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Original Article

Prevalence of Pediatric Ear, Nose, and Throat Disorders Among Schoolchildren in Zawia: A School-Based Screening Study.

Abeer M. Elsherif[1*], Zahra A. Balkhayr[1] and Nadia Sifennasr [2]

[1.] Department of Surgery, Faculty of Medicine, University of Zawia, Zawia, Libya.

[2.] Department of Medical Microbiology and Immunology, University of Tripoli, Tripoli, Libya.

Corresponding author Abeer M. Elsherif: Email: a.ejlsherif@zu.edu.ly.

Abstract

Background: Otorhinolaryngology diseases are very common, especially among school-aged children. There is increasing concern regarding school-based screening to detect subclinical cases, as many unrecognised pathologies can negatively affect children's quality of life and academic performance. The objective of this study was to screen and assess the prevalence of otorhinolaryngological disorders among school-aged children in late childhood within a non-clinical population. **Methods:** This study was designed as a prospective, descriptive, cross-sectional, school-based screening study conducted between 15 January and 28 February 2025, across five primary schools in Zawia City during a community health campaign organised by the Faculty of Medicine, Zawia University. The study included 233 school-aged children N = 233 who underwent ENT examination. The participants were enrolled from Grades 5 and 6, corresponding to approximately 10–12 years of age. **Results:** A total of 233 students were included in the clinical screening, comprising 137 males 58.8% and 96 females 41.2%. Allergic rhinitis was the most common finding, affecting 64.8% n = 151. This was followed by nasal obstruction in 60.9% n = 142 of the sample and nasal discharge in 48.1% n = 112. Middle ear pathology, particularly tympanic membrane retraction and loss of lustre, was identified in 39.1% n = 91 of students. Tonsillar hypertrophy Grade III–IV was observed in 16.8% n = 39, while adenoid facies was noted in only 4.3% n = 10 of children. A slight male predominance was observed across most findings, although no statistically significant differences were found for the majority of recorded pathologies**. Conclusion:** The findings highlight the importance of school-based screening for early detection and management of ENT conditions, particularly allergic rhinitis and rhinosinusitis, with special emphasis on hearing assessment.

Keywords: Allergic rhinitis; Middle ear disease; Nasal obstruction; Pediatric otorhinolaryngologic disorders; School-based screening; Schoolchildren; Libya.

Introduction

The ear, nose, and throat are intimately connected structures. They form the upper aerodigestive tract, functioning as the primary physiological gateway to both the respiratory and digestive systems [1,2]. Which make them continuously exposed to environmental pathogens, allergens, and mechanical stressors [2]. Diseases affecting these organs are diagnosed, managed, and treated within the specialised field of Otorhinolaryngology [3]. Otorhinolaryngological disorders remain highly prevalent worldwide and contribute significantly to global childhood disability rates [4]. Common conditions include otitis media, tonsillitis, adenoid hypertrophy, allergic rhinitis, and sinusitis, highlighting a major health burden among school-aged children [4,5]. ENT disorders can markedly compromise a patient's quality of life and daily functional performance [1,2]. School-age children are particularly susceptible to ENT diseases because of anatomical immaturity, frequent exposure to infectious agents in crowded school environments, and the increasing prevalence of allergic conditions [2]. Beyond the immediate clinical symptoms, chronic upper airway disorders in children may have important long-term consequences [6]. Prolonged mouth breathing during childhood may influence normal craniofacial growth, leading to the development of adenoid facies [7]. In addition, Chronic nasal obstruction and persistent nasal discharge directly affect normal ventilation and pneumatization of the middle ear and mastoid air cells, resulting in a favourable environment for recurrent otitis media, both types acute and chronic [1,2]. Otitis Media with Effusion may manifest as hearing impairment that is often subtle or undetected, quietly compromising a child's speech perception, language development, and classroom learning before obvious clinical signs become apparent [8,9]. Recent comprehensive clinical data demonstrate that chronic adeno-tonsillar hypertrophy and its secondary obstructive sleep apnea (OSA) serve as aggressive risk factors for early cardiovascular complications in the pediatric population [10]. All these factors highlight the importance of early identification and management of pediatric ENT disorders. School-based screening provides localised epidemiological data essential for assessing the true burden of pediatric ENT disorders. The lack of such studies in our country makes this

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research both necessary and timely. This study was designed as a prospective cross-sectional school-based screening study, conducted between 15 January and 28 February. The objective of this study was to screen and assess the prevalence of otorhinolaryngological disorders among school-aged children in late childhood within a non-clinical population. A school-based setting was used to obtain more representative data and to reduce the selection bias commonly associated with hospital-based studies.

