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Prevalence of parafunctional habits and malocclusion in 6–9-year-old children and their association with socioeconomic status in Cayambe, Ecuador

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Abstract
Dental malocclusion represents one of the three most prevalent oral pathologies in childhood, along with caries and periodontal disease, its origin is multifactorial, combining genetic factors such as craniofacial inheritance and environmental factors, especially parafunctional habits such as digital sucking, onychophagia, mouth breathing and tongue thrusting, recent studies suggest that unfavorable socioeconomic conditions may increase the presence of these oral practices, negatively affecting the development of the stomatognathic system. In this context, the study aims to determine the prevalence of parafunctional habits and malocclusions in children aged 6 to 9 years dental age in Cayambe, Ecuador, and its relationship with the socioeconomic factor is influential in the presence of this type of non-functional habits and dental malocclusion. A cross-sectional observational study was conducted with a sample of 221 children aged 6 to 9 years, selected using proportional stratified sampling. Structured surveys were used to assess oral habits and socioeconomic status (SES), in addition to a clinical examination to record the type of occlusion according to Angle's classification and specific malocclusions (crossbite, open bite, deep bite, bis-a-bis bite, and diastemas). Statistical analysis was performed using SPSS v. 24, using Kruskal-Wallis and chi-square tests to establish relationships between variables ($p < 0.05$). The results showed that Angle's class II was the most prevalent type of malocclusion (42.1%), followed by class I (41.6%) and class III (16.3%). A bis-a-bis bite (38%) was the most common occlusal alteration. Regarding parafunctional habits, mouth breathing (17.6%), nail biting (15.8%), and tongue thrusting (10.9%) were the most common, with a complete absence of pacifier use. No statistically significant associations were found between socioeconomic level and most of the occlusal variables or habits, except for tongue thrusting ($p = 0.040$) according to the chi-square test. Therefore, the findings of this study are useful for planning and establishing oral health strategies to encourage early visits to dental services, which is an important measure for preventing malocclusion and parafunctional habits in the population.

Keywords: Dental malocclusion, parafunctional habits, mouth breathing, nail biting, tongue thrusting, socioeconomic status

Introduction

Dental malocclusion is defined as a deviation in craniofacial growth and development that impedes the proper functioning of the stomatognathic system [1] It causes alterations in dental position and the relationship between the teeth and dental arches that exceed the normal parameters of functional occlusion [2] According to the World Health Organization, it is one of the three main oral diseases, along with caries and periodontal disease [3, 4, 5]. Epidemiological studies have shown that the prevalence of malocclusions varies significantly globally, with figures ranging from 20% to 93% in the child population, depending on factors such as geographic region, access to health services, and the diagnostic methods used [6, 7, 8, 9]

The anatomical structures compromised in malocclusions include the teeth, jaws, and surrounding soft tissues, such as muscles and temporomandibular joints [10, 11, 12, 13] These alterations can be classified in different planes: sagittal, vertical, and transverse, manifesting as open bite, deep bite, crossbite, or dental crowding [14, 15, 16, 17] These conditions, in addition to affecting facial aesthetics, can interfere with essential functions such as chewing, phonation, and swallowing [18, 19, 20]significantly affecting patients' quality of life, including psychologically [21, 22]

The etiology of malocclusions combines genetic and environmental factors that interact in a complex manner, highlighting their multifactorial nature [22, 23] Genetic components include hereditary characteristics such as the size and shape of the jaws and teeth, which determine the individual's predisposition to developing malocclusions. On [25, 19, 26] the other hand, environmental factors include non-functional or parafunctional oral habits, such as finger sucking, bruxism, mouth breathing, atypical swallowing, and nail biting, which are highly relevant modifiable factors [27, 28]. These habits generate anomalous forces that affect craniofacial development and dental position, being especially harmful if they persist beyond three years of age [29, 27, 30, 31]. Recent studies suggest that the interaction between both factors is crucial, since an unfavorable environment can exacerbate an underlying genetic predisposition, affecting craniofacial and occlusal development [32, 33, 34]

