CHAPTER – V- SUMMARY & CONCLUSION

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5.1 Summary of results

5.1.1 General Workplace Environment Condition

Monitoring of indoor environment shows that ginning operations generate more dust and emit excessive noise at the workplace. The noise levels at various units of the ginning industries are high particularly at ginning and pressing units of these industries. The Workers are exposed to the high noise for 8 to 12 hours per day. Most of the workers work for extra time to get more incentive. Noise emitted through old machineries of the industries is the main cause of poor environmental quality at workplace. Dust levels are also observed above the permissible limits laid down under Factory Act 1948 in the units like ginning and pressing compared to the other units of the industries. Air pollution at workplace environment contributes to the development of chronic respiratory diseases such as asthma and hypersensitivity and pneumoconiosis. The unhygienic environment at workplace also cause of headache, loss of concentration, loss of work efficiency, increasing workplace injuries and accidents, nausea, fatigue and noise induced hearing loss etc. Increase in blood pressure and eosinophils count in blood are the effects of high noise exposure and high dust levels prevailing at industries.

5.1.2 Workplace Noise Pollution, Exposure and Effects

Higher noise levels are observed at ginning and pressing units where most of the ginning workers are involved in the work on continuous basis. Other area like loading unloading, raw cotton storage and finished good (Pressed buldles) storage area of the unit are not observed noisy because these activities are mostly conducted in open areas and no machinery work is involved in these work areas.

i) Noise Exposure

Exposure of workers to workplace noise is high because they spend most of the time at shop floor. Noise dose analysis shows very high exposure
to the workers than the recommended value. Long-term exposure to such high noise leads into noise induced hearing loss.

ii) Auditory Effects of Long-term Noise Exposure

The outcome of the present study shows that hearing impairment is observed in the ginning and pressing unit’s workers. Long-term exposure to high workplace noise have serious impact on the hearing. Mild to moderately severe degree of hearing impairment was observed among the workers exposed to workplace noise as compared to the control group. Study on degree of hearing impairment shows that moderate to moderately severe hearing loss is observed in the worker having long-term exposure to workplace noise. Unilateral and bilateral hearing impairment is also observed in varying proportion in the workers under study.

iii) Self Reported Hearing Loss

Oisaeng (2005) reported occupational hearing loss to be a permanent due to damage of hair cells present in cochlear canal of the inner ear. The results on positive agreement between self-reported hearing symptoms (hearing loss, unilateral and bilateral hearing loss) and hearing impairment defined by audiometric hearing threshold observed during the study. High sensitivity and specificity observed for the hearing symptoms reported during questionnaire survey.

iv) Statistical Analysis

Significant difference in hearing status is observed between target group and control group. Significant hearing impairment observed among all the exposure groups. However, highest hearing impairment is observed among the workers having more than 10 years of exposure to the workplace noise.

Noise exposure and effect study shows that hearing impairment is increasing with increase in the exposure period. High value for odds ratio, positive predictive value (PPV) and negative predictive values are increasing with increasing the period of exposure. This shows that, the cotton ginning
workers having long-term exposure are at risk as compared to the less exposure group.

5.1.3 Air Environment and Health Effects

i. Particulate Matter

Particulate pollution is very important part of the workplace air environment. Higher prevalence of PM\textsubscript{10} was noted at ginning and pressing units of the industries. This is because all major operations are carried out in these areas of the industry. The other activities in these industries especially loading and unloading of cotton and bales are conducted in open shed area. Low particulate concentration was observed in these sections of ginning industries.

ii. Dust Exposure and Respiratory Impairment

Cotton ginning workers mostly working in ginning and pressing room exposed to higher concentration of cotton dust. Pulmonary function test shows significant reduction in the lung capacity with increasing exposure duration among cotton ginning workers. Increase in Eosinphils, ESR and WBCs, shows characteristics feature of respiratory impairment or allergy, among the workers exposed to the cotton dust. In the present study, we observed high percentage of moderate to severe chronic obstructive diseases in the workers exposed for longer period to the workplace environment. The result also shows significant decline in the FEV\textsubscript{1}, FVC and PEFR with respect to the period of exposure. The study shows strong relationship between period of exposure and risk of respiratory disease symptoms among the workers.

This study concludes that ginning workers are vulnerable to respiratory impairment due to cotton dust exposure at the workplace environment. We recommend that cotton ginning workers must use mask to avoid dust to enter in to the respiratory tract. Pictorial information about use of mass should be displayed at the workplaces to make aware the workers. Regular medical check-up of workers is important for early identification of...
workers experiencing breathing problems that may be related to the workplace environment.

iii. Risk Assessment

High value for odds ratio, positive predictive value (PPV) and negative predictive values shows increase in the risk with increasing the period of exposure. This shows that, the cotton ginning workers having long-term exposure to cotton dust are at risk as compared to the less exposure group of workers.

