

**Prevalence of Respiratory Disorders and Occupational Health  
among Workers in Textile Industries and Developing Protective  
Measures**

**Final Technical Report Major Research Project Submitted To The  
University Grants Commission New Delhi**

(F.41-671/2012(SR) 23.07.2012)

**By**

**R.I. Sathya  
Professor of Home Science  
Principal Investigator  
Department of Home Science  
The Gandhigram Rural Institute –Deemed to be University,  
Gandhigram, Dindigul District,  
Tamil Nadu.**

## Acknowledgement certificate

I wish to thank the University Grants Commission, New Delhi for the financial assistance to carry out this work sanction letter (F.41-671/2012(SR) 23.07.2012).



Dr. R.I.SATHYA

(Principal Investigator)

Dr.(Mrs) R.I. SATHYA, M.Sc., M.Phil., Ph.D.,  
Professor  
Department of Home Science  
Gandhigram Rural Institute  
(Deemed to be University)  
Gandhigram - 624 302, Dindigul Dt. Tamilnadu.

## Contents

	<b>Annexure</b>	<b>Page.no</b>
Proforma of the final report	I	1
Objectives and achievements of the		
Project work	II	2
Summary of the findings	III	43
Evaluation certificates	IV	46
Utilization certificate	V	48

## **Final report of the work done on the major research report**

**(2012-2015)**

1. Project report no : Final
2. UGC reference no : F.41-671/2012(SR)
3. Period of report : 2012-2015
4. Title of the research project : **“Prevalence of Respiratory Disorders and Occupational Health Among Workers in Textile Industries and Developing Protective Measures”**
5. Name of the principal investigator : Dr.R.I.Sathya
  - a) Department : Home Science
  - b) University where work has progressed : Gandhigram Rural Institute  
Deemed to be University
6. Effective date of Starting of the project : 23.07.2012
7. Grant approved and expenditure incurred during the period of the report:
  - a) Total amount approved : **Rs 7,00,000/-**
  - b) Total expenditure : **Rs. 4, 58,901/-**  
**(Utilization certificate enclosed)**
  - c) Report of the work done : Enclosed
    - i) Brief objective of the project
    - ii) Work done so far and the results achieved and publications if any resulting from the work(Give the details of the papers name of the journals which it has been published or accepted for the publication) :Not applicable
    - iii) Has the progress been according to original plan of work and towards achieving the objective: Yes
    - iv) Please indicate the difficulties if any, experienced, implementing the project: Enclosed



v) If the project has been completed please enclose the summary of the findings of the study. One bound copy of the final report of work done may also be sent the University grants commission.

vi) Any other information which would help in evaluation of the work done on the project. At completion of the project first report should indicate the output such as a) Manpower trained b) Ph.D awarded c) Publication of results

**PRINCIPAL INVESTIGATOR**

**Dr. (Mrs) R.I. SATHYA, M.Sc., M.Phil., Ph.D.,**  
*Professor*  
Department of Home Science  
Gandhigram Rural Institute  
(Deemed to be University)  
Gandhigram - 624 302. Dindigul Dt. Tamilnadu.

**REGISTRAR** 21/1/2020  
**REGISTRAR**  
Gandhigram Rural Institute  
(Deemed to be University)  
Gandhigram-624 302.  
Dindigul Dist, Tamilnadu.



**Annexure-I**

**Proforma for submission of information at the time of sending the final report of the work done on the project**

1. Title of the project : "Prevalence of Respiratory Disorders and Occupational Health among Workers in Textile Industries and Developing Protective Measures"
2. Name and address of the principal Investigator: Dr.R.I.Sathya, Professor,  
Department of Home science  
Gandhigram Rural Institute –Deemed to Be University, Gandhigram – 624 302
3. Name and address of the institute : Gandhigram Rural Institute – Deemed to be University, Gandhigram – 624 302,  
Dindigul District, Tamil Nadu.
4. UGC approval letter No. and Date : F.41-671/2012(SR) 23.07.2012
5. Date of implementation : 23.07.2012
6. Tenure of the project : Three Years 2012 – 2015
7. Total grant allocated : Rs 7,12,500/-
8. Total grant received : Rs 5, 00,000/-
9. Final expenditure : Rs. 4, 58,901/- (Utilization certificate Enclosed)
10. Objectives of the project : Annexure II
11. Whether objectives were achieved : Annexure II
12. Achievement from the project : Annexure II
13. Summary of the findings : Annexure III
14. Contribution to the society : Annexure III
15. Whether any Ph.D enrolled/ produced out of the project : No
16. No of publications out of the project : Nil

  
**PRINCIPAL INVESTIGATOR**

Dr.(Mrs) R.I. SATHYA, MSc., M.Phil., Ph.D.,  
Professor  
Department of Home Science  
Gandhigram Rural Institute  
(Deemed to be University)  
Gandhigram - 624 302, Dindigul Dt. Tamilnadu.

1

  
**REGISTRAR**  
REGISTRAR  
Gandhigram Rural Institute  
(Deemed to be University)  
Gandhigram-624 302,  
Dindigul Dist, Tamilnadu.

### **i) Brief objectives of the project**

- The prevalence of general and respiratory symptoms among workers in industries.
- To create workers awareness and public attention.
- To identify the the proper implementation of health and safety measures.
- To develop appropriate protective clothing or other measures.
- To experiment with the techniques by pre and post studies on the usage of simple techniques.
- To evaluate and modify the limitations in design and shape, size and to improve its comfortable use.

### **Introduction**

India is the second-largest cotton producing country in the world next to china. In the cotton industry, nearly 20 million people were working in the industry. The textile processing sector is one of the most important sectors of the textile industry, with regard to production, export and labor force employment. A cotton mill is one of the factories of houses spinning and weaving machinery. Typically built between 1775 and 1930, mills spun cotton which was an important product during the industrial revolution (Jack Mack Faragher 2012).

The idea of occupational health has developed from the work-related ailments occupational health broadly means any injury, impairment is the disease affecting a worker during his course of employment. It also referred to as the identification and control of the risk arising from physical, chemical and other workplace hazards to establish and maintain a safe and healthy environment. Occupational safety and health are about making the physical condition of work safe, thereby preventing short or long term illness the major occupational disorder is respiratory problems, ergonomic disorder musculoskeletal disorder and psychological stress (National Institute of Environmental Health Science 2014).

## **Review of literature**

### **1.1 Cotton Industry Workers' Health Problem**

Cotton industry workers are exposed to various hazardous in the different departments of the textile factories in the spinning and weaving section which play a role in the high incidence of industrial health hazards. The effect of the cotton dust that is produced at the textile mills on the health of the workers. Cotton dust is defined as the dust generated into the atmosphere through the handling and processing of cotton. The dust is produced through the process of fabric production of yarn through to weaving or knitting into the fabric. This dust is a very complex mixture that includes the ground-up plant moisture, cotton fiber, bacteria, fungi soil, or pesticides. Dust can cause explosions. Cotton dust is a colorless, odorless, solid when breathed in, irritates lungs and cause adverse health effects. Workers are exposed to cotton dust particles which are in the sizes from 0.1 to 150 microns. The particles more than 10 microns settle down from the air rapidly while smaller particles smaller than 5 microns are directly inhaled to lungs and are retained there. This fraction of dust is called respirable dust and is mainly responsible for respiratory diseases (Prabhakara Rao et al 2013).

Inhalation of cotton dust causes the release of histamine from mast cells. Histamine acts on the smooth muscles resulting in bronchitis constriction airway mucus glands secrete some more amount of mucus in the presence of histamine. Histamine directly stimulates vagal nerves causing smooth muscles of airways to reduce the air entry into the lungs (Prabhakara Rao 2013).

A pulmonary disease is a group of lung diseases called chronic obstructive pulmonary diseases. The common types are chronic bronchitis lasting for three or more months of the year and recurring year after year. Asthma is an allergic type of response that causes airways to swell and become narrow. Increased mucus cause wheezy whistle sound to breathing. Emphysema is the destruction of delicate walls between tiny air sacs in the lungs. There is no way to repair the destroyed air sacs. (U.S Department of health human services 1988)

### **1.2 OSHA Guidelines**

OSHA has laid down a cotton dust standard with a view of reduction of the exposure of the workers to cotton dust and protecting them from the risk of byssinosis. It has set up Permissible Exposure Limits (PEL's) for cotton dust for different operations in the textile industry. Standard measures have helped bring down the rate of occurrence of byssinosis significantly for an eight



hours, the OSHA cotton standard has been resolute at 200 micrograms of cotton per cubic meter of air in case of yarn manufacturing, 500 micrograms in case of textile waste houses, 750 micrograms in case of weaving operation and 1000 micrograms in case of for waste recycling (OSHA guidelines for cotton dust 1988). To reduce the diseases associated with cotton dust exposure, the following measures have been implemented. usage of exhausts to increase ventilation, wetting procedures to decrease aerosols, sampling of work done to determine the amount of cotton dust in the environment for every six months, regular health checkups and providing masks (Prabhakararao 2013).

Occupational health interview and physical examination should be performed at regular intervals. Additional examinations are done if a worker has symptoms that attributed to exposure to cotton dust medical screening biological monitoring test should be directed at identifying an excessive trend in the physiological functions of the respiratory break as compared to the baseline status of the individual and procedure worker. The test should be standardized, questionnaires pre and post-shift tests of lung function, chest x-ray. The medical, environmental, occupational interviews the physical examinations K, and selected physiologic and laboratory tests which were conducted with the time of placement should be repeated time of job transfer are termination. Because occupational exposure to cotton dust make causes diseases of prolonged induction lateness the need for medical surveillance may extend well beyond the termination of employment (OSHA guidelines for cotton dust).

### **1.3 Protective Measures**

A mask is a device designed to protect the wearer from inhaling harmful dust, fumes, vapor or gases. It comes in a wide range of types and sizes and it ranges from cheaper, single-use, disposal mask, it is and protective equipment which should be used by the employees of the textile industry the mask which is mostly used is non woven anti-dust mask. The usage of respirator or mask is the preferred or important of controlling worker exposure to dust. It should not normally be used as the only means of protecting or minimizing exposure during routine operations. A respiratory protection program should include a minimum evaluation of the workers' ability to perform the work while wearing a mask, fit testing, maintenance, etc (OSHA). Therefore the proper wearing of a mask and worker education are easier, more effective, and less expensive methods than instituting local exhaust system and total ventilators technical, psychological and social factors are associated with whether or not workers wear, therefore,

improvements in mask type, mask fitness, and worker education addressing these factors helps to reduce the risks (yokotakemura et al 2008).

## **1.4. Objectives**

- To create workers' awareness and public attention.
- To identify general and respiratory symptoms among workers in industries.
- To develop appropriate protective clothing or other measures.
- To ensure the proper implementation of health and safety measures.
- To experiment with the techniques by pre and post studies on the usage of simple techniques.
- To evaluate and modify the limitations in design and shape, size and to improve its comfortable use.

## **2. Material and Methods**

The methodology of the project about “**Prevalence of Respiratory Disorders and Occupational Health among Workers in Textile Industries and Developing Protective Measures**” is discussed as follows

### **2.1 Planning and Preparatory Phase:**

2.1.1. Selection of the area for the study

2.1.2 Selection of the samples

2.1.3. Method of data collection

### **2.2 Second Survey**

2.2.1 Data Analysis

2.2.2 Risk factor Analysis

### **2.3 Designing Protective Clothing Materials**

2.3.1. Selection of Fabric

2.3.2. Preparation of Fabric

2.3.3. Selection of Herbal

2.3.4. Designing and developing a Face Mask

2.3.5. Assessment of the Treated Fabric

2.3.6. Analysis for Antimicrobial test

## **2.4. Evaluation and Research Report –**

### **2.1 Planning and Preparatory Phase**

#### **2.1.1 Selection of the Area for the Study**

The area selected for the study was Vedasenthur, Chinnalapatti, Gandhigram and the outskirts of Dindigul. All small and tiny units like spinning, printing, dyeing, weaving, and processing units were concentrated for the study.

