

Hearing Sensitivity & Influence of Hereditary Factors in Adults of "Perumkollan" Community

Adithyan S¹, Nadhanial Antony², Sona Paul³, Swathisri V⁴, Mishal K⁵, Dr. Satish Kumaraswamy⁶

Abstract: "Perumkollan" is a community in Kerala, whose main occupation is blacksmiths. A study was conducted to check hereditary factors that may have affected the hearing sensitivity and Otoacoustic emission of the adult "Perumkollan community. Pure tone audiometry and Distortion product Otoacoustic emission tests were conducted in 20 individuals from the 2nd generation adults of this community. It concluded an estimate of about 85% of people's right ear shows hearing sensitivity affected whereas in the left ear it's about 80%. More than 50% of people have been 'REFERRED' in OAE screening test. This shows the chances of inheritance of hearing loss to the second generation of the community.

Keywords: Perumkollan community, Blacksmiths, Distortion Product Otoacoustic Emission, Pure tone audiometry, Hearing sensitivity, Hereditary factors

1. Introduction

Hearing loss comprises of reduced hearing for pure tones and problems in the understanding of speech (Eggermont, 2016). The loss of hearing sensitivity results from deficits in the transmission of sound via the middle ear and/or loss of transduction of mechanical vibrations into electrical neural activity in the inner ear. Hearing loss may be present at birth or acquired at any time afterwards.

Pure tone audiometry is a standard audiological test for hearing and hearing loss. It is a way to measure hearing thresholds at different frequencies for both ears. Pure - tone screening is a behavioral test which involves the active participation of the individuals. Through this test we can obtain the hearing threshold of a subject. A threshold is defined as a smallest intensity of a sound that a person needs to detect its presence (Gelfand, 1997). Hearing loss can be classified according to the severity or degree of disease. Severity of hearing loss is based on thresholds at individual frequencies.

Otoacoustic emission test is done to find out proper functioning of inner ear or cochlea. Through this test we measure the otoacoustic emissions or OAEs which are sound produced by the inner ear when responding to a sound. Kemp (1978) described OAE and since then OAE has become a standard part of diagnostic test battery and a screening for hearing loss. OAE screening, when compare to pure - tone testing is faster but needs a quiet environment for the proper functioning of the equipment.

Hearing screening is a test to check how well an individual hears various sounds. Both the individual pass or fail the screening and it can be done at any age. If an individual fails a screening test an audiologist can give a more complete hearing test which is called an evaluation and it can be done as soon as possible after the failed screening.

Partial or complete hearing loss in an individual's one or both ears as the results in one's employment called as occupational hearing loss (Nandi and Dhatak, 2008). Studies have shown that about 16% of hearing loss in adults is contributed by occupational noise worldwide.

"PERUMKOLLAN" is a minority community in Kerala and they are known for their occupation of 'blacksmiths'. They are also called 'smith', craftsmen who fabricates objects out of iron by hot and cold forging on an anvil. Some type of deafness can be inherited and the occurrence of developing deafness due to mutated gene depends on whether the gene is recessive or dominant.

Dennis (2020) estimated hearing level of workers exposed to continuous noise, blacksmiths showed a greater degree of hearing loss, more involved in the adjacent frequencies and pronounced noise notch in 4000 - 6000 Hz range and differences in asymmetry between the ears.

Markova' (1989) examined hearing of 140 blacksmiths from different workplace which revealed the presence of occupational deafness after a prolonged period of exposure to noise typically at a frequency of 4 KHz.

Bayazit & Yilmaz (2004) approximated almost 50% of profound hearing loss is due to genetic factors and more than 120 independent genes have been identified.

Siregar, Uwandi & Martini (2015) conducted a research on the hearing of blacksmiths in the village of Sungai Pinang, Kandagan, South Kalimantan in (2014) which concluded that, there are some factors that affects worker's hearing, those are age, gender and length of employment. Use of personal protective equipment (PPE) effect on auditory condition of blacksmith workers.

Blacksmiths are a domestic industry with technologically simple and traditional, during the production process it generates a lot of noise coming from the furnace burning, grinding, forging iron and the iron formation which unwittingly physically will cause hearing loss.

