

THE PREVALENCE OF HEARING IMPAIRMENT AMONG SCHOOL ENTRY
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ABSTRACT

Background: ‘Disabling’ Hearing Loss (DHL) in children can be defined as the loss of hearing that exceeds 30 decibels (dB) in the better-hearing ear. About 80% of the people with the DHL live in the middle- and low-income areas. **Objectives:** determining the prevalence of hearing impairment at school entry for children in Al-Zubair, Basra, Iraq, along with some associated risk factors. **Methodology:** A cross-sectional study had been conducted through a multi-stage systematic random sampling for 6 of 12 Primary Health Care centers at Al-Zubair city, Basrah, Iraq, from the 1st of September 2021 to the end of October 2021. 324 children were undergoing screening audiometry. **Results:** the study involved 324 students aged 6-7 years; 52.5% of them were males and 47.5% were females; 33 children failed the screening test; hearing impairments were proved in 26 of them. The prevalence of hearing impairment is 80/1000. Conductive hearing loss was the main type (80%). A significant association has been found between the hearing loss and some of the risk factors, like family history and natal history. **Conclusion:** Preventable risk factors significantly contributed to hearing impairment in preschool children, highlighting the need for targeted programs to address them.

KEYWORDS: Prevalence of the hearing impairment, screening audiometry, primary school children attendants, hearing assessment.

INTRODUCTION

Hearing impairment (HI) is a major global public health concern, particularly among children, because of its substantial effects on speech, language, education, and psychosocial development. Globally, more than 5% of the population, or approximately 466 million people, experience disabling hearing loss, including about 34 million children. Unaddressed hearing impairment among primary-school children can negatively affect academic performance, communication, social interaction, and future educational and vocational opportunities.^[1] The burden is particularly high in low- and middle-income countries, where approximately 80% of individuals with disabling hearing loss live.^[2,3] Hearing loss refers to a reduction in the ability to hear compared with normal hearing thresholds and may range from mild to profound. It can affect one or both ears and may interfere with the perception of conversational speech and environmental sounds. Individuals with mild-

to-severe hearing loss are commonly described as “hard of hearing” and generally communicate through spoken language, sometimes supported by hearing aids, cochlear implants, captioning, or other assistive technologies. Profound hearing loss may substantially limit auditory communication and may require alternative communication methods, including sign language.^[4] Hearing loss is among the most common yet frequently neglected childhood disabilities because it may develop gradually, remain painless, and lack obvious physical manifestations. Consequently, early detection among school-aged children represents an important opportunity to prevent or minimize its long-term consequences.^[5] An estimated 32 million children worldwide experience hearing loss, with a substantial burden occurring in South-East Asia and sub-Saharan Africa.^[6] Studies among schoolchildren have demonstrated considerable variation in prevalence; for example, estimates from Nigeria have ranged from 13.9% to 58.9%.^[7,8]

Differences in diagnostic criteria and screening methods may partly explain this variability. The American Speech-Language-Hearing Association has traditionally used thresholds above 15 dB HL to identify hearing loss, whereas WHO definitions have used different pure-tone average thresholds, potentially affecting prevalence estimates across studies.^[9] Hearing loss can be classified as conductive, sensorineural, or mixed, depending on the anatomical site and underlying pathology.^[10,11] Importantly, several causes of childhood hearing impairment, including cerumen impaction and middle-ear disease, are potentially preventable or treatable when detected early.^[9] Timely identification facilitates appropriate treatment, hearing-aid fitting, assessment for cochlear implantation, and selection of suitable communication strategies.^[12] For children whose impairment is not identified through newborn screening, school-entry hearing screening provides another critical opportunity for detection.^[1,4] In Iraq, where systematic school hearing-screening programs remain limited, undetected hearing impairment may impose considerable educational, social, and economic consequences. Therefore, determining the prevalence and characteristics of hearing loss among schoolchildren is important for planning effective screening, early intervention, and preventive services.

