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## ORIGINAL ARTICLE

### Hearing Assessment of Kindergarten Children in Mangalore

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#### ABSTRACT

Identification of hearing loss proves vital at any age for health considerations. In school, hearing loss may interfere with learning and if undetected, it can cause poor school performance. This study was conducted to assess the hearing status of 339 preschool children attending 6 kindergarten schools in Mangalore. Each child underwent an otoscopic examination, followed by tuning fork tests and pure tone audiometry. Otosopic findings were found to be significant in 217(64.01%) children. After the audiological examination, 37 (10.91%) children were found to have conductive hearing loss and none had sensorineural hearing loss. Out of the 31 children with middle ear disease, only 11 (35.48%) were detected to have hearing impairment. Prevalence of hearing impairment and otitis media was higher in rural school children than in urban schools.

**Key Words:** Hearing assessment in children; Kindergarten children.

**Key Message:** Schools in developed countries provide screening to identify children with significant hearing loss. Such hearing loss, when identified, can be corrected. However, such a system does not exist in India. The early detection of hearing loss in children plays a major role in health care system.

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#### Introduction

Hearing impairment accounts for 14% of total disabilities in India. The incidence of the same is around 3 per 1000 children in the country. In contrast to blindness which has received major attention from the national authorities for its prevention, deafness as yet, remains a major neglected issue, even when hearing function is equally vital for learning. In schools, hearing loss may interfere with learning and if undetected, can cause poor scholastic performance or academic failure. Further, children with hearing loss may exhibit

negative behavior related to hearing loss; such as not paying attention, interrupting others, inappropriately responding to oral directions or not responding at all. Yet, a major problem exists in the lack of timely identification of many children with hearing impairments. These inadequacies appear to be due to a lack of awareness on the part of healthcare providers, as to the potential hearing losses, ignorance concerning the ability to diagnose and a lack of awareness about the potential of effective treatment [1].

Hearing assessment in the 0-5 year children's age group is difficult, but is not impossible. Technical advances in the past 15 years have made reliable hearing tests possible even in very young children [2]. The pure availability of sophisticated screening methods is insufficient if they are not included in a universal screening program [3]. Schools in developed countries

provide screening to identify children with significant hearing loss. Such hearing loss, when identified, can be corrected. However, such a system does not exist in India.

This study therefore, aims at

- 1) Assessing the degree of hearing in kindergarten children and finding the occurrence of hearing loss in these children.
- 2) Finding out the type of hearing loss (conductive/sensorineural/mixed).
- 3) Assessing the aetiology of hearing loss (treatable/untreatable).

The secondary objective of this study was to analyze its effect on the academic performance of the child.

### Methods and Materials

This descriptive study was conducted in the months of July and August 2007. Six schools among all the schools in Mangalore, having kindergarten, were selected using the cluster sampling technique. Three schools were from the rural region and three were from urban region.

The consent from the hospital ethical committee was obtained. The principals of the schools were approached one week in advance and consent for conducting the study in the school was obtained. Parent consent forms in English and Kannada (native language) languages were handed out to the parents, one week in advance. Parents were requested to bring the filled in consent forms on the day of conduction of the study.

The study was conducted in the school premises itself. All children whose parents gave consent were included. A total of three hundred and thirty-nine children were included in the study.

Each child underwent the following modalities of hearing assessment.

- 1) Otoscopic examination.
- 2) Tuning fork tests.
- 3) Diagnostic pure tone audiometry .
- 4) Tympanometry (if required).

Otoscopic examination was done to detect any ear pathology. Hearing was tested using a 512Hz tuning fork, followed by pure tone audiometry by a trained audiologist in a sound proof room. Hearing at frequencies 500Hz, 1000Hz, 2000Hz and 4000Hz, were tested in the child. For each ear, the pure tone average was recorded in decibels. Hearing was graded according to the American Speech and Hearing Classification as mild(loss in 25-40dB range), moderate(loss in 41-55dB range), moderately severe(loss 56-70dB range), severe(loss of 71-90dB range) and profound ( loss of >90dB).

To analyse the academic performance of the child, child-parent questionnaires (Vineland maturity scale) relating to the child's academic performance, social skills and behaviour were sent to the parent. The parents were requested to bring the same and to meet the child psychologist during follow up.

The data was analysed by the SPSS statistical Package 11.5. For comparing outcomes, the Chi-Square test was used. A p value of <0.05 was taken as significant.