It is worth emphasizing that another important factor is socioeconomic status, a key determinant in the prevalence and management of malocclusions [35, 36]. Children from low-income families often have higher rates of malocclusions and harmful habits due to limited health education and restricted access to dental services [2, 37, 38, 39] Furthermore, factors such as malnutrition, common in vulnerable populations, negatively impact craniofacial and stomatognathic development [40, 23, 41]

Therefore, dental malocclusion is a multifactorial problemwith aesthetic, functional, and social implications. Prevention and treatment require a comprehensive approach that combines clinical care with educational and community interventions [42] This study aims to determine the prevalence of parafunctional habits and malocclusions in children aged 6 to 9 years in Cayambe, Ecuador, and their relationship with socioeconomic factors, which influence the presence of these types of nonfunctional habits and dental malocclusions.

Materials and Methods

A cross-sectional observational study was conducted with a sample determined by stratified sampling. Considering the universe of the study includes 510 children from 6 to 9 years of dental age who regularly attend the "Remigio Crespo Toral" Basic Education School, Zone 2 - District: 17D10 - Circuit: 01_02_06 in Cayambe, Pichincha, the total population amounts to 510 children. Considering this population, a specific statistical formula for observational studies was applied to obtain the sample size, considering the prevalence of dental malocclusion obtained from similar studies, taking an estimation error of 0.05 and a confidence level of 1.96; in this way, the sample considered for the study was 219 participants. The study was reviewed and approved by the CEISH-UNIANDES Human Research Ethics Committee of the Universidad Regional Autónoma de los Andes. (2024-EXT-OB-0015)

Inclusion and Exclusion Criteria

The inclusion criteria were: children between 6 and 9 years of age with dental age; healthy upper and lower first permanent molars in the mouth to determine the type of occlusion; permanent or deciduous central incisors; signed informed consent from parents or legal guardians; and the children's assent. Exclusion criteria were: children with systemic diseases; a history of orthodontic treatment; and students whose parents did not consent to participate in the study.

To respect the bioethical principle of justice, all legal representatives of children between 6 and 9 years of age who are part of this universe, and the minors themselves, were informed about the study in a meeting organized by the authorities of the 'Remigio Crespo Toral' School. They were invited to take part in the study, allowing everyone the opportunity to decide whether or not to participate, taking care not to discriminate against any potential participant.

The methodology includes standardization in the identification of malocclusion types by observing the molar and incisal relationship. Harmful habits such as finger sucking, mouth breathing, nail biting, and tongue thrusting were also assessed through clinical and visual inspection of nails, fingers, hands, and lips. The information was compiled on specifically designed forms and correlated with data on socioeconomic status and parafunctional habits, provided by the legal representatives of the participating children through surveys on each of the topics mentioned.

Subsequently, the collected data were recorded in a data collection sheet and filed in an Excel version document, consecutively this information was processed and analyzed in the SPSS v 24 program. For the corresponding statistical analyses with which the relationships between the variables and their dimensions were verified. Prior to conducting the study, a meeting invitation was sent to parents. Initial contact was made with parents, who outlined the meeting's topic, date, and time. On the day of the meeting, the study's contents and purpose were explained, as well as the data collection method used. Informed consent and assent were also provided so that participants could read it and, if necessary, clarify any questions they might have. Next, the questionnaires addressing socioeconomic status were explained, as well as the questionnaire on functional habits their children may suffer from. These could be completed and distributed at the end of the meeting. Parents who were unable to attend the meeting also received this information, which was later collected by the researcher.

Clinical Examination

The children's oral cavity clinical evaluations were conducted in a safe, quiet, and private setting within the school. The setting was equipped with portable dental equipment and biosecurity barriers to provide comfort and safety to the participating children and their legal guardians. The examination lasted 15 minutes per participant.

Occlusion Variable

In the intraoral examination, the types of occlusion were visually determined, using Angle's molar classification, which establishes 3 Classes: Class I, Class II, Class III.

The presence of diastemas, open bite, crossbite, deep bite, and bisected bite was also assessed.

