

Prevalence of caries and gingivitis in 2- to 4-year-old children attending daycare centers managed by the Chilean National Kindergartens Board (JUNJI) and municipal schools, Valdivia.

Yarela Soto,¹ Camila Wilson¹ & Carmen Herreros.²

Affiliations: ¹Universidad Austral, Valdivia, Chile. ²Department of Odonto-Stomatology, Universidad Austral, Valdivia, Chile.

Corresponding author: Yarela Soto. Independencia 631, Valdivia, Región de los Ríos, Chile. Phone: (56-9) 49002923. E-mail: yare.jsc@gmail.com

Receipt: 03/27/2018 **Revised:** 04/04/2018
Acceptance: 04/09/2018 **Online:** 05/30/2018

Conflict of interests: The authors declare no conflicts of interest of any kind.

Ethics approval: Research Ethics Committee of the Public Health Service of Valdivia, Chile (ref No. 210/2016), Department of Municipal Education, and the Regional Board of Kindergartens JUNJI.

Funding: School of Dentistry. Faculty of Medicine. Universidad Austral de Chile.

Authors' contributions: All authors carried out the entire study, and approved the final

Acknowledgements: Cristian Rosas-Méndez, assistant professor Department of Odonto-Stomatology. Universidad Austral Valdivia, Chile.

Cite as: Soto Y, Wilson C & Herreros C. Prevalence of caries and gingivitis in 2- to 4-year-old children attending daycare centers managed by the Chilean National Kindergartens Board (JUNJI) and municipal schools, Valdivia. *J Oral Res* 2018; 7(5):185-189. doi:10.17126/joralres.2018.046

Abstract: Objective: To determine the prevalence of carious lesions and gingivitis in 2- to 4-year-old children attending JUNJI daycare centers and urban municipal schools in the city of Valdivia, Chile. Material and method: Descriptive cross-sectional study. A population of 182 two-year-old children and 285 four-year-old children were examined. Subjects were selected by stratified random sampling. All subjects were enrolled in daycare centers managed by JUNJI and municipal schools in the city of Valdivia. An oral examination was performed to measure the DMFT and hemorrhagic indexes according to the WHO diagnostic criteria. The presence of cavitated carious lesions and gingivitis was determined, resulting in descriptive statistics according to age and gender. Results: The prevalence of caries was 12.6% in two-year-old children and 41% in four-year-olds, respectively. The prevalence of gingivitis was 36.8% at 2 years of age and 70.5% at 4 years. There were no significant differences by gender at 2 years of age ($p=1$) or at 4 years ($p=0.37$). Two year-old children have significantly fewer carious lesions and gingivitis less frequently than four-year-olds ($p<.001$). Conclusion: Two year-old children have a lower prevalence of carious lesions and gingivitis than four-year-old ones. No relationship between the variables and gender was found.

Keywords: prevalence; dental caries; gingivitis; child; preschool.

INTRODUCTION.

Carious lesions, gingivitis and dento-maxillary anomalies are the most frequent pathologies reported in Chilean children according to studies carried out between 2007 and 2012. Among them, carious lesions have been identified as the most prevalent condition.¹

Carious lesions are one of the most common and preventable diseases in childhood. It is a multifactorial and chronic disease that progresses slowly with age.² Early detection is critical to implement adequate preventive measures, as well as providing timely treatment.³

Studies conducted by the WHO⁴ at an international level show that between 60% and 90% of school age children and about 100% of adults have dental caries. According to the Chilean Ministry of Health (MINSAL), the latest epidemiological oral health data regarding infants reported 17.5% prevalence of dental caries in 2-year-old children and 50.4% in 4-year-olds.⁵

Likewise, manifestations of periodontal disease also begin in early

childhood.⁶ Zaror⁷ and Orozco⁸ reported gingivitis in more than 80% of school aged children.

Periodontal disease must be diagnosed and treated as soon as possible, as it affects both hard and soft tissues, resulting in loss of teeth at an early age.⁹

According to the latest MINSAL report from the southern area of Chile,¹⁰ the mean prevalence of gingivitis is 3.7% and 5.2% in 2-year-old and 4-year-old children, respectively.