Material and Methods

This study was designed as a prospective, descriptive, cross-sectional, school-based screening study. It was conducted between 15 January and 28 February 2025, across five primary schools in Zawia City:17 February Basic Education School, Al-Ola Model School, Martyr Abdulrahman Al-Turaiki School, Othman Bin Affan Basic Education School, and Ahmed Al-Sharif Basic Education School, as part of a community health campaign organised by the Faculty of Medicine, Zawia University.

Study Population and Participant Enrollment

The study included 233 school-aged children N = 233, comprising 137 males (58.8% and 96 females 41.2%. The students enrolled in Grades 5 and 6 were approximately 10–12 years of age. This age group was selected based on their ability to cooperate with detailed clinical examinations. A convenience sampling method was applied, as participation was limited to students attending the screening campaign during the study period.

Inclusion criteria were enrollment in Grade 5 or Grade 6 in participating schools, attendance during screening days, provision of written parental consent and child assent, and completion of the full ENT examination protocol. No specific exclusion criteria were applied**.** However, students who were unable to complete the clinical examination were excluded from the final analysis.

Clinical Examination Protocol

LED headlamps were used as light source, and standard ENT instruments; including a metallic nasal speculum for anterior rhinoscopy, a wooden tongue depressor for oropharyngeal examination, and a handheld otoscope for otoscopic assessment. All instruments were disinfected with Cidex solution between examinations. Each child underwent a structured ENT evaluation covering oropharyngeal, nasal, and otoscopic examination.

Oropharyngeal examination evaluated throat mucosa and palatine tonsil size using the Brodsky classification (Grades 0–IV), as well as congestion and cobblestone appearance [11]. Anterior rhinoscopy assessed nasal mucosal colour, congestion, discharge type, nasal patency, and septal deviation. Allergic rhinitis was diagnosed clinically according to established criteria [12–14]. Ear examination assessed the auricle, external auditory canal, and tympanic membrane to evaluate congenital deformity, infection, impacted cerumen and tympanic membrane condition (loss of lustre, retraction, congestion, perforation)

Data Management and Statistical Analysis

Clinical data were recorded on standardised data collection forms during examination and subsequently entered into a structured electronic database using Google Forms. The dataset was cleaned, verified, and exported for statistical analysis. Statistical analysis was performed using SPSS version 25.0. Descriptive statistics were used to summarise categorical variables as frequencies and percentages. Inferential analysis was conducted using cross-tabulation and the Chi-square test to assess associations between categorical variables. Fisher's exact test was used when expected cell counts were small or when the assumptions of the Chi-square test were not met. No correlation analysis (Pearson or Spearman) was performed, as all variables were categorical. A p-value of < 0.05 was considered statistically significant for all analyses.

Ethical consideration: The ethical approval was obtained by the Bioethics Committee of Libyan Medical Research Centre, Zawia, Libya (approval reference: NBC:018.H.26.121). Written informed parental consent and child assent were obtained prior to participation.

Result

Socio-demographic characteristics:

The study cohort consisted of 233 schoolchildren from the Zawiya region. The participants were aged between 10 and 13 years, with a mean age of 11.39 years. Gender distribution showed a male predominance, with 137 males (58.8%) and 96 females (41.2%) Fig. (1)

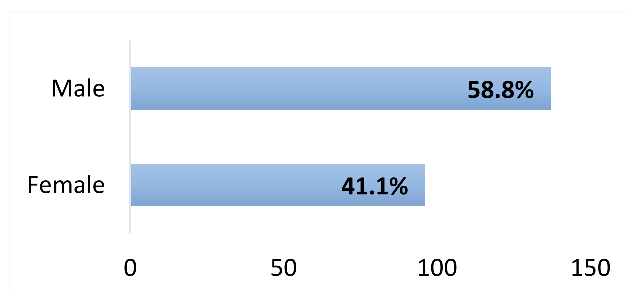

Figure 1. Gender distribution among Schoolchildren in Zawia (N=233)