The functional habits presented by the participants were evaluated through extraoral and intraoral clinical observation of the following structures based on normal characteristics in children:

Extraoral Examination

- **Fingers:** presence of calluses (digital sucking) Nails and cuticles presence of bites and/or infections (onychophagia)
- **Lips:** Presence of skin irritation near the lower lip, lip incompetence, hypotonic upper lip, hypertonic lower lip, thick and everted lower lip, altered lip closure. (Mouth breathing, tongue thrusting)

Intraoral Examination

The following structures were clinically observed as normal with the aid of a mouth mirror:

- **Tongue:** Position of the tongue during the gesticulation of words on the upper and lower teeth, presence of difficulty in pronouncing the phonemes D, T, S. (lingual interposition)
- **Palate:** Presence of a narrow, deep palate (mouth breathing, digital sucking)
- **Upper incisors:** Protrusion of incisors (digital sucking); protrusion of upper front teeth (mouth breathing).
- **Lower incisors:** Retroclination of incisors (digital suction)

Variable on Socioeconomic Level and Parafunctional Habits.

The variable on Socioeconomic Level was assessed using the INEC Socioeconomic Level Stratification Survey, which consisted of 24 questions. The participants' non-functional habits were also assessed using an 8-question survey addressed to their parents. The type of non-functional habit and whether or not the habit was present will be specified.

Absolute confidentiality will be maintained for each of the participants, as they were managed with codes, for which a number was assigned to each data collection form, thus safeguarding their identity: name, gender, and age. The survey was also coded with the assigned number, which will be managed exclusively by the researcher.

Results

Table 1 Parafunctional habits (survey) according to socioeconomic level

		Socioeconomic Level										
		D (low)		C-(Medium-low)		C+ (Typical medium)		B (Medium-high)		TO (high)		
		Children	%	Children	%	Children	%	Children	%	Children	%	
Child takes bottle or breast before bedtime	No	4	100.0	77	100.0	101	98.1	33	94.3	2	100.0	
	Yeah					2	1.9	2	5.7			
Frequency of bottle or breastfeeding	Never	4	100.0	76	98.7	100	97.1	34	97.1	2	100.0	
	1 time a day			1	1.3	1	1	1	2.9			
	3 times a day					2	1.9					
Child uses pacifier	No	4	100.0	77	100.0	102	99.0	35	100.0	2	100.0	
	Yeah					1	1					
Child often sucks his thumb	No	4	100.0	66	85.7	96	93.2	33	94.3	2	100.0	
	Yeah			11	14.3	7	6.8	2	5.7			
Child has the habit of sucking or licking his lip	No	3	75.0	63	81.8	90	87.4	32	91.4	1	50.0	
	Yeah	1	25.0	14	18.2	13	12.6	3	8.6	1	50.0	
Child has the habit of sucking or putting some object in his mouth	No	2	50.0	39	50.6	60	58.3	29	82.9	2	100.0	
	Yeah	2	50.0	38	49.4	43	41.7	6	17.1			
Child, usually sleeps with mouth open	No	1	25.0	56	72.7	82	79.6	27	77.1	2	100.0	
	Yeah	3	75.0	21	27.3	21	20.4	8	22.9			
Child has a habit of keeping his mouth open	No	3	75.0	60	77.9	86	83.5	30	85.7	2	100.0	
	Yes, during the day			2	2.6	4	3.9	3	8.6			
	Yes, during the night			12	15.6	7	6.8					
	Both	1	25.0	3	3.9	6	5.8	2	5.7			

Note: Data obtained from the study conducted

Table 1 shows that, by differentiating between participants by socioeconomic level, the use of bottle or breastfeeding before bedtime was practically non-existent. Thumb sucking was more common in children from socioeconomic levels C- (14.3%) and C+ (6.8%). Lip sucking was more prevalent in children from socioeconomic levels D (25%) and A (50%), although the sample size for these groups was small. It progressively decreased at intermediate levels, being lowest at level B (8.6%). Inserting objects into the mouth was more common in children from socioeconomic levels D (50%) and C- (49.4%), and significantly less common at level B (17.1%). A similar situation occurs with the habits of sleeping with the mouth open and keeping the mouth open, as in the previous cases, the latter habit is mostly present at night.