Although some authors have described the situation in Chile,^{5,10,11,12} there are few published studies reporting the prevalence of these diseases. The objective of this study was to determine the prevalence of carious lesions and gingivitis in 2- to 4-year-old children attending JUNJI daycare centers and urban municipal schools in the southern city of Valdivia, Chile, with the aim of updating existing epidemiological data.

MATERIALS AND METHODS.

This study follows the STROBE guidelines.¹³

Study design

A descriptive cross-sectional study was conducted between July and August 2016. The target population included 2- to 4-year-old children, enrolled in JUNJI daycare centers and urban municipal schools in the city of Valdivia, Chile.

Sample size

The sample of 2-year-old children was obtained from 15 daycare centers managed by JUNJI in the city of Valdivia. The sample of 4-year-old children was obtained from 29 urban municipal schools and JUNJI daycare centers in the city of Valdivia. Sample size was calculated according to the number of children who met the inclusion criteria. The finite population was composed of 245 two-year-old and 459 four-year-old children.

The number of children to be examined was determined by means of a stratified proportional allocation according to the total number of participants who met the inclusion criteria. An estimated true proportion of 50%, 95% confidence interval, precision of 4%, and a margin of error of 20% were used. The final sample included 218 two-year-old and 326 four-year-old children.

Participants of each school were selected through simple random sampling.

Participants

The eligible population was composed of children who met the following criteria:

Inclusion criteria: (1) ASA I, healthy patients, according to the "Physical Status Classification System" of the American Society of Anesthesiologists;¹⁴ (2) Children who at the time of the examination were between 2 years 0 months and 2 years 11 months old; (3) Children who at the time of the examination were between 4 years 0 months and 4 years 11 months old; (4) Children attending municipal schools or JUNJI daycare centers in Valdivia who agreed to participate in the study.

Exclusion criteria: (1) Children with disabilities, basic systemic disease and chronic use of medications; information was obtained from parents; (2) Children with partially erupted teeth that could not be diagnosed; (3) Uncooperative children (4) Children with infectious diseases that prevented examination; (5) Children whose parents or guardians did not provide written consent.

Each parent and/or guardian of the children who met the inclusion criteria signed an informed consent form.

Exclusion criteria were applied on the day of the examination, keeping a record of the reason or cause for exclusion.

Measurements

Two examiners were calibrated before the measurement in two clinical practice sessions, where 15 children were examined.

A mean inter-examiner kappa of 0.95 (examiner I 0.95, examiner II 0.95), and a mean intra-examiner kappa of 0.94 (examiner I 0.94, examiner II 0.93) were obtained.

Clinical examination was carried out at each daycare center and school. The procedure was explained to the participating children by the examiners. Sterile basic examination instruments (No. 4 mirror and orthodontic pliers, WHO dental probe) gloves and mask, and a hands-free head flashlight (HD Energizer hands-free headlight 3 LED) were used.

Each child was asked to brush their teeth before the examination. The DMFT index was used to calculate the prevalence of caries. A dental probe (CP-11.5B Screening color-code probe, Hu-Fredy, Chicago, USA)

Table 1. Prevalence of caries, gingivitis, mean DMFT index and percentage of cavitated carious lesions by gender and age.

	2-year-old children			4-year-old children		
	M	F	Total	M	F	Total
Number	96 (52.7%)	86 (47.25%)	182 (100%)	125 (43.8%)	160 (56.1%)	285 (100%)
Prevalence of carious lesions ^a	12 (12.5%)	11 (12.7%)	23 (12.6%)	55 (44%)	62 (38.7%)	117 (41.0%)
Mean DMFT (SD ^b)	0.2 (0,6)	0.16 (0,4)	0.18 (0,55)	1.67 (2.7)	1.52 (2.8)	1.59 (2.8)
Prevalence of Gingivitis	40 (41.6%)	27 (31.3%)	67 (36.8%)	95 (76%)	106 (66.2%)	201 (70.5%)
Cavitated carious lesions ^c	12 (12.5%)	11 (12.7%)	23 (12.6%)	48 (38.4%)	55 (34.3%)	103 (36.1%)

^a measured and calculated using DMFT index. ^b Standard deviation. ^c Absence/Presence.

was used to confirm the presence of a cavitated lesion on the tooth surface.

