Research article

Oral health status of 6- to 12-year-old children in Madrid, Spain: A cross-sectional study

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ABSTRACT

Based on the results of the 2015 oral health survey in Spain, the prevalence of untreated dental caries in temporary dentition, in the six-year cohort was 27,8%, and in the twelve-year cohort 14,6%. Due to the magnitude of the problem, the high health cost and the possibilities of prevention, monitoring the oral health status of the child population is extremely important, as it will allow the implementation of prevention and early care strategies. Objectives: To study the caries prevalence and malocclusion in the mixed dentition in children aged 6–12 years in Madrid, Spain. . Materials and methods: This is a descriptive, cross-sectional study carried out in the city of Madrid during the 2018–2019 school year. Fifth year students of the European University of Madrid through health surveys, calibrated and supervised by the two main researchers, collected the data. The schoolchildren assessed were students from different schools in the city of Madrid, between 6 and 12 years old. According to WHO standards, data were collected in 2 months. Results: The total number of students examined was 303 students from 4 different schools in the community of Madrid. The prevalence of caries in our sample in the primary dentition was 45.21% with dmf> 0 and in the permanent dentition it was 23.7 % with a DMF> of 0. Conclusions: The oral health survey carried out in the sample shows a high prevalence of caries, as well as in the dmf and DMF indicators. Most of the children needed fluoride applications, so it would be interesting to evaluate which of them can be prevented with different public health projects.

1. Introduction

The World Health Organization (WHO) states that oral diseases share risk factors with 4 major chronic diseases: cardiovascular problems, cancer, chronic respiratory diseases and diabetes [1].

Dental caries, is currently the most common chronic disease in childhood worldwide, with a high prevalence in Spanish preschoolers.

This non-infectious, non-communicable disease has serious repercussions on children's general health, such as severe pain, facial infections, decreased physical development and learning ability [2]. Children, due to pain in the oral cavity, do not ingest adequate nutrients. In terms of learning ability, schoolchildren with a higher prevalence of caries miss more classes than those with good oral health [2]. It also increases hospitalizations and emergency room visits, making outpatient management difficult and generating high treatment costs [1, 2].

Risks factors implicated in childhood caries include: poor oral hygiene, frequent consumption of fermentable carbohydrates, early oral bacterial colonization, presence of visible bacterial plaque, previous history of caries, high levels of Streptococcus Mutans (SM), reduced salivary flow or function, low socio-economic status of parents and low oral health knowledge [1].

Given that caries is a potentially controllable disease, it is surprising that our daily practice is almost entirely related to this disease. On the other hand, we must be aware that traditional restorative approaches have failed to reduce caries in recent decades. Therefore, we must rethink this situation and dedicate more and more preventive and educational efforts to offer our patients the possibility to live free of oral diseases.

Education based on the control of risk factors must be offered not only to parents and family members, but must be present in all the environments surrounding the child: health services, kindergartens, schools, community, political programs…, what is known as the dental home. This education should start as early as possible, ideally during pregnancy and the first years of the child's life.

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The dental home is a continuously accessible, comprehensive, affordable, and coordinated family-centered oral health program, under the supervision of a dentist, and offers the opportunity to implement preventive oral health practices and reduce the risks of avoidable oral disease.

The concept "family-centered care" indicates a strategy for approaching oral heath planning, delivery and evaluation, governed by a mutually beneficial partnership between families and caregivers of children and oral health professionals. The dental home recognizes parents as the primary managers of their child's oral health care, being with them every day and dealing with all the professionals who treat them.

With regard to oral health, epidemiological studies are used to diagnose the main oral problems (such as caries, periodontal diseases, dental trauma, fluorosis, malocclusions) of a population through surveys, thereby establish care priorities, planning preventive and community projects aimed at focusing more on the real problems, verifying their effectiveness and modifying or expanding the program, if necessary [2, 3].

Goes et al. proposed that oral health should be addressed within the scope of chronic diseases, due to the invasive nature of its main ailments. To this end, a health surveillance model was developed that provides primary data capable of generating information for action in population specific programs [4].

Epidemiological studies are the best source of primary data.