Prevalence of ENT Disorders:

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The ENT clinical screening of 233 students demonstrates that Allergic Rhinitis is the most prevalent, with a prevalence of 64.8% (n=151). Followed by Nasal Obstruction, which affects 60.9% (n=142) of the population sample, and Nasal Discharge, present in 48.1% (n=112) of cases. Middle Ear Pathology (specifically TM retraction and loss of lustre) was identified in 39.1% (n=91) of the students. While Tonsillar Hypertrophy (Grade III & IV) was found in 16.8% (n=39), the development of Adenoid Facies was found in just 4.3% (n=10) of the children. Notably, a slight male predominance was observed *across* most findings, with no statistical significance for the majority of the recorded pathologies.

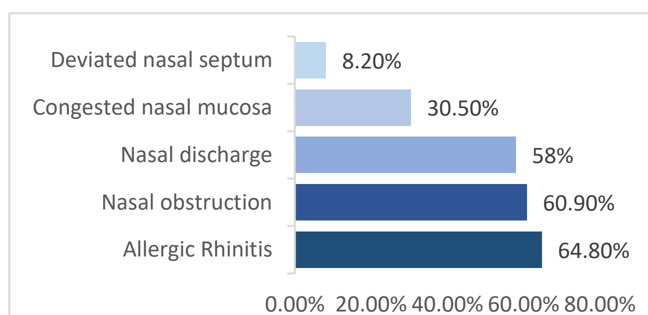

Figure 2. Prevalence of ENT Pathologies among Schoolchildren in Zawia (N=233).

Rhinological Evaluation:

Through history and clinical examination of the nose, 64.8% (n=151) of children complain of allergic rhinitis, which is more prevalent among males (70.1%, n = 96) than females (57.3%, n = 55). Nasal obstruction was identified in 60.9% (n = 142) of students; 27.0% bilateral and 33.9% unilateral nasal obstruction.

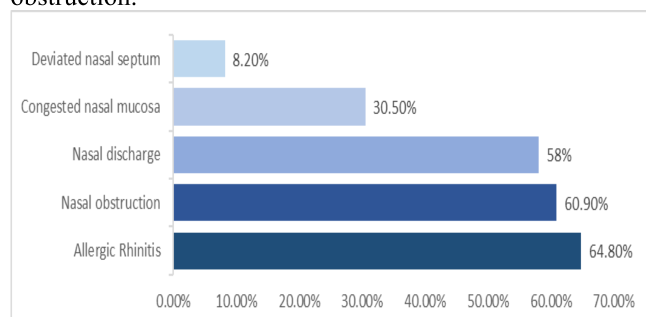

Figure 3. Prevalence of nasal Pathology seen among Schoolchildren in Zawia (N=233)

Direct anterior rhinoscopic examination of the nasal cavity revealed active nasal discharge in 58.0% n = 135 of the study population. Among these children, watery discharge was observed in 8.6% n = 20/233, mucoid-white discharge in 28.8% n = 67/233, and mucopurulent-green discharge in 20.6% n = 48/233. Congestion of the nasal mucosa was observed in 30.5% n = 71 of children. Deviated nasal septum (DNS) was detected in 8.2% n = 19/233 of students, including 14 right-sided deviations, 4 left-sided deviations, and 1 S-shaped deviation. Septal deviation was 5 times more prevalent among males compared with females. Recurrent epistaxis was reported in three students with DNS.

Otological Evaluation:

All children presented with normally developed pinnae and external auditory canals, with no evidence of preauricular tags, sinuses, or any other congenital anomalies. The examination of the EAC showed that the majority of the students had clear canals 85%, n=198. The most common finding was the presence of wax in 14.6% n=34 of the children. While acute inflammation of the canal (Otitis Externa) affects only one child 0.4%.