#### **2.1.2 Selection of the Sample**

A sample is “a smaller (but hopefully representative) set of units from a population used to determine accuracy about that population” The selection of the respondents has represented the total population and as possible to produce a miniature cross-section on. The selected respondents comprise what is technically called ‘Sample’ and the selection process is called “Sampling technique”

**Sampling Technique:** Simple random sampling is used for selecting the samples from the available workers. All units were chosen purposefully.

**Simple Random Sampling:** A simple random sample is a subset of individuals (a sample) chosen from a larger set (a population). In each sample is selected randomly, such that each sample has the same probability of being chosen at any stage during the sampling process, and each subset of individuals has been the same probability of being chosen for the sample. This process and method are known as simple random sampling. The survey had been conducted with employees in the Textile units located in the selected area. The size of the sample collected is 500 randomly.

#### **2.1.3 Method of Data Collection**

The pilot study was conducted before the actual study and by visiting the textile units one by one. Each day was spent among the samples by interviewing with the prepared questionnaire. The samples were responded with the clarification of the investigator. The data was collected for about five months without affecting the regular work – break time, lunchtime like free hours the investigator did the data collection. Some of the industries' permission was not given to meet the workers in working environments. Hence, the samples were met at out of their units. Per day two shift system of eight hours, study. During their off (Rest Time) some of the respondents were not cooperative due to their discomfort of the location. To get the data, they felt they were disturbed during their timings.



## **2.2. Second Survey**

The prevalence of respiratory risks had been determined by spirometry tests to show occupational-related health issues. Concerning the prevalence of respiratory disorder, the data pooled from the earlier survey was not able to predict the problems. Due to the timing of shift system, availability and cooperation the ‘spirometer’ test were not conducted in their work environment. Based on the fund availability, a medical examination with a qualified physician the pulmonary test has to be conducted to distinguish between temporary irritations and more serious lung pathology.

### **2.2.1. Data Analysis**

The collected data were edited, coded and tabulated for presenting the same in the desired format. Both one-way and two-way tables were used. Simple statistics like total and percentage (%) age have been used for presenting the findings.

### **2.2.2 Risk Factors**

**Within the availability of the fund, the PI engaged a ‘spirometer’ lab technician and the test was carried out** (at that day the available workers the tests had been carried out in a commonplace).

The pulmonary function test is an evaluation of the respiratory system to identify the severity of pulmonary impairment. The spirometer was used to assess the lung's function by measuring air quick in inhale (volume) quick exhale (volume). By blowing a deep breath and blow into a mouthpiece attached to the spirometer. The individual must blow out a hand as fast as he/she can until the lung's feeling empty. By repeating the test several times good effort during the test is important to get the results. A sensor is a part of the spirometer that calculates the graphs.

After Mid Term review Meeting the second installment was not received by the institute to continue the progress. The Medical camp has been planned by the PI by engaging a medical doctor that was not carried out due to the fund shortage. (Different location inviting a pulmonologist and the team of technical support and documentation, vehicle hiring estimated around three lakhs) It was conducted by engaging a Technical person with the ‘spirometer’ one hundred (100) sample was able to do the test.

## **2.3 Designing Protective Clothing Materials and Planning New Measures or Modification**

### **2.3.1. Selection of Fabrics**

100% grey cotton plain woven fabrics 40 S counts were selected and purchased. A bulk of fabric ten meter was purchased for the entire work. The following fabrication was found in the selected fabrics.

**Table 2.3.1. Fabrication**

S.NO	FABRIC	COTTON (Grey)
1	Composition	100%
2	Ends/inch	95
3	Picks/inch	65
4	Count	40S
5	Width of the fabric	36 inch

### 2.3.2. Preparation of Fabric

The preparation of fabric is an important process for the easiest way to finish the cotton fabric to start with, Desizing, Scouring, bleaching, as all the preliminary stage was carried out for the finishing process is necessary.

- Desizing
- Scouring
- Bleaching
- Finishing

**Figure: 1 Preparation of Fabrics**



#### 2.3.2.1 Desizing

Desizing was done to remove the starch from the warp yarns of the woven fabrics. During warping the warp yarns coated with sizing agents before weaving to reduce their frictional properties during weaving. Fabric weight was determined by using a weighing balance. As per the standard procedure, desizing bath was set up with a material liquor bath, maintaining temperature 1½ hour. Then the material was washed and rinsed using cold water and dried.

**Chemicals and Conditions for Desizing Recipe:**

Wetting Agent	–	1:60
Temperature	–	60°C, 90°C
Time	–	1½ hrs
PH	–	3 – 4

**Figure: 2 Desizing process**



**2.3.2.2 Scouring**

Scouring is almost invariably the wet process applied to textile materials. The object is to remove oils, fats, waxes, soluble impurities and any particulars or solid dirt adhering to the fibers' natural cotton, unlike raw wool, contain only a comparatively small proportion of impurities. Hence before coating herbal extract, the fabric was scoured to remove the impurities. The standard procedure was adopted for the preparation.

**Chemicals and Conditions for Scouring Recipe:**

Sodium hydroxide	–	2%
Sodium Carbonate	–	2%
Wetting Agent	–	2 %
Temperature	–	100°C



Time	-	1½ hrs
M:L:R	-	1:20
PH	-	13

As per the weight of the sample calculated, the bath was set up with the required amount of material liquor ratio. After the sodium hydroxide, wetting agent, sodium carbonate was added to the water in a 1:20 ratio in the bath. The temperature maintained at 100°C for 1½ hour. After that, the fabric was taken out and given cold wash and dried.

### 2.3.2.3 Bleaching

In bleaching is a process removes the original grey colour from the fabric. Jigger was used to do the bleaching. As per the fabric weight, the bath was set up with the required amount of material liquor ratio. After the sodium hypo Chloride 1%, sodium chloride 1% was added to the water in a 1:60 ratio in the bath. The temperature maintained at 100°C for 1½ hour in pH 11. After that, the fabric was taken out and given cold and dried. Remove the fabrics from bleach, squeeze them and expose to air for a few hours. This process can be repeated until the fabric turned white enough for dyeing, then rinse very thoroughly.

### Chemicals and Conditions Bleaching Recipe

Sodium Hypo Chloride	-	1%
Sodium chloride	-	1%
Time	-	1½ hrs
PH	-	11
Temperature	-	100°C
M: L: R	-	1:60

### 2.3.3. Selection of Herbals

#### 2.3.3. Selection of Herbals

Neem (*Azadirachta indica*) and Tulsi (*Ocimum tenuiflorum*) leaves were selected for the study. Due to the antimicrobial properties of both herbals, it had been selected for the preparation of Masks(face)

Figure: 3 Neem (*Azadirachta indica*) and *Ocimum tenuiflorum* leaves

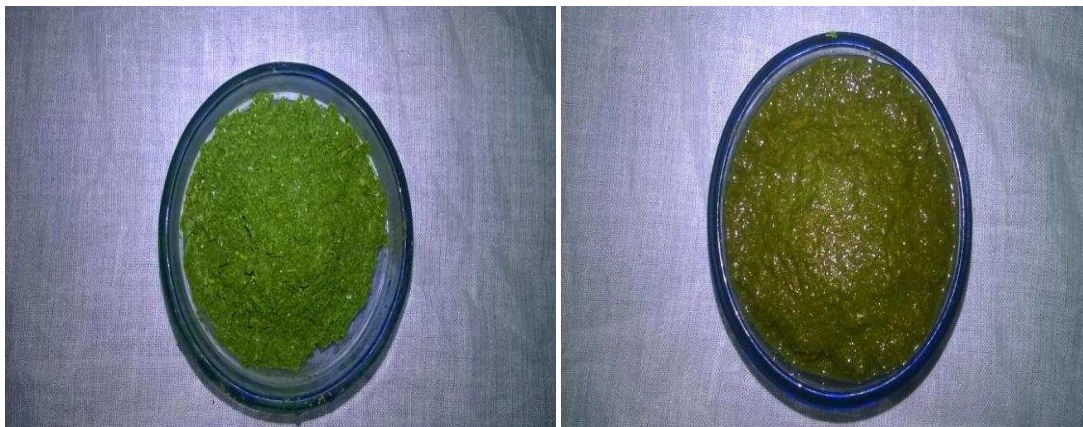


The leaves were collected as per the requirement of fabric treatment and the extract was used for finishing the cotton fabric.

### 2.3.3.1 Extraction

A liquid extractor is a machine that mechanically separates liquid from the solid part (leaves) of leaves. The waste was discarded. Most liquid extractors are electric, which requires less effort than their manual counterparts. To prepare the coating bath from the (paste) 50ml of liquid and 20 ml ethanol were added and stirred the contents for 2 minutes. The clear extract was collected in a clean vessel.

**Figure: 4 Neem Leaves *Azadirachta indica* Paste    *Ocimum tenuiflorum* Leave paste**



### 2.3.3.2 Application on Fabric

Leaves extract was coated on bleached cotton fabric. The extract was heated and stirred well in a magnetic stirrer in 2% concentrations (3 g/l) was set in a bath. The material to liquor ratio was taken as 1:20. The sample was treated into the antimicrobial bath with pH 5-6 adjusted with acetic acid. The bath temperature was raised to 70°C and it was kept at this temperature for

30 minutes. Finally, the samples were washed with cold water and dried. To estimate the actual amount extract absorbed by the fabric, the treated fabric calendared and go through the curing camper for pressing the total weight to add on the treated fabric.

#### **Conditions for coating**

Concentration	-	3gpl
Citric acid	-	% on the weight of fabric
Temperature	-	70°C
Time	-	30 minutes
Materials Liquor	-	1:20

was calculated using the following formula.

$$\text{Add-on (\%)} = [(W2 - W1)/W1] \times 100$$

Where W1: weight of fabric before treatment (g)

W2: weight of fabric after treatment (g)

**Figure: 5 Stirrers the Extract before Application**



#### **2.3.4 Designing and Developing a Face Mask**

The width 5inch and length 4 inches of each fabric fixed the measurements are followed by per the markedly available face mask products





**Figure: 6 Measurement Followed Model Non woven Sample Face Mask**

The finished fabrics are head by stitching all the ends of both the strips to secure the center of one strip on the upper part of the nose and take its ends behind the head. Placing the center of the other strip on the mouth and brings the ends on the top of the head and then fix it with a knot adjust the tightness according to the comfort level and pull the second strip-till the lower jaw. The strips were a little loose fixed easy breathing.



**Figure :7 Construction of Finished Cotton Masks**



Untreated Bleached



Herbal Finished Mask –Tulsi, Neem

Figure :8 Construction of Finished Cotton Masks

Five hundred and fifty (550) masks were stitched; the face masks were distributed to the workers to wear study.

