2012

Respiratory Problems Among Rice Mill Workers in Bangladesh

ANASRI, MD. MOSTAQUE HOSSAIN

University of Rajshahi

RESPIRATORY PROBLEMS AMONG RICE MILL WORKERS IN BANGLADESH

THESIS SUBMITTED FOR THE DEGREE
OF
DOCTOR OF PHILOSOPHY
IN THE
INSTITUTE OF BIOLOGICAL SCIENCES
RAJSHAHI UNIVERSITY
BANGLADESH

SUBMITTED
BY

MD. MOSTAQUE HOSSAIN ANASRI
Ph D FELLOW
SESSION 2009-2010

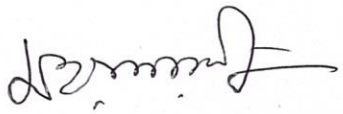
OCTOBER 2012

INSTITUTE OF BIOLOGICAL SCIENCE
RAJSHAHI UNIVERSITY
BANGLADESH

DECLARATION

I, Md Mostaque Hossain Ansari hereby certify that I had personally carried out the work depicted in this thesis entitled **'RESPIRATORY PROBLEMS AMONG RICE MILL WORKERS IN BANGLADESH.'** No part of the thesis has been submitted for the award of any degree or diploma prior to this data.'

Date: October 21, 2012.



Md Mostaque Hossain Ansari
Ph D Fellow
Session: 2009-2010
Institute of Biological Science [IBSC]
Rajshahi University
BANGLADESH

CERTIFICATE

This is to certify that Md Mostaque Hossain Ansari, Ph.D Fellow of Institute of Biological Science, Rajshahi University has fulfilled the requirements prescribed for the Ph D degree. The thesis entitled **'RESPIRATORY PROBLEMS AMONG RICE MILL WORKERS IN BANGLADESH'** was carried out under our direct supervision. No part of the thesis was submitted for the award of any degree or diploma prior to this date.

Date: October 21, 2012.

Dr. Md. Abdul Mukit Sarkar
Professor
Department of Community Medicine
Rajshahi Medical College.

Co-supervisor

Dr. Md. Rezaul Karim-3
Professor
Department of Biochemistry and Molecular Biology
Rajshahi University

Supervisor

Abstract

Rice mills are small scale industry abundant in Bangladesh producing parboiled rice. A large number of female also works in those major and automatic types of rice mills. Workers are exposed to occupational hazards mostly organic dust during parboiling, husking, storage and transport operations there. The rice mill dust contains disintegrated rice grain, bran, cereal germ, pollens, fungi, insects, mites and endotoxins. Prolonged inhalation of the dust can produce symptoms of the respiratory system diseases. This cross sectional descriptive study was done with the view to determine the prevalence of the symptoms of chronic respiratory health problems (CRHP) and to qualify those symptoms in respect of selective aggravating factors. Data were collected from five hundred sampled workers (266 male and234 female) of the selected rice mills situated in Rajshahi BSCIC area and the mills around Rajshahi city. In-depth face to face interview with pre-tested closed end questionnaire, Physical examination and lung function tests were done. Majority (69.0%) of the respondents were found working in the Parboiling and drying section (PBDS) of the mills. Among the workers, 34.0% were suffering from the symptoms of CRHP. Cough, dyspnoea, rhinitis and wheezing were the prevalent symptoms in 18.0%, 10.0%, 6.8% and 5.8% of the respondents respectively. Non-productive cough, running nose and dyspnoea without wheezing were the major presenting features of CHRP. Those workers were in job for short period and had those symptoms for short duration also. The symptoms of CRHP were found aggravated in the winter but had no relation with the other aggravating factors. Myalgia, headache and

malaise were the common acute health symptoms in 66.2% of the respondents. Symptom of Chronic conjunctivitis was found in 7.4 % of the workers. Among the male respondents, 87.6% were smoker. No clinical abnormality or any ailment was detected and all lung function tests values were in normal limit. BMI (Body Mass index) of the majority (59.4%) workers was in normal weight group. It was concluded from the study that the rice mill workers were suffering from symptoms only and signs of occupational respiratory diseases had not developed in them. Recommendations were made to arrange immediate medical treatment for the sufferers to eliminate the symptoms as micro-measures. As respiratory health problems in rice mill workers were at initial stage, macro-planning of medical, engineering, legislative and some general measures had been recommended for the promotion of health and prevention of occupational respiratory disease development in future among them.

Acknowledgement

I thank Almighty 'Allah Subhanatala' for granting me strength, wisdom, confidence and perseverance to carry out this study. Without His sufficient grace and mercy, I would not have been able to complete the task.

I express my gratitude to Professor M Khalequzzaman, ex-director of the Institute of Biological Science (IBSC), Rajshahi University who granted and allowed me to carry out this research. I am grateful to him for his constant inspiration through out the period of research. He trained us a very practical aspect of statistics related to the biological research and it was most helpful during the analysis of data.

I would like to express my sincere appreciation to my supervisor Professor Md. Rezaul Karim-3, Department of Biochemistry and Molecular Biology of this university for his outstanding guidance and for providing me the opportunity for this rewarding research experience. Thank him for his excellent field supervision and sparing his valuable time to share his vast experiences.

I am also grateful to my co-supervisor Professor (Dr) Md Abdul Mukit Sarkar, Professor of Community Medicine of Rajshahi Medical College for his excellent wisdom, experience and outstanding guidance in completing the research work.

I salute the contributions of Professor Parvez Hassan, Professor Md Wahidul Islam and all other faculty members of IBSC, officers and stuffs of the institute who helped in all aspects during the research work and report writing.

I greet the help of my past colleague Professor Md Jawadul Haque, Professor and Head

of department of Community Medicine and all the teachers of Rajshahi Medical College who cooperated and supported me actively during the data collection.

I admire the help of my present senior colleague Professor Hussain Reza, Professor of Medical Physiology and Principal Khwaja Yunus Ali Medical College, Enyetpur Sharif, Sirajganj, with whom I discussed many times about respiratory physiology and dust related changes in human respiratory system. Thank him for giving me his valuable time in sharing his vast teaching and research experiences that was most helpful to me during writing this report book.

I would must node to and thanks all the workers and respondents of the studied rice mills who spared their valuable time and had sincere effort to provide all required data. Their active cooperation and respect to a physician had charmed me. It was really a chance for me from 'all mighty' to come in contact with the rice mills workers, an under-privileged section in this country in gaining a lot of practical knowledge of sufferings of the poor people. Managers of those studied rice mills were very much cooperative and extended all possible supports. I still remember the sincere helpful hearty cooperation of Md Mizanur Rahman, a local grain businessman who was most acceptable well-wishers to the workers helped me in understanding the local language of the workers.

Finally, I owe my most heart full thanks to my wife, Anjuara Begum and our children Istiaque and Musfique for their unconditional support that was my constant inspiration. I feel the blessing of my parents from the haven and all my teachers and well-wishers.

Md Mostaque Hossain Ansari.
October 21, 2012.

Table of contents

List of Tables

Chapter: 1

Introduction

Rice mills are small scale industry for the production of rice from paddy. There are different types of rice mills in every part of Bangladesh. A large number of unskilled and semi-skilled people mostly female work there. Lack of specific guide lines for rice mills establishment and operation, workers face a lot of problems including health hazards. Respiratory hazards are important one. These problems develop mostly due to exposure to dust at various stages of operations in the rice mills. Respiratory health problems may be acute or chronic. Whatever the problem, the main presenting respiratory symptoms are cough, dyspnoea, wheezing and nasal irritation or watering. The normal respiratory physiology tries to expel the dust out. Composition and nature of dust, duration of exposure, altered respiratory path-physiology, immunity status and allergies, rice mills environment, use of protective devices and a lot of other factors contribute in the development of those symptoms. The higher prevalence of different symptoms also depends on these factors. For the reduction of the symptoms of problems and their prevalence in the workers, the major contributory factors would be reviewed to have recommendation for prevention, control and rehabilitation measures.

1.1. Rice Mills and Operational guide line:

Rice Mills are defined as any premises on which paddy is manufactured into rice by mechanical power and includes any place, building, machinery or equipments used in

connection with storage of paddy or rice or the manufacture of rice. [1,2]

In the rice mills, the net operations are as like the paddy is first milled using a rice huller to remove the chaff (the outer husks of the grain). At this point in the process, the product is called brown rice. The milling is continued to remove *i.e.*, the rest of the husk and the germ, thereby creating white rice. White rice, which keeps longer, lacks some important nutrients. [3]

Parboiling is a hydrothermal treatment of paddy. Parboiled rice is "par-tially boiled" (i.e. partially cooked rice). Paddy is first hydrated, then heated to cook the rice and finally dried before husking.[4] In many countries of the world parboiled rice is consumed. Parboiling causes nutrients from the outer husk, especially thiamine to move into the grain itself. The parboiling process also causes a gelatinization of the starch in the grains. The grains become less brittle, and the color of the milled grain changes from white to yellowish. The paddy is then dried, and can then be milled as usual. Milled parboiled rice is nutritionally superior to standard milled rice. This type of rice is eaten in many parts of India. People of many countries of West Africa are also accustomed in consuming parboiled rice.[3] In Bangladesh, parboiled rice is popular to the most of the people. Al most all rice mills here produce parboiled rice. In 'Major Rice mills' of Bangladesh, a large section of the workforce are engaged in parboiling and drying section especially the female workers.

All most all rice exporter and developed countries have guide lines for rice mills operation.[1] The main activities described in those guidelines for rice mills include

- receipt, weighing and grading of paddy;

- drying to reduce moisture for safe storage in warehouse;
- cleaning to remove weeds soil and other foreign matters;
- milling to remove husk and other by products (bran);
- rice grading into whole grain, broken and chips,
- bagging and bulk storage, and
- Out loading to road transport.

Following the milling process, cleaning of mills and factory area as well as servicing of mills had been suggested also.

For the parboiling mills included additional recommendations were

- potable water must be available,
- drains to dispose of waste water,
- the steam generating unit should be sited away from storage and immediate work areas,
- the soaking tanks should be located close to the drying area,
- the steaming tank made of non-corrosive metal should located close to the soaking tank
- the steam conduit pipes should be insulated and free from leaks, and
- The effluent coming from these operations should be treated prior to disposal to the receiving environments.

A large number of environmental issues had been prescribed in that operational guideline like hygienic handling of rice grain during making and packaging, water resource management and effluent discharge, air emission of dust, noise and odor management,

disposal of solid waste and its management

1.2. Dust.

Dust are small particles, conventionally taken as those particles below 75 μm in diameter, which settle out under their own weight but may remain suspended for some time.[5] According to the "Glossary of Atmospheric Chemistry Terms" the dust particles are those that of usually in the size range from about 1 to 100 μm in diameter.[6] The important appropriate measure of particle size for most occupational hygienic situations, is the 'particle aerodynamic diameter'.[7] It is defined as "the diameter of a hypothetical sphere of dust particles density 1 g/cm^3 having the same terminal settling velocity in calm air as the particle in question, regardless of its geometric size, shape and true density." The aerodynamic diameter expressed in this way is appropriate because it relates closely to the ability of the particle to penetrate and deposit at different sites of the respiratory tract, as well as to particle transport in aerosol sampling and filtration devices.[7]

In the rice mills, the worker expose to the dust during the parboiling and drying paddy, during husking operation and also during loading and storage. It may be inorganic but primary concern in grain handling is organic dust as the paddy is moved from field after harvesting and the drying procedure, inorganic contents tends to drop.[8] Rice mill dust is composed disintegrated rice grain (endosperm), chaff, bran, cereal germ, as well as pollens, fungi, insects and mites and endotoxin.[9] It may also contains 5% to 15% silicon dioxide and is contaminated by excreta of rodents and pigeons.[10].

1.3. Human respiratory tract and dust particles deposition.

The human respiratory system can be described in relation to dust into nasopharyngeal, tracheo-bronchial and alveolar region. Particles small enough to stay airborne may be inhaled through the nose (nasal route) or the mouth (oral route). The inhaled particles may then either be deposited or exhaled again, depending on a whole range of physiological and particle-related factors. There are five deposition mechanisms of dust namely sedimentation, inertial impaction, diffusion (significant only for very small particles < 0.5 μm), interception, and electrostatic deposition. Among them, sedimentation and impaction are the most important mechanisms in relation to inhaled airborne dust, and these processes are governed by particle aerodynamic diameter.[11] The largest inhaled particles, with aerodynamic diameter greater than about 30 μm, are deposited in the nose and the larynx. Retention after deposition is helped by mucus, which lines the nose. Of the particles which fail to deposit in the nose, the larger ones will deposit in the tracheobronchial region and may later be eliminated by mucociliary clearance but if soluble may enter the body by dissolution. The smaller particles may penetrate to the alveolar region. In aerodynamic diameter terms, only about 1% of 10-μm particles gets as far as the alveolar region, so 10 μm is usually considered the practical upper size limit for penetration to this region. Maximum deposition in the alveolar region occurs for particles of approximately 2-μm aerodynamic diameter. Most particles larger than this have deposited further up the lung. For smaller particles, most deposition mechanisms become less efficient, so deposition is less for particles smaller than 2 μm until it is only about 10-15% at about 0.5 μm. Most of these particles are exhaled again

without being deposited. For still smaller particles, diffusion becomes an effective mechanism and deposition probability is higher. Deposition is therefore a minimum at about 0.5 μm.

1.4. Physiological clearance of dust.

After deposition, the insoluble particles are cleaned out by many processes. The defense or clearance mechanisms for the retention of inhaled insoluble dusts have been broadly described into four ways.[12] These are

- Fast-clearing compartment, linked to the ciliary clearance process in the tracheo-bronchial region (clearance time of the order of half a day);
- Medium-clearing compartment, linked to the "first-phase" macrophage clearance action in the alveolar region (clearance time of the order of 10 days);
- Slow-clearing compartment, linked to the "second-phase" macrophage clearance action in the alveolar region (clearance time of the order of 100 -200 days); and
- Sequestration compartment in which particles are stored permanently (e.g. “embedded" in fixed tissue).

1. **Mucociliary clearance**: The trachea, bronchi and down to the terminal bronchioles, are lined with cells with hair like cilia (the ciliated epithelium) covered by a mucous layer. The cilia are in continuous and synchronized motion, which causes the mucous layer to have a continuous upward movement. Insoluble dust particles deposited on the ciliated epithelium are moved towards the epiglottis, and then swallowed or spat out within a relatively short time.

2. **Bronchiole movement**: intermittent peristaltic movements of the bronchioles, and coughing and sneezing can propel in the mucous lining towards the larynx and beyond.
3. **Phagocytosis:** The epithelium of the alveolar region is not ciliated. The insoluble particles deposited in this area are engulfed by macrophage cells (phagocytes). The macrophages then travel to the ciliated epithelium and then are transported upwards and out of the respiratory system or remain in the pulmonary space or enter into the lymphatic system.

Accumulation of large enough burdens of insoluble particles in the lungs leads to impaired clearance, so-called "dust overload" condition may occur as a result of prolonged occupational exposures, even at relatively low levels.[13]

1.5. Mechanism of action of grain rice dust:

The mechanism of producing effects of grain dust on lung has been described as local irritation and hypersensitivity reaction, mostly Type-I and some time Type-III. The irritation provokes inflammatory reaction in airways that causes cough and when the irritants are more and for prolonged duration leads to cough with phlegm production. In type I hypersensitivity reaction, IgE (a short lived antibody) that is produced in responds to dust triggers de-granulation of mast cells and basophiles when cross-linked by antigen resulted the allergens (dust contents) triggering inflammation. This causes the bronchi and bronchioles to swell (edema) and may also be excessive mucus production [phlegm]. Both these processes narrow the bronchial trees produces dyspnoea and wheezing. [14, 15, 16]

And these lead to development of occupational asthma [grain dust asthma] in grain handlers and grain mills workers.

1.6. The problems related to grain dust:

The grain dust produces its effect on the parts of the body that come in contact with it. But the respiratory system which seems to be primary target of grain dust produce a variety of symptoms such as cough, wheezing, dyspnoea and running nose. Effect on eye as conjunctivitis and skin itching, fungal infection may occur.

The respiratory problems may be presented as acute symptoms (mostly for short time exposure) or chronic symptoms (for long duration exposures). The most common symptoms are cough, expectoration, wheezing, chest tightness, eye and nasal irritation. [17,18,19,20,21,22,23] A remarkable portion of exposed workers also experience one or more episodes of grain fever characterized by malaise, chills and fever occurring during or several hours following exposure. [17-22] The symptoms of cough and with wheezing significantly more marked among smokers. These effects either acute or chronic are independent of age, length of employment and smoking habit.[22] The symptoms of chronic respiratory diseases in grain workers are persistence cough, phlegm production, wheezing and dyspnoea had been described in many studies. [17, 18-23, 24]

The mostly described disease in grain handlers are chronic bronchitis, grain dust asthma, Farmers lung - extrinsic allergic alveolitis, grain fever, Silo-filler lung, silicosis, rhinitis and conjunctivitis. [25] Rice millers' syndrome has been described in rice mill workers with the common respiratory symptoms in several places. Factors influencing the prevalence

and type of these lung diseases include quality and quantity of dust, duration of exposure and some host factors like smoking, atopic person, alpha-antitrypsin level in blood and Bronchial hypersensitivity.[25]

1.7. Rationales of the study.

Rice mills workers expose to the dust and may develop respiratory problems for their employment there. There are few investigations report and published data about the rice mill workers in our country. There is no clear operational guideline for rice mills establishment and operation here. Unplanned rice mills settlement and operations are creating hazards in the workers as well as a risk for the common people living around the mills. Environmental pollution (mostly air, water and soil) by dust, noise, waste water and solid waste are constantly occurring both in urban and rural areas, did not been able to attract the concerned authorities. Improper health Information system and almost inactive occupational health services have failed to bring the situation in the limelight. It might be hoped that information collected in the present study about the symptoms of the respiratory illness would be able to reflect the respiratory health problem [diseases-which are very difficult to made confirmed diagnosis] in the rice mills workers as an 'ice-berg' of the total problems in the rice mills. Information collected about the aggravation of the symptoms with various factors and presence of various predisposing conditions for the said symptoms would be able to attract the health authority to provide effective promotive, curative, preventive and rehabilitation measures. It will sensitize the health service planners for appropriate planning measures and adequate budgeting in this sector.

Improvement of the rice mills working environment will be helpful in prevention of environmental pollutions. It will increase the working capacity and capability of the workers and will put positive effects on the national economy of the country. The present study will be able to draw the attention of occupational health researchers on this aspect. More research is needed to explore the health situation of the workers as well as environmental impacts of rice mills establishments in the country.

1.8. OBJECTIVES OF STUDY

A. General Objective:

To determine the symptoms of chronic respiratory health problems among workers employed in rice mills.

B. Specific Objectives

1. To estimate the prevalence of different symptoms of chronic respiratory problems in rice mill workers,
2. To qualify the symptoms of the respiratory problems in respect of
   a. presenting clinical features
   b. duration of employment,
   c. working section in the rice mill
   d. season, time and period of symptoms and their aggravation.

Chapter: 2

Literatures review

The present study was conducted among the rice mills worker to explore the prevalence of chronic respiratory symptoms and to qualify the symptoms in respect of various aggravating factors. The respiratory health problems among the rice mills workers usually extend from minor irritation symptom of cough to extreme dyspnoea and chronic asthmatic attacks that withhold them from work along with the deterioration of most respiratory variables' measurements. The occurrence of symptoms and or its aggravation have relation with the working section, nature, duration of employment and works, time and seasons and many other conditions. The hazardous agents causing such problems are usually dust, microbial agents, toxins, disintegrated grains particles, husk and bran of the rice. The articles published in different journals had been discussed in this section considered as relevant to the presents study. In this section, a few articles were about the rice mills concerned directly but mostly of them are related to the dust and grains that the workers expose during their occupation resulted similar symptoms.

James Leigh et al. [26] made an estimate about the global morbidity and mortality due to occupational factors using available data published in 1994. They estimated approximately 100,000,000 occupational injuries (100,000 deaths) and 11,000,000 occupational diseases (700,000 deaths) 'occur in the world each year. With the application of the results of their study, they calculated disability- adjusted life years

(DALYs) about 38 million DALYs, or 2.7% of all world DALYs being due to occupational factors. They commented that occupational risk factors were responsible for 18.6 DALYs per 1,000 persons in the working population. In our country, such occupational morbidity and mortality data are not available and there is no record keeping system. Rice mills authorities employ a large section of unskilled and semi-skilled rural people especially the female in Bangladesh, so the burden of occupational diseases and injuries must to be estimated and documented to ensure their occupational safety, wellbeing and life. Though this article is not related to the present study, yet it has been included in the literature review portion to emphasize the threshold of the problems in the rice mills workers that are needed to be count.

The Environmental Protection Agency of Guyana [1] made a Draft Document in 2000. In that draft document, they mentioned clearly about the operational guidelines for rice mills / factories. The purpose of those guidelines was to support legislation and regulations for the protection and enhancement of environment by providing developers with practical options for managing their rice milling operation in an environmentally sound manner. In the draft document, rice mills were defined as per Guyana Rice Factory Bill 1998. All the operational activities at rice mills and issues related to workers health, safety and environmental pollution for waste water and refuse disposal had described with appropriate suggestive measures were mention in the draft document. In Bangladesh, Ministry of Labor and Industries should make such guidelines for rice milling operation along with active consultation with ministry Forest and Environment of the country. It is necessary to protect workers health and life as well as environmental pollution of soil,

water and air.

Manfreda et al. [27] carried a survey under a Research Support, (Non-U.S.Gov't) about the chronic symptoms and airflow obstruction in a rural population. They grouped the study sample as current (exposed to grain for on an average 2 months a year), former and never farmer categorizes. The farmers did not suffer from chronic respiratory symptoms or impairment of lung function for their exposure to grain dust was mentioned in that study. They did not explore any association between symptoms and exposure to grain and farming categories, rather there was a strong association between most symptoms and smoking. In our country, similar situation exists because the workers are not employed permanently in rice mill job here and duration of exposure usually occurs for very short period. The present study would be very relevant with it.

