as the primary modifiable factor that is most critical to address in order to inhibit the progression of periodontal disease in individuals with Down Syndrome

CONCLUSION

This study confirms a significant, strong, and positive correlation between age and periodontal pocket depth in individuals with Down Syndrome. Furthermore, tooth brushing practices were proven to have a significant relationship with the subjects' periodontal conditions. In contrast, this research found that sex and nutritional status (BMI) do not have a significant association with the severity of periodontal disease. Overall, age serves as a robust non-modifiable determinant, while tooth brushing practices emerge as the most critical modifiable factor that must be addressed through oral hygiene interventions and adequate supervision.

ACKNOWLEDGMENTS

The authors extend their sincere appreciation to the Faculty of Dentistry at Mulawarman

University for the institutional support, administrative assistance, and facilities provided during the conduct of this study.

REFERENCES

- Vergier V, Collignon A, Gosset M, Bonnet A. Periodontal diseases in Down syndrome during childhood: a scoping review. <https://doi.org/10.1186/s12903-025-05540-2>
- Ghaffarpour M, Karami-Zarandi M, Rahdar HA, Feyisa SG, Taki E. Periodontal disease in down syndrome: Predisposing factors and potential non-surgical therapeutic approaches. *J Clin Lab Anal.* 2024;38(1-2):1-14. <https://doi.org/10.1002/jcla.25002>
- Umar W, Salim AA, Putri DNCK. The Prevention upon the Congenital Anomalies Effect: A Comparative Study between Indonesia, the United Kingdom and the United States. *Indones Comp Law Rev.* 2019;2(1). <https://doi.org/10.18196/iclr.2115>
- Antonarakis SE, Skotko BG, Rafii MS, Strydom A, Pape SE, Bianchi DW, et al. Down syndrome. *Nat Rev Dis Primers.* 2020;6(1):1-43. <https://doi.org/10.1038/s41572-019-0143-7>
- Nuernberg MAA, Ivanaga CA, Haas AN, Aranega AM, Casarin RCV, Caminaga RMS, et al. Periodontal status of individuals with Down syndrome: sociodemographic, behavioural and family perception influence. *J Intellect Disabil Res.* 2019;63(10):1181-92. <https://doi.org/10.1111/jir.12629>
- Scalioni FAR, Carrada CF, Martins CC, Ribeiro RA, Paiva SM. Periodontal disease in patients with Down syndrome: A systematic review. *J Am Dent Assoc.* 2018;149(7):628-39.e11. <https://doi.org/10.1016/j.adaj.2018.03.010>
- Amira S, Fauziah E, Suharsini M. Occurrence of gingivitis and oral hygiene in individuals with down syndrome. *Pesqui Bras Odontopediatria Clin Integrada.* 2019;19(1):1-7. <https://doi.org/10.4034/PBOCI.2019.191.145>
- Octafianto A, Saskianti T, Wahlujo S, Tedjosasongko U, Novianti A, Sahar D. Gingivitis in Children with Down Syndrome: Review of Local and Systemic Factors. *Acta Med Philipp.* 2023;57(6):52-8. <https://doi.org/10.47895/amp.vi0.3955>
- Puteri MM, Saskianti T, Estu AR, Bornado B, Maulani B, Naomi N. The Correlation between Oral Health Condition in Down Syndrome Children with Physical Fitness: A Literature Review. *J Int Dent Med Res.* 2022;15(2):922-5.
- Roba I, Elena Z, de los Angeles D, Gustavo S. Prevalence of Periodontal Disease in Young Adults with Down Syndrome. *J Oral Health Dent Sci.* 2018;2(3):1-7.
- Culebras-Atienza E, Silvestre FJ, Silvestre-Rangil J. Possible association between obesity and periodontitis in patients with down syndrome. *Med Oral Patol Oral Cir Bucal.* 2018;23(3):e335-43. <https://doi.org/10.4317/medoral.22311>
- Barnett ML, Press KP, Friedman D, Sonnenberg EM. The Prevalence of Periodontitis and Dental Caries in a Down's Syndrome Population. *J Periodontol.* 1986;57(5):288-93. <https://doi.org/10.1902/jop.1986.57.5.288>
- Morgan J. Why is periodontal disease more prevalent and more severe in people with Down syndrome? *Spec Care Dent.* 2007;27(5):196-201. <https://doi.org/10.1111/j.1754-4505.2007.tb00346.x>
- Ziegler J, Spivack E. Nutritional and dental issues in patients with intellectual and developmental disabilities. *J Am Dent Assoc.* 2018;149(4):317-21. <https://doi.org/10.1016/j.adaj.2017.11.014>
- Salmiah S, Mustafa NS. Gambaran Maloklusi Dan Kebiasaan Buruk Penderita Sindrom Down Usia 6-18 Tahun Di Sib-C Kota Medan. *Dentika Dent J.* 2016;19(1):42-6. <https://doi.org/10.32734/dentika.v19i1.147>
- Al Shayeb KNA, Turner W, Gillam DG. Periodontal probing: a review. *Prim Dent J.* 2014;3(3):25-9. <https://doi.org/10.1308/205016814812736619>
- Saptorini KK. Hubungan Oral Higiene Index (OHI) Dengan Probing Pocket Depth (Ppd) Dan Loss Of Attachment (LOA) Pada Lanjut Usia. *J Visikes.* 2014;10(2):138-45. <https://doi.org/10.33633/visikes.v10i2.694>
- Helal, O., Göstemeyer, G., Krois, J., Fawzy El Sayed, K., Graetz, C., & Schwendicke, F. (2019). Predictors for tooth loss in periodontitis patients: Systematic review and meta-analysis. *Journal of clinical periodontology*, 46(7), 699–712. <https://doi.org/10.1111/jcpe.13118>
- Porovic S, et al. Oral health of Down Syndrome adults in Bosnia and Herzegovina. *Mater Sociomed* 28 (2016): 437-9. <https://doi.org/10.5455/msm.2016.28.437-439>
- Goud E.V.S.S., et al. Implications of Down's syndrome on oral health status in patients: A prevalence-based study. *J Family Med Prim Care.* 2021;10(11):4247–52. https://doi.org/10.4103/jfmpc.jfmpc_885_21
- López M., Hernández J. Gender differences in periodontal disease prevalence. *Int J Periodontol.* 2016;11(3):145–53. <https://doi.org/10.1161/01.STR.0000136767.71518.36>
- Elrefadi R., et al. Oral health status in individuals with Down syndrome. *Libyan J Med.*

