Prevalence of caries, gingivitis and malocclusions in school-age children in Ciudad Victoria, Tamaulipas, and its relationship with their nutritional status

Prevalencia de caries, gingivitis y maloclusiones en escolares de Ciudad Victoria, Tamaulipas y su relación con el estado nutricional

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ABSTRACT

Aim: Assessment of caries, gingivitis and malocclusion prevalence in school-age children in the city of Ciudad Victoria, Tamaulipas, Mexico and determination of its relationship with their nutritional status. **Methodology:** A comparative, cross-sectional study was conducted on 402 school-age children (ages 7-12 years). These children could exhibit measurement of body composition. Children were randomly selected from the study list of «Obesity in Tamaulipas' under 30 population, effects on health, treatment and prevention» conducted in this hospital. All subjects provided written consent, thereafter, oral examination was performed in order to determine, according to WHO parameters, presence of dental caries, gingivitis and malocclusions. Version 9.0 of STRATA program was used to conduct statistical analysis. **Results:** 50% of school age children had never attended a dental office. 32.2% were overweight or obese. Caries prevalence was 87%, gingivitis was present in 63% of all cases, and malocclusions were present in 33% of patients. *Ceo-d* index was 2.97 and *CPO-D* was 3.08. Multivariate analysis revealed relationship between the *ceo-d* index with age (p = 0.00), with overweigh and obesity and with malocclusions (p = 0.016) as well as relationship between age and gingivitis (p = 0.01) and age and malocclusion (p = 0.042). **Conclusions:** Malocclusion and caries prevalence resulted similar to that observed in other studies performed in Mexico. Nevertheless, gingivitis was more frequent. In our casuistry; the most significant relationship was that found between *ceo-d* index with overweight and obesity.

RESUMEN

Objetivo. Estimar la prevalencia de caries, gingivitis y maloclusiones en escolares de Ciudad Victoria, Tamaulipas y determinar su relación con el estado nutricional. **Metodología:** Se realizó un estudio transversal comparativo en 402 escolares entre 7 y 12 años de edad los cuales contaban con la medición de su composición corporal, seleccionados aleatoriamente del listado del estudio «Obesidad en la población menor de 30 años de Tamaulipas: efectos sobre la salud, tratamiento y prevención» que se lleva a cabo en este hospital. Previo consentimiento por escrito, a todos ellos se les realizó un examen bucal, determinando la presencia de caries dental, gingivitis y maloclusiones según la OMS. Para el análisis estadístico, la base de datos electrónica se transfirió al programa STATA versión 9.0. **Resultados:** El 50% de los escolares nunca había acudido a una consulta dental, 36.2% tenían sobrepeso y obesidad, la prevalencia de caries fue de 87%, de gingivitis de 63% y de maloclusiones de 33%, el índice *ceo-d* de 2.97 y el *CPO-D* de 3.08. El análisis multivariado mostró relación entre el índice *ceo-d* con la edad (p = 0.00), con el sobrepeso y obesidad y con las maloclusiones (p = 0.016), así como relación entre la edad con la gingivitis (p = 0.01) y las maloclusiones (p = 0.042). **Conclusiones:** La prevalencia de caries y maloclusiones es similar a la de otros estudios en el país, en cambio la gingivitis se presenta con mayor frecuencia en nuestra casuística, la relación más significativa es entre el índice *ceo-d* y el sobrepeso y obesidad.

Key words: Prevalence, school-age children, caries, gingivitis, malocclusions, nutritional status.
Palabras clave: Prevalencia, escolares, caries, gingivitis, maloclusiones, estado nutricional.

INTRODUCTION

Any given population's state of health is a reflection of its society's financial and cultural development. Oral health can be found within these parameters. Dental caries and gingivitis are oral diseases which affect most of the world's population, the former can be found at any age, race and financial status. Recently, malocclusions have acquired greater relevance, and can be now found in third place within the realm of oral conditions.[1]

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In the last four years, caries prevalence in Mexican population has decreased. This could be due to government programs such as «Semana Nacional de Salud Bucal» (National Week for Oral Health) as well as access to public health services for a greater number of subjects.[2] Nevertheless 61% of all Mexican children over 6 years of age suffer caries.[3] In Mexico City, Moreno Altamirano et al reported in 2001 high prevalence (95%) of caries in school-age children with primary dentition. Caries prevalence in children with permanent dentition was 33%.[4] In 2005, In Navolato, Sinaloa, a report was made confirming that caries was found in 82% of school-age children with primary dentition, and 90% of children with permanent dentition.[5] Concurrently, Zelocuatecatl[6] found presence of a relationship between number of decayed teeth and corporal mass index. A year later, Juarez et al when assessing pre-school children, reported caries presence of 68%. The proportion was divided as follows: 60% with normal weight, 19% with low weight, and 22% with overweight and obesity.[7]