A WHO-type periodontal probe was used to determine the presence of gingivitis; presence or absence of bleeding was recorded.

On the day of the examination, each child who complied with the inclusion criteria was assigned a number and their clinical record was filled out, in addition to recording the examiner's data and the date on which the exam was performed.

Variables and statistical methods

Data were tabulated in an electronic spreadsheet and analyzed with Epidata 4.1, in order to obtain descriptive statistics. The prevalence of carious lesions was determined by gender and age. Statistical data were analyzed with the Chi Square program. In addition, mean DMFT values, and the incidence of gingivitis and cavitated carious lesions were determined.

Sources of bias

Common bias found in observational studies based on clinical records, in which the diagnostic criteria of the teaching clinician and examiners may differ.

RESULTS.

In both groups, a 20% margin of error was added to the calculated sample., There was a deficit of 16.5% in the 2-year-old group, and of 12.5% in the 4-year-old group. Specifications by gender and results are shown in Table 1.

Two-year-old children: A sample of 182 children ranging in age from 24 to 35 months was examined from a population of 245. Prevalence of dental caries was 12.6% (23/182); mean DMFT index p -value of 0.18.

Prevalence of gingivitis was 36.8% (67/182).

Four-year-old children: A sample of 285 children ranging in age from 48 to 59 months was examined from a population of 459. Prevalence of dental caries was 41% (117/285); mean DMFT index of 1.59. Prevalence of gingivitis was 70.5% (201/285).

The abovementioned figures were obtained by dichotomizing the result of the DMFT index, taking into account the history of carious lesions and their absence.

Two-year-old children had significantly fewer carious lesions and less gingivitis than 4 year-olds ($p < .001$).

The difference in the number of carious lesions between males and females was not significant at 2 or 4 years of age, ($p=1$) and ($p=0.37$) respectively.

Likewise, prevalence of gingivitis in males and females at 2 or 4 years of age, ($p=0.15$) and ($p=0.07$) respectively, was not significantly different.

DISCUSSION.

Epidemiological studies usually adopt the WHO criteria for the detection of carious lesions. Its main disadvantage is that incipient lesions are not included in these criteria, masking the true extent of the disease.¹²

The present study included cavitated lesions only, which can be considered a limitation.

The MINSAL¹¹ has reported a caries prevalence of 17% at 2 years of age (mean DMFT index 0.54), and 48% at 4 years (mean DMFT index 2.32), in a report on the Metropolitan region of Chile.

Similar results were obtained in another study conducted by MINSAL⁵ between 2007-2010 at national level. A prevalence of 17.5% was reported in 2 year old children (DMFT 0.46); and a prevalence of 50.4%

(DMFT 2.25) in 4 year-olds. According to the above, both studies reported a prevalence of carious lesions higher than that found in this study (12.6% at 2 years of age, and 41% at 4 years). However, a comparison between the studies is not possible because they were conducted in different regions of the country.

On the other hand, a study conducted in the southern area of Chile¹⁰ reported a dental caries prevalence of 20.3% (95% CI 17.7, 23.2) for 2-year-old children. In the southern Los Ríos region and Los Lagos region the prevalence was 10.2%. In the same study, 52.7% of 4-year-old children in the southern area had dental caries and of those, 44.3% were from Los Ríos and Los Lagos regions.¹⁰

Results obtained in this study were only focused on those children who met the inclusion criteria and lived in the city of Valdivia. A sample proportional to the region population was not studied, so they are not comparable.

The Chilean government has implemented preventive programs for children since 2005. One of these is GES (*Explicit Health Guarantees Program*), which includes government sponsored "comprehensive oral health care for 6-year-old children,"¹⁵ aimed at educating, preventing and treating oral pathologies. However, in a epidemiological study carried out in 2007,¹⁶ it was observed that prevention and dental care are also crucial for children under 6 years of age. Furthermore, it is always better to treat children at the earliest stages of life. Consequently, prevention programs should begin before the age of 3 years.

