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Prevalence of Deleterious Oral Habits and Their Association with Malocclusions in Children Aged 3–6 Years

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Abstract:

Background: *Oral habits during early childhood have a significant influence on the normal growth and development of the orofacial structures. Physiological habits, such as sucking and swallowing, are a normal part of early development; however, their persistence beyond the age of three years may have a negative impact on the development of the teeth and jaws.*

Deleterious oral habits, such as thumb sucking, prolonged pacifier use, mouth breathing, tongue thrusting, and nail biting, represent significant etiological factors in the development of various forms of malocclusion.

Early detection of these habits and their timely correction are of particular importance for the prevention of subsequent orthodontic abnormalities.

Objective: *The aim of this study was to determine the prevalence of deleterious oral habits among children aged 3 to 6 years and to analyze their association with the occurrence of malocclusions.*

Materials and Methods: *A cross-sectional study was conducted among 209 children from four preschool institutions in Bitola. Data were collected through a structured questionnaire completed by the parents and through an intraoral clinical examination.*

The collected data were analyzed using descriptive statistical analysis and appropriate statistical tests to determine the association between oral habits and malocclusions. During the clinical examination, the presence of malocclusions was recorded, while the questionnaire provided information regarding the presence of deleterious oral habits, including thumb sucking, pacifier use, mouth breathing, tongue thrusting, and nail biting.

Results: *The results demonstrated a high prevalence of deleterious oral habits in the study population. Children with registered deleterious oral habits showed a higher prevalence of malocclusions compared with children without such habits.*

The most frequently recorded habit was tongue thrusting (57.89%), followed by mouth breathing (23.45%), pacifier use (20.1%), thumb sucking (11.96%), and nail biting (10.53%). The overall prevalence of deleterious oral habits was 72.73%.

Conclusion: *Based on the obtained findings, it can be concluded that deleterious oral habits are significantly associated with the occurrence of malocclusions in preschool-aged children. Early recognition and elimination of these habits, timely intervention, continued parental education, and interdisciplinary collaboration represent key preventive measures for maintaining proper orofacial development.*

Keywords: *Deleterious oral habits; thumb sucking; pacifier use; mouth breathing; tongue thrusting; nail biting; malocclusion; preschool-aged children.*

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I. INTRODUCTION

Malocclusions are defined as discrepancies or improper relationships between the teeth of the maxillary and mandibular dental arches in the vertical, sagittal, and transverse dimensions.[1]They are considered among the most prevalent oral health problems, alongside dental caries and periodontal disease.

The identification of aetiological factors contributing to the development of malocclusion is of considerable importance to dental practitioners, as the occurrence and severity of malocclusion may be prevented or reduced through early detection and the implementation of appropriate preventive measures, including patient and parent or guardian education and counselling.

In addition to genetic predisposition, malocclusions may result from environmental factors, including deleterious oral habits during early childhood. Such habits may significantly alter the functional dynamics of the stomatognathic system, thereby contributing to the development of occlusal disturbances.

Owing to their high prevalence, the World Health Organization (WHO) considers malocclusions to be among the major global oral public health concerns.[2]

The presence of malocclusion during the primary and mixed dentition stages constitutes a risk factor for the need for orthodontic treatment during the permanent dentition.[3]

A habit is defined as a repetitive behaviour performed automatically.[4] Repetitive behaviours are common during infancy, and most disappear spontaneously. However, when such habits persist beyond a certain age, they may adversely affect the developing dentition, occlusion, and surrounding oral tissues and may consequently constitute an important aetiological factor in the development of malocclusion. Persistent oral habits can significantly influence tooth position and interarch relationships, interfere with normal jaw growth, and affect the function of the orofacial musculature.[5,6]

According to Shahraki[4] and Agurto et al.,[7] oral habits can be categorized into functional and parafunctional habits. Functional habits arise from the repetition of normal physiological functions, such as respiration, mastication, deglutition, phonation, and speech articulation. Conversely, parafunctional habits are acquired through the practice of non-functional or repetitive behaviors, including thumb sucking, lip sucking, bruxism, mouth breathing, and tongue thrusting.[4,7]

Harmful oral habits that adversely affect the dentofacial complex include:

- Thumb and finger sucking
- Pacifier sucking
- Mouth breathing
- Tongue thrusting
- Bruxism
- Nail biting (onychophagia)

MOUTH BREATHING

Mouth breathing represents a functional disorder that may result from various anatomical and pathological conditions.[8]

According to Moss,[9] chronic mouth breathing leads to alterations in the muscular balance of the orofacial complex, resulting in a characteristic craniofacial phenotype characterized by an elongated adenoid facies, a constricted maxilla, and a tendency toward the development of an open bite.[9]

Harari et al.[10] confirmed that children with chronic mouth breathing exhibit a higher prevalence of malocclusions and impaired orofacial muscle function.[10]

The presence of airway obstruction, particularly at the nasal and pharyngeal levels, may compel the patient to adopt oral breathing as an alternative respiratory pattern.[11]

Children who habitually breathe through the mouth often exhibit characteristic facial features, including an increased lower anterior facial height, periorbital dark circles, narrow nostrils, transverse maxillary deficiency, a high-arched (Gothic) palate, and excessive gingival display. These features may be associated with Class II malocclusion or, in some cases, Class III malocclusion, as well as a high prevalence of posterior crossbite and anterior open bite. Furthermore, mouth-breathing children frequently demonstrate posterior rotation of the mandible and may subsequently develop a Class II malocclusion and a skeletal Class II facial profile accompanied by an increased overjet.[12,13,14]