Von Essens S et al. [28] carried a cross-sectional (comparative) study of occupational respiratory complaints in farmers who experienced organic dust toxic syndrome (ODTS). In the study, 290 people completed a questionnaire about agricultural practices, respiratory health (including history of febrile episodes while handling grain), and use of respirators. ODTS symptoms were described by 107 of the people (36%). A strong significant association was found between ODTS and cough or chest tightness after handling grain. Similar study is essential in our country to diagnosed ODTS among the rice mills worker. The present study was concerned with the symptoms and not with syndrome identification.

Yach D et al. [29] carried a comparative study to explore the prevalence of respiratory symptoms in 582 grain mill workers and 153 control subjects (not exposed to grain dust)

in Cape Town. Grain workers showed significant deterioration in lung function values over the week, with forced expiratory volume in one second (FEV_1) declining on average by 4.8% compared with an increase of 3.3% in control subjects. Grain workers had significantly higher prevalence of regular cough, expectoration, wheeze, and watery eyes than the control subjects. These symptoms were not related to the duration of employment. The present study was similar with this study, but was not concerned with syndrome identification.

Dopico GA et al. [30] in a study compared the respiratory parameters of 310 grain handlers exposed to grain dust and 237 city workers (not exposed to grain dust) having same backgrounds. Data was collected by questionnaire, interview and pulmonary function tests examination. The prevalence of acute work-related and chronic respiratory symptoms and positive auscultatory airways lung obstruction findings were significantly higher ($p=<0.05$) in grain handlers than in control subjects. The mean values of all lung functions were significantly lower in grain workers than in control subjects. The effects of smoking and grain handling on symptom prevalence and lung functions [adjusted for age and height, analyzed by logistic regression model] were highly significant and independent. The effect of grain dust exposure on symptom prevalence was greater than that of smoking. The present study would probably run with the similar expected result. In the present study, acute and chronic symptoms were identified and their prevalence was estimated.

Post W et al [31] in a longitudinal study followed 140 workers of grain processing and animal feed industries for five years to observe the changes in the prevalence of

respiratory symptoms and lung function test. Annual decline in FEV1 and maximal mid-expiratory flow (MMEF) in the workers were significantly related to occupational exposure to dust and endotoxin / endotoxin in the grain processing and animal feed industry were found in that study. The present study was a descriptive, so such result did not be expected. Similar study was essential to observe the long tern effect of rice mills dust exposure.

Cotton DJ et al. [32] compared pulmonary function variables of workers (smokers and non-smokers) and prevalence of respiratory symptoms of Saskatchewan country grain elevators with community control (smokers and non-smokers) subject. They collected data with a questionnaire and performed lung function tests. They observed increased prevalence of respiratory symptoms and reductions in pulmonary function both associated with grain dust exposure and smoking but the effects of smoking were slightly more pronounced. They mentioned in that study that the combined effects of grain dust and smoking on lung function appeared to be additive except in the least exposed workers (five years or less) where a synergistic effect was observed in tests of peripheral airways dysfunction. In the present study, similar effects of dust exposure and smoking were expected to be observed but as being this one a descriptive, control group had not been assigned in it.

Manrfeda J et al. [33] in a study collected data from 661 male and 535 female (current and former farmers) who had the history of acute symptoms (cough, wheezing, shortness of breath, fever, stuffy nose, and skin itching / rash) following exposure to grain dust. Among them, 60% of male and 25% of female farmers reported at least one such

symptom on exposure to grain dust. They mentioned in their study as those entire symptoms were allergic in nature and showed that smoking might modify the susceptibility to react to grain dust with symptoms. In the present study, the prevalence of the symptoms was to be explored in respect of sex and other background variables and the relation with them to be estimated.

Chan-Yeung et al. [34] studied lung abnormalities in 22 grain workers with history of respiratory symptoms. They mentioned that grain dust asthma had allergic basis. They found that grain dust caused airflow obstruction in two ways: first by inducing asthma [through immunologic mechanisms] and secondly by causing industrial chronic bronchitis. In the present study, the prevalence of symptom of asthma was to be estimated but mechanism of the disease causation was not included for the type of the present study.

Dosman J A et al.[35] in a comparative study between 90 lifetime nonsmoking grain elevator workers and 90 lifetime nonsmoking community control subjects observed the clinical symptoms and lung functions. They mentioned in that study that the prevalence of chronic bronchitis was higher and had lower maximal mid-expiratory flow rate and maximal expiratory flow in lifetime nonsmoking grain elevator workers than lifetime nonsmoking community control. They concluded in that study that grain dust exposure was responsible for such changes in lifetime nonsmoking grain elevator workers. In the present study, the prevalence of the symptoms in smoker and non-smokers was estimated and relation of the symptoms with the smoking behavior was explored similarly.

Skorska C et al.[36] in a comparative study examined 76 Polish farmers exposed to grain dust during harvesting and threshing and 63 healthy urban dwellers not exposed to organic dusts (controls). They found 44.7% of the worker had work related symptoms. The common symptoms found in the subjects were dry cough (26.3%), dyspnoea (19.7%), tiredness (15.7%), chest tightness (10.5%), plugging of nose and hoarseness (6. 5%) but no such symptoms in control group. In the present study, prevalence of the symptoms were estimated and compared with this study.

Schwartz DA et al. [37] conducted a comparative study in Poland to observe the role of grain dust endotoxin induced lung disease in 410 grain workers and 201 postal workers (control group). The Grain workers were found to be exposed to higher concentrations of airborne dust and endotoxin and had significant higher prevalence of work-related related (cough, phlegm, wheezing, chest tightness, and dyspnoea) and chronic (usual cough or phlegm production) respiratory symptoms than postal workers. The concentration of total dust in the bio-aerosol was marginally related to these respiratory problems. They mentioned in their study that after controlling for age, gender, and cigarette smoking status, grain workers were found to have reduced spirometric measures of airflow (FEV1, FEV1/FVC, and FEF25-75) and enhanced airway reactivity to inhaled histamine when compared with postal workers, indicating that the concentration of endotoxin in the bio-aerosol may be particularly important in the development of grain dust-induced lung disease. In the present study, only symptoms in the rice mill workers had been explored and relations with background variables were established. Pahwa P et al.[38] followed Canadian grain elevator workers in a longitudinal study for 15 years

(1978 to 1993) and collected data on respiratory symptoms and did lung function tests (forced expiratory volume in 1 second [FEV1], forced vital capacity [FVC]). They mentioned in the study result that there was annual decline in FEV1 and FVC according to length of time in the grain industry among nonsmoking, ex-smoking and smoking grain elevator workers. Lung function values improved after dust control, and yearly declines in FEV1 and FVC after dust control were smaller compared with yearly losses before dust control. In the present study, the prevalence of respiratory symptoms had been explored but there was not so such scope to follow the respiratory variables changes in respect of time with exposure.

Ye TT et al.[39] conducted a cross-sectional study among 474 rice-granary workers and 235 non-granary worker controls in a rural area near Shanghai, China with questionnaire and did pre- and post exposures spirometry. The granary workers reported significantly more respiratory symptoms, including chronic cough, sputum production, chronic bronchitis, and grain fever (ODTS) and nasal and skin irritation than control group. They observed additive effect of tobacco smoking on the respiratory symptoms. They showed association between chronic grain-dust exposure and chronic airway obstruction by observing FEV 1 and FVC during pre- and post-shift in the study. They commented about the result of their study that exposure to rice dust can induce pulmonary responses similar to those observed with exposures to other types of grains. In the present study, respiratory symptoms and their prevalence had been explored.

Herbert F A et al. [40] in 1978 conducted a study on equal number of grain handlers and office worker (control group). They found that smoker grain handlers had more dyspnoea

symptom and had reduced lung function parameters than non-smoker grain handlers. In the present study, it was expected that similar result would be found along with others symptoms related to rice dust exposure to be estimated also.

Corey P et al.[41] performed pulmonary function tests of worker exposed to grain dust at the beginning and at the end of the work shifts over a period of one week and similarly a group of outside laborers as control in a comparative study. They observed changes in case group indicative of obstructive nature within-day and small restrictive defect over the course of week but control group had no such restrictive lung defect. The respiratory flow rates decreased in the case group who did not use mask as a proof of dose effect relationship. The acute changes in the study were unaffected by age, duration of employment, or extent of smoking in both group. As the present study was a descriptive one, changes in values in respect of time and not be explored rather prevalence due to changes was estimated.

Chan-Yeung M et al. [42] mentioned the composition of grain dust and the clinical syndromes for exposure in that review article. They mentioned that grain dust was usually composed of various types of grain and their disintegration products, silica, fungi, insects and mites and syndrome associated with the exposure includes chronic bronchitis, grain dust asthma, extrinsic allergic alveolitis, grain fever, silo-filler's lung, rhinitis and conjunctivitis. They also described smoking as an influencing factor for increased prevalence of chronic bronchitis. In the present study, prevalence of respiratory symptoms and relation with various variables were explored along with the effects due to smoking.

Hogan DJ et al. [43] conducted a study by questionnaire (survey method) among 796 grain elevator workers in 1985 described their findings that 95% of the workers complained short duration pruritus and 13.1% had skin rash following exposure to grain dust. Younger workers were more likely to complain than older workers. Other health complains were frequent Nasal congestion, ocular and oro-pharyngeal irritation. In the present study also, effects of dust on skin were noted besides the respiratory symptoms.

Fonn S et al. [44] in 1993 conducted a respiratory health survey in a grain mill to observe the relationship of health indicators to quantitative measures of airborne dust, fungal, and bacteria in the dust. The result of their study was as Respiratory symptoms were more prevalent in the high dust exposure categories with decreased lung functions parameters. Total dust and microbiological (fungal and bacterial) load were found to be significantly related to each other, and the relationship of microbiological load to lung function level and changes over the working week were similar to those found for total dust. Their study indicated that increased dust exposure also increases the probability of microbiological infections. In the present study though quantity of dust and its microbiological contents did not measured, yet among the respondent in whom symptoms would be found more intense, it was to be seemed that the dust also contained more microbiological agents.

doPico G A et al.[45] in an experimental study allowed six grain workers and six healthy non-grain workers to inhale airborne grain dust for study of clinical and physiological manifestation grain fever syndrome (characterized by facial warmth, headache, malaise, myalgias, feverish sensation, chilliness, throat and tracheal burning sensation, chest tightness, dyspnoea, cough, and expectoration). In their experiment, they could not

detect any evidence of complement activation by the classical or alternate pathway and none of the subjects had serum precipitins to grain dust. The airways responses to high concentrations of grain dust inhalation were unrelated to the presence of immediate skin hypersensitivity. They mentioned that the manifestations of grain fever probably reflect the host reaction to grain dust bacterial endotoxins and/or non-allergic mediator release by grain or grain dust constituents. Similar events might happen in the present study, in which the symptoms would to be more pronounced.

Gimenez C et al.[46] in a study compared the prevalence of chronic respiratory symptoms and acute ventilatory effects of 142 flour mill workers and 37 referent workers. They collected data by questionnaire and performed pulmonary function tests before and after the work shifts. In their study, the exposed workers had a significantly higher prevalence of usual cough and usual phlegm than the referents. After the work-shift, all the lung function values showed a slight decrease, significant for forced vital capacity and forced expiratory volume during 1st second in both groups. In the present study, spirometry would to be done only during the time of data collection, so there was no immediate of effects of exposure.

Prakash S et al. [47] conducted a cross sectional study in 2010 among 75 rice mill workers to observed the morbidity pattern and its relationship with duration (years) of working in India. In that study they found the workers suffering from respiratory morbidity (42.66%), low backache (26.66%), generalized / musculo-skeleton pain (20%), and allergic conjunctivitis (6.6%) and skin allergy (4%). The respiratory morbidity was significantly associated with duration (years) of working in the rice mills. Among the

worker suffering from respiratory problem, 10.66% had PEFR less than 200L/min. In the present study, the prevalence of respiratory symptoms along with other health was noted like this research. Similarities existed in present study.

Prasanna Kumar G V et all.[48] Conducted a noise survey in the workrooms of eight renowned rice mills of the north-eastern region of India during the period between 1980 and 1985. They identified several machinery parts producing high sound. About 26% of the total workers were exposed to noise of more than 85 dBA. They noted that the normal working period in the rice mill was 48 h/week and it was 56 h/week during the peak season of rice milling. They mentioned that 26% of the worker complaint noise interferes in their work. They identified noise as an important occupational hazard in rice mills. Though this article was not concerned with the present study, but as an important health hazard of the rice mills, it was necessary to always bear in mind when any study ever conducted, it would be brought into consideration.

Pradhan CK et all. [49] in their study evaluated the workers of rice mills and grain depots engaged for processing paddy and rice, storage and distribution [lifting, carrying and depositing sacs of food grain] with respect to their nutritional status, workload, energy expenditure and musculoskeletal pain or discomfort resulting out of work practice. They found moderate to heavy work load in them. Low backache and knee joint was complained by 61.5% of the rice mills workers. The study population and sample population of the present study was same as the present study, but the present study was mainly concerned with the respiratory health problem, yet the data concerned with this study would to be also collected.

Singh SK et al. [50] Conducted a comparison study in 150 male rice mills workers and 50 control of similar age, sex, ethnic and agricultural work background to determine the effects of rice husk dust on pulmonary functions. Twenty eight Rice mill workers showed obstructive and eight workers showed restrictive type of pulmonary impairment. They showed that decline in FVC, FEV1, FEV3, PEFR and MVV were related to the duration of exposure of rice husk. This study was completely comparable with the present study, as the present study was descriptive type, no control or comparison group was included.

McCurdy SA et all. [51] Conducted a cross-sectional study among 464 male rice farmer of California to assess their respiratory health with a self-administered health and work questionnaire, spirometry and chest radiography. The prevalent symptoms were: chronic bronchitis (6.3%), physician-diagnosed asthma (7.1%), and persistent wheeze (8.8%). Cough was reported by 7.1% of the respondents and was associated with burning rice stubble. They found FEV 1 and FVC within expected values but FEV 1 was inversely associated with years working in rice storage. They found irregular lung opacity in 10.1% of 178 chest radiographs taken indicating dust or fiber exposure. They commented in the study findings that asthma prevalence among California rice farmers had increased. The present study was comparable with this study, but our study population was rice mill workers. The workers of the rice mills face same hazards as rice farmers had, so the effect of agriculture and the paddy rice handling at the mills to be almost same.

Dosman JA et all [52] carried out a study in 1824 farmers and 556 controls [not farmers] in rural area to assess respiratory health and pulmonary function tests for farming. Their research instruments were questionnaire and spirometry. There was higher prevalence of

respiratory symptoms of phlegm, wheeze, shortness of breath, and the condition of chronic bronchitis with significant decreased values of FVC, FEV 1 and the maximum mid-expiratory flow rate in the cases than the controls. The present study was comparable with this study. The symptoms of problems and the respiratory variables measurements would be comparable, but being a descriptive type, no control or comparison group was to be use in the present study.

Long W et all. [53] conducted a mailed survey to identify characteristics associated with respiratory symptoms due to an episode of air pollution among 428 people [with mild to moderate airways obstruction and a high level of airways hyper reactivity] of the city of Winnipeg who exposed to elevated levels of particulate matter (total and <10 micron size), carbon monoxide, nitrogen dioxide, and volatile organic compounds due to smoke from adjacent fields where farmers were burning agricultural residue (straw and stubble). Forty two percent respondents reported the symptoms (cough, wheezing, chest tightness, shortness of breath) developed or became worse due to the air pollution episode and 20% had breathing trouble. Those with symptoms were more likely to be female than male and were more likely to be ex-smokers than smokers. Subjects with asthma and chronic bronchitis were also more likely affected. In conclusion of the study they mentioned that gender, smoking habit, and respiratory symptoms were the factors for influencing susceptibility to symptoms due to air pollution in adult smokers and former smokers. The respiratory health symptoms of the present study were comparable with the workers who through rice husk in the furnace to produce steam for parboiling the rice.

Golshan M et all. [54] conducted a cross-sectional study among 433 male and 561 females

of three villages in Isfahan of Iran to assess respiratory effects of this smoke-induced air pollution by smoke from burning of the agricultural waste. They used physician-administered health questionnaire and spirometry before and after the rice burning episode in October 2000. They showed the Prevalence rates for respiratory symptoms before smoke were: recent asthma attacks (7.7%), using asthma medications (3%), sleep disturbed by dyspnoea and cough (7.4%), exercise-induced cough (13.3%), which increased to 9.5, 7.1, 9.3 and 17%, respectively after exposure. There were significant decrease of initial values of FEV1, FEV1/FVC, PEFR, and FEF25-75 also. In conclusion of the study, they mentioned that the result was suggestive of increased respiratory morbidity associated with rice burning episodes among all people living in the areas. The workers in the present study had the same symptoms who through rice husk in the furnace to produce steam. No comparison group had been used in the present study for the type of study.

Abu Sham'a F et al [55] conducted a cross-sectional study among 250 farmers to assess their lung function and respiratory symptoms in association to exposure to pesticides and dust. The most prevalent symptoms found in the study were chronic cough [14.0%], wheeze [26.4%] and breathlessness [55.2%]. All the lung function values were no significant association between the symptoms the exposure was detected. They concluded from the study that farmers were more aware about the hazards of pesticide or dust exposure. The respiratory symptoms of the present study were comparable with the symptoms of this study.

Lim HH et all.[56] carried out a study on 122 male Malaysian rice millers to determine the

effect of rice husk and took 42 controls of similar age, sex, ethnic group and agricultural work background. In that study, they observed a distinct clinical syndrome from clinical, hematological and radiological findings and named it as 'rice miller syndrome'. The manifestation of rice miller syndrome included were (a).acute and chronic irritant effects affecting the eyes, skin, and upper respiratory tract; (b).allergic responses such as nasal catarrh, tightness of chest, asthma, and eosinophilia and (c). Radiological opacities in the chest, probably representing early silicosis or extrinsic allergic alveolitis. This study was an important step in the progress of occupational health of rice mill workers. The authors had nicely opened a new dimension for the diagnosis and understanding of rice mills workers respiratory health and other problems.

Melbostad et all.[57] carried a cross-sectional study in 1991 among 10,792 farmers to observe the chronic bronchitis symptoms in relation to work time and years of exposure in farming, as well as to production type, dusty occupation outside farming, and the combination of work exposure and smoking. They divided the respondents into full-time farmers and part-time farmers who had worked in the dusty occupations outside farming. The research instrument was self administered questionnaire. They analyzed the exposure factors for chronic bronchitis in the term of full-time farming versus part-time farming, livestock production types (poultry, dairy, swine, horse and combinations), and occupational dust exposure outside agriculture. They found out the combinations of the work exposure factors were significant and showed a 2- to 3-fold increase in risk for chronic bronchitis. Combinations with smoking showed up to a 6-fold increase in risk.

This study was compatible with the present study. The respiratory health problems of rice

mills workers were to be alike with them in the present study.

Senthilselvan A et al [58] carried out a prospective study in 263 male grain farmers and 261 non-farming controls to observe the respiratory effects of exposure to dust and endotoxin. They recorded baseline data in 1990/91 and followed up in 1994/95 and in 2003/4. They mentioned in the study that after controlling for potential confounders, grain farmers had an excess annual decline of 9.2 ml/year (95% confidence interval [CI]: 2.7, 15.8, p =0.006) in forced vital capacity (FVC) in comparison to control. Their comment was that long-term exposure to grain dust and other substances in lifetime grain farmers resulted in progressive loss in lung function. This study was computable with the present study. The respiratory symptoms and decline of the pulmonary functions of the present study were to be probably similar with this study.

Korunic Z [59] in a review article mentioned that in the developed countries allergies problems had increased for unsafe foods due to presence of allergens in agro products during storage. He mentioned that stored agro products might contain allergenic contaminants of plant, microbial, or animal origin. Several stored-product insect and mite species were confirmed as sources of allergens. Among these, the most important were storage mites because they cause occupational asthma by inhalation and anaphylactic reactions when ingested in high numbers. The urine of rats and mice could be a significant source of allergens. Stored moulds had been confirmed as potential source of allergens. The workers in the present study might have the same problems as like them because they were exposed to the different allergens as mention in this study.

Alvarez M J et all [60] carried an experimental study to identity the additional allergen other than cereals for asthma in cereal workers. They carried out in vivo and in vitro tests for cereals, enzymes, soybean, storage mites and egg. They found Cereals were the main sensitizers among bakers (75%) and farmers (66%). Bakers were also sensitive to alpha-amylase (41%) and soybean (25%), and farmers were also sensitive to soybean (33%) and storage mites (33%). Occupational asthma was due to cereals, soybean and storage mites among millers. They concluded from the study that besides cereals, other allergens such as enzymes, leguminous, egg and storage mites can be the causative agents of occupational asthma among cereal workers. The rice mills worker in the present study were exposed to the grain and grain dust and might had the respiratory problems like workers of that study.

Tse CS et al.[61] in a case report mentioned that a 48 years old male black bakery worker developed asthma symptoms after 9 years job at a bakery. Skin testing revealed reactivity to dust, mold and wheat extract. Bronchial provocation test was negative with commercial wheat extract but test with his own bakery flour gave immediate positive reaction. The researcher concluded that it was grain dust induced asthma. The workers of the presents study might have asthmatic attack but the mechanism of asthma is different.

Kayaba H et al. [62] carried a study to elucidate the mechanism of airway hypersensitivity in rice growing areas during the harvest. They measured the eosinophilic activation capability of rice husk dust. They found LPS (lipo-polysaccharides), a potent activator of inflammatory cells in the rice hush dust. They commented in their study that Rice-husk dust and its smoke, hazardous air pollutants probably play a major role in the aggravation

of airway diseases in agricultural areas. The workers of the present study had to face the allergic problems as during the handling of raw and parboiled paddy, they had to inhale dust of the husk. The present study design was different from this study.

