PREVALENCE OF HEARING LOSS AMONG JUNIOR SECONDARY SCHOOLS STUDENTS IN OSOGBO –OSUN STATE, NIGERIA

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Abstract-
Introduction: Hearing is essential to learning spoken language and is important for the cognitive development of children. Without suitable interventions, hearing loss is a barrier to both education and social integration. It has been reported that more than 80% of persons with hearing loss reside in developing world but there are limited prospects of early detection for hearing loss because of numerous barriers. It is estimated that over 60% of such hearing loss could be avoided through preventive measures. This study aimed to determine the prevalence of hearing loss among secondary school students in Osogbo the capital of Osun State and its suburb.
Methods: This is a cross sectional descriptive study. It was conducted in Osogbo, the capital of Osun State and its suburb. The participants were all the junior students of six (6) selected secondary schools in the state. Five hundred and twenty-eight (528) students participated in the study. Otoacoustic Emission (OAE) machine was used to screen all the participants to determine those with hearing loss.
Results: Out of 528 participants, 224 (42.4%) males and 304 (57.6%) females participated in the study with a mean age of 13.59 and standard deviation of 1.67. Approximately, a prevalence of 9% hearing loss was discovered in this study, that is, 8.7% in the right ears and 9.3% in the left ears.
Conclusion: Hearing loss is becoming a public health problem which calls for an urgent attention. We therefore recommend school hearing screening and prompt management in order to reduce ear and hearing problems among school age students that may result into permanent hearing loss in the future.

***Keywords*: Hearing Loss, Otoacoustic Emissions, Secondary School Students, Nigeria**

I. INTRODUCTION

Hearing loss among school children in many developing countries of the world has been reported as a significant health issue [1]. Normal hearing is essential to learning spoken language and is important for the cognitive development of children. The interaction between an individual and his or her environment is conciliated through sensory experiences. The sense of hearing, facilitates communication and promotes social interaction [2]. Hearing loss is a barrier to both education and social integration if appropriate interventions are not employed [3,4].

According to World Health Organization (WHO), hearing loss is the most prevalent disabling condition globally [5]. Disabling hearing loss refers to hearing loss greater than 35 decibels (dB) in the better hearing ear [6]. Nearly 80% of people with disabling hearing loss live in low- and middle-income countries. It is estimated that by 2050 over 700 million people or 1 in every 10 people will have disabling hearing loss [6].

In developing nations of the world, where more than 80% of persons with hearing loss reside, there are limited prospects of early detection for hearing loss [5]. and this is due to a number of barriers which is not limited to scarcity of hearing specialists. In a study by Ogundiran, et al., it was advocated that audiologists should be well trained and be available to render services to individuals with hearing impairment [7]. This may allow for early detection and intervention of hearing loss not only among school age students but among all individuals with hearing loss.

Many studies from developing areas of the world reported diverse hearing loss prevalence rates among school children. These figures range from 1.4% in China [8] and 1.75% in Saudi Arabia [9] to as high as 11.9% in India [10]. The diverse ranges in prevalence are also seen in sub-Saharan Africa with prevalence ranging between 5.6% in Kenya [11], 7.9% in Western Cape [12] and 13.9% in Nigeria [13].

It is estimated that over 60% of these people suffering from hearing loss could be avoided through preventive measures. Moreover, children with disabling hearing loss can benefit greatly from early identification with timely and appropriate interventions. Preventable causes of hearing loss should be avoided and those with unavoidable hearing loss should be (re)habilitated, educated and empowered.

Hearing loss is more prevalent in developing countries than developed countries of the world. It is estimated that two out of three of the world's hearing impaired are in developing countries, the reasons include: absence of regular screening programmes for ear

disease, poverty, malnutrition, ignorance and paucity of accessible healthcare [14]. Tobih et al. also reported poor obstetric management as another major cause [15]. Untreated hearing loss is frequently associated with academic underachievement, which can lead to reduced employment opportunities later in life [16].

Hearing impairment has adverse effects on a child academic performance, as well as development of appropriate speech, language, and psychosocial abilities [17].

