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**Original Research Article**

# Impact of workplace environment on health of leather factory workers

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## ABSTRACT

**Background:** The working environment and basic facilities available in the workplace have impact on physical and psychological health of leather workers. The objective was to study the effect of workplace environment on health of leather workers.
**Methods:** A cross section study was carried out in eight permitted leather factories at rural area in Sripuram near Chromepet, Chennai. Using a pretested scheduled questionnaire, 230 workers were interviewed, their corresponding socio-demographic profile was collected and various health scores were recorded based on the general and physical examination. Scoring technique and student 't' test was used to identify the correlation and degree of association between workplace environmental factors and health status of workers.
**Results:** The scoring technique and correlation coefficient revealed an association between workplace health status and clinical symptoms ($p<0.001$), duration of work and clinical symptom scores ($p=0.001$), duration of work and workplace health ($p<0.001$), Workplace health status and occupation (t-test value 5.562, $p<0.001$), and facilities available and occupation (t value 3.758, $p<0.001$).
**Conclusions:** The above results show the impact of workplace environment on the health status of workers and require adequate measure to improve the facilities and thereby the health status of workers.

**Keywords:** Occupational health, Health status in leather tanneries, Health risk, Environmental impact

## INTRODUCTION

India is world's fifth largest exporter of leather products and accessories. The Industry gives employment to more than 2.5 million workers, 30% being women.[1] Common hazards among health workers includes physical injuries due to poor maintenance of the work area, poor lighting, inhalation of raw dust as well as chemical mist produced by alkalis and sulphides, contact dermatitis by various chemicals, infection from raw hides and skins which have not been properly disinfected, cancer of various organs influenced by chromium and other chemical. Ergonomic factors includes working posture, lifting of heavy weight, standing for a long duration, holding a machine for a long time, all factors have influence on health of workers.

Majority of the workers are employed only as casual labourers, and thus do not fall in the ambit of various acts. Thus they are not covered by insurance and other benevolent schemes provided by the Government. There are about 180 leather industries in and around Chromepet and Pallavaram near Chennai, among them 160 tanneries are under Pallavaram Tannery Association. Most of the industries in this area involve in tanning and dyeing

process. The joint ILO/WHO committee defines that, "occupational health should aim at the promotion and maintenance of the highest degree of physical, mental and social well-being of the workers in all occupation, the prevention among workers of departure from health caused by working condition, protection of workers in their employment from risk resulting factors adverse to health, the placing and maintenance of workers in an occupational environment adapted to their physiological, psychological ability and to summarize the adaptation of "work to man and man to work".[2] Adequate self-protective devices are not given to the workers in many industries. Many tanneries were lacking in provisions of lunch rooms, thus the chances of ingestion of dust and chemical from the environment in food is possible.[3]

It is estimated that work place hazards and exposure resulted in 150 million workers to fall ill; annually 1.2 million workers were affected with occupational accidents and 21,000 dies because of occupational disease worldwide.[4] It was also observed that many labourers hailing from this area are regular visitors to Sree Balaji Medical College Rural Health centre, which prompted to explore the connection between the industry and their ailments.

The nature of labour needed in this Industry is not skilled labour. Thus most of these labourers are semi or illiterate. These workers continue to be employed by such firms, either ignorant of the health hazards, or knowingly, mainly because of their very low economic status.[5] The objective of this study is to assess the health status of workers employed in Leather tanning and dyeing industries in Sripuram near Chromepet, Chennai, to determine the facilities of working environment in which the workers are exposed and engaged and to study the effect of workplace environment on health of leather factory workers.

## METHODS

This is a cross-sectional descriptive study with one time interview of leather industries workers (tanning or dyeing). The workers are selected from eight industries after obtaining permission from Pallavaram Tannery Association. The data collection was carried out from August 16th, 2011 to till March 20th, 2012.

There are nearly 160 leather industries which come under Pallavaram Tannery association and in that more or less 62 factories are located in and around Sripuram and Nagalkenni area which comes under Rural Health Centre of Sree Balaji Medical College. Permission for the study was obtained from the Pallavaram tannery association. The study was also approved by the institutional research council and the institutional ethical committee.

### *Sample size*

The sample size of single proportion can be calculated by

$$n = \frac{Z_\alpha{}^2 (PQ)}{d^2}$$

Where in the above formula,
n: is the sample size.
Zα: Z Value for level of significance
P: is proportion
Q: 1–P
d: is the difference (precision)

Here Zα = 1.96 for 5% level of significance (two sided)

P = 50% (Failure rate)
Q = 100 – 50 = 50%
d = 20% of P = 10%.

