NOISE INDUCED HEARING LOSS AS A MAJOR OCCUPATIONAL HAZARD AMONG WORKERS OF ILORIN COCA-COLA BOTTLING COMPANY

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ABSTRACT

The study investigated the effect of industrial noise on the workers of Ilorin Coca-Cola bottling company. It used forty workers from the factory consisting of 20 production workers and 20 administrative workers. The subjects were randomly selected based on picking ballot paper of Yes and No.

The instrument used for the study comprised of 20 structures questions in a likert format that was validated by experts in the Department of Guidance and Counselling of University of Ibadan. Similarly sound level audiometer, Amplaid A 37 audiometer that was caliberated by ANSI standard was used as well as otoscope was used to sight the samples ear, measure their hearing acuity and sound levels in the workers environment. The data was analysed using tables, percentages, mean hearing loss and t-test statistical tools.

From the overall data collected, it was discovered that noise has a debilitating effect on the production workers in both the right and left ears and that the right ear is was more affected. The study further revealed that those who stayed longer than ten years in the company's services have serious hearing problems, while the auditory perception abilities of those workers that use protective devices are better than those who do not use it. On the whole the effects of noise on the workers

affected their personalities and their day-to-day communication and interaction. The awareness of the entire workers on the implication of noise is nil in this study.

The study recommended the provision of adequate protective devices of medical facilities for all the workers in the factory while awareness campaign is advocated via hearing conservation programme and provision of audiologists in factories in order to curb the evil effect of noise-induced hearing loss.

BACKGROUND AND PROBLEM

Noise is a normal product of man's activities. It is an off-shoot of the process of energy production or expenditure called energy residual. Man produces sounds at different levels which are usually moderate or excessive. According to Owolawi (1998) noise is an erratic inharmonic meaningless or statistically random variation in sound pressure.

Bakare (1979) submitted after survey that Nigeria is one of the nosiest countries in the World. It is evident therefore that noise has become a leading menace facing Nigeria. This has necessitated the Federal Government of Nigeria to establish the Federal Environmental Protection Agency (FEPA) to control noise and other environmental pollutants like air, oil, water, that constitute health hazard to the nation's populace.

Davis and Silverman (1979) confirmed that man cannot hear sound with frequency much above 20,000 Hertz. Much noise-induced hearing loss starts at approximately 4000 Hertz region on the audiogram and this can result into sensorineural hearing loss, cochlear damage or other acoustic trauma. Noise is an unwanted sound that impairs the hearing abilities of those exposed to it. Getty and Hetu (1990) are of the opinion that the effects of occupational noise-induced hearing loss are in terms of reduced hearing sensitivity and frequency sensitivity.

Industrial noise exposures vary during a workday, hence noise dosimeter is sometimes used to measure time weighted average (TWA) or noise exposure in a day's time. This can be worn by our factory workers to sample the sound broadcast in the environment several times per second. The permissible noise exposure levels (PELs) are specified by the Occupational Health and Safety Administration (OSHA) and this was adopted in Nigeria by the Environmental Protection Agency (EPA), but how far this is adhered to in Nigeria is a mirage since is broadcast into the common air by everybody at random not minding the implications for other peoples health.

In fact the risk of noise-induced hearing loss is related to both its sound intensity and duration, and one experiences noise in a number of ways in which the individual can be the cause or the victim of the noise as in disco jockeys, blacksmith, jet planes-operators, grinders, garbage trucks drivers, construction equipment, manufacturing processes, road traffic congestion, ear horns, all of which negatively affect human health and well being. However, the consequence of noise on family health, leisure activities as well as social life of those affected is of grievous concern to these researchers especially in Coca-Cola bottling company in Ilorin, since noise interferes with speech communication, reduces working efficiency, causes physiological changes in heart beat rate, induces blood pressure and psychological distress, as well as affect auditory perception.