Desai MR et al. [7] carried an experimental study on the environmental mycoflora of rice mills situated in Bawla of Ahmedabad of India. They isolated and identified several airborne funguses. Among the funguses the genus Aspergillus was predominant and among the Aspergillus species, the most common isolated was A. flavus. They concluded in the study that the rice mill workers are occupationally exposed to airborne aflatoxin. It is true that the workers of the present study might be attacked by such fungus. Though the present study was mainly concerned with respiratory problems, this environmental information would guide to open new dimension of research in the rice mills of the country.

Jayaraman P et al [63] carried another study in the rice mills in and around the Madras city to analyze the mycoflora and mycotoxins in the stored rice bran. They collected samples of rice bran of raw rice and parboiled rice and found more fungi of the Aspergillus flavus group in raw rice bran than parboiled rice bran. Majority of fungus found were toxigenic. The workers of the present study had to work with the raw and parboiled rice has to face the fungus and toxigenic products that might aggravate the respiratory symptoms. It needed further research.

Jayaraman P et al [64] observed the changes in moisture content, storage mycoflora and Aflatoxin B1 (AFB 1) in raw rice and parboiled rice bran at Centre for Advanced Study in Botany, University of Madras, India in another study. In their experiment, they found

the rapid deterioration of all parameters more in stored raw rice than in parboiled rice bran. Aspergillus flavus was the dominant fungus in parboiled rice bran and A. candidus and Trichoderma viride were abundant in raw rice bran. The frequency of incidence as well as concentration of AFB1 increased with storage time in both types of bran, but the rate of increase as well as overall concentration were much higher in raw rice bran. They suggested in their study that raw rice bran is unsuitable for prolonged storage. The workers in the present study had to work with raw and parboiled rice. So the respiratory health problems for these funguses were to be faced.

Chapter: 3

Methodology

This descriptive study was carried out during the academic period [July 2009 -June 2012] in the Institute of Biological Science [IBSC], University of Rajshahi, Bangladesh. The objective of the study was to explore the prevalence of symptoms of respiratory health problems among the rice mill workers and to qualify the symptoms in respect of various aggravating factors. Data were collected from the workers of the rice mills situated in Bangladesh Small and Cottage Industries Corporation (BSCIC) Rajshahi area and other mills outside the Rajshahi City Corporation. In-depth face to face interview, physical examination of the workers and recording were done. SPSS 16 version soft ware was used for data entry and analysis.

3.1. Rice mills in Bangladesh.

Rice mills in Bangladesh are generally classified into three categories, Husking rice mills, Major Rice mills and Automatic rice mills.[65]

1. Husking rice mills are abundant in rural Bangladesh. In every village, there is at least one such mill. It is in a single room situated usually at the road side. The husking machine is locally called 'huller machine' run by diesel oil and rarely by electricity. One machine man [called driver] and an assistant operate such mill. Villagers soak, parboil and Sun dry the paddy at their home. They bring the paddy

for milling in husking mills. Here there are two stages of operation. At first, husk is removed and during the second stage operation bran and fresh rice is separated in the same machine.

2. A Major Rice Mill complex is called "Chatal" locally. It consists of three sections namely Pre-husking section, the husking section and the Store. Pre-husking section consist of soaking chambers, boiler for steam production, steaming chamber and a large drying bed for the Sun drying of parboiled paddy. The husking sections in chatals are alike husking mills and operations there also go alike. The store section has separate store rooms for raw paddy and finished rice. There is an office room usually in the chatal. The free residences for workers are made around the drying bed closed to the boundary wall. The rooms are narrow and unhealthy. Non-local migrated workers of Parboiling and drying section [PBDS] live with their family there.

   The whole operations at the Chatal are carried out by three groups of labors. The largest group consists of 8-20 workers, mostly females are engaged in soaking paddy, parboiling and drying operations. The second group of labors work for milling paddy [husking and fanning for bran separation] is mostly male. And the third group is male workers for loading and unloading motor tracks and carrying to stores.

3. In Automatic Rice Mills, Parboiling, drying, milling (de-husking) and polishing were done in machine with minimal manual intervention.

3.2. Preliminary survey.

The fellow visited the rice mills at Mohadevpur, Patnitola and Dhamoirhat of Noagoan district, at Puthia in Rajshahi district, at Natore sadar of Natore districts, one mill in the Rajshahi BSCIC area and a mill at Katakhali outside the Rajshahi city corporation area to observe the type of mills, the activities there, the existing working sections in the mills and the workers groups. Broad discussions were done with the workers and the mill authorities in those mills about facilities and health problems especially the respiratory symptoms. It was observed in those preliminary surveys that all the information to fulfill the selected objectives of the research was found similar. So, it was decided that data would be collected at the mills situated in BSCIC Rajshahi area and out side of the city corporation for the convenience of the study.

In greater Rajshahi district, there are 108 Automatic, 640 Major and 9633 Husking rice mills with the total capacity of 34443, 13454 and 857580 Metric Tone monthly.[65] In the study area, there were one automatic [Haq Rice Mill] and 20 Major Rice mills were at function.[66] Data were collected in those mills. During the preliminary survey, it was also observed that the automatic rice mills were on operation at night usually. Every Automatic rice mills complex had attached a Major Rice mill section.

3.3. Places of study.

Data were collected from the rice mills in BSCIC Rajshahi area and the mills functioning at Katakhali, Nowhata (along the Noagaon road) and Poba Darusha areas [majority of the mills were outside of city corporation area].

1. Mills at BSCIC, Rajshahi: BSCIC previously called East Pakistan Small and Cottage Industries Corporation (EPSCIC)) was started in 1957 by an Act of Parliament (Pakistan National Assembly) to established and develop small and cottage industries in eastern part of Pakistan which become Bangladesh Small and Cottage Industries Corporation [BSCIC] after independent of Bangladesh. BSCIC Rajshahi industrial estate was established in 1961 on 95.71 acres of land containing 325 industrial plots on the city's outskirts. Since early, it had been providing electricity, water supply, security, road and drainage facilities to the entrepreneurs for running their industrial business. Notable numbers of plots were occupied by silk weaving and printing [small scale] industries. Other plots occupied industries are at present mostly sick industries. Only one automatic rice mill [Haque Rice mill with four units] with high chimneys visible from a far away and six major rice mills were running well there at the time of data collection.
2. Rice mills around Rajshahi City area: Data were also collected from 14 major rice mills situated at Katakhali, Nowhata and Paba Drasha. The total numbers of workers in these mills were less that of BSCIC area. In these mills, there was no any labor in Loading and storage section (LSS) as these mills did not have own motor track. Other sections and works of the labors were same that of the BSCIC areas mills.

3.4. Operations at the studied rice mills.

During the preliminary survey and preparatory phase of the study, it was observed that the whole activities of the rice mills could be properly described into three broad

sections, namely (1). Parboiling and Drying Section [PBDS], (2). Husking and Fanning Section [HFS] and (3). Loading and Storage Section [LSS]. Each section had several groups of labors working only there and had gained expertise about the works of that section.

1. PBDS: During the study, majority of the workers were found working in the PBDS. Female was the greater dominators there. All the activities in this section were manual. There were usually 8-20 workers in PBDS section. Four to six workers made a group. The groups worked on contact basis [not on daily wage]. The mill authorities paid Taka 12.00 and one Kilogram of Khud (broken rice) for each bag (80 Kg) of paddy for Soaking, boiling and drying operation. In this section, the workers poured 8,000-10,000[100-125 bag] kg paddy in a big tank [soaking chamber], filled it with water and kept it for soaking for 24 hours. Then they filled four small steaming chambers (each capacity about 200 kg) with soaked paddy along with a little extra water. Each steaming chamber was connected with a boiler by metal pipe for entrance of steam. Steam was produced in the boiler of capacity 3,000-4000 liters. The process of steaming was continued repeatedly until the whole soaked paddy was steamed. Rice bran was used as fuel for steam production and was thrown in the oven manually. It usually took about an hour for each episode of steaming in the chamber. Then they threw the steamed paddy on the drying bed for the Sun dry in 2-3 days. When adequately dried, the processed paddy was then transferred to HFS for husking.

2. HFS: The HFS was usually on operation throughout the night. Four labors and a machine man (locally called driver) worked in each HFS on monthly wage. The labors carried the parboiled paddy from the store and poured the paddy in the husking machine. After separation of the bran, the finished rice was allowed to pass in front of a fan to blow out the bran completely in some mills. The labors brought back the finished rice to the store.
3. LSS: In the Loading and storage section (LSS), there were several set [group] of labors, each consist of usually six who always moved on a motor truck. They load the paddy on the track at the market, unload and stack the bag in the store and reloaded the finished rice product on the track. They got Taka four for each bag of paddy for total carrying operations.

3.5. Study type.

It was a Descriptive type of Observational study. The researcher had only observed the existing symptoms of respiratory health problems among the workers of the rice mills [study population] in the study area.

The study had the following descriptive features:

1. The epidemiological approach was only asking questions about the symptoms of the respiratory problems the workers had or faced. No any interventions by drugs, health education or by other means were done. No any laboratory investigations were done for confirmation of the existence of symptoms. Only general physical examinations were done as a routine medical examination and the findings were recorded.

2. Our study population was the adult male and female, at least working for a year in the rice mill.
3. The defined symptoms were (1.) cough, wheezing and dyspnoea indicators of chronic problems of trachea, bronchus and lungs; (2.) Rhinitis, an important symptom, indicating the problems in Naso-pharynx [upper respiratory tract]. Besides the symptoms of the respiratory problems, the respondents were also questioned to inform any other health problems [either acute or chronic] they faced during work or at the time of leisure. [As wheezing, being an objective symptom, the description of wheezing by the workers was not accurate and confusing. So the information about the symptom of wheezing and its aggravation was decided to be excluded during the analysis and not be mentioned in this study report].
4. The respiratory symptoms were described [qualified] by nature of their clinical presentation, the season, time and period of symptoms aggravations.
5. In the analytical section of this study report, relation of symptoms with demographic variables and occupational environment had been observed.

3.6. Sample size estimation.

The required sample size for the study was calculated by using the following statistical formula

$$n = \frac{z^2 \times p \times q}{d^2}$$

It was assumed that 50% of the respondent might had symptoms of respiratory illness. [37,42,67,68, 69]

Here $p = 50\% = 0.5$

$q = 1 - p = 1 - 0.5 = 0.5$

$d = 5\% = 0.05$

So, putting the value into above equation

$$n = \frac{1.96^2 \times 0.5 \times 0.5}{0.05^2} = 384.16 = 385$$

So the estimated sample size was 385.

3.7. Development of research instrument.

The research instruments in the study for in-depth interview were Questionnaire and for physical examinations were Aneroid Blood Pressure Machine, Stethoscope, weight machine, height measuring tape and Microspirometer for lung functions assessment.

1. QUESTIONNAIRE: The questionnaire was developed under the close supervision of the guide for collecting information to fulfill the objectives of the study. The fellow also consulted with the chest physicians of Rajshahi Chest disease hospitals about the questionnaire, techniques of asking questions of the respiratory symptoms and methods of physical examinations.

   The questionnaire had 4 sections. The first section was the recording of the workers' particulars including some socio-demographic variables. The second section was about the symptoms of health problems the workers faced at the time of work or at leisure either acute or chronic in nature. The third section contained

the qualifying questions about the symptoms of the respiratory problems and their aggravation in respect of season, period and time. And the fourth section was the recording of physical examinations- height, weight, blood pressure, heart and lung auscultation findings and lung function [ventilatory capacity] by Microspirometer.

MICRO-SPIROMETER SPECIFICATION:

Type: Micro Medical Digital Volume Transducer.

Resolution: 10 ml.

Accuracy: ± 3%.

Volume range: 0.1-9.99 liters B T P S.

PRE-TESTING OF THE QUESTIONNAIRE:

Pre-testing was done with the developed questionnaire to assess its validity and accuracy. Data were collected from 25 workers at five mills outside the city corporation area for pre-testing. The questionnaire was finalized after a little correction.

3.8. Data collection procedure.

The fellow collected data himself. Data were collected at the rice mills in BSCIC area and at the mills out side the city corporation on the alternate day. It was decided purposively that a total 400 sample would be collected include 250 sample from the mills outside of city corporation [100 at Nowhata, 75 at Katakhali and 75 at Poba Darsha] and 150 from BSCIC area considering the numbers of workers and mills in those areas.

The starting point of data collection was at the mill situated on the south-west corner of the areas. The day before the data collection, the fellow used to visit the mill, met with the authority there, talked with them about the purpose of data collection and got permission verbally. The authority was requested to inform the workers for full cooperation.

The fellow used to go on data collection at the time of lunch or prayer breaks at early afternoon and before the evening at the ending of the works.

The authority at the major rice mills had permitted to use the office room for the purpose of interview and examination. In the BSCIC area, the passage in front of the office room of the mills was used for this purpose, was found more suitable.

The data collection was done in the office room at the Chatal [major rice mills]. The room was equipped with necessary furniture and enough natural light and electric supply. The female workers were usually interviewed and examined at lunch break. A female co-worker was requested to be the attendant during the examination.

On reaching the mills, the investigator looked for workers who were on leisure. They were requested to participate in the study one by one. The investigator talked with the self-motivated workers. The aims and objectives of data collection were informed to them. In the calm and quit environment, in depth interview was taken. Then the interviewed worker was physically examined and height, weight, blood pressure, heart and lung findings were recorded. He/she was demonstrated to use the Microspirometer. After two times trails, the Total vital capacity [TVC] and forced expiratory volume in

After complete entry, it was checked for any omission. One hundred (data) questionnaire were sampled by systemic random sampling for checking the correctness of data entry.

3.10. Data analysis.

The entered data were compiled and categorized for analysis to fulfill the objectives. As the study was a descriptive one, descriptive statistics were done during the analysis with qualitative and quantitative data. Frequencies were first calculated and cross tabulations were done. Non-parametric tests- Chi square test and Binomial tests were commonly used. The analysis was done using SPSS 16 software also. In some cases, for the quick analysis [chi square value and probability] occasionally Epi Info 3.5.1 software was used.

Chapter: 4

Results of the study

Tables

In the present study, data were collected from 500 workers of the studied rice mills with a view to determine the prevalence of symptoms of respiratory health problems and to qualify the symptoms with various factors for aggravation along with some socio-demographic variables. The collected data were verified for any omission and were entered on the data sheet using SPSS v 16 software. After data entry, as an onward step of analysis and interpretation, tabulation was done. The important observations were tabulated and here by briefly described.

Table 1: Age and sex of the respondents.

Age	Sex				Total		
	Male		Female				
	No	[%]	No	[%]	No	Percent	P value
Age 18-27 Years	29	50.9 (10.9)	28	49.1 (12.0)	57	100[11.4]	0.895
Age 28-37 Years	74	44.8 (27.8)	91	55.2 (38.9)	165	100[33.0]	0.186
Age 38-47 Years	123	55.9 (46.2)	97	44.1 (41.5)	220	100[44.0]	0.080
Age 48-57 Years	30	65.2 (11.3)	16	34.8 (6.8)	46	100[9.2]	0.039
Age more than 57 Years	10	83.3 (03.8)	2	16.7 (0.9)	12	100[2.4]	0.021
Total	266	(100.0) 53.2	234	(100.0) 46.8	500	100.0	

Mean age (both sexes combined) = 38.04 ± 8.53 years
Mean age (male) = 39.21 ± 8.97 years.
Mean age (female) = 36.71 ± 7.81 years.

Table 1 showed that 500 respondent workers were brought under study. The total number of male respondents were more than female [male vs. female =266 vs.234]. Women workers were more than male only in 28-37 years age group. The calculated mean age for male was also larger than female.

Table 2: Employment and work profile of the respondents

Description	Number of respondents				Total		
	Sex						
	Male		Female				
	No	%	No	%	No	%	P value
A. Employment nature							
1. Seasonal	4	44.4	5	55.6	9	100.0 [01.8]	
2. Perennial	261	53.8	224	46.2	485	100.0 [97.0]	
3. Causal	1	16.7	5	83.6	6	100.0 [01.2]	
Total	266	53.2	234	46.8	500	100.0	
B. Working sections							
1. PBDS[+]	128	37.1	217	62.9	345	100.0 [69.0]	
2. HFS[++]	41	87.2	6	12.8	47	100.0 [09.4]	0.000
3. LSS[+++]	82	97.6	2	2.4	84	100.0 [16.8]	0.000
4. More than one sections	5	62.5	9	37.5	14	100.0 [04.8]	0.221
Total	266	53.2	234	46.8	500	100.0	
C. Daily working hours							
1. Up to 8 hrs	74	71.8	29	28.2	103	100.0 [20.6]	0.000
2. 9-12 hours	173	48.3	185	51.7	354	100.0 [71.6]	
3. > 12 hours	19	48.7	20	51.3	39	100.0 [07.8]	
Total	266	53.2	234	46.8	500	100.0	
D. Duration of employment in years							
1. < 3 years	49	43.8	63	56.2	112	100.0 [22.4]	
2. 3-5 years	86	56.2	67	43.8	153	100.0 [30.6]	
3. 6-9 years	63	58.3	45	41.7	108	100.0 [21.6]	
4. 10-14 years	86	52.3	42	47.7	88	100.0 [17.6]	
5. 15-19 years	12	50.0	12	50.0	24	100.0 [04.8]	
6. ≥20 years	10	66.7	5	33.3	15	100.0 [03.0]	
Total	266	53.2	234	46.8	500	100.0	

[+] PBDS = Parboiling and drying section.

[++] HFS = Husking and Fanning section.

[+++] LSS = Loading and storage section.

Mean duration of employment (both sexes combined) = 6.335 ± 0.21151 years.

Mean duration [male] = 6.539 ± 4.7683 years.

Mean duration [female] = 6.1026 ± 4.6842 years.

Table 2 described the employment nature and some profiles of work of the respondents. A large portion (97%) of the respondents was employed for the whole year. Majority [69.0%] of the workers was employed in Parboiling and drying section (PBDS), included a large section of women population. The numbers of male were significantly more [p=0.000] in Husking and fanning section [HFS] and also in loading and storage section [LSS] than female. Majority of the respondents worked for the whole day [9-12 hours]. But number of male workers in 'up to 8 hours' categorized working group was significantly more (p=0.000) than the female workers. About the duration of employment in rice mills, it was remarkable that majority of the respondents were working there relatively for short duration [22.4% for < 3 years and 30.6% for 3-5 years] with insignificant number of male and female. About one third [30.6%] were working there for 3-5 years constitute the larger employed group.

Table 3: Previous job of the respondents.

Previous job	Sex of the respondents				Total		
	Male		Female				
	No	%	No	%	No	%	P value
Agri-labors	160	97.6 (60.2)	4	2.4 (1.7)	164	100.0 (32.2)	0.000
Dusty job before	20	87.0 (7.5)	3	13.0 (1.3)	23	100.0 (4.6)	0.000
Rikshow / van puller	31	100.0 (11.7)	0		31	100.0 (6.2)	
Laborer	33	94.3 (12.4)	2	5.7 (0.9)	35	100.0 (7.0)	0.000
First Job	11	42.3 (4.1)	15	57.7 (6.4)	26	100.0 (5.2)	0.433
Other	11	100.0 (4.1)	0		22	100.0 (2.2)	
House keeping / odd job	0		210	100.0 (89.7)	210	100.0 (42.0)	
Total	266	53.2	234	46.8	500	100.0	

Table 3 disclosed the previous jobs of the respondent workers before their employment in the rice mills. Majority of the male workers [60.2%] were agriculture labor. A very large section [89.7%] of the female respondents was house wife or engaged in odd jobs like house keeping (domestic worker).

Table 4: Findings of physical examinations of the respondents.

Measurements	Number of respondents						
	Sex				Total		
	Male		Female				
	No	%	No	%	No	%	P value
A. Anthropometry							
a. Height in meter							
< 1.25	01	08.3	11	91.7	12	100 [2.4]	0.004
1.25-<1.35	04	30.8	09	69.2	13	100 [2.6]	
1.35-<1.45	13	32.5	27	67.5	40	100 [8.0]	0.027
1.45-<1.55	09	06.1	138	93.9	147	100 [29.4]	0.000
1.55-<1.65	115	71.4	46	28.6	161	100 [32.2]	0.000
≥1.65	124	97.6	03	02.4	127	100 [25.4]	0.000
Total	266	53.2	234	46.8	500	100.0	
b. Weight in Kg							
< 40	10	23.8	32	76.2	42	100 [8.4]	0.001
40-<45	36	27.1	97	72.9	133	100 [26.6]	0.000
45-<50	119	62.6	71	37.4	190	100 [38.0]	0.000
50-<55	63	77.8	18	22.2	81	100 [16.2]	0.000
55-<60	25	78.1	07	21.9	32	100 [6.4]	0.001
≥60	13	59.1	09	40.9	22	100 [4.4]	
Total	266	53.2	234	46.8	500	100.0	
B. Blood Pressure (diastolic) mm Hg							
<90	177	50.7	172	49.3	349	100[69.8]	
≥90	89	58.9	62	41.1	151	100[30.2]	0.028
Total	266	53.2	234	46.8	500	100.0	
C. Auscultation of Lungs							
Ronchi	21	95.5	1	04.5	22	100 [66.6]	0.000
Crepitation	11	91.7	1	08.3	12	100 [43.4]	0.000
Total	31	93.9	2	06.1	33	100.0	
D. Inspection of skin for diagnosis of infection other than fungal							
Bacterial	11	64.8	6	35.2	17	100 [64.7]	
Scabies	1	16.7	5	83.3	6	100 [35.3]	
Total	12	52.2	11	47.8	23	100.0	

Mean height [combined] = 1.5623 ± 0.10795 meter, Mean Weight [combined]= 48.318± 6.16091 Kg
Mean height [Male] =1.6208 ± 0.07902 meter, Mean Weight [Male] =50.278 ± 5.63996 Kg.
Skew ness = - 2.203 Mean Weight [Female] = 46.089 ± 5.97818 Kg.
Mean height [Female] = 1.4958 ±0.09747 meter,
Skew ness = +3.739

Table 4 described the findings of general and physical examinations of respondents. Anthropometric measurement of height and weight were recorded for nutritional status calculation. The males were taller and had more body weight than the female workers. The number of male and female respondents in different height and weight categorizes were significantly different. This table also revealed that 30.2% of the respondents were diagnosed as hypertensive and the number of hypertensive male was significantly (0.028) more than female. The table also described that only 34[6.8%] of the respondents had added sounds on their chest. Both ronchi and crepitation were predominantly found in male [21(95.5%), 11(91.7)]. During skin inspection for infective condition [other than the fungal] diagnosis, the table showed that 17(3.4%) workers had bacterial infection predominantly in male [11 (64.8 %)] and 1.2% had scabies mostly in female [5 (83.3 %)].