#### 2.3.4.1 Mask Wear Study

The developed masks (untreated, coated) were distributed among the workers at various units to wear study. Three types developed; all three types of the mask were tested for wear study

1. Untreated cotton fabric mask (Grey Fabric)
2. Azadirachta indica treated (Neem Fabric)
3. Ocimum tenuiflorum treated cotton fabric (Tulsi Fabric)



**Figure: 9 Spinning Mill workers wear the Mask give res ponsible ans wers**

### **2.3.5 Assessment of Physical Properties of Treated Fabric**

#### **Technical Analysis**

##### **2.3.5.1. Fabric Weight**

Fabric weight method is one of the measurements to take a weight in mass per unit area and is suitable for most of the fabrics. The weight of the samples was taken using electrical balance 'Metter PM 200'. From this method, the readings had taken in digital count form. By using a template the samples were cut randomly from different places of textile material. The prepared samples were weighted and readings were recorded. Each of the cut samples was weighted and the readings were recorded and the mean weight also calculated. This was expressed in grams/square meter (GSM). All treated samples were tested for their weight.



**Figure: 10 Weighing Balance**

### **2.3.5.2 Fabric Thickness**

The thickness of a woven fabric is calculated as the space between the reference plate on which the sample rests and a parallel circular pressure foot that use a specific pressure on the area under test. The Mijutoya thickness tester was used. The anvil and the pressure foot are the two parts of this equipment, earlier worked under a pressure foot and later worked under level spring action. The thickness of the sample specifies as thousands of an inch on the top of the equipment. Each division on the dial read 0.01 mm. The sample was placed between anvil plates. Selvages and creased areas should be avoided. The indicated the thickness of the sample. The readings of the sample were taken at different places of the fabrics and also average was calculated. Fabric thickness is mainly used for checking the conformity of the specification. All samples were tested for thickness.



**Figure: 11 Fabric Thickness Tester**



### 2.3.5.3 Fabric Fastness

The percentage of the reduction in antibacterial activities after 30 cycles of laundering the samples was determined using the Wash Durability Test by 'Laundrometer'. These fabric samples are treated with all the antimicrobials used in the study and were subjected to laundering procedures. These fabrics are tested for the percentage in the reduction of the microorganisms using American Association of Textiles chemist in Colourists (AATCC 100).



Figure: 12 Laundrometer Wash Fastnesses

### 2.3.6 Antimicrobial Test

- **Microorganism:** In Pathogenic strains of E.coli, P.aeruginosa, S.aureus, C.albicans, and B.subtilis were purchased from (MTCC) Microbial Type Culture Collection.
- **Substrate:** A 100% cotton plain woven fabric (medium weight, plain weave, ends 95/inch, picks 65/inch) 36 inches of the fabric was used for the Herbal finishing treatment.
- **Evaluation of antimicrobial Efficacy:** Pathogenic strains of S. aureus (gram-positive bacteria), E. coli (gram-negative bacteria), P. aeruginosa (gram-negative bacteria), B. subtilis (gram-positive bacteria) and C. albicans (fungi) were used for the present study. The qualitative antibacterial assessment was done using the Agar diffusion method (AATCC 147 test method).
- **Agar Diffusion Test (147 AATCC):** In the Agar diffusion test is used for qualitative analysis. It was simply carried out and suitable for a large number of samples are to be screened for the presence of antimicrobial activity. In this test, the first test organisms are

inoculated on nutrient agar plates. Textile samples were placed above inoculated nutrient agar plates for close contact. The plates are incubated at 37°C for 18–24 hrs and analyzed for the zone of inhibition. There is no bacterial growth directly below the fabric sample indicates the presence of antimicrobial activity. The zone of inhibition becomes obvious when the antimicrobial agent can diffuse into the agar. Effectiveness of the antimicrobial activity or the release rate of the active agent can be checked by the size of the zone of inhibition (Patel Margi H et al 2014).

### **3. Results and Discussion**

The results of the study entitled “**Prevalence of Respiratory Disorders and Occupational Health among Workers in Textile Industries and Developing Protective Measures**” are presented under the following headings.

#### **3.1 Objective: 1 To create workers awareness and public attention.**

1. Occupational profile of the respondents
2. Facility available in textile units

#### **3.2 Objective: 2 To identify the of general and respiratory symptoms among workers in industries.**

##### **A) General Health Problems of Textile workers**

- 3.2.1. Socioeconomic background of respondents
- 3.2.2. General background of the respondents
- 3.2.3. The physical problem among the respondent
- 3.2.4. Skin problem among the respondents
- 3.2.5. Accident met by the respondents

##### **B) Respiratory problem identified among textile workers**

- 3.2.6. The respiratory problem of the respondents
- 3.2.7. Spiro meter test – Pulmonary function test using the spirometer

#### **3.3 Objective:3 To develop appropriate protective clothing or other measures.**

- 3.3.1. Analysis of Developed Protective Clothing
- 3.3.2. Performance of the Developed Masks – User study among the workers

(Bleached Neem and Tulsi

#### **3.4 Objective:4 To ensure proper implementation of health and safety measures.**

- 3.4.1. Health profile of the respondents
- 3.4.2. Anthropometrical assessment

### 3.1 Objective: To create workers awareness and public attention.

#### 3.1.1. Occupational Profile of the Respondents

Table 3.1.1 Occupational Profile of the Respondents

S. No	Variables	Number of Respondents N=500	Percentage of Respondents N-=500(%)
<b>I</b>	<b>Nature of Job</b>		
1	Permanent	352	70
2	Temporary	148	30
	<b>Total</b>	<b>500</b>	<b>100</b>
<b>II</b>	<b>Type of work</b>		
1	Spinning	180	36
2	Weaving	240	48
3	Piercing	080	16
	<b>Total</b>	<b>500</b>	<b>100</b>
<b>III</b>	<b>Working hours/day</b>		
1	8 hours	500	100
	<b>Total</b>	<b>500</b>	<b>100</b>
<b>IV</b>	<b>Work experience(years)</b>		
1	0-5 years	28	06
2	6-10 years	232	46
3	11-15 years	156	31
4	16-20 years	44	09
5	Above 21 years	40	08
	<b>Total</b>	<b>500</b>	<b>100</b>

Table 3.1.1 reveals the occupational details of the respondent's nature of the job, type of work, working hours and experience. Most of the seventy percent (70%) reported as they are permanent and the remaining thirty percent (30%) reported as a temporary. On behalf of the type of work forty-eight percent (48%) of the respondents reported as weavers, thirty-six percent (36%) of them were as in the spinning section and the remaining sixteen percent (16%) of them revealed their work as piercing. With regards to the hours of work (100%), all the respondents were shift systems in the industries for 8 hours. About forty-six percent (46%) of them were reported as they are having 6-10 years of experience, thirty-one percent (31%) of them were having an experience of 11-15 years of experience, nine percent (9%) of them were experienced for about 16-20 years of experience, eight percent (8%) of the respondents have more than 21 years of experience and the remaining six percent (6%) of the respondents having less than 5 years of experience.

**Figure 3.1.1**

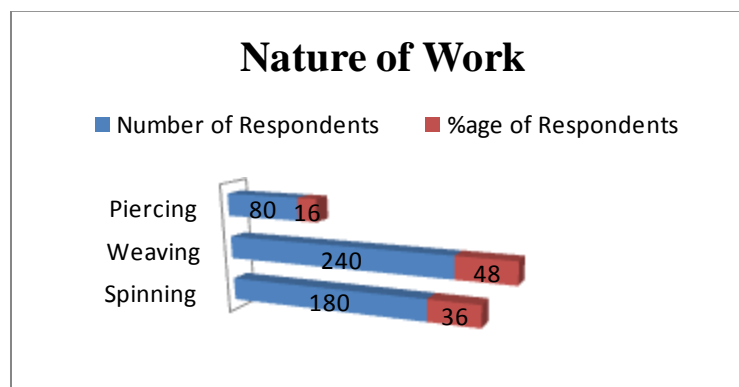


Table 3.1.2 indicates the views of workers about the facilities available inside the industry about thirty-eight percent (38%) of the respondents were satisfied with air circulation facility, thirty percent (32%) of them were neutral in their opinion, eighteen percent (18%) of the respondents were highly satisfied with air circulation facility and the remaining twelve percent (12%) were dissatisfied with the air circulation. With regards to the toilet facility about forty eight percent (48%) of them were reported as satisfied, twenty one percent (21%) of them were reported as highly satisfied, nineteen percent (19%) of them were reported as neutral in opinion and the remaining twelve percent (12%) of them were reported as dissatisfied with regards to the sanitation facility.

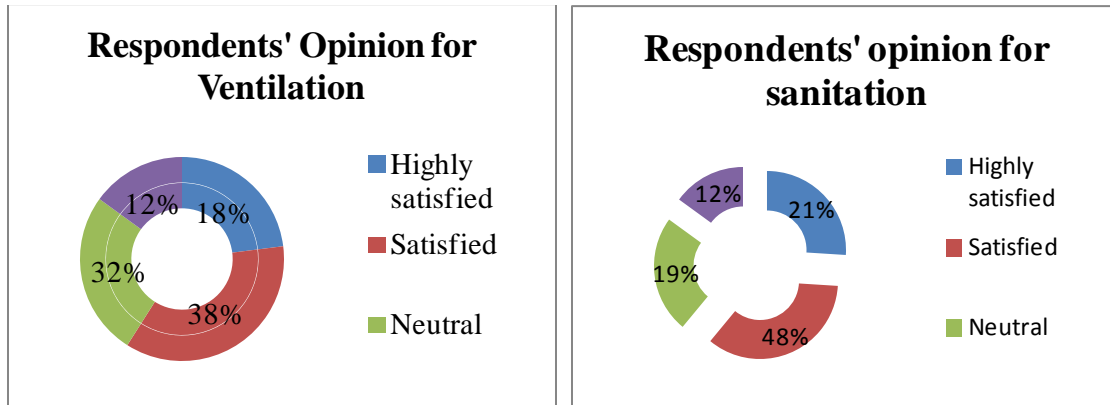
### 3.1.2. Facility available in textile units

**Table 3.1.2 Opinion for facilities available in Textile units**

S.No	Opinion for Ventilation	Number of Respondents N=500	Percentage %
1.	Highly satisfied	92	18
2.	Satisfied	194	38
3.	Neutral	154	32
4.	Dissatisfied	60	12
5.	Highly dissatisfied	--	--
	<b>Total</b>	<b>500</b>	<b>100</b>
<b>II</b>	<b>Opinion for sanitation</b>		
1	Highly satisfied	104	21
2	Satisfied	240	48
3	Neutral	96	19
4	Dissatisfied	60	12
5	Highly dissatisfied	--	--
	<b>Total</b>	<b>500</b>	<b>100</b>



**Figure 3.1.2**



**3.2 Objective: The prevalence of general and respiratory symptoms among workers in industries.**

**A) General Health Problems of Textile workers**

**3.2.1. Socioeconomic Background of Respondents**

**Table 3.2.1 Socioeconomic Background of the Respondents**

S. No	Variables in Gender	Number of Respondents	Percentage of Respondents (%)
1	Male	192	38
2	Female	308	62
	<b>Total</b>	<b>500</b>	<b>100</b>

Table 3.2.1 reveals that for this study five hundred samples were interviewed with an interview schedule. All respondents were able to meet outside the industries. Details like the nature of work, hours of shift, facilities available, and health issues had been discussed during an interaction. The majority of the respondents sixty two percent (62%) of them were female and thirty eight percent (38 %) of male respondents were chosen for this study.