By substituting these values in the above formula, the required sample size will be

n = 96≈100.

The prevalence is considered as 50% as it will give the maximum sample size. As there are 48 leather industries in the survey area each industry is considered as a cluster and cluster sampling survey methodology is used to collect the data. Because of cluster sampling a design effect of 2 is considered. Therefore the required sample size will be 2×100 = 200. To achieve the required sample size of 200, a random sample of 8 leather industries were selected and all the employees from these industries are surveyed. Thus the total sample size becomes 230. Pretested semi structured questionnaires was used. Questionnaires are translated to Tamil/English. All the questions in the questionnaire and the need of our study have been also explained to the workers and informed consent has been obtained.

### *Scoring technique*

It is necessary to identify the degree of association between various factors with regard to the health status of leather factory workers hence scoring technique is used with that correlation coefficients can be derived. Student t test and chi-square test is also used.

### *Clinical symptoms scoring*

About ten clinical symptoms identified among the leather factory workers. All the occurrence of clinical symptoms is classified either as acute or chronic, while the non-occurrence is classified as normal. The clinical symptoms scores are listed below. Also, it is necessary to pair the classifications with high scores with higher difficulties or clinical symptoms. Hence a positive correlation score is used for the classifications as listed below,

- Normal= 0, implies non-occurrence of a clinical symptom
- Acute= 1, implies acute occurrence of a clinical symptom

- Chronic= 2, implies chronic occurrence of a clinical symptom

Based on the above illustration, scoring of identified clinical symptoms is done. There are about ten clinical symptoms identified, so the cumulative score for occurrence of clinical symptom could range from 0 to 20. Hence, higher scoring denotes identification of more than one acute or chronic disorder in a worker.

***Workplace health status scoring***

The workplace health status scores are listed below.

Workplace health status is assessed based on the health status of workers after working in leather factories and their problems at workplace as a result of emotional or work stress.

Information has been collected about the health condition of workers (sample units) after working in leather factories with regard to various limitations in their body activities like running or lifting heavy objects, climbing steps, bending or kneeling and walking and work stress.

The health condition of the sample unit after joining the work is classified under, 'Good', 'Normal', and 'Poor'. If limitation is identified in a worker, then the sample unit is classified either under 'Moderate limitation' or 'Limitation present', while the absence of limitations is classified as 'No limitation'. Various problems due to work stress like, reduction in amount of time spent on work, less work accomplishment than capable and carelessness are classified as 'Yes' if work stress is experienced and 'No' if no stress.

It is necessary to pair the classifications with low scores with lower workplace health status. Hence a negative correlation score is used for the classifications as listed below,

For information gathered regarding questions related to workplace health status after working in leather factories i.e., from 1a to 1 e, the scores are,

- Good/no limitation = 2
- Normal/moderate limitation = 1
- Poor/limitation present = 0

For information gathered regarding questions related to stress experienced by the workers after working in leather factories, i.e., from 2a to 2c, the scores are,

- Yes= 1
- No= 0

Based on the above illustration, scoring of workplace health status is done. There are about eight categories identified, so the cumulative score for health status of a leather factory worker (sample unit) from 1a to 1e could range from 0 to 10 and the cumulative score for stress experienced after working in leather factories in 2a to 2c could range from 0 to 3. Therefore the total cumulative workplace health score could range from 0 to 13. Hence, lower the scores denote lower workplace health status of workers.

***Scoring of facilities available for workers in leather factory***

The scores of facilities available in the leather factories are listed below.

The facilities available to the workers in the leather factories are assessed based on the availability of the six basic facilities (Refer Questionnaire from 7a to 7f). Availability of a facility to the workers provided by the leather factory is classified as 'Yes' and absence of a facility is classified as 'No'. It is necessary to pair the classifications with high scores with absence of facilities. Hence a negative correlation score is used for the classifications as listed below,

- Yes= 0, implies availability of a basic facility
- No= 1, implies absence of a basic facility

Based on the above illustration, scoring of facilities available for workers in leather factory is done. There are about six basic facility required by a leather factory worker while working in the industry, so the cumulative score for occurrence of facilities available could range from 0 to 6. Hence, higher scoring denotes lack of one or more basic facility required by a worker in a leather factory.