Table 5: Nutritional Status of the respondents.

BMI	Sex				Total		
	Male		Female				
	No	%	No	%	No	Percent	P value
<18.5 [under weight]	123	72.4 (46.2)	47	27.6 (20.1)	170	100.0 (34.0)	0.000
18.5-<25.0 [Normal weight]	134	45.1 (50.4)	163	54.9 69.7)	297	100.0 (59.4)	0.092
25-<30 [Over weight]	6	22.2 (2.3)	21	77.8 (9.0)	27	100.0 (5.4)	0.004
25-<30 [Obese]	3	50.0 (1.1)	3	50.0 (1.2)	6	100.0 (1.2)	1.000
Total	266	100.0 53.2	234	100.0 46.2	500	100	

Table 5 explored the nutritional status of the respondent workers. Majority [59.4%] of the respondents and of both sexes [male 50.4% and female 69.7%] had BMI with in normal range [18.5-<25.0]. The number of male [123(46.2%), p=0.000] respondents in under weight group [BMI <18.5] and the number of female in [21(77.8), p=0.004] over weight group were found remarkable more than their counter sex group.

Table 6: Prevalence of Smoking variables among the respondents.

Smoking Variables		Number	Percent
A. Have Smoking Habit			
	Male [231]	233	46.6
	Female [2]		
Do not smoke		267	53.4
	Total	500	100.0
B.. Smoking materials			
	Cigarette	127	54.5
	Bidi	106	45.5
	Total smoker	233	100.0
C. Number of sticks smoked daily by the smokers			
	Less than 10 sticks	57	24.5
	10-20 sticks daily	157	67.4
	More than 20 sticks	19	8.2
	Total [smoker]	233	100.0
D. Habit of other addiction			
	No Addiction	488	97.6
	Ganja [Male only]	12	2.4
	Total	500	100.0

Table 6 showed the smoking pattern of the respondents. The prevalence of smoker was 46.6% [233] including 2 females only. Among the smokers, 54.5% [127] smoked cigarette. Majority [67.4%] of them took 10-20 sticks of cigarette or bidi daily, but none gave correctly, the history of total duration of smoking. Only 12 (2.4%) of the respondents admitted the addiction with Ganja in addition to cigarette smoking.

Table 7: Symptoms of Chronic respiratory health problems in the respondents.

Respiratory Symptoms	Sex of respondents				Total		
	Male		Female				
	No	%	No	%	No	Percent	Prevalence [%] [N=500]
Cough	60	66.7	30	33.3	90	100.0	18
Wheezing	14	48.3	15	51.7	29	100.0	5.8
Breathlessness	33	66.0	17	34.0	50	100.0	10.0
Rhinitis	19	55.9	15	44.1	34	100.0	6.8

Table 7 expressed the prevalence of chronic respiratory disease symptoms. Four important symptoms of chronic respiratory problems namely cough [18.0%], dyspnoea [10.0], rhinitis [6.8] and wheezing [5.8%] were reported.

Table 8: Symptoms of chronic non-respiratory problems in the respondents.

symptoms of Chronic non-respiratory problems	Sex of respondents				Total		
	Male		Female				
	No	%	No	%	No	%	Prevalence[%] (N=500)
Conjunctivitis	17	45.95	20	54.05	37	100.0	7.4
Eczema skin	3	60.00	2	40.00	5	100.0	1.0
Fungal Skin Infection	7	36.80	12	63.2	19	100.0	3.8
Backache	202	52.50	183	47.5	385	100.0	77.0

Table 8 revealed the prevalence of symptoms of the diseases other than of the respiratory system. These included the prevalence of Conjunctivitis [7.4%], Eczema Skin [1.0], fungal skin infection [3.8%] and most common non-specific complaint of backache [77.0%].

Table 9: Acute Symptoms of health problems in the respondents.

Acute health symptoms during work	Sex of respondents				Total (N=500)	
	Male		Female			
	No	%	No	%	No	%
	*[N=266]		** [N=234]			
Facial Warmth	8	3.0	22	9.4	30	06.00
Headache	42	15.8	74	31.6	116	23.20
Malaise	56	21.0	54	23.0	110	22.00
Myalgia	87	32.7	65	27.8	154	30.80
Feverish	23	8.6	40	17.1	63	12.60
Chilliness	07	2.6	06	2.6	13	02.60
Burning Throat	01	0.4	03	1.3	4	00.80
Chest tightness	17	6.4	16	6.8	33	06.60

* Total male respondents.

** Total Female respondents.

Table 9 showed the acute symptoms faced by the workers especially at the time of works. Myalgia (30.8%), Headache (23.2) and Malaise (22.0%) were the most three prevalent acute symptom in both sexes [combined]. But the most prevalent symptoms (in order of number) in female were headache (74, 31.6%), myalgia (65, 27.8%) and feverish feeling (40, 17.1%) and in male were myalgia (32.7%), malaise (21.0%) and headache (15.8%).

Table 10: Single and combined symptoms of chronic respiratory health problems [CRHP] in the respondents.

Number of symptoms of the Chronic Respiratory Health Problems [CRHP]	Respondents with CRHP		
	Total		
	Number		%
1. Have symptoms	170		34.00
a. Single symptom	141	[82.94%]	(28.20)
b. More than one symptoms	29	[7.06%]	(5.80)
Total	170	[100.0 %]	
2. No problem	330		66.00
Total	500		100.0

Table 10 summarized the number of felt symptoms of chronic respiratory health problems by the respondents either single or more symptoms in the body. Total 170 [34.0%] respondents complained suffering from the chronic symptoms. Among them, 141[28.2% of the total respondents] had only one symptom and 29 [5.8% of the total respondents] had more than one symptoms.

Table 11: Single and combined symptoms of chronic non-respiratory health problems [conjunctivitis, eczema, fungal skin and backache].

Symptoms of the Chronic Non-respiratory Health Problems	Respondents with Chronic Non-respiratory health problems		
	Total		
	Number		%
1. Have symptoms	400		80.0
a. Single symptom	362	90.5%	[72.4]
b. Two symptoms	38	9.5%	[07.6]
Total	400	[100.0 %]	
2. No problem	100		20.0
Total	500		100.0

Respondents with only backache symptom = 347 [69.4%]
Respondents with backache and other symptom = 385 [77.0%]
Respondents with other symptom but not backache = 15 [03.00%]

Table 11 revealed the chronic non-respiratory health problems faced by the workers. Four hundred (80.0%) respondents workers complained suffering from such symptoms. Among them, 362 (90.5%) had only one complain included 347 (69.4%) respondents with backache, a non-specific one that carried a little impact on total suffering.

Table 12: Single and combined symptoms of acute health problems [AHP] in the respondents.

Symptoms of the Acute health Problems [AHP]	Respondents with AHP		
	Total		
	Number		%
1. Have symptom	331		66.2
a. Single symptom	193	[58.3%]	(38.6)
			(19.2)
b. Two symptoms	96	[29.0%]	
c. More than Two symptoms	42	[12.7%]	(08.4)
Total	331	[100.0]	
2. No problem	169		33.8
Total	500		100.0

Table 12 revealed the prevalence of acute health problem faced by the respondent workers at the time of work mostly. Majority [331(66.2%)] of the respondents had complained of getting acute symptoms of health problems. Among them, 193 [58.3], 96[29.0%] and 42 [12.7%] had one, two and more than two symptoms respectively.

Table 13: Profile of the respondents suffering from chronic cough symptom.

Characteristics	Number of respondents					
	Sex				Total	
	Male		Female			
	No	%	No	%	No	%
A. Age in years						
18-27	6	54.5	5	45.5	11	100.0 [12.2]
28-37	8	53.3	7	47.7	15	100.0 [16.7]
38-47	26	66.7	13	33.3	39*	100.0 [43.3]
48-57	14	73.7	5	26.3	19**	100.0 [21.1]
> 57	6	100.0	0	0.00	6	100.0 [6.7]
Total	60	66.7	30	33.3	90	100.0
B. Working section						
PBDS +	36	57.1	27	42.2	63	100.0 [70.0]
HFS ++	10	100.0	0	0.00	10	100.0 [11.1]
LSS +++	10	83.3	2	16.7	12	100.0 [13.3]
More than one	4	80.0	1	20.0	5	100.0 [05.6]
Total	60	66.7	30	33.3	90	100.0
C. Duration of employment in years						
< 3	5	41.7	7	58.3	12	100.0 [13.3]
3-5	16	72.7	6	27.3	22	100.0 [24.4]
6-9	11	64.7	6	35.3	17	100.0 [18.9]
10-14	14	66.7	7	33.3	21	100.0 [23.3]
≥ 15	14	77.8	4	22.2	18	100.0 [13.3]
Total	60	66.7	30	33.3	90	100.0
D. Duration of suffering in years						
< 1	7	70.0	3	30.0	10	100.0 [11.1]
1-3	35	66.0	18	34.0	53	100.0 [58.9]
4-6	13	65.0	7	35.0	20	100.0 [22.2]
> 6	5	71.7	2	28.6	7	100.0 [7.8]
Total	60	66.7	30	33.3	90	100.0

* p= 0.037
** p= 0.039
+ PBDS= Parboiling and drying section
++ HFS = Husking and fanning section
+++ LSS = Loading and storage section

Mean age of sufferers		Mean duration of employment	
(both sexes combined)	= 41.77 ± 1.04 years.	[both sexes combined]	= 8.4222 ± 5.56217 years.
Mean age for male	= 43.63 ± 10.38 years.	Mean duration [male]	= 8.7500 ± 5.68189 years.
Mean age for female	= 38.03 ± 9.50 years.	Mean duration [female]	= 7.7667 ± 5.34779 years.

Mean duration of suffering	
[both sexes combined]	= 3.1561 ± 2.53384 years.
Mean duration [male]	= 3.5008 ± 2.87022 years.
Mean duration [female]	= 2.4667 ± 1.48518 years.

Table 13 showed the profile of respondents suffering from cough symptom. There were total 90 suffers with cough symptom and the male suffers were double in number than the female [60 vs30]. The most prevalent age groups were 38-47 years and 48-57 years. The male workers were significantly more in these two groups [p=0.037, p=0.039] also. The mean age of females was less by about 5 years than that of male. It was observed that PBDS was significantly crowed (p=0.0236) than the other sections. Majority (90.0%) of the female sufferers worked there. The number of male respondents with cough symptoms were more in every sections and significantly in the LSS [p=0.021]. This table also revealed that the number of male workers were more in all categories of working durations and were suffering from the cough symptom for longer period than their female counterpart in those categorizes of sufferers.

Table 14: Qualifying factors for aggravation of chronic cough symptom among sufferers.

Qualifying characteristics	Number of respondents						
	Sex				Total		
	Male		Female				
	No	%	No	%	No	%	P value
A. Nature of cough (Phlegm production)							
Non-productive	27	54.0	23	46.0	50	100.0 [55.6]	
Productive	33	82.5	7	17.5	40	100.0 [44.4]	0.000
Total	60	66.7	30	33.3	90	100.0	
B. Color of phlegm							
Yellow	9	100.0	0		9	100.0 [22.5]	
White	20	76.9	6	23.1	26	100.0 [65.0]	0.006
Black	4	80.0	1	20.0	5	100.0 [12.5]	
Total	33	82.5	7	17.5	40	100.0	
C. Period of aggravation							
During work load	14	70.0	6	30.0	20	100.0 [22.2]	0.074
Perennial	20	62.5	12	37.5	32	100.0 [35.6]	0.157
Irregular	26	68.4	12	31.6	38	100.0 [42.2]	0.023
Total	60	66.7	30	33.3	90	100.0	
D. Season of aggravation							
Winter	39	62.2	19	32.8	58	100.0 [64.4]	0.009
Summer	2	100.0	0		2	100.0 [2.2]	
No effect	19	63.3	11	36.7	30	100.0 [33.4]	0.144
Total	60	66.7	30	33.3	90	100.0	
E. Time of aggravation daily							
Morning	10	58.8	7	41.2	17	100.0 [18.9]	
During work hours	9	75.0	3	25.0	12	100.0 [13.3]	0.083
Night	19	65.5	10	34.5	29	100.0 [32.2]	0.095
Always	22	68.8	10	31.2	32	100.0 [35.6]	0.034
Total	60	66.7	30	33.3	90	100.0	

Table 14 described the qualifying factors for the symptoms of cough and its relation with aggravation of the symptom. The cough was productive in less than the half of the respondents [40(44.4%)] and the number of male respondents was significantly more [33(82.5%), p=0.0000] with this symptom. The color of the phlegm was white frothy in majority of the respondents indicating non-infective condition. But yellow phlegm [purulent] of infective nature was solely present in male. This table revealed that a larger section [38(42.2%)] of the both sexes mentioned cough symptom as an irregularly persistent problem through out the year and only 20 [22.2%] described aggravation when the work load increased. Majority [58(64.4%)] of the respondents mentioned the aggravation of cough symptom in winter. The table also showed that only 13.7 %(12) respondents mentioned the aggravation of cough at the time of work but a large section significantly [p=0.034] described the persistent presence through out the all times of the day.

Table 15: Profile of the respondents suffering from dyspnoea symptom.

Characteristics	Number of respondents					
	Sex				Total	
	Male		Female			
	No	%	No	%	No	%
A. Age in years						
18-27	4	80.0	1	20.0	5	100.0 [10.0]
28-37	8	61.5	5	38.5	13	100.0 [26.0]
38-47	11	50.0	11	50.0	22	100.0 [44.0]
48-57	7	100.0	00		07	100.0 [14.0]
>57	3	100.0	0		3	100.0 [06.0]
Total	33	66.0	17	34.0	50	100.0
B. Working section						
PBDS +	18	54.5	15	45.5	33	100.0 [66.0]
HFS ++	7	77.8	2	22.2	9	100.0 [18.0]
LSS +++	8	100.0	0		8	100.0 [16.0]
Total	33	66.0	17	34.0	50	100.0
C. Duration of employment in years						
< 3	6	46.2	7	53.8	13	100.0 [26.0]
3-9	16	80.0	4	20.0	20	100.0 [40.0]
≥10	11	64.7	6	35.3	17	100.0 [34.0]
Total	33	66.0	17	34.0	50	100.0
D. Duration of suffering in years						
< 1	2	50.0	2	50.0	4	100.0 [08.0]
1-3	18	64.3	10	35.7	28	100.0 [56.0]
4-6	9	75.0	3	25.0	12	100.0 [24.0]
> 6	4	66.7	2	33.3	6	100.0 [12.0]
Total	33	66.0	17	34.0	50	100.0

+ PBDS = Parboiling and drying section
++ HFS = Husking and fanning section
+++ LSS = Loading and storage section

Mean age [Both sexes combined] = 40.32 ± 8.87 years.
Mean age [Male] = 41.73 ± 11.44 years.
Mean age [Female] = 37.29 ±7.65 years.

Mean duration of dyspnoea [both sexes combined] = 3.23 ± 2.77 years.
Mean duration of dyspnoea [male] = 3.29 ± 2.72 years.
Mean duration of dyspnoea [female] = 3.11 ± 2.93 years.

Table 15 showed the profile of respondents suffering with dyspnoea symptom. There were 50 respondents with this problem. The number of male suffers was about doubled than the female [33 vs.17]. The predominant sufferer age group was 38-47 years, composed of equal number [11] of respondents from both sexes. Majority [64.7%] of females was in this age group. All elder males [48 years and above] were the victim of this symptom. More than a half [33(66%)] of the sufferers worked in the PBDS. This section included the majority of respondents of both sexes [male and female=54.5% and 88.2%]. The table also revealed that 20[40.0%] respondents were the larger group of sufferers working in the rice mills for 3-9 years. This group also included larger section of male [16 (48.5%)] suffers. Majority of the respondents [28 (56.0%)] and of both sexes [male 54.5% and female 58. 8%] had the problem for 1-3 years.

Table 16: Qualifying factors for aggravation of dyspnoea symptom among sufferers.

Qualifying characteristics	Number of respondents						
	Sex				Total		
	Male		Female				
	No	%	No	%	No	%	P value
A. Presenting nature							
With wheezing	12	60.0	08	40.0	20	100.0 [40.0]	
Without wheezing	21	70.0	09	30.0	30	100.0 [60.0]	
Total	33	66.0	17	34.0	50	100.0	
B. Period of symptom aggravation through out the year							
Working load	9	64.3	5	35.7	14	100.0 [28.0]	
Perennial	9	69.2	4	30.8	13	100.0 [26.0]	
Irregular	15	65.2	8	34.8	23	100.0 [46.0]	
Total	33	66.0	17	34.0	50	100.0	
C. Season of symptom aggravation							
Winter	20	66.7	10	33.3	30	100.0 [60.0]	0.068
Summer	2	50.0	2	50.0	4	100.0 [08.0]	
Always	11	68.8	5	31.2	16	100.0 [32.0]	0.134
Total	33	66.0	17	34.0	50	100.0	
D. Daily time of aggravation							
Morning	6	75.0	2	25.0	8	100.0 [16.0]	
During work	7	70.0	3	30.0	10	100.0 [20.0]	
Night	8	57.1	6	42.9	14	100.0 [28.0]	
Always	12	66.7	6	33.3	18	100.0 [36.0]	
Total	33	66.0	17	34.0	50	100.0	

Table 16 described the presenting nature of dyspnoea symptoms and the factors related to the aggravation of symptom. Majority of the respondents (60.0%) [and of both sexes] mentioned the absence of wheezing when they felt dyspnoea symptoms. Regarding its chronic nature 20[46.0%] respondents remarked the symptom as an irregular onset includes larger section of both sexes [male 15(45.4%) and female 8(47.1%)]. This table also revealed that more than a quarter of the respondents [28.0%] expressed its aggravation during working load and about another quarter [26.0%] described it as a perennial symptom. Majority [30(60.0)] of the respondents and also major section of both sexes [male 60.6% and female 58.8%] described the winter aggravation of the symptom. About a quarter [16(32.0%)] mention its persistent presence without seasonal influence. A large section [18(36.0%)] of respondent and of both sexes [12 male (36.4%), and 6 female (35.6%)] described it as the persistent presence at all times of the day if occur. Only about one fifth [10(20.0%)] of the respondents mentioned its aggravation during the work and more than a quarter [14(28.0%)] had more symptoms at night.

Table 17: Profile of the respondents suffering from rhinitis symptom.

Characteristics	Number of respondents					
	Sex				Total	
	Male		Female			
	No	%	No	%	No	%
A. Age in years						
18-27	3	75.0	1	25.0	4	100.0 [11.8]
28-37	0		3	100.0	3	100.0 [08.8]
38-47	12	57.1	9	42.9	21	100.0 [61.8]
48-57	4	66.7	2	33.3	6	100.0 [07.6]
Total	19	55.9	15	44.1	34	100.0
B. Working section						
PBDS +	14	48.3	15	55.7	29	100.0 [85.4]
HFS ++	3	100.0	0		3	100.0 [08.8]
LSS +++	1	100.0	0		1	100.0 [02.9]
More than one	1	100.0	0		1	100.0 [02.9]
Total	19	55.9	15	44.1	34	100.0
C. Duration of employment in years						
< 3	3	50.0	3	50.0	6	100.0 [17.6]
3-9	11	78.6	3	21.4	14	100.0 [41.2]
≥10	5	35.7	9	64.3	14	100.0 [41.2]
Total	19	55.9	15	44.1	34	100.0
D. Duration of suffering in years						
< 1	3	75.0	1	25.0	4	100.0 [11.8]
1-3	13	52.0	12	48.0	25	100.0 [73.5]
4-6	2	100.0	0		2	100.0 [05.9]
> 6	1	33.3	2	66.7	3	100.0 [08.8]
Total	19	55.9	15	44.1	34	100.0

+ PBDS = Parboiling and drying section
++ HFS = Husking and fanning section
+++ LSS = Loading and storage section

Mean age [both sexes combined] = 40.3 ± 8.87 years.

Mean age [male] = 40.5 ± 9.9 years.

Mean age [female] = 40.1 ± 7.7 years.

Table 17 described profile of the respondents suffering from rhinitis, an important symptom of upper respiratory tract illness. The major suffers were male [19(55.9%)] among the total 34 respondents. Age group 38-47 years was most affected section [61.8%] composed by major sections of both sexes of about equal proportion [male-63.2% and female-60.0%]. Mean age of both male and female suffers was almost same. All the females [15(100.0%)] suffering with rhinitis and major section [14(73.7%)] of the male worked in PBDS. Majority of the suffers were in the job comparatively for longer duration (> 3 years). It included equal number of respondents [14] from 3-9 years and ≥ 10 years working groups. The number of male respondents [11(78.6%)] working for 3-9 years group was significantly more [p=0.033] than the female. This group also included the major portion [11(57.9%)] of the male sufferer workers. Similarly in ≥10 years working group, women were the majority [9(64.3%)] suffers. Majority [9(60.0%)] of the female workers was in this working class. The table revealed that majority [25(73.5%)] of respondents were suffering from the problem for 1-3 years. This group included the largest section of both male [68.4%] and female [80.0%] respondents.

Table 18: Qualifying factors for aggravation of rhinitis symptom among sufferers.