According to Rakosi and Schilli,[15] mouth breathing may play a role in the aetiopathogenesis of certain forms of Class III malocclusion. Children who habitually breathe through the mouth tend to maintain a persistently open mandibular posture and a low tongue position, which may be associated with excessive mandibular growth. The continuous inferior displacement of the mandibular condyle away from the glenoid fossa may, in turn, act as a stimulus for mandibular growth.[15]

TONGUE THRUSTING

Tongue function is integral to a range of oral and orofacial activities, including mastication, swallowing, respiration, and speech articulation. Impairment of tongue function may consequently contribute to feeding difficulties, atypical swallowing patterns, obstructive sleep apnea, and speech disorders. Therefore, the objective clinical assessment of tongue posture and movement in relation to the development and presence of malocclusion is of considerable clinical relevance.[16]

Tongue interposition, commonly referred to as tongue thrusting, is characterized by the anterior displacement of the tongue, particularly the tongue tip, between the dental arches or teeth.

According to Proffit, Fields, and Sarver,[17] tongue thrusting represents an aberrant orofacial myofunctional pattern involving swallowing and speech articulation. This habit has been associated with the

development of anterior open bite, interdental spacing, and compromised stability of orthodontic treatment outcomes when left uncorrected.[17]

Mason[18] has suggested that tongue thrusting frequently develops as a secondary adaptation to prolonged non-nutritive sucking habits or chronic mouth breathing, highlighting the complex interrelationship among dysfunctional oral and orofacial functional patterns.[18]

Tongue interposition within the maxillary dental arch may result in proclination of the anterior teeth, consequently leading to an increased horizontal overlap (overjet, OJ). Conversely, tongue interposition within the mandibular dental arch may contribute to retroclination of the mandibular teeth, depending on the specific pattern and type of tongue thrusting.

Tongue thrusting, also referred to as visceral swallowing or infantile swallowing, plays a significant role in the aetiology of certain orofacial deformities.[19,20]

According to Subtelny,[21] tongue thrusting may be classified as primary or secondary. The aetiological factors associated with primary tongue thrusting include hypertrophic tonsils, prolonged thumb sucking, nasal congestion, and macroglossia. Secondary tongue thrusting, on the other hand, may develop as a consequence of premature extraction of primary teeth or the presence of an anterior open bite.[21]

II. MATERIALS AND METHODS

To achieve the objectives of the present study, an investigation was conducted on a sample of 200 participants. The study population consisted of children aged between 3 and 6 years, who were divided into two age groups. The first age group comprised participants aged 3 to 4.5 years with primary dentition, whereas the second group comprised participants aged 4.5 to 6 years with mixed dentition. The distribution of female and male children within the study sample was comparable, comprising 98 girls and 111 boys.

For the purposes of this study, a specially designed closed-ended questionnaire was developed and administered through an interview with the parent or legal guardian. Only children for whom informed consent was obtained from a parent or legal guardian were included in the study. Parents or legal guardians were personally informed in writing about the nature and purpose of the research.

Data regarding the presence of malocclusion were obtained through a clinical intraoral examination of predefined parameters in all children included in the study.

All clinical examinations were performed by a single examiner, namely the principal investigator and author of the present study. Each child was examined while seated on a chair facing the examiner. The examinations were conducted under natural daylight, using latex gloves and single-use wooden spatulas.

Acquired malocclusion was diagnosed in otherwise healthy children with no congenital oral abnormalities and no history of previous orthodontic treatment. The diagnostic criteria included:

1 Class I, Class II, or Class III malocclusion;
2 Unilateral or bilateral crossbite;
3 Anterior open bite;
4 Deviation of the dental midline (linea mediana).

The collected data were entered into a database and analysed using the statistical software package SPSS, version 23.0 for Windows.

A cross-sectional study design was employed for the purposes of the present investigation.

Categorical variables were presented as absolute frequencies and percentages, whereas numerical variables were presented as means with standard deviations, minimum and maximum values, medians, and interquartile ranges.

The Chi-square test or Fisher's exact test was used to compare categorical variables.

A p-value of <0.05 was considered statistically significant.

III. RESULTS

I. RESULTS OF THE PARENT/GUARDIAN QUESTIONNAIRE

A total of 200 parents/guardians were surveyed in the present study. Of the children included in the study, 92 (46%) were female and 108 (54%) were male. Regarding age distribution, 70 children (35%) were aged between 3 and 4.5 years, whereas 130 children (65%) were aged between 5 and 6 years (Table 1).

Table no 1. Demographic characteristics of the study population

Variable	n (%)
Sex	
Female	92 (46)
Male	108 (54)
Total	200
Age group(years)	

3 – 4,5	70 (35)
5 – 6	130 (65)
Total	200

According to the parents' responses, 34 children (17%) exhibited persistent oronasal breathing, whereas 127 children (63.5%) exhibited oronasal breathing only during episodes of common colds and allergies (Table 2)

Table no 2. Distribution of children according to their oronasal breathing status

Variable	N (%)
Does the child exhibit persistent oronasal breathing?	
Yes	34 (17)
No	152 (76)
No response	14 (7)
Total	200
Does the child exhibit oronasal breathing only during episodes of common colds and allergies?	
Yes	127 (63,5)
No	51 (25,5)
No response	22 (11)
Total	200

Otorhinolaryngological pathological findings were identified in 10 children (5%) (Table 3).