### 3.2.2. General Background of the Respondents

**Table 3.2.2.General Background of the Respondents**

<b>Sl.No</b>	<b>Marital status</b>	<b>Number of Respondents N=500</b>	<b>Percentage of Respondents N=500</b>
1	Single	148	30
2	Married	304	60
3	Widow	048	10
	<b>Total</b>	<b>500</b>	<b>100</b>
<b>II</b>	<b>Type of family</b>		
1	Nuclear	424	85
2	Joint	076	15
	<b>Total</b>	<b>500</b>	<b>100</b>
<b>III</b>	<b>Size of the family</b>		
1	Small (2-4)	396	79
2	Medium (5-7)	088	17
3	Large (above 7)	016	04
	<b>Total</b>	<b>500</b>	<b>100</b>

Table 3.2.2 shows the details of the respondent's general profile like, marital status, family types and size of the family. Majority sixty percent (60%) of them were found as married, thirty percent (30%) of them were single and ten percent (10%) of them were found as widows. With regards to their family types like joint family and nuclear family, Eighty five percent (85%) of the respondents were belonged to nuclear family and the remaining fifteen percent (15%) were from joint family system. With regards to their size of the family seventy nine percent (79%) of the respondents have 2-4 members in the family, seventeen percent (17%) of them were reported 5-7 members in the family and the remaining four percent (4%) of them reported as above seven members in the family. The study concludes that, most of the workers were in nuclear family system both men and women found working to support their family.

### 3.2.3. Physical Problem Among the Respondent

Table 3.2.3 Physical Problem Among the Respondent

S. No	Variables	Total Respondents N=500							
		With problem						Without problem	
		M		F		Total	Percentage (%)	N	Percentage (%)
		N	%	N	%				
1	Head ache Male	22	20	88	80	110	22	390	78
2	Pain in hand	258	69	11	31	376	75	124	25
3	Blurred vision	144	74	50	26	194	39	306	61
4	Stiff neck	14	13	92	87	106	21	394	79
5	Shoulder pain	226	76	72	24	298	60	202	40
6	Pain in heal	89	85	16	15	105	21	395	79
7	Pain in fingers	164	83	33	17	197	39	303	61
8	Leg cramps and varicose veins	302	76	95	24	397	79	103	21

The above table 3.2.3 indicates the physical problems of the respondents. Seventy-nine percent (79%) of them reported their problem as leg cramp; seventy-five percent (75%) of the respondents were having the problem of pain in hands. Thirty-nine percent (39%) of respondents were having Blurred vision and pain in fingers respectively. Twenty-one percent (21%) of them reported for heal pains. Twenty two percent (22%) were having a headache. Twenty one percent (21%) of them reported that they were suffering from a stiff neck. Sixty percent (60%) of them reported that they were suffering from shoulder pain. Due to the nature of work, the majority of the workers stated that they were suffering from heel pain, stiff neck, leg cramps, varicose veins, and blurred vision. The work station atmosphere leads to huge problems.

With reference to the physical problems, the study revealed that **the male respondents** seventy four percent (74%) of them were having the blurred vision, eighty three percent (83%) of them were suffering from pain in fingers, seventy six percent (76%) were reported as they were suffering from shoulder pain. Eighty five percent (85%) having the problem like pain in heals, sixty nine percent (69%) suffered from pain in hands. Thirteen percent (13%) were reported as

stiff neck, twenty percent (20%) of them were reported as headache. Seventy six percent (76%) of them were reported as they are having the problem of leg cramps.

Regarding **the female respondents**, eighty percent (80%) of them were suffering from a headache. Eighty seven percent (87%) of them were suffering from a stiff neck. Twenty four percent (24%) and thirty one percent (31%) were reported as leg cramps and pain in hands respectively. Fifteen percent (15%) pain in heel and twenty four percent (24%) were reported as shoulder pain, seventeen percent (17%) and twenty six percent (26%) of them were suffering from pain in finger and blurred vision respectively. The management/government should take initiative work to improve the work stations environment to reduce the problems.

### 3.2.4. Skin Problem Among the Respondents

**Table 3.2.4 Skin Problem Found Among the Respondents**

S.No	Skin problems	Total Respondents N=500							
		With problem						Without problem	
		M		F		Total	Percentage (%)	N	Percentage (%)
N	%	N	%						
1.	Allergy	11	73	4	27	74	15	426	85
2.	Pimples	2	22	7	78	44	9	456	91
3.	Rashes	1	16	5	84	28	6	472	94

Table 3.2.4 gives the details of the skin problems found among the respondents. Fifteen percent (15%) of them were reported for skin allergy, six percent (6%) of them were reported as they are having rashes and the remaining nine percent (9%) were reported that they are having the problem of pimples due to the work environment.

With reference to the skin problem the above table indicates that seventy two percent (72%) male and twenty eight percent (28%) female were found suffering from allergy. Seven three percent (73%) (female) and twenty percent (20%) male suffered from the problem of the pimple, and twenty five percent (25%) male and seventy five percent (75%) female were reported as rashes have been their skin problem. The skin problem arises due to body heat. Due to environmental impact, the heat arises in humans leads to such problems as stated workers working in spinning mills, printing and dyeing units.



### 3.2.5. Accident Met by the Respondents

**Table 3.2.5 Accident Met by the Respondents**

S.No	Variables	Accident met by workers		No accidents reported by workers	
		N	Percentage (%)	N	Percentage (%)
1	Needle pricking	128	26	372	74
2	Hand wounds	38	08	462	92
3	Cutting injury	118	24	382	76
4	Trimmer piercing the palm	10	2	490	98
	• Fly wheel	-	-	-	-
	• Heat boil/	-	-	-	-
	• Electrical	-	-	-	-
	• shock				
	• others				

Table 3.2.5 reveals the accident met by respondents, among the respondents twenty six percent (26%) were reported that they met adversity with needle pricking; twenty four percent (24%) were injured with cutting injury. Remaining eight percent (08%) and two percent (2%) of the injured with hand wounds and trimmer piercing in the palm. Regarding other accidents flywheel, heat boil/ pimple and electric shock there are no accidents were reported. There are no major accidents taken place in the units.

### B) Respiratory problem Identified among Textile Workers

#### 3.2.6. Respiratory Problem of the Respondent

**Table 3.2.6 Respiratory Problem found among the Respondents**

S.No	Variables	Total Respondents N=500					
		With problem		Without problem		Total	
		N	%	N	%	N	%
1	Nasal allergy	103	21	397	79	500	100
2	Continuous sneezing	47	9	453	91	500	100
2	Breathing problem	135	27	365	73	500	100

Table 3.2.6 illustrates the respiratory problem found among the respondents. Among the respondents, twenty one percent (21%) of them reported for nasal allergy, nine percent (9%) of them reported for continuous sneezing and twenty seven percent (27%) of them reported for

breathing problems. Being the Indian climate, there was no evidence of heavy risks in breathing. But the basic health problem leads to asthma-like nasal allergy, continuous sneezing, and breathing problem. From the observation, it is understood that many of the workers are not having awareness of their health-related to their environment. Wearing the importance and the awareness of face mask known by the workers, but they are not wearing it due to its inconvenience and discomfort. Environmental pollution leads to such health problems. If the workers are continuing their work in the same atmosphere, the problem will be acute in the future. Hence the investigator aimed to design herbal treated facemasks.

### 3.2.7. Spiro Meter Test – Pulmonary function test using spirometer

**Table 3.2.7 Spirometer Test**

S.No	Variables	Total no of respondents N=100	
		Number of Respondents	Percentage %
<b>I</b>	<b>Gender</b>		
I	Male	57	57
ii	Female	43	43
	<b>Total</b>	<b>100</b>	<b>100</b>
<b>II</b>	<b>Smoking status</b>		
I	Smokers	61	61
II	Non-smokers	39	39
	<b>Total</b>	<b>100</b>	<b>100</b>
<b>III</b>	<b>Classification of severity</b>		
I	Normal	66	66
II	Stage I	17	17
III	Stage II	10	10
IV	Stage III	7	7
	<b>Total</b>	<b>100</b>	<b>100</b>

In a spirometry test, a person breathes into the mouthpiece that is connected to an instrument called a spirometer. The spirometer records the amount and the rate of air that is breathed in and out over a specified time. Some of the test measurements are obtained by normal, quiet breathing, and other tests require forced inhalation or exhalation after a deep breath. Based upon

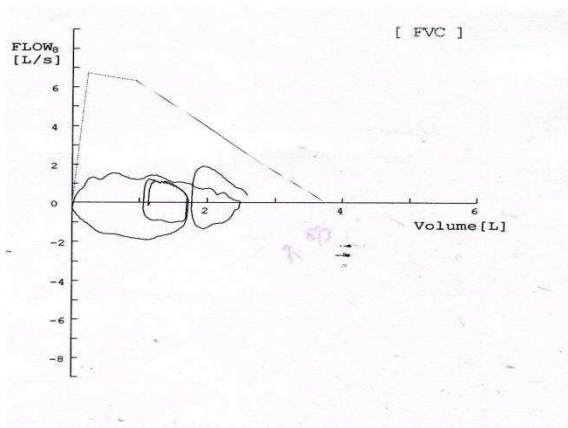
the performance of the worker, age, height, weight and background, and sex of the person the results as normal and severity being tested. The results are expressed as a percentage. The differences in the prevalence of lung pathologies as determined by spirometry tests and auscultation serve to show that occupational-related lung conditions need a thorough, all-encompassing medical examination to distinguish between temporary irritations and more serious lung pathology.

The result will show the person's airflow rate (or) the volume forced out within the first second (FEV1), will indicate the airway obstruction. This test also records the total volume of air forced out of the lung forced vital capacity (FVC). The percentage of (FEV1) is calculated with a spirometer. During the testing, volume the forced vital capacity (FVC) and the forced expiratory volume (FEV1) by the person is a little bit difficult to bring the total volume 0.15L to 1L less than 1L. All are guided and practiced well for the test to avoid repetition.

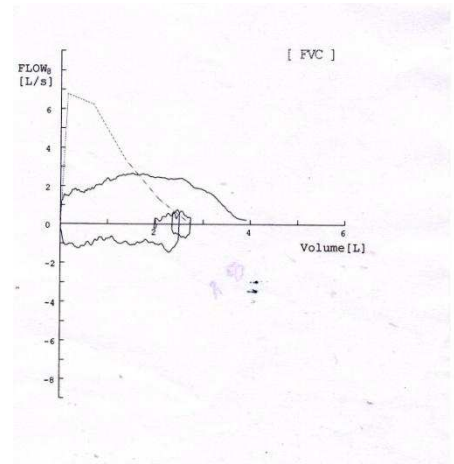
Table 3.2.7 reveals that workers were selected 100 respondents in the selected area. Majority fifty-seven percent (57%) of them were found as male and forty three percent (43 %) of the respondents were female. Among the selected respondents it has been found that sixty one percent (61%) of them were smokers and remaining thirty nine percent (39%) were non-smokers of male and female. With regards to the classification of severity also to found the sixty six percent (66%) were in normal stage and seventeen percent (17%) of them were in stage I and ten percent (10%) of them were in stage II and remaining of them were in stage of III of the severity. Figure 3.7 shows that the spirometer analysis of the selected respondents. Figure 3.2.7 (a) stage shows the diagram of normal breathing without any problem.

Figure 3.2.7 (b) stage-I indicates a mild disturbance in breathing. A breathing problem has been found. Figure 3.2.7(c) & (d) indicates the problems in respiration by the respondents. The stage of obstructive and severity (10 % & 7%) had been found among them.