METHOD

A cross-sectional study was conducted from September 1 to October 31, 2021, among school-entry children attending primary healthcare centers (PHCCs) in Al-Zubair City, Basra, Iraq. The study population comprised children aged 6–7 years who were residents of Al-Zubair. Children whose parents or guardians declined participation and those with cognitive problems were excluded. A multistage systematic random sampling technique was used. Six of the 12 PHCCs in Al-Zubair were randomly selected, and the required number of participants from each center was allocated proportionally according to the population served. The calculated sample size was 282, based on an expected prevalence of 7.1%, 95% confidence level, 3% margin of

error, and design effect of 1.8. After allowing for a 15% non-response rate, the final sample size was increased to 324 children. Data were collected through direct interviews with parents or guardians using a structured questionnaire covering sociodemographic characteristics and relevant otological, family, prenatal, natal, postnatal, and childhood histories. Each child subsequently underwent otoscopic examination, 512-Hz tuning-fork testing (Rinne and Weber tests), and pure-tone hearing screening. Children who failed the initial screening were referred to Al-Zubair General Hospital for diagnostic pure-tone audiometry. Hearing screening was performed using an Amplivox screening audiometer with TDH-39 supra-aural headphones. Both ears were tested at 20 dB HL at frequencies of 500, 1000, 2000, and 4000 Hz. A child was considered to have passed when responding to all test tones in both ears; failure to respond to one or more tones in either ear was considered a failed screening result and required referral for further audiological assessment. Data were analyzed using SPSS version 25. Categorical variables were summarized using frequencies and percentages, while appropriate descriptive measures were used for continuous variables. Associations were assessed using Chi-square or Fisher's exact tests, and regression analysis was performed to identify potential risk factors. A P-value <0.05 was considered statistically significant. Ethical approval was obtained, and informed consent was secured from parents or guardians before participation.

RESULTS

A total of 324 school-entry children were included, comprising 170 (52.5%) males and 154 (47.5%) females. Initial hearing screening identified 33 children (10.2%) who failed the screening test, while 291 (89.8%) passed. Among the 33 children referred for diagnostic assessment, hearing impairment (HI) was confirmed in 26 (78.8%), whereas seven (21.2%) had normal hearing. Accordingly, the overall prevalence of confirmed HI was 8.0% (26/324), equivalent to 80 cases per 1,000 children. As in table 1.

Table 1: Study Population and Prevalence of Hearing Impairment.

Variable	No.	%
Total study population	324	100.0
Gender		
Male	170	52.5
Female	154	47.5
Hearing screening result		
Passed screening	291	89.8
Failed screening	33	10.2
Diagnostic assessment among children who failed screening (n=33)		
Hearing impairment confirmed	26	78.8
Normal hearing	7	21.2
Final hearing status of total population (n=324)		
Normal hearing	298	92.0
Hearing impairment	26	8.0

Prevalence of confirmed hearing impairment = $26/324 = 8.0\%$ (80 per 1,000 children).

Among the 26 children with confirmed HI, conductive hearing loss was the predominant type, accounting for 21 cases (80.8%), while sensorineural hearing loss was identified in five (19.2%); no mixed hearing loss was recorded. Bilateral involvement was most frequent (73.1%), followed by left-sided (19.2%) and right-sided

impairment (7.7%). Most affected children had mild HI (69.2%), whereas 19.2% had slight and 11.5% had moderate impairment. Consistent with the predominance of conductive loss, the lesion was located in the middle or external ear in 80.8% of cases. As in table 2.

Table 2: Characteristics of Children with Confirmed Hearing Impairment (n=26)

Characteristic	No.	%
Type of hearing impairment		
Conductive hearing loss	21	80.8
Sensorineural hearing loss	5	19.2
Mixed hearing loss	0	0.0
Side of hearing impairment		
Right	2	7.7
Left	5	19.2
Bilateral	19	73.1
Degree of hearing impairment		
Slight	5	19.2
Mild	18	69.2
Moderate	3	11.5
Moderately severe	0	0.0
Severe	0	0.0
Profound	0	0.0
Site of lesion		
Middle or external ear	21	80.8
Inner ear or auditory nerve	5	19.2
Both	0	0.0

Most confirmed cases were conductive (80.8%), bilateral (73.1%), and mild in degree (69.2%).

Otoscopic findings showed a significant association with hearing status ($P<0.001$). Among children with a normal otoscopic examination, only five (1.7%) had confirmed HI. In contrast, all children with chronic suppurative otitis media (3/3, 100%) and all those with otitis media with effusion (18/18, 100%) had HI. No HI was detected

among children with ear deformity or foreign bodies. These findings demonstrate that abnormal middle-ear findings, particularly otitis media with effusion and chronic suppurative otitis media, were strongly associated with HI in the studied children. As in table 3.