Qualifying characteristics	Number of respondents						
	Sex				Total		
	Male		Female				
	No	%	No	%	No	%	P value
A. Presenting nature							
Running Nose	15	60.0	10	40.0	25	100.0 [73.5]	0.317
Itchiness nose	1	25.0	3	75.0	1	100.0 [11.8]	0.317
Sneezing	3	100.0	0		3	100.0 [08.8]	
Stuffiness of Nose	0		2	100.0	2	100.0 [05.9]	
Total	19	55.9	15	44.1	34	100.0	
B. Period of symptom aggravation through out the year							
Working load	7	63.6	4	36.4	11	100.0 [32.4]	0.366
Perennial	7	38.9	11	61.1	18	100.0 [52.9]	0.346
Irregular	5	100.0	0		5	100.0 [14.7]	
Total	19	55.9	15	44.1	34	100.0	
C. Season of symptom aggravation							
Winter	15	60.0	10	40.0	25	100.0 [73.5]	0.317
Summer	3	50.0	3	50.0	6	100.0 [17.6]	
Always	1	33.3	2	66.7	3	100.0 [08.9]	
Total	19	55.9	15	44.1	34	100.0	
D. Daily time of aggravation							
Morning	6	50.0	6	50.0	12	100.0 [35.3]	
During work	6	75.0	2	25.0	8	100.0 [23.6]	0.157
Night	0		1	100.0	1	100.0 [02.9]	
Always	7	53.8	6	46.2	13	100.0 [38.2]	
Total	19	55.9	15	44.1	34	100.0	

Table 18 presented the qualifying factors for the symptom of rhinitis and the conditions for aggravation of the symptom. Majority [25(73.5%)] of the respondents described the symptom as running nose problem. This symptom was also the complaint of the largest section of male [15(78.9%)] and female [10(66.7%)] workers. The table also revealed that the majority [18(52.9%)] of the respondents defined the persistent presence of the symptom throughout the year. It was a perennial problem of majority female [11(73.3%)] also. Only 7(36.8%)] male mentioned the problem aggravation during working load. Seasonal aggravation in winter was the problem in majority [25(73.5%)] of the respondents and also of both male [15(78.9%)] and female [10(66.7%)] workers. About one third [13(38.2%)] of the respondents [7 male and 6 female] mentioned the continuous presence of the symptom through out the day and another one third [12(35.3%)] mentioned the aggravation during the morning. In less than a quarter [8(23.6%)] of the respondents, the symptom aggravated with work was described.

Table 19: Profile of the respondents suffering from chronic conjunctivitis symptom.

Characteristics	Number of respondents					
	Sex				Total	
	Male		Female			
	No	%	No	%	No	%
A. Age in years						
18-27	2	66.7	1	33.3	3	100.0 [08.1]
28-37	4	30.8	9	69.2	13	100.0 [35.1]
38-47	9	47.4	10	52.2	19	100.0 [51.4]
> 57	2	100.0	0		2	100.0 [05.4]
Total	17	45.9	20	54.1	37	`100.0
B. Working section						
PBDS [+]	5	21.7	18	78.3	23	100.0 [62.2]
HFS [++]	5	83.3	1	16.7	6	100.0 [16.2]
LSS [+++]	5	100.0	0		5	100.0 [13.5]
More than one	2	66.7	1	33.3	3	100.0 [08.1]
Total	17	45.9	20	54.1	37	`100.0
C. Duration of employment in years						
< 3	3	42.9	4	57.1	7	100.0 [18.9]
3-9	8	40.0	12	60,0	20	100.0 [54.1]
≥10	6	60.0	4	40.0	10	100.0 [27.0]
Total	17	45.9	20	54.1	37	`100.0
D. Duration of suffering in years						
< 1	3	75.0	1	25.0	4	100.0 [10.8]
1-3	11	39.3	17	60.7	28	100.0 [75.7]
4-6	1	33.3	2	66.7	3	100.0 [08.1]
> 6	2	100.0	0		2	100.0 [05.4]
Total	17	45.9	20	54.1	37	`100.0

[+] PBDS = Parboiling and drying section
[++] HFS = Husking and fanning section
[+++] LSS = Loading and storage section

Mean age of sufferers		Mean duration of work	
(both sexes combined)	= 38.57± 9.13 years.	(both sexes combined)	=7.36 ± 5.34 years.
Mean age (male)	= 40.82 ± 1.16 years.	Mean duration [male]	= 8.11 ± 6.58 years.
Mean age (female)	= 36.65 ± 5.94 years	Mean duration [female]	= 6.73 ± 4.12 years

Mean duration of suffering [both sexes]	=2.41± 1.68670 years
Mean suffering [male]	= 2.62 ± 2.24673 years
Mean [female]	= 2.22 ± 1.03205 years

Table 19 described the profile of the respondents suffering from the most prevalent a non-respiratory symptom of chronic conjunctivitis. There were 37 respondents with female majority [20(54.1%)]. The predominant sufferer [19(51.4%)] age group was '38-47' years. Majority of both male [9(52.9%)] and female [10(50.0%)] were in that age group. A larger section of respondents [23(62.2%), p=0.002] worked in PBDS. Majority of female [18(90.0%)] worked in this section. The number of male workers was equal [5 (29.3%)] in BPDS, HFS and LSS. Majority [20(54.1%)] of the workers were in rice mills job for 3-9 years included the majority [12(60.0%)] of female and a larger section of male [6(35.3%)]. The number of male was more than the female [6 Vs.4] in the group of employment '≥ 10 years'. More than three quarter [28(75.7%)] of the respondents had the problem for 1-3 years include majority of the male [11(64.7%)] and female [17(85.0%)].

Table 20: Qualifying factors for aggravation of conjunctivitis symptom among sufferers.

Qualifying characteristics	Number of respondents						
	Sex				Total		
	Male		Female				
	No	%	No	%	No	%	P value
A. Presenting nature							
Watering eye	4	26.7	11	73.3	15	11.0 [40.5]	0.071
Redness of eye	11	78.6	3	21.4	14	11.0 [37.8]	0.033
Irritation	1	14.3	6	85.7	7	11.0 [18.9]	0.059
Swelling eyelids	1	100.0	0		1	11.0 [02.8]	
Total	17	45.9	20	54.1	37	100.0	
B. Period of symptom aggravation through out the year							
Work load	8	66.7	4	33.3	12	11.0 [32.4]	
Perennial	5	29.4	12	70.6	17	11.0 [45.9]	0.134
Irregular	4	50.0	4	50.0	8	11.0 [21.6]	
Total	17	45.9	20	54.1	37	100.0	
C. Season of symptom aggravation							
Winter	4	66.7	2	33.3	6	11.0 [16.2]	0.414
Summer	4	30.8	9	69.2	13	11.0 [35.1]	0.166
Always	9	50.0	9	50.0	18	11.0 [48.7]	
Total	17	45.9	20	54.1	37	100.0	
D. Daily time of aggravation							
Morning	1	20.0	4	80.0	5	11.0 [13.5]	
During Work	4	50.0	4	50.0	8	11.0 [21.6]	
Night	7	46.6	8	53.4	15	11.0 [40.5]	
Always	5	55.5	4	44.5	9	11.0 [24.4]	
Total	17	45.9	20	54.1	37	100.0	

Table 20 described the presenting features and the qualifying factors for the aggravation of the conjunctivitis symptoms in the sufferers. Watering eye [15(40.5%)] and red eye [14(37.8%)] were important presenting complains of the major of female [11(55.0%)] and male [11(64.7%)] workers. The number of male workers with red eye was significantly [p=0.033] more than that of female. A large section [17(45.9%)] reported the existence of the symptoms through out the year. The majority [12(60.0%)] of the female respondents were included in this group. About half of the male [8 out of 17 (47.1%)] respondents had aggravation of conjunctivitis symptom during the workload period. A large section [18(48.7%)] of the respondents and equal number of both sexes mentioned the persistent presence of symptom through out the year. The table also revealed that a large section [15(40.5%)] of the respondents reported the night aggravation of symptom in both male [7(41.2%)] and female [8(40.0%)].

Chapter: 5

Discussion

This cross sectional descriptive study was carried out among 500 rice mill worker with a view to determine the prevalence of the symptoms of chronic respiratory health problems (CRHP) and to qualify those symptoms aggravation in respect of various factors. Cough, dyspnoea, rhinitis and wheezing were the prevalent chronic respiratory symptoms in 18.0%, 10.0%, 6.8% and 5.8% of the respondents. Chronic conjunctivitis, a non-respiratory symptom was complaint of 7.4% of the respondents. Remarkable portion of the workers had complaint of acute symptoms like myalgia, headache and malaise. The sufferers of chronic respiratory symptoms were in rice mills job for short duration, majority (69.0%) of them worked in Parboiling and drying section (PBDS) and had the symptoms for short period. Non-productive cough, running nose, dyspnoea without wheezing and watering or red eye was major presenting features of the CHRP symptoms. The CRHP symptoms aggravated in the winter and were found not related with the work load or diurnal variations. No signs of respiratory system diseases were found during physical examination and all lung function tests values were in normal limit. Nutritional status (BMI) was in normal weight group in majority (59.4%) of the respondents.

Among 500 rice mill workers included in this study, 266 (53.20%) were male. The mean age of the respondents were 38.04 years (SD ±8.53 years, range 52 [maximum 70 minimum 18]). The mean age of male was greater than that of female (male vs.

female=39.21 ± 8.97 years vs. 36.71 ±7.81 years; t=0.386, d f= 497.973, p=0.001). The numbers of male respondents in all categories of ages except 28-37 years group were more than females with significant difference of their number in 48-57 years and > 57 years (30 vs.16, p= 0.039; 10 vs. 2, p=0.021) categories. The highest number (220[44.0%]) of workers and of both sexes (male vs. female= 123[46.2%], p=0.000 vs. 97[41.5%], p=0.000) were in most active age category of 38-47 years. As the jobs in rice mills are most arduous and tiring, the negligible proportional numbers of labors below and above this active age group was in fact reasonable. The workers on duty at the time of data collection were interviewed, examined and included in the study irrespective of their sex. Bangladesh occupational safety, Health and Environment Foundation (OSHE) mentioned that out of 5 million unorganized workers in 40,000 rice mills, 60% were female.[70] But in the present study, the number of male workers was insignificantly more than female. This study was conducted in the greater Rajshahi district and here exist little facilities for women employment as it is in and around Dhaka. Besides these, some social factors including religious and economical conditions keep apart women to be engaged such hard works of the rice mills. So, male-female workers' ratio in the present study did not reflect the national data of OSHE. Yet, rice mills are probably the largest sector for women employment in the Northern Bangladesh especially in the Rajshahi area where rice cultivation is the main crop.

It was revealed in the study that 95.20% workers were married, living with the partner and working in the same mill. It was a unique example of universality of marriage custom in Bangladesh.

Majority (60.20% [301]) of the workers came from Greater Rangpur notably Lalmonihat district. A remarkable part of greater Rangpur is seasonally poverty stricken zone and the poor people migrate for work to other parts of the country. As Rajshahi is the nearer large city for them, migration for work here was obvious. The mills authority arranged accommodation (unhealthy and unhygienic) free of cost around the mill premises closed to the boundary wall, that was the additional attraction for the migrated poor people to get work there. Beside these, friends and relatives who migrated here first helped them to be engaged there. The rice mill authorities were satisfied with them as the workers gained expertise in the work as well as they provided security service for the mill areas that could not be provided by the local workers. So, the proportion of local workers in the rice mills was found less than the migrated workers from Greater Rangpur.

Majority of the male (60.2%) was agri-labor and about nine-tenth of the female (89.7%) were engaged in house keeping as house wife (or in odd job like domestic workers that they did not want to disclose) before coming to rice mills job. These two jobs were the extreme poles of previous employments in the respondents for the two sexes. Relatively a few female reported their previously employment in hard and tiring works like as agri-labor, in dusty works or laborer in the present study. Involvements of women in relatively soft works were due to their physic and also an indication of social norm in this country.

The height and weight were measured to calculate Body Mass Index (BMI) for assessing the nutritional status of the workers and their physical fitness. The mean height of the respondents (both sexes combined) was 1.5623 M ± 0.10795 with negatively skewed distribution (-1.175). The mean height for male was 1.6208 M ± 0.07902 with also

negatively skewed (-2.203) distribution and for female, it was 1.4958 M ± 0.09747 but with positively skewed (3.739) distribution. These statistics indicated that the majority of the male workers were taller and at the same time, the majority of the female workers were shorter than for the average calculated heights of the sexes concerned in the collected data. The male workers in the present study was about to close as tall as Indian male but females were shorter than Indians (Indian Male vs. Female= 1.612 vs. 1.521 meter). [71] Similarly for the weight concerned, the calculated mean weight of combined sexes (both male and female), mean of male and that of female were 48.318 Kg ± 6.1609, 50.2782 Kg ± 5.6399 and 46.0897 Kg ± 5.9781 respectively with all distributions positively skewed indicating that the majority (number) of the both sexes workers were below the mean weight (calculated) from the data in the present study. The number of male workers in all categories of weights was remarkably more than females except < 45 Kg body weight group.

Body Mass Index (BMI) was calculated using height and weight data. Majority (297, 59.4%) of the respondents and also of both sexes (male and female= 50.4% and 69.7%) had BMI 18.5-<25.0 [called Normal weight] indicating average nutritional status in the studied workers.

In the underweight group (BMI= <18.4) of the present study, the number of male (123) workers was significantly more (p=0.000) than their female (47) counterpart. On the other hand, the number of female (21) was remarkably (p=0.004) more than the male (6) in overweight group indicating better nutritional status in female than male workers. Pradhan, Thakur and Chowdury in a study in India mentioned the proportion of

underweight and overweight groups were 15.0% each among the rice mill workers.[49] In the present study, the number of workers in under weight [BMI category] group was found more than double and at the same time, the number of over weight worker was about one third of the Pradhan et all 's study. In comparison to the Indian rice mills workers, Bangladeshi workers possessed poor nutritional status. The remarkable better nutritional status of females than that of male in the present study that might be considered for dietary factors, yet female hormones and age factors would be responsible for such variations.

Blood pressure recording was done as a routine examination. Diastolic blood pressure 90 m m Hg was selected as the cut off point for hypertension diagnosis as conventional measurement. Diastolic blood pressure $\geq$ 90 m m Hg. were found in 151 (30.2%) respondents (called hypertensive). M A Zaman and M A Rouf of Bangladesh National centre for control of rheumatic fever and heart disease in a study mentioned the prevalence of Hypertension in adult population of Bangladesh was 11.3%.[72] The prevalence of hypertension among the rice mill workers were about three fold more in the present study than the above mentioned study. The number of male sufferers in this study was significantly more than the female (male vs. female= 89 vs. 62; p=0.028). The blood pressure recordings in the present study was done during the leisure (or at mid-day break) and after finishing works. Though the prevalence of high diastolic blood pressure level recorded in this study showed a wide difference with the above mentioned study, yet, anxiety, excessive salt intake and other factors for hypertension could not be ignored. It needs further investigation for actual information.

Auscultation of chest with stethoscope was also done as a routine examination also. Only 34 (6.8%) respondents was found having added lung sound namely ronchi and crepitation. Both sounds were predominantly present in male workers. It might be for smoking and or for more out door exposure to dust and air irritants in the cases of male than female. These sounds did not indicate major lung and bronchial lesions and did not remove the workers from their duties ever.

Rice mill workers usually expose to dust that might lead to develop occupational dermatitis and fungal infection. In the present study, 19 (3.8%) workers were diagnosed suffering from fungal skin infection predominantly in female (63.2%). Besides this, 17 (3.4%) workers had ulcer (clinically diagnosed bacterial) on body and other 6 (1.2%) were suffering from scabies infection. Males were predominant sufferer (11, 64.8%) of bacterial skin infection and scabies was more prevalent (5, 83.3%) in female. Both bacterial infection and scabies were the indicators of improper personal hygiene and living conditions (unhealthy housing and living environment).

Smoking is a global public health concern. About 1.1 billion people smoke worldwide, which is expected to rise to more than 1.6 billion by 2025. [73] It causes huge premature deaths. [74, 75] The smoking also poses considerable economic burden among the poor people especially living in developing countries like Bangladesh.[76] In the present study, smoking habit and its patter was studied with much attention as it has own impact on respiratory health as well as have synergetic effect along with the dust that the workers exposed during the work. In the present study, 233 (46.6%) respondents reported about the habit of regular smoking including only 2 female. The prevalence rate of smoking in

(231) male was 87.6%. Among the smokers, 54.5% (127) took cigarette and the rest (45.5%) smoked bidi regularly. Majority (157[67.4%]) of them took 10-20 sticks and about one third (24.5% [57]) smoked less than 10 sticks daily. In a World Health Organization report, the prevalence of smoking in Bangladesh was mentioned 38.7% (Male 53.6% Female 23.8%).[77] Though combined prevalence rate in the present study was closed to the WHO report but the calculated prevalence rate among male was too much high and prevalence in female was very negligible. Khan M M H, Khan A, Kraemer A and Mori Mitsuru in a study found the over all smoking prevalence rate 53.6% and in male, it was 59.8 % among slum dwellers of Bangladesh.[78] . In the present study, the total prevalence of smoking was closed to Khan et al findings but the prevalence among male was remarkable higher. The wide variations in the prevalence rates found in the present study were probably due to lack of awareness about ill-effects of smoking among the respondents especially among the male and the sampled population were of same working strata. The females were non-smoker for their social background as they were complete house wife or domestic workers before their job in rice mills, did not grow habit of smoking in their earlier life. More respondents consumed cigarette (54.5%, 127) than bidi (45.5%, 106) was found in the present study. Khan M M H, Khan A, Kraemer A and Mori Mitsuru in their study also found about similar prevalence of more smoking cigarette smokers (53.6%) than bidi.[78] Bidis are the cheapest substitutes of cigarettes, mostly consumed by the poor people. It contains more tar and nicotine than cigarettes that were also more risky for health.[79,80,81] Now-a-day in Bangladesh, the low band (quality) cigarettes are more available and their price differs a

little with bidi. On the other hand, cigarette smoking indicates better social status in the lower classes of people. These seemed to be the cause of higher prevalence rate of cigarette smoking in the present study.

The prevalence rate of smoking was high among the Loading and storage Section (LSS) workers (93.9%). It might be for the facts that they had more leisure time and more outside exposure than the workers of other sections.

The number of smokers was less in younger workers(when categorized into two groups - below 48 years and $\geq$ 48 years) [table not shown]. The calculated prevalence rates (45.02% and 58.62%) of smoking in these two categorized age groups might evident that younger were more aware of harmful effects of smoking.

In the present study, it was observed during the analysis that acute and chronic health problems were more in non-smokers (table not shown). Higher prevalence of acute health problems (55.1%) and chronic respiratory problem symptoms (69.3%) in non-smoker though nullified the additional effects of smoking on the symptoms, probably produced spurious negative association between smoking habit and the symptoms. It might be assumed from the present study that for both acute and chronic health problems symptoms, dust exposure during the work had more impact on producing these effects.

Regarding the nutritional status, 46.8% (109) of the smokers were in under weight (BMI=<18.5) group and 68.2% of the non-smokers had normal weight (BMI=18.5-<25.0) group proved the worse nutritional status in the smokers in comparison to the non-smokers.

Addiction with Ganja was present only in 12(2.4%) respondents, solely among the smokers in the lower categorized age groups between 18 to 47 years. The younger workers and of active age groups (38-47 years) were found more addicted with ganja in the present study.

The study was carried among the rice mill workers of Rajshahi BSCIC (Bangladesh Small and Cottage Industries Corporation) and at the mills situated outside the city area. During the preliminary survey, three important operation (working) sections were identified, namely Parboiling and Drying Section (PBDS), Husking and Fanning Section (HFS) and Loading and Storage Section (LSS). It was found in the present study that majority (345[69.0%]) of the respondents worked in PBDS with significant (p=0.000) number (217[92.7%) of more female there. The numbers of male workers were similarly remarkably more (p=0.000, p=0.000) in HFS and LSS. PBDS was occupied by 48.1% (128) and 92.7% (217) of total male and female sampled population respectively. The operations at PBDS were solely manual and took 3-4 days to complete a cycle, included soaking paddy for 1 day, steaming operation for 2-3 hours and the Sun drying for 2-3 days. The workers in this section were on contact basis and worked in groups. The works in this section were relatively less laborious but continued for comparatively longer duration. These were the probable factors for employment of large number of workers and more female in this section. It could be concluded (from the observation during the data collection period and discussion with officials and workers) that Factory rules and regulation for employments in rice mill and termination from job were not followed. It was the only desire and decision of the authority. Yet, workers had freedom to take

decision for the continuation of the job in the concerned mills. The work management and the administrative system in the rice mills of Bangladesh yet was far better than the bonded labor of rice mills of Red Hills in Chennai of India where they had been working for generation to generation. [82] No workers had complained any kinds of harassment from mill authority any time (table not shown).

The mean duration of employment in rice mill was 6.34 ± 4.73 years and the calculated mean lengths of employment for both sexes were almost equal. The larger group of 153 (30.6%) workers included larger section of both male (32.3% [86]) and female (28.7% [67]) respondents were in rice mills job for 3-5 years. Such short duration of exposure was merely able to produce any permanent effect in the lung or on the respiratory passage. Almost all workers (97.00%) were employed perennially. It indicated that the workers had gained experience in the work and were not engaged in other jobs for a long since.

The majority (71.6% [358]) of the respondents and of both sexes worked the whole day (9-12 hours) from morning till night but the number of male in the group who worked for 8 hours was remarkably more (p= 0.000). The daily working hour's information indicated that female workers gave more (time) labor in rice mills than male but it carried little value as the respondents in majority sections worked on contact basis and in groups. On the other hand, it also indicated that females were more attentive about their duties and responsibilities but male were more reluctant and lost the time in smoking and gossiping. In Bangladesh, rice mill industries play important role in local food market and had major contribution in employment sector. The labors were unorganized here and

these industries were mostly uncovered by labor law and labor inspection system.[70] So, appointment and working hours did not be followed by the labor law. The workers had no complain about the daily working hours.

