

Hearing impairment among school going adolescents in coastal region of southern India –

A cross sectional study

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Abstract

Introduction :

Studies state that adult males are more prone to hearing deficits compared to females; occupational and medication related causes being described as the etiology. However, any such etiology would be similar in the adolescent school goers which would help us to analyze regarding similar pattern in the study population as well.

Overcrowding, poor hygiene, socio-economic status, climate, lack of resources to avail medical facilities, poor medical awareness have their bearing on the incidence of hearing loss .The family of each hearing-impaired child has its own cultural, social, educational, and financial background, and its own special needs. The repercussions of auditory deficits are more marked in children as the maximum development of their potentialities was affected

Methodology:

Study was conducted among 2000 students in various schools in karaikal. Informed consent was obtained from all patients after meeting the inclusion and exclusion criteria Children was subjected to detailed ENT examination. The ear examination include: pinna and external auditory canal, tympanic membrane and Tuning fork tests (Rinne's test, Weber's test and Absolute Bone Conduction (ABC) test) to be performed with Tuning Forks of 512 Hz. The results are documented and analyzed.

Results:In this study, Hearing loss was detected in one fifth of the sample size taken and upon analysis, P-value was significant for Otomycosis, Otitis Externa and Acute Otitis Media.

Conclusion:

Hearing loss and its consequent difficulties on speech and language could be controlled and treated to a great extent via appropriate measures. Early identification and or intervention of hearing loss has a significant positive predictive effect on a child's academic development in terms of pictorial, co- relational, vocabulary, grammatical comprehension and sentence completion which include word production, semantics and syntax.

Key Words: Hearing impairment , school going, adolescent.

INTRODUCTION

Hearing deficit is a genuine concern particularly among lower and middle- income countries across the globe. An estimated number of at least 75% of hearing disabled population lives in these regions.¹ It can moreover be considered as one of the forerunning manifestation of innate illnesses which has a genetic predisposition attributed to it.²

The importance of understanding the disease begins with the fact that hearing impairment are either preventable and or reversible, since they are even associated with systemic associations like endocrine disorders as well.³ The World Health Organization (WHO) estimates that 5% of the worldwide population is affected by Disabling Hearing Loss (DHL), and amongst them, about one-tenth are children. Disabling Hearing Loss is characterized as hearing loss (HL) more than 30dB when compared to the better hearing ear.⁴ This also add to the higher incidence rate in developing nations predominantly due to inadequate healthcare facilities.⁵

In children, hearing impairment is initially ignored since the deficit at first are not associated with the loss. Also they get adjusted with social and or scholastic challenges until it worsens.⁶ Thereby, then the children are affected by negative social and educational effects relating with hearing disability. It could be a reality that the limited levels of communication, are often branded as “absent minded” and or “being distracted”.⁷ Further, if left undiagnosed with hearing deficit, and since many other systems like vision could be conjointly be defective too since which lead to long term speech and language deficits.⁸

METHODOLOGY

StudyDesign

Cross-sectional school based survey

StudySetting

The study was done in 10 Primary Schools in Karaikal, Puducherry

SampleSize Calculation

$$n = 4Pq/d^2$$

where,

n = the required samplesize

P =prevalence of hearing impairment (11%)

D = margin of absolute error2%

Q = (1-d) /100

For this study, 2000 students were included as total sample size including estimation of non-responders.

Sampling Procedure

Private Schools in Karaikal district were grouped into four zones according to their geographical location. From these, only co-education schools were randomly sampled and the children were selected by convenience sampling.

Inclusion Criteria

13 to 17 years old children
Children with parents / guardians who provided consent.

Exclusion Criteria

Children outside the age bracket of 13 to 17 years
Children whose parent / guardians who did not provide consent for participation.

Study duration

The study was conducted for the period of 2 years.