A lot of researchers have documented that occupational hearing loss often results in reduced ability to use the hearing sensitivity in everyday life situations which hamper communication and listening capabilities of the affected individual. Campbell (1993), Owolawi (1998), Kaley (1999), Daniel (1999), Blanvestein (1999) Vinsenten (1999) observe the effects and documented the effect of noise on hearing and concluded that it may result to temporary or permanent threshold loss which is determined

by the source of noise and duration of exposure. Psychologically, long periods of exposure to intense sound level of 85-120 dB has implication for the individual confirmed Spon and Spon (1991), while Pope (1995) further pointed out that high level of environmental noise will give rise to feelings of annoyance, irritability and fatigue. This attests to the fact that noise cause distraction and loss of productivity and a general reduction in the quality of life and opportunity for tranquility. It also causes stress of different kinds, sleep loss, high blood pressure, annoyance, irritability and fatigue (Hetscher, 1997).

In essence, excessive noise makes human being to develop low level of tolerance, uncomfortable state of mind and even melancholy. Olateju (1997) and Owolawi (1998) confirmed many undesirable effects of noise on mental and physical health of man; while Lusk (1997) concluded that continual exposure to noise leads to high level of damages to hearing cells within the ear, leading to noise-induced loss which may be irreversible. Henderson and Salvi (1998) attested that noise-induced hearing loss is accompanied by a wide variety of hearing deficits including threshold and supra-threshold deficits, which often prevent effective rehabilitation even when hearing aids are used. Kryster and Poza (1980) associated high noise level with high accident rate in industry. This observation is related to the masking effect of noise, which always interferes with speech communication, thereby limiting the warning signals of dangers to workers.

Similarly, Morata (1993) added that noise-induced hearing loss represents excessive wear and tear on the delicate inner ear structures while concurrent exposure to ototoxic substances such as silver and heavy metals may even increase the damage potential of noise. Ward (1995) restated that once exposure to damaging noise level is discontinued/further significant progression of hearing loss stops. Tsapogas (1997) observed that when noise comes on top of other stressful conditions, it

can provoke depression as well as organic diseases and that prolonged exposure can affect the individual is total personality. Rabinowitz (2000) further explained that sound must exert some force on the Sterocilla hair cells lining the basilar membranes on the cochlea before sounds can be perceived. When this force is excessive it leads to cellular metabolic overload, cell damage and cell death. It can affect the middle ear bones and even the vestibular balance as well as the eardrum leading to dysfunction; While susceptivity is further dependent on genetic factor predisposition, tobacco abuse, autotoxin, oxidative state of individual as well as dyslipidemia. Regecova and Kellerova (1993) reported that noise exposure resulted into vascular problem such as increase in blood pressure, heart beat, hypertension, metabolic and biochemical disorder; while Numinem (1995) indicated that noise induces stress reactions in pregnant mothers. It is capable of causing reproductive and menstrual disturbance as well as infertility to mention. These problems demand that noise must be controlled in our environment.

In advanced countries legislation is made and stringently observed in order to prevent the damaging effect of noise on individuals in the society, especially in companies and factories. Godlee (1992) observed that most European countries adopted the permissible exposure allowing a 3 dB doubling rate. The American conference of Government Industrial Hygienists further used the same standard of 85 dB exposure level per 8 hours as damaging risk criteria. The Occupational Safety and Health Administration (OSHA) also uses the permissible, exposure limit of 90 dB for 8 hours daily at 5 dB doubling rate, up to a maximum of 115 dB for steady state noise. In Nigeria, however, the Environment Protection Agency (EPA) used permissible exposure limit of 80 dB. In short, the Nigeria Factory Act of 1990 and its subsidiary legislation stipulate in general terms, the minimum standard for safety, health, and welfare of

workers. But there was no specific mention of control of noise at the working place as it was itemized in the Federal Government of Nigeria Factories decree of 1987.