Hearing loss can be caused by the factors of workers working related or not related to work. Thus, it can be said that the health status of the working population is affected not only by health hazards in the work place, the work environment and the behavior of workers, but also by a factor of occupational health services (Ministry of Health, 2013).

2. Method

Aim of the study:

The aim of the present study is to assess the hearing sensitivity that may be affected by the occupation of blacksmith & find out the chances of hearing loss in the 2nd generation of the “Perumkollan community”.

Participants:

A group of 20 members from the “Perumkollan community” are chosen for this study. A total of 2 members from each family were taken for this study.

Inclusive:

- 1) The individuals whose ancestors belong to this community.
- 2) The study used 20 subjects in the “Perumkollan community”.
- 3) Both males & females are included in this study.
- 4) Individuals in the age range of 21 to 70 years.
- 5) Subjects who are not working as a blacksmith in the community.

Exclusive:

- 1) Individuals less than 21 years of age and greater than 70 years of age.
- 2) Participants with congenital anomalies.
- 3) Subjects who do not belong to the “Perumkollan community”.
- 4) Individuals with neurological and visual problems.
- 5) Subjects with any history of ear discharge, exposure to loud noise & ototoxic drugs.

Test Room

The test was conducted in a well illuminated environment & well - ventilated area, which was free of ambient noise and other distractions. The height of the seat backward is recommended to be below the listener’s ear level, allowing unobstructed hearing without reflection.

3. Procedure

Pure tone audiometry and OAE was conducted in both of the ear in the ‘Perumkollan’ community. The otoscopic examination was done prior to the PTA and OAE recordings.

For pure tone average evaluation: -

The tested frequencies are 500Hz, 1 KHz & 2 KHz. The client was asked to sit straight on a chair comfortably then the individual were given an outline about the testing procedure and headphones were placed.

Instructions were given as “You are going to hear tones from the earphones. Some tones would be loud and other tones would be soft to hear. Your job is to raise your hand every time you hear a tone no matter how faint it is and to put your hand down whenever you don’t hear tones. ”

For Otoacoustic emission evaluation: -

OAE screening was carried out using GSI corti instrument.

Here we have measured the Distorted Product Otoacoustic Emission. DPOAE was obtained at duration of 32 seconds. According to the size and shape of the ear canal of the individuals, a probe has been selected then probe was placed in the ear canal while pulling the upper helix upward and backward. An ideal ambient noise environment has been taken for conducting this test. Proper instructions were given for obtaining better emissions.

Instructions were given to the subjects prior to the tests. Subjects were asked to sit comfortably on a chair without any body movements and also told not to swallow and to keep quiet till the test is completed.

4. Results and Discussions

The present study was undertaken with the aim of evaluating the hearing profile and the influence of hereditary factor among “PERUMKOLLAN COMMUNITY”.

4.1 Results

Hearing Evaluation Done by Pure Tone Audiometry Fig 1.1:

Shows the number of individuals who obtained threshold above and below 25 dBHL in left ear

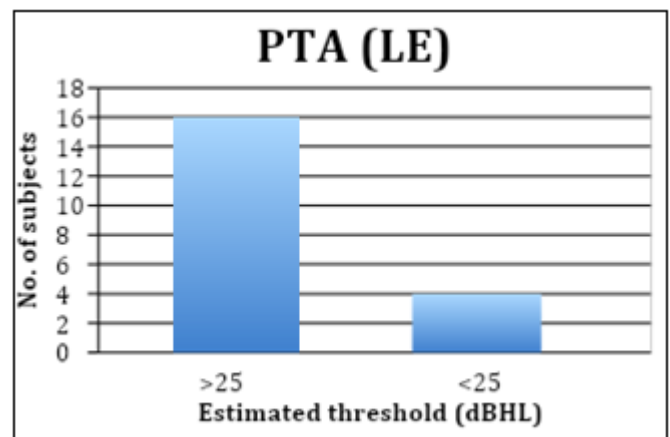


Figure 1.1

From the Fig 1.1, it is observed that about 16 subjects obtained thresholds above 25 dBHL and about 4 subjects obtained thresholds below 25 dBHL. Individuals who had hearing sensitivity below 25dBHL were considered “Normal hearing sensitivity”& above 25dBHL were considered as “Hearing impaired” according to Goodman’s classification.