Table 3: Association Between Diagnostic Hearing Assessment and Otoscopic Findings (n=324)

Otoscopic finding	Normal hearing No. (%)	HI No. (%)	Total No. (%)	P-value
Normal otoscopic examination	294 (98.3)	5 (1.7)	299 (100)	<0.001
Ear deformity	1 (100)	0 (0.0)	1 (100)	
Foreign body	3 (100)	0 (0.0)	3 (100)	
Chronic suppurative otitis media	0 (0.0)	3 (100)	3 (100)	
Otitis media with effusion	0 (0.0)	18 (100)	18 (100)	
Perforated eardrum	0 (0.0)	0 (0.0)	0 (0.0)	

HI, hearing impairment. P-value reported in the original thesis for the overall association between otoscopic findings and diagnostic hearing assessment.

The prevalence of HI differed significantly according to sex, with HI detected in 11.2% of males compared with 4.5% of females ($P=0.039$). Significant associations were also observed for family history ($P<0.001$), prenatal history ($P=0.005$), natal history ($P=0.008$), postnatal history ($P=0.013$), and childhood history ($P<0.001$). Relatively high proportions of HI were observed among children with a family history of reduced hearing (75.0%), prematurity (50.0%), underweight during the

postnatal period (30.8%), and chronic suppurative otitis media during childhood (60.0%). These are unadjusted associations and should not by themselves be interpreted as independent risk factors. As in table 4.

Table 4: Association of Demographic and Risk Factors with Hearing Impairment (n=324).

Factor	Category	Normal hearing No. (%)	HI No. (%)	Total No. (%)	P-value
Gender	Male	151 (88.8)	19 (11.2)	170 (100)	0.039
	Female	147 (95.5)	7 (4.5)	154 (100)	
Family history	Negative	280 (94.0)	18 (6.0)	298 (100)	<0.001
	Reduced hearing	1 (25.0)	3 (75.0)	4 (100)	
	Nasal obstruction	11 (73.3)	4 (26.7)	15 (100)	
	Recurrent tonsillitis	6 (85.7)	1 (14.3)	7 (100)	
Prenatal history	Negative	284 (93.1)	21 (6.9)	305 (100)	0.005
	Drug exposure	8 (66.7)	4 (33.3)	12 (100)	
	Fever/rash	3 (100)	0 (0.0)	3 (100)	
	Toxoplasmosis	3 (75.0)	1 (25.0)	4 (100)	
Natal history	Negative	268 (93.1)	20 (6.9)	288 (100)	0.008
	Prematurity	2 (50.0)	2 (50.0)	4 (100)	
	Caesarean section	24 (85.7)	4 (14.3)	28 (100)	
	Assisted labour	4 (100)	0 (0.0)	4 (100)	
Postnatal history	Negative	277 (93.0)	21 (7.0)	298 (100)	0.013
	Underweight	9 (69.2)	4 (30.8)	13 (100)	
	Asphyxia	7 (100)	0 (0.0)	7 (100)	
	Jaundice	5 (83.3)	1 (16.7)	6 (100)	
Childhood history	Negative	288 (92.9)	22 (7.1)	310 (100)	<0.001
	Mumps	1 (50.0)	1 (50.0)	2 (100)	
	Measles	2 (100)	0 (0.0)	2 (100)	
	Chronic suppurative otitis media	2 (40.0)	3 (60.0)	5 (100)	
	Drug history	2 (100)	0 (0.0)	2 (100)	
	Foreign body	3 (100)	0 (0.0)	3 (100)	

HI, hearing impairment. P-values are reported for the overall association within each factor, as presented in the original results. Categories with zero observations were omitted.

In the regression model, otoscopic history and postnatal history remained statistically significant predictors of HI. Otoscopy history showed the strongest association ($B=0.239$, standardized $\beta=0.852$, $P<0.001$; 95% CI for B : 0.223–0.254), while postnatal history was also independently associated with HI ($B=0.039$, $\beta=0.075$,

$P=0.007$; 95% CI: 0.011–0.067). Gender, family history, prenatal history, natal history, and childhood history did not reach statistical significance after inclusion in the model (all $P>0.05$), although childhood history was borderline ($P=0.052$), as in table 5.