Table 2. Clinical and observed occlusion according to socioeconomic status

		Socioeconomic Level											
		D (bass)		C- (medium low)		C+ (Typical Medium)		B (medium high)		A (high)		Total	
		Children	%	Children	%	Children	%	Children	%	Children	%	Children	%
Angle Classification	Class 1	2	50.0	32	41.0	48	47.1	9	25.7	1	50.0	92	41.6
	Clase 2	2	50.0	35	44.9	41	40.2	14	40.0	1	50.0	93	42.1
	Clase 3			11	14.1	13	12.7	12	34.3			36	16.3
Bite Crusade	Absent	4	100.0	70	90.9	90	87.4	31	88.6	2	100.0	197	89.1
	Present			7	9.1	13	12.6	4	11.4			24	10.9
Bite Open	Absent	3	75.0	57	74.0	84	81.6	29	82.9	1	50.0	174	78.7
	Present	1	25.0	20	26.0	19	18.4	6	17.1	1	50.0	47	21.3
Deep Bite	Absent	2	50.0	69	89.6	95	92.2	32	91.4	2	100.0	200	90.5
	Present	2	50.0	8	10.4	8	7.8	3	8.6			21	9.5
Mordida to a to	Ausente	4	100.0	45	58.4	63	61.2	23	65.7	2	100.0	137	62.0
	Present			32	41.6	40	38.8	12	34.3			84	38.0
Diastemas	Absent	4	100.0	59	76.6	77	74.8	25	71.4	2	100.0	167	75.6
	Present			18	23.4	26	25.2	10	28.6			54	24.4

Note: Data obtained from the study conducted

In this case, Table 2 presents information on the relationship between observed occlusions and the socioeconomic level of the infants studied. According to Angle's classification, Classes I and II are the most prevalent, with greater frequency in the middle socioeconomic levels. Crossbite is rare, with levels C+ (12.6%) and B (11.4%) being the most representative. Open bite has a total prevalence of 21.3%, with greater frequency in levels D (25.0%) and A (50.0%). Deep bite is more frequent in levels D (50.0%) and less common in intermediate levels (C- and C+, 10.4% and 7.8%, respectively). Bite-to-bis bite is a more common type of occlusion in intermediate levels, especially in C- (41.6%)

and C+ (38.8%). Its prevalence is lower at the extremes. Regarding diastemas, this occlusion is smaller at extreme levels (D and A, 0%) and greater at intermediate levels such as C+ (25.2%) and B (28.6%).

Table 3. Clinical and observed parafunctional habits according to socioeconomic level

		Socioeconomic Level											
		D (bass)		C- (medium low)		C+ (Typical Medium)		B (medium high)		A (high)		Total	
		Children	%	Children	%	Children	%	Children	%	Children	%	Children	%
Sucker	No	4	100.0	77	100.0	103	100.0	35	100.0	2	100.0	221	100.0
	Si												
Onicofagia	No	3	75.0	64	83.1	88	85.4	29	82.9	2	100.0	186	84.2
	Si	1	25.0	13	16.9	15	14.6	6	17.1			35	15.8
Mouth breathing	No	4	100.0	60	77.9	87	84.5	30	85.7	1	50.0	182	82.4
	Yeah			17	22.1	16	15.5	5	14.3	1	50.0	39	17.6
Lingual Interposition	No	3	75.0	65	85.5	96	92.3	32	91.4	1	50.0	197	89.1
	Yeah	1	25.0	11	14.5	8	7.7	3	8.6	1	50.0	24	10.9

Note: Data obtained from the study conducted

Table 3 shows the absolute and percentage relationships between the parafunctional habits and the socioeconomic level of the children studied. Pacifier use is not relevant. Nail-biting is more common in the C- (16.9%) and C+ (14.6%) socioeconomic levels. Mouth breathing is more common in the C- (22.10%) and C+ (15.50%) levels. Finally, tongue thrusting is most common in the C- (14.5%) and C+ (7.7%) levels.

