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Study on auditory difficulties prevail in primary school-aged children from the coastal region of Karaikal, Puducherry

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Abstract

Background: Auditory health difficulties can impede educational outcomes in children. This study aims to investigate the prevalence of auditory challenges and difficulties among school-going children in primary schools and its relation with the high humidity level in this coastal region of Karaikal Puducherry.

Subjects and Methods: We assessed 306 students aged 6 to 12 who participated in the screening program. Hearing evaluations were conducted by Audiologists in 5 primary schools in the coastal region of Karaikal. Each child underwent an otoscopic examination, followed by pure tone audiometry and immittance audiometry.

Results: The results showed a range of otological symptoms and conditions, including normal ear condition in 235 (77%), occluding wax in 37 (12%), active ear discharge in 16 (5%), perforated eardrums in 6 (2%), and otalgia in 6 (2%), Congenital hearing loss in 6 (2%).

Conclusion: The study highlighted the importance of conducting hearing screenings for primary school children residing in coastal regions of Karaikal, where high humidity is prevalent, early detection and intervention can significantly alleviate conditions such as earwax compaction.

Keywords: Hearing impairment, primary school children, coastal region, humidity, earwax, ear discharge

Introduction

Hearing impairment is the most prevalent sensory deficit. According to WHO estimates, approximately 63 million people in India suffer from hearing impairment, with a prevalence rate of 6.3%. In India, around 63 million people have a significant auditory impairment^[1]. Children with hearing impairment often experience delayed development of speech and cognitive skills, which may result in slower learning and difficulty in progressing at school. The level and type of hearing impairment and the age of onset, especially if it begins before the age when speech normally develops also have an impact on the child's speech, language and social integration^[2].

Ear wax is the most commonly observed external ear pathology and about 2%-6% of the general population suffers from impacted wax^[3]. It is one of the main causes of reversible HL. Depending on the wax impaction, hearing impairment can range from 5 to 40 dB HL^[4]. In children, HL of even a mild degree can lead to delayed language development and education development and therefore should be managed early.

As the screening is done in the coastal region of Karaikal High humidity can lead to increased wax production and moisture in the ear canal, creating an environment prone to bacterial and fungal growth, and potentially causing ear infections.

Children require normal or adequately corrected hearing to facilitate the formal education process effectively. Hearing impairment in infancy can be either congenital or acquired. Identifying the likely cause of hearing impairment is essential, although in many cases, the exact cause remains unclear^[5]. So, a screening test can detect this kind of potential health condition or those likely to develop a specific condition. This study aims to identify primary school students with potential hearing problems that, if unaddressed, could impede their intellectual, social, linguistic, emotional, and speech development.

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Emphasizing early identification and intervention can prevent permanent hearing loss and associated educational hindrances. Thus, primary school hearing screening programs are crucial for early detection.

Aim and Objectives

The primary aim of this study is to detect and intervene in hearing impairments among school-going children in the rural coastal region of Karaikal. The objectives are to understand the prevalence and categorize the nature of hearing impairments among these children. Another goal is to increase awareness among teachers and parents about the potential causes of ear problems due to high humidity and the possibilities of prevention, diagnosis, treatment, and rehabilitation.

Materials and Methods

Participants: Hearing screening was performed in 5 primary schools located in coastal region Karaikal, Puducherry. The study sample consisted of 306 students, screened over 2 months in January and February 2024. The children were divided into three grade groups:

- **Grade I:** Age 6 to 8 years
- **Grade II:** Age 8 to 10 years
- **Grade III:** Age 10 to 12 years

The distribution of participants across these grades, based on gender, is as detailed in the table below

Gender	Grade 1	Grade 2	Grade 3
Male	49	56	51
Female	43	52	55

Audiological Assessments: All auditory assessments were conducted at the coastal public primary schools in Karaikal.

Otoscopic Examination: Before any auditory testing, an otoscopic examination was conducted by an Audiologist on each child to inspect the ear canal and eardrum.

