AN AUDIOLOGICAL CARE OF INDUSTRIAL NOISE – INDUCED HEARING LOSS IN NIGERIA

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Abstract

This paper studied "an audiological care for industrial noise-induced hearing loss in Nigeria". An experimental research design was used. Twenty workers were purposively selected from forge and management units of Nigeria machine tools, Oshogbo as research subjects. The instruments (workers clerking sheet, diagnostic report sheet, audiometer, audiogram, auriscope, Jobson Horne probe, tuning fork) were validated and they are reliable because medical doctors (otorhinolaryngologists) in the Ear Nose and Throat Department of University Teaching Hospital Ilorin had been using them for diagnosing and treating patients with hearing problems. Direct audiometric diagnosis was used to collect hearing capability levels and hearing problems for use. Based on the levels of problems detected, experiments were conducted, after five days of application of olive oil to the ear with wax, and removing same with Jobson Horne Probe, hearing efficiency of such workers changed from bilateral hearing loss to normal hearing capability for worker in an administrative unit. The workers who had moderate hearing loss changed to mild hearing loss. Based on the result, it was recommended among others that workers in steel industries be given ear muffs to wear to protect their efficiency.

The ear is the organ of balance, less functioning ear causes unbalanced body. The body balance is defective in Nigeria since health care in Nigeria is defective; the less privileged citizens are at the mercy of God for health maintenance. There could be misconception, misunderstanding due to imbalanced body. The ear also is the organ of hearing and could be slapped with impurity in Nigeria. It's also used to listen to loud sounds from radio, television, generators, drumming, crickets, car horns and mega – phoned musical instruments during marriage, naming & burial ceremonies and coupled with toxic nutrients like tobacco, cassava mushroom, grapes consumptions. In Thailand, Japan and America, noise management strategies are enforced based on Brigitte, Tomas, Ditctich and kee – Tai (2000) in the order of:

a. "The precautionary principle: In all causes, noise should be reduced to the lowest level achievable in a particular situation. Where there is a reasonable possibility that public health be damaged, action should be taken to protect public without awaiting full scientific proof

b. "The polluter pays principle: The full cost associated with the noise pollution(including monitoring, management, high level and supervision) should be met by those responsible for the source of noise"

c. "The prevention principle: Action should be taken where possible to reduce noise at the source. land use planning should be guided by an environmental health impact assessment that considers noise as well as other pollutants".

Had Nigeria been educated as to take these health measures? In developed countries, the health consideration takes premium on the state budget especially in the compensations received (Abelson's and Dixon 1993), However, due to low education, poverty, urge to be fully employed, Nigerians would readily accept whatever workplace and working environment, even the deadliest noisy and unhealthy environment (Udoh and Ajala 1993, Afejuku, Agdafa and Akinbode 1978). Also the dietary Consumption of Nigerians does not favorably protect the ear, "the all –carbohydrate (mono-dietary-status) "possibly aggravated the production of ear-wax and ear-fluids the may have negative effect on hearing efficiency and effectiveness.

The ear is the organ that collects air waves through the pinnae. it transmits and amplifies vibration of air waves to produce sound. Through the malleus, incus and stapes, the air wave hits the ear drum. The eardrum is constantly cleaned by hair cell which filters the air. Also, in the ear canal wax is produced naturally by the canal to constantly protect and lubricate the ear drum, ear wax secretion is gummy in nature, also sticky but can constantly be removed through normal ear cleaning with cotton wool (Maxwell, 1990) .

According to Maxwell (1990) ear canal plays an important role in the collection and concentrations of airwaves on the eardrum coupled with the production of wax to oil and lubricate the drum which constantly produced circular movement and vibrates when struck by sound. Unclean accumulated ear wax can impair hearing efficiency (Catlin, 1996). Loudness of sound aggravates the varying pressure exerted on the eardrum therefore making it insensitive to sounds at different frequencies; excessive sound is injurious to the ear, it can cause hearing loss due to intensity of vibrated sound energy; sound reaching the eardrum becoming queanple (Abott, 1979).

The body balance; Oxlade & marshal (1992) asserted is due to adequate function of the ear. The ear is the organ of balance as well as of hearing. The receptor organs in this case are the semicircular canals, with the membranous part of the cochlea and also contained endolyph. The vestibular portion of the eight nerve contains the nerve fibers running from the end-organs, which lie in ampullae's of the semicircular canal and the maculae of the saccel and the utricle to the cerebellum, which co-ordinates the muscle movements controlling posture and balance, injury or diseases involving the labyrinths of the inner ear e.g. menierls disease, well affect the power of balance; so he/she suffers from sense of fallowing or rotation (vertigo) (Oxlade & Marshal 1992).