Table 4. Kruskal-Wallis test (Malocclusion-Socioeconomic level)

0.	Angle Classification	Crossbite	Overbite	Open Bite	Deep Bite	Bite back to back	Diastemas
H de Kruskal-Wallis	,231	,003	,996	,573	,009	,795	.078
Gl	1	1	1	1	1	1	1
Sig. Asymptotic	,631	,960	,318	,449	,926	,373	780

Table 4 shows a nonparametric test used to assess whether there are significant differences in the distribution of parafunctional habits according to socioeconomic status. All significance values were > 0.05, suggesting a lack of statistical association between occlusal classification and socioeconomic status.

Table 5. Chi-square test (Parafunctional habits - Socioeconomic level)

		Worth	Df	Significance asymptotic (bilateral)	significance (bilateral)	Significanc (unilateral)
Chupón- Socioeconomic Level	Pearson's Chi- square	[a]				
	Continuity correction □					
	Likelihood ratio					
	Fisher's exact test					
	Linear by linear association					
	Number of cases valid	221				
Nail biting - Socioeconomic Level	Pearson's Chi- square	1,706[th]	1	,192		
	Continuity correction □	,736	1	,391		
	Likelihood ratio	1,421	1	,233		
	Fisher's exact test				,187	,187
	Linear by linear association	1,698	1	,193		
	Number of cases valid	221				
Breathing oral - Socioeconomic Level	Pearson's Chi- square	1,245[th]	1	,265		
	Continuity correction □	0.47	1	,493		
	Likelihood ratio	1,072	1	,300		
	Fisher's exact test				,380	,232
	Linear by linear association	1,239	1	,266		
	Number of cases valid	221				
interposition - Socioeconomic level	Pearson's Chi- square	4,211[th]	1	,040		
	Continuity correction □	2,326	1	,127		
	Likelihood ratio	3,037	1	,081		
	Fisher's exact test				,075	,075
	Linear by linear association	4,193	1	,041		
	Number of cases valid	221				

Table 5 shows that nail biting and mouth breathing have significance levels > 0.05, indicating no significant association with socioeconomic status (p = 0.192 and p = 0.265, respectively). The habit of tongue thrusting is the only variable with evidence of a significant statistical association using Pearson's chi-square test, with a value of 4.211 (p = 0.040), and a linear-by-linear association of 4.193 (p = 0.041). This indicates a significant relationship between tongue thrusting and socioeconomic status, suggesting that this habit may be more prevalent in certain social groups.

Discussion

Malocclusion not only represents an aesthetic and functional challenge, but also has significant psychosocial implications, especially in pediatric populations [43]. While genetic factors play an important role in occlusal development, environmental factors such as parafunctional habits have been shown to considerably influence the development of malocclusions [44] Therefore, the present study aimed to determine the prevalence of malocclusion and parafunctional habits and their relationship with socioeconomic status. An effort was made to ensure the accuracy of the diagnosis of oral habits, based not only on a parental questionnaire, but also on clinical observation.