Literature review showed that children with a hearing loss have limited educational and vocational attainment. Risks of physical, social, emotional, and sexual abuse and even fatal injuries are higher among these children [16], in this wise, hearing loss should be identified as early as possible in order to prevent long-term consequences on its sufferers. The environment for hearing screening should be conducive and the selected instrument should be commensurate with the age of the individual being screened. Hearing screening should be conducted in a quiet area or sound proof-booth so that environmental noise will not alter test result.

Young children need special procedure during hearing screening and many of them may be sedated in order to get a valid result.

Unfortunately, the instruments required for testing hearing abilities and to detect hearing loss in the young children are not widely available in developing countries. In developed countries, children are screened for hearing loss routinely at periodic intervals right from birth, but this neonatal assessment or screening equipment such as otoacoustic emission machine (OAE) and Automated Auditory Brainstem Response (Automated ABR) are not readily available at the moment in many hospitals with high birth rate in Nigeria.

Screening at school prior to admission is the only feasible means of ensuring that children are evaluated for hearing capabilities, at least once. It would help if there were identified causes or risk factors of hearing impairment, so that children at greatest risk can undergo further evaluation.

There are not enough specialists in the area of hearing health and education for individuals with hearing loss: Audiologists, Otologists and Teachers to provide the require care and services. Also hearing devices are not readily accessible. Hearing aids and cochlear implants have considerably improved the available options for people with hearing loss. Despite this, only a fraction of those who need these devices have access to them [18]. Particularly in developing countries, there are several significant barriers to accessing hearing aids for people with hearing loss. A major barrier is the cost of hearing aids, batteries and maintenance [19,20]. There is also a scarcity of health care professionals able to fit, maintain and repair devices[19]. Moreover, McPherson and Amedofu reported that people with hearing loss in rural areas may have challenges about cost of transportation and travel time to health facilities [20].

Also, indiscriminate use of ototoxic drugs and noise pollution are on the rise not only in urban centres but also in our so-called rural areas especially now that airPods are available and affordable to most people. Whereas some of these airPods are very cheap but the havoc they cause if used on a standard volume and for a long time is very damaging. A study of the prevalence of hearing loss among school age students to determine the prevalence of hearing loss among this population allows for adequate planning to ensure hearing health services are made available. Therefore, this study describes the prevalence hearing loss among Junior Secondary School Students in Osogbo, Osun State, Nigeria.

II. METHODS

Study Location, Participants, and Design

This is a cross sectional descriptive study. It was conducted in Osogbo, the capital of Osun State and its suburb. The participants were all the junior students of six (6) selected secondary schools in the state. Five hundred and twenty-eight (528) students participated in the study using convenience sampling technique. All but non-consenting students were considered for recruitment. Participants found to have hearing loss were referred to the teaching hospital for follow-up.

Sample size was determined using the formula for a cross-sectional study estimating a simple proportion:

$N = Z_{\alpha^2} P (1-P) / d^2$, where $Z\alpha$ = standardized normal deviates exceeded with probability α (the level of significance), P = prevalence of the condition, and d = the closeness one is willing to tolerate of the proportion of interest to the desired estimate, i.e., tolerable margin of error setting α at 0.05, $Z_{0.05} = 1.96$, d at 0.05 (95% CI) and P at 0.5 since various prevalences are cited in literature and true prevalence is not known,

$N = 1.96^2 (0.5 \times 0.5) / 0.05^2 = 384.16$

Adjusting for possibility of a high non-response/attrition rate of 25%, the minimum sample size became: N = 1/ (1-0.25) x 384 = 512.

Instrumentation

Otoacoustic Emission (OAE)

The primary purpose of otoacoustic emission test is to determine cochlear status, specifically hair cells function. The normal cochlea does not just receive sound; it also produces low-intensity sounds called OAEs. These sounds are produced specifically by the cochlear outer hair cells as they expand and contract. OAEs can be measured noninvasively, objectively, and it is a quick means of screening individuals with hearing loss. A "passed" OAE testing indicates that the hearing is within 0dB – 35dB while a "referred" testing indicates hearing loss, with "refer" a further diagnostic audiological battery is needed to determine the degree of hearing loss (threshold) and probably the site of lesion.