The care of the ear and hearing efficiency had been presented in America, Japan and Austrialia as;(i) workers in noisy steel industries will reject working unless hearing aids (hearing protective devices) are provided (ii.) workers would detest listening to megaphone music (iii.) nutrients consumed are $^{3/4t}$ (three quarters) proteinous and vegetable to aid healthy living (iv.) workers are adequately sensitized to avoid exposure to noise (v.) Supervisors supervise workers in noisy environment unlike in Nigeria where workers never mind what noise level they are exposed to as long as monetary gain accompanied such noise hazards. (Kloids, Konno, Yashikwa 1990, Glorig 1999, Albert 1991, Reynald, Royster and person 1990, Albetrti 1997 and Wu, Liou, Hus 1998.

Statement of the Problem

Nigerians do not possess effective listening skill. Nigerians do not hear sounds adequately. Nigerians listen to excessive loud noise. Noise affects Nigerians hearing ability. Inadequate hearing can cause communication problem and confusion amongst people. Nigerian steel industries proprietors do not give workers in noisy area effective hearing protective devices.

Research Question

Loudness of sound has the characteristics of impairing the hearing ability, the following questions are asked with the purpose of sensitizing the steel industry workers on how best to preserve their hearing efficiency and their ear.

1. What happens after steel industry workers are exposed to factory/ industry noise?
2. What can the steel industry workers do to prevent accumulated wax in the ear?
3. For steel industry workers who already have wax in their ear, would there be a change in their hearing efficiency after wax removal?

Purpose of the Experiment

1. To see the levels of hearing impairments or hearing efficiency among steel industry
2. To find out the levels of hearing efficiency among the administrative workers.
3. To elucidate the hearing efficiency of workers that has wax in their ears.
4. To show the hearing efficiency level of workers from whom ear wax had been removed.

Significance of the Experiment

1. To sensitize industrial workers on the levels of hearing efficiency.
2. To show the industrial workers that wax can cause hearing inefficiency.
3. To educate the audiologists workers on the techniques of ear wax removal.
4. To sensitize steel industry managers on the need to constantly conduct periodic ear and hearing tests.

Research Methodology

Research Design: The research design for this study is an experimental method.

Table1: Audiological Instrument

S/N	Instruments	Description	Functions	Remark
1	Workers cleansing sheet	This is the researcher designed instrument for questioning the workers: Bio- data (background information) before they proceed for hearing and ear test.	This is used for recording the history of the patients/ workers and used by the researcher / medical audiologists.	This is filled by the audiologist or could be filled by the individual workers.
2	Diagnostic report sheet	This is the instrument used as doctor's questionnaire to obtain worker background information before the doctor's test.	This is used for recording the history; used by otorhinolaryngology.	Doctor's fill this form as he/she tests patient. The otorhinolaryngologists fill this form.
3	Audiometer	This is an instrument used for measuring the levels of hearing efficiency. it is graduated in hertz and decibel i.e. $125H_z$ 0. $5kH_z$ $4.0kh_z$ ……$8.0kH_z$ and – 10,0-160 decibels	This is used by the audiologist and speech therapists.	Audiologists and therapists use this test to be in perfect condition, with the accessories/ear muffs attached.
4	Audiogram	This is a graduated sheet of instrument in hertz & DBA	This is used for recording the level of workers hearing efficiency.	The markings are done in different colours. The right ear in red & left ear in blue.
5	Auriscope	This is an instrument that has electric component for lighting the inner ear.	It is used to view the workers or patient's inner ear	It reveals wax, foreign bodies in the ear. In red & left ear. for viewing the texture of the inner ear
6	Jobson Horne probe	This is an instrument that is used to pick wax from the ear.	It is used for picking the wax or foreign body from the ear.	
7	Turning fork	It is used to detect sound	It is used to detect sound	

The ear canal/ tympanic membrane results could be: (i) Neat (ii) Obscure and (iii) Full of wax. The turning fork test results are either (i) tve = positive -ve= negative in left ear
→ ← and right ear second sound heard into the inner ear sound heard outside the inner ear. An audiologist (Oladunmoye 2000) regarded all these procedural results before ascertaining the hearing efficiency type which could be:

1. 0.-30dBA= normal hearing efficiency
2. 31- 50dBA = mild hearing loss
3. 51-60dBA= moderate hearing loss
4. 61-120dBA = severe hearing loss
5. 71- 120dBA = profound hearing loss

These levels of hearing measurements are the teaching hospitals approved grades. These recorded hearing levels were focused for results and discussions.