Gingivitis is the second cause of oral disease.[8] Prevalence of gingivitis increases with age, it begins, in average, at five years of age, reaches maximum level at puberty, to then decrease, but it is permanent all through the patient's life.[9] Epidemiological studies suggest the fact that gingivitis in children is not constant. In 2004, Murrieta et al reported 20.6% prevalence of gingivitis, especially in the upper anterior region, in school-age children in Mexico City.[8] Treviño et al reported 15% in school-age children of San Pedro Garza Garcia. They reported that a balanced and fiber-rich nutrition decreases dental plaque accumulation and prevents initiation of gingivitis.[9]

Malocclusions are alterations of the balance between developmental systems composing the oral-facial complex. They can affect upper teeth, temporomandibular joint and muscles.[1] Its frequency is variable in different countries. Based on available information on malocclusions in Mexico, Montiel et al in 2004 found a 54% malocclusion prevalence in school age children in Mexico City.[10] There was no clear evidence of a relationship between malocclusions and corporal weight status, nevertheless, it is generally known that consumption of soft foods does not stimulate chewing, compromising thus proper development of oclusion.[11]

Urbanization, financial development and communication media influence elicit changes in lifestyle, feeding patterns and physical activities of subjects. Sedentary life predominates, and with it, consumption of foodstuffs with high contents of carbohydrates and saturated fats. This explains the increase observed in overweight and obesity which currently represents a world health problem.[12] According to the National Survey of Health and Nutrition 2006 (ENSANUT 2006), between 1999 and 2006 overweight and obesity increased by one third; 26% of children (5-11 years) of both genders were affected. The previously mentioned data meant that 4,158,800 school-age Mexican children were overweight or obese.[13]

Doubtlessly, oral and dental health are linked to a combination of factors associated to the disease, among which we can count educational, cultural, socio-economic and nutritional factors.

The objective of the present study was to assess malocclusion, gingivitis and caries prevalence in school-age children (7-12 years) and determine its relationship with their nutritional status.

METHODS

A comparative, cross-sectional study was conducted in 402 school-age children between 7 and 12 years of age analyzing cases and control groups. Children were randomly selected from the database of the study «Obesity in under 30 population in the state of Tamaulipas: effects on health, treatment and prevention strategies» conducted by the Tamaulipas Children`s Hospital. The aforementioned project is still being carried out with financing of Conacyt Fund, Tamaulipas Government, code tamps 2005c08-27. Subjects of the present study were school children from three public primary schools (348 children), and one private school (54 children). Body composition measurements were provided for these children; children suffered no systemic diseases and parent or tutor authorization was previously granted. The size of the sample was calculated using the package SSIZE version 2.0, with alpha 5 and power 90. All children were subjected to oral examination which was conducted by 7 stomatologists. These professionals were trained to standardize measurement criteria. Oral examinations were conducted in a specially adapted classroom of each participating school. Activities were distributed into two work teams as follows: the first team was composed of three stomatologists which were responsible for the oral examination. The second team was in charge of recording in the statistics, capture tab results of the aforementioned exam as well as data pertaining to identification of each child. For oral inspection, the following were used: number 5 oral mirrors, dental explorers, tongue depressors, disposable gloves, masks and artificial light.

Caries presence was determined through epidemiological indexes ceo-d and CPO-D.[14,15] Gingivitis was established through Loe simplified index.[8,14,16] Malocclusions were defined with the help of the malocclusion index, which divided the following types: anterior open bite, anterior and posterior cross bite, edge to edge bite, horizontal overbite (over 9 mm) and vertical overbite (over 90%).[15]

All data were captured in an electronic base of Microsoft Excel Program, and were transferred to STATA program, version 9.0 for analysis. Central tendency and dispersion measures were calculated for numeral variables, and reasons and proportions for nominal variables, as well as frequency measurements (prevalence) for caries, gingivitis and malocclusions. To establish relationship of the presence of these conditions with the nutritional status, a multiple linear regressive analysis was conducted for each dependent variable (ceo-d or CPO-D index) as well as a logistic regression analysis for gingivitis and malocclusions. In both analyses, possible effect of confounding variables (age, gender) were considered.