Otoscopy was performed on all the participants prior to hearing screening and this was done to rule out actively discharging ears among the participants. In this study, a calibrated Maico Ero-Scan Otoacoustic Emission (OAE) Hearing Screener Testing System was used to determine "pass" and "refer" ears. All the available students who were in junior secondary classes of the selected schools and consented were included in the study except in the case of otorrhea which none was seen during this study.

III. RESULTS

Table 1: Age Distribution in Years

Minimum	Maximum	Mean	Std. Deviation
9	21	13.59	1.67

Table 1 above shows that the youngest participant was 9 years old while the oldest was 21 years old. The mean age was 13.59 with 1.67 standard deviation

Table 2: Gender Distribution

Gender	Frequency	Percent
Male	224	42.4
Female	304	57.6
Total	528	100

Table 2 shows that out of 528 participants, 224 males and 304 females participated in the study

Table 3: Otoscopy

Otoscopy	Frequency	Percent
Intact and Shining Bilaterally	520	98.4
Wax Unilaterally	4	.8
Wax Bilaterally	3	.6
Dull TM	1	.2
Total	528	100

Table 3 shows that 520 (98.4%) had intact and shining tympanic membranes, 4 (.8%) had wax in one ear, 3 (.6%) had wax in both ears, while only one (.2%) participant had dull tympanic membrane.

Table 4: Otoacoustic Emission Outcome of Right Ears

OAE Outcome	Frequency	Percent
Pass	482	91.3
Refer	46	8.7
Total	528	100

The above table 4 reveals that 482 (91.3%) participants passed while the remaining 46 (8.7%) participants referred.

Table 5: Otoacoustic Emission Outcome of Left Ears

OAE Outcome	Frequency	Percent
Pass	479	90.7
Refer	49	9.3
Total	528	100

Table 5 shows that 479 (90.7%) participants passed while 49 (9.3%) participants referred.

IV. DISCUSSION

The prevalence of hearing loss in children in developed countries is typically lower compare to that of developing countries, in sub-Saharan Africa, the prevalence ranges between 5.6% in Kenya [11], 7.9% in Western Cape and 13.9% in Nigeria [13] but in the UK, 1.49% has been reported, 2% in Sweden [21], 2.5% in Finland [22] and 3.6% in Denmark [23].

Fortnum et al., suggested that the reasons for differences in prevalence between developed and developing countries include the absence of regular hearing screening programmes, the impact of poverty and malnutrition, ignorance of hearing loss and paucity of accessible health care in developing countries [24]. Moreover, Bhoola and Hugo opined that the method of determining a hearing loss varied across the studies, with most basing it on screening outcome as opposed to a confirmed hearing loss with diagnostic audiometry [25]. Furthermore, the screening protocol utilized in these studies varied in terms of the frequencies and screening levels employed for pass/refer criteria. Some studies included diagnosis assessment [9], while some utilized questionnaires [26].

In our study, the participants were interviewed to obtain demographics, the screening protocol utilized included otoscopy and otoacoustic emission testing. Ear examination was performed on all the participants (otoscopy) before testing with otoacoustic emission machine and table 3 reveals that 520 (98.4%) had intact and shining tympanic membranes, that is normal, with no wax, there was no participants with tympanic membrane perforation and there was no one with accumulated fluid behind the drum. Also, 4 (.8%) had wax in one ear, 3 (.6%) had wax in both ears, while only one (.2%) participant had dull tympanic membrane. These participants with wax (unilaterally and bilaterally) were able to participate in the study because the wax was not occluding their ear canals and we were able to visualize their tympanic membranes. Otoscopic examination revealed self-ear cleaning and the students were advised against this unhealthy practice.

Tables 4 and 5 reveal the outcomes of otoacoustic emission test conducted on the participants. On the right ears, table 4 reveals that 482 (91.3%) participants passed while the remaining 46 (8.7%) participants referred. On the left ears, table 5 shows that 479 (90.7%) participants passed while 49 (9.3%) participants referred.