Table no 3. Distribution of children according to identified otorhinolaryngological pathological findings

Has any otorhinolaryngological pathological finding been identified in the child?	n (%)
Yes	10 (5)
No	181 (90,5)
No response	9 (4,5)
Total	200

According to the parents' responses regarding the type of deleterious oral habit recognised in their child, the most frequently reported habit was tooth clenching, observed in 40 children (30.53%), followed by nail biting in 32 children (24.43%), mouth breathing in 26 children (19.85%), finger sucking in 16 children (12.21%), pacifier sucking in 11 children (8.40%), and tongue thrusting in 6 children (4.58%) (Table 4 and Figure 1).

Table no 4. Distribution of children according to the type of parent-reported deleterious oral habit

Which deleterious oral habit has been recognised by the parent/guardian in the child?	n (%)
Thumb and/or finger sucking	16 (12,21)
Tongue thrusting	6 (4,58)
Nail biting	32 (24,43)
Pacifier sucking	11 (8,4)
Mouth breathing	26 (19,85)
Tooth clenching	40 (30,53)
Total	131

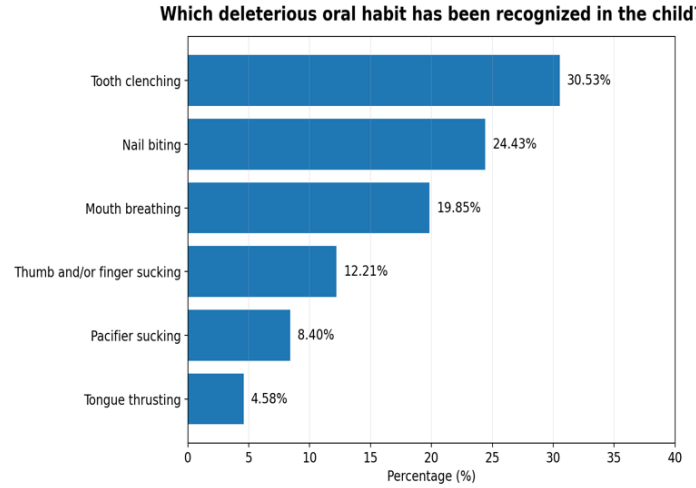

Figure 1. Graphical presentation of the prevalence of deleterious oral habits

II. RESULTS OF THE ANALYSIS OF DATA OBTAINED FROM THE INTRAORAL EXAMINATION OF THE STUDY GROUPS OF CHILDREN

IIa. Descriptive Analysis

This section of the study presents the results obtained from the analysis and processing of data collected during the intraoral examination of 209 children.

The distribution of female and male children within the study population was similar, with 98 (46.89%) female and 111 (53.11%) male children (Table 5).

The children were aged between 3 and 6 years, with 5 years being the most frequently represented age, comprising 74 children (35.41%). Children aged 5 to 6 years constituted the predominant age group, accounting for 127 children (60.77%) (Table 5).

Table no 5. Distribution of children according to sex and age

Variable	n (%)
Sex	
Female	98 (46,89)
Male	111 (53,11)
Total	209
Age(years)	
3	32 (15,31)
4	46 (22,01)
4.5	4 (1,91)
5	74 (35,41)
5.5	2 (0,96)
6	51 (24,4)
Age group (years)	
3 – 4.5	82 (39,23)
5 – 6	127 (60,77)
Total	209

Children with primary dentition accounted for 140 (66.98%) of the study population, whereas 69 children (33.01%) had mixed dentition (Table 6 and Figure 2).

Table no 6. Distribution of children according to dentition type

Dentition type	n (%)
Primary dentition	140 (66.98)
Mixed dentition	69 (33.01)
Total	209

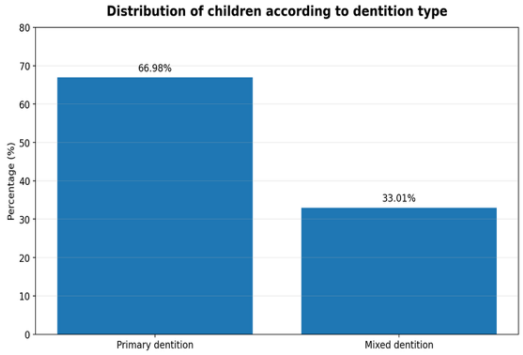

Figure 2. Graphical presentation of the distribution of children according to dentition type

The distribution of children according to the prevalence of sagittal malocclusions is presented in Table 7 and Figure 3.

Class I malocclusion was the most frequently identified sagittal malocclusion, observed in 122 children (58.37%), followed by Class ½ II malocclusion in 70 children (33.49%), Class II malocclusion in 13 children (6.22%), anterior crossbite in 11 children (5.26%), and Class III malocclusion in 4 children (1.91%).