In Spain, Gimeno de Sande published the first national study on the prevalence of oral diseases in 1971, with fieldwork since 1969 [5]. Since then, several national cross-sectional series have been published in Spain. In 1986, Cuenca published a report on Spanish oral health based on a national epidemiological survey carried out in 1983 on behalf of the Ministry of Health and Consumer Affairs [6]. Sicilia et al. published in 1990 the third nationwide study, with fieldwork conducted in 1987 [7,8]. Noguerol et al. published in 1995 the fourth epidemiological study of oral health in Spain, with fieldwork conducted in 1993 [9]. In 2002, Llodra-Calvo, Bravo-Pérez and Cortés-Martinicorena published the fifth nationwide study, with fieldwork conducted in 2000 [10]. Bravo-Pérez et al. in 2006 published the Oral Health Survey in Spain 2005 and, finally, in 2012 published the new oral health survey in Spain with the updated data [11, 12].

The last two surveys, one national and one from the Community of Madrid, were carried out in 2015 and published in 2016 [13,14].

National oral health surveys have the basic function of providing an overview of the health and treatment needs of the population in order to be able to follow the evolution of morbidity rates. They provide information on:

- The extent to which the existing dental services meet the needs of the population.
- The nature and quantity of preventive and restorative services needed.
- The resources required implementing, maintaining, increasing or reducing oral health programs, estimating the quantitative needs and the type of personnel required.

Therefore, in order to evaluate the evolution of oral health in children in the Community of Madrid since the last survey in 2015, we consider it necessary to carry out an epidemiological study to assess the oral health status of schoolchildren in the city of Madrid.

2. Materials and methods

This cross-sectional descriptive epidemiological study evaluated the oral health status of schoolchildren in the Community of Madrid, in different aspects: caries rates, oral hygiene, need for preventive treatments and malocclusions.

The study population was schoolchildren from the Community of Madrid. It was collected with consecutive sampling in the schools that accepted and signed the inform consent form. The sample size was calculated using the sample size formula, with a confidence level of 95% and a margin of error of 3%. Thus, 290 schoolchildren, were obtained

and 303 screenings were performed. The schools participating in the study were informed, and the informed consent form was sent for parents to sign before the examinations. The Ethical Committee of the European University granted ethical approval number 19/128.

All the schoolchildren whose parents signed the inform consent were screened. Not all school pupils were included in the study; those whose parents did not signed the consent were not included. The inclusion criteria for the study were:

- Subjects between 5 and 10 years of age at the time of screening
- Informed consent completed and signed by the parents.

  Exclusion criteria were:

- Failure collecting correctly oral health data.
- Failure to present the consent form signed by the parents.

The data were collected by means of health records completed by the 5th year dental students of the European University of Madrid. The fifth year dentistry students carried out the first check-up of the schoolchildren, and collected the data. All the students were trained before the checkups. There were two sessions with different teachers on the WHO oral indices and how to record them. Both sessions were with different teachers. All the fifth year dental students had this two sessions. Two professors, who were calibrated for this purpose, supervised all the oral examinations of the children. The calibration was carried out in the Dental Clinic of the European University, with a concordance of 92% and a Kappa test result of 0,70 to be able to carry out the study.

The Health forms were the data were collected are based on WHO indications, and were adapted for this study. Caries was diagnosed at the cavitation level, and caries status was reported using DMFT index for permanent teeth and dmft index for primary teeth. Malocclusion was recorded according to WHO guidelines. Data were collected on Excel sheets to perform a descriptive analysis of the population.

The variables studied were:

- Age
- dmf/index (Caries index for primary teeth, d is for decayed teeth, m is for missing, f is for filled teeht)
- DMF/index (Caries index for permanent teeth, D is for decayed teeth, M is for missing teeth, F is for filled teeth)
- Presence of malocclusion: malocclusion was recorded according to WHO indications. (Class I, Class II, Class III, Transverse Alteration, Vertical Alteration, and Not assessable. We added Crowded teeth and Malocclusion not described)

The processing communication and transfer of personal data of all participating subjects, complied with the provisions of the RGPD UE 2016(European Law of Data Protection Act). Therefore, patient data were completely anonymous.

3. Results

3.1. Description of the sample

The total number of students reviewed was 303 students from 4 different schools in the Madrid community. A total of 350 schoolchildren were invited according to the number of students in the schools studied. The response rate was 86.6%.