5.2 Important Findings of the Study

5.2.1 Health Effects of Noise

- High noise levels prevailing at ginning and pressing units of the ginning industries because machineries are very old.
- Higher risk of hearing impairment is observed to the workers exposed for long-term period to the workplace noise.
- This study shows that the hearing threshold values are increasing with increasing noise dose and exposure period; therefore, NIHL was more among the cotton ginning workers who were exposed to the workplace noise for a longer period.
- The results of this study indicate that occupational noise exposure has a significant impact on the hearing ability of cotton ginning workers in all age groups as compared with the control subjects.
- A significant important finding of the study is the prevalence of high hearing impairment above 90% of the exposed workers at binaural low, mid and high frequencies among the cotton ginning workers.
- Hearing loss is observed at higher frequencies and spreading at lower frequencies in a large percentage of workers. Percentage of hearing loss is higher in the workers exposed to higher noise for a long duration, i.e. 7-9 years and above 10 years of exposure to workplace noise.
- Mild to moderately severe degree of hearing impairment is observed among the cotton ginning workers. Percentage worker having moderate and
moderately severe hearing impairment is increasing with increase in exposure period. However only mild hearing impairment is observed in very few peoples from control group.

5.2.2 Health Effects of Air Pollution

- Due to poor ventilation high dust concentration (1.2 to 6 mg/m$^3$) was observed in the ginning industries. This is higher than the permissible exposure limit for cotton dust in India (0.2mg/m$^3$) as per Factories Act, 1948.
- Questionnaire survey of present study shows that more than 51% of the workers reported problem of chest tightness and more than 33% workers reported difficulty in respiration.
- The results of pulmonary function tests shows, decline in mean observed values (in percent) of FVC ranged between 75% - 61%, FEV$_1$ ranged between 74% - 60% and for PEFR was ranged between 71% - 65% in different exposure group. These values are below the expected value showing the impact of exposure to cotton dust. This decline in the values of FVC and FEV$_1$ may be due to the obstruction of the cotton dust particles in the lung air-ways which reduces the force applied by a subject during the inhalation and exhalation.
- Byssinosis symptoms like chest tightness, chest pain and frequent coughing are more in the workers (71%, 62% and 40% respectively) exposed more than 10years to the cotton dust.
- Eosinphils, ESR and WBCs shows characteristics feature of respiratory impairment or allergy are also observed in high percentage of the workers exposed to cotton dust.
- In the present study, we observed high percentage of moderate to severe chronic obstructive diseases in the workers exposed for longer period to the workplace environment. The results of this study also shows significant decline in the FEV$_1$, FVC and PEFR with respect to the period of exposure. The study shows strong relationship between period of exposure and risk of respiratory diseases symptoms among the workers.
This study concludes that cotton ginning workers are vulnerable to respiratory impairment due to cotton dust exposure at the workplace environment.

5.3 Recommendations

1. We recommend that cotton ginning workers must use mask to avoid dust to enter in to the respiratory tract. Pictorial information about use of mass should be displayed at the workplaces to make aware the workers.

2. Regular medical check-up of the workers is important for early identification of workers experiencing breathing problems.

3. Workshops or demo training may be organized for small-scale industries by government or group of small-scale industries at local level to make aware these people about workplace health and safety aspects.

4. Workplace environment monitoring for noise and dust should be conducted frequently and hazardous area should be isolated or effective control measures should be taken and effectiveness should be ensured to make workplace healthy.

5. If engineering controls are not possible workers should be removed or shifted to low level noise area within 3 hours if noise levels are above 95 dBA to avoid risk associated high noise dose exposure as shown in table 4.9.

6. Use of excel based model as given in table 4.13 and table 4.14 for distribution of working hours of ginning industries can reduce noise dose and noise levels (TWA) of the workers.

7. Distribution of working hours as recommended in table 4.13 and table 4.14 for ginning unit and pressing unit will help to protect workers hearing and other health impacts.
8. The efficiency of workers can be improved using this model and accident reduction can be controlled which may cause due to annoyance resulted from long-term exposure to high noise.

9. The workers should not be allowed to work without mask in high dust prevailing area.

10. Considering the area of shopfloor (workplace area) area of the ginning and pressing units of these industries turbo ventilators or mechanical ventilators of suitable capacity can be installed to improve ventilation at the workplace.