### Result

The study was conducted on a total of 339 children whose parents gave consent for their child to be enrolled in the study. Of the 339 children, 23% (n=77) were from rural schools and 77% (n=262) were from urban schools. The prevalence of hearing impairment and otitis media was higher in rural school children than in urban schools. While 16.9% (13 out of 77) of the children in rural schools had hearing impairment, only 9.2% (24 out of 262) of the urban school children had hearing impairment. Similarly, 14.29% (11 out of 77) of the rural school children were found to have middle ear disease, while only 7.63% (20 out of 262) of the urban school children were found to have the same. The prevalence of chronic suppurative otitis media was found in 9.09% (7 out of 77) of the rural school children and in 0.76% (2 out of 262) of the urban school children. Of the total 339

children that were studied, 37.2% (n=126) were males, while 62.8% (n=213) children were females. 14.2% (n=48) of the children were 3 years old, 50.1% (n=170) were 4 years old, 34.8% (n=118) were 5 years old and 0.9% (n= 3) were 6 years old.

No significant correlation could be drawn between the age or sex of the children and their hearing function. Of the 339 children, 64.01% (n=217) had significant otoscopic findings. The otoscopic findings have been detailed in [Table/Fig 1].

(Table/ Fig 1) Otosopic Findings

Otosopic Findings	Frequency	Percentage
Cerumen Impaction	186	54.90%
Mild impacted wax	38	11.2%
Impacted wax	148	43.70%
Ear discharge(Chronic Suppurative Otitis Media)	9	2.70%
Secretory Otitis Media	18	5.30%
Congested tympanic membrane(Acute Otitis Media)	4	1.20%
Dull looking tympanic membrane	5	1.50%
Retracted tympanic membrane	13	3.80%
Incidental Foreign Bodies	3	1.00%
normal	122	35.90%

On testing by tuning forks, Rinne's test [Table/Fig 2] was found to be negative in the right ear in 8% (n=27) children, whereas it was negative on the left side in 71% (n=24) children. ss

(Table/Fig 2) Rinnes Test

	RIGHT EAR		LEFT EAR	
	Frequency	Percent	Frequency	Percent
Positive	296	87.3	299	88.20%
Negative	27	8	24	7.1
Not cooperative	16	4.7	16	4.7
Total	339	100	339	100

Findings of Weber's test and Absolute Bone Conduction Test have been depicted in [Table/Fig 3] and [Table/Fig 4] respectively.

(Table Fig 3) Weber's test

	Frequency	Percent
Central	310	91.4%
Lateralised to right	9	2.7%
Lateralised to left	4	1.2%
Not cooperative	16	4.7%
Total	339	100%

(Table /Fig 4) ABSOLUTE BONE CONDUCTION TEST

	RIGHT EAR		LEFT EAR	
	Frequency	Percent	Frequency	Percent
Positive	320	94.4	322	95
Negative	3	0.9	1	0.3
Not cooperative	16	4.7	16	4.7
Total	339	100	339	100

By tuning fork tests, only 27 children were suspected to have conductive deafness and 4 were suspected to have sensorineural deafness. However, on audiological examination, only six children of those suspected by tuning fork tests had conductive deafness and none of the children had sensorineural deafness [Table/Fig 5]. Hence, tuning fork tests are not reliable in children of this age group.

(Table/Fig 5) Audiometric Evaluation

Audiometric Findings	Frequency	Percentage
<b>Normal Audiometry Findings</b>	<b>320</b>	<b>89.10%</b>
Normal in Right Ear and Mild Conductive hearing loss in Left Ear	1	0.30%
Normal in Right Ear and Moderate Conductive hearing loss in Left Ear	4	1.20%
Mild Conductive hearing loss in Right Ear and Moderate Conductive hearing loss in Left Ear	1	0.30%
Mild Conductive hearing loss in Left Ear	1	0.30%
Bilateral Mild Conductive hearing loss	6	1.80%
Moderate Conductive hearing loss in Right Ear and Normal in Left Ear	2	0.60%
Moderate Conductive hearing loss in Right Ear and Moderately Severe Conductive hearing loss in Left Ear	1	0.30%
Bilateral Moderate Conductive hearing loss	14	4.10%
Moderately Severe Conductive hearing loss in Right Ear and Moderate Conductive hearing loss in Left Ear	1	0.30%
Bilateral Moderately Severe Conductive hearing loss	4	1.30%
Severe Conductive Hearing Loss in Right Ear	1	0.30%
Bilateral Severe Conductive Hearing Loss	1	0.30%
<b>Total</b>	<b>339</b>	<b>100%</b>

Audiometry results revealed that 37 children (10.91%) had some form of conductive hearing loss. Of these, 11 children (29.73%) had otitis media and the remaining 26 (70.27%) had cerumen impaction. Hence, cerumen impaction was also concluded to cause considerable hearing loss. Only 11 children (35.48%) with middle ear disease were detected to have hearing impairment.