Similarly, the Federal Environmental Protection Agency (FEPA) 1990 has adopted the OSHA criteria for Nigeria in application to all forms of environmental noise pollution in industrial settings, among others. However implementation and adequate monitoring remain, a mirage in Nigeria which stems this research to document the hazard experienced by staff of a bottling company in Ilorin in order to suggest different preventive measures both at source and on individual so as to curb or totally reduce noise-induced hearing loss which has become a menace in our companies/factories and society at large. The objectives of this study therefore are to:

(a) determine whether the workers in Coca-Cola company Ilorin are aware of the risk involved in exposing their auditory organs to loud noise over a period of time;

(b) find out if the workers in the production unit are given adequate protective devices against noise and whether they constantly use it;

(c) identify the effect of noise exposure on the workers' hearing acuity. The hypotheses tested in this study are:

(i) There is no difference in the perception of noise as a hazard by those in the production unit and those in the administration unit.

(ii) There is no significant difference in the effect of noise hazard on those in the production centres compared to those in the administration unit.

(iii) There is no significant difference in the levels of perception abilities of workers that had worked for 10 years or less when compared with those who had worked

for 11 years and above.

(iv) There is no significant difference in the hearing acuity of those workers who used protective devices and those who do not use any protective devices.

(v) There is no significant difference in the left and right ears perceptual acuity of those in the production unit in those in the production unit in Ilorin Coca-Cola bottling company.

METHODOLOGY

The study used a comparative-causal research design to investigate the auditory performance of the Ilorin bottling company workers in the production and administration units. Stratified random sampling technique was used to collect 20 subjects each from the two units in the company mentioned above. The age ranges between 20 and 54 years with a mean age of 35 years. Proportionate sampling technique was however used to select equal male and female subjects for the study.

Four instruments were used to collect data for the study. They consisted of 20-item structured questionnaire on the effect of hearing loss on the workers and their background information based on sex, years of experience on the job, sections attached to the number of hours spent in the production unit per day. The questionnaire was validated by two experienced experts in the department of guidance and counselling of the University of Ibadan. Other instruments used are:

(i) amplaid A 37 audiometer which was used to screen the workers hearing abilities;

(ii) otoscope - to examine the tympanic membrane for wax, cerumen or other additional ear ailment such as ear discharge;

(iii) sound level meter - Eagle 120dB meter caliberated acoustically according to Jis (dB) 'A' specification used to survey and measure the level of noise generated in the environment of the company production unit and administration section.

The audiometer measures the pure tone and bone, conduction assessment of the workers. The electro acoustic and biological calibration was done by an electro-acoustic engineer at Lagos before embarking on the study and it was calibrated to the ISO standard of 389:1985. The researchers performed the measurement of hearing thresholds, using the established audiometric procedure recommended by America National Standards Institute (ANSI, 53.21:1986). The set of TDH 39 ear phones with type MX411 AR type cushions was used to feed the tone to the workers' ears.

The procedure: The researchers (Dr. Abiodun and Dr Elemukan) paid several familiarization visits to the company to ensure rapport and interest of the participants as well as to seek permission of the manager and the subjects involved in this study. A particular week was agreed upon by all for the experiment. The questionnaires were given first to participants to complete on the first day of the agreed week, after which subsequent tests and experimental process were done on the subsequent days of the week. Audiometric tests were performed on the finally randomly selected groups in each of the units after they had balloted to participate in the study. The hearing acuity of the subjects was measured with amplaid A 37 audiometer on the third and fourth days of the study at frequencies 500 Hertz, 1000 Hertz, 2000 Hertz and 4000 Hertz respectively. Counselling / question time was observed on the last day of the week.

Analysis of Data collected made use of percentages, means, standard deviation and t-test statistical tools.