The prevalence of hearing loss in this present study conducted among junior secondary school students is 8.7% on the right ears and 9.3% on the left ears, this is 9% approximately bilaterally. The prevalence of 9% reported in our study is close to the study of North-Matthiassen and Singh in Western Cape who discovered hearing loss prevalence of 7.9% [12]. The prevalence found in the studies conducted in developed countries is however low compared to the one found in this present study, although these studies were conducted to determine the prevalence of hearing loss in preschool children; in the United States of America, a study by Serpanos reported a prevalence rate of 1.8% [27], 1.49% for the UK [24], 2% for Sweden [21], 2.5% for Finland [22] and 3.6% for Denmark [23]. Fortnum et al. suggested that the reasons for differences in prevalence between developed and developing countries include the absence of regular hearing screening programmes, the impact of poverty and malnutrition, ignorance of hearing loss and paucity of accessible health care in developing countries [24].

V. CONCLUSION

Hearing loss is becoming a public health problem which calls for an urgent attention. The prevalence of hearing loss found in this study was 9%. Screening for hearing loss is justifiable only if there is provision for managing those detected. We therefore recommend school hearing screening and prompt management; if implemented and enforced, this will reduce ear and hearing problems among school age students that may result into permanent hearing loss in the future. By this, the prevalent rate of hearing loss in Nigeria will be drastically reduced.

VI. RECOMMENDATIONS

- Baseline hearing assessment should be made available prior to school enrolment.
- Educational Audiologists should be employed in schools.
- Students are advised to stop self-ear cleaning and treatment. They should visit ear specialists when they have cerumen impaction including any other ear pathology in order to avoid or reduce ear and hearing problems.
- Excessive loud sounds should be avoided. Ear protective devices such as earplugs and/ earmuffs should be used while in a noisy environments.
- Lastly, students should have regular medical checkup especially audiometric assessment which is very pivotal for their academic success.
- Hearing professionals should continue to advocate for newborn hearing screening and hearing screening before enrolment to school.
- This present study employed a convenience sampling technique, one limitation of this study is the employment of convenience sampling, a probability sampling technique will likely give a more accurate prevalence and is recommended for further studies.

REFERENCES:

1. Mencher GT, Madriz Alfaro JJ (2000). Prevalence of Sensorineural Hearing Loss in Children in Costa Rica. Audiology; 39:278-83.
2. WHO (2016). Childhood Hearing Loss Strategies For Prevention and Care.https://www.who.int/docs/default-source/imported2/childhood-hearing-loss--strategies-for-prevention-and-care.pdf?sfvrsn=cbbbb3cc_0
3. Theunissen SC, Rieffe C, Netten AP, Briaire JJ, Soede W, Schoones JW, Frijns JH. (2014). Psychopathology and its Risk and Protective Factors in Hearing-Impaired Children and Adolescents: A Systematic Review. JAMA Pediatrics; 168(2): 170-177.
4. Fellinger J, Holzinger D, Pollard R (2012). Mental Health of Deaf People. Lancet.; 379(9820): 1037-1044.
5. WHO (2013) Millions of People in the World have a Hearing Loss that Can be Treated or Prevented. https://www.who.int/news/item/27-02-2013-millions-have-hearing-loss-that-can-be-improved-or-prevented
6. WHO (2023) Deafness and hearing loss. https://www.who.int/news-room/fact-sheets/detail/deafness-and-hearing-loss
7. Ogundiran O., Falade J., Ogundiran A. C., Yakubu A. & Eegunranti B. A. (2021). Adolescent Depression and Hearing Impairment: The Causes, Complications and Management. The International Journal of Science & Technoledge, vol 9 (9), pp 18- 21.
8. Lu J., Huang Z., Yang T., Li Y., Mei L., Xiang M., et al., (2011). Screening for Delayed-Onset Hearing Loss in Preschool Children Who Previously Passed the Newborn Hearing Screening, Int. J. Pediatr. Otorhinolaryngol. 75, 1045–1049, http://dx.doi.org/ 10.1016/j.ijporl.05.022.
9. Al-Rowaily M.A., AlFayez A.I., AlJomiey M.S., AlBadr A.M., Abolfotouh M.A. (2012). Hearing Impairments among Saudi Preschool Children, Int. J. Pediatr. Otorhinolaryngol. 76 1674–1677, http://dx.doi.org/10.1016/j.ijporl.2012.08.004.
10. Rao R.S.P., Subramanyam M.A., Nair N.S., Rajashekhar B. (2002). Hearing Impairment and Ear Diseases among Children of School Entry Age in Rural South India, Int. J. Pediatr. Otorhinolaryngol. 64, 105–110, http://dx.doi.org/10.1016/S0165-5876(02)00032-0.
11. Hatcher J., Smith A., Mackenzie I., Thompson S., Bal I., Macharia I., et al.(1995). A Prevalence Study of Ear Problems in School Children in Kiambu District, Kenya, Int. J. Pediatr. Otorhinolaryngol. 33, 197–205, http://dx.doi.org/10.1016/ 0165-5876(95)01209 5. 9
12. North-Matthiassen C., Singh S.A. (2006). The Hearing Profile among Learners in Schools in the Western Cape, South Africa, Int. J. Pediatr. Otorhinolaryngol. 71, 113–118, http://dx.doi.org/10.1016/j.ijporl.2006.09.012.