Procedure for Data Collection

The otorhinolaryngists after detection of wax in the workers ear advised them to apply olive oil to the wax to soften it. This was applied for 5 days at night. The workers were subjected to hearing inspection by the use of auriscope, thereafter the clerking sheet, the hearing report sheet and the audiogram used for assessment by the doctor were collected and analyzed.

Procedure for Data Analysis

Data (scores figure) gathered for analyses were treated using frequency counts and percentages (inferential statistics) cum audiologram assessment.

Results and Discussion

The result of the data collected through the use of workers clerking sheet and the audiogram would be discussed:

Table 2: Workers' Responses to the Bio-Data

S/N	Statements	Responses			
		Yes		No	
		F	%	F	%
1	Do you have hearing defect before?	1	5.0	19	95.0
2	Did you complain of hearing defect before Joining this company?	5	25.0	15	75.0
3	Were you given hearing protective devices?	6	30.0	14	70.0

4	How often did you wear it?				
	Always	3	15.0	17	85.0
	Never	17	85.0	3	15.0
5	Have you tested your hearing efficiency before?	0	0.0	20	100

Table 2 above reveals workers' responses 1(5.0%) asserted that he had hearing defect before; while 95% (19 workers) denied the fact: i.e. they claimed that they never had hearing defect before. Though 5 (25%) confirmed that they had complained of hearing defect before joining the industry; while 75% (15 workers) denied the fact. further still, 70% (14 workers) asserted that they were not given hearing protective device, while 6(30%)of the workers said they were given hearing protective devices. in the same vain 85%(17) workers said they do not always wear hearing protective devices; while 3(15%) of the confirmed that they always wore it. and 100%(20workers) never had their ear and hearing efficiency tested before. There could have been a mixed up: some workers must have forgotten that they had tested their hearing efficiency before since (25%) of them confirmed that they had complained of hearing defect before joining their company. well, the complaint must have been rectified adequately before these workers joined the steel industry though with simple ear ache, unless thorough examination is conducted on the hearing status of such worker/ patient; the hearing efficiency would have become impaired/ defective.

These findings present a correlation between findings of Ajala & Udoh (1991) and Afejuku, Agdafa and Akinbode (1978); that Nigerians are not worried as long as they could earn money; some Nigerians do manage to go to work. These finding however negate the submissions of Abelon (1994) and Dixon (1993) who reiterated that workers in developed countries place premium on their health status rather than monetary gains. But the level of education in America, Japan, and Australia are higher than in Nigeria. The level of education is higher; health status demands could therefore be higher. Infact, the machines imported into Nigeria are obsolete and do not conform to the noise management strategies as enumerated for enforcement in Nigeria (Brigita, Tomas, Dietrich and Kee- Tai 2000).

If not for illiteracy, how could a worker accept to work in a forge & foundry unitys where several megahertz and highest decibel noise is emitted without wearing the cheapest hearing protective device i.e. earplug. An earmuff is the most effective noise repeller. Compensation claims should be paid to accidental or uncontrolled noise effect on hearing capability of American steel workers since such worker could sue erring steel company. Unlike in Nigeria; where worker's right to health is not guaranted. Also heath insurance for hearing defect abounds in developed world. But in Nigerian; health insurance is not available, and even if available; could be for very influential few.

With 75% complaints of hearing defect and with 70% non –practising of wearing hearing protective device and with 100% non- test of the hearing efficiency even annually, one wonders what type of hearing impairments would prevail in Nigerian steel industries. The ideal of hearing efficiency would have fallen on 0-30dBA and at 1.0 KHz though for Educational pursuit; Ademokoya (2002) would have preferred 0-15dBA at the same 1.0kHz. Which recreational areas and outdoors parklands can have low noise that is as lower than that of academic environment? How had the workers hearing fared?

Pre- Wax Detection and Hearing Efficiency Measurement

The auriscope was used to view workers ear. Those that had wax (2 workers) were earmarked for removal using visual ear wax evacuation method. Those that do not have wax had their hearing efficiency determined by the use of the audiometer, the audiometer is an instrument that is graduated in decibel and hertz as revealed in table 1 above and revealed in figure 1 as follows.