***Correlation coefficient***

Pearson's coefficient of correlation (r) can have a value between -1 and 1. The larger r, ignoring sign, the stronger the association between the two variables considered for identifying the association. At its extreme, a correlation of 1 or -1 means that the two variables are perfectly correlated, meaning that one can predict the values of one variable from the values of the other variable with perfect accuracy. At the other extreme, an r of zero implies an absence of a correlation and there is no relationship between the two variables. This implies that knowledge of one variable gives you absolutely no information about what the value of the other variable is likely to be. The sign of the correlation implies the "direction" of the association. A positive correlation means that relatively high scores on one variable are paired with relatively high scores on the other variable, and low scores are paired with relatively low scores. On the other hand, a negative correlation means that relatively high scores on one variable are paired with relatively low scores on the other variable.

***Data analysis***

The data collected were entered in 2009 Microsoft excel sheet. The SPSS (Statistical Package for the Social Sciences) version 15 was used for analysis of the data collected. In addition to this clinical symptom scoring, work place health status scoring and scoring for facilities available for leather factory workers were derived. All the scoring was used to derive the association between clinical symptoms, duration of work, work place health status and facilities available. The statistical methods like correlation, t test and chi-square were used.

## RESULTS

Workers who were working in eight leather factories from August 15th 2011 to march 20th 2012 were included in the study. All workers consent to participate in the study and hence two hundred and thirty workers were interviewed for the study. All the data collected from all the workers were compiled and analysed.

The SPSS output for computing Pearson's correlation for the scored data is shown in Table 1. In the table, correlation (r) denotes the Pearson's correlation between various variables like duration of work, clinical symptoms, workplace health status and facilities available at workplace. Underneath p value is a test of hypothesis about the 'significance' of the correlation. Underneath again, N means the sample size or the number of workers considered for this study.

From the Table 1, with regard to *duration of work*, the correlation between duration of work with clinical symptoms score is significant at 0.01 level (2 tailed) and r is positive, which implies that, with higher the duration of work or work experience, the likelihood of occurrence of clinical symptoms are higher. The correlation between duration of work with workplace health status score is significant at 0.01 level (2 tailed) and r is negative, which implies that, there exists a negative correlation, such that higher duration of work or work experience lower is the workplace health status. The correlation between duration of work with facilities available at workplace is significant at 0.05 level (2 tailed) and r is negative, which implies that, there exists a negative correlation, such that higher duration of work or work experience, lower is the facilities available at the workplace. So, all the variables are either negatively or positively associated or interdependent on the work experience or duration of work.

**Table 1: Pearson's correlation table between various variables and workplace environment.**

| | | Duration of work (in years) | Clinical symptoms score | Workplace health status score | Facilities available at workplace score |
|---|---|---|---|---|---|
| **Duration of work (in years)** | Correlation | 1.000 | 0.274** | -0.359** | -0.139* |
| | P value | | <0.001 | <0.001 | 0.036 |
| | N | | 230 | 230 | 230 |
| **Clinical symptoms score** | Correlation | 0.274** | 1.000 | -0.498** | 0.025 |
| | P value | <0.001 | | <0.001 | 0.702 |
| | N | 230 | | 230 | 230 |
| **Workplace health status score** | Correlation | -0.359** | -0.498** | 1.000 | -0.122 |
| | P value | <0.001 | <0.001 | | 0.064 |
| | N | 230 | 230 | | 230 |
| **Facilities available at workplace score** | Correlation | -0.139* | 0.025 | -0.122 | 1.000 |
| | P value | 0.036 | 0.702 | 0.064 | |
| | N | 230 | 230 | 230 | |

**. Correlation is significant at the 0.01 level (2-tailed); *. Correlation is significant at the 0.05 level (2-tailed).

**Table 2: Scoring and association of variables under study.**

| Scores | Occupation | N | Mean | Std. dev. | t value | P value |
|---|---|---|---|---|---|---|
| **Clinical symptoms Score** | Dyeing | 110 | 0.8818 | 0.98364 | 2.404 | 0.017 |
| | Tanning | 120 | 1.2167 | 1.11659 | | |
| **Workplace health status score** | Dyeing | 110 | 10.8182 | 2.57077 | 5.562 | <0.001 |
| | Tanning | 120 | 8.7083 | 3.17129 | | |
| **Facilities available at workplace score** | Dyeing | 110 | 4.9909 | 0.45927 | 3.758 | <0.001 |
| | Tanning | 120 | 5.2500 | 0.58338 | | |

With regard to clinical symptoms score, its correlation with work experience and workplace health status is still significant at 0.01 level (2 tailed) either as positive correlation or negative correlation respectively. It is found from the above Table 1 that clinical health symptoms correlation with facilities available at

workplace score is insignificant, implying that there is no association between clinical health symptoms and facilities available at workplace.