Among the respondents, 170 (34.0%) workers reported suffering from symptoms of chronic respiratory problems. The reported number of sufferers from the symptoms of chronic non-respiratory problems including backache was 400 (80.0%). Among the workers, majority (271, 54.2%) mentioned certain acute symptoms during the work.

The prevalent chronic respiratory symptoms were cough [90 (18.00%)], wheezing [29 (5.80%)], dysponea [50 (10.00%)] and rhinitis [34 (6.40%) and the chronic non-respiratory symptoms were conjunctivitis [37 (7.40%)], eczema [5 (1.00%)], fungal skin infection [19 (3.80%)] and backache [385 (77.0%)].

Among the sufferers from the chronic respiratory symptoms, 141(28.20%) workers had only one symptoms and 29 (5.80%) suffered from more than one. And among 400 chronic non-respiratory symptom sufferers, 385 respondents had symptoms of different problems including backache. Only backache was the complained symptoms of 347 (69.4%) workers. Backache symptom though was the complaint of great majority of the workers, it might be considered as vague and non-specific one because it did not compel the respondent to be abstained from the work. Not only the working posture, but there might have a lot of factors for backache. During the analysis, it was calculated that number of sufferers from only one chronic non-respiratory (excluded backache symptom) was only 15 (3.0%) and no sufferers from more than one chronic non-respiratory

symptoms. Therefore ignoring of backache symptom from the list of chronic non-respiratory symptoms prevalence was justifiable.

Among the 271 (54.2 %) complainers of acute symptoms sufferers, the prevalent symptoms among them were faced facial warmth (30, 11.07 %), headache (116, 42.80 %), malaise (110, 40.59 %), myalgia (154, 56.83 %), feverish (63, 23.24 %), chilliness (13, 4.79 %), burning throat (4, 1.47 %) and chest tightness (33, 12.17 %). The proportion of sufferers from the single symptom of acute problem among the studied population was 29.2% (146) and having more than one symptom of acute problems was 25.0% (125).

Acute and chronic respiratory symptoms and their prevalence had been described in many studies.[29,30,33,35-37,39,42,45,56,67,69,83-87]. DoPico GA, Reddan W, Flaherty D, Tsiats A, Peters ME,Rao P, Rankin J mentioned in their study that 88% of grain elevator workers had respiratory symptom which was more than double than the finding of the present study.[30] But Shorska C, Mackiewiez B, Dutkiewiez J, Krysinska-Traecyk F, Milanowski J, Large J, Thorne P found 44.7% of the farmers reported work related symptoms during harvesting and threshing.[36] The prevalence rate of work related symptoms in present study was a little higher than that of their findings. Ijadunola KT, Erhabor GE, Onayade A A, Ijadunola MY, Fatusi AO, Asuzu MC in a study in Nigeria observed that 54 % had of the grain mills workers had least one respiratory symptoms.[67] But in the present study the prevalence of single chronic respiratory symptoms (28.2%) was about half of their findings. Warren CP, Manfreda J found delayed onset of acute symptom in 44 % Manitoba farmers who handle grain and hay.[87] But in the present study the prevalence of

acute symptoms among the workers (54.2 %) who exposed to grain dust was more than their findings. The present study showed that 144 (54.1%) among the male and 127(54.3%) among the female were sufferers of acute health problems symptoms but Manfreda J, Holford-Strevens V, Cheang M, Warren C P in their study found 60% of male and 25% of female current and former farmers had acute symptoms following exposure to grain dust.[33] Though the proportion of male acute sufferers in the present study was closed to their findings but the female respondents suffered more than their study.

Cough is a weapon in the armory of lung defense. It is a reflex. Center of the cough reflex is in medulla. Afferent fibers arise from the receptors situated in the mucosa of pharynx, larynx, trachea and bronchial tubes. These receptors are activated easily when there is inflammation due to infections or by irritants like fumes, dusts, collected secretions, foreign materials and so on. It is the prime presenting symptom of respiratory problem. In the present study, 90 (18.0%) respondents had complaint of suffering from chronic cough symptom. Various factors related with symptoms of cough prevalence, nature of cough, product of cough (phlegm production) and its aggravation with like seasonal effects, working situation, diurnal variation and others had been studied and analyzed in the present study.

In the present study, the prevalence of cough was 18.0%. It was the first and most prevalent chronic respiratory symptoms among the workers of the studied rice mills. Many researchers found different prevalence rate of cough in their studies. Yach D, Myers J, Bradshaw D and Benatar S R in a survey found 46% of grain mills workers in

Cape Town who exposed to grain & flour dust suffered from chronic cough.[29] Awad EL, Karim M A, Gad el Rab MO, Omer A A, el Haimi Y A found 29% prevalence of cough among the same type of workers. [83] do-Pico G N, Reddan W, Flaherty D, Petyers MF, Rao P, Rankinn J, showed the existence of cough among 42% grain handlers.[86] In these studies the prevalence rates were about double than the prevalence estimated in the present study. But Cookson W O, Ryan G, Mac Donald S, Musk A W mentioned in their study about the prevalence of cough in seasonal grain handlers as 18%.[88] Finding of the present study was equal to Cooksom W O et. al observation. Deacon SP, Paddle GM. found 8-13% prevalence of cough and other respiratory problems among in grain and grain based food industries workers who exposed to the grain dust during their work.[89] McCurdy SA, Ferguson TJ, Goldsmith DF, Parker JE. Schenker MB also mentioned 7.1% cough prevalence in rice farmer who exposed to dust and smoke of agricultural waste burnings in a study.[51] Prevalence of cough in these two studies was less than the prevalence found in the present study.

The number of total male respondents with cough symptom was doubled than female [60 vs. 30]. But the prevalence of cough symptom in sampled male (266) and female (234) workers [(Male vs. female=22.6% vs.12.8%) showed the significant sex selective association (p=0.005) what ever might be the causes. Considering the common factors for initiation of cough reflex, smoking was the only differentiating factor between male and female irrespective of occupational dust exposure. In the present study, 53 (88.3%) out of 60 male sufferers (from cough) workers were smokers but none of the female. Many researchers mentioned additive effects of smoking on the prevalence of cough

symptom. [30,39,90,91] So, higher prevalence of cough in male workers in the present study might be for the smoking in addition to the other causes.

In the present study, among the respondents suffering from cough symptom, 10 (11.1%) worked in HFS (Husking and fanning section) and were solely male. The prevalence rate of cough symptom in the HFS workers was 21.3% (10 out of 47) which was highest than the prevalence rates among the workers of the other sections. The workers of this section exposed to more dust arising from the hushing machine during the de-husking and bran separation operations. Again, 80% (8) of the worker of this section (suffering from the cough symptoms) were smokers. So, higher prevalence rate of cough symptom in HFS was unsurprising in comparison to the workers of the other sections. The prevalence of cough symptoms in male workers was also more than that of female in Parboiling and drying section (PBDS). It might be also for the smoking habit in male besides other causes.

In the present study, the most prevalent age group of the workers suffering from cough symptom was 38-47 years. Thirty nine (43.3 %) respondents were in this age group. It included larger section of both total male (43.4% [26]) and females (43.4% [13]) sufferers. The next prevalent second age group was 48-57 years included 21.1 %(19) of the sufferers. The numbers of male suffers in all categorized age groups were more than female but their difference were significant ($p=0.037$ and $p=0.039$) only in those two age groups mentioned above. The age group 38-47 years and 48-57 years also contained the larger sections of the total smokers (43.3% and 23.3%). They were also working in the rice mills for longer duration in comparison to the others age groups. On the other hand,

in > 57 years age group, there were only 6 (10.0%) male sufferers who were smokers. These information in the present study helped to conclude that the prevalence of cough was directly proportional with increase of age and smoking. Smoking though might had additional impact, yet other causes of cough especially the cardiac causes in elderly might to be excluded (when the age factor is considered).

Majority (58.9% [53]) of the respondents were suffering from cough symptom for 1-3 years. But the prevalence rates of cough increased in the respondents who were in rice mills jobs for the longer duration, especially the male. Longer duration of dust exposure in the rice mills occupation as well as smoking habit might be the cause of such higher prevalence in them.

Majority (55.6% [50]) of the respondents described cough symptom as non-productive (dry cough) and if phlegm was produced, mention it of different (non-specific) color. Whereas those (44.4% [40]) who described the cough as 'productive' mentioned the color of phlegm 'yellow' (22.5%) indicative of infection only in male workers. But majority of the respondents described the phlegm as whitish frothy (included majority of male [60.6%] and female [85.7%] workers). This whitish frothy phlegm might be for an allergic responds or for other reasons including initial stage of infection or mild infection.

Only 22.2 %(20) respondents suffering from cough symptom described its aggravation when the work load increased but the larger section (38 [42.2%]) included both remarkable number of male (26, 43.4%) and female (12, 40.0%) mentioned the irregular aggravation of symptom. On the other hand, about one third (32 [35.6%]) of the respondents described presence of cough symptom as a chronic one (persisted through

out the year). At the same time, majority (58 [64.4%]) of the sufferers described the winter seasonal aggravation of symptom. Among the respondents who described the aggravation of cough during the work load, 75 % (15) of them also mentioned the significant impact of (p=0.000) winter for more symptom. All these findings indicated that aggravation of cough symptom in the respondent workers was independent of work load and was associated with winter seasonal aggravation that invited the more infection or allergies manifestation proved by the yellow or white frothy phlegm production.

Dyspnoea means difficult breathing. In a conscious subject, dyspnoea is awareness to breathe more. It may be due to physiological factor as during exercise or may be due to certain pathological states of lung and respiratory passages, for certain metabolic conditions or may be psychogenic. The prime patho-mechanism of dyspnoea in rice mill worker is the narrowing of respiratory passage. Extensive dust exposure for prolong period usually produces dyspnoea in the workers. The dust produces it effect either by causing local inflammation due to irritation or induces allergenic reactions (for allergens namely grain dust, mites or molds) resulted in narrowing of respiratory passages.[92] In the present study, 50 (10.0%) respondents had complaint of dyspnoea and the proportion of male sufferers was double than female (33 [66.0%] vs. 17 [34.0%]). Among the total sampled respondents in the present study, the dyspnoea prevalence rates in male and female were 12.41% and 7.26% respectively. It was the second most prevalent symptom of chronic respiratory problem in the studied rice mills. Dyspnoea, as an important complain of grain, grain processing and flour and food processing workers had been described in many studies. [33,37,83,45,87,88,89,93] Researchers had mentioned various

prevalence rates of dyspnoea in their studies. Awad el Karim M A, Gad el Rab MO, Omer A A, el-Haimi Y A. found 18% prevalence of dyspnoea among workers exposed to grain & flour dust.[83] Cookson W O, Ryan G, MacDonald S, Musk A W found 14% dyspnoea prevalence in seasonal grain handlers.[88] Deacon SP, Paddle GM. observed dyspnoea and other respiratory problems in 8-13% in grain and grain based food dusts workers.[89] Prevalence of dyspnoea among the rice mills workers of the present study was less than Prevalence rate mentioned in above mentioned studies. Among the respondents suffering with dyspnoea symptom, had also associated symptoms of chronic complaints of cough (12 [24.0%]), wheezing (4 [8.0%]) and rhinitis (2[4.0%]).

The larger section (22 [44.0%]) of the sufferers from dyspnoea symptom belonged to 38-47 years age group and the majority (11 [64.7%]) of the female respondents with dyspnoea complaint were in this age limit. The mean age of the sufferers was 40.32 ± 8.87 years with positive skewed distribution. The female sufferers were younger than male (Mean male vs. female age = 41.32 vs. 37.29).

Among the total 345 respondents (128 male and 217 female) working in PBDS, 33 (9.57%) were suffering from chronic dyspnoea. Again, among (128) the male and (217) female of the PBDS workers, the dyspnoea prevalence rates were 14.06% (18) and 6.91% (15) respectively. Higher prevalence rates of dyspnoea in male indicated the influence of other factors besides the occupational exposure at the PBDS, probably for smoking habit that was solely present in male. But among the sufferers of dyspnoea, only 26 (52.0%) were smoker. All the workers (8 [100.0%]) of LSS and the majority (55.6 % [5]) of the respondents of HFS suffering from dyspnoea was smoker. These evidences proved the

additional impact of Smoking on the respiratory symptoms of dyspnoea along with other causes.

Majority [28 (56.0%)] of the respondents were suffering for 1-3 years (mean=3.22 ±2.77 years) with dyspnoea symptom. It included major portion of male 18(54.5%) and female 10(58.8%) workers. On the other hand, only 20 (40.0%) respondents with the symptom of dyspnoea were in the rice mills job for 3-9 years constituted the larger section of workers. Duration of suffering with dyspnoea symptom did not show notable co-relation with the employment duration for the said symptom. This was probably for the fact that a very few workers were in the rice mills job for shorter duration, resulted minimal exposure to the hazards, did not able to produce symptoms like dyspnoea.

Presentations of dyspnoea with wheezing, represents intense form of breathlessness. In the present study, majority (30 [60.0%]) of the respondent mentioned the dyspnoea symptom without wheezing indicated that the symptom of was not so severe. Schwartz D A, Thorne P S, Yagla SJ, Burmeister LF, Olenchock S A, Watt JL, Quinn T J and Becklake M, Broder I, Chan-Yeung, Dosman J A, Ernst P, Herbert F A, Kennedy S M, Warren P W had also mentioned presence of wheezing in dysponic respondents in their study. [37,69] Cookson WO, Ryan G, MacDonald S, Musk AW, found wheezing in 13% workers. [88] And Yach D, Myers J, Bradshaw D and Benatar S R in their survey of grain mills workers in Cape Town, South Africa showed wheezing (25.0%) among the respondents.[29] In the present study the prevalence rate of wheezing in respondents was calculated 5.8% in sampled population. It was much lower than the above mentioned studies. Wheezing is an objective phenomenon and in the present study, appearance of

wheezing during dyspnoea was asked to measure the intense of the dyspnoea symptom. On lung auscultation, only 4 subjects had wheezing. So the prevalence of wheezing during dyspnoea might be doubtful.

A minor (14[28.0%]) portion of the respondents mentioned the aggravation of dyspnoea symptom when the work load increased but a large (23[46.0%]) section described as an irregular onset. Rather, majority (30 [60.0%]) of the sufferers from dyspnoea and of both male (20 [60.6%]) and female (10 [58.8%]) described influence of winter season in aggravation of symptom. A larger section (18 [36.0%]) of the respondents described that once the symptom started, continued through out the day. All these factors that were related with aggravation of the symptoms indicated that dyspnoea symptom in rice mills workers in the present study not solely for the exposure to the hazards but might be for other related factors for the symptom.

Nasal cavity, the upper respiratory passageways performs its function by conditioning the air while passing through it by worming, humidification and filtration. Nasal hairs normally filter particle larger up to 6 micrometers. The conditions like infections, allergic condition leading to increased mucosal secretion, deposited filtered particles or any foreign substances in the nose normally initiate sneeze reflex. The afferent impulses pass in fifth cranial nerve to the medulla triggers the sneeze reflex to clean off the material from the cavity. Due to chronic irritation and as an allergic responds nasal polyps are formed, manifested by the symptoms of nasal obstruction and excessive secretion called running nose. The grain dust of size larger than 6 micrometers and the other dust arise at rice mills are filtered by the nasal hairs normally and deposited in the cavity. It makes the

cavity dry for short duration of exposure but in prolonged exposure causes irritation, running nose and or obstruction manifestation. But for the initiation of symptom by dust and as allergic response for its contents of allergens manifest the running nose symptoms. In the present study, the manifestation of symptoms in the nose had been described simply as 'rhinitis' includes stuffiness, itching nose, sneezing or running nose. In this study, 34 (6.8%) of the respondent workers complained the symptom of rhinitis. There were 19 (55.9%) male and 15 (44.1%) female suffering from the symptoms.

Nasal symptoms had been mentioned in several studies among the grain and other dusty job workers. [29,30,33,35,39,42,56,86,89,94] Chan-Yeung M, Ashley MJ, Grzybowski S[42] and Yach D, Myers J, Bradshaw D, Benatar SR;[29] mentioned rhinitis a common symptom in grain handlers and in grain mill workers. DoPico GA, Reddan W, Flaherty D, Tsiatis A, Peters ME, rankin J. mentioned 64% of the nasal symptoms due to exposure to airborne grain dust which was independent of age and length of employment in grain handlers.[30] Deacon SP, Paddle GM mentioned prevalence of rhinitis 20% in workers exposed to grain and grain based food dusts.[89] Monso I, Magarolas R, Radon K, Danuser B, Iversen M, Weher C, Oprayd U, Donham KI, Nowak D. had described 14.4% nasal allergy in European crop farmers.[94] Manfreda J, Hulford-strevens V, Cheang M, Warren CP found stuffy nose in 60% of male and 25% of female among the workers exposed to grain dust during farming.[33] The prevalence of rhinitis in the present study was much lower than the above mentioned studies. It might be for shorter duration of exposure or presence of less hazardous contents in dust or less presence of allergens.

Various researchers described the manifestation in different ways. Ye TT, Huang JX, Shen YE, Lu PL, Christiani DC mentioned nasal irritation as the problem in Chinese rice granary workers.[39] Lim HH, Domala Z, Joginder S, Lee SH, Lim CS, Abu Bakar CM described nasal catarrh as an important symptom of Rice millers' syndrome in their study in Malaysia rice millers due to exposure rice husk dust.[56] In the present study, running nose was the main presenting feature of rhinitis in about three fourth of the respondents [25(73.3%)]. It was also the main presenting feature in majority of male (15 [78.9%]) and female (10 [66.7%]) respondent workers. A very negligible portion (5.9%) had stuffy nose symptom which did not coincide with the finding of Manfreda J, Hulford-strevens V, Cheang M, Warren CP' s study.[33]

In the present study, only less than a third (11 [32.4%]) of the respondents with the complaint of rhinitis symptoms mentioned the suffering more during the work load, whereas majority (18 [52.9%]) of the workers described it as a persistent symptoms through out the year. On the other hand, 73.5% (25) of the respondents mentioned aggravation of symptom in winter. These findings of the present study indicated that occupational exposure to the rice mills dust had less impact for the symptom aggravation. Regarding the diurnal aggravation of symptom, almost equal number of the respondents described morning aggravation (12 [35.3%]) and persistent (13 [38.2%]) presence of the symptom if started.

In the present study, majority of the respondents with rhinitis symptom belonged to age group 38-47 years and 12 (63.2%) male and 9 (60.0%) female were major sufferers in this age group. A very large section of workers with the symptom of rhinitis worked in

the PBDS. It included 15 females and 14 male workers. All those female complainers of rhinitis solely from PBDS but 73.7% (14) of the male complainers worked there. These findings of the present study showed the greater sensitivity to the symptom among the females than male workers of PBDS. Majority (28 [82.4%]) of the sufferers were working in rice mills for more than three years [mean duration of employment=7.82 ± 5.99 years] indicated longer duration of exposure to the hazards. But majority of the sufferers had the problem for 1-3 years [mean duration of suffering = 2.12 years SD ± 0.73 years] on the other hand put evidence that prolong duration of employment in the rice had little impact for the said symptom.

Conjunctivitis is the inflammatory respond of conjunctiva due to infection or irritation. The clinical presentation may be redness of conjunctiva, irritation and foreign body sensation, watering eye and occasionally pain and edema. These symptoms might be due to grain dust and the dust arises during the processing and milling of the paddy for rice production. In the present study, presence of any of these chronic symptoms had been described as conjunctivitis. Though it was not a symptom of chronic respiratory problems, yet had been considered for discussion for its greater impact and prevalence among the workers. There were 37 (07.4%) respondents complained suffering from chronic conjunctivitis symptoms. Among them, female workers [20 (54.1%)] were the major sufferers. Conjunctivitis had been described as an important problem in several studies. [29,95] Yach D, Myers J, Bradshaw D and Benatar S R mentioned prevalence of watering eye 25.0% among the grain mill workers in Cape Town.[29] Prevalence of

conjunctivitis in the present study was much less than their finding. It might be for short duration of exposure, less irritant content in the dust or for other causes.

Among the respondents suffering from chronic conjunctivitis, majority (19 [51.4%]) were in 38-47 years age group, included both major section of both male (9[52.9%]) and female (10 [50.0%]) sufferers. Like other chronic respiratory symptom, this age group (38-47 years) was most prone of to be attacked with the symptom. On the other hand, this age group was the larger section of respondents, so the prevalence of any problem symptom might be more in this age group generally.

Majority (23[62.2%]) of the sufferers from conjunctivitis symptom worked in PBDS included a significant majority (18 [90.0 %]; p=0.0007) of female respondents.

Majority (20 [54.1%]) of the respondents with conjunctivitis symptom were in rice mills jobs for 3-9 years included majority of female (12 [60.0%]) and a larger section (8 [47.1%])) of the male sufferers. They had the symptom of problem for 1-3 years in the major section (28 [75.7%]) of worker included the majority of both male (11 [64.7%]) and female (17 [85.0%]).

Watering eye was the presenting symptom in a larger section (15[40.5%]) of the workers with significant majority among the female workers (11 [55.0%]). On the other hand, redness of eye was the complaint in the majority of the male workers (11 [64.7%]) suffering from conjunctivitis symptom. Not only for irritation of conjunctiva but also for more proneness among the female to the allergen in the paddy dust may be the cause of watering eye in the female or redness in larger section of male respondents. Less than a third (12 [32.4%]) of the respondents mentioned worked related aggravation; rather a

larger section (17 [45.9%]) mentioned persistent presence of the symptom through out the year and no effect of season (18 [48.7%]) for aggravation of the symptom. The little effects of aggravating factors for conjunctivitis symptom in the present study indicated that irritant contents of dust and its composition might be responsible for conjunctivitis symptom.

