

# Lung Function Abnormalities among Tannery Workers in Vellore District

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## Abstract

Vellore and its allied areas have a high concentration of tanneries. There is a very large population engaged in the different sections of the tanneries. They are constantly exposed to leather tanning chemicals like chromium, HCL, H<sub>2</sub>SO<sub>4</sub>, alum etc. The constant exposure to these chemicals makes the workers susceptible to many lung function abnormalities. More over the contact with these chemicals can cause skin diseases, nasal cancer, ocular abnormalities and respiratory diseases. Duration of exposure is a major criterion for the reduction in lung function. It is a cross sectional study involving 39 male subjects aged between 18-60 years working in different sections of the tanneries in Vellore district as study group and 25 male subjects of the same age group and socio economic status and who do not have any previous exposure to leather tanning chemicals as control group . Lung function testing was done using Eagles's global spirometer. Our study shows moderate restriction and mild obstruction in study group when compared to normal subjects and also shows progressive decrement in FVC and FEFmax with their age and duration of occupation.

**Keywords:** Tannery workers, PFT, FVC, FEF max.

## Introduction

In Tamil Nadu, Vellore district was found to have more number of tannery factories. Vellore district is the topmost suppliers about 37% of finished leather around the country.<sup>(1)</sup> Vellore and its allied areas have a high concentration of tanneries. There is a very large population engaged in the different sections of the tanneries. They are constantly exposed to leather tanning chemicals like chromium, Hydrochloric acid (HCl), Hydrogen sulphate (H<sub>2</sub>SO<sub>4</sub>), alum etc. Constant exposure to environmental chromium this can affect lung airways and parenchyma. A study among chrome tannery

workers showed that there was significant prevalence of cancer not only of the lungs but also pancreas, bladder, kidney, testes, nasal cavity, lymphoma etc.<sup>(2)</sup> Another risk is exposure to chromium as it enters the body through inhalation, ingestion leading to the risk of nasal septal perforations<sup>(3)</sup> and even direct cutaneous contact with chromium can cause severe eczema.<sup>(4)</sup> The exposure to these chemicals makes the workers susceptible to many lung function abnormalities. More over the contact with these chemicals can cause skin diseases, nasal cancer, ocular abnormalities and respiratory diseases. Duration of exposure is a major criterion for the reduction in lung function. Benzene based dyes and formaldehyde are the chemicals used in tanning process are considered to be carcinogenic.<sup>(5)</sup> According to the International Agency for Research on Cancer (IARC), showed that there is evidence of carcinogenicity in humans who work in leather tanning and processing whereas the production process involves more exposure to numerous chemicals.<sup>(6)</sup> Leather tanners can be also exposed to pesticide which can cause prostate cancer.<sup>(7)</sup>

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**Table 1: Shows here the chemicals used in the process of tanning and its purpose (8) Kanpur-occupational**

S.No	Processes	Chemical Used	Purpose
1	Preparation for hide tanning	DDT, Zincchloride, phenols, formaldehyde, arsenic	Defestationand disinfection
2	Tanning process	Calcium hydroxide, sulphide, benzene, ethanol, H2SO4	Removal of epidermis and subcutaneous layer.
3	Finishing-Casein finishing & Nitrocellulose finishing	Formaldehyde as fixer, anilines and resins	Coloring, softness, brightness, elasticity

Hence we choose to do pulmonary function tests in tannery workers who come to the chest clinic with respiratory symptoms to our hospital.

### Materials and Methodology

This study was done in the Vellore district involving the tannery workers and lung function tests were done in the department of Physiology, Government Vellore medical college (GVMC). This cross sectional study involved 39 male subjects aged between 18-60 years working in different sections of the tanneries in Vellore district as study group were the patients attending the chest clinic outpatient department (OPD) in our hospital. The control group 25 male subjects of the same age group and socio economic status and also who do not have any previous exposure to leather tanning chemicals were the patients attending the medicine OPD in our hospital. More importance was given while taking history where mainly focussed on personal and occupational history. The Personal history includes the name, age, height, weight, BMI, smoking history, alcohol consumption, history of previous respiratory illnesses, surgeries etc. The Occupational history included occupational duration, type of work, toxicants they work with and the mode of contact with the chemicals. The medicine and chest clinic were intimated earlier about the study and contact number of the principal investigator (PI) were also given. So before sending the patient to the physiology department for doing PFT, the PI was also intimated. The study was proceeded after getting consent from the both the groups.

Lung function testing was done using “EAGLES’S GLOBAL SPIROMETER” in the department of

Physiology and the following parameters were studied - FVC, FEV<sub>1</sub>, FEV<sub>1</sub>/FVC, FEF 25-75%, FEF max and MVV.

Forced vital capacity/ Timed vital capacity- Maximum volume of air that can be breathed out forcefully and rapidly after a maximum inspiration.

