CHAPTER II

SUBJECTS AND METHODS

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(1) Selection of Subjects:

In one of the shifts of 'B' unit there are total 294 male workers present, out of which six workers are in blow-room, ten in carding, thirtytwo in speedframe, ninetyone in ringframe, fiftyeight in doubling, reiling and packing and ninetyseven in winding sections in one of the textile industries in Ichalkaranji. From these, 171 workers were randomly seleted. The age-group of the workers ranged from 25 to 55 years. An anthropometric measurement and clinical examinations of all these workers were carried out. A detailed questionnaire was prepared to obtain information about their age, service experience, meal habits, past and present clinical defects, if any, and family size. The recorded noise level pressure in ringframe was 94 dB; a large number of workers was exposed to such type of worst noise. Therefore, workers from these areas were selected for the present investigation. According to the clinical examination, i.e., pulse rate, heart-rate and blood pressure, hypertensive cases were selected for further audiometric study.

As compared to different sections in textile mill, recorded noise level pressure in office was found lower. Thus, office members were exposed to less noise. Therefore, these members were considered as control group. Eighteen members were randomly selected for an anthropometric measurement and clinical examination. Same questionnaire

was used for same purpose. Their age-group ranged from 25 to 55 years. From this age-group again five members were randomly selected for further audiometric study.

Most of the work in the textile mill is repetitive type, which is carried out in three different shifts from 8 a.m. to 4 p.m., 4 p.m. to 12 a.m. and from 12 a.m. to 8 a.m.. To obtain detail information and to record the results of the present investigation spot-study was carried out by visiting the mill in different shifts.

(2) Measurement of Sound Level:

To determine the worker's exposure to the noise during a shift a noise survey has to be conducted and thus a precise instrument is needed to measure different noise levels in different sections of the textile mill. Three various instruments for measurement of sound, such as Sound level meter, Dosimeter, Octate band analyser, Sound scopes, Noise integrators, Graphical level recorders etc.. Unfortunately none of these instruments is manufactured in India. We import these instruments at heavy cost.

A sound level meter consists of an omnidirectional microphone, calibrated attenuator, amplifier, weighting networks, RMS Rectifier and a display meter for indicating the Root Mean Square (RMS) sound pressure level. It is powered by a small battery and measures the sound leven in terms of decibels.

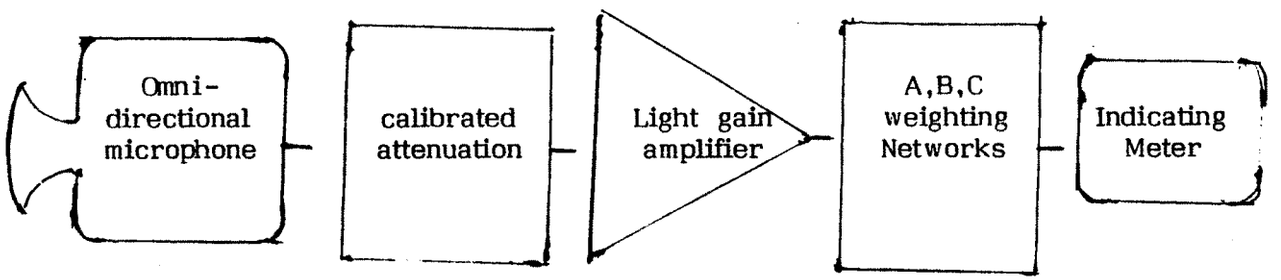
Depending on the accuracy and functional requirements,


Lo 40 50 60 CAL
70
80 90 100 110 80
Hi
B OK
OFF
Lo
Hi
CAL
BATT
OFF
YF-20
SOUND LEVEL METER

sound level meters are divided into two types:

(1) General purpose - used only for quick surveying and determining the approximate sound levels;

(2) Precision instruments used for accurate measurement.



Simplified block diagram of a sound level meter

For measurement of sound pressure levels in the various sections of textile industry SOUND LEVEL METER Y.F.20 MODEL was used. This instrument has provided with all audible frequencies. The sound pressure levels were measured at the entry, middle, near the machine and exist of the various sections. The results were recorded in dB(A).