RESULTS

402 school-age children were examined (208 females 194 males). Mean age was 9.5, standard deviation ±1.5. As relevant information, it was disclosed that 50% of subjects had never attended a dental office and 36.2% suffered overweight or obesity *(Table I)*. 331 children (82%) presented mixed dentition, 70 (17%) permanent dentition, and one (0.25%) primary dentition.

350 children of the sample were afflicted with at least one carious lesion, prevalence was 87% irrespectively of the dentition type *(Figure 1)*. Gender did not reveal significant differences.
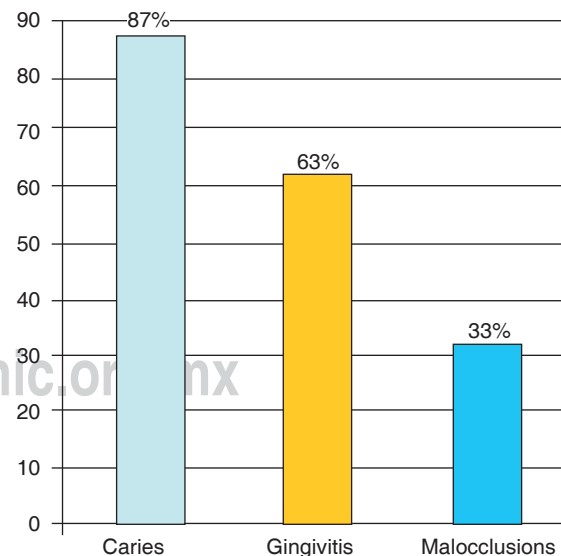
Ceo-d index was 2.97 ± 2.1 and CPO-D was 3.08 ± 2.18 *(Figure 2)*.

Table II shows results of studied conditions by dividing children according to their weight status. It reveals that in cases of permanent dentition, caries prevalence is similar in children afflicted with different stages of nutritional status. Overweight or obese (p = 0.01) children with primary dentition were less affected.

When establishing comparison of *ceo-d* mean index among overweight and underweight children, a statistically significant difference was revealed (p = 0.011). This was also the case when comparing normal weight children with overweight children (p = 0.003). These differences are confirmed in the multiple linear regression analysis which revealed that for every change in the weight condition, *ceo-d* index was modified in average -0.653, with certain adjustments according to age and gender *(Table III)*.

In a similar manner, for each change in age, *ceo-d* index modifies in an average of -0762 *(Table III)* allowing adjustments for weight status and gender.

As observed in *figure 1*, gingivitis prevalence was 63%, in which affected surface average was 2.21

Table I. General characteristics of studied population, Cd Victoria Tamaulipas, January 2008.

Total number of children 402			
Age	Mean		9.2 years
	Standard deviation		± 1.5 years
		n	(%)
Gender	Female	208	(51.74)
	Male	194	(48.26)
Attendance to	Never	202	(50.25)
dental office	At least once	200	(40.75)
Status of BMI*	Low weight	30	(7.46)
	Normal weight	226	(56.22)
	Overweight	65	(16.17)
	Obese	81	(20.15)

*Source: Database of the study «Obesity in population under 30 in Tamaulipas, effects on health, treatment and prevention».

Source: Direct.

Figure 1. Prevalence of caries, gingivitis and malocclusions in schoolchildren in Cd. Victoria, Tamaulipas, January 2008.

surfaces. Tendency analysis revealed that affected surfaces statistically significantly increased with age (p = 0.01). When using Student t-test to analyze according to weight status, the mean surface affected by gingivitis was greater in underweight children in comparison to normal weight children (p = 0.0021). A similar relationship was found when comparing underweight and overweight children (p = 0.0014). Nevertheless, upon performing multivariate analysis, variance analysis revealed the fact that there is no statistically significant difference between weight status of the subject and surface affected by gingivitis.

Figure 1 reveals that 33% of examined children (127) presented some type of malocclusion, among which the most frequent was vertical overbite (27 cases), and the least frequent was posterior cross-bite (15 cases). This can be observed in *figure 3*.