Table no 7. Distribution of children according to the prevalence of sagittal malocclusions

Sagittal malocclusions	n (%)
Class I	122 (58.37)
Class½ II	70 (33.49)
Class II	13 (6.22)
Class III	4 (1.91)
Anterior crossbite	11 (5.26)

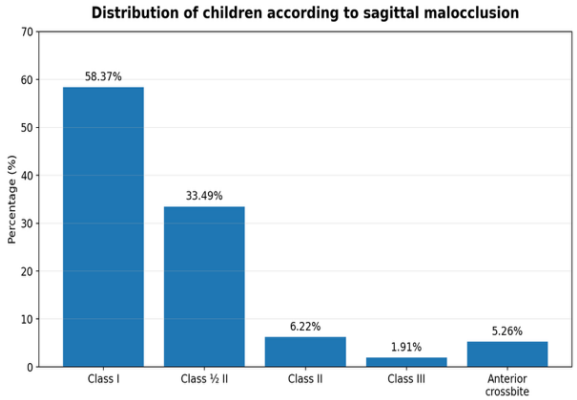

Figure 3. Graphical presentation of the distribution of children according to the prevalence of sagittal malocclusions

Table 8 present the distribution of children according to the prevalence of vertical malocclusions. Deep bite was the most prevalent vertical malocclusion, observed in 152 children (72.73%). Open bite and edge-to-edge bite (tête-à-tête bite) demonstrated an identical prevalence, with each condition being identified in 12 children (5.74%).

Table no 8. Distribution of children according to the prevalence of vertical malocclusions

Vertical malocclusions	n (%)
Open bite	12 (5.74)
Deep bite	152 (72.73)
Edge-to-edge bite	12 (5.74)

A total of 152 children exhibited deleterious oral habits, corresponding to a prevalence of 72.73% in the study group (Table 9 and Figure 4).

Table no 9. Distribution of children according to the prevalence of deleterious oral habits

Deleterious oral habits	n (%)
Yes	152 (72,73)
No	57 (27,27)
Total	209

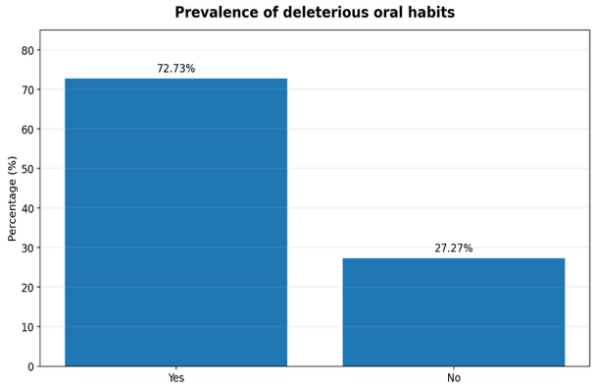

Figure 4. Graphical presentation of the distribution of children according to the prevalence of deleterious oral habits

Tongue thrusting was the most frequently observed deleterious oral habit, identified in 121 children (57.89%), followed by mouth breathing in 49 children (23.45%), pacifier sucking in 42 children (20.10%), thumb/finger sucking in 25 children (11.96%), and nail biting in 22 children (10.53%) (Table 10 and Figure 5).

Table no 10. Distribution of children according to the type of deleterious oral habit

Type of deleterious oral habit	n (%)
Tongue thrusting	121 (57.89)
Mouth breathing	49 (23.45)
Finger sucking	25 (11.96)
Pacifier sucking	42 (20.1)
Nail biting	22 (10.53)

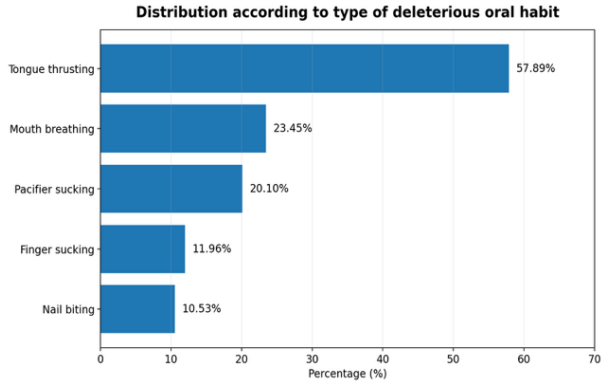

Figure 5. Graphical presentation of the distribution of children according to the type of deleterious oral habit

II b. Correlation between deleterious oral habits and children's age

Children's age was not significantly associated with the presence of deleterious oral habits (p = 0.41). Deleterious oral habits were observed in 69.51% of children aged 3–4.5 years and in 74.8% of children aged 5–6 years (Table 11 and Figure 6).

Table no 11. Prevalence of deleterious oral habits according to children's age

Deleterious oral habits	**Age group (years)**			p-level
	n	3 – 4.5 n (%)	5 – 6 n (%)	
Yes	152	57 (69,51)	95 (74,80)	$X^2 = 0,7$
No	57	25 (30,49)	32 (25,20)	p =0,41
Total	209	82	127	

X^2 (Pearson Chi-square test)

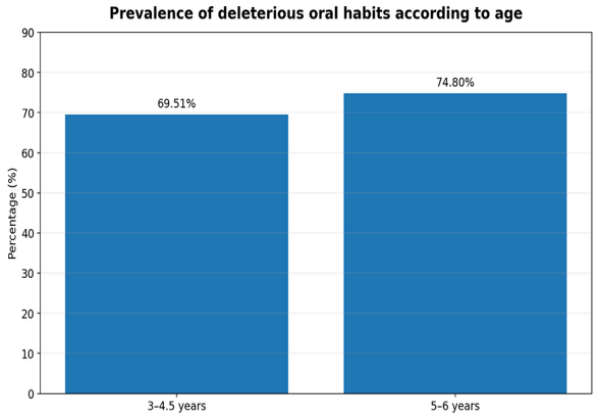

Figure 6. Graphical presentation of the prevalence of deleterious oral habits according to children's age

Tongue thrusting was observed in 60.98% of children aged 3–4.5 years, whereas 55.91% of children aged 5–6 years exhibited this habit. The difference in the prevalence of tongue thrusting between the two age groups was not statistically significant (p = 0.468) (Table 12 and Figure 7).