(3) Anthropometric Measurements:

Anthropometric measurements of body height in Cm and body weight in Kg were carried out. The height was measured without footwear with the object standing straight against the wall on which the height was marked in centimetres, with the object looking straight

ahead and back touching to the wall. A flat foot-rule was kept perpendicular to the wall, touching the top of the head. Hair pushed down with the footrule. The height was measured to the nearest centimetre and results were recorded.

The weight was measured without footwear of the object standing straight on weighing machine. The weight was measured in Kg and results were recorded. At the beginning of the work weight-machine was checked for zero reading.

A detailed questionnaire was used to obtain information about age, sex, nature of service and experience, meal - either veg. and non-veg., drinking and smoking habits etc.. Information about history of past illness and clinical defects at present, if any, was obtained and recorded.

(4) Measurements of Cardiovascular Responses:

Pulse of the subject was recorded by simple method by holding wrist and keeping three fingers over branchial artery. Pulse was recorded per minute.

Heart-rate was also recorded by simple method, by keeping chest piece of stethoscope on chest at the left side. The heart-rate was recorded per minute.

There are two methods to measure blood pressure - directly and indirectly. Direct method is accurate. It is most impracticable except perhaps in research laboratories. Today blood pressure is

measured clinically by indirect method; by Sphygmomanometre (Sphygmos - Greek term = Pulse) Riva-Rocci described the mercury sphygmomanometer in the year 1896. Since that time much interest has been focused on the blood pressure

Before taking blood pressure the workers were told about the instrument and the nature of the act of taking blood pressure so as to reduce tension. The blood pressure of the workers was recorded in a cabin in the textile mill premises between various shifts. It was also ensured that the worker had not eaten heavy meal at least one hour before the blood pressure was taken. The procedure used to measure blood pressure was according to K.M. Bykov (1958), Dr. K.D. Datey (1983), Dr. A.A. Hingorani (1983) and E.C. Perce (1962).

Sphygmomanometer consists of an inflated cuff-Riva-Rocci cuff-attached to a mercury manometer and a tube connected with a rubber bulb with screw to decrease the pressure in the cuff.

The sphygmomanometre was kept at the eye level to avoid the effects of parallax. Cuff was wrapped around the arm and stethoscope was placed on a branchial artery at the elbow. Screw was tightened and air was pumped in the cuff with the help of rubber bulb. Pressure in the cuff was raised beyond the systolic pressure and the column of mercury was raised rapidly above the point of the systolic pressure. At the same time screw was loosened slowly. The pressure in the cuff was slowly decreased which became equal or slightly less than

systolic blood pressure. Then blood from brachial artery was released during systolic and first 'click' sound was heard in the brachial artery called Korotkov sounds. The sounds were discovered in the year 1905 by N. Korotnov at M.Yanovsky's clinic in Petersburg. Once sound was heard with stethoscope reading was read on mercury monometer noted as systolic blood pressure.

Further the screw was loosened slowly. As the cuff pressure became lower, the sound became louder, thereafter dull and muffled and finally almost disappeared. Pressure in the manometer at that time was noted as diastolic blood pressure. The sound disappeared because pressure in the cuff was less than diastolic pressure and hence cuff pressure was unable to press the brachial artery.

(5) Audiometry:

The cornerstone of an industrial hearing testing programme is a pure tone air conduction threshold test. Threshold should be measured at the frequencies 250, 500, 750, 1,100, 1,500, 2,000, 3,000, 4,000, 6000 and 8,000 Hz in each ear by audiometer. In earlier part of nineteenth century, hearing tests were performed with percussion, string and wind instruments like Galton whistle, tunning fork, monochord and with spoken as well as whispered voices. Audiometer can reproduce any intensity and frequency according to the requirement of the subject. When signals are emitted at an intensity they are recorded and charted in the audiogram in symbolic pattern.