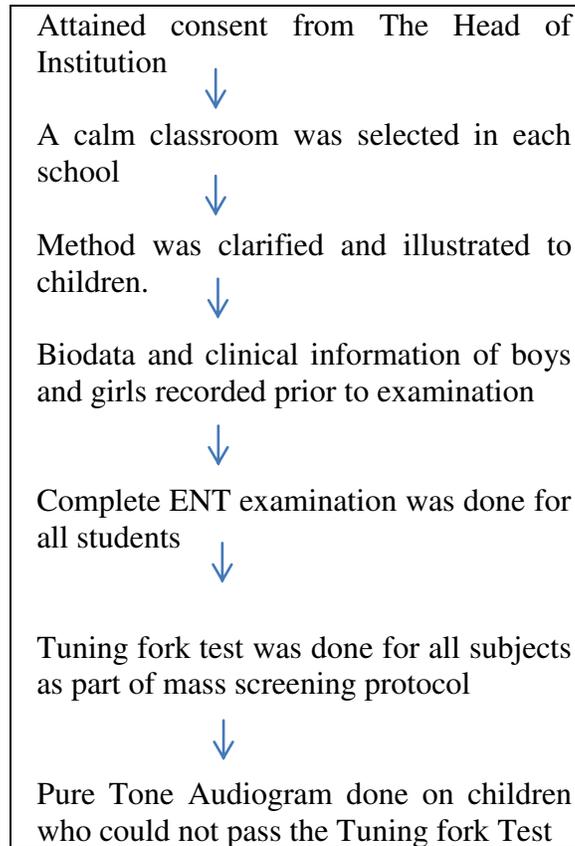
Data collection

Children were clinically evaluated by the examiner and was helped by an assistant and an audiologist to record biodata, clinical history and to conduct clinical examination using an organized questionnaire.

Materials used:

Aural speculums
Welch Allyn LED Oscope
Tilley's and Hartmann's forceps.
Duke's Headlight/mirror
Siegel's ear speculum
Foreign body / wax hooks
Jobson Horne earprobe
Gardiner Brown Tuning Forks
Pure Tone Audiometer – Elkon Digital
Lukewarm water, Kidney trays and other consumables.

Procedure



When considering the various health related programs executed by our country in collateral with worldwide bodies, screening and management of hearing loss accounts for comparatively less expensive modalities. However, to ensure that to happen in a country like India, political and authoritative will is pivotal.⁹ This helps to mitigate the negative impacts occurring in longterm.¹⁰

Statistical Analysis

Data was analyzed using SPSS version 16.0. Graphical representation was displayed using charts and tables wherever suitable. Chi-square test & P- value were done to survey for any association between the observations and results related variables.

RESULTS (ADD GRAPHS AND TABLES)

This cross sectional study was conducted in 10 private schools of Karaikal, after getting ethical committee clearance from the institutional ethical committee. The sample population was taken as 2000. Informed consent was obtained from all patients after meeting the inclusion and exclusion criteria. After taking proper history and complete otorhinolaryngology examination,

Hearing assessment was done using Tuning Fork Test and Pure Tone Audiogram. The maximum number of patients belonged to the age group 14years. Statistical analysis was done using SPSS Version 16.0.

In this study, Hearing loss was detected in one fifth of the sample size taken and upon analysis, P-value was significant for Otomycosis, Otitis Externa and Acute Otitis Media. The students were guided to ENT OPD in Vinayaka Missions Medical College and Hospital Karaikal for further evaluation and management.

Results

**Table 1: Age Range with Mean and SD levels
(Descriptive Statistics)**

	N	Minimum	Maximum	Mean	Std. Deviation
Age Scale	2000	13.00	17.00	14.2020	1.00105
Valid N (listwise)	2000				

Table 2: Age with Gender Comparison:

Gender	No. of Children	Age Mean \pm SD
Male	1032	14.83 \pm 1.55
Female	968	14.84 \pm 1.53

Table 3: Associated Symptoms

Associated Symptoms	No. of Subjects	Percentage
Hearing Loss	406	20.3%
Ear Ache	214	10.7%
Ear Discharge	169	8.4%
Headache	118	5.9%
Giddiness	125	6.2%

Table 4: Type of Hearing Impairment

Type of Hearing Impairment	No. of Counts (n = 406)	Percentage
CHL	357	88%
SNHL	28	7%
MHL	21	5%
TOTAL	406	100%

Table 5: Severity of Hearing Impairment:

Hearing Impairment difference	RIGHT EAR		LEFT EAR	
	Number	Percentage(%)	Number	Percentage(%)
Mild	349	86.0%	289	71.0%
Moderate	53	13.0%	97	24.0%
Severe	0	0%	20	5.0%
Profound	4	1.0%	0	0%
TOTAL	406	100%	406	100%