Table no 12. Prevalence of tongue thrusting according to children's age

Tongue thrusting	**Age group (years)**			p-level
	n	3 – 4.5 n (%)	5 – 6 n (%)	
Yes	121	50 (60.98)	71 (55.91)	$X^2 = 0,52$ p = 0,468
No	88	32 (39.02)	56 (44.09)	
Total	209	82	127	

X^2 (Pearson Chi-square test)

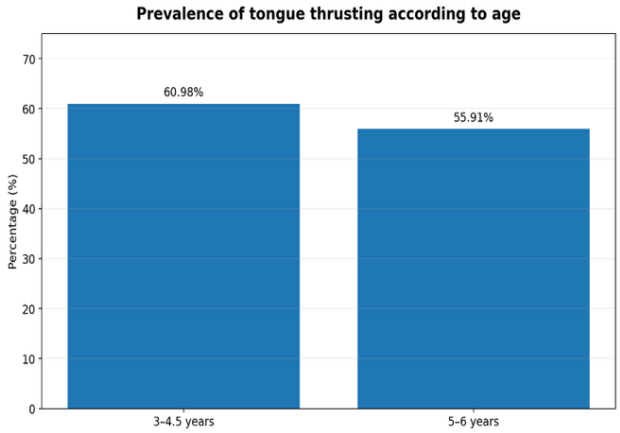

Figure 7. Graphical presentation of the prevalence of tongue thrusting according to children's age

Children aged 5–6 years exhibited mouth breathing more frequently than those aged 3–4.5 years (25.98% vs. 19.51%); however, the difference between the two age groups was not statistically significant (p = 0.281) (Table 13 and Figure 8).

Table no 13. Prevalence of mouth breathing according to children's age

Mouth breathing	**Age group (years)**			p-level
	n	3 – 4.5 n (%)	5 – 6 год. n (%)	
Yes	49	16 (19.51)	33 (25.98)	$X^2 = 1.16$ p = 0.281
No	160	66 (80.49)	94 (74.02)	
Total	209	82	127	

X^2 (Pearson Chi-square test)

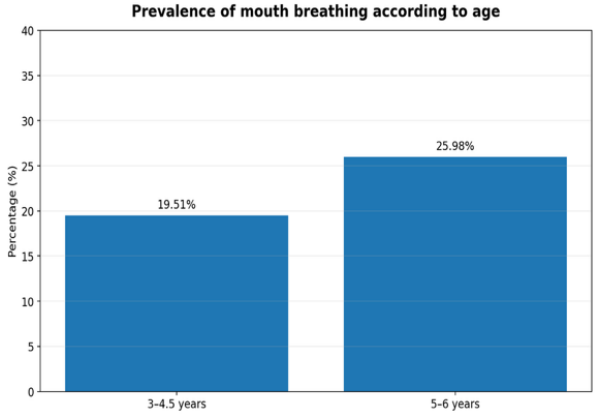

Figure 8. Graphical presentation of the prevalence of mouth breathing according to children's age

IIc. Association of Deleterious Oral Habits with the Class of Malocclusion

Deleterious oral habits were observed in 66.39% of children with Class I malocclusion, 80% of those with Class ½ II malocclusion, 92.31% of those with Class II malocclusion, and 75% of those with Class III malocclusion. No statistically significant difference was found in the distribution of children with and without deleterious oral habits according to the type of malocclusion (p = 0.067) (Table 14 and Figure 9).

Table no 14. Prevalence of deleterious oral habits according to the class of malocclusion

Deleterious oral habits	**Sagittal malocclusion**					p-level
	n	Class I n (%)	Class ½ II n (%)	Class II n (%)	Class III n (%)	
Yes	152	81 (66.39)	56 (80.0)	12 (92.31)	3 (75.0)	Fisher's exact p=0.067
No	57	41 (33.61)	14 (20.0)	1 (7.69)	1 (25.0)	
Total	209	122	70	13	4	

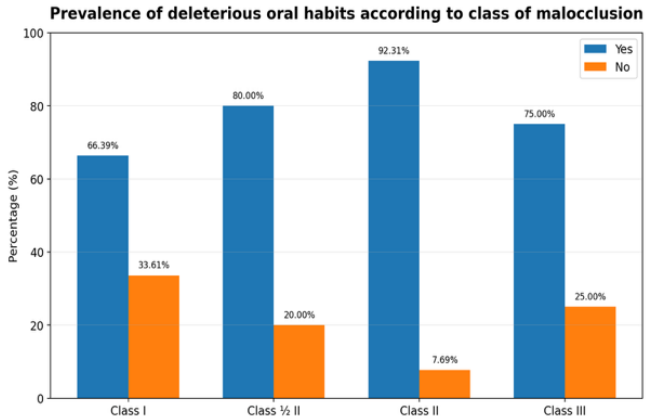

Figure 9. Graphical presentation of the prevalence of deleterious oral habits according to the class of malocclusion

Tongue thrusting was observed with no statistically significant difference among children with Class I, Class I/II, Class II, and Class III malocclusions (52.46%, 67.14%, 61.54%, and 50.00%, respectively; p = 0.232) (Table 15 and Figure 10).