Chapter: 6

Conclusion

The present descriptive study was carried out among 500 the rice mill workers with the view to determine the prevalence of symptoms of respiratory problems in them and to qualify those symptoms for aggravation with certain related factors. After in-depth interview and physical examination, collected data were tabulated and analyzed.

The following conclusions were made considering the net results and findings of the study that:

1. The rice mill workers were suffering from symptoms of chronic respiratory problems but the signs of chronic respiratory occupational diseases had not developed in them.
2. One third (34.0%) of the workers were suffering from the symptoms of chronic respiratory problems namely cough (18.0%), dyspnoea (10.0%), rhinitis (6.8%) and wheezing (5.8%) either singly or in combinations, mostly aggravated in winter and were independent of other aggravating factors.
3. Immediate medical treatment might improve the respiratory health of the effected workers by reducing the symptoms but demanded improved diagnostic facilities and research in this aspect.

Chapter: 7

Recommendation

It was concluded from the study that one third of the respondents were suffering from the symptoms of chronic respiratory problems and signs of occupational respiratory diseases had not developed in them. The workers were in the rice mill jobs for short duration with smaller period of sufferings. Bangladesh is at primary stage of industrial development and rice mills are small scale industry abundant in rural area of the country. It is well known from the knowledge of occupational medicine that once the signs of chronic occupational diseases especially dust borne diseases develop, any preventive or curative approaches carries little value. Considering the existing respiratory situations of rice mill workers, the following Micro and Macro measures were recommended to eliminate the problems.

A. Micro-measures [micro-planning]: ensuring the 'immediate medical treatment of the workers who had the symptoms' is the key approach of micro-measures. It includes

    1. Arrangement of treatment by qualified health personnel on regular basis,
    2. Establishment of small clinic at the industry or in the industrial zone,
    3. Supply of drugs usable at primary health care level at affordable cost,
    4. Arrangement of emergency transport if necessary.

5. Development of referral system for un-manageable cases at the local center.

B. Macro-measures [Macro-planning]: These were the comprehensive measures for promotion of health of rice mill workers. The recommended measures were included under the head lines of Medical, Engineering, General and Legislative approaches.

1. Medical approaches- These included the provision of
   a. Pre-placement examination of the worker: by physical and a battery of biological and radiological examinations if necessary to select the right man in right job.
   b. Periodic examination of the workers: to detect any abnormality in the course of employment to ensure continuous fitness for the job.
   c. Improvement of health care service and facilities,
   d. Periodic supervision of the working environment by appropriate health authority, provision of notification of occupational diseases and record keeping,
   e. Health education and counseling for good health behavior development.
2. Engineering measures:
   a. Proper designing of the room with good ventilation, suitable floor, enough light and sound protecting system and their proper maintenance
   b. provision of refuse and waste water disposal facilities to prevent environmental pollution,

c. Adequate dust control measure at the point of origin in the rice mills,

d. development of personal protective devices for constant use,

e. provision of fence and cover on the moving wheels for accident prevention,

f. Periodic environmental monitoring and environmental protection measures.

3. Legislative measures: these were concerned with different law and rules extended from establishment of industries to the personal safety for the workers. Enforcement of Factory Acts and other law would be helpful in solving the workers problems, thus indirectly put contribution in eliminating the symptom from the sufferers. These included

   a. Introduction of Operational guideline for establishment and operation of rice mills.

   b. Provision of medical, sickness, maternity, disability funeral expenses and rehabilitative allowance in the cases of all rice mills worker whom it necessary.

4. General measures: these included the facilities for promotion of workers and family health. The measures were

   a. Provision of food supply at affordable cost and establishment of cafeteria/ canteen at subsidized rate for improvement of nutritional status of the workers,

   b. Improve housing and residential facilities.

c. Education facilities for children and adult literacy program for worker that would bring social and mental development.

d. Medical and vocational rehabilitation programs for already disabled workers.

Chapter: 8

References

1 Government of Guyana. Operational Guidelines for Rice Mills / Factories. Environmental Protection Agency. Draft Document. December 2000 [cited 2009 Aug 17]. Available from: URL: http://www.sdnp.org.gy/epa/.

2 Government of India. Indian Kanoon [cited 2011 July 8]. Available from: URL: http://www.indiankanoon.org/doc/1617191/

3 Rice. Rice wikipedia [cited 2011 July 8]. Available from: URL: http://en.wikipedia.org/wiki/rice.

4 Parboiled rice. Parboiled rice wikipedia [cited 2011 July 8]. Available from: URL: http://en.wikipedia.org/wiki/Parboiled rice assessed

5 ISO. Air Quality - Particle Size Fraction Definitions for Health-related Sampling. ISO Standard 7708. International Organization for Standardization (ISO), Geneva 1995. In Hazard Prevention and Control in the Work Environment: Airborne Dust. WHO/SDE/OEH/99.14.

6 IUPAC. Glossary of atmospheric chemistry terms. International Union of Pure and Applied Chemistry, Applied Chemistry Division, Commission on Atmospheric Chemistry. Pure and Applied Chemistry .1990. 62. (11):2167-2219.]

7 Desai M R, Ghosh S K. Occupational exposure to airborne fungi among rice mill workers with special reference to aflatoxin producing A. Flavus strains. Ann Agric

Environ Med 2003, 10, 159-162.

8 Donham K. Hazardous agents in agricultural dusts and methods of evaluation. Am. J. Ind. Med 1986; 10:205-220.

9 Training Materials. Respiratory hazards. Hosta Task sheet 3.3. National tractor and machinery operation program. The Pennsylvania State University. Agricultural and Biological Engineering department. 2004.

10 Windish JP, Farant JP, Moore JP, Moore CF. Dust Hazards in Manitoba and Saskatchewan Country Grain elevators, report HHAW 73- 1, Ottawa,Health and Welfare Canada, 1973, p 7.

11 Lippmann M. Regional deposition of particles in the human respiratory tract. In Lee DHK, Murphy S (editors), Handbook of Physiology: Section IV, Environmental Physiology, 2nd edition. Philadelphia; Williams and Wilkins,. 1977. Pp. 213-232.].

12 Vincent JH. Aerosol Science for Industrial Hygienists. Oxford, UK: Pergamon/Elsevier; 1995. ISBN-0-08-042029-X.

13 Morrow PE. Dust overloading of the lungs: update and appraisal. Toxicology and Applied Pharmacology; 1992; *113:1*-12.]

14 Dr. Crist. Occupational Asthma (workplace induced) Types, symptoms, Causes [cited 2011 July 8]. Available from :URL: http://www.healthhype.com/occupational-asthma-workplace-induced-types-symptoms-causes.html.

15 Immune system. Immune system wikipedia [cited 2011 July 8]. Available from :URL: http://en.wikipedia.org/wiki/Immune_system.

16 Allergy. Allergy wikipedia [cited 2011 July 8]. Available from: URL: http://en.wikipedia.org/wiki/Allergy.

17 Wendel P, Dick H, Remco H. Decline in lung function related to exposure and selection processes among workers in the grain processing and animal feed industry. Occup Environ Med 1998;55:349–355

18 Huy T, de Schipper K, Chan-Yeung M. Grain dust and lung function. Dose-response relationships. Am Rev Respir Dis 1991; 144:1314–21.

19 Chan-Yeung M, Dimich-Ward H, Enarson A. Five cross-sectional studies of grain elevator workers. Am J Epidemiol 1992; 136:1269–79.

20 Pahwa P, Senthilselvan A, McDuffie HH. Longitudinal estimates of pulmonary function decline in grain workers. Am J Respir Crit Care Med 1994;150:656–62.

21 Smid T, Heederik D, Houba R. Dust and endotoxin related respiratory effects in the animal feed industry. Am Rev Respir Dis 1992; 146:1474–9.

22 Clapp WD, Becker S, Quay J. Grain dust-induced airflow obstruction and inflammation of the lower respiratory tract. Am J Respir Crit Care Med 1994;150:611–7.

23 Rylander R. Organic dusts and lung reactions exposure characteristics and mechanisms for disease. Scand J Work Environ Health 1985; 11:199–206.

24 Jacobs RR. Airborne endotoxins: an association with occupational lung disease. Appl Ind Hyg 1989;4:50–6.

25 Moira Chan Yeung, Mary JA, Stefan G. Grain dust and the lungs. C M A journal 1978 May 20; 118: 1271-74.

26 James L, Petra M, Eeva K, and John M. Global Burden of Disease and Injury Due to Occupational Factors. Epidemiology September 1999; 10(5): 626-631.

27 Manfreda J, Cheang M, Warren CP. Chronic respiratory disorders related to farming and exposure to grain dust in a rural adult community. Am J Ind Med 1989; 15(1):7-19.

28 Von Essen S, Fryzek J, Nowakowski B, Wampler M. Respiratory symptoms and farming practices in farmers associated with an acute febrile illness after organic dust exposure. Chest 1999 Nov; 116(5):1452-8.

29 Yach D, Myers J, Bradshaw D, Benatar SR. A respiratory epidemiologic survey of grain mill workers in Cape Town, South Africa. Am Rev Respir Dis 1985 Apr; 131(4):505-10.

30 Dopico GA, Reddan W, Tsiatis A, Peters ME, Rankin J. Epidemiologic study of clinical and physiologic parameters in grain handlers of northern United States. Am Rev Respir Dis 1984 Nov; 130(5):759-65.

31 Post W, Heederik D, Houba R. Decline in lung function related to exposure and selection processes among workers in the grain processing and animal feed industry. Occup Environ Med 1998 May; 55(5):349-55.

32 Cotton DJ, Graham BL, Li KY, Froh F, Barnett GD, Dosman JA.Effects of grain dust exposure and smoking on respiratory symptoms and lung function. J Occup Med 1983 Feb; 25(2):131-41.

33 Manfreda J, Holford-Strevens V, Cheang M, Warren CP. Acute symptoms following exposure to grain dust in farming. Environ Health Perspect 1986 Apr; 66:73-80.

34 Chan-Yeung M, Wong R, MacLean L. Respiratory abnormalities among grain elevator workers. Chest 1979 Apr; 75(4):461-7.

35 Dosman JA, Cotton DJ, Graham BL, Li KY, Froh F, Barnett GD. Chronic bronchitis and decreased forced expiratory flow rates in lifetime nonsmoking grain workers. Am Rev Respir Dis 1980 Jan; 121(1):11-6.

36 Skórska C, Mackiewicz B, Dutkiewicz J, Krysińska-Traczyk E, Milanowski J, Feltovich H, Lange J, Thorne P. Effects of exposure to grain dust in Polish farmers: work-related symptoms and immunologic response to microbial antigens associated with dust. Ann Agric Environ Med 1998; 5(2):147-53.

37 Schwartz DA, Thorne PS, Yagla SJ, Burmeister LF, Olenchock SA, Watt JL, Quinn TJ. The role of endotoxin in grain dust-induced lung disease. Am J Respir Crit Care Med 1995 Aug; 152(2):603-8.

38 Pahwa P, Senthilselvan A, McDuffie HH, Dosman JA. Longitudinal decline in lung function measurements among Saskatchewan grain workers. Can Respir J 2003 Apr; 10(3):135-41.

39 Ye TT, Huang JX, Shen YE, Lu PL, Christiani DC. Respiratory symptoms and pulmonary function among Chinese rice-granary workers. Int J Occup Environ Health 1998 Jul-Sep; 4(3):155-9.

40 Herbert FA, Woytowich V, Schram E, Baldwin D. Respiratory profiles of grain handlers and sedentary workers. Can Med Assoc J 1981 Jul 1; 125(1):46-50.

41 Corey P, Hutcheon M, Broder I, Mintz S. Grain elevator workers show work-related pulmonary function changes and dose-effect relationships with dust exposure. Br J Ind Med 1982 Nov; 39(4):330-7.

42 Chan-Yeung M, Ashley MJ, Grzybowski S. Grain dust and the lungs. Can Med Assoc J 1978 May 20; 118(10):1271-4.

43 Hogan DJ, Dosman JA, Li KY, Graham B, Johnson D, Walker R, Lane PR. Questionnaire survey of pruritus and rash in grain elevator workers. Contact Dermatitis 1986 Mar; 14(3):170-5.

44 Fonn S, Groeneveld HT, deBeer M, Becklake MR. An environmental and respiratory health survey of workers in a grain mill in the Johannesburg area, South Africa. Am J Ind Med 1993 Oct; 24(4):387-400.

45 doPico GA, Flaherty D, Bhansali P, Chavaje N. Grain fever syndrome induced by inhalation of airborne grain dust. J Allergy Clin Immunol 1982 May; 69(5):435-43.

46 Gimenez C, Fouad K, Choudat D, Laureillard J, Bouscaillou P, Leib E. Chronic and acute respiratory effects among grain mill workers. Int Arch Occup Environ Health 1995; 67(5):311-5.

47 Prakash S, Manjunatha S, Shashikala C. Morbidity patterns among rice mill workers: A cross sectional study. Indian J Occup Environ Med 2010 Sep; 14(3):91-3.

48 Prasanna Kumar GV, Dewangan KN, Sarkar A, Kumari A, Kar B. Occupational noise in rice mills. Noise Health 2008 Apr-Jun; 10(39):55-67.

49 Pradhan CK, Thakur S, Chowdhury AR. Physiological and subjective assessment of food grain handling workers in West Godavari district, India. Ind Health 2007 Jan;

45(1):165-9.

50 Singh SK, Nishith SD, Tandon GS, Shukla N, Saxena SK. Some observations on pulmonary function tests in rice mill workers. Indian J Physiol Pharmacol 1988 Apr-Jun; 32(2):152-7.

51 McCurdy SA, Ferguson TJ, Goldsmith DF, Parker JE, Schenker MB. Respiratory health of California rice farmers. Am J Respir Crit Care Med 1996 May; 153(5):1553-9.

52 Dosman JA, Graham BL, Hall D, Van Loon P, Bhasin P, Froh F. Respiratory symptoms and pulmonary function in farmers. J Occup Med 1987 Jan; 29(1):38-43.

53 Long W, Tate RB, Neuman M, Manfreda J, Becker AB, Anthonisen NR. Respiratory symptoms in a susceptible population due to burning of agricultural residue. Chest 1998 Feb; 113(2):351-7.

54 Golshan M, Faghihi M, Roushan-Zamir T, Masood Marandi M, Esteki B, Dadvand P, Farahmand-Far H, Rahmati S, Islami F. Early effects of burning rice farm residues on respiratory symptoms of villagers in suburbs of Isfahan, Iran. Int J Environ Health Res. 2002 Jun; 12(2):125-31.

55 Abu Sham'a F, Skogstad M, Nijem K, Bjertness E, Kristensen P. Lung function and respiratory symptoms in male Palestinian farmers. Arch Environ Occup Health 2010 Oct-Dec; 65(4):191-200.

56 Lim HH, Domala Z, Joginder S, Lee SH, Lim CS, Abu Bakar CM. Rice millers' syndrome: a preliminary report. Br J Ind Med 1984 Nov; 41(4):445-9.

57 Melbostad E, Eduard W, Magnus P. Chronic bronchitis in farmers. Scand J Work

Environ Health 1997 Aug; 23(4):271-80.

58 Senthilselvan A, Chénard L, Grover V, Kirychuk SP, Hagel L, Ulmer K, Hurst TS, Dosman JA. Excess longitudinal decline in lung function in grain farmers. J Agromedicine 2010 Apr; 15(2):157-65.

59 Korunic Z.Allergenic components of stored agro products. Arh Hig Rada Toksikol 2001 Mar; 52(1):43-8.

60 Alvarez MJ, Tabar AI, Quirce S, Olaguibel JM, Lizaso MT, Echechipia S, Rodriguez A, Garcia BE. Diversity of allergens causing occupational asthma among cereal workers as demonstrated by exposure procedures. Clin Exp Allergy 1996 Feb; 26(2):147-53.

61 Tse CS, Raghuprasad PK. Baker's asthma (grain-dust-induced asthma). Drug Intell Clin Pharm 1982 Jan; 16(1):14-8.

62 Kayaba H, Meguro H, Muto H, Kamada Y, Adachi T, Yamada Y, Kanda A, Yamaguchi K, Hamada K, Ueki S, Chihara J. Activation of eosinophils by rice-husk dust exposure: a possible mechanism for the aggravation of asthma during rice harvest. Tohoku J Exp Med 2004 Sep; 204(1):27-36.

63 Jayaraman P, Kalyanasundaram I. Natural occurrence of toxigenic fungi and mycotoxins in rice bran. Mycopathologia 1990 May; 110(2):81-5.

64 Jayaraman P, Kalyanasundaram I. Changes in moisture content, mycoflora and aflatoxin content of rice bran during storage. Mycopathologia 1994 May; 26(2):115-20.

65 Francesco Goletti. The Changing Public Role in a Rice Economy approaching Self-Sufficiency the Case of Bangladesh. Research report 1998. International Food Policy

Research Institute. Washington DC.]

66 Government of Bangladesh. Procurement division, Directorate of Food, Bangladesh [cited 2010 January 1]. Available from: URL: http://www.rice foundation – bd.org/ricedata/search rice mill.Phd.

67 Ijadunola KT, Erhabor GE, Onayade A A, Ijadunola MY, Fatusi AO, Asuzu MC. Prevalence of respiratory symptoms among wheat flour mill workers in Ibadan, Nigeria. Am J Ind Med 2004 March; 45(3): 251-9.

68 Bachmann M, Myers J E. grain dust and respiratory health in South African milling workers. Br J Ind Med 1991 Oct; 48(10): 656-62.

69 Becklake M, Border I, Chan-Yeung M, Dosman JA, Ernst P, Herbert FA, Kennedy SM, Warren PW. Recommendations for reducing the effect of grain dust on the lungs. Canadian Thoracic Society Standards Committee. CMAJ 1996 Nov. 15; 155(10): 1399-403.

70 G O B. Developmental project in Agro based industry. Bangladesh Occupational Safety, Health and Environment Foundation. Specialized Labor Foundation [cited 2009 April]. Available from URL: http://www. oryza-Asia Bangladesh.Report.htm.

71 Average height around the world. Wikipedia [cited 2009 Sept 8]. Available from: URL: http://en.wikipedia.org/wiki/Body_height.

72 Zaman M M and Rouf M A. Prevalence of hypertension in a Bangladeshi adult population. Journal of Human Hypertension 1999; 13: 547-49.

73 World Bank. Curbing the epidemic: Governments and the economics of tobacco control. Washington DC: The World Bank; 1999. In Khan MM, Khan A, Kraemer

A, Mori Mitsun. Prevalence and correlation of smoking among urban adult man in Bangladesh: slum versus non-slum comparison. BMC Public Health 2009; 9: 149. [cited 2009 Sept]. Available from: URL: http://biomedcentral.com/1471-2458/9/149.

74 Gavin A: Smoking is a major cause of premature death worldwide. Evidence-based Healthcare 2004; 8:95-96.

75 Ezzati M, Lopez AD: Estimates of global mortality attributable to smoking in 2000. Lancet 2003; 362:847-852.

76 Efroymson D, Ahmed S, Townsend J, Alam SM, Dey AR, Saha R, Dhar B, Sujon AI, Ahmed KU, Rahman O. Hungry for tobacco: an analysis of the economic impact of tobacco consumption on the poor in Bangladesh. Tobacco Control 2001; 10:212-217.

77 Prevalence of smoking by country the world. [cited 2009 Sept 7] Available from:URL: http://encarta.msn.com/media_701500668/Prevalence_of_Smoking_by_Country_in_the_World.html.

78 Khan Md Mobarak Hossain, Khan Aklimunnessa, Kramer Alexander and Mori Mitsuru. Prevalence and correlates of smoking among urban adult men in Bangladesh: slum versus non-slum comparison. B M C Public Health 2009; 9: 149-57.

79 Choudhury K, Hanifi SMA, Mahmood SS, Bhuiya A: Sociodemographic characteristics of tobacco consumers in a rural area of Bangladesh. J Health Popul Nutr 2007; 25:456-464.

80 Khan MMH, Khandoker A, Kabir MA, Kabir M, Mori M: Tobacco consumption and its association with illicit drug use among men in Bangladesh. Addiction 2006; 101:1178-1186

81 Rahman M, Fukui T: Bidi smoking and health. Public Health 2000; 114:123-127.

82 Rice mills workers allege inhuman condition. The Hindu. Tamil Nadu Chennai. [Online edition of India's National News paper]. 2004 Sept 22 [Wednesday].

83 Awad el Karim M A, Gad el Rab MO, Omer A A, el Haimi Y A. Respiratory and allergic disorders in workers exposed to grain and flour dusts. Arch. Environ Health 1986 Sep-Oct; 41 (5): 197-301.

84 Armentia A, martinez, castrodeza R, Martinez J, Jimeno A, Mendez J, Stolle R. Occupational allergic disease in cereal workers by stored grain pests. J Asthma 1997; 34(5): 369-78.

85 Bachmann M, Myers J E. grain dust and respiratory health in South African milling workers. Br J Ind Med 1991 Oct; 48(10): 656-62.

86 DoPico GA, Reddan W, Flaherty D, Tsiats A, Peters ME, Rao P, Rankin J. Respiratory abnormalities among grain handlers: a clinical, physiologic, and immunologic study. Am rev respir Dis 1977 June; 115(6):915-27.

87 Warren CP, Manfreda J. respiratory symptoms in Manitoba farmars: association with grain and hay handling. Can Med Assoc J 1980 Jun 7;122(11):1259-64.

88 Cookson W O, Ryan G, Mac Donald S, Musk A W. Atopy, non-allergic branchial reactivity, and past history as determinants of work related symptoms in seasonal grain handlers. Br J Ind Med 1986 June; 43(6): 396-400.

89 Deacon SP, Paddle GM. Respiratory symptoms and ventilatory performance in workers exposed to grain and grain based food dusts. Occup Med (Lond) 1998 May; 48(4):227-30.

90 Cotton D J, Graham B L, Li K Y, Froh F, Barnett G D, Dosman J A. Effect of grain dust exposure and smoking on respiratory symptoms and lung function. J Occup Med 1983 Feb; 25(2): 131-41.