Table 5: Regression Analysis of Predictors Associated with Hearing Impairment.

Predictor	B	Std. Error	Standardized β	t	P-value	95% CI for B
Constant	1.013	0.024		42.007	<0.001	0.965–1.060
Otoscopy history	0.239	0.008	0.852	30.225	<0.001	0.223–0.254
Postnatal history	0.039	0.014	0.075	2.715	0.007	0.011–0.067
Gender	−0.009	0.015	−0.017	−0.614	0.540	−0.039–0.020
Family history	0.007	0.009	0.022	0.786	0.433	−0.011–0.025
Prenatal history	0.031	0.018	0.048	1.750	0.081	−0.004–0.066
Natal history	0.015	0.012	0.036	1.306	0.192	−0.008–0.038
Childhood history	0.021	0.011	0.054	1.948	0.052	0.000–0.042

B, unstandardized regression coefficient; β , standardized coefficient; CI, confidence interval. Statistically significant predictors in the original regression model were otoscopic history and postnatal history.

DISCUSSION

The present study demonstrated that hearing impairment (HI) remains an important health problem among school-entry children in Al-Zubair, Basrah. Among 324 children aged 6–7 years, 33 (10.2%) failed the initial hearing screening and 26 were subsequently confirmed to have HI, yielding an overall prevalence of 8.0% (80/1000). This prevalence is close to the 7.1% reported among school-entry children in Tikrit, Iraq^[13], but lower than the

16.3% reported among primary-school children in Al-Nasiriyah.^[14] Studies from Saudi Arabia and other settings have also reported higher prevalence estimates.^[15,16] Differences between studies may reflect variation in age groups, sampling strategies, hearing thresholds, screening protocols, and confirmatory diagnostic procedures. The pattern of impairment observed in this study is particularly important clinically. Conductive hearing loss accounted for 80.8% of

confirmed cases, whereas sensorineural hearing loss represented 19.2%. Furthermore, 73.1% of affected children had bilateral impairment and 69.2% had mild hearing loss. These findings are consistent with the Iraqi study from Tikrit, where conductive hearing loss constituted the great majority of detected cases.^[13] They are also consistent with previous evidence demonstrating the importance of otitis media with effusion as a cause of conductive hearing impairment during childhood.^[1] The predominance of mild conductive loss is clinically relevant because affected children may remain undiagnosed despite potential adverse effects on speech perception, classroom communication, and academic performance.^[1,17,18] Otoscopic findings were strongly associated with HI. All children identified with chronic supportive otitis media or otitis media with effusion had confirmed impairment, whereas HI occurred in only a small proportion of children with a normal otoscopic examination. This supports the established role of middle-ear disease as an important and potentially preventable cause of childhood hearing loss.^[19,20] The predominance of middle/external-ear lesions among affected children further supports this interpretation. Similar findings have been reported in Egypt, where otitis media was identified as an important cause of hearing impairment among schoolchildren.^[21] Several demographic and clinical factors were associated with HI in unadjusted analyses. Hearing impairment was more frequent among males than females (11.2% versus 4.5%, $P=0.039$), while significant associations were also observed with family, prenatal, natal, postnatal, and childhood histories. Comparable risk factors, including low birth weight, prenatal exposures, jaundice, infections, and chronic otitis media, have been reported in previous studies.^[21-23] However, findings across studies are not entirely consistent; studies from Ghana and Iran, for example, did not demonstrate a significant sex difference.^[24,25] In the regression analysis, otoscopic history and postnatal history remained significantly associated with HI, whereas gender, family, prenatal, natal, and childhood histories were no longer statistically significant. These findings emphasize the potential importance of identifying middle-ear abnormalities and relevant postnatal factors during early childhood. Nevertheless, because of the cross-sectional design and the relatively small number of confirmed HI cases, causal interpretations should be avoided. Overall, the findings support hearing assessment at school entry, particularly where universal childhood hearing-screening programs are not established, with prompt evaluation and management of middle-ear disease to reduce potentially preventable hearing impairment.

CONCLUSION

Hearing impairment affected 8% of school-entry children. Conductive and mild hearing loss were the predominant patterns. Hearing impairment was associated with male gender, family, prenatal, natal, and otological factors, particularly otitis media. These findings highlight the importance of early hearing

screening and timely management of preventable causes in children.

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