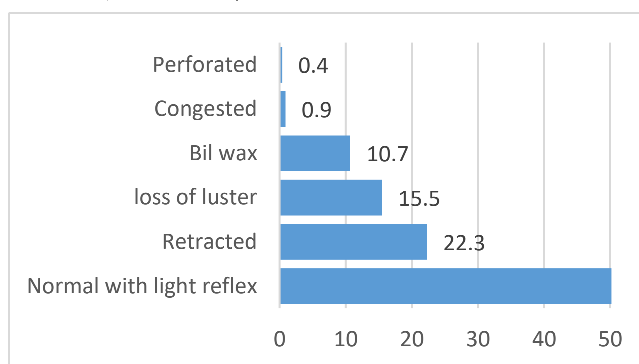

Figure 4. Distribution of Tympanic Membrane Findings Among the Study Population

Notably, no foreign bodies were identified in the EAC of any participant**.** Otoscopic examination of the tympanic membrane revealed that only 50.2% n = 117/233 of the students demonstrated a healthy tympanic membrane with a preserved light reflex. While loss of luster observed in 15.5% n = 36 and tympanic membrane retraction in 22.3% n = 52.

Oropharyngeal Evaluation:

At the time of clinical examination, the majority of the study population, 85.8% n = 200/233, presented with normal throat mucosa. Congested throat mucosa was observed in 10.7% n = 25 of students, while a cobblestone appearance was identified in 3.4% n = 8. Examination of the palatine tonsils demonstrated normal tonsillar mucosa in 82.0% n = 191 of participants and congested in 12.4% n = 29. Regarding tonsillar size, Grade I tonsils were the most common finding, accounting for 51.1% n = 119/233 of participants. Grade II enlargement was identified in 25.8% n = 60/233, while clinically significant hypertrophy (Grades III and IV) was present in 17.6% n = 41/233. Specifically, Grade III hypertrophy was observed in 15.0% n = 35/233 and Grade IV (kissing tonsils) in 2.6% n = 6/233. Participants with previous tonsillectomy (Grade 0) represented 5.6% n = 13/233 of the study population.

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Table 1: Distribution of throat mucosal findings according to tonsillar mucosal status and its size.

Tonsil size	Tonsillar mucosa	Normal throat n (%)	Congested throat n (%)	Cobblestone throat n (%)	Total	
Grade 0		11	0	2	13	
Grade I	Normal	101	6	4	111	119
	Congested	6	2	0	8	
Grade II	Normal	45	4	2	51	60
	Congested	5	4	0	9	
Grade III	Normal	23	1	0	24	35
	Congested	5	6	0	11	
Grade IV	Normal	4	1	0	5	6
	Congested	0	1	0	1	
Total		200	25	8		233

Association between Nasal, Ear and Oropharyngeal Findings:

Significant associations were observed between allergic rhinitis and both nasal breathing and nasal discharge, and are well associated with tympanic membrane findings ($p < 0.00$). A significant association was observed between sex and deviated nasal septum. No significant associations were found between the throat mucosa and the tympanic membrane finding. Detailed results are presented in Tables 2–8.

Table2. Association between allergic rhinitis and nasal obstruction.

Allergic status	Normal nasal breathing	Unilateral obstruction	Bilateral obstruction	Total
Allergic rhinitis (n=151)	29 (19.2%)	62 (41.1%)	60 (39.7%)	151
Non-allergic (n=82)	62 (75.6%)	17 (20.7%)	3 (3.7%)	82

Chi-square test: $\chi^2 = 75.345$, df = 2, $p < 0.001$.

Table 3: Association between allergic rhinitis and nasal discharge

Allergic status	No nasal discharge	Nasal discharge present	Total
Allergic rhinitis (n=151)	36 % (23.8)	115 (76.2%)	151
Non-allergic (n=82)	n=62 (75.6%)	20 (24.4%)	82

Chi-square test: $\chi^2 = 18.412$, df = 3, $p < 0.001$

Table 4: Nasal obstruction pattern vs nasal discharge characteristics and Chi-square test.