- 2022;17(1):2116794.
<https://doi.org/10.1080/19932820.2022.2116794>
23. Boukhalfa Y., et al. Prevalence and characteristics of oral and dental anomalies in Tunisian individuals with Down syndrome: a descriptive study. *Egypt J Med Hum Genet.* 2025;26(1):81.
<https://doi.org/10.1186/s43042-025-00700-z>
24. Stein Duker L.I., et al. Oral Care Experiences and Challenges for Children with Down Syndrome: Reports From Caregivers. *Pediatr Dent.* 2020;42(6):430–5.
25. Kayacı Ş.T., Gezgin O. Clinical investigation of the effects of oral health education in children with Down Syndrome. *Med Sci Discov.* 2022;9(6):319–23.
<https://doi.org/10.36472/msd.v9i6.742>
26. Putri M.H., et al. The effect of using dental and oral health book on the knowledge and skills of parents with Down Syndrome children. *Padjadjaran J Dent.* 2018;30(3):231–40.
<https://doi.org/10.24198/pjd.vol30no3.19277>
27. Saptiwi, B., Subijanto, A. A., & Cilmiaty, R. Problems in Maintaining Oral Health in Children with Down Syndrome: A Pilot Study with In-Depth Interview Analysis. *Journal of International Dental & Medical Research*, 2023. 16(2).
28. Makieh R.E., Kouchaji C.N. Nutritional status, dental caries and parental attitude to junior oral hygiene among children and adolescents with Down syndrome. *Dent Med Probl.* 2025;62(3):409–418.
<https://doi.org/10.17219/dmp/174161>