We distributed the sample in three cohorts of 5–6 years (including 6–6.9 years), 7–8 years (including 8–8.9 years) and 9–10 years. The children were distributed in these cohorts to facilitate data collection, as this is the distribution by school years.

The distribution by school was, in school number 1: 38 students reviewed, in school number 2: 104, in school number 3: 117, and school number 4: 44 children.

The number of children in each cohort was as follows: 5–6 years cohort 183 children; 7–8 years cohort 87 children and 9–10 cohort 33 children.

3.2. Oral health indices

3.2.1. Caries rate

In reference to our total data, in our sample we have a total caries experience of our sample in the primary dentition of 45.21% of the total sample (dmf> 0), while in the permanent dentition it is 23.7 % with a DMF> 0. The distribution of the indices is shown in the following figures. (see Figures 1, 2)

In the entire population of our study we have a total caries experience, i.e. dmf/DMF> 0 of 37,6% of the entire sample, and a mean dmf of 1,84, and DMF of 0,3. This data is quite important in order to compare our study with other similar epidemiological studies in the city of Madrid.

In the cohort of children age 5–6 years, we have a greater number of students, and the majority of the cohort had no caries, dmf index 0, 101 out of 183, representing 55% of the cohort. In the 7–8 years old cohort, there were a total of 69 children without caries, or 79,3% of the entire cohort. In the third cohort, that of students aged 9–10 years this

percentage of no caries in deciduous teeth is lower, a total of 13 children out of 33, being 39,4% of the total.

3.3. Malocclusion

The children the sample had a high percentage of malocclusion according to the ideal occlusion. (see Figure 3)

1. Class I: 170 students out of 303, 56,1% of all the entire sample had ideal occlusion.
2. Class II: 20 children.
3. Class III: 10 children.
4. Transversal Alteration: 28 Children.
5. Vertical Alteration: 28 Children.
6. Not evaluable: 8 Children.
7. Crowded Teeth: 10 Children.
8. Malocclusion not described: 34 Children.

4. Discussion

The total number of students examined was 303 students from 4 different schools in the community of Madrid. We distributed the sample
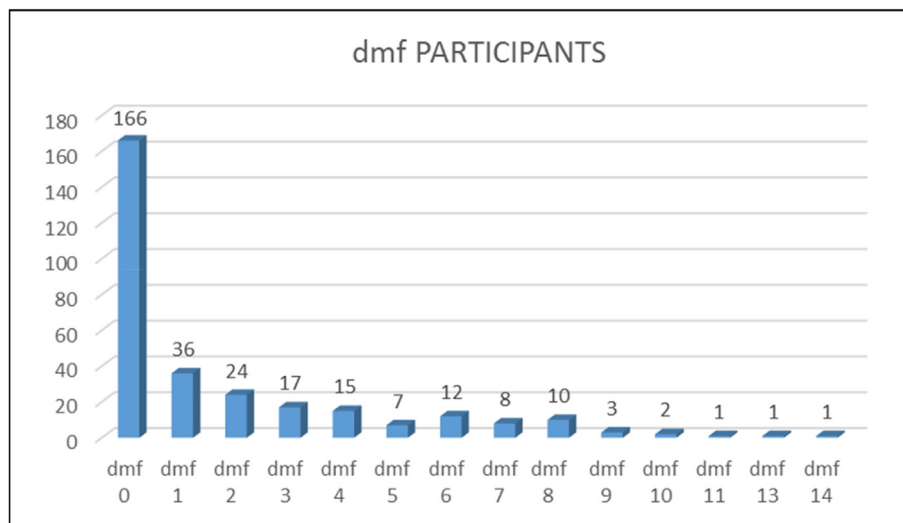