Table 6: Hearing Impairment and its association with Ear Diseases

Ear Disease	Response	Hearing Impairment		Odds Ratio (95% CI)	P value
		Yes (%)	No (%)		
OTITIS Externa	Yes	29 (1.4%)	187 (9.4%)	0.58 (0.39 – 0.87)	0.008 Significant
	No	377 (18.8%)	1407 (70.4)		
Wax	Yes	40 (2.0%)	130 (6.5%)	1.23 (0.85 – 1.79)	0.274 Not Significant
	No	366 (18.3%)	1464 (73.2%)		
OTOMYCOSIS	Yes	343 (17.2%)	0 (0%)	NA	0.0001 Significant
	No	63 (3.2%)	1594 (79.7%)		
ETD	Yes	8 (0.4%)	61 (3.0%)	0.51 (0.24 – 1.1)	0.067 Not Significant
	No	398 (19.9%)	1533 (76.6%)		
OME	Yes	33 (1.6%)	112 (5.6%)	1.2 (0.78 – 1.75)	0.445 Not Significant
	No	373 (18.6%)	1482 (74.1%)		
AOM	Yes	24 (1.2%)	157 (7.8%)	0.58 (0.37 – 0.90)	0.014 Significant
	No	382 (19.1%)	1437 (71.8%)		
COM	Yes	6 (0.3%)	30 (1.5%)	0.78 (0.32 – 1.89)	0.584 Not Significant
	No	400 (20.0%)	1564 (78.2%)		

Figure 1: Hearing Impairment and association

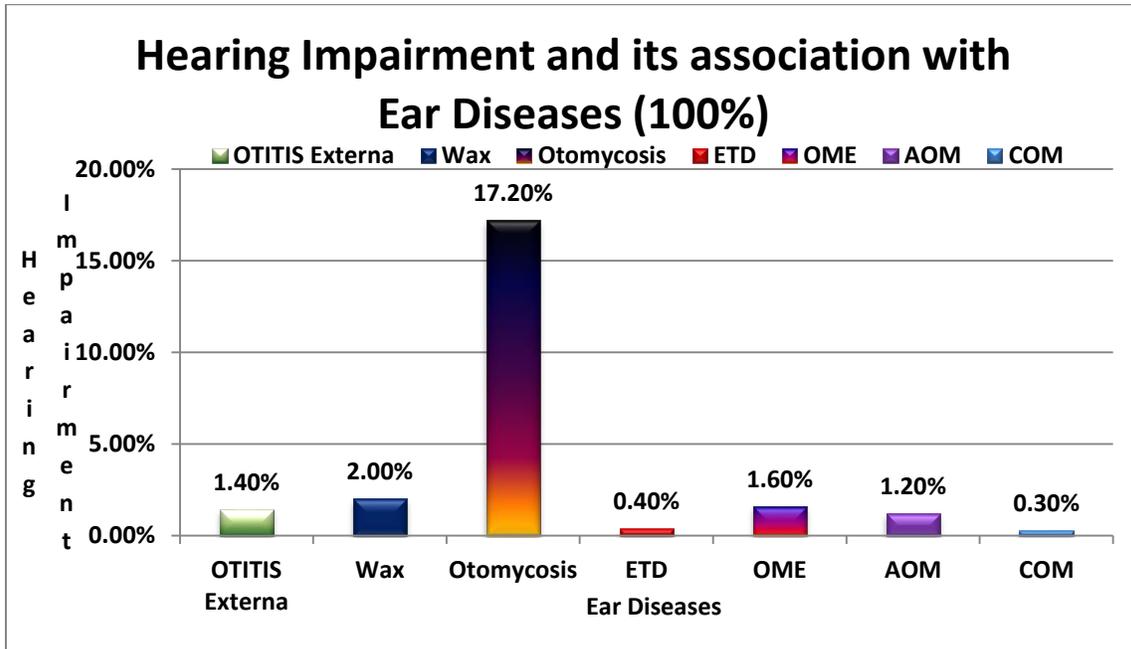


Table 7: Ear Disease and its association with Gender

Ear Disease	Response	Gender		Chi Square Value	P value
		Male (%)	Female (%)		
OTITIS Externa	Yes	100 (5.0%)	116 (5.8%)	2.72	0.09 Not Significant
	No	932 (46.6%)	852 (42.6%)		
Wax	Yes	88 (4.4%)	82 (4.1%)	0.002	0.96 Not Significant
	No	944 (47.2%)	886 (44.3%)		
OTOMYCOSIS	Yes	199 (10.0%)	144 (7.2%)	6.83	0.009 Significant
	No	833	824		

		(41.6%)	(41.2%)		
ETD	Yes	28 (1.4%)	41 (2.0%)	3.48	0.062 Not Significant
	No	1004 (50.2%)	927 (46.4%)		
OME	Yes	78 (3.9%)	67 (3.4%)	0.30	0.583 Not Significant
	No	954 (47.7%)	901 (45.0%)		
AOM	Yes	90 (4.5%)	91 (4.6%)	0.28	0.596 Not Significant
	No	942 (47.1%)	877 (43.8%)		
COM	Yes	19 (1.0%)	17 (0.8%)	0.020	0.887 Not Significant
	No	1013 (50.6%)	951 (47.6%)		

DISCUSSION

2000 children between age group of 13 to 17 years from 10 private schools were examined and study was carried out in Karaikal. The total number of boys and girls who were examined is in the ratio 51.6% (1032):48.4% (968) which make the ratio to almost 1:1. The predominant age group was 14 years and the least frequency was 17 years of age, which accounted for a sum total of 644 subjects.