Nasal obstruction type	No discharge n (%)	Mucoid discharge n (%)	Mucopurulent discharge n (%)	Watery discharge n (%)	Total
Normal breathing	70 (77.0)	12 (13.2)	6 (6.6)	3 (3.3)	91
Unilateral obstruction	24 (30.4)	25 (31.6)	19 (24.1)	11 (13.9)	79
Bilateral obstruction	4 (6.3)	30 (47.6)	23 (36.5)	6 (9.5)	63

Chi-square test: $\chi^2 = 59.843$, df = 6, $p < 0.001$.

Table 5. Association of deviated nasal septum (DNS) with nasal obstruction and sex

A. DNS vs nasal obstruction.

Nasal septum	*Normal nasal breathing*	*Unilateral obstruction*	*Bilateral obstruction*	*Total*
Central	*88 (41.1%)*	*64 (30.0%)*	*62 (29.0%)*	*214*
Deviated	*3 (15.8%)*	*15 (79.0%)*	*1 (5.2%)*	*19*

Chi-square test: $\chi^2 = 18.873$, $p < 0.001$.

B. DNS vs sex:

Nasal septum	*Male*	*Female*	*Total*
Deviated	*16 (84.2%)*	*3 (15.8%)*	*19*

Chi-square test: $\chi^2 = 5.514$, $p = 0.019$.

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Table 6. Association between tympanic membrane status and nasal clinical findings

A. Nasal breathing vs Tympanic membrane:

Nasal breathing	Normal TM	Loss of lustre	Retraction	Total
Normal	64	7	9	80
Unilateral obstruction	35	14	19	68
Bilateral obstruction	18	15	24	57
Total	117	36	52	205

Chi-square test: $\chi^2 = 37.664$, $p < 0.001$

B. Nasal discharge vs Tympanic membrane:

Nasal discharge	Normal TM	Loss of lustre	Retraction	Total
No discharge	70	3	12	85
Mucoid	21	19	21	61
Mucopurulent	16	11	13	40
Watery	10	3	6	19
Total	117	36	52	205

Chi-square test: $\chi^2 = 55.835$, $p < 0.001$

Table 7: Association between throat mucosal status and Tympanic membrane.

Mucosa of throat	Normal TM	Loss of lustre	Retraction	Total
Cobblestone	2	2	3	7
Congested	10	4	8	22
Normal	105	30	41	176
Total	117	36	52	205

Chi-square test: $\chi^2 = 4.982$, $p = 0.28$

Discussion

Among the primary school children screened in Zawia, the mean age was 11.39 years, with a male-to-female ratio of 1.4:1 (Fig. 1). Nasal disorders represented the most common ENT findings, with allergic rhinitis affecting 64.8% of children and nasal obstruction observed in 60.9%. Ear pathologies were identified in 39.1% of the population, while hypertrophic tonsils (Grade III–IV) and congested throat were found in 17.6% and 10.7% of children, respectively (Figs. 2 and 3).

Allergic rhinitis showed a significant male predominance, 70.1% vs. 57.3%; p = 0.044. A strong association was observed between allergic rhinitis and nasal obstruction $\chi^2 = 75.345$, $p < 0.001$. Children with allergic rhinitis were more likely to exhibit unilateral 41.1% or bilateral 39.7% nasal obstruction, whereas non-allergic children predominantly demonstrated normal nasal breathing 75.6%, (table 2).

Anterior rhinoscopy revealed nasal discharge in 58.0% of children, predominantly mucoid (28.8%), mucopurulent (20.6%), and watery secretions (8.6%). Nasal mucosal congestion was observed in 30.5% of cases, supporting the presence of active nasal inflammation in a substantial proportion of the study population. In contrast, normal nasal breathing was strongly associated with the absence of nasal discharge, occurring in 77.0% (n=70/91) of children without obstruction (table 3). These findings suggest that much of the nasal obstruction observed in this study was related to mucosal inflammation and allergic disease rather than fixed anatomical obstruction.