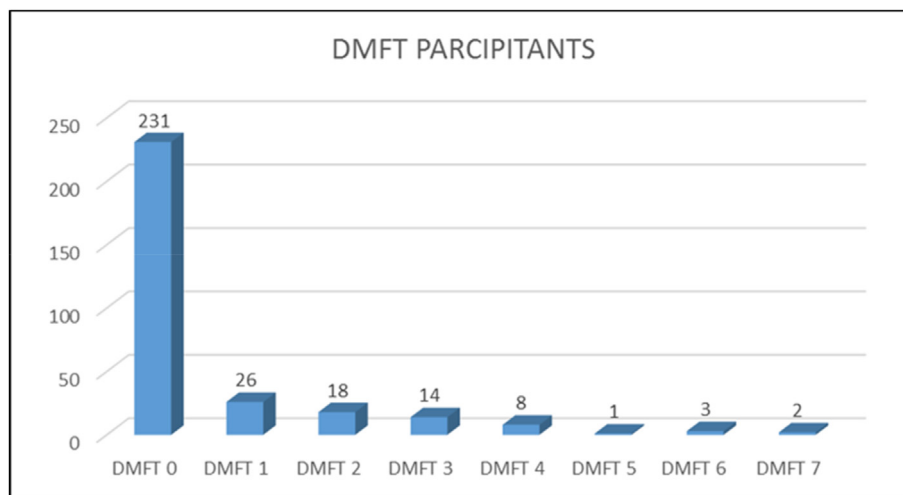**Figure 1.** Distribution of the dmf index in the study population.

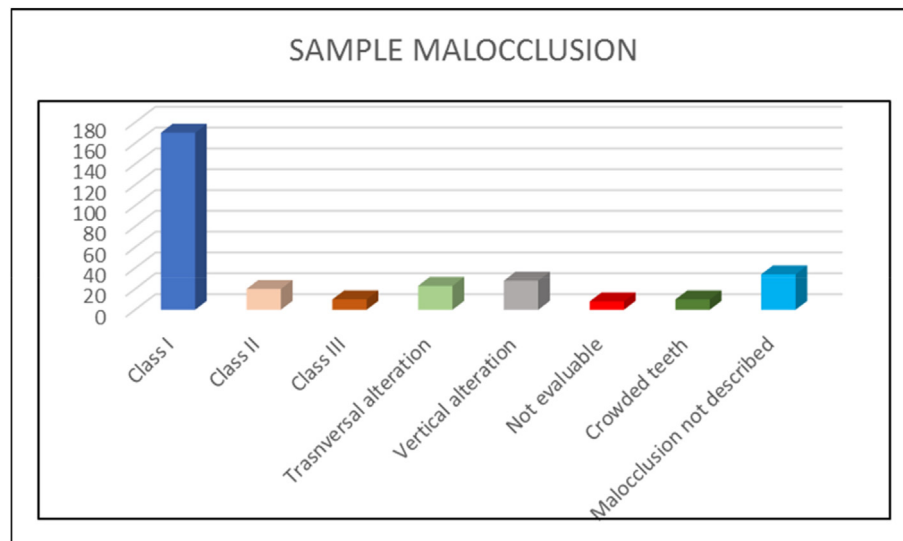**Figure 2.** Distribution of the DMF index in the study population.

Figure 3. Malocclusion in the sample.

in three cohorts of 5–6(including 6 to 6,9 years) years, 7–8(including 8 to 8,9 years) years and 9–10 years, so that the data would be comparable with the oral health surveys of Spain and Madrid [13, 14].

The comparison of our study with the national and Community of Madrid health surveys can be made in the 5–6 years cohort, since in our study we do not have 12-year-old children. In our cohort of 5–6 years we have 183 children, while in the national health survey in Spain there are 661, and in the Madrid survey there are 501, therefore, in our study, which will continue to expand, we have fewer children at these ages. . It must be said that we also have children in the cohorts of 7–8 and 9–10 years, making a total of 303 students. The sample of the national and Madrid surveys is representative of the entire population, while in our case the schools we have studied are from one area of the city of Madrid, we plan to increase our capabilities and expand the sample to representative points throughout the city [13, 14].

4.1. Caries indices

In order to be able to compare all the data from epidemiological studies in public health, in the area of dentistry, some indexes are the gold standard for studying oral health in the population. For school-children, the dmf and DMF indices are the most studied, due to the information they provide and the easy way of recording them. The dmf is a caries index for deciduous teeth that counts the number of decayed, missing and filled teeth (dfm). And it is the same for permanent teeth, DMF refers to decayed, missing and filled teeth.

The results obtained in our epidemiological study, for the cohort aged 5–6 years, highlight caries rates similar to those referred to in the latest oral health surveys in Spain in 2015 and 2020 [14,15]. Particulary, the 2015 survey sample had a dmf index of 1.11; while in our study there was a mean dmf index = 1.84.