Audiometry: Participants underwent Pure Tone Audiometry and Immittance Audiometry. The equipment used included the AD528 audiometer for pure tone measurements and the Maico MI24 impedance audiometer for tympanometry. The screening adhered to established guidelines, detailed as follows:

Pure Tone Screening Guidelines

Daily biological checks were conducted on the pure tone screening apparatus to ensure proper functioning. Screening was performed on children aged 5. Pure tone testing was executed at frequencies of 1000, 2000, and 4000 Hz, the intensity level used was 20 dB HL. The threshold was considered obtained if there was a response on 2 out of 3 trials. Screenings were executed in acoustically suitable environments.

Tympanometry Screening Guidelines

Daily calibration of the tympanometry equipment was

mandated to ensure accurate measurements.

Tympanometry was administered as secondary testing after pure tone screening.

The recommended measurement was a 250 daPa tympanometric width. If this width couldn't be obtained, a static compliance of 0.2 mmhos was utilized as the criterion, an additional failure criterion was a negative pressure range between > -200 daPa and -400 daPa.

Ethical Considerations: This study was conducted under the BASLP Department of Vinayaka Mission Medical College, Karaikal.

Results

The research aimed to explore the prevalent auditory challenges among school-going children in primary public schools in the coastal region of Karaikal. Upon evaluating 306 participants, varied auditory health conditions emerged:

Normal Ear Condition: Out of 306 participants, 235 children (77%) had normal ear conditions and normal hearing.

Compaction of Earwax: Out of the total participants, 37 children (12%) had compacted earwax. Although a natural secretion, earwax can sometimes accumulate excessively, blocking the ear canal and causing discomfort and temporary hearing impairment. Regions with high humidity levels can influence ear wax production. When humidity is higher, the ear canal may become moist, leading to the softening of ear wax. 8 children showed no hearing impairment despite the compaction, while 29 children experienced minimal to mild conductive hearing loss.

Active Ear Discharge: 16 children (5%) had active ear discharge, which is watery, bloody, and whitish-like pus. Active ear discharge (otorrhea) is drainage from the ear. Depending on the cause of the discharge, people may also have ear pain, vertigo, tinnitus, and/or hearing loss. Most of these children faced hearing loss, with 10 children showing mild conductive hearing impairment in the low-frequency range, 3 children facing moderate conductive loss, and 3 children having moderate mixed hearing loss.

Perforated Eardrum: 6 children (2%) had a perforated eardrum, resulting in mild to moderate conductive hearing loss for 4 children and mild mixed hearing loss for 2 children.

Otalgia: 6 children (2%) had ear pain (otalgia) without significant hearing loss.

Congenital Hearing Loss: 6 children (2%) had congenital hearing loss; Congenital hearing loss can be defined as hearing loss present at birth. The hearing loss can be sensorineural or conductive. 4 children showed moderate sensorineural hearing loss, and 2 children showed severe mixed hearing loss.

Table 1: Overall Prevalence of Auditory Health Issues

Conditions	Total number affected children	Percentage of total participant (306)
Normal Ear Condition	235	77%
Ear Wax	37	12%
Active ear discharge	16	5%
Perforated ear drum	6	2%
Otalgia	6	2%
Congenital hearing Loss	6	2%

Table 2: Hearing Assessment for Overall Ear Condition

Conditions	Normal hearing	Minimal hearing loss	Mild			Moderate			Severe		
			C*	S*	M*	C*	S*	M*	C*	S*	M*
Normal ear condition	235	-	-	-	-	-	-	-	-	-	-
Ear wax	8	21	8	-	-	-	-	-	-	-	-
Active ear discharge	-	-	10	-	-	3	-	3	-	-	-
Perforated ear drum	-	-	2	-	2	2	-	-	-	-	-
Otalgia	6	-	-	-	-	-	-	-	-	-	-
Congenital hearing loss	-	-	-	-	-	-	4	-	-	-	2

*C- Conductive Hearing loss *S- Sensorineural hearing loss *M-Mixed hearing loss

Discussion

Hearing, an indispensable sensory function is fundamental for effective communication, particularly during the formative years of childhood. In the environment of a school, where learning largely transpires through auditory communication, any hindrance in hearing can considerably impede a child's academic and social development.