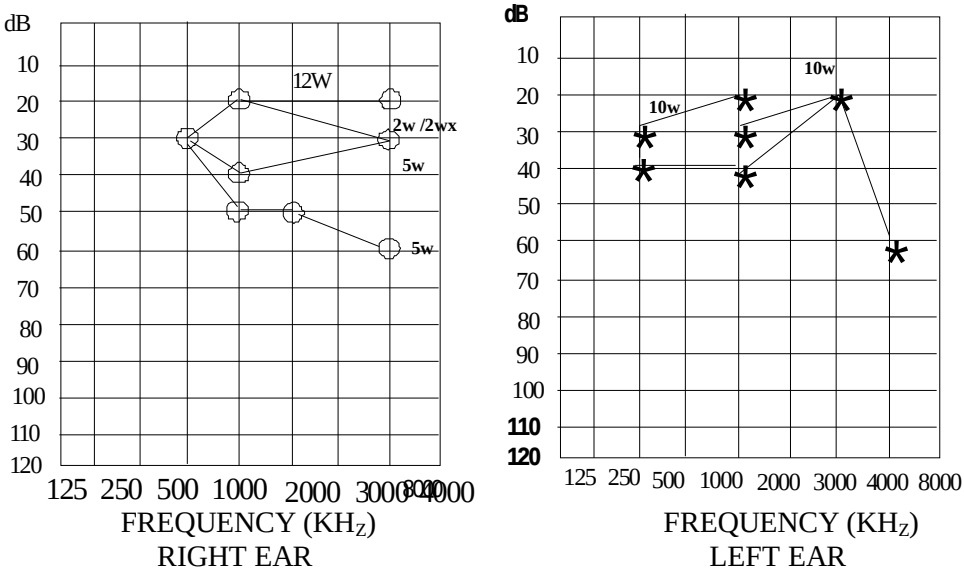


Fig 1: Audiogramic assessment of pre – wax tests

Fig 1 Presents an Audiogram reading of the steel workers in Nigeria. The hearing deficiencies prevalent among them are (i) Mild hearing deficiency (impairment) and (ii) moderate hearing deficiency (impairment). Some workers however have no hearing efficiencies: In the figure, the hearing efficiency reveal that (i) twelve (12) workers could hear sound at 2.0 KHz and at 20dBA, (ii) five workers could hear sound at 1.0KHz -4.0KHz and at 30 dBA but (iii) five workers heard sound at 1KHz and at 30 dBA also five workers heard sound at 1KHz and at 50 dBA in the right ear.

Furthermore, the audiogram above shows that 12 workers had no hearing loss, while 5 workers also had moderate hearing inefficiency. Also 9 workers had no hearing loss; 10 workers had mild hearing loss with 2 of them having wax and 1 worker had moderate hearing loss in the left ear. These findings correlate with Oladunmoye (2000) who confirmed the workers who had their hearing efficiency at 0-30dBA at which decibel could hear socially: They have no hearing efficiency for Ademokoya (2002), the workers had fallen into groups of students who may have to be moved to the front of the class where he/she should hear the lecturer adequately. And those workers whose hearing efficiency fall within 31-50 decibels have mild hearing loss (deficiency); can hear socially need hearing aid; since their hearing defect is moderate hearing loss (deficiency) mild and moderate hearing deficiency (loss or impairment) can constitute communication problems.

The test was within twenty workers; one wonders how many workers would have been affected in steel industries in Nigeria. Apart from the levels of hearing efficiency the hearing psychology was tested also to reveal the status of ear the workers' ear canal.

Assessment of the doctor's report confirmed the following ear canal result:-

Table 3:- Workers' Ear Canal Report

ASSESSEDEAR			RESULT		NOTE
			N	%	
EAR CANAL	RIGHT EAR	1.Neat 2.Obscure 3.wax	16 2 2	80 10.0 10.0	Weber test -The base of the vibrating turning fork is;- - Place on the forehead - Sound waves pass across the skull. - Both ear hear it - Conductive deafness makes the sound to be heard loudly on the affected ear. Renine test - The prongs of the vibrating tuning fork used;- placed beside the ear. - The base of the tuning fork is there after placed
TYMPANIC	LEFT EAR	1.neat 2.obscure 3. wax	14 4 2	70.0 20.0 10.0	
Membrane	RIGHT EAR	neat obscure wax	18 2 0	90.0 10.0 10.0	
Rinne	LEFT EAR	1.neat 2.obscure 3.wax	Z19 95.0 0	 5.0	
Test	RIGHT EAR	1.-ve 2.+ve	1 18 2	0.0 50.0 10.0	

LEFT EAR	1.-ve 2.+ve	18 90.0 2 10.0	on the mastoid process. - The two are compared.