Table no 15. Prevalence of tongue thrusting according to the class of malocclusion

Tongue thrusting	**Sagittal malocclusion**					p-level
	n	Class I n (%)	Class ½ II n (%)	Class II n (%)	Class III n (%)	
Yes	121	64 (52.46)	47 (67.14)	8 (61.54)	2 (50)	Fisher's exact p=0.232
No	88	58 (47.54)	23 (32.86)	5 (38.46)	2 (50)	
Total	209	122	70	13	4	

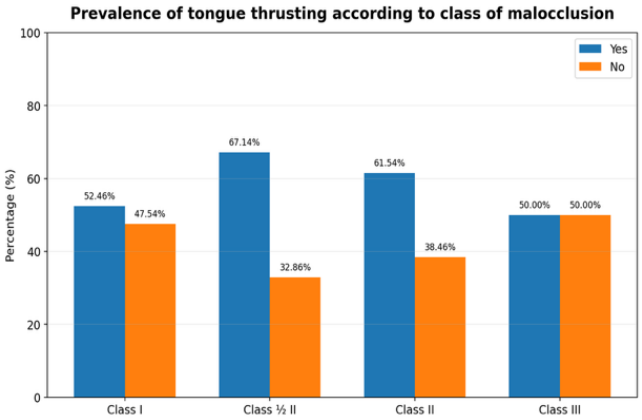

Figure 10. Graphical presentation of the prevalence of tongue thrusting according to the class of malocclusion

Mouth breathing was observed in 17.21% of children with Class I malocclusion, 30.00% of children with Class ½ II malocclusion, 38.46% of children with Class II malocclusion, and 50.00% of children with Class III malocclusion (Table 16 and Figure 11).

The type of malocclusion had a statistically significant effect on the prevalence of mouth breathing (p = 0.034). Intergroup comparisons showed that this overall statistically significant difference was attributable to a significantly higher prevalence of mouth breathing among children with Class ½ II malocclusion compared with those with Class I malocclusion (p = 0.0391) (Table 16).

Table no 16. Prevalence of mouth breathing according to the class of malocclusion

Mouth breathing	**Sagittal malocclusion**					p-level
	n	Class I n (%)	Class ½ II n (%)	Class II n (%)	Class III n (%)	
Yes	49	21 (17.21)	21 (30)	5 (38.46)	2 (50)	
No	160	101 (82.79)	49 (70)	8 (61.54)	2 (50)	
Total	209	122	70	13	4	
p-level	Fisher's exact *p=0.034 Class I vs ½ II X^2 = 4,3 *p=0.0391					

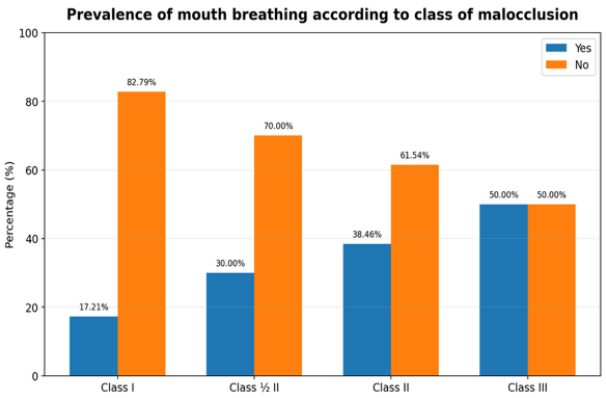

Figure 11. Graphical presentation of the prevalence of mouth breathing according to the class of malocclusion

IId. Association of Deleterious Oral Habits with Anterior Open Bite

All children with an anterior open bite exhibited deleterious oral habits, compared with 71.07% of children without this type of malocclusion. The difference in the prevalence of children with and without deleterious oral habits between the groups with and without anterior open bite was statistically significant. Accordingly, anterior open bite as a vertical malocclusion was significantly associated with the presence of deleterious oral habits (p = 0.029) (Table 17 and Figure 12).

Table no 17. Prevalence of deleterious oral habits among children with and without anterior open bite

Deleterious oral habits	**Open bite**			p-level
	n	Yes n (%)	No n (%)	
Yes	152	12 (100)	140 (71.07)	$X^2 = 4.8$ *p = 0.029
No	57	0	57 (28.93)	
Вкупно	209	12	197	

X^2 (Pearson Chi-square) *sig p<0.05

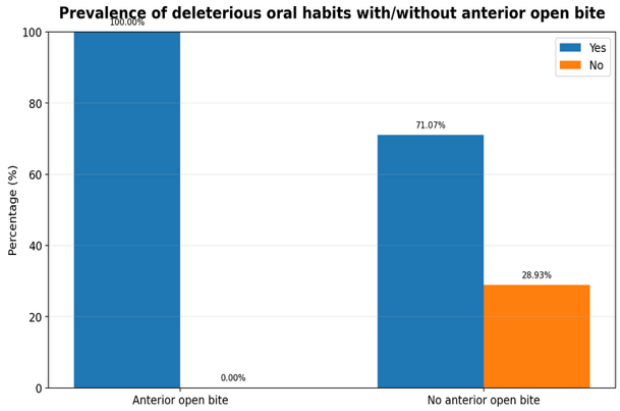

Figure 12. Graphical presentation of the prevalence of deleterious oral habits in children with/without anterior open bite

Children with anterior open bite exhibited tongue thrusting more frequently than children without this type of malocclusion (83.33% vs. 56.35%). However, this difference did not reach statistical significance (p = 0.066) (Table 18 and Figure 13).