In our study it was found that Angle's Class II malocclusion is the most prevalent type at 42.1%, followed by Class I at 41.6%, while Class III accounted for 16.3%. In relation to the study, (Yu et al., 2019) it is quite comparable to the reported data where Angle's Class I, Class II, and Class III accounted for 42.3%, 50.9%, and 5.9% respectively. On the contrary, the studies in (Asiry & Alshahrani, 2019) [1] reportaronwhich Class I presented the highest percentage, 61% of the total sample, while Class II and III accounted for 16.3% and 7.7%, respectively. They also Yin [39] point out that the percentage of Class I was 48.9%, being the most prevalent within this study, while Class II and Class III were 14.7% and 19.0% respectively. Regarding the prevalence of malocclusion features in this study, we found that the bis-a-bis bite was the most common in the sample at 38%, followed by the open bite at 21.3%, the crossbite at 10.9%, and finally the deep bite at 9.5%. This does not fully coincide with the results of the study conducted by [45] where the highest prevalence was the crossbite at 15.1%, and bis-a-bis occlusion at 7.7%. Next, it mentions the deep bite at 13.3% and an interincisor spacing of 10.3%, the lowest prevalence was 2.7% for the open bite. This discrepancy could be due to the variation in the methods used to examine occlusion and the different variables taken into account in each study.Through the questionnaire and clinical analysis in this study, it was found that the prevalence of parafunctional habits was 11.1%, which is consistent with studies conducted by [46, 46] which presented a prevalence of 13.1%; likewise, the study conducted by [6] which presented 16.9% of parafunctional habits in the study population. While the studies conducted by [47] showed a 36% higher percentage compared to the present study. While the highest prevalence was presented in the studies of [30] 42.7%; and of [48] with 56.1%. This difference could be due to the variation in the selection of different types of oral habits and the methods used to examine them and data collection methods. The present study showed a higher prevalence of parafunctional habits in men with 58.2% compared to women with 41.8%, which is consistent with the studies of [30] unlike the research of [7] where they indicate that the highest prevalence was in women with 82.1% in relation to men. The findings in the present study show that the most frequent parafunctional habit was mouth breathing which was observed in 39 children (17.6%), this is very consistent with the study of [6] in which indicates that the habit of mouth breathing was the most prevalent condition with 10.1%. In our study the next habit was nail biting which was recorded in 35 children (15.8%) and tongue thrusting which was presented by 24 children (10.9%), the pacifier habit was not present in the participants. Unlike the studies where the most common [27] parafunctional habits were bruxism, followed by finger sucking and nail biting, they also [49] point out that bruxism was the most frequent habit (17.3%), followed by pacifier use (10.1%), finger sucking (8.7%), nail biting (5.8%), tongue thrusting (4.9%), and mouth breathing (4.3%). Their [7] findings showed that the most frequent habit was pacifier use, with 30.0% of the total sample. This habit was not present in any of the participants in our study because the age range of the study in comparison was from 5 years of age, followed by mouth breathing, which was recorded in 23.2% of schoolchildren. Differences in prevalence may correspond to a difficult diagnosis, different data collection methods, and also different samples from different age groups. Regarding malocclusion and parafunctional habits in relation to socioeconomic status, this study determined that there was no statistical significance. In other words, we can say that the presence of malocclusion and parafunctional habits is independent of socioeconomic status. This is very consistent with the study, which [28] indicates that no significant relationship was found between malocclusion and different types of oral habits with family economic status. The author points out that these variables have not been investigated in recent studies, which made it impossible to compare them with the results of other studies. However, [50] he points out that socioeconomic status was significantly associated with malocclusion. The prevalence of malocclusion in his study was higher among participants belonging to lower socioeconomic groups. While [40] the study notes that intergroup comparison of parafunctional habits by socioeconomic status revealed that nail biting and mouth breathing were significantly higher in the high socioeconomic status group compared to the low socioeconomic status group. No other parafunctional habits were found to differ significantly between the two groups.

Therefore, the findings of this study are useful for planning and establishing oral health strategies to encourage early visits to dental services, as this is an important measure for preventing malocclusion and parafunctional habits in the population. We suggest creating new hypotheses to strengthen the quality of future research. We recommend expanding the population sample to include children from diverse regions of the country, both urban and rural, and expanding the age groups evaluated. This would allow for more robust comparisons and better generalization of the results. We also suggest implementing longitudinal designs that allow observing the evolution of parafunctional habits and malocclusions over time, evaluating their appearance, persistence, or modification at different stages of craniofacial development. Furthermore, it is advisable to improve diagnostic conditions through the use of complementary clinical records such as intraoral photographs, digital study models, cephalometric analysis, and functional tools that provide a more accurate and objective assessment. We also propose including new variables such as nutritional status, psychosocial environment, and access to health services. Limitations of this study include that most parents did not recall their children's parafunctional habits, and another limitation is the possibility of parental bias when answering survey questions.

Conclusions

Dental malocclusion and parafunctional habits in relation to socioeconomic level was not statistically significant, which

in other words is interpreted as meaning that the presence or absence of dental malocclusion and parafunctional habits is independent of the socioeconomic level in which they are found.

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