For the assessment of the social maturity quotient of the child and the treatment of the diagnosed pathology in the child, parents were requested to come for follow up through the hospital out patient facility. Three twenty four (95.5%) of the 339 children did not come for follow up after the screening [Table/Fig 6]. As a result of poor follow up, the secondary objective of finding the relationship between the child's hearing and his /her social quotient was not met.

The present study was a descriptive one to bring out the prevalence of hearing impairment among the (3-6 years) Kindergarten attending children. A low prevalence of chronic suppurative otitis media was noticed among urban children, probably due to better medical services which facilitate early diagnosis and

(Table/ Fig 6) Vineland social maturity scale (VSMS)

VSMS	Frequency	Percentage
<b>Above average social maturity quotient</b>	<b>3</b>	<b>0.90%</b>
<b>Average social maturity quotient</b>	<b>4</b>	<b>1.20%</b>
<b>Below average social maturity quotient</b>	<b>5</b>	<b>1.50%</b>
<b>Borderline social maturity quotient</b>	<b>1</b>	<b>0.30%</b>
<b>Dull normal social maturity quotient</b>	<b>1</b>	<b>0.30%</b>
<b>Superior social maturity quotient</b>	<b>1</b>	<b>0.30%</b>
<b>Did not reply</b>	<b>324</b>	<b>95.50%</b>
<b>Total</b>	<b>339</b>	<b>100%</b>

treatment of acute otitis media. Similar observations were made by Minja BM and Machemba A in 1998 [4]. The same study when conducted in school children in Tanzania, ear disease was found in 27.7% of the children, 15.7% had cerumen impaction, 2.6% had chronic suppurative otitis media and 8.7% had sensorineural hearing loss [4]. These are similar to the findings of the present study.

Jacob et al reported otological abnormalities (excluding wax) in 21.5% of 284 children from rural primary schools, whose ages ranged from 6-10 years. Otitis media was diagnosed in 17.6% of the children [5]. In the present study, only 9.15% were diagnosed with middle ear disease, which could be attributed to the sample being drawn from both the urban as well as rural populations.

They further reported hearing impairment in 34 (11.9%) of the 284 children. Conductive hearing impairment (10.9%) was predominant. While 91.2% of the children with hearing impairment had associated middle ear disease; only 53.4% of those with middle ear disease were detected as having hearing impairment, which is comparable with the results of this study [5].

In an evaluation study by Weichbold V et al, on conducting a screening for hearing at nursery schools, they found that in most cases, as seen in the present study, a temporary conductive hearing loss due to external or middle ear problems was diagnosed, which is a treatable entity [6].

Poor patient follow up in the present study was disappointing. This was seen despite motivation by the researchers and availability of free services. Similar observations were made by Weichbold V et al (2004) [6] and Flanary V A et al (1999) [7]. This throws light on the lack of awareness and attitude of the present day society on the harmful effects of hearing impairment in children. Caretakers don't take hearing impairment seriously till it is severe. Most of the middle ear diseases cause mild to moderate problems in hearing. This attitude is different for diseases related to vision. Blindness related studies tend to have much better follow up rates. This calls for the need of not only a nationwide screening program, but also the need for education of the general public on the prevalence of hearing impairment and the effects of hearing impairment on their child's development and performance.

### Conclusion

- 1) In this study, the prevalence of undetected hearing impairment among the kindergarten children of Mangalore was brought to light. Mass screening of hearing status in the school system is useful for detecting transient conductive hearing losses
- 2) Parental awareness of hearing impairment in their children is very poor.
- 3) Tuning fork tests are not reliable in very young (pre school) children.

4) There is a higher prevalence of hearing impairment in rural school children as compared to that in children studying in urban schools

5) Prevalence of chronic suppurative otitis media among rural school children is more than in urban school children. This emphasizes the need to improve the health services in rural areas.

6) There is poor follow up among the families of those students detected with hearing loss in the screening program.

In light of this research and other similar studies, it is evident that a nation wide screening program for hearing impairment in school children is a necessity.

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