Table no 18. Prevalence of tongue thrusting among children with and without anterior open bite

Tongue thrusting	**Open bite**			p-level
	n	Yes n (%)	No n (%)	
Yes	121	10 (83.33)	111 (56.35)	$X^2 = 3.38$ p = 0.066
No	88	2 (16.67)	86 (43.65)	
Total	209	12	197	

X^2 (Pearson Chi-square test)

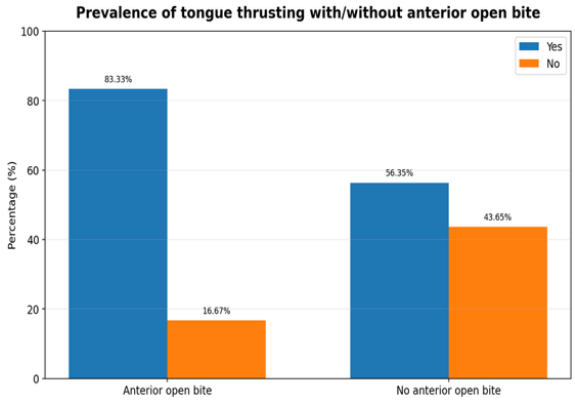

Figure 13. Graphical presentation of the prevalence of tongue thrusting in children with/without anterior open bite

Mouth breathing was observed in 16.67% of children with anterior open bite and in 23.86% of children without anterior open bite. No statistically significant difference was found between the groups with and without anterior open bite (p = 0.826) (Table 19 and Figure 14).

Table no 19. Prevalence of mouth breathing among children with and without anterior open bite

Mouth breathing	**Open bite**			p-level
	n	Yes n (%)	No n (%)	

Yes	49	2 (16.67)	47 (23.86)	$X^2 = 0.048$
No	160	10 (83.33)	150 (76.14)	p = 0.826
Total	209	12	197	

X^2 (yates Chi-square test)

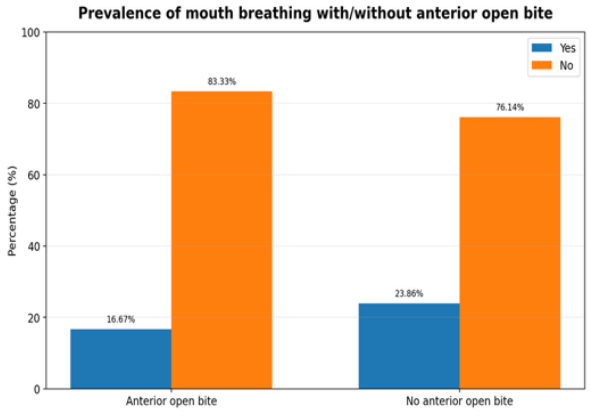

Figure 14. Graphical presentation of the prevalence of mouth breathing in children with/without anterior open bite

IV. DISCUSSION

There is a strong association between the type of deleterious oral habit and the type of dentofacial abnormality observed in children. Every routine examination of young children should include an assessment of occlusion and documentation of oral habits as part of the medical history. Particular attention should be directed towards the prevention of malocclusion at an early age through the elimination of deleterious oral habits during childhood. Parental education should constitute the first component of a comprehensive programme for the prevention of malocclusion.

Malocclusion may result from a variety of interacting factors and represents a deviation from normal craniofacial growth and development, primarily involving the masticatory musculature and the jaws during childhood and adolescence. Its development may also be associated with deleterious oral habits established during early childhood.[22]

Oronasal breathing may develop as a consequence of prolonged non-nutritive sucking habits, including prolonged bottle-feeding, pacifier use, and finger sucking. Nasal obstruction may also contribute to the development of an oronasal breathing pattern. Mouth breathing has been associated with the development of dentofacial alterations, including bilateral crossbite, anterior open bite, tongue thrusting, and lip biting. However, parents may not always recognise prolonged sucking or biting of objects, as well as mouth breathing, as deleterious oral habits. Consequently, parental awareness and active involvement are essential for the early identification and elimination of such habits. Physiological nasal breathing and appropriate tongue posture within the oral cavity contribute to normal maxillary arch development and harmonious craniofacial growth.

Thumb sucking and tongue thrusting are among the most prevalent deleterious oral habits and may contribute to the development of anterior open bite in children. Mouth breathing, identified as the second most common deleterious oral habit, may likewise contribute to the occurrence of open bite, which appears to be among the more frequently observed forms of malocclusion.

The adverse effects of persistent deleterious oral habits should be recognised during the preschool period in order to minimise their potential long-term consequences for oral function and dentofacial aesthetics. A thorough understanding of the relationship between oral habits and malocclusion is essential for their early diagnosis, timely intervention, and appropriate management.