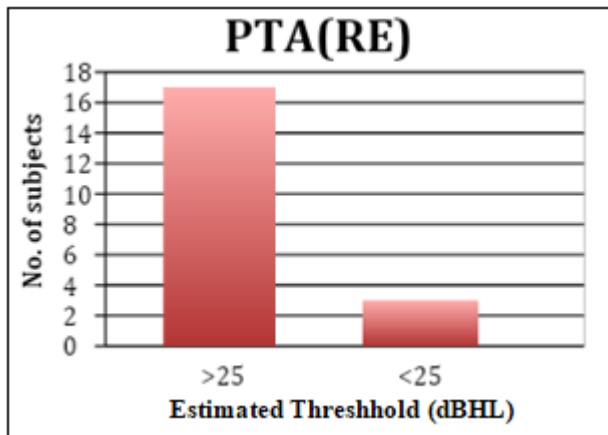


Figure 1.2: Shows the number of individuals who obtained threshold above and below 25 dBHL in right ear

From the fig 1.2, it is observed that 17 subjects obtained thresholds above 25 dBHL and about 3 subjects obtained thresholds below 25 dBHL.

Hearing Evaluation Done by Otoacoustic Emission Fig 1.3:

Shows the Distortion Product Otoacoustic emission (DPOAE) test results in left ear.

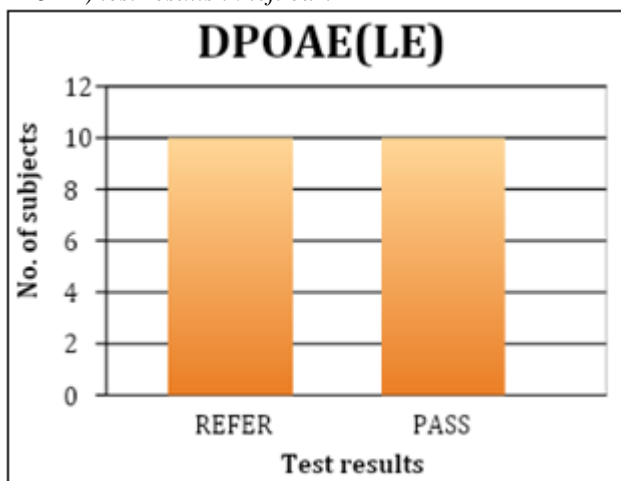


Figure 1.3

From the above fig 1.4, it is observed that 10 individuals were “Referred” and 10 individuals were “Passed” in OAE screening tests.

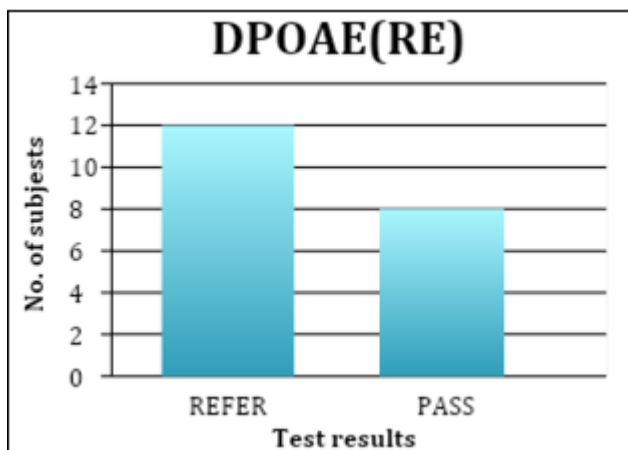


Figure 1.4: Shows the distortion product Otoacoustic emission test (DPOAE) results in the right ear

From the above fig 1.4, it can be inferred that 12 individuals were “Referred” and 8 individuals were “Passed” in DPOAE screening test.

5. Discussion

Previous cross - sectional study has shown that, presence of hearing loss in “PERUMKOLLAN COMMUNITY” on pure tone audiometry and OAE evaluation. In the present study, a group of 20 individuals consisting second generation of this community were tested.

Pure - tone audiometry is a “gold” standard test of audiological examination since it plays a role to assess whether hearing acuity is normal or impaired. Classifying hearing loss according to the degree is the primary information required to determine further interventions. Hearing sensitivity of each ear is measured separately and the severity is generally classified in seven categories as per Goodman’s (1965) classification.