Hypertensive cases from the ringframe section were randomly selected for further audiometric test. From the ringframe section five workers of the age group of 25 to 35 years were selected for the audiometric test. Ten workers of the age group of 36 to 45 years were selected for audiometric test. Five members were selected from control group for audiometric test. Audiometry was carried out in a sound-proof room. Audiometer was checked and calibrated. Audiometry was carried out by trained technician. Audiogram and results were checked by ENT surgeon and he gave his remarks. The procedure used for conducting the pure tone audiogram was according to Jack Katz (1979).

The 'up 5 - down 10" method of threshold exploration for the test frequencies was used. Red colour earphone marked with 'red O" was placed over right ear and blue coloured "blue X" over left ear of the subject. Diaphragm of audiometer earphone placed squarely over the opening of the external canal. 1000 Hz tone selected first because it is an important speech frequency. Sometimes workers showed uncertainty when technician started with 250 Hz tone. When technician suspected a profound loss, he started the test with 250 Hz. After the threshold for 1000 Hz was established, the procedure was repeated for the other audiometric frequecies including 2000, 4000, 6000, 8000, 500 and 250 Hz in that order. Threshold is a finest tone, which subject can hear. Testing of the second ear we should begin with last frequency which was used to test the first ear. There is no need to start again with 1000 Hz tone, because if one side

of the head has learned the listening task, the other side knows it as well.

Here the subject was presented with a signal of sufficient intensity to evoke a clear response. This can be done by turning the tone on continuously and starting from a completely attenuated signal, gradually increasing the sound pressure level until a response occurs. When the subject heard stimulus, his response was 'Yes'. The tone was switched off and again switched on at the same level, then the subject gave second positive response, then the technician proceeds to the threshold measurements. The first presentation of the tone for threshold measurement is 10 dB below the level at which the subject first responded. Each succeeding presentation was determined by the preceding response. After each failure to respond to a signal, the level was increased by 5 dB until the first 'Yes' response was given by the subject. After this response, the intensity was again decreased by 10 dB and another ascending series began.

For diagnosis of hearing loss, comparison of the air conduction thresholds and bone conduction threshold was necessary. Bone conduction audiometry was also performed in textile workers. It was identical with air conduction audiometry. Bone vibrator enclosing in a metal case surrounded with belt and having only the vibrating rod exposed to the outside. A metal ring holding a pair of rubber rings was fastened to the outside of the case. When the vibrating rod was applied to skull, the rubber rings also made contact with head and formed an airtight junction. Clinical bone conduction measurements

have been performed with the vibrator located on the mastoid process.

Air conduction and bone conduction audiometry were carried out at frequencies 500, 1000, 2000, 4000, 6000 Hz. Results were recorded and audiogram was prepared by using audiometric symbols. Recently a set of audiometric symbols was developed by the committee for audiometric evaluation of the American Speech and Hearing Association (1974) which was approved by the Executive Board of ASHA (American Speech and Hearing Association).

Recommended Symbols for Threshold Audiometry

Modality	EAR		
	Right	Both	Left
Air conduction-Earphones Unmasked	O		X
,, ,, ,, Masked	Δ		[]
Bone conduction-mastoid Unmasked	<		>
,, ,, ,, Masked	[		]
Bone conduction - Forehead Unmasked		V	
,, ,, ,,	⌐		⌐

500, 1000, 2000 Hz are the main speech frequencies; therefore, average of these three frequencies is considered as per cent hearing loss of the subjects. Then type of hearing impairment was decided according to Goodman table (1965).

Scale of Hearing Impairment
(After Goodman 1965)

Sr. No.	Hearing Threshold Level* 1969 ANSI reference** dB	Descriptive Term
1	-10 to 26	Normal limits
2	27 to 40	Mild hearing loss
3	41 to 55	Moderate hearing loss
4	56 to 70	Moderately severe hearing loss
5	71 to 90	Severe hearing loss
6	91 plus	Profound hearing loss

* Average of hearing threshold levels from 500, 1000 and 2000 Hz

** Equivalent to ISO 1964 Reference (Katz 1979)