Also, from the Table 1, it is found that the correlation of workplace health status with work experience and clinical symptoms score is significant at 0.01 level (2 tailed) as negative correlation, i.e., with lower workplace health status higher the possibility of work experience and clinical health symptoms. It is also found that the correlation of workplace health status with facilities available at workplace is insignificant.

**Table 3: Independent samples t-test to compare two mean values.**

| Scores | Gender | N | Mean | Std. dev. | t value | P value |
|---|---|---|---|---|---|---|
| **Clinical symptoms Score** | Male | 165 | 1.0000 | 1.10432 | 1.366 | 0.174 |
| | Female | 65 | 1.2000 | 0.95525 | | |
| **Workplace health status score** | Male | 165 | 10.0545 | 3.05489 | 2.680 | 0.008 |
| | Female | 65 | 8.8615 | 2.99936 | | |
| **Facilities available at workplace score** | Male | 165 | 5.0727 | 0.53606 | 2.398 | 0.018 |
| | Female | 65 | 5.2615 | 0.53843 | | |

**Table 4: Scoring health status based on stress factor.**

| Scores | Job satisfaction | N | Mean | Std. dev. | t value | P value |
|---|---|---|---|---|---|---|
| **Clinical symptoms score** | Stressful | 35 | 1.6857 | 1.30094 | 3.215 | 0.003 |
| | Comfortable | 195 | 0.9436 | 0.98016 | | |
| **Workplace health status score** | Stressful | 35 | 7.9714 | 2.46726 | 4.365 | <0.001 |
| | Comfortable | 195 | 10.0308 | 3.07954 | | |
| **Facilities available at workplace score** | Stressful | 35 | 5.2286 | 0.42604 | 1.216 | 0.225 |
| | Comfortable | 195 | 5.1077 | 0.55954 | | |

**Table 5: Overall scoring in leather industry.**

| Scores | Occupation | N | Mean | Std. dev. | t value | P-value |
|---|---|---|---|---|---|---|
| **Clinical symptoms score** | Dyeing | 110 | 0.8818 | 0.98364 | 2.404 | 0.017 |
| | Tanning | 120 | 1.2167 | 1.11659 | | |
| **Workplace health status score** | Dyeing | 110 | 10.8182 | 2.57077 | 5.562 | <0.001 |
| | Tanning | 120 | 8.7083 | 3.17129 | | |
| **Facilities available at workplace score** | Dyeing | 110 | 4.9909 | 0.45927 | 3.758 | <0.001 |
| | Tanning | 120 | 5.2500 | 0.58338 | | |

In Table 2, scoring technique and correlation showed there is association between workplace health status and clinical symptoms ($p<0.001$), duration of work and clinical symptom scores ($p=0.001$), duration of work and workplace health ($p<0.001$), workplace health status and occupation (t-test value- 5.562, $p<0.001$), facilities available and occupation (t value-3.758, p value-<0.001) values were found to be significant for duration of work, clinical symptoms and workplace health status**.**

Table 3 shows workplace health status score is more for male (mean=10.0545) than females (mean=8.8615) and it is statistically significant ($p=0.008$). Females (mean=5.2615) said that facilities available at workplace is better while comparing with males (5.0717) which is statistically significant ($p=0.018$).

Above Table 4 shows if stress is more clinical symptoms score will be more (mean=1.6857, p value is 0.003) statistically significant.

Table 5 shows workers in tanning (mean=0.1.21167) have more clinical symptoms than the workers at dyeing (mean=0.8818) and it is statistically significant ($p=0.017$). The workers at tanning (mean=8.7083) have poor workplace health status than the workers at dyeing (mean=10.8182). Workers at tanning conveyed that facilities available is better while comparing with workers in dyeing unit and it is statistically significant ($p=0.001$).