Considering this background, a program of oral health care in pre-school children was implemented in 2007.¹⁶ In 2009, a "Guide for primary dental care for 2- to 5-year-old children"² was published; and in 2012, a preventive program was included in Primary Health Care (PHC) for the prevention of caries and promotion of healthy eating and hygiene habits in the pre-school population.¹

The goals of the Chilean government for the 2011-2020 period include increasing the number of caries-free children at 6 years of age from 30% to 40%.¹⁷ However, the diagnosis of caries in children under 6 years has not yet improved, since cavitated lesions can still be found in 2 year-old pre-school children.¹⁶

This is why prevention must be improved in pre-school day care centers. Likewise, parents must be encouraged to take care of their children's oral health from their first medical check-up onwards. PHC regulations establish that children should visit the dentist at 2 and 4 years of age. If the child is under 6 years old and diagnosed with any type of oral pathology, the health professional should refer him/her to the dentist for evaluation.¹⁸

On the other hand, international epidemiological studies have shown great variation in the prevalence of gingivitis in children and adolescents, with figures ranging from 14.5% to 70.2%.^{19,20}

These data agree with the figures obtained in this study, 36.8% for the 2-year-old children and 70.5% for the 4-year-olds. In contrast, a study conducted in the city of Temuco reported a higher prevalence of gingivitis: 93.1% at 4 years of age.⁷ This difference could be due to the variability of diagnostic methods used between the two studies.

In a systematic review on periodontal diseases²¹ in Central and South America, it was reported that gingivitis is widely distributed among children, with a slightly higher prevalence in males and in people from lower socioeconomic levels. These data agree with the present study, where at 2 and 4 years of age the prevalence of gingivitis was higher in males, 41.6% and 76% respectively; and 31.3% and 66.2% for females at the same age ranges.

In addition, other studies have revealed that the prevalence of gingivitis increases with age.^{22,23} These data are consistent with this study, where the prevalence of gingivitis rose from 36.8% at 2 years of age to 70.5% at 4 years. This increase could be attributed to the rise in the number of vulnerable areas, and plaque accumulation associated with dental eruption and exfoliation.²⁴

Periodontal alterations associated with aging can also be related to differences in the anatomical and histological characteristics of the structures of the periodontium and its inflammatory response to changes in the bacterial composition of the plaque.²⁵

A study on oral diagnosis carried out by Universidad Mayor and MINSAL reported a 7.5% prevalence of gingivitis at 4 years of age and 4.2% at 2 years, in Los Ríos and Los Lagos regions.¹⁰ This contrasts with the

figures provided by MINSAL¹⁸ in 2010 at national level, where the prevalence of gingivitis was 32.6% and 45% at 2 and 4 years of age, respectively. The results of this study are similar to the figures obtained at national level.

This significant difference could be due to the fact that, in the first study,¹⁰ the sample was not proportionally stratified, affecting the representativeness of the sample and its possible extrapolation to the city of Valdivia.

This report¹⁰ reveals an alarming situation, 63.4% of children at 2 years of age and 32.7% of children at 4 years, in the Region of Los Ríos and Los Lagos, have never visited the dentist. Taking into account the abovementioned data, there are two factors that could

explain the high prevalence of gingivitis and the high number of cavitated carious lesions reported in this study: first, that coverage of dental care for children is insufficient; and second, that although people have access to dental care, they nonetheless do not visit the dentist.

CONCLUSION.

Two-year-old children in the district of Valdivia have fewer carious lesions and less prevalence of gingivitis than four-year-olds. No relationship between the variables and gender was established. It is necessary to analyze oral health practices and the effectiveness of government preventive programs in further comparative studies.

REFERENCES.