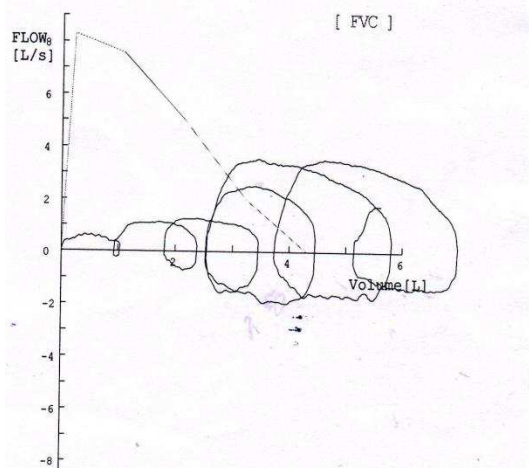
**Figure 3.2.7 Spirometer Test**



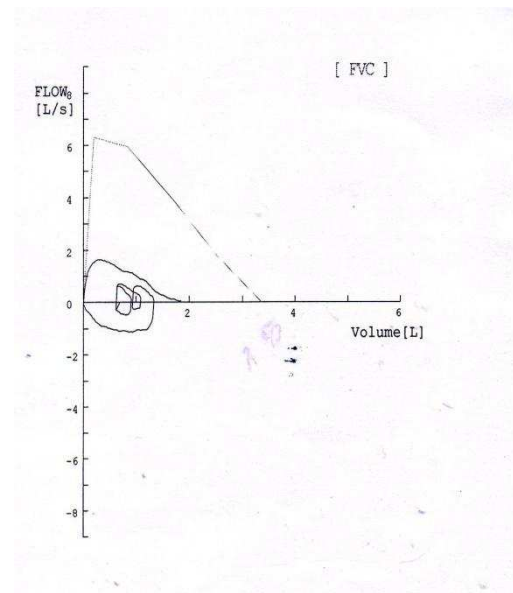
(a) Normal stage



(b) Stage I



(c) Stage-II



(d) Stage-III



### 3.3 Objective: Developing Appropriate Protective Clothing or Other Measures.

#### 3.3.1. Analysis of Developed Protective Clothing

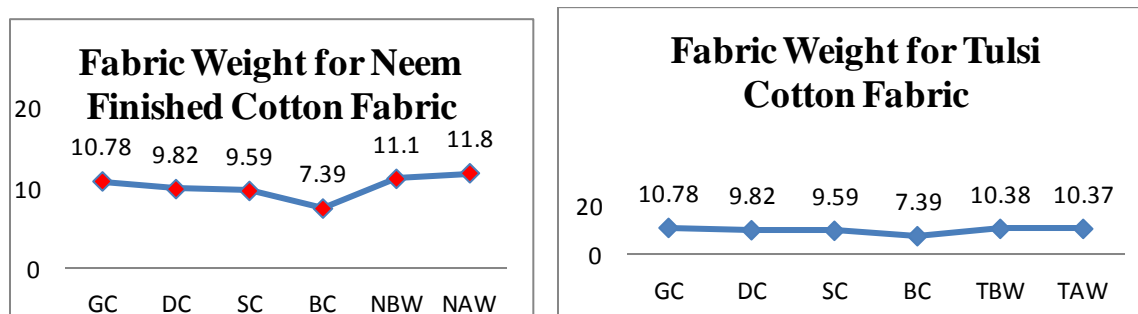
##### 3.3.1.1. Fabric Weight

**Table: 3.3.1.1 Fabric Weight**

S.No	Samples	Mean Fabric Weight (gsm)
1	Grey Cotton Sample (GC)	10.78
2	Desized Cotton fabric (DC)	9.82
3	Scoured Cotton fabric (SC)	9.59
4	Bleached Cotton fabric (BC)	7.39
5	Neem Before washing cotton fabric (NBW)	11.10
6	Neem After washing cotton fabric (NAW)	11.08
5	Tulsi Before washing cotton fabric (TBW)	10.380
6	Tulsi After washing cotton fabric (TAW)	10.37

Table: 3.3.1.1 shows the fabric weight for treated cotton plain weave fabric of treated and untreated fabrics. The Grey Cotton fabric has weight 10.78 GSM when compared to Desized Cotton Fabric has decrease in weight 9.82 GSM due to the reduction reaction of the Scoured Cotton Fabric SC is 9.59 GSM, Bleached Cotton Fabrics 7.39 GSM, Neem Before washing cotton fabric were increasing the weight 11.10 GSM and the Neem After washing cotton fabric was little reduction in the weight 11.08 GSM concluded that fabric weight was not affected by the finish applied on the fabric. Tulsi Before washing cotton fabric was increasing the weight 10.38 GSM and the Tulsi After washing cotton fabric was little reduction in the weight 10.37 GSM concluded that fabric weight was not affected by the finish applied on the fabric.

**Figure 3.3.1.1**



Y axis indicates- GSM (gram per square meter)

X axis indicates – Samples

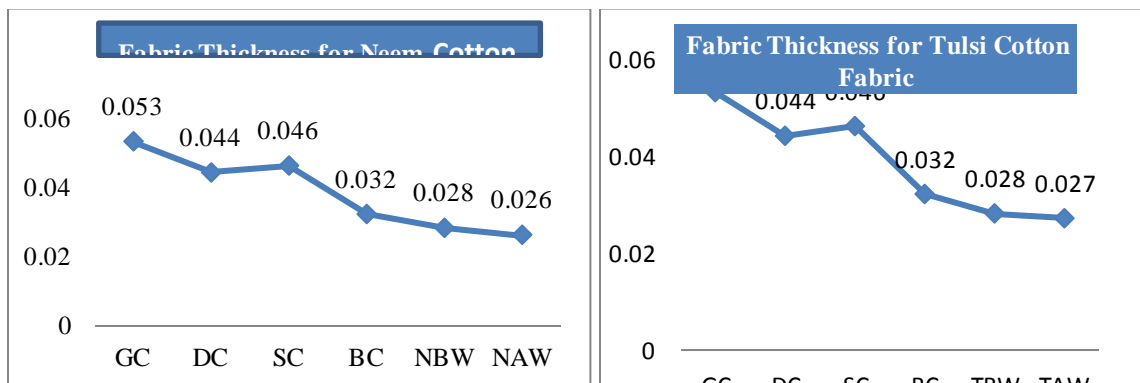
### 3.3.1.2. Fabric Thickness

**Table: 3.3.1.2 Fabric Thickness**

S.No	Samples	Fabric Thickness (mm)
1	Grey Cotton Sample (GC)	0.053
2	Desized Cotton fabric (DC)	0.044
3	Scoured Cotton fabric (SC)	0.046
4	Bleached Cotton fabric (BC)	0.032
5	Neem Before washing cotton fabric (NBW)	0.028
6	Neem After washing cotton fabric (NAW)	0.026
5	Tulsi Before washing cotton fabric (TBW)	0.028
6	Tulsi After washing cotton fabric (TAW)	0.027

Table 3.3.1.2 shows the fabric thickness for cotton plain weave fabric of treated and untreated fabrics. The Grey Cotton fabric has the thickness 0.053mm when compared to desized Cotton Fabric has decreased in thickness 0.044mm due to the reduction reaction of the Scoured Cotton Fabric is 0.046mm, Bleached Cotton Fabrics 0.032mm, Neem Before washing cotton fabric were increasing the thickness t 0.028mm and the Neem After washing cotton fabric was little reduced in the thickness 0.026mm concluded that fabric thickness was not affected by the finish applied on the fabric. Tulsi Before washing cotton fabric was increasing the thickness 0.028mm and the Tulsi After washing cotton fabric was little reduction in the thickness 0.027mm concluded that fabric thickness was not affected by the finish applied on the fabric.

**Figure 3.3.1.2**

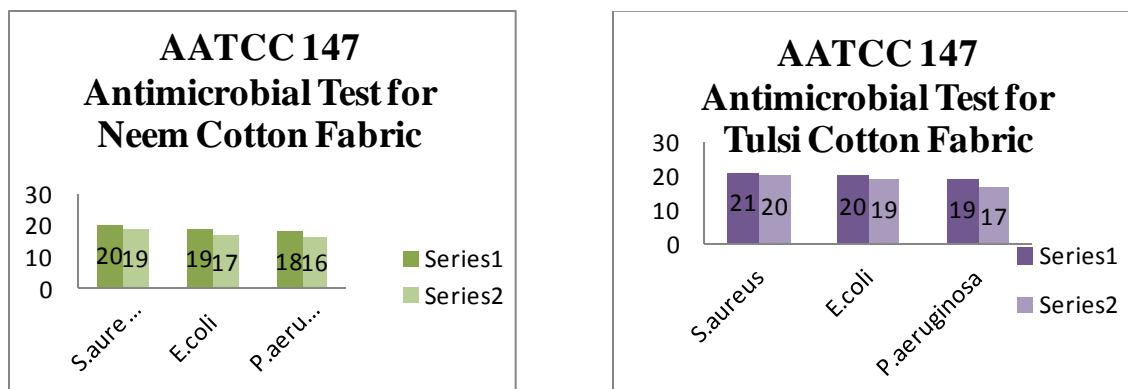


### 3.3.1.3. AATCC 147 Antimicrobial Test for Neem and Tulsi Cotton Fabric

**Table: 3.3.1.3 AATCC 147 Antimicrobial Test for Neem and Tulsi Cotton Fabric**

S.No	Herbals			Zone of inhibition (mm)		
	Botanical Name	Common Name	Samples	S.aureus	E.coli	P.aeruginosa
1	Azadirachta Indica	Neem	Before Wash	20	19	18
			After Wash	19	17	16
2	Ocimum Tenuiflorum	Tulsi	Before Wash	21	20	19
			After Wash	20	19	17

**Figure 3.3.1.3. AATCC 147 Antimicrobial Test**



Series 1 before Wash, Series 2 after Wash

Table: 4.3.1.3 Shown the for AATCC 147 Antimicrobial Test for neem cotton plain weave fabric before washing was Zone of inhibition (mm) S.aureus shown 20 mm, E.coli shown 19mm, P.aeruginosa shown 18mm. The antibacterial activity shows best result in neem finished. Before washed treated Cotton samples. Ocimum tenuiflorum cotton plain weave fabric before washing was Zone of inhibition (mm) S.aureus shown 21 mm, E.coli shown 20mm, P.aeruginosa shown 19mm. The antibacterial activity has shown the best result before washing Tulsi treated Cotton samples.

Regarding the antimicrobial test for neem cotton fabric before wash, the zone of inhibition of S.aureus was 20mm, E.coli was 19mm and P.aeruginose was 18mm. regarding the antimicrobial test for neem cotton fabric after wash, the zone of inhibition of S.aureus was 19mm, E.coli was

17mm and P.aeruginose was 16mm. The best result for antimicrobial activity is before washing neem treated cotton fabric.

### 3.3.2. Performance of the Developed Masks – User study among the workers (Bleached Neem and Tulsi)

**Table.3.3.2.1**

#### Performance of the Developed Neem and Tulsi Finished Mask Among Respondents

S. No	Variables		Non- Allergic		Breathable		Comfortable	
			N	Percentage (%)	N	Percentage (%)	N	Percentage (%)
1.	<b>Bleached</b>	Yes	276	55	291	58	292	58
		No	224	45	209	42	208	42
		<b>Total</b>	<b>500</b>	<b>100</b>	<b>500</b>	<b>100</b>	<b>500</b>	<b>100</b>
2.	<b>Neem</b>	Yes	376	75	410	82	373	75
		No	124	25	90	18	127	25
		<b>Total</b>	<b>500</b>	<b>100</b>	<b>500</b>	<b>100</b>	<b>500</b>	<b>100</b>
3.	<b>Tulsi</b>	Yes	414	83	437	87	446	89
		No	86	17	63	13	54	11
		<b>Total</b>	<b>500</b>	<b>100</b>	<b>500</b>	<b>100</b>	<b>500</b>	<b>100</b>

Regarding the above table 3.3.2.1 the mask developed by the tulsi, neem treated and bleached cotton mask used by the workers.