RESULTS AND DISCUSSION

The results are summarised in the following tables:

Table 1: Respondents' Hours spent on the Job by unit in a Noisy environment

Nature of Job	Hours (hrs) spent on the Job per Day											
	1-2hrs		3-5hrs		6-10hrs		11-15hrs		16-20hrs		Total	%
	No	%	No	%	No	%	No	%	No	%		
Factory Workers	3	30	2	20	2	20	2	20	1	10	10	25
Engine Room Workers	3	30	2	20	2	20	2	20	1	10	10	25
Administrative Workers	3	30	5	50	3	30	4	40	5	50	20	50
Total	9	22.5	9	22.5	7	17.5	8	20	7	17.5	40	100

Table one shows the number of hours spent on the job by workers as well as the units they belong to. Twenty-five percent of the sample are factory workers as well as workers in the engine room respectively, (10 respondents each). Fifty percent (20 respondents) are administrative workers. However, 9 respondents each (22.5%) spent 1-2 hours as well as 3-5 hours on the job, while 7 respondents (17.5%) spent 6-10 hours on the job in a noisy room two respondents each (20%) spent 11-15 hours on the job in a noisy room. While 17.5% (7 respondents) spent 16-20 hours on the job in a noisy environment. The above table clearly indicates that 15 respondents are staying beyond the permissible limit of 8-9 hours in a noisy environment, which portrayed that they must experience noise-induced hearing loss, while another seven are at the borderline of permissible limits. However, in order to answer the research hypotheses the samples of this study were divided into two groups. One group consisted of those in the

administration section (20 subjects) and the other group was made up of workers in the production unit. The mean score and standard deviation of the hearing acuity of the two groups were computed. The t-test was used to test the statistical significance of the observed differences between the two groups of workers' hearing acuity.

HYPOTHESIS TESTING

Hypothesis 1 (Ho1): There is no significant difference in the level of awareness of noise as hazards by those -in the production unit as compared to those in the administrative unit.

Table 2: Comparison of noise hazard awareness among the Ilorin coca-cola workers.

Category	N	X	S.D	D.F	t. obs	table t	P
Production unit	20	3.22	7.42				
				38	-0.492	2.02	0.05
Administration unit	20	3.47	8.24				

$-0.492 < 2.02$ - Not significant

Table two showed that the mean scores of those in the administration unit is higher than that of those in the production unit (3.47 to 3.22 and 8.24 to 7.42 respectively), which indicates that the awareness of Administration unit is better than that of those in the production unit.

Table two further reveals that t. calculated is -0.492 at 0.05 level which is lesser than the table't' of 2.02 hence the difference is

not significant, which shows that the level of awareness of noise as hazards among the workers is the same since majority have low educational exposure on noise problems.

Hypothesis 2 (Ho2): There is no significant difference in the effect of noise hazard on those in the production unit as compared to those in the administration unit, of Ilorin Coca-cola bottling company.

Table 3: Effect of Noise on staff in the production unit as compared to its effect on those in the administration unit

Category	N	X	S.D	D.F	t observed	tablet	P
Production	20	3.94	5.01				
				38	*3.965	2.02	0.05
Administration	20	3.48	8.1				

3.965 > 2.02 * significant

The above mean difference indicates that the administration workers hear better than those in the production unit (3.48 to 3.94); The calculated t-value of 3.965 at 0.05 indicates that there is a significant difference in the subjects' hearing acuity when the two groups are compared. Therefore, the hypothesis which states that there is no significant difference is rejected since the calculated t-value of 3.965 is greater than table t of 2.02.

Hypothesis 3 (Ho3): There is no significant difference in the Right and Left ears hearing acuity of the workers in the production unit of Ilorin coca-cola company.

Table 4: Comparison of hearing acuity of Right and Left ears of the workers in the production unit.

Ear	N	X	S.D	D.F	Calculated t	Table t	P
Right	20	72.75	11.468				
				38	-1.774	2.02	0.05
Left	20	65.43	51.08				

-1.774 < 2.02 at 0.05 Not significant

The mean average for the production workers right ear hearing acuity indicates a hearing level of 72.75dB as against 65.43db of the left ear, hence the left ear is hearing better than the right ear among the production workers but statistically the 't' value of -1.774 is lesser than table 't' of 2.02. Thus there is no significant difference statistically in the acuity of the right and left ear of the production workers in Ilorin Coca-Cola Company. The hypothesis stands accepted.