1. Ministerio de Salud (MINSAL). Programa Preventivo en Salud Bucal en Población Pre escolar en Atención Primaria de Salud. Santiago, Chile: MINSAL; 2012.
2. Ministerio de Salud (MINSAL) Guía Clínica Salud Oral integral para niños y niñas de 6 años. Santiago, Chile: MINSAL; 2009.
3. Pinto-Sarmento TC, Abreu MH, Gomes MC, Costa EM, Martins CC, Granville-Garcia AF, Paiva SM. Determinant factors of untreated dental caries and lesion activity in preschool children using ICDAS. *PLoS One*. 2016;11(2):e0150116.
4. Organización Mundial de la Salud (OMS) Salud Bucodental. Nota informativa No. 318. OMS; 2012.
5. Letelier MJ, Mendoza C, Del Valle C. Informe consolidado del Diagnóstico Nacional de Salud Bucal de los niños y niñas de 2 y 4 años que participan en la educación parvularia. Chile 2007-2010. Chile: MINSAL; 2012.
6. Oh TJ, Ebar R, Wang HL. Periodontal diseases in the child and adolescent. *J Clin Periodontol*. 2002;29(5):400–10.
7. Zaror C, Muñoz P, Sanhueza A. Prevalencia de gingivitis y factores asociados en niños chilenos de cuatro años. *Av Odontostomatol*. 2012;28(1): 33-8.
8. Orozco JRE, Peralta LH, Palma MGG, Pérez RE, Arroniz PS, Llamas HE. Prevalencia de gingivitis en adolescentes en el municipio de Tlalnepantla. *Rev ADM*. 2002;59(1):16–21.
9. Axelsson P. An Introduction to Risk Prediction and Preventive Dentistry. 1st Ed. Berlin: Quintessence; 1999.
10. Hoffmeister L, Moya P, Vidal C, Fuentes R, col. Diagnóstico de salud bucal en niños de dos y cuatro años de edad que asisten a educación parvularia en zona sur del país. Santiago, Chile: MINSAL; 2010.
11. Ceballos M, Acevedo C, col. Diagnóstico en Salud Bucal de niños de 2 y 4 años que asisten a la educación preescolar en la Región Metropolitana. Santiago, Chile: MINSAL; 2007.
12. Belmar B. Estudio de prevalencia, índice signficante, severidad de caries y distribución de lesiones por diente y superficie, en niños de 2 a 3 años pertenecientes a jardines infantiles Integra de la Región Metropolitana. Santiago, Chile: Facultad de Odontología, Universidad de Chile; 2015.
13. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP, STROBE Initiative. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *Lancet*. 2007;370(9596):1453–7.
14. Ministerio de Salud (MINSAL) Guía Clínica Salud Oral integral para niños y niñas de 6 años. 3st Ed. Santiago, Chile: MINSAL; 2013.
15. Ministerio de Salud (MINSAL) Perfil Epidemiológico de Salud Bucal. Chile: MINSAL; 2007.
16. Ministerio de Salud (MINSAL); Subsecretaría de Salud Pública, División Prevención y Control de Enfermedades, Departamento Salud Bucal. Análisis de situación de Salud bucal en Chile. Chile: MINSAL; 2010.
17. Ministerio de Salud (MINSAL) Norma Técnica para la supervisión de niños y niñas de 0 a 9 años en la Atención Primaria de Salud. Chile: MINSAL; 2014.
18. Umer MF, Farooq U, Shabbir A, Zofeen S, Mujtaba H, Tahir M. Prevalence and associated factors of dental caries, gingivitis, and calculus deposits in school children of sargodha district, pakistan. *J Ayub Med Coll Abbottabad*. 2016;28(1):152–6.
19. Rodan R, Khlaifat F, Smadi L, Azab R, Abdalmohdi A. Prevalence and severity of gingivitis in school students aged 6-11 years in Tafelah Governorate, South Jordan: results of the survey executed by National Woman's Health Care Center. *BMC Res Notes*. 2015;8:662.
20. Gjermeo P, Rösing CK, Susin C, Oppermann R. Periodontal diseases in Central and South America. *Periodontol* 2000. 2002;29:70–8.
21. Dhar V, Jain A, Van Dyke TE, Kohli A. Prevalence of gingival diseases, malocclusion and fluorosis in school-going children of rural areas in Udaipur district. *J Indian Soc Pedod Prev Dent*. 2007;25(2):103–5.
22. Kumar P, Joseph T, Varma RB, Jayanthi M. Oral health status of 5 years and 12 years school going children in Chennai city - An epidemiological study. *J Indian Soc Pedod Prev Dent*. 2005;23(1):17–22.
23. Zaror C, Pineda P, Orellana J. Prevalencia de Caries Temprana de la Infancia y sus factores asociados en niños chilenos de 2 y 4 años. *Int J Odontostomat*. 2011;5(2):171–7.
24. Bimstein E, Matsson L. Growth and development considerations in the diagnosis of gingivitis and periodontitis in children. *Pediatr Dent*. 1999;21(3):186–191.