

# Oral Epidemiological Profile and Risk Factors in Adolescents with Different Degrees of Down Syndrome in a Vulnerable Peruvian Rural Population

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## ABSTRACT

**Aim:** The aim of this study is to assess the epidemiological profile of 12- to 16-year-old adolescents with Down syndrome in the Special Basic Education Center in Lima—Peru.

**Materials and methods:** A cross-sectional descriptive study was performed, where the epidemiological profile was determined through the DMF-T index, oral hygiene index (OHI), and the gingival index from Silness and Löe. A sample of 107 adolescents with Down syndrome in a Peruvian rural population were considered who were evaluated with the formula of proportion estimation, of which 48 (44.8%) were females and 55 (59%) males.

**Results:** Patients with mild to moderate Down syndrome were with a caries prevalence of 42 and 27.1%, respectively. Likewise, class III malocclusion was present in 42.9 and 25.2%. The most prevalent OHI was the regular category with 66.2%.

**Conclusion:** It was evident in mild Down syndrome adolescents, a higher prevalence of the indexes: dental caries, malocclusion, periodontal disease, and oral hygiene, moderate to severe.

**Keywords:** Caries, Down syndrome, Oral hygiene index, Periodontal disease.

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## INTRODUCTION

Down syndrome is a congenital autosomal disorder characterized by the generalized development of intellectual impairment.<sup>1,2</sup> It is considered the most common chromosomal alteration in newborns, with a risk of one from every 600–1,000 born infants.<sup>3</sup> Around 95% of the cases in infants have chromosome 21 with a count of 47 chromosomes. The other 5% of abnormalities in the chromosomes include translocation (3%) and mosaicism or partial trisomy (2%).<sup>4</sup> The subjects diagnosed with this condition suffer a high incidence of epilepsy, diabetes, leukemia, hypothyroidism, upper respiratory tract and chest infections, and other disorders.<sup>5</sup>

Otherwise, dental caries is a disease that appears at an early age, mainly affecting vulnerable populations.<sup>6</sup> For instance, children diagnosed with Down syndrome have dental problems, such as dental agenesis, hypoplasia, and hypocalcification. Due to the underdevelopment of the middle facial third, they also present a hypoplastic maxilla in relation to their mandible, generating a high prevalence of anterior open bite and posterior crossbite.<sup>7</sup>

People with Down syndrome have an increased risk of gingival diseases (periodontal disease). Even when they do not have observable plaque, they have a higher frequency of periodontal diseases caused by having a poor immune system. Patients with this condition are prone to cavitated lesions, so brushing with fluoride pastes, flossing, and limiting the amount and frequency of consumption of sugars and refined carbohydrates help prevent the development of caries lesions.<sup>8</sup>

Therefore, the aim of this study is to evaluate the oral epidemiological profile in adolescents aged 12–16 years with Down syndrome in a Peruvian population.

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## MATERIALS AND METHODS

### Type of Study

An observational, descriptive, and cross-sectional study was developed, evaluating the epidemiological profiles based on the decay, missing, filled Index (DMF-T) and oral hygiene index (OHI) and the Silness and Löe index for the gingival state. The present investigation was carried out following the standards declared in the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE), which guarantees the methodological rigor during its execution.

### Population and Sample

The sample consisted of 107 adolescents, of which 48 were females and 59 males, from 12 to 16 years of age, who strictly complied with

the inclusion and exclusion criteria collected by a simple random probabilistic sampling. This sample was calculated using the formula for estimating a proportion for a finite population based on the prevalence obtained previously in our pilot study where both men and women with Down syndrome were evaluated (70%), with a significance level of 0.5 ( $\alpha$ ) and a power of the test of 0.8 ( $\beta$ ) through the Stata® 12.0 program was used.

## Inclusion and Exclusion Criteria

### *Inclusion Criteria*

Adolescents with Down syndrome of male and female gender; between 12 years and 16 years of age; with or without dental caries, malocclusion, and periodontal disease; and with signature of informed consent by parents or guardians.

### *Exclusion Criteria*

Adolescents who have other pathologies added to the syndrome and who do not have the consent of their parents or guardians.

## Ethical Approval

The informed consent from the parents or caretakers was applied prior to coordination with the institution, the study being previously approved by the Ethics Committee of the Universidad Privada San Juan Bautista with code CEPB-FCS0008. The degree of Down syndrome was determined with the registration card of the children diagnosed by the specialist.