In the logistical regression analysis a significant statistical relationship was found between malocclusions and *ceo-d* index (p = 0.016) and age (p = 0.042). Risk of presenting malocclusions was an influencing factor. BNo statistical significance was found when assessing possible association between nutritional status and malocclusions. In a similar fashion, gender did not bear influence upon presence of malocclusions *(Tables II and IV).*
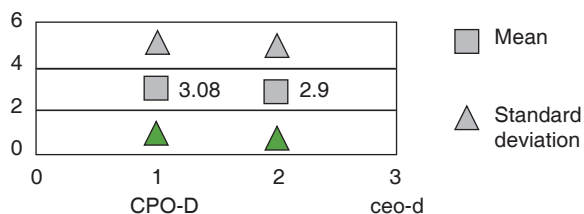

Figure 2. *Ceo-d* and CPO-D indexes and their standard deviation.

DISCUSSION

WHO has widely recommended to conduct epidemiological studies to explore oral health conditions in different populations, since they would be useful for planning health programs adapted to different populations. Examination of results obtained in the present research, drew attention to the fact that half of the examined school age children had never before been in a dental office. This datum can be compared to reports from Mouradian et al[17] who informed that in USA only 1 in 5 children with medical insurance receive oral health preventive measures. Other authors confirm this fact.[17-19] Furthermore, deficient attention to oral health is brought about by the parents low socio-economic and education level, as well as the scarce importance given by the pediatrician. In the present study, these data have not been researched, nevertheless, they can also explain the high caries and gingivitis prevalence found in the sample. Moreover, prevalence of overweight or obesity is greater than national average as reported by ENSANUT2006[13] (Encuesta Nacional de Salud y Nutricion 2006, National Survey of Health and Nutrition 2006) for school age children aged 5-11 years. That is to say, our population is part of this worldwide public health problem.

With respect to the extent of caries assessed by means of *ceo-d* and CPO-D indexes respectively, values found in the present study were below those reported by Villalobos,[5] instead, Moreno Altamirano[4] reported a greater *ceo-d* index and a lesser CPO-D index. These differences could be explained when considering the different environmental and dietary factors present, since the studies were conducted in different cities: Navolato, Sinaloa and Mexico City.

In the present research, findings related to relationships between caries presence and nutritional status differ from those reported by other authors,[20-22]

Table II. Prevalence of caries, gingivitis and malocclusions in studied population according to BMI January 2008.

Nutritional status	Low weight	SD	Normal weight	SD	Overweight	SD	Obesity	SD	p value
Number of schoolchildren	30		226		65		81		
Caries Prevalence in Children`s Dentition	70%		70%		53%		61%		0.01 *
Ceo-d index	3.5	± 3.3	3.22	± 2.93	2.07	± 2.27	2.85	± 2.87	0.01 *
Caries prevalence in permanent dentition	73%		79%		75%		74%		0.5
CPO-D index	2.73	± 2.57	3.21	± 2.6	3.01	± 2.89	2.91	± 2.29	0.5
Gingivitis prevalence	80%		61%		64%		62%		0.93
Malocclusion prevalence	30%		33%		29%		28%		0.22

BMI- Body mass index. * With statistical significance. SD Standard deviation.

this might be due to the fact that , according to our results caries exhibited an inverse relationship with the magnitude of the *ceo-d* index; that is to say, to a greater weight, lesser *ceo-d* index. This concurs with findings reported by Juarez et al, who state that low weight
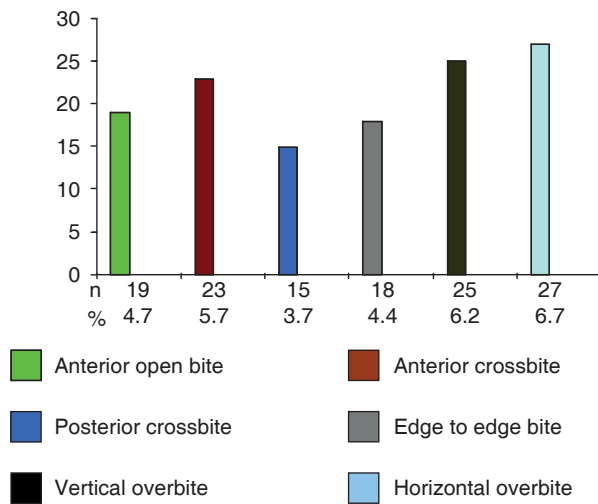
is related to a greater number of caries[7]. Kopycka-Kedzierawsky et al[23] reported results similar to ours. Multivariate analysis of our data was consistent with the aforementioned relationship, adjusting by age and gender. There was no exact explanation for this finding; it is well know that caries and obesity are multi-factorial conditions which, besides having biological factors, are directly influenced by socio-cultural aspects such as age, gender, race, educational and socio-economic level. The relationship between obesity and caries is very complex. Results do not mean that teeth can be protected by overweight in the subject, nevertheless, questions about their association cannot fail to be raised. Analysis of diet and lifestyle for both groups is recommended in order to better understand results of specific overweight factors, as mentioned by Kopycka-Kedzierawski et al,[23] Perhaps, not only diet practices contribute to the obesity epidemic, sedentary lifestyle might also be an associated factor.