13. Olusanya B.O., Okolo A.A., Ijaduola G.T.A. (2000). The Hearing Profile of Nigerian School Children, Int. J. Pediatr. Otorhinolaryngol. 55, 173–179.
14. Jacob A, Rupa V, Job A, Joseph A (1997). Hearing Impairment and Otitis Media in a Rural Primary School in South India. Int J Pediatr Otorhinolaryngol;39:133-8.
15. Tobih J.E., Adedeji T.O., Ogundiran O. and Olaosun A.O (2014). Profile of Childhood Hearing Loss in a Nigerian Teaching Hospital, *Archives of ClinicalExperimental Surgery* DOI:10.5455/aces. 20131121024930
16. Olusanya BO, Neumann KJ, Saunders JE (2014). The Global Burden of Disabling Hearing Impairment: A Call to Action. Bulletin of the World Health Organization.; 92(5): 367-73.
17. Westerberg BD, Skowronski DM, Stewart IF, Stewart L, Bernauer M, Mudarikwa L. (2005). Prevalence of hearing loss in primary school children in Zimbabwe. International Journal of Pediatric Otorhinolaryngology; 69(4):517–25.
18. WHO (2004) Guidelines for Hearing Aids and Services for Developing Countries. Geneva: WorldHealthOrganization;(http://www.who.int/pbd/deafness/en/hearing_aid_guide_en.pdf
19. McPherson B (2014). Hearing Assistive Technologies in Developing Countries: Background, Achievements and Challenges. Disability & Rehabilitation: Assistive Technology. 2014; 9(5): 360-364.
20. McPherson B, Amedofu G (2013). Hearing Aid Candidacy and Strategies in Developing Countries. ENT and Audiology News. 2013; 88-90.
21. Darin N., Hanner P., Thiringer K. (1997). Changes in Prevalence, Aetiology, Age at Detection, Dev. Med. Child Neurol. 39, 797–802.
22. Marttila I. (1986). Results of Audiometrical Screening in Finnish School Children, Int. J. Pediatr. Otorhinolaryngol. 11 (1986) 39–46.
23. Parving A. (1999). Hearing Screening Aspects of Epidemiology and Identification of Hearing Impaired Children, Int. J. Pediatr. Otorhinolaryngol. 49, 287–292.
24. Fortnum H.M., Summerfield Q., Marshall D.H., Davis A.C. (2001). Prevalence of Permanent Childhood Hearing Impairment in the United Kingdom and Implications for Universal Neonatal Screening: Questionnaire Based Ascertainment Study, BMJ 323, 1–6.
25. Bhoola D., Hugo S.R. (1995). Prevalence: Outer and Middle Ear Disorders in Black and Indian Preschool Children from Durban, S. Afr. J. Commun. Disord. 42, 19–27.
26. Skarzyński P.H., Świerniak W., Piłka A., Skarżynska M.B., Włodarczyk A.W, Kholmatov D., *et al*. (2016). A Hearing Screening Programme for Children in Primary Schools in Tajikistan: A telemedicine Model.Med Sci Monit, 12, pp. 2424-2430
27. Serpanos A.C. (2007). Quantitative and Qualitative Follow-up Outcomes from a Preschool Audiologic Screening Programme: Perspective Over a Decade, Am. J. Audiol. 16 (2007) 4–12.

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