FEV<sub>1</sub> (Forced vital capacity in 1 second)- Volume of FVC expired in one second of exhalation.

FEF 25-75% -The maximum flow during the middle third of the total expired volume which is expressed as forced expiratory flow at 25% to 75% of lung volumes.

MVV-(Maximum voluntary ventilation)-also called maximum breathing capacity where the maximum volume of gas can be breathed per minute by maximal voluntary effort.

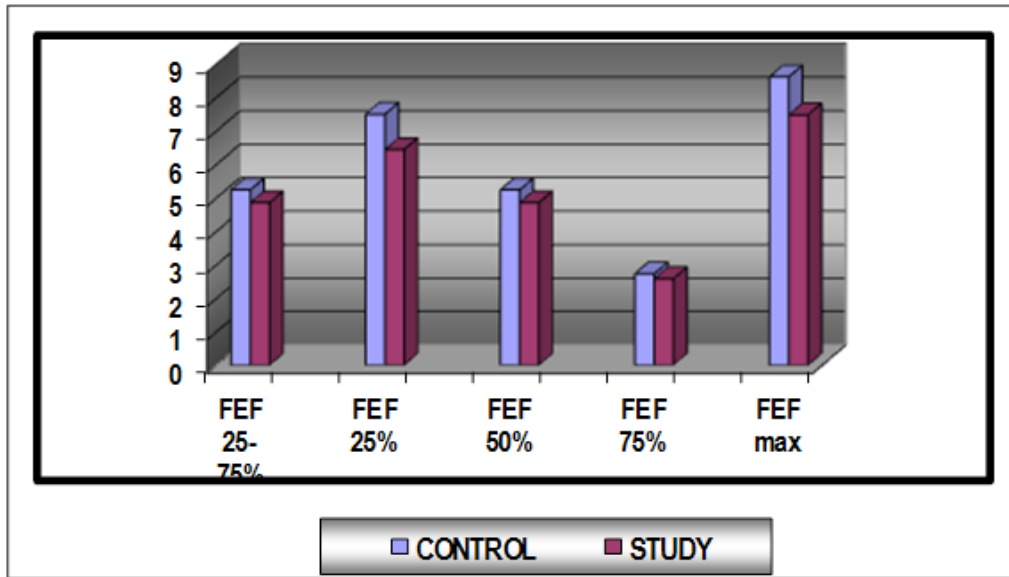
### Results

The comparison of the mean values of the anthropometric measure between the study and the control group was done. But there was not much significant because both the groups were of the same age and socio-economic status. The table 2 below shows the mean values of FVC, FEV<sub>1</sub>/FVC, FEF25-7%, FEF max and MVV when compared between the study and the control group showed significant reduction in all the parameters among the study group especially in FVC and MVV. So there is 22% reduction in FVC with p value of 0.019, 23% reduction in FEF 25-75% with p value of 0.001, 13% reduction in FEF max with p value of 0.00021 and 85% reduction in MVV.

**Table 2: Shows the comparison between the control and study group of the lung parameters assessed**

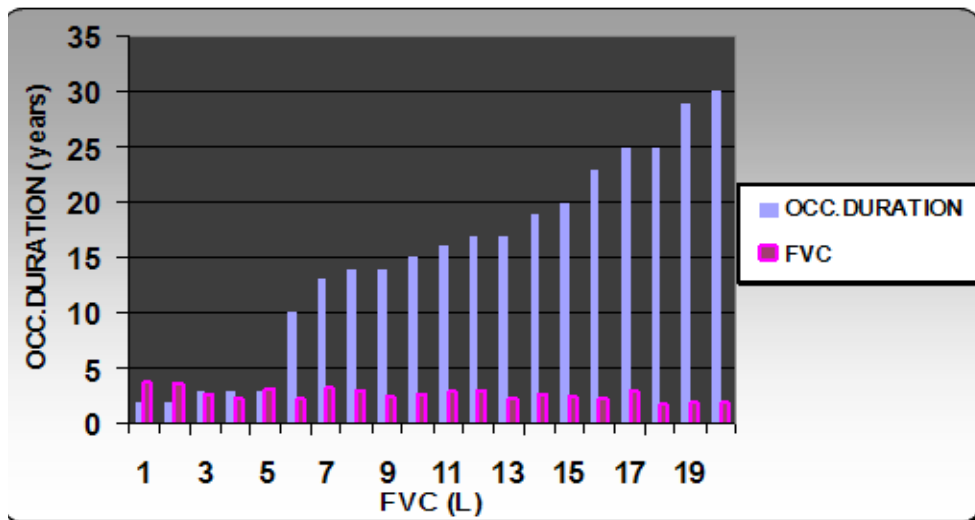
Parameters	Control (Mean)	Study (Mean)	P- value
FVC	3.51133	2.7128	>0.019581
FEV1	3.25933	2.616	
FEV1/FVC	92.45867	95.4872	
FEF25-75%	4.55267	3.4964	>0.009930
FEFmax	8.606	7.4772	>0.000029
MVV	127.81867	109.3488	

The reduction in FEF 25%, FEF 75%, FEF 50% among the study group when compared to the control group and also the study group showed 13% reduction in FEF max is shown in Fig 1 as bar graph representation below.