With regards to the No allergic of the developed masks, eighty three percent (83%) of the respondents felt nonallergic in tulsi, seventy five percent (75%) of the respondents felt nonallergic in neem treated mask and fifty five percent (55%) of them felt nonallergic for bleached masks. The remaining seventeen percent (17%) of them felt as allergic while using tulsi treated mask and twenty five percent (25%) of them felt as allergic while using a neem treated mask. While using a bleached mask by the workers forty five percent (45%) of them felt allergic.

Breathable characteristics felt in all masks, eighty seven percent (87%) of the respondents felt breathable in tulsi treated mask, eighty two percent (82%) of the respondents felt breathable in neem treated mask and fifty eight percent (58%) of them felt breathable in bleached fabric.

Thirteen percent (13%) of them felt as non-breathable while using tulsi treated mask, eighteen percent (18%) of them felt as non-breathable while using neem treated and forty two percent (42%) of them felt non-breathable for bleached masks.

The developed masks were distributed to workers in spinning (Blow room), dyeing and printing units. With regards to the comfort, eighty nine percent (89%) of the workers reported comfortable in tulsi treated mask, seventy five percent (75%) of the workers reported for neem treated mask and fifty eight percent (58%) of reported for bleached. The remaining eleven percent (11%) of them reported as uncomfortable while using tulsi, twenty five percent (25%) of them for neem treated mask and, while using bleached mask by the workers and remaining forty two percent (42%) of them felt uncomfortable.

### **3.4 Objective: To ensure a Proper Implementation of Health and Safety Measures.**

#### **3.4.1. Health Profile of the Respondents**

**Table 3.4.1. Health Profile of the Respondents**

S. No	Health profile	Number of Respondents N=500				Total Percentage %
		Problems reported	Percentage %	No Problem	Percentage %	
<b>I</b>	<b>Previous illness</b>					
1	Jaundice	64	13	436	87	100
2	Typhoid	44	9	456	91	100
3	Malaria	48	10	452	90	100
4	Fever	144	29	356	71	100
<b>II</b>	<b>Heredity disease</b>					
1	Diabetes mellitus	164	33	336	67	100
2	Cardiac failure	68	14	432	86	100
3	Stroke	16	3	484	97	100



Figure 3.4.1

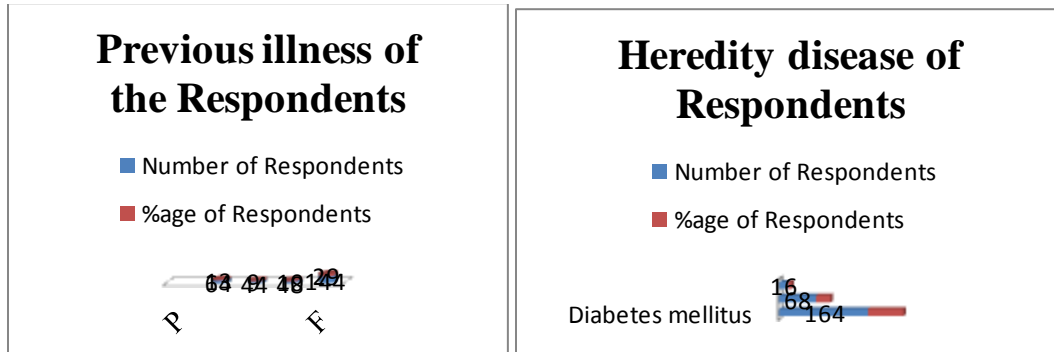


Table 3.4.1 indicates the previous illness due to the cooperation of the workers, among of them thirteen percent (13%) were reported that they are suffering from diseases like jaundice, nine percent (9%) affected by typhoid and ten percent(10%) of them were suffered from malaria and twenty nine percent (29%) of them were suffered from fever. With regards to hereditary disease of health profile only two hundred and forty eight were answered properly. Among them thirty three percent (33%) suffered from hereditary disease like diabetes mellitus , fourteen percent ( 14%)of them reported as cardiac failure and the remaining three percent (3%) of them suffered from stroke.

### 3.4.2. Anthropometrical Assessment

Table 3.4.2 Anthropometrical Assessment of the Respondents

S.No	Variables	Number of Respondents N=500	Percentage %
<b>I Height (cm)</b>			
1	Less than 150cm	40	08
2	150cm –155cm	380	76
3	156 cm– 160cm	72	14
4	More than 160cm	08	02
<b>Total</b>		<b>500</b>	<b>100</b>
<b>II Weight (kg)</b>			
1	Less than 50 kgs	60	12
2	50 – 60 kgs	337	67
3	61 – 70 kgs	40	8
4	More than 70 kgs	63	13
<b>Total</b>		<b>500</b>	<b>100</b>
<b>III Body mass index</b>			
1	<18.5(Underweight)	305	61
2	18.5-25(Normal)	97	19
3	25-30(Overweight)	58	12
4	Above 30(Obese)	40	8
<b>Total</b>		<b>500</b>	<b>100</b>

**Figure 3.4.2**

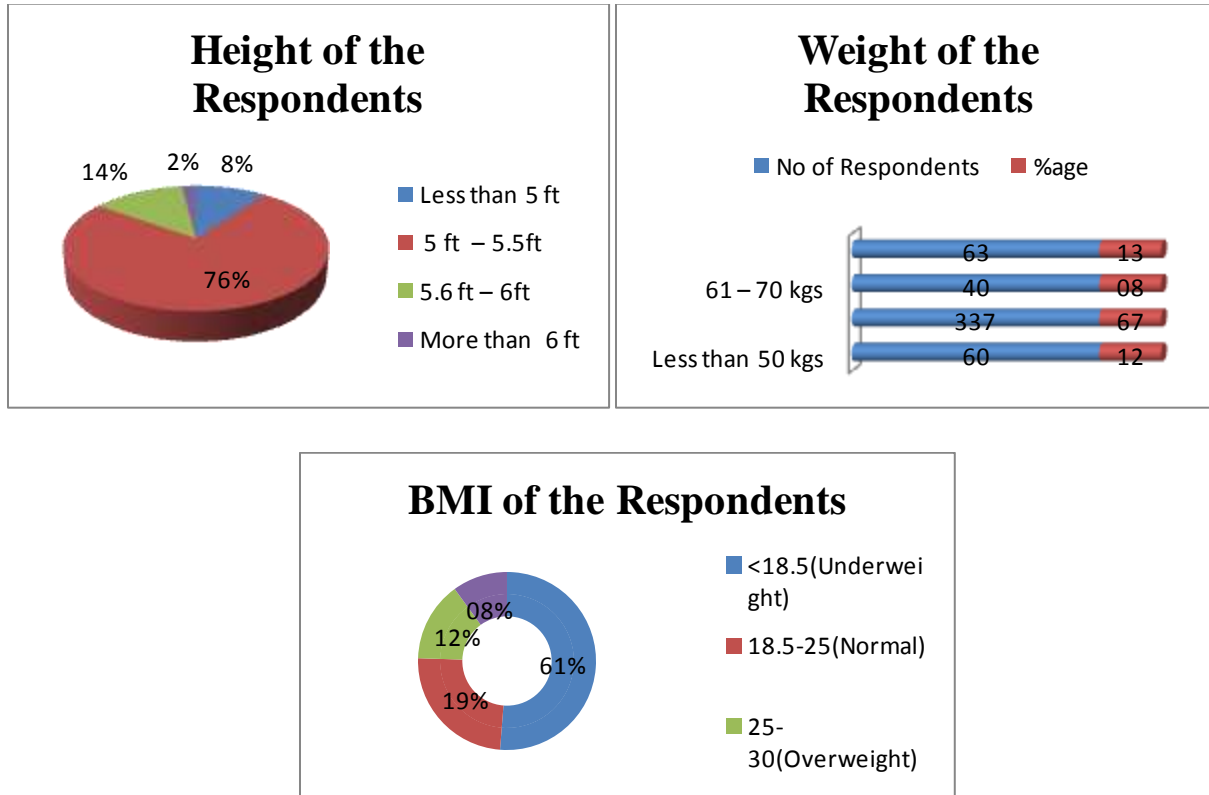


Table 3.4.2 shows the Height, weight and Body Mass Index of the workers. With regards to their height, seventy six percent (76%) of the respondents' height was between 150cm-155cm, fourteen percent (14%) of them were between 156cm – 160cm, eight percent (8%) of the respondents' were less than 150cm and remaining two percent (2%) was identified more than 160cm. With regards to their weight sixty seven percent (67%) were identified between 50 kg – 60 kg, twelve percent (12%) of them were less than 50 kg, eight percent (8%) of them were between 61 kg – 70 kg and remaining thirteen percent (13%) of them found more than 70 kg. With regards to BMI of the respondents, sixty one percent (61%) of them were having low BMI, nineteen percent (19%) of them were found as normal BMI, twelve percent (12%) of them were found as overweight BMI, 8% of the respondents BMI, was above 30 (Obese).

#### **4. The findings of the study are summarized below**

##### **4.1 Objective: To create workers' awareness and public attention.**

- The occupational details of the respondent's nature of job, type of work, working hours and experience. Most of them seventy percent (70%) reported as they are permanent and the remaining thirty percent (30%) reported as a temporary. On behalf of the type of work forty eight percent (48%) of the respondents reported as weavers, thirty six percent (36%) of them were as in the spinning section and the remaining sixteen percent (16%) of them revealed their work as piercing. With regard to the hours of work (100%), all the respondents were in the shift system in the industries for 8 hours. About forty six percent (46%) of them were reported as they are having 6-10 years of experience, thirty one percent (31%) of them were having an experience of 11-15 years of experience, nine percent (9%) of them were experienced for about 16-20 years of experience, eight percent (8%) of the respondents have more than 21 years of experience and the remaining six percent (6%) of the respondents having less than 5 years of experience.
- The views of workers about the facilities available inside the industry about thirty eight percent (38%) of the respondents were satisfied with air circulation facility, thirty percent (32%) of them were neutral in their opinion, eighteen percent (18%) of the respondents were highly satisfied with air circulation facility and the remaining twelve percent (12%) were dissatisfied with the air circulation. With regards to the toilet facility, about forty eight percent (48%) of them were reported as satisfied, twenty one percent (21%) of them were reported as highly satisfied, nineteen percent (19%) of them were reported as neutral in opinion and the remaining twelve percentage (12%) of them were reported as dissatisfied with regards to the sanitation facility.