In comparison with the 2020 oral health survey [15], with a population sample of 768 children with a mean age of 5.6 years, the difference is also evident, since the authors obtained a dmf index of 1.28, with a percentage of caries-free individuals of 64.5 %, while we obtained a mean dmf index = 1.84 for this age cohort.

At the national level since 1993 with a DMF = 3.1 [15] the trend has been very positive in Spain, with a maximum peak in the 2010 survey with a DMF of 3.7. After that peak the DMF has declined considerably to a value of DMF = 1,3 in the 2020 survey, therefore, the situation of children with an age range of 5–6 years in our study is lower than that of national surveys [13, 14, 15].

The Spanish and Madrid health surveys show a prevalence of 31.5% and 35.9% respectively for this cohort. Our survey shows similar values with a prevalence of 37.6% of students with DFM/dfm >0 in the 5–6 years cohort [13, 14].

Our study shows a mean dmf of 1.84. Higher than those shown in the Spanish and Madrid surveys, 1.11 and 1.21 respectively. This indicates a higher caries concentration in the children in our study. The mean DMF is only available in the Madrid survey; again our value for this index is higher, 0.3 versus 0.11 shown in the previous survey [13, 14].

In relation to the 2002 Navarra children's oral health survey [16], two age cohorts are used for this study, the first at 6 years of age and the second at 8–9 years of age. The 6-year-old cohort had a dmf index = 1.28 and DMF = 0.04, while the 8-9-year-old cohort had a dmf index = 1.58 and DMF = 0.27. Also in this case, the results obtained in our study are similar to the 2002 Navarra averages.

In a study carried out in the Community of Valencia in 2006 [17], a 6-year cohort was used for this study, with a dmf index of 1.07 and a DMF = 1.84. This sample had a percentage of foreigners of 64.1% compared to 31.7% of Spanish children, and precisely the hypothesis of this study was to test the association between caries and immigration. The cohort was larger than our study.

We analyzed the oral health survey of schoolchildren in Aragon [18], with a useful population for this study of 851 children, with a mean age of 6 years. With lower total average indexes with respect to this study, respectively; dmf = 0.61 and DMF = 0.02; considering the indexes by age cohorts, they obtained; in the range of 5–9 years, in 30 children, a dmf index = 3.7 and DMF = 1.15. All these indices show a lower dmf and DMF index in our study, that is, a smaller cohort, but we believe that there should be other variables that could explain these data. In the future, more studies should be carried out to explain this objective.

4.2. Malocclusion

With regard to malocclusion, in the Oral Health Survey of Aragon [18], 77% presented a malocclusion, resulting in only 0.7% of patients with orthodontic appliance, a parameter higher than that obtained in this study, students presented some type of malocclusion in a percentage of 43.89%, so a large part of the sample will need orthodontic treatment.

Furthermore, in relation to the prevalence of malocclusion, Cristina Martin Cid et al. (2009) [19] conducted a study with a sample of 203 individuals between 6-15 years of age, where they found a prevalence of

malocclusion of 58.31%, while in our study the percentage of children with malocclusion in the total sample was only 43.89%.

5. Conclusions

The oral health data collected in the sample (schoolchildren aged 5–6 years) show a high mean prevalence of caries, as well as CPO and DMF indicators. Although our results are difficult to compare with other studies, due to the differences in dispersion and sample size, they present values to those carried out in the same Autonomous Community, Madrid, and also similar to other Spanish communities.

Almost half of the children reviewed presented some malocclusion, so it would be interesting to assess which of these can be prevented by changing habits and/or which should be treated early to avoid future complications.

It would be interesting to extend the sample to other areas and schools in the community of Madrid in order to evaluate how the social and cultural context affects oral health and thus be able to implement specific actions and measures aimed at groups at greater risk of developing dental caries.

6. Institutional review board statement

"The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Institutional Ethics Committee of the European University of Madrid(19/128 approved: october 22 2019).

7. Informed consent statement

"Informed consent was obtained from all subjects involved in the study. In this case the Inform Consent was obtained from the parents of the school-children".

Declarations

Author contribution statement

Alberto Adanero: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Mónica Miegimolle: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

María Berasategui and Lucía Baquero: Performed the experiments; Wrote the paper.

Laura Velayos, Miguel Espí and Marta Piñeiro: Contributed reagents, materials, analysis tools or data; Wrote the paper.

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Data availability statement

Data will be made available on request.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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