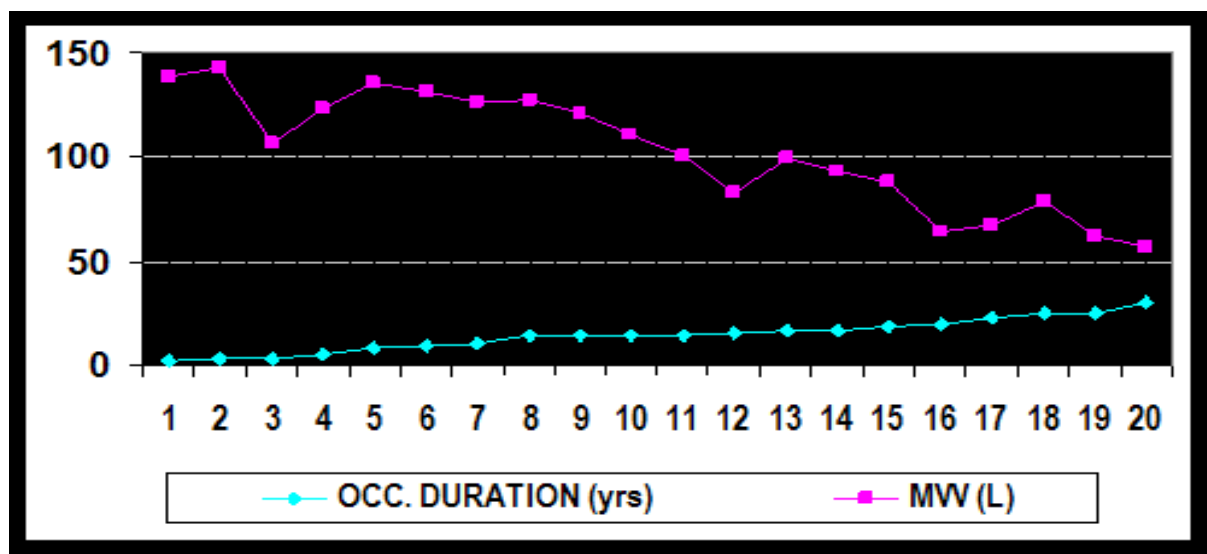
**Fig 1: Shows the bar graph comparison of Various FEF values between the study and control groups**

The Co-relation of FVC with duration of occupational years of exposure showed an inverse relationship between them, that is the more was the occupational duration, the less was the value of FVC has been shown below in fig 2.



**Fig 2: Shows the bar graph comparison of FVC values with the occupational years**

Fig 3 below shows that the correlation between MVV and occupational duration also showed an inverse relationship between them. The MVV decreases as the occupational duration increases.



**Fig 3: Shows the line graph comparison of MVV values with the occupational years**

### Discussion

Vellore and its surroundings has got many tannery workers where they are involved in various processes before the final production and exposing themselves to harmful chemicals. Chromium is one among the chemicals which can cause cancer of not only the lungs but also the bladder, kidney, nasal cavity.<sup>(9)</sup> Many studies have been done to assess the effect of such harmful chemicals in lung functions. Long term exposure to these biological hazards like endotoxins mycotoxins could be another cause of reduction in lung function because during the tanning process, the hide contains numerous microorganisms which serve as a medium for exposure. In another study showed that chronic and long term exposure to tanning chemicals can cause asthma related symptoms that is features of obstructive lung disease. This study was done among tannery workers working in Tuzla Organized Industry Region, Istanbul was done to know whether long term exposure to chemical affects lung function parameters showed a significant deficit in the lung parameters of FVC%, FEV<sub>1</sub>%, FEV<sub>1</sub>/FVC%, PEF%, FEF<sub>25-75</sub>%.<sup>(10)</sup> All the lung parameters were also reduced in another study done in Kanpur leather where the study group showed the features of bronchial obstruction.<sup>(8)</sup>

Our study too showed moderate restriction and mild

obstruction when compared to normal subjects. This study correlates with previous study of tannery workers and chrome plate workers. It also shows progressive decrement in FVC, FEFmax and MVV with their age and duration of occupation. Decrement in MVV which was found may be due to aging process. Respiratory illness was found in 60% of our study group when compared to <40% in control group.

Long-term exposure to biological hazards, especially to microbial agents; endotoxins, proteases and mycotoxins, about which there is a large literature, may be another reason for continuing