In our study of 306 school-going children, Children with impacted wax were found to be 12% ($n = 37$), Ear wax is the most prevalent ear problem in our study, As the study was conducted in the coastal area of Karaikal Puducherry where the humidity was found to be high. Similar results were found in the study in Brazil by Nogueira *et al* [6], Thakur *et al.* [7] also observed excess ear wax as the commonest problem. But in the majority of the cases, it was found to be asymptomatic and had not received any attention for treatment.

In our study, we found that there is a high prevalence of ear wax in school-going children of Karaikal is associated with high humidity that prevails in coastal areas, as High humidity can lead to increased moisture in the ear canal, creating an environment conducive to bacterial and fungal growth, and potentially causing ear wax build-up [8]. This condition causes earwax to become soft and expand, potentially leading to blockages and discomfort. Its intervention still poses an immense challenge to the prevention of hearing impairment, especially in children. We found that there is a high prevalence of ear wax in children, but the prevalence of hearing loss due to wax is relatively less. Similar studies observed ear wax prevalence is higher in schools of Kathmandu Valley Nepal by Maharajan *et al* [9] in Nepal.

In coastal areas like Karaikal, the high humidity condition not only leads to ear wax problems but there will be associated conditions of otitis externa, otitis media, and hearing loss, so its management still poses a bigger challenge for the prevention of deafness, especially in children. Vieira *et al.* [10] also reported that school children usually presented hearing loss because of excess wax, foreign bodies, otitis externa, and otitis media with effusion. In our study, we also found that 5% of children had active ear discharge which untreated leads to otitis externa, and otitis media. A study done by Adhikari in 2008 reported a 3.7% prevalence of OME [11].

In case of high humidity, ensure ears are thoroughly dried to prevent infections [12]. Regular ear check-ups can help manage ear health effectively, especially when experiencing symptoms related to humidity and consulting a professional if you experience symptoms of ear wax impaction or infection. Proper ear hygiene is essential to prevent excessive ear wax build-up and to ensure optimal hearing health in these areas. Ear wax impaction was the root cause of hard of hearing in many studies [13].

Creating awareness about ear wax and its possible complications among children and their parents through school-based ear health programs could prevent possible complications associated with ear wax impaction. Early identification and treatment of children with hearing loss have been demonstrated to improve their prognosis and outcomes [14, 15].

The significance of early detection of hearing impairments in children, especially in developing regions, cannot be overstated. Olusanya (2001) delved into the options available for early detection in developing countries and highlighted the challenges faced, a sentiment echoed in our study which emphasizes the importance of early identification [16].

By identifying and intervening early, we can drastically reduce the possibility of associated speech and language complications that children might encounter in their subsequent years. This emphasis on early identification finds alignment with studies conducted in diverse global regions. For instance, in the Northern regions of Quebec, a study by Julien *et al.* (1987) pinpointed chronic otitis media as a prime contributor to hearing deficits among Native children [17]. From a global standpoint, the burden of childhood hearing impairment remains heavy. Olusanya and Newton (2007) elucidated the global implications of childhood hearing impairment, particularly focusing on disease control priorities in developing nations [18]. The importance of early identification was also emphasized by Yoshinaga-Itano *et al.* (1998), who delineated the stark differences in language development between children identified early with hearing loss compared to those identified later [19]. School screening programs assist in diagnosing and managing common ear problems, providing a cost-effective approach to ear health. Likewise, raising awareness about ear wax and its potential complications

among children and their parents through school-based ear health programs can prevent issues associated with ear wax impaction.

Conclusion

The landscape of hearing impairment among children in primary schools in the coastal region of Karaikal reflects a global issue. In our study, earwax buildup, linked to high humidity, was identified as a primary cause. Impacted ear wax can lead to hearing impairment. The broader consequences of untreated hearing impairments highlight the urgent need for robust, early, and comprehensive screening programs. Moving forward, parents and professionals must collaborate in implementing systematic hearing screenings in primary schools, ensuring that our children's auditory health—and, consequently, their academic and social futures—remain bright.

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