406 children failed screening using tuning fork test and Pure Tone Audiogram tests yielding a Hearing impairment prevalence of 20.3%. This prevalence is higher than a similar study conducted in Dhaka conducted by Islam et al¹², in which the total study population was taken as 250 children, showed 12.8% students had hearing loss in almost the same age group. The varying prevalence rates could be due to different methodologies and population count which were used in the study. This is evidenced by the prevalence rates of a study conducted by Hatcher et al (1992)¹³ and Westerberg et al (2008)¹⁴ suggested 300 children (5.6%) and 612 (7.3%) suffered from hearing loss in Kenya and Uganda respectively.

Out of the 406 subjects with hearing loss, 288 (71%) children had binaural minimal hearing loss

which at most was equal to the data published by Mugabo et al (2009)¹⁵ in Nairobi who conducted study on 866 children and found 623 subjects to suffer from hearing loss and another study by Clark et al (2006)¹⁶ in Mozambique which showed 2148 out of 2685 students had similar type of hearing loss (79%).

In addition, in our study, 357 students (88%) had conductive hearing loss which proved that the commonest type of hearing loss was CHL. This is in accordance with that reported in various studies which was done by Rajab et al (2009)¹⁵ in Rwanda and Vengala et al (2014)¹⁷ in India who reported prevalence of 65% and 96.2% respectively.

Furthermore, 28 children were diagnosed SNHL and 21 MHL which accounted for 7 and 5 percentage respectively. However, this was much better compared to a study conducted by Adegbiyi et al (2018)¹⁸ in Nigeria which showed more than 60%, although it shall be noted that the similar study was done in pre- school children. Even this need to be taken into consideration since the higher percentage in preschool children affects the educational and vocational career.

There were up to 86% of hearing loss in single ear and to substantiate the clinical significance, a study conducted by Lieu et al¹⁹ suggests that such individuals are more likely to experience academic challenges in comparison to their peers without hearing loss. However data for academic performance of children were not collected as it is beyond the study protocol.

In our study, 222 male children were found to have more hearing loss (11.1%) when compared to 184 female children (9.2%). Many internationally accepted studies like Abdel Hamid et al (2007)²⁰ in Pakistan and Tahir et al (2011)²¹ in Egypt also reported similar findings in favour of the male gender. There were similar studies conducted in Nigeria and Iraq by Ogunleye et al (2005)²² and Ahmad Nasrat et al (2013)²³, in which it was shown that there was male predominance of foreign bodies in ear which showed that any disease affecting the ear interfere with sound transmission as well.

In our study, 626 children were diagnosed as having other ear diseases which included Eustachian Tube Dysfunction (ETD), Otitis Media with Effusion (OME) and Otomycosis as well. This accounted for about 31.3% of the sample population which was comparable to the one conducted in Rwanda by Rajab et al (2009)¹⁵ that showed 34% prevalence. However it was found to be lower than a study conducted by Adhikari et al (2008)²⁴ in Katmandu (Nepal) which accounted for 942 students out of 1245 taken by them (75.7%).

The most common ear disease diagnosed in this study was Otomycosis (17.2%) which was followed by Wax impaction (2%), OME (1.6%) and Otitis Externa (1.4%). Chronic Otitis Media (COM) and ETD were of the least prevalence (0.3 and 0.4 percentages respectively). However, wax impaction was diagnosed as the most common ear disease amongst school children in Kathmandu valley by Adhikari et al (2008)²⁴ (60.6%), Chadha et al (2013)²⁵ in Northern India (53.8%) and Olusanya et al (2000)²⁶ in Nigeria in Africa (52.6%). In an analysis done in Saudi Arabia, by Afaf et al²⁷ at the King Abdul Aziz University noted wax impaction in 12% of children aged 4-15 years. The contrast could have been because the study included a very lower age group unlike our study. Regional factors could also explain the wide variation in these findings.