## DISCUSSION

Health of leather factory workers could be affected on many factors. It was found that health status varies from men to women factory workers. Health status is also dependent on their age, type of work they are involved, workers socio demographic profile, facilities provided for the workers in the factory, duration of work they are involved and the environment in which they are exposed to work. The above factors are assumed to have an impact on the health of leather factory workers. In the previous study conducted by us at the same period of time, we have described only about the morbidity pattern of the leather workers and association in their socio-demographic profile have been assessed.[6] Majority of the

workers were affected with Musculo-skeletal disorder (31.7%) and others problems including skin problem (15.7%), respiratory problem (16.9%), eye problem (6.5%), ear problem (0.4%), dental problem (2.6%), C.N.S problem (0.4%), C.V.S problem (0.9%), abdomen problem (2.6%), Uro-Genital problem (0.4%) and also there is association between certain factors like gender ($p<0.0001$), occupation ($p=0.001$), nourishment ($p<0.0001$), past history of illness ($p<0.0001$) with the morbidities among the leather workers. In a study conducted among leather factory workers in Kanpur, India by authors Ory, Rahman and Katagade only the respiratory disorders, skin complaints and low back pain were discussed.[7] In another study conducted at Kanpur by Rastogi, Pandey, and Tripathi occupational health risks among leather factory workers emphasizing the morbidity pattern of various health factory workers were determined.[8] Other studies conducted in various leather factories emphasize more on respiratory illness of workers due to chemical exposure.[9,10]

However, association of health status with regard to workplace environment and the clinical symptoms of the workers were not studied in the previous studies. Therefore, in this study, work place health status of the leather factory workers were assessed with regard to the facilities available in the leather factory, workplace environment, type of work and duration of work they are exposed to along with their association with the clinical symptoms were discussed.

With higher the duration of work or work experience, the likelihood of occurrence of clinical symptoms are higher as said in Table 1 (significant at 0.01 level [2 tailed] and r is positive). There is a negative correlation, such that higher duration of work or work experience lower is the workplace health status as in Table 1 (significant at 0.01 level (2 tailed) and r is negative). The correlation between duration of work with facilities available at workplace is significant at 0.05 level (2 tailed) and r is negative, which implies that, there exists a negative correlation, such that higher duration of work or work experience, lower is the facilities available at the workplace. So, all the variables are either negatively or positively associated or interdependent on the work experience or duration of work.

With regard to clinical symptoms score, its correlation with work experience and workplace health status is significant at 0.01 level (2 tailed) either as positive correlation or negative correlation respectively. Also, from the Table 1, it is found that the correlation of workplace health status with work experience and clinical symptoms score is significant at 0.01 level (2 tailed) as negative correlation, i.e., with lower workplace health status higher the possibility of work experience and clinical health symptoms. It is also found that the correlation of workplace health status with facilities available at workplace is insignificant By this study we conclude that the workplace health status have an effect on clinical symptoms with $p<0.001$,there is an association between duration of work and clinical symptom scores ($p=0.001$),duration of work and workplace health ($p<0.001$), workplace health status and occupation (t-test=5.562, $p<0.001$),facilities available and occupation (t value=3.758, $p<0.001$). All the values were found to be significant for duration of work, clinical symptoms and workplace health status

From the result it is identified that, work experience and clinical symptoms score are positively correlated and vice versa, work experience and workplace health status score is negatively correlated and vice versa, clinical symptoms score and workplace health status score is negatively correlated and vice versa. It is also found that clinical symptoms variable is independent of facilities available and vice versa, and workplace health status variable is independent of facilities available at workplace and vice versa, implying that availability of facilities in workplace has very little or no impact on clinical symptoms and workplace health status with regard to this study. And from the above results it implies stressful work have an impact on the clinical illness, workplace health status of the workers. Males reported that health wise they were satisfied in working in leather industry however females found discomfort in health while working in leather industry.

Among the workers from both tanning and dyeing, it was found that workers from tanning unit have more health problem than that of workers from dyeing. The workers in dyeing units reported that they are more comfortable with their work while in tanning workers felt it stressful.

## CONCLUSION

The study has identified that there is an association between the number of years worked in leather industry with their clinical symptoms, work place health status and facilities available for them in the industry**.** These factors can be corrected by reducing the duration of work, provision of proper interval and reducing the work load. By providing needed protective devices like masks, gloves and shoes to workers, it was found that we could prevent them from the Respiratory, Skin, and Ocular disorders. Exclusive lunch rooms insulated from chemicals of leather industry prevents the ingestion of chemicals and dust. The waste water from leather industry should be sent to treatment plants where the water can be recycled and the chrome effluent can be reused so that contamination of water can be prevented.

### *Recommendations*

1. Regular health check-up for the workers at their workplace is advised.
2. Provision of basic required protective devices and clothing to prevent them from chemical and environmental hazards.
3. Improving the needed facilities at work place.

4. Health education and appropriate counselling should be given to the health workers regarding the illness that can occur commonly in leather industries.
5. Through the Ministry of Labor and Employment, Government of India and Labor Department of State and Union Territories new health programs should be initialized.

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