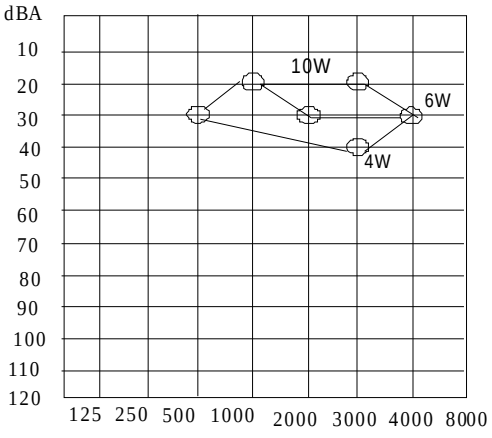
TUNING FORK TEST	Weber TEST	RIGHT EAR	1. 2	⟶ ⟵	17 85.0 3 15.0	- Conductive deafness sound is heard on the placement of the tuning fork beside ear.
		LEFT EAR	1. 2	⟶ ⟵	17 85.0 3 15.0	

Table 3 shows the result of ear assessment with the use of Jobson Horne probe and Tuning Fork test. 80% of the workers 'right ear is neat, 10% obscure and 10%had wax. The workers 'left ear canal is 70% neat, 20% obscure and 10% had wax. The tympanic membrane assessment reveals 90% neat, 10%obscure and no further wax was recorded in the right ear. Also, the left tympanic membrane had 95% neatness and 5%obscure.

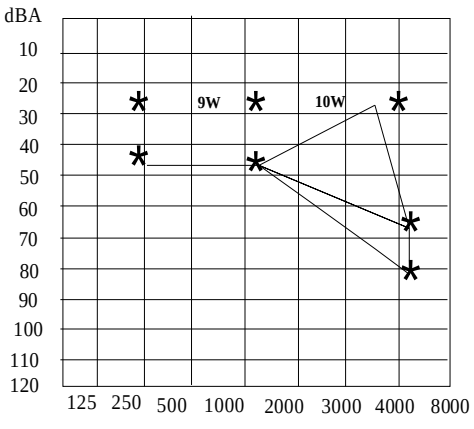
The assessed ear results of 90% -ve, 10+ve (right ear), 90%=ve and 10%+ve (left ear)

75% ⟶ 15% (right and left respectively) indicate that there are conductive bilateral and perceptive mild and moderate hearing loss among the workers. Note:- the mild and moderate hearing loss inflicted workers can still hear. These hearing impairments are still within the social hearing defects.

Post ear wax removal and personal ear care result prior to the visual wax ear removal, the affected workers were advised to put five drops of olive oil into their ears three times per day for five days. And other workers who had mild and moderate hearing impairment were advised to avoid staying within noise area. After the fifth day of the doctor's instruction, the doctor picked the wax with Johnson Horne probe and the hearing efficiency was taken as follows:



FREQUENCY (KH_Z)
RIGHT EAR



FREQUENCY (KH_Z)
LEFT EAR

The audiogram above reveals that 16workers'right ear had been cleared of the hearing defect while only 4 workers's still had mild hearing loss also on the right ear. Also, 5 hear efficiently. The medical advice on these workers had become effective. This is as a result of reduction of mild hearing loss to none hearing loss and moderate hearing impairment to mild hearing impairment.

Conclusion

Ear wax is normal cleansing solution secreted by everybody's ear canal. This wax can become dangerous to the ear if allowed to accumulate. The patients diagnosed that had wax were given olive oil to soften the wax. Therefore, the wax was removed using visual wax evacuation. It was discovered also that those workers who did not have wax but that had moderate and mild hearing impairment would have been so affected because they did not wear hearing protective devices. Those who wore hearing protective devices used the earplug. And ear plug is becoming obsolete in hearing conservation program internationally. However, the effectiveness of olive oil was shown because the visual wax evacuation which is the simplex method of wax removal was used. It indicated that the wax got softened and therefore was easy to be removed, instead of the syringing method.

Recommendation

It is clear that steel industry workers are prone to hearing loss due to constant vibration of airwaves surrounding the workplace environment; which is higher than normal. Therefore regulations guiding excessive noise production within Nigerian environment should be bared and it should be enacted into edict or regulation or decree by Federal Government to safeguard hearing efficiency of workers in industries that generate sound/noise higher than 80kilohertz.

Earmuffs, not ear plugs should be provided for steel industry workers to protect their hearing efficiency. Each steel industry worker should be paid extra-medical allowance bi-annually for the purpose of their ear examination and care.

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