COM was identified in 36 children (prevalence 0.30%), which is regarded as a very healthy situation in the community as per prevalence rate statistics of the World Health Organization.¹ It was even lower than the study done in Mozambique and published in the Lancet by Pisacane et al in 1982²⁸ which showed only 2% prevalence and also with that which was reported in Angola by Bastos et al (1995)²⁹, Manni et al (1987)³⁰ in Tanzania, and Hatcher et al (1992)¹³ in Kiambu Kenya as 1.6%, 1.5% and 1.1% respectively.

Amongst all the ear diseases, only Otomycosis had significant association with hearing impairment. This is substantiated by the fact that CHL was more in number (357 out of 406) making up to 88% prevalence. Also, hearing impairment was only minimal loss in 86% of the children which shows that the deficit was not due to a chronic symptomatic illness, but occurred as a result of probably a lifestyle and regional consideration.

The prevalence of Otitis Media with Effusion in this study was a mere 1.6% which is very much lower compared to a study conducted in the Middle East and South America by Sayyed et al (1995)³¹ and Irander et al (1993)³² (13.8% and 10% respectively) The value was high in those regions which coincided with weather transformation phase in which children especially are prone for OME. However, in a study conducted by Zielhuis et al in 1990³³, the rate was low like our study.

The prevalence of hearing loss was as high as 20.9% among the age group of 6-12 years in Egypt amongst 555 primary-school students in a study by Taha et al (2010).³⁴ It is wise to be noted that the study was conducted in rural and urban schools. Although the rate of Hearing impairment did not differ across the schools, this high prevalence rate was associated with house crowding, passive smoking, Rhesus incompatibility, and Consanguineous marriages. In their study minimal CHL was the most common type of impairment and no difference was noted in its rate between school settings.

A study which was carried out in selected rural and urban areas of Delhi showed an overall prevalence of hearing loss of 26.9% among persons aged 5 years and over. It was suggesting that while up to 15.8% children had SNHL, only 10.3% suffered from conductive hearing loss and just a mere number of 0.8% was diagnosed as having mixed hearing loss. Furthermore, about 89.9% of the children under 5 years had passed an Oto-acoustic emission test (OAE), while 10.1% were determined as having a hearing loss. The study concluded that that increasing age, female gender and low education were significantly associated with hearing loss, which is also in accordance with our findings (Garg et al).³⁵

In a survey of 170 students conducted by Tahir et al (2009)²¹ in Karachi school children between the ages of 5–15 years, no significant difference in prevalence of Hearing impairment was noted among females (13.0%) and males (14.1%) were recorded. It showed that had 12% children suffered from mild hearing loss; 0.8% with moderate hearing loss and about 0.2% children had severe hearing loss. The drastic difference in the findings which could probably be due to very limited selection of subjects for the study. However, 88% had CHL, 8.3% had SNHL and 3.5% children were diagnosed as mixed type of HL. This is in accordance with our study as well, which proved that as the sample size were increased, the predominant variant of type of hearing loss could be assessed precisely.

Stevens et al (2011)³⁶ studied hearing impairment with reference to the region, gender, and age by utilizing data from about 42 studies. It showed that children between 4 and 15 years in African region was found to have Mild hearing loss, Moderate hearing loss, Severe hearing loss and Profound hearing loss in the order 70.9%, 12.2%, 2.4% and 0.6% respectively which was again at par with those findings of our study as well.

A prospective analysis of patterns of otologic diseases were estimated by Prakash et al (2008)³⁷ conducted on 1245 school children between the age group of 5-12 years. The most common otological diseases were ear wax (60.6%), followed by CSOM (5.7%) and OME (3.7%). This when compared to our study implies that as age advances for teenage group, their health awareness and parental preferences change which lead to better hygiene and personal care (67)

Again it should be sounded positive that unlike Prakash et al (2008)³⁷ in which 60% were male population, almost equal subjects from either groups and almost 800 more sample population taken by us provides more strength to our study.

CONCLUSION

School-based screening for hearing assessment may vary significantly across the globe. Having understood that the prevalence of hearing impairment may result from preventable acoustic etiology, more consistent screening including testing for High Frequency Hearing Loss should be considered for better results.

The most important aspect of any screening protocol in a developing country with huge population like India is meticulous follow-up. Thorough evaluation and addressing the needs of the children who did not pass the screening shall be conducted by an ENT specialist to identify their requirement and support accordingly.

As per the obtained results, it is worthy to incorporate an annual regular hearing screening programme for students in all settings of the nation to promote health care, especially in the rural community where awareness might be lacking.

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