#### **4.2 Objective: To identify the of general and respiratory symptoms among workers in industries.**

- All respondents were able to meet outside the industries. Details like nature of work, hours of shift, facilities available, and health issues had been discussed during the interaction. Majority of the respondents sixty two percent (62%) of them were female and thirty eight percent (38 %) male respondents were chosen for this study.
- The respondent's general profile like marital status, family types, and size of the family. The Majority sixty percent (60%) of them were found as married, thirty percent (30%) of them were single and ten percent (10%) of them were found as widows. With regards to their family types like joint family and nuclear family, Eighty five percent (85%) of the respondents belonged to the nuclear family and the remaining fifteen percent (15%) were from the joint family system.
- With regards to their size of the family seventy nine percent (79%) of the respondents have 2-4 members in the family, seventeen percent (17%) of them were reported 5-7 members in the family and the remaining of them reported as above seven members in the family. The study concludes that, most of the workers were in nuclear family system both men and women are working to support their family.
- The study indicates the physical problems of the respondents. Seventy five percent (75%) of the respondents were having the problem of pain in hands. Thirty nine percent (39%) of respondents were having Blurred vision and pain in fingers respectively. Twenty one percent (21%) of them reported for heal pains. Twenty two percent (22%) were having a headache. Twenty one percent (21%) of them reported they were suffering from a stiff neck. Seventy nine percent (79%) of them reported their problem as leg cramp; sixty percent (60%) of them reported they were suffering from shoulder pain. Due to the nature of work, the majority of the workers stated that they were suffering from heel pain, stiff neck, leg cramps, varicose veins, and blurred vision. The work station atmosphere leads to huge problems.
- The skin problems among the respondents were revealed that the Fifteen percent (15%) of them were reported for skin allergy, six percent (6%) of them were reported as they are having rashes and remaining nine percent (9%) were reported that they are having the problem of pimples due to the work environment.

- The respiratory problem found among the respondents. Among the respondents, twenty one percent (21%) of them reported for nasal allergy, nine percent (9%) of them reported for continuous sneezing and twenty seven percent (27%) of them reported for breathing problems. Being the Indian climate, there was no evidence of breathing problem. From the observation, it is understood that many of the workers are not having awareness of their health-related to their environment. Wearing the importance and the awareness of face mask known by the workers, but they are not wearing it due to its inconvenience and discomfort. Environmental pollution leads to such health problems. If the workers are continuing their work in the same atmosphere, the problem will be acute in the future. Hence the investigator aimed to design herbal treated facemasks.
- The accidents met by respondents, among the respondents twenty six percent (26%) were reported that they met adversity with needle pricking; twenty four percent (24%) were injured with cutting injury. Remaining eight percent (08%) and two percent (2%) of them injured with hand wounds and trimmer piercing in the palm. Regarding other accidents flywheel, heat boil/ pimple and electric shock there are no accidents were reported. There are no major accidents taken place in the units.
- In a spirometry test, a person breathes into the mouthpiece that is connected to an instrument called a spirometer. The spirometer records the amount and the rate of air that is breathed in and out over a specified time. Some of the test measurements are obtained by normal, quiet breathing, and other tests require forced inhalation or exhalation after a deep breath. Based upon the performance of the worker, age, height, weight and background, and sex of the person the results as normal and severity being tested. The results are expressed as a percentage. The differences in the prevalence of lung pathologies as determined by spirometry tests and auscultation serve to show that occupational-related lung conditions need a thorough, all-encompassing medical examination to distinguish between temporary irritations and more serious lung pathology.
- Majority fifty seven percent (57%) of them were found as male and forty three percent (43%) of the respondents were female. Among the selected respondents it has been found that sixty one percent (61%) of them were smokers and the remaining thirty nine percent (39%) were nonsmokers. With regards to the classification of severity also to



found the sixty six percent (66%) were in normal stage and seventeen percent (17%) were in stage I, ten percent (10%) were in stage II and remaining of them were in the stage of III of the severity.

#### **4.3 Objective: To develop Appropriate Protective Clothing or Other Measures.**

- The fabric weight for treated cotton plain weave fabric of treated and untreated fabrics. The Grey Cotton fabric has weight 10.78 GSM when compared to Desized Cotton Fabric has decreased in weight 9.82 GSM due to the reduction reaction of the Scoured Cotton Fabric SC is 9.59 GSM, Bleached Cotton Fabrics 7.39 GSM, Neem Before washing cotton fabric were increasing the weight 11.10 GSM and the Neem After washing cotton fabric was little reduction in the weight 11.08 GSM concluded that fabric weight was not affected by the finish applied on the fabric. Tulsi Before washing cotton fabric was increasing the weight 10.38 GSM and the Tulsi After washing cotton fabric was little reduction in the weight 10.37 GSM concluded that fabric weight was not affected by the finish applied on the fabric.
- The fabric thickness for cotton plain weave fabric of treated and untreated fabrics. The Grey Cotton fabric has the thickness 0.053mm when compared to desized Cotton Fabric has decreased in thickness 0.044mm due to the reduction reaction of the Scoured Cotton Fabric is 0.046mm, Bleached Cotton Fabrics 0.032mm, Neem Before washing cotton fabric were increasing the thickness t 0.028mm and the Neem After washing cotton fabric was little reduced in the thickness 0.026mm concluded that fabric thickness was not affected by the finish applied on the fabric. Tulsi Before washing cotton fabric was increasing the thickness 0.028mm and the Tulsi After washing cotton fabric was little reduction in the thickness 0.027mm concluded that fabric thickness was not affected by the finish applied on the fabric.
- AATCC 147 Antimicrobial Test for neem cotton plain weave fabric before washing was Zone of inhibition (mm) S.aureus shown 20 mm, E.coli shown 19mm, P.aeruginosa shown 18mm. The antibacterial activity shown best result neem Before washed treated Cotton samples. Ocimum tenuiflorum cotton plain weave fabric before washing was Zone of inhibition (mm) S.aureus shown 21 mm, E.coli shown 20mm, P.aeruginosa shown 19mm. The antibacterial activity has shown the best result before washing Tulsi treated Cotton samples. Regarding the antimicrobial test for neem cotton fabric before

wash, the zone of inhibition of S.aureus was 20mm, E.coli was 19mm and P.aeruginose was 18mm. Regarding the antimicrobial test for neem cotton fabric after wash, the zone of inhibition of S.aureus was 19mm, E.coli was 17mm and P.aeruginose was 16mm. The best result for antimicrobial activity is before washing neem treated cotton fabric.

- The Non-allergic of the developed masks, eighty three percent (83%) of the respondents felt non-allergic in tulsi, seventy five percent (75%) of the respondents felt non allergic in neem treated mask and fifty five percent (55%) of them felt non-allergic for bleached masks. The remaining seventeen percent (17%) of them felt as allergic while using tulsi treated mask and twenty five percent (25%) of them felt as allergic while using a neem treated mask. While using a bleached mask by the workers forty five percent (45%) of them felt allergic.
- Breathable characteristics felt in all masks, eighty seven percent (87%) of the respondents felt breathable in tulsi treated mask, eighty two percent (82%) of the respondents felt breathable in neem treated mask and fifty eight percent (58%) of them felt breathable in bleached fabric. Thirteen percent (13%) of them felt as non-breathable while using tulsi treated mask, eighteen percent (18%) of them felt as non-breathable while using neem treated and forty two percent (42%) of them felt non-breathable for bleached masks.
- The developed masks were distributed to workers in spinning (Blow room), dyeing and printing units. With regards to the comfort, eighty nine percent (89%) of the workers reported comfortable in tulsi treated mask, seventy five percent (75%) of the workers reported for neem treated mask and fifty eight percent (58%) of reported for bleached. The remaining eleven percentages (11%) of them reported as uncomfortable while using tulsi, twenty five percent (25%) of them for neem treated mask and While using bleached mask by the workers and remaining forty two percent (42%) of them felt uncomfortable.

#### **4.4 Objective: To ensure the Proper Implementation of Health and Safety Measures.**

- The previous illness to reported by the respondents that thirteen percent (13%) were reported that they are suffering from diseases like jaundice, nine percent (9%) affected by typhoid and ten percent(10%) of them were suffering from malaria and twenty nine percent (29%) of them were suffering from fever. With regards to heredity disease of health profile, only two hundred and forty eight were answered properly. Among them

thirty three percent (33%) suffered from heredity disease like diabetes mellitus, fourteen percent (14%) of them reported as cardiac failure and the remaining three percent (3%) of them suffered from a stroke.

- The Height, weight, and Body Mass Index of the workers. With regards to their height, seventy six percent (76%) of the respondents' height was between 150cm- 155cm, fourteen percent (14%) of them were between 156cm – 160cm, eight percent (8%) of the respondents' were less than 150cm and remaining two percentage(2%) was identified more than 160cm. With regards to their weight sixty seven percentage(67%) were identified between 50 kg – 60 kg, twelve percent (12%) of them were less than 50 kg, eight percentage(8%) of them were between 61 kg – 70 kg and remaining thirteen percent (13%) of them found more than 70 kg. With regards to BMI of the respondents, sixty one percentage (61%) of them were having low BMI, nineteen percentage (19%) of them were found as normal BMI, twelve percentage(12%) of them were found as overweight BMI, 8% of the respondents BMI was above 30 (Obese).

#### **4.5 Conclusion**

Textile Industries are playing a vital role in the Indian economy. The textile sector is a sector and backbone of the economy of India. This industry also contributory to pollution like air pollution, water pollution etc .Great risk also there for the workers in these industries. For example dyeing, processing, and spinning industries workers factory a lot of health risk knowingly and unknowingly. "Prevention is better than cure". Hence this project had been undertaken the workers with regards to their occupational health and safety issues. Basic safety issues were not able to observe in the work environment. Regular medical checkups for their workers' have been reported by the respondents. Apart from that the designed and developed mask is a good attempt and workers felt comfort while wearing. In general common factor identified is most of the workers are not comfortable to wear a mask available in the market/developed mask. Hence, the awareness created on the health issues of blow room/process/spinning room had been given to them to protect from breathing problems, early stages of asthma, burning of eyes/irritation of noses, etc. They also accepted to wear a mask during the work.

Due to the fund availability, the minimum number of the mask had been prepared and given to the local textile units. The investigator also suggested the same to the HR/MD/ of the unit. The

technical support also will be provided to them. In the future as an entrepreneurial activity, the technology will be transferred to our on the student to take-up the responsibility of supplying masks to the Textile industry/unit.

#### **4.6 ACHIEVEMENTS FROM THE PROJECT**

- Five hundred samples were interviewed and the data was collected on the general and health profile.
- Developed the protective measures for the workers – Using Herbal extractions like Tulsi, Neem (*Azadirachta indica*, *Ocimum tenuiflorum*)

Limitations:

- All workers were able to contact after working hours.

## SUMMARY OF THE FINDINGS

### **Objective: To create workers awareness and public attention.**

- Majority eighty five percent (85%) of the respondents were from nuclear family and the remaining fifteen percentage (15%) of the respondents from joint family system. Among them seventy percentage (70%) of the respondents were permanent employees and thirty percentage (30%) of them were temporary. Forty eight percent (48%) of them were found in weaving, thirty six percent (36%) of them were found in spinning and sixteen percent (16%) of them were found in piercing as their regular work. With regards to facility available in textile unit thirty eight percent (38%) of the respondents satisfied with air circulation facility and forty eight (48%) of them were reported as satisfied with sanitation facility.

### **Objective: To identify the general and respiratory symptoms among workers in industries.**

- The physical problems existing among respondents, the male respondents seventy six percent (76%) of them were reported as they are having the problem of leg cramps. The female respondents thirty one percent (31%) were reported as leg cramps. About seventy six percent (76%) male respondents were reported as they were suffering from shoulder pain and twenty four percent (24%) female respondents were reported as shoulder pain.
- With regards to the skin problems among respondents seventy two percent (72%) male and twenty eight percent (28%) female found suffering from allergy and twenty five percent (25%) male and seventy five percent (75%) female found suffered as rashes their skin problem. The skin problem arises due to the body heat. Due to environmental impact the heat arises in human leads to such problems as stated by the workers working in spinning mills, printing and dyeing units.
- With regards to the respiratory problem, among 500 respondents, twenty one percent (21%) of them reported for nasal allergy, nine percent (9%) of them reported for continuous sneezing and twenty seven percent (27%) of them reported for breathing problem.