91 Cotton D J, Graham B L, Li K Y, Froh F, Barnett G D, Dosman J A. Effects of smoking and occupational exposure on peripheral airway function in young cereal grain workers. Am Rev Respir Dis 1982Oct; 126(4): 660-5.

92 Bem Stein I L, Chan-Yeung M, Berstein D I, eds. Asthma in work place. New York. Marcl Dekker Inc.1999.

93 James A L, Cookson WO, Butters G, Lewis S, Rvan G, Huckey R, Musk AW. Symptoms and longitudinal changes in lung function in young seasonal grain handlers. Br J Ind Med 1986 Sept; 43 (9):587-91.

94 Monso F, Magarlos R, Radon K, Danuser B, Iversen M, Weber C, Oprad U, Donham K I, Nowak D. Respiratory symptoms of obstructive lung disease in European crop farmers. J Respir Crit Care Med 2000 Oct; 162(4 pt 1):1246-50.

95 Broder I, Hutcheon MA, Mintz S, Davies G, Leznoff A, Thomas P, Corey P. Changes in respiratory variables of grain handlers and civic workers during their initial months of employment. Br Ind Med 1984 Feb; 41(1):94-9.

Appendix A 1-

Table 21: Profile of the respondents suffering from the symptom of fungal infection.

Characteristics	Number of respondents					
	Sex				Total	
	Male		Female			
	No	%	No	%	No	%
A. Age in years						
18-27	0		1	100.0	1	100.0 [05.3]
28-37	3	30.0	7	70.0	10	100.0 [52.7]
38-47	2	50.0	2	50.0	4	100.0 [21.0]
48-57	2	50.0	2	50.0	4	100.0 [21.0]
Total	7	36.8	12	63.2	19	100.0
B. Working section						
PBDS +	4	25.0	12	75.5	16	100.0 [84.1]
HFS ++	1	100.0			1	100.0 [05.3]
LSS +++	1	100.0			1	100.0 [05.3]
More than one	1	100.0			1	100.0 [05.3]
Total	7	36.8	12	63.2	19	100.0
C. Duration of employment in years						
1	1	33.3	2	66.7	3	100.0 [15.8]
2-3	2	25.0	6	75.0	8	100.0 [42.1]
≥ 4	4	50.0	4	50.0	8	100.0 [42.1]
Total	7	36.8	12	63.2	19	100.0
D. Site of fungal infection:						
On the body	7	50.0	7	50.0	14	100.0 [73.7]
On the limbs	0		5	100.0	05	100.0 [26.3]
Total	7	36.8	12	63.2	19	100.0

+ PBDS = Parboiling and drying section
++ HFS = Husking and fanning section
+++ LSS = Loading and storage section

Mean age [both sex combined]= 38.53 ± 8.21 years.
Mean age [male] = 41.14 ± 7.24 years.
Mean age [female] = 37.0 ± 8.66 years.

Mean duration of work (both sexes combined) = 4.40 ± 3.70 years.
Mean duration of work (male) = 3.93 ± 2.05 years
Mean duration of work (female) = 4.67 ± 4.46 years

Mean duration of suffering
[both sexes combined] = 1.80 ± 0.54 years
Mean duration suffering [male] = 2.07 ± 1.30 years
Mean duration suffering [female] = 1.48 ± 0.98 years

Table 21 described profile of the respondent suffering from the fungal infection. Nineteen workers reported about the fungal skin on their body. Majority [12(63.2%)] sufferers were the female and most prevalent [10(52.7%)] age group was 28-37 years with female predominance [7(58.3%)]. More than three fourth [16 (84.1%)] of the respondents worked in PBDS that included all the female suffers. Majority [6(50.0%)] of the female were in rice mill job for 2 years but major section [4(57.1%)] of male were working there for $\geq$ 4 years. Mean suffering duration in male are longer than female. Majority [14(73.7%)] of the infection was on the trunk (body) skin Only 5 female respondents showed infection on their limbs skin.

Appendix A 2-

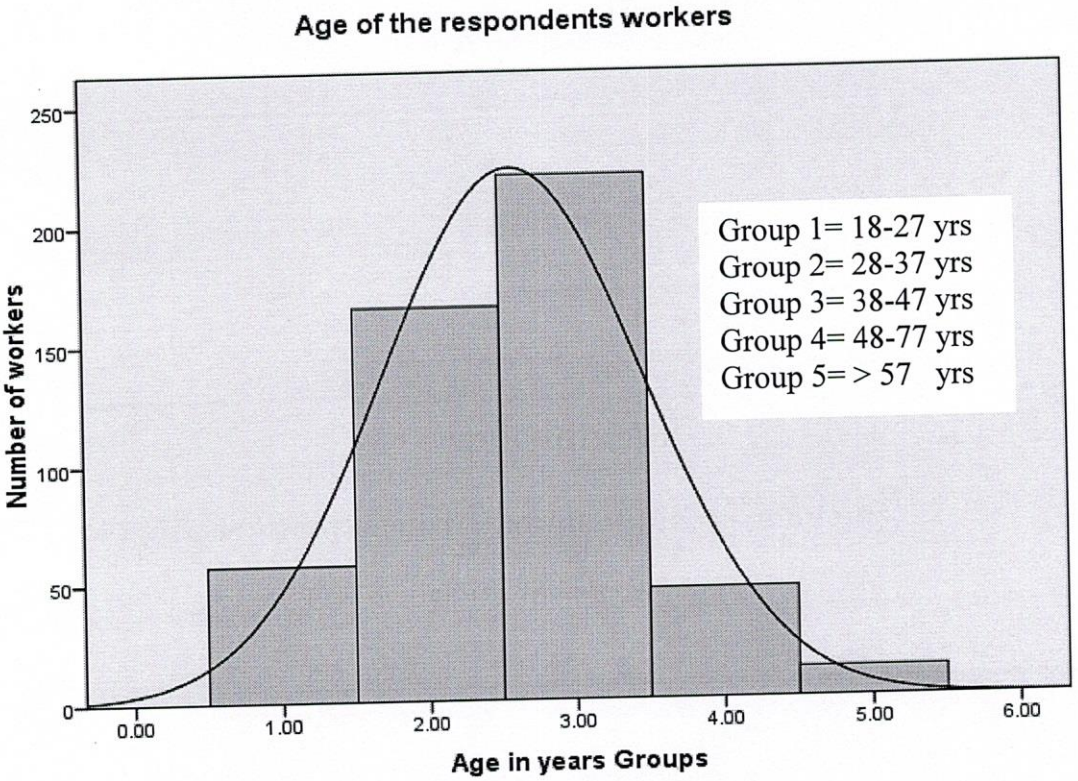
Table 22: Qualifying factors for aggravation of symptom of fungal infection among the sufferers.

Qualifying characteristics	Number of respondents						
	Sex				Total		
	Male		Female				
	No	%	No	%	No	%	P value
A. Period of symptom aggravation in the year							
Working load	1	100.0	0	00.0	1	100.0 [05.3]	
Perennial	3	42.9	4	57.1	7	100.0 [36.8]	
Irregular	3	27.3	8	72.7	11	100.0 [57.9]	
Total	7	36.8	12	63.2	19	100.0	
B. Season of symptom aggravation							
Winter	1	50.0	1	50.0	2	100.0 [10.5]	
Summer	5	41.7	7	58.3	12	100.0 [63.2]	
Always	1	20.0	4	80.0	5	100.0 [26.3]	
Total	7	36.8	12	63.2	19	100.0	
C. Daily time of aggravation							
During work	0	00.0	3	100.0	3	100.0 [15.8]	
Night	6	66.7	3	33.3	9	100.0 [47.4]	
Always	1	14.3	6	85.7	7	100.0 [36.8]	
Total	7	36.8	12	63.2	19	100.0	

Table 22 described the factors related with aggravation of the symptoms. Majority [12(63.2%)] of the respondents and of both sexes [male 5, 71.4% and female 5, 71.4 %] mentioned that the itching symptom increased during the summer. Majority [6(85.7%)] of the male respondents described increase itching at night.

Appendix A 3-

Figure 1:Age wise distribution of the respondents



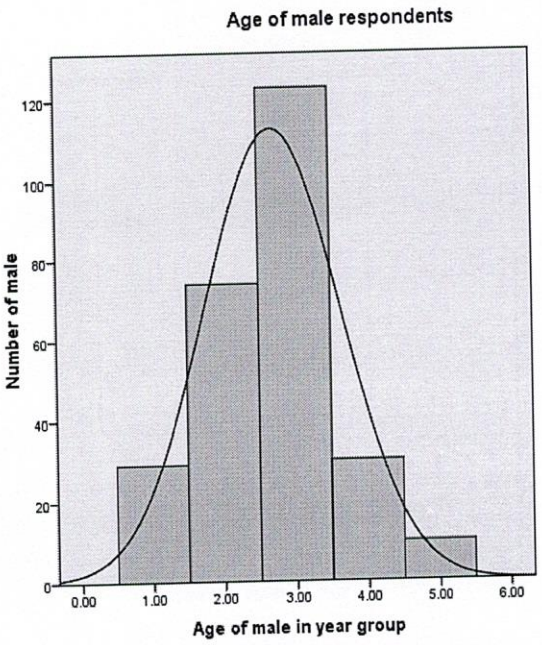


Figure 2: Age wise distribution of male workers

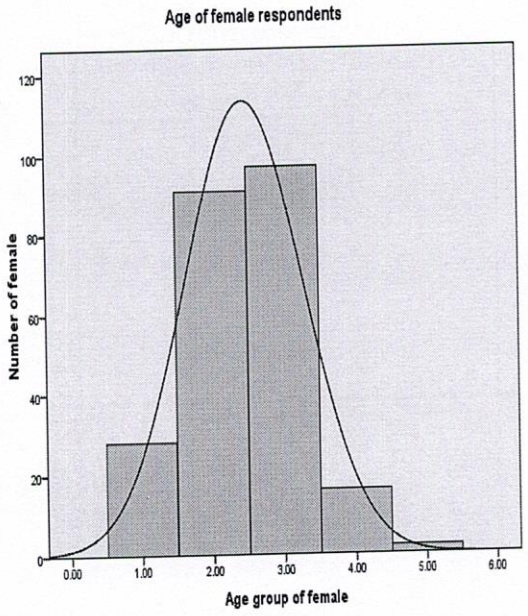


Figure 3: Age wise distribution of female workers

Appendix A 4-

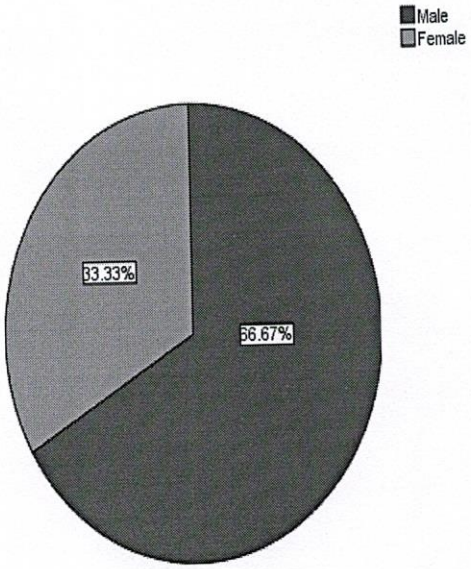


Figure 4: Distribution of respondents suffering from cough symptom

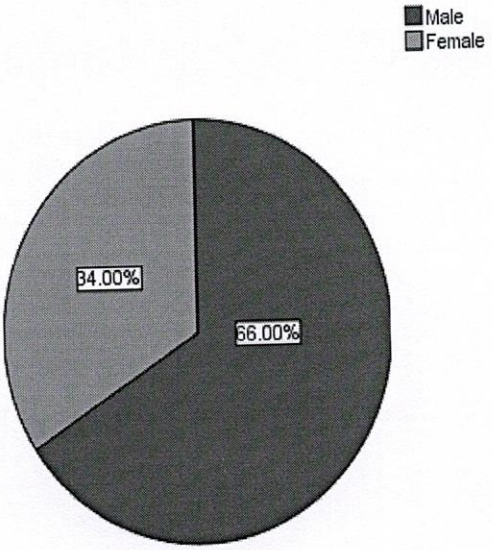


Figure 5: Distribution of respondents suffering from dyspnoea

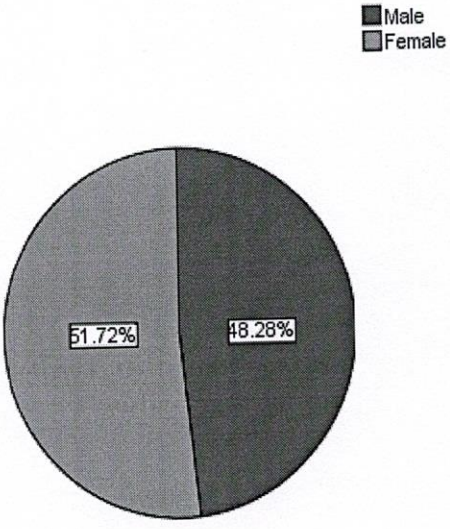


Figure 6: Distribution of respondents suffering from wheezing symptom

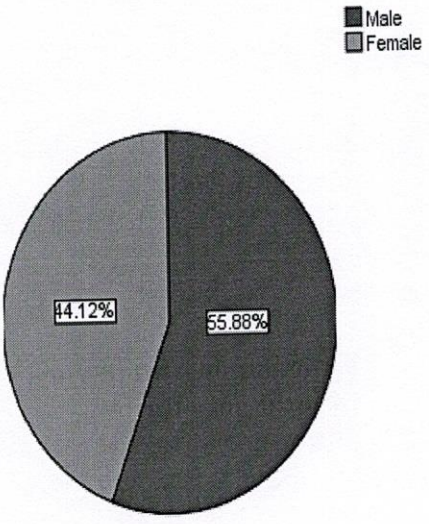


Figure 7: Distribution of respondents suffering from rhinitis symptom

Appendix A 5-

RESPIRATORY PROBLEMS AMONG RICE MILL WORKERS IN BANGLADESH.

QUESTIONNAIRE

1. CODE No.....

Name of Rice Mill.....Address..... Telephone No..... Mobile.....

Day of data collection .....Date .....Time.....

Instruction: Please encircle the serial number of correct answer on the right side while talking during in-depth interview. Do not fill the computer code boxes at the bottom.

PART-I

PERSONAL DATA

Name of the worker .....

2. Age in Years .....

3. Sex 1. Male 2. Female

4. Marital Status 1. Married 2. Unmarried 3. Divorced 4. Separated 5. Widow 6. Widower

5. Work in Section: of mill
1.Soaking, Boiling & Drying
2. Husking, crushing & Fanning
3. Loading & storage
4.Works in more than one sections

6. Total duration of employment in Rice mill.....years

7. Nature of Employment 1. Seasonal 2. Perennial 3. Casual 4. Other

8. Daily working period.....hours

9. Home District of the worker .....

10. Past Employment 1. Agri-Laborer 2. Dusty job 3. Rickshaw /van driving 4. Laborer 5. First employment 6. Other

1	**2**	**3**	**4**	**5**
6	**7**	**8**	**9**	**10**

PART-II

A. CHRONIC HEALTH PROBLEMS

11	Cough	1. Yes	2. No	**12.** Duration of cough .....Years
13.	Wheezing	1. Yes	2. No	**14.**Duration of wheezing .....Years
15.	Breathlessness	1. Yes	2. No	**16.** Duration of breathlessness .....Years
17.	Rhinitis	1. Yes	2. No	**18.** Duration of rhinitis .....Years
19.	Conjunctivitis	1. Yes	2. No	**20.** Duration of conjunctivitis .....Years
21.	Eczema skin	1. Yes	2. No	**22.** Duration of eczema skin .....Years
23.	Fungal infection of skin on body	1. Yes	2. No	**24.** Duration of fungal skin .....Years
25.	Fungus in finger & toes space	1. Yes	2. No	**26.** Duration of nail toe fungus.....Years
27.	Backache	1. Yes	2. No	**28.** Duration of backache .....Years

B. Acute Health Problems Developed During OR Immediate after Work

29.	Facial warmth	1. Yes	2. No
30.	Headache	1. Yes	2. No
31.	Malaise	1. Yes	2. No
32.	Myalgia	1. Yes	2. No
33.	Feverish sensation	1. Yes	2. No
34.	Chilliness	1. Yes	2. No
35.	Throat Burning sensation	1. Yes	2. No
36.	Chest Tightness	1. Yes	2. No

11	**12**	**13**	**14**	**15**
16	**17**	**18**	**19**	**20**
21	**22**	**23**	**34**	**25**
26	**27**	**28**	**29**	**30**
31	**32**	**33**	**34**	**35**
36				

PPART-III

A. COUGH: Qualification of cough

37. Nature of Cough — 1. Non-Productive (Dry Cough) 2. Productive (Cough with Phlegm)

38. Color of Phlegm — 1. Yellow 2. White 3. Blackish 4. No phlegm

39. Period of Symptoms — 1.During working Season 2. Perennial 3. Irregular

40. Aggravation Season — 1. Winter 2. Summer 3. Monsoon 4. Always

41. Time of onset of symptoms — 1. Late night 2.Early Morning 3. Early work 4. Afternoon 5. Evening 6. Early Night 7. Always

B. Breathlessness: Qualification of breathlessness

42 Breathlessness — 1. With wheezing 2.Without wheezing 3. Exertional

43. Period of Symptoms — 1. In working Season 2. Perennial 3. Irregular

44. Aggravation Season — 1. Winter 2. Summer 3. Monsoon 4. Always

45. Time of onset of symptoms — 1. Late night 2. Early Morning 3. Starting early Work 4. Afternoon during work 5. Evening 6. Early Night 7. Always

C. Rhinitis: Qualification of Rhinitis

46. Nature of Symptoms — 1. Running Nose 2.Itchiness of Nose 3. Sneezing 4. Stuffiness of Nose

47. Period of Symptoms — 1. During working Season 2. Perennial 3. Irregular

48. Aggravation Season — 1. Winter 2. Summer 3. Monsoon 4. Always

49. Time of onset of symptoms — 1. Late night 2. Early Morning 3. Starting early work 4. Afternoon during work 5. Evening 6. Early Night 7. Always

37	**38**	**39**	**40**	**41**
42	**43**	**44**	**45**	**46**
47	**48**	**49**		

D. CONJUNCTIVITIS: Qualification of Conjunctivitis

50. Nature of Symptoms 1.Watering eyes 2.Redness of eyes 3. Irritation 4. Swelling of inner lids

51. Period of Symptoms 1. During working Season 2. Perennial 3. Irregular

52. Aggravation Season 1. Winter 2. Summer 3. Monsoon 4. Always

53. Time of onset of symptoms 1. Late night 2. Early Morning 3. Starting early work 4. Afternoon during work 5. Evening 6. Early Night 7. Always

E. ECZEMA: Qualification of eczema

54. Site of Occurrence 1. Leg 2. Hand 3. Trunk 4. Genitalia 5. More than one sites

55. Period of Symptoms 1. During working Season 2. Perennial 3. Irregular

56. Aggravation Season 1. Winter 2. Summer 3. Monsoon 4. Always

57 Time of onset of itching symptoms 1. Late night 2. Early Morning 3. Starting early work 4. Afternoon during work 5. Evening 6. Early Night 7. Always

F. FUNGAL infection of skin, Toes and Fingers spaces: Qualification

58. Site of Occurrence 1. Body Skin 2. Toes space 3. Finger Space 4. Genitalia 5. Toes Nail 6. Fingers Nail

59. Period of Symptoms 1. During working Season 2. Perennial 3. Irregular

60. Aggravation Season 1. Winter 2. Summer 3. Monsoon 4. Always

61. Time of causing more trouble 1. Late night 2. Early Morning 3. Starting early work 4. Afternoon during work 5. Evening 6. Early Night 7. Always

50	**51**	**52**	**53**	**54**
55	**56**	**57**	**58**	**59**
60	**61**			

PART-IV

A. OTHER CHEST ILLNESS DIAGNOSED BY Physical examination and by Stethoscope

62.	Heart Trouble	1. Yes	2. No
63.	Asthma (Typical)	1. Yes	2. No
64.	Consolidation of Lung	1. Yes	2. No
65.	Ronchi	1. Yes	2. No
66.	Crepitation	1. Yes	2. No
67.	Effusion	1. Yes	2. No
68	Other Chest Finding if any	1. Yes	2. No

B. Blood Pressure Recording

69. Systolic Blood Pressure: .....mm Hg

70. Diastolic Blood Pressure: .....mm Hg

C. Anthropometry:

71. Height .....centimeter.

72 Weight .....Kg.

D. Spirometry: Lung function tests

73. FVC : .....

74. FEV1:.....

75. FEV1 / FVC X100 =.....

76. PEFR:.....

62	**63**	**64**	**65**	**66**
67	**68**	**69**	**70**	**71**
72	**73**	**74**	**75**	**76**

E. Skin Inspection:

77. Skin condition including any ulcer clinically diagnosed

1. Bacterial Ulcer, 2. Clear skin 3. Scabies infection

F. SMOKING HABIT

78. Do you smoke? 1. Yes 2. No

79. Nature of smoking 1. Regularly 2. Irregularly 3. Non-Smoker

80. Number of sticks smoked daily .....sticks 99. Non-Smoker

81. Material of smoke 1. Bidi 2. Cigarette 3. Ganja 4. Non-smoker

82. Habit of Addiction 1. No 2. Alcohol or Bangla (Local made) 3. Heroin 4. Ganja

G. HARASHMENT AT WORKING PLACES

83. Ever Harassed verbally 1. Yes 2. No 3. Frequently 4. No response

84. Ever Harassed Physically. 1. Yes 2. No 3. Frequently 4. No response

85. Ever Harassed Sexually 1. Yes 2. No 3. Frequently 3. No response

86. Harassed by 1. Owner 2. Manager 3. Colleague 4. Other 5. Not harassed

Signature of Data Collector
Date.....

77	**78**	**79**	**80**	**81**
82	**83**	**84**	**85**	**86**