The present study was designed to evaluate the association between oral habits and related malocclusions among preschool children. Specifically, the study aimed to investigate the prevalence of deleterious oral habits in children aged 3–6 years and to assess their association with the presence of malocclusion.

An intraoral examination was performed in 209 children. The distribution of female and male participants within the study population was comparable, comprising 98 females and 111 males. The children were aged between 3 and 6 years, with 5 years being the most frequently represented age (n = 74). Children aged 5–6 years constituted the predominant age group (n = 127). Primary dentition was present in 140 children, whereas 69 children had mixed dentition.

With regard to sagittal malocclusions, Class I malocclusion was the most frequently identified, affecting 122 children (58.37%), followed by Class ½ II malocclusion in 70 children (33.49%), Class II malocclusion in 13 children (6.22%), anterior crossbite in 11 children (5.26%), and Class III malocclusion in 4 children (1.91%).

In the present study, deleterious oral habits were identified in 152 children, corresponding to a prevalence of 72.73%. Tongue thrusting was the most frequently observed deleterious oral habit, occurring in 121 children (57.89%), followed by mouth breathing in 49 children (23.45%), pacifier sucking in 42 children (20.10%), finger sucking in 25 children (11.96%), and nail biting in 22 children (10.53%). Our findings are consistent with those reported by Lopes et al.,[23] who examined 275 children and identified deleterious oral habits in 224 participants, corresponding to a prevalence of 81.5%.

Mouth breathing was observed in 23.45% of the study participants. It was present in 17.21% of children with Class I malocclusion, 30.00% of children with Class ½ II malocclusion, 38.46% of children with Class II malocclusion, and 50.00% of children with Class III malocclusion. The type of malocclusion was significantly associated with the prevalence of mouth breathing ($p = 0.034$). Intergroup comparisons indicated that this overall statistically significant difference was primarily attributable to a significantly higher prevalence of mouth breathing among children with Class ½ II malocclusion compared with those with Class I malocclusion ($p = 0.0391$). These findings are in agreement with the observations of Moss M. L.[9] and Harari D. et al.[10] who reported a higher prevalence of sagittal and transverse malocclusions among children with chronic mouth breathing.

The tongue plays a fundamental role in several oral functions, including respiration, mastication, speech, and swallowing. A swallowing pattern involving tongue interposition is considered physiologically normal during infancy; however, a functionally mature swallowing pattern is generally established between 2 and 4 years of age.[24]

In the present study, tongue thrusting was the most frequently observed deleterious oral habit, with a prevalence of 57.89%. This prevalence was considerably higher than that reported by Vejdani et al.,[25] who found a prevalence of tongue thrusting of 44.4% among their study participants.

Children with anterior open bite exhibited tongue thrusting more frequently than those without this type of malocclusion (83.33% vs. 56.35%). However, this difference did not reach statistical significance ($p = 0.066$). This finding supports the view proposed by Mason and Moyers,[26] according to which tongue thrusting is frequently a secondary habit that may develop as a consequence of prolonged sucking habits or mouth breathing rather than representing a primary etiological factor. Accordingly, tongue thrusting may act as a secondary contributing and perpetuating factor in the maintenance of anterior open bite.[26]

V. CONCLUSION

Based on the results obtained in the present study and the findings reported in the relevant literature regarding the type, frequency, and impact of deleterious oral habits on the development of various abnormalities within the orofacial region, the following conclusions were drawn:

1. The most frequently reported deleterious oral habit identified by parents in their children was tooth clenching, observed in 40 participants (30.53%). This was followed by nail biting in 32 participants (24.43%), mouth breathing in 26 participants (19.85%), finger sucking in 16 participants (12.21%), pacifier sucking in 11 participants (8.40%), and tongue thrusting in 6 participants (4.58%).
2. Following the intraoral examination of 209 children, the following malocclusions were identified:
   2a. Sagittal malocclusions: Class I malocclusion was identified in 122 children (58.37%), followed by Class ½ II malocclusion in 70 children (33.49%), Class II malocclusion in 13 children (6.22%), anterior crossbite in 11 children (5.26%), and Class III malocclusion in 4 children (1.91%).
   2b. Vertical malocclusions: Deep bite was the most prevalent vertical malocclusion, observed in 152 children (72.73%). Open bite and edge-to-edge bite were each identified in 12 children (5.74%).

   Deleterious oral habits were identified in 152 children, corresponding to a prevalence of 72.73% within the study population.
3. Tongue thrusting was the most prevalent deleterious oral habit, identified in 121 children (57.89%), followed by mouth breathing in 49 children (23.45%), pacifier sucking in 42 children (20.10%), finger sucking in 25 children (11.96%), and nail biting in 22 children (10.53%).
4. Children with Class I, Class ½ II, Class II, and Class III malocclusions did not differ significantly with regard to the overall prevalence of deleterious oral habits or the prevalence of individual habits, including tongue thrusting, finger sucking, pacifier sucking, and nail biting.
5. The same groups of children differed significantly with respect to the prevalence of mouth breathing ($p = 0.034$), primarily due to the significantly higher prevalence of this habit among children with Class ½ II malocclusion compared with those with Class I malocclusion (30.00% vs. 17.21%, respectively; $p = 0.0391$).
6. Anterior open bite was significantly associated with the presence of deleterious oral habits ($p = 0.029$). Deleterious oral habits were identified in all children with anterior open bite and in 71.07% of children without anterior open bite.

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