- The accidents met by respondents, thirty five percent (35%) were reported that they met accident with needle pricking; thirty four percent (34%) were injured with cutting injury. Remaining twenty eight percent (28%) and three percent (3%) of them injured with hand wounds and trimmer piercing in the palm.
- With regards to spirometer test was conducted by the among textile workers. The study reveals that the respondents were fifty seven percent (57%) of them were male and forty three percent (43%) of them were female. Among the selected male respondents it was found that sixty one percent (61%) of them were smokers and remaining of them thirty nine percent (39%) were nonsmokers. With regards to classification of severity sixty six percentage(66%) were in normal stage and seventeen percent (17%) were in stage I and ten percent (10%) were in stage II remaining of them were in stage of III of the severity.

**Objective: To develop Appropriate Protective Clothing or Other Measures.**

- With reference to the mask developed by the tulsi, neem treated and bleached cotton mask used by the workers. Eighty three percentage (83%) of the respondents felt non allergic in tulsi treated mask, seventy five percentage (75%) of the respondents felt non allergic in neem treated mask and While using bleached mask by the workers fifty five percentage(55%) of them felt as allergic.
- Tulsi treated mask used by the workers eighty nine percentage (89%) and eighty seven percent (87%) of workers felt comfortable and breathable. Eighty two percent (82%) and seventy five percent (75%) of the workers felt breathable and comfortable while using neem treated mask. Fifty eight percent (58%) of the workers felt breathable and not comfortable with treated bleached mask made of bleached fabric.

**Objective: To ensure a Proper Implementation of Health and Safety Measures.**

- With regards to the health all workers directed to check regular health check up and to change their diet pattern. With regards to this anthropometric assessment general health history has been taken for discussion. According to their height and weight diet, intake of fruits, seasonal vegetables had been discussed. Among them seventy six percent (76%) of the respondents' height was noted between 150cm- 155cm, with regard to weight sixty seven percent (67%) between 50 kg – 60 kg. With regards to BMI of the respondents sixty one percent (61%) of them were having low BMI, 8%

of the respondents BMI is above 30 (Obese). Obesity also leads to different health issues discussed to create the awareness among the workers.

- With regards to the safety measures, all units and the industries followed the rules and regulations of safety measures by the government except small and tiny units like printing and dyeing.

## **CONTRIBUTION TO THE SOCIETY**

- Created awareness on their health risks and also recommended to use the protective measures.
- Insisted them for regular Health checkups under Industry support and ESI hospitals for their problems to avoid chronic.
- **“Prevention is better than Cure”** by avoiding Smoking, Alcohol and other drugs. Also ensures to use **FACE MASK** during their **WORK**
- All workers suggested to go for proper diet pattern
- Workers with long duration of working in the same environment suggested for to go for different jobs.

## Evaluation certificate

### Final Report Assessment/ Evaluation Certificate

(Two Members Expert Committee Not Belonging to the Institute of Principal Investigator)

(To be submitted with the final report)

It is certified that the final report of major Research project entitled **“Prevalence of Respiratory Disorders and Occupational Health among Workers in Textile Industries and Developing Protective Measures.”** Dr.R.I.Sathya, Professor of Home Science, Department of Home Science. The Gandhigram Rural Institute -Deemed to be University, Gandhigram has been assessed by the committee consisting the following members for final submission of the report to the UGC New Delhi under the scheme of major research project 41-671/2012(SR), dated (23.07.2012)

#### Comments/Suggestions of the Expert Committee:

- The project entitled “Prevalence of Respiratory Disorders and Occupational Health among workers in Textile Industries and developing Protective measures” is a need based work taken by the PI.
- The objectives were highly suitable to the environmental and Health Issues.
- The objectives stated by the PI for this project is well taken, focused and obtained the same within the budget provision by UGC.
- We would like to appreciate the Principle Investigator for the efforts taken by her to complete the project.
- All objectives were covered by the PI.
  - PI also created the awareness among the textile workers about their working environment like lighting, ventilation, health issues, safety measures, medical checkup, protection, clothing etc.
  - Developing an appropriate protective measure using the Herbal finished mask is a good attempt.
  - We would like to appreciate the PI for her contribution in developing the mask, The workers were of the opinion that the herbal mask(Tulsi) was more comfortable and breathable (90%) rather than regular masks.




- Over all, the outcome of the project covered the objectives and this is highly appreciable. This project is well contributed in creating awareness on health risks, recommended to regular health checkups as ESI, to follow good Diet with fruits available and seasonal and finally to regularize their face mask during their work.

**Name & Signature of Experts with Date:**

S.No	Name of the Expert	Designations & Experience	University/College Name
1.	Dr.R. Latha, (Specialization in Textile and Clothing)	Associate Professor, 33 years of Experience	Department of Home Science, Fatima college, Mary land, Madurai -18
2.	Dr.G.Manonmani, (Specialization in Textile and Clothing)	Assistant Professor, 23 years of Experience	Department of Home Science, Research of Extension Centre, Coimbatore-2

It is certified that the final report has been uploaded on UGC-MRP portal on \_\_\_\_\_. It is also certified that final report Executive Summary of the report, Research documents, provided under Major Research project have been posted on the website of the University/College.

  
12.07.19  
**Signature with Seal**  
**Dr.R. LATHA**  
Associate Professor,  
Department of Home Science,  
Fatima college, Mary land,  
Madurai -18

  
12/7/19  
**Signature with Seal**  
**Dr.G.MANONMANI,**  
Assistant Professor,  
Department of Home Science,  
Research of Extension Centre,  
Coimbatore-2

Dr. R. LATHA, M.Sc., Ph.D.,  
Associate Professor  
Dept. of Home Science with Food Biotechnology  
Fatima College  
Madurai-625 018



# Utilisation certificates

## Annexure V


**THE GANDHIGRAM RURAL INSTITUTE - DEEMED UNIVERSITY - GANDHIGRAM**  
**UGC MRP on "Prevalence of Respiratory Disorders among workers in Textile Industries and**  
**Developing Protective Measures"**  
**Dr.R.I.Sathya, Dep. of Home Science**  
**UTILISATION CERTIFICATE from (24.09.2012 To 31.03.2016)**  
 (Project Period 3 Years from 01.07.2012 to 30.06.2015)

Grant	Amount allocated	24.09.2012		01.04.2013		01.04.2014		01.04.2015		Total Rs.
		To	31.03.2013	To	31.03.2014	To	31.03.2015	To	31.03.2016	
<b>INCOME</b>	<b>7,12,500</b>									
Grant received		5,00,000								5,00,000
SB Interest		7,080		13,552		3,194.00		2,461		26,287
<b>Total</b>	<b>7,12,500</b>	<b>5,07,080</b>		<b>13,552</b>		<b>3,194</b>		<b>2,461</b>		<b>5,26,287</b>
<b>EXPENDITURE - Non-Recurring</b>										
Books & Journals	50,000			40,256		9,776				50,032
Equipments	2,00,000			1,99,500						1,99,500
<b>Recurring</b>										
Honorarium										
Chemical/Glassware/Consumable	50,000			23,671						49,671
Hiring services	2,00,000			16,200						31,725
Contingency(Including Audit fees)	1,25,000			36,498		2,000				66,369
Travel / Field work	50,000			22,166						24,104
Special Needs										
Overhead Charge	37,500									37,500
<b>Total</b>	<b>7,12,500</b>	<b>1,08,834</b>		<b>3,38,291</b>		<b>11,776</b>				<b>4,58,901</b>

Dr. R. I. SATHYA, M.Sc., M.Phil., Ph.D.,  
 Principal Investigator - UGC MRP  
 WIPPM - Prevalence of ... Protective Measures  
 Department of Home Science, GRI - DU  
 Gandhigram 624 302 Dindigul Dt.

**ABSTRACT**

Income Rs. 5,26,287  
 Less: Expenditure Rs. 4,58,901  
 Unspent balance as on 31.03.2016 Rs. 67,386

  
**REGISTRAR**  
 Gandhigram Rural Institute

For: A.V. SUBRAMANIAM & CO.,  
 CHARTERED ACCOUNTANTS  
 C.A. J. Srinathi  
 M.No: 029617, Partner  
 ICAI: FRN: 010643S

  
 Special Officer (Finance)  
 Gandhigram Rural Institute



**FORM GFR 19-A**  
**FORM OF UTILISATION CERTIFICATE**  
**THE GANDHIGRAM RURAL INSTITUTE – DEEMED UNIVERSITY,**  
**GANDHIGRAM, TAMILNADU – 624302**  
**GFR 19-A**

**UGC MRP on “Prevalence of Respiratory Disorders among workers in Textile Industries and Developing Protective Measures”**

(Dr.R.I.Sathya,Principal Investigator, Dept. of Home Science)  
(Project period -01.07.2012 to 30.06.2015)

**UTILISATION CERTIFICATE**  
**for the period of 24.9.2012 to 31.03.2016**

Sl. No	Letter No. and Date	Amount in Rs.
1	2012-2013	
2	F.No.41-671/2012(SR),dt. 23.07.2012	5,00,000/-
	<b>Total</b>	<b>5,00,000/-</b>

Certified that out of Rs. 7,12,500/- of grant-in-aid sanctioned, a sum of Rs.5,00,000/- has been received during the year 2012-13, in favour of the Registrar, Gandhigram Rural Institute – Deemed University, Gandhigram-624302, Dindigul District, Tamil Nadu, vide UGC Letter No. given in the margin, along

with interest earned of Rs.26,287/-, a sum of Rs.4,58,901/- has been utilized for the purpose for which it was sanctioned and a balance of Rs.67,386/- remains as unspent as on 31.3.2016.

**Details of funds received and expenditure incurred so far**

Year	Opening Balance	Opening Balance	Grants Received	Interest earned	Total funds available	Expenditure incurred			Unspent Balances at the end of year
						Recurring	Non recurring	Total	
2012-13	-	5,00,000	7,080	5,07,080	1,08,834		1,08,834	3,98,246	
2013-14	3,98,246	-	13,552	4,11,798	98,535	2,39,756	3,38,291	73,507	
2014-15	73,507	-	3,194	76,701	2,000	9,776	11,776	64,925	
2015-16	64,925	-	2,461	67,386	-	-	-	67,386	
<b>Total</b>		<b>5,00,000</b>	<b>26,287</b>	<b>5,26,287</b>	<b>2,09,369</b>	<b>2,49,532</b>	<b>4,58,901</b>	<b>67,386</b>	

*Unspent balance as on 31.03.2016 Rs.67,386/-*

2. Certified that I have satisfied myself that the conditions on which the grants-in-aid was sanctioned have been duly fulfilled/are being fulfilled and that I have exercised the following checks to see that the money was actually utilized for the purpose for which it was sanctioned.

**Kinds of checks exercised**

1. Cash Book
2. Ledger-
3. Bank Books A/c. No.12841
4. Bank Reconciliation

*Special Officer (Finance)*  
*Gandhigram Rural Institute*

*REGISTRAR*  
*Gandhigram Rural Institute*

*Dr. R.I. SATHYA, M.Sc., M.Phil., Ph.D.,*  
Principal Investigator - UGC MRP  
Prevalence of ..... Protective Measures  
Department of Home Science, GRI - DU  
Gandhigram 624 302 Dindigul Dt.

For A.V. SUBRAMANIAN & CO  
CHARTERED ACCOUNTANTS



C.A. J. S. J.  
M.No: 0296  
ICAI: FRN: 100435