According to Goodman’s classification people with sensitivity above 25dBHL are considered as “HEARING IMPAIRED”, and below 25dBHL are considered as “NORMAL HEARING SENSITIVITY”.

From the current study, PTA measurements revealed that out of 20 subjects more than 50% of people had hearing sensitivity above 25dBHL in each ear. The test results obtained in the right ear was about 17 subjects with threshold above 25dBHL and 3 subjects below 25dBHL. In left ear it was about 16 subjects with threshold above 25dBHL and 4 subjects below 25 dBHL.

The otoacoustic emission test (OAE) measures hair cell function in the inner ear and it is used for a number of reasons, including screening of special populations. In the present study DPOAE was obtained in 20 individuals. DPOAE screener showed “REFERED” for 10 individuals and “PASSED” for remaining 10 individuals in left ear. Where as in right ear 12 individuals were “REFERRED” and 8 individuals were “PASSED”. OAEs may also be used for monitoring cochlear damage due to noise or ototoxicity (Shetty et al., 2020).

Hearing loss can be due to several factors and the implications according to the type, degree, cause and age of occurrence. Hearing screening is a common procedure which helps for pre - clinical identification and necessary referrals.

The goal of this study was to examine the hearing profile and hereditary factor that involved in the hearing loss among the “PERUMKOLAN COMMUNITY”. The screening test was measured in 20 individuals in the age range of 21 - 70 years. The importance of this study was to find out the chances of inheritance of hearing loss in the second generation from their ancestors since they were involved in the occupation of ‘Blacksmiths’.

An estimate of about 85% of people’s right ear shows hearing sensitivity at affected range whereas in the left ear

it's about 80%. More than 50% of people have been 'REFERRED' in OAE recordings. From the data collected for this study, we can draw a conclusion that hearing loss can be inherited to the second generation from their forebears. Various studies gave an overview about different genes that are involved in non - syndromic hearing loss and modes of inheritance of deafness. The loss of hearing can occur through genetic mutation, through environmental factors or through a combination of both. Management of this condition is still a pending task besides the previous researches.

References

- [1] Adult hearing screening, *retrieved from <https://www.asha.org>*
- [2] Aprianita, S., Tjipdo, U., & Sanitma M., (2015). Analysis of factors affecting to the hearing condition of blacksmith workers in Sungai pinang village, district of Daha selatan, south Kalimantan, *IJSR*, 4 (5), 556 - 562.
- [3] Blacksmiths, *retrieved from <https://www.britannica.com>*
- [4] Dennis C., (2020). Noise Induced Hearing Loss among Blacksmiths, Boilermakers and metalsmiths: *Hearing journal* 73 (1), 44 - 46
- [5] Gelfand (2016). Pure tone audiometry, *Essentials of audiology*, 4, 108
- [6] Hearing impairment, *Rehabilitation council of India retrieved from <http://www.rehabcouncil.nic.in>*
- [7] Hearing screening: consideration for screening, World Health Organization *retrieved from <https://www.who.int/>*
- [8] Jos, J., (2017). Hearing basics, *Hearing loss: causes, Prevention and treatment*.3
- [9] Magda, A., Afonso, S., Adriane, R., Patrícia, M., Alexandre, H., & Ângelo, J., (2021). Development and accuracy of a hearing screening application: *Brazilian Journal of Otorhinolaryngology*, 87 (6), 711–717.
- [10] Moza, Al - K., & Meritzell, E., (2019). Genetic and Acquired Hearing Loss. *Geriatric Medicine and Gerontology*, *retrieved from <https://cdn.intechopen.com>*
- [11] Markova, M., (1989). The development of occupational perceptual deafness in blacksmiths: *Europe PMC*, 38 (1), 25 - 31
- [12] Subroto, S., & Sarang, V., (2008). Occupational Noise Induced Hearing Loss in India, *IJOEM*, 12 (2), 53–56
- [13] Yildirim, A., & Metin, Y., (2004). An overview of hereditary hearing loss, *retrieved from <https://pubmed.ncbi.nlm.nih.gov>*