From an epidemiological perspective, the prevalence of allergic rhinitis observed in this study was considerably higher than rates reported in several international studies. A systematic review of Iranian children reported allergic rhinitis prevalence rates of 11.9% among children aged 6–7 years and 21.2% among those aged 13–14 years [15]. Similarly, a large school-based study from Shanghai, China, involving 18,316 children aged 6–12 years, reported an allergic rhinitis prevalence of 32.9%, approximately half of that observed in the present study [6]. A study on Nigerian schoolchildren also identified nasal disorders as a common finding, with nasal discharge reported in 20% and nasal obstruction in 11.1% of participants [16]. Likewise, a school-based screening study reported an overall ENT morbidity rate

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of 42.1%, with nasal disorders accounting for 28.3% of cases [9]. The prevalence of deviated nasal septum (DNS) in the present study was lower than that reported among Turkish primary school children (38.7%) [18] and Croatian schoolchildren aged 7–14 years (21.1%) [19]. DNS was predominantly associated with unilateral nasal obstruction observed in 78.9% of affected children. However, nasal obstruction was also frequently identified among children with a straight nasal septum, suggesting that the high prevalence of nasal obstruction observed in the present study is more likely attributable to inflammatory nasal conditions, particularly allergic rhinitis, rather than structural septal abnormalities (table 5-A).

The sinonasal findings observed in the present study are consistent with current understanding of pediatric upper airway disease. According to the European Position Paper on Rhinosinusitis and Nasal Polyps (EPOS 2020), the diagnosis of pediatric chronic rhinosinusitis requires the presence of at least two symptoms, one of which must be either nasal obstruction or nasal discharge [17]. Notably, these two symptoms represented the most common nasal findings in the Zawia cohort, affecting 60.9% and 58.0% of children, respectively. Although symptom duration was not assessed, the high frequency of these manifestations indicates a substantial burden of clinically relevant sinonasal disease within the study population.

Several environmental factors may contribute to the high burden of allergic rhinitis observed in this cohort. Airborne dust, desert sand particles, seasonal aeroallergens, and environmental pollutants are recognized contributors to chronic upper airway inflammation and allergic sensitization [20,21]. These environmental exposures may promote persistent mucosal inflammation, epithelial dysfunction, vascular congestion, and tissue edema [22,23]. This study was conducted at a period characterized by variable weather conditions and the onset of the orange blossom season in the region. These environmental factors may have contributed to the increased frequency of allergic symptoms observed.

The otological findings in the present study demonstrated normal pinna and external auditory canal development in all screened children, with no congenital anomalies identified. The most common external ear finding was cerumen impaction, affecting 14.6% n = 34 of students, whereas acute external ear pathology was uncommon, with otitis externa identified in only one child 0.4% and no foreign bodies detected (fig.4) Similar observations have been reported in other school-based screening studies, where clinically significant external ear disease is considerably less frequent than middle ear pathology [24,25]. The low prevalence of otitis externa and foreign bodies may be explained by the school-based nature of the present study, as these conditions are often symptomatic and more likely to prompt medical consultation. In contrast, cerumen impaction is frequently asymptomatic and may remain undetected. The prevalence of cerumen impaction observed in this study is comparable to findings from other community-based screening programs. Cerumen was reported as the most common otological finding among Nepalese schoolchildren, while impacted wax was documented in 10.6% of children screened in East Delhi [26]. Otoscopic examination revealed a that about half of the student 50.2% demonstrated a healthy tympanic membrane with preserved translucency and light reflex, whereas 49.8% exhibited one or more abnormal findings. The most common abnormalities were tympanic membrane retraction 22.3% and loss of tympanic membrane luster 15.5%, while acute inflammatory changes and tympanic membrane perforations were uncommon. The predominance of retraction and dullness over acute suppurative pathology suggests that chronic or subclinical middle ear dysfunction represents a greater burden in this population than active ear infection, which is consistent with other studies [9]. This finding aligns with results from other school-based screening programs that have demonstrated a substantial burden of undiagnosed otological disease among children. A study reported that 43% of primary school children in southeastern Nigeria had cerumen impaction, while 11% showed abnormal tympanic membrane findings [18]. Similarly, a school screening study conducted in Samoa involving 1,491 students identified impacted cerumen as the most common otological condition (36.8%), followed by otitis media with effusion (7.5%) and chronic suppurative otitis media (2.6%) [27]. Another study reported an overall prevalence of ear disease of 47.2% and hearing impairment in 34.7% of schoolchildren [25], whereas another study identified otological conditions in more than half of the children screened [4]. Otological disorders were documented in 75.7% of schoolchildren in the Kathmandu Valley [28]

Although prevalence estimates vary across studies because of differences in study design and population characteristics, the collective evidence indicates that pediatric ear disease is common in school age children and frequently remains undetected.