Hypothesis 4 (Ho4): There is no significant difference in the level of speech and language perception abilities of workers that have worked for 10 years or less as compared with workers that have worked for 11 years and above.

Table 5: Ear Perception of Workers Based on Years of Experience

	Category	N	X	S.D	D.F	Calculated t	Table t	P
Left ear	< 10 years	20	74.5	116.31	38	-27.303	2.02	0.05
	> 11 years	20	106.4	116.16				
	-27 303 > 2.02 at 0.05							
Right ear	< 10 years	20	81.6	127.2	38	-3.29	2.02	0.05
	> 11 years	20	117.6	185.95				
	-3.29 .202 at 0.05							

Table five reveals that the right ear is worse than the left ear for both groups, the mean hearing level being 84.6dB to 74.5dB and 118.6dB to 106.4dB respectively for the right and left ears compared, while those who had worked for 10 years or less had better hearing acuity than those who had worked for 11 years and above. This means that the left ear (-7.303) is greater than (2.02) as well as on the right ear (-3.29) is greater than (2.02) statistically, hence the hypothesis of no significant difference is rejected since those workers with longer years on the job experienced weaker hearing acuity/perception.

Hypothesis 5 (Ho5): There is no significant difference in the hearing levels of those who wear protective devices and those workers who do not wear protective devices (non-user).

Table 6: Comparison of the subjects hearing acuity of those who used protective devices and those who did not use protective devices

	Category	N	X	S.D	DF	Calculated t	Table t	P
Left ear	Protective devices users	10	54.63	85.253				
					18	21.12	2.10	0.05
	Non-users of protective devices	10	75.65	37.40				
	21.12 > 2.10 at 0.05 - significant							
Right ear	Protective devices users	10	60.63	94.66				
					18	5.082	2.10	0.05
	Non-users of protective devices	10	84.88	132.51				
		5.082 > 1.10 at 0.05 - significant						

Table six reveals that the left and right ears of workers that used protective devices are significantly better than those of non-user of protective devices with the mean being 54.63dB to 75.65dB left ear and 60.63dB to 84.88dB right ear respectively while statistically the left ear of those who use protective devices showed significant difference with calculated t being 21.2 as against table t of 2.02. While the right ear of those who used protective devices further indicates significant difference statistically with t calculated being 5.082 as against table t of 2.02 hence the hypothesis of no significant difference is rejected which implies that those who used protective devices had better hearing conservation as against those who refused to wear any device.

DISCUSSION

Five hypotheses were tested in this study. It was discovered that the findings in this study supported two Null hypotheses while three hypotheses were rejected. Hypotheses 1 and 3 were accepted while hypothesis 2,4,5 were rejected.

In essence, the result of analysis based on the generated hypothesis showed that there is no significant difference in the level of awareness of noise as hazardous by those in the production unit as compared to those in the administration unit based on the data in table 2 which indicated that the administration section are adequately aware of the hazardous effect of noise exposure, due to their high educational background. While those in the production have little awareness due to their low education thus there is a significant difference statistically. It is a fact that education assists to wipe away ignorance. Considering Hong, Chen, and Conrad (1998) findings on the effect of airport noise on the workers who sustained a high frequency hearing loss, therefore there is a need for hearing conservation programme among those exposed to noise as to raise their awareness. The study further indicated that there is a high degree effects of noise on auditory perception of workers in the production unit as shown in table 3 although those in the administration unit hear better, since there are significant differences in the findings of this study among different categories of workers in Ilorin Coca-Cola bottling company. This study corroborates some studies conducted by Bakare in Nigeria in 1989 as well as that by Morata (1998) who confirmed the effects of noise within the factory settings with its adverse effects on hearing acuity of workers in the environment. From the responses that were obtained, the factory workers agreed that they suffered hearing losses and this study supported that of Jack (1977) who noted that frequent exposures to loud noise can produce temporary

threshold shifts that are chronic and sometimes it may lead to permanent threshold shifts, and one single exposure can even lead to permanent damage. The subjects in the production unit demonstrated a great deal of insensitivity to noise as a result of their continual exposure in the factory. Hence they are accustomed to noise in the factory with evidence of tolerance and coping skills and even researchers have buttressed the fact that noise above 90 dBA for more than 5 hours daily leads to noise-induced hearing loss which begins as temporary threshold shift and later develop into permanent threshold shift as documented by Bakare (1991).