Like Villalobos,[5] the present study found a relationship between *ceo-d* index and age, wherein the former decreases when age advances. This is consistent since, to greater age, lesser amount of primary teeth will be found, therefore, lesser will be the *ceo-d* index. Moreover prevalence of gingivitis was higher than that reported by Treviño et al[9] and Murrieta et al.[8] An apparent cause could be the practice of deficient hygiene habits, since, as, reported before, half of the assessed children had

Source: direct.

Figure 3. Distribution of malocclusion in studied simple. Results are expressed as number and proportion of affected schoolchildren (n) according to the malocclusion type.

Table III. Multiple linear regression analysis for *ceo-d* index.

	Coeff.	St. err.	T	P>|t|	CI	
Gender	0.130	0.260	0.50	0.616	-0.381	0.642
Age	-0.762	0.083	-9.19	0.000*	-0.926	-0.599
D x weight 2	-0.653	0.270	-2.42	0.016*	-1.185	-0.121
_cons	10.214	0.785	13.00	0.000	8.669	11.759

Coeff: coefficient
*Idem
CI Confidence interval: 95%

Table IV. Logistical regression multivariate analysis for malocclusion cases.

	Odds ratio	Std. Err.	Z	P>|z|	CI	
Age	1.18	0.09	2.03	0.042*	1.006	1.385
Gender	0.95	0.21	-0.22	0.829	0.608	1.488
D x weight 2	0.81	0.19	-0.83	0.405	0.509	1.312
Zero index	1.11	0.04	2.40	0.016*	1.019	1.212

* With statistical significance
CI: Confidence interval 95%

never attended a dental office; this would give rise to lack of hygiene and prevention knowledge in both parents and children. In concordance with other previously mentioned studies, it was found that the upper anterior region was most affected by gingivitis. The present study concurs with Murrieta et al[8] insofar as considering the fact that affected surfaces increase with age. No significant relationship was found between nutritional state and presence of gingivitis.

Upon examining school-age children afflicted with malocclusion in our population, lesser prevalence was observed than that reported by Montiel et al.[10] No statistically significant relationship was found with nutritional status, nevertheless this relationship was found when comparing with age, that is to say, presence of malocclusions increased with advancing age. This information differs from results obtained by Segura et al,[1] although it must be considered that in his study, children were 3-5 years of age and in ours, the sample was composed of children ages 7-12 years, therefore, it might be proposed that when suction habits, so common in the first years of life, are suppressed, malocclusion prevalence decreases; nevertheless, when dentition transition stages begin, malocclusions increase. A relationship with *ceo-d* index was established. This is understandable when viewed from the perspective that when there is loss of space due to carious lesions, the occlusion development guide results altered.

CONCLUSIONS

Analysis of results of this research led us to conclude the following:

- Studied population was afflicted with a serious health problem with respect to caries and gingivitis.
- Malocclusions exhibited less prevalence
- Differing with other authors[20,22] who reported overweight and obesity as caries risk factors, we found an inverse relationship: to greater body weight, lesser amount of caries.
- No relationship was observed between gingivitis and malocclusions with respect to nutritional status.

RECOMMENDATIONS

Results emphasize the existing need to implement and monitor nutrition and oral health protection and promotion studies targeting school-age children and their parents in order to improve suitable diet and hygiene habits. The importance of regular dental visits

must also be stressed, so that, in future studies these tendencies might decrease.

In order to better define the relationship existing between caries and nutritional status, it might be convenient to conduct further studies with epidemiological designs such as cases and controls, or cohort studies which might establish a cause-effect relationship, since, the transverse design analyzed as cases and controls does present some limitations.

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