Similarly, the present study demonstrated a strong association between nasal obstruction and tympanic membrane abnormalities. Nasal obstruction was present in 80% of children with loss of tympanic membrane luster, 82% of

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those with tympanic membrane retraction, and all children with tympanic membrane perforation, significant Pearson $\chi^2<0.001$ (table 6-B). Among children with normal nasal breathing, 70.3% exhibited a healthy tympanic membrane with a preserved light reflex, compared with only 28.5% of those with bilateral nasal obstruction. Likewise, tympanic membrane retraction was substantially more common among children with bilateral nasal obstruction 38.0% than among those with normal nasal breathing 9.8%.

A similar pattern was observed when nasal discharge was evaluated. While 71.4% of children without nasal discharge demonstrated normal tympanic membrane findings, 91.6% of those with loss of tympanic membrane lustre had active nasal discharge. Furthermore, mucoid-white and mucopurulent-green nasal discharge accounted for the majority of tympanic membrane retraction cases, 65.4% (Table 6-B]

These findings support the well-established pathophysiological relationship between chronic nasal inflammation, Eustachian tube dysfunction, and middle ear disease. Persistent nasal obstruction and mucosal inflammation may impair Eustachian tube ventilation, resulting in negative middle ear pressure and subsequent tympanic membrane changes, particularly retraction and loss of lustre, as described in the European Position Paper on Rhinosinusitis and Nasal Polyps [17]. Conversely, no statistically significant association was identified between throat mucosal abnormalities and tympanic membrane pathology ($\chi^2 = 8.106$, $p = 0.919$) (Table 7).

The clinical examination of the oropharynx revealed that the majority of children had normal pharyngeal mucosa 85.8%, which was consistent with normal tonsillar mucosa 82.0%. According to the Brodsky grading system, Grade I tonsils were most frequent, 51.1%, followed by Grade II enlargement, 25.8%. Clinically significant hypertrophy Grades III–IV were identified in 17.6% of children, which is comparable to the 20% reported in previous studies [17]. However, our study demonstrates that only 29.2% of cases with tonsillar hypertrophy showed associated tonsillar congestion (Table 1), suggesting that most enlarged tonsils likely represent chronic lymphoid hypertrophy rather than acute infectious tonsillitis. Similar prevalence patterns have been reported among Turkish and Korean school-aged children, where tonsillar hypertrophy was identified in approximately 11% and 10% of cases, respectively [30,31]. A previous study conducted in the same region reported that 34% of sore throat patients had tonsillitis, and among these, 41% were children aged 1–15 years [32].

In our study, we found that 16/233 children had bilateral nasal obstruction with Grade III–IV tonsillar hypertrophy, which may indicate a risk of significant upper airway obstruction. These highlight the importance of school-based screening and health education for early identification and prevention of potential complications in high-risk group [9].

Adenoid facies were identified in 4.3% of the study population (Fig.2). Although nasal obstruction was highly prevalent, only a small proportion of affected children demonstrated craniofacial features suggestive of chronic functional upper airway obstruction rather than isolated mechanical or inflammatory nasal disease [7]. The considerable burden of the high prevalence of allergic rhinitis and the subclinical ear disease identified in this study underscores the value of school-based screening programs.

Conclusion

Our study provides baseline information on the prevalence of ENT disorders among school-aged children in Zawia. The findings highlight the importance of school-based screening for early detection and management of ENT conditions, including allergic rhinitis and rhinosinusitis, with particular emphasis on hearing assessment. Future studies are recommended to focus on high-risk groups identified in this research, particularly children with untreated allergic rhinitis, who may be at increased risk of hearing impairment.

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Disclaimer

The article has not been previously presented or published and is not part of a thesis project.

Conflict of Interest

There is no financial, personal, or professional conflict of interest regarding the publication of this study.

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