Hypothesis 3 tried to compare the left and right ears of the workers in the production unit at Ilorin Coca Cola bottling company. It was discovered that both ears have the problems although the right is worse than the left ear and that was why the t test of -1.774 indicated worse right ear as against the left, but of no statistically significant difference.

Hypothesis 4 indicates that there is a significant difference in right and left ears of workers who worked 10 years or below as against those who worked for longer years above 11 years. In fact, Nguyen,' Ngue, Yan, Hoang, Jonal Villanneve, Matsuda, Sotayama, and Sudo (1998) found out that workers with more than 10 years of exposure had the worst hearing threshold levels at 1000 Hertz and 4000 Hertz 3. They further revealed that workers of more than 35 years age had 4000 Hertz notch, which suggested intense noise exposure. This is in line with Zhu, Sakakibara and Yamade (1997) who affirmed that exposure to noise is hazardous to the hearing system. The noise from heavy machines automobiles and other noise producing gadgets, is of different intensity levels while it hamper the hearing system of Ilorin coca-cola bottling company workers, especially those in the production units that stayed 6-15 hours daily on the job for a long period of time.

Similarly, Henderson and Salivi (1998) confirmed that, noise-induced hearing loss is always accompanied by a wide variety of health problems; and that hearing deficit accompanied it which even prevents the use of hearing aids and disturbs other effective rehabilitation processes. Noise is an environmental pollutant and it is insidious to the general health of the individual. This research like others discovered that most of the workers from the production units talk at the top of their voices. Workers in this company claimed that they had no hearing loss before they started working in the factory. In short, there are other evil effects of noise on human health especially among the Ilorin bottling company staff such as biochemical changes, electrophysiological effects, physiological effects, sleeping effects as documented by Owolawi (1998).

Hypothesis five indicate the significant difference between those that used protective devices and non-users in both the right and left ears of the subjects. This is in line with Shaikh's (1996) study, where he compared the effect of noise on Polyester workers and suggested that safety measures should be provided for the workers to prevent high level noise damages. This study supported the use of cotton wools, earmuff, earplugs, helmets and protective shoes or canvas by the workers in Ilorin bottling company and other noisy environments.

*It may be concluded that it is more economical to prevent noise-*induced hearing loss from the source (machine) itself, by the production engineers, while at the same time other protective devices are to be provided in the factory for workers exposed to noise since the eardrum, ossicles, cochlea and the nerve can be destroyed or damaged as a result of noise exposure as documented by Burns (1978). It usually affects the auditory perception, hearing sensitivities and speech communication of the workers as this study revealed. It may even result into emotional problems and mental illness; hence there is a need

to raise the awareness of production workers towards the evil effects of noise and the need to use protective devices and other medical facilities as well as to advocate the use of hearing aids among those affected by noise in the Ilorin bottling industry. There should be a legislation in Nigeria to be monitored by environmental protection agency in Nigeria. Essentially workers should not be exposed for long hours/periods in the engine room through shifting practices, while sound proof shoes should be worn by workers in the engine room. Other protective devices should be mandatory for all workers in the engine room as well as the payment of compensation for those affected coupled with frequent medical attention provision in our industries for all the workers as to curb noise-induced hearing loss among the industrial workers in Nigeria. All factories with machines should employ the service of an audiologist in their company for better monitoring of noise induced hearing loss in companies with highly generated noise. Finally, FEPA should implement to the letter the occupation noise health hazard law with fines and adequate police monitoring of companies, to see that they adhered strictly with the law in Nigeria society, since noise has a deliabilitating effect on health as documented in this research.

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