## Clinical Examination

In this research, on the one hand, the factors considered to classify Down syndrome as mild, moderate, and severe were based on the intellectual coefficient and academic performance to learn in class by the teachers in special education. On the other hand, Down syndrome was classified into three different degrees of chromosomal alteration, trisomy of chromosome 21, translocation, and mosaicism. This genetic disorder was previously diagnosed and duly registered in the registration card of each adolescent evaluated by the specialist doctor.

The evaluation of the type of Down syndrome was made in the hospital where each child was born, which was respectively recorded in his medical history and whose diagnosis was made by the specialist doctor in the area. On the other hand, in the special education school, this diagnosis was valued according to the enrollment of each adolescent.

An auditorium space was used for the clinical evaluation under daylight. The workstation was placed together with the necessary elements, and then the dental diagnostic equipment (explorer, cotton clip, air pear, gauze, etc.) was used to place the adolescent with Down syndrome in a chair and, thus, begin the clinical evaluation with a tongue depressor for adequate observation. To record the presence of caries lesions, the DMF-T index was used to evaluate each quadrant of the oral cavity, focusing on the coloration and inflammation of the gums, thus, determining the degree of gingivitis. Subsequently, the periodontium was evaluated to observe the presence of insertion loss, which was taken as a reference for the corresponding clinical values and, thus, was recorded in the registration sheets. To determine the degree of malocclusion, the Angle classification (classes I, II, and III) was used in relation to the first upper molar, registering in their respective collection form. Finally, the simplified OHI was evaluated by means of the pigmentation of six dental pieces.

First, the gums were stained to determine the degree of gingivitis; later to evaluate periodontal disease We proceeded to measure the presence of the periodontal insertion loss, taking as reference the clinical values of 0–1 mm as healthy, from 1 to 2 mm as mild, 3–4 mm moderate and  $\geq 5$  severe; with the use of the periodontal probe.

Then, to determine the malocclusion classes the Angle classification was used. Classes I, II and III were observed in relation to the upper first molar. Finally, the OHI was evaluated, staining 6 teeth: 16 (vestibular), 26 (vestibular), 11 (vestibular), 31 (vestibular), 36 (lingual), and 46 (lingual), and, therefore, the result it was classified according to the categories of 0.1–1.2 (good); 1.3–3 (regular); and 3.1–6 (bad), recording the data in the respective epidemiological data sheets. To complete the evaluation, the teeth were dried and the fluoride gel was placed, recommending to the tutors that the child not eat any food for 1 hour. The process was completed with the delivery of toothpaste, toothbrushes for each patient.

## Statistical Analysis

For the univariate analysis, the frequency and percentage measurements of the main study variables, such as Down syndrome, dental caries, periodontal disease, malocclusion, and OHI, were carried out. For the bivariate analysis, the Chi-squared test was used and the association of the variables was determined: Down syndrome, dental caries, periodontal disease, malocclusion, and OHI. The database was obtained using the Microsoft Excel program and the results were analyzed using Stata® statistical packages version 12.0, establishing a level of significance of  $p < 0.05$ .

## RESULTS

The sample consisted of 107 children from the Special Basic Education Center of Lima, Peru. On the one hand, when determining the association of the degree of severity of Down syndrome in relation to gender, caries risk, type of malocclusion, gingivitis, periodontitis, and OHI, it was found that the females presented the higher prevalence in the chromosome 21 type with 36 (33.6%) cases. On the other hand, the same type of Down syndrome presented the highest risk of caries with 45 (42%) affected adolescents. In relation to malocclusion, it was determined that class III was the most prevalent in children diagnosed with the chromosome 21 type in 46 (42.9%) and 27 (25.2%) in translocation type, respectively. Finally, the predominant OHI was in the regular category in children with chromosome 21 type with 42 (39.2%) cases. This shows that most of the variables evaluated predominated in the case of chromosome 21 type, finding only a statistically significant association between the severity of Down syndrome and the levels of periodontitis within  $p = 0.014$ . However, in the other variables, such as gender, caries risk, malocclusion, gingivitis, and OHI, no statistically significant associations were found ( $p > 0.05$ ; Table 1).

According to the data, when observing the risk of dental caries with respect to gender, malocclusion, periodontal disease, and OHI, it was found that both genders had a low risk of dental caries in 10 (9.3%) cases. On the other hand, children with class III malocclusion had a high risk of dental caries with 52 (48.5%) cases. In relation to gingivitis and periodontitis, the highest prevalence was found in children with a high risk of dental caries in their mild categories with 45 (42%) and 72 (67.2%), respectively. Finally, the category of regular IHO was present in the adolescents with high risk of dental caries.

**Table 1:** Association of the Down syndrome severity degree in relation to gender, caries risk, malocclusion, gingivitis, periodontitis, and OHI

		Down syndrome								p*
		Chromosome 21		Translocation		Mosaicism		Total		
		n	%	n	%	n	%	n	%	
Gender	Female	36	33.6	12	11.2	0	0	48	44.8	0.185
	Male	35	32.7	23	21.4	1	0.9	59	55	
Caries risk	Low risk	15	14	5	4.6	0	0	20	18.6	0.229
	Medium risk	11	10.2	1	0.9	0	0	12	11.1	
	High risk	45	42	29	27.1	1	0.9	75	70	
Malocclusion	Class I	1	0.9	1	0.9	0	0	2	1.8	0.597
	Class II	24	22.4	7	6.5	0	0	31	28.9	
	Class III	46	42.9	27	25.2	1	0.9	74	69	
Gingivitis	Normal gum	8	7.4	4	3.7	0	0	12	11.1	0.737
	Mild inflammation	44	41.1	18	16.8	1	0.9	63	58.8	
	Moderate inflammation	19	17.7	13	12.1	0	0	32	29.8	
	Severe inflammation	0	0	0	0	0	0	0	0	
Periodontitis	Healthy	12	11.2	0	0	0	0	12	11.2	0.014
	Mild	59	55.1	32	29.9	1	0.9	92	85.9	
	Moderate	0	0	3	2.8	0	0	3	2.8	
	Severe	0	0	0	0	0	0	0	0	
OHI	Good	29	27.1	7	6.5	0	0	36	33.6	0.079
	Regular	42	39.2	28	26.1	1	0.9	71	66.2	
	Bad	0	0	0	0	0	0	0	0	
								Total	107	100%

\*Pearson's Chi-squared test

\*Significance level  $p < 0.05$

**Table 2:** Caries risk association regarding gender, malocclusion, periodontal disease, and OHI

		Caries risk								p*
		Low		Medium		High		Total		
		n	%	n	%	n	%	n	%	
Gender	Female	10	9.3	8	7.4	30	28	48	44.7	0.198
	Male	10	9.3	4	3.7	45	42	59	55	
Malocclusion	Class I	0	0	0	0	2	1.8	2	1.8	0.913
	Class II	6	5.6	4	3.7	21	19.6	31	28.9	
	Class III	14	13	8	7.4	52	48.5	74	68.9	
Gingivitis	Normal gum	10	9.3	2	1.8	0	0	12	11.1	0.000
	Mild inflammation	10	9.3	8	7.4	45	42	63	58.7	
	Moderate inflammation	0	0	2	1.8	30	28	32	29.8	
	Severe inflammation	0	0	0	0	0	0	0	0	
Periodontitis	Healthy	9	8.4	3	2.8	0	0	12	11.2	0.000
	Mild	11	10.2	9	8.4	72	67.2	92	85.8	
	Moderate	0	0	0	0	3	2.8	3	2.8	
	Severe	0	0	0	0	0	0	0	0	
OHI	Good	19	17.7	7	6.5	10	9.3	36	33.5	0.000
	Regular	1	0.9	5	4.6	65	60.7	71	66.2	
	Bad	0	0	0	0	0	0	0	0	
								Total	107	100%

\*Pearson's Chi-squared test

\*Significance level  $p < 0.05$

Statistically significant associations were found between gingivitis, periodontitis and OHI ( $p < 0.001$ ). However, no statistically differences were found between the variables: gender and malocclusion with respect to caries risk ( $p > 0.05$ , Table 2).

## DISCUSSION

There are health complexities with dental manifestations in patients with Down syndrome, many of them are related to oral health and quality of life.<sup>9</sup> This disease affects one in every 700

newborns approximately.<sup>5,10</sup> Therefore, the purpose of the present investigation was to evaluate the oral epidemiological profile in adolescents aged 12–16 years with Down syndrome in a rural Peruvian population due to the fact that this vulnerable group theoretically has a tendency to present a higher incidence of dental caries due to a diminished salivary flow and lack of motor skills so that an adequate oral hygiene can be carried out.<sup>11</sup>

Authors report that children with this condition see their oral functions altered due to abnormalities of the perioral muscles, with a traumatic occlusion promoting perioral alterations.<sup>12</sup> The early onset dental caries is more prevalent in children, which may impair their quality of life.<sup>13</sup>

Garcia et al., in their research, mentioned that the objective of their study was to assess oral health in individuals with Down syndrome in Mexico; according to the World Health Organization (WHO), the gingival index and dental plaque turned out to be 53%, it was also determined that gingivitis had no direct relationship with plaque accumulation. Comparing the results, it was found that dental caries and gingivitis are related because 42% had mild inflammation and 28% had moderate inflammation.<sup>14</sup>

Currently, according to Ait Yahya-Graison et al., Down syndrome is classified into three different degrees of chromosomal alteration, trisomy of chromosome 21, translocation, and mosaicism.<sup>15</sup> Also, the studies carried out by Culebras et al. correlate dental alteration in children with Down syndrome. The objective was to evaluate the most frequent oral diseases and the result of the investigation was that individuals with mild Down syndrome had higher prevalence than the moderate-degree individuals. Then, Hannelore and Archila reported the higher prevalence of periodontitis in young people and later several studies showed that children and adolescents can develop severe and generalized gingivitis and periodontitis.<sup>9</sup> Likewise, Paiva and Ferreira mentioned that gingivitis and periodontal diseases begin early in life and the severity increases with age, and that 58% of patients with Down syndrome have periodontitis before the age of 30.<sup>16</sup>

Ibrahim and Abuaffan, in the University of Sudan with the study of prevalence of malocclusion and orthodontic treatment in Sudanese individuals with Down syndrome, made reference to the classification of Angle; the result of the study was 58.7% in class III malocclusion, which coincided with our study with 42.9% ( $n = 46$ ) with respect to mild degree and 25.2% ( $n = 27$ ) to a moderate degree. In addition, 39.2% were obtained for the mild degree and 26.1% for the moderate degree in the OHI.<sup>17</sup>

In this study, there were some limitations regarding the evaluation of children due to lack of necessary clinical equipment, and it is also important to mention the infrequency of research in Down syndrome adolescents with permanent dentition, the existing literature includes both children and adults, which makes it difficult to study properly these age groups. Finally, this study provides important evidence to provide epidemiological indicators to determine the prevalence of dental caries, periodontal disease, malocclusion, and OHI in these individuals, helping to propose a projection on prevention approaches and comprehensive health treatments in the future. Therefore, it will be necessary to conduct additional research with respect to other indicators to recognize the risk factors that would contribute to determine the prevalence of oral diseases in these patients.

Another main limitation of the research is that it was not possible to compare the number of subjects with the different degrees of Down syndrome, due to the fact that in the studied population, there was a lot of heterogeneity, so it was difficult to

divide the sample size into equal parts, therefore, it is possible to perform a more homogeneous statistical comparative analysis. Finally, the results shown in this research allowed establishing health policies to reduce the experience of caries, gingivitis, and periodontal diseases of this population of vulnerable adolescents through a periodontal and restorative intervention program.

## CONCLUSION

In conclusion, in chromosome 21 cases, the patients are affected by the presence of class III malocclusion, a higher prevalence of dental caries, and periodontal disease that worsens over the years, in addition to the characteristic factors of the disease that hinder its control. According to the study, a positive association was found between the degree of severity of Down syndrome and the levels of periodontitis, with a  $p$  value of 0.014 being statistically significant, in addition to the risk of dental caries associated with gingivitis, periodontitis, and OHI with a  $p$  value of  $<0.001$  being statistically significant. Down syndrome affects the patient, increasing the prevalence of diseases in the oral cavity, thus, worsening their quality of life. This research evidences the existing problems in patients with Down syndrome.

## CLINICAL SIGNIFICANCE

This research provides important evidence to provide significant epidemiological indicators to determine dental caries, periodontal disease, malocclusion, and OHI for this vulnerable population; this will help to propose a projection on prevention approaches and treatments for comprehensive health in the future. Thus, this study recognizes the risk factors that may influence the prevalence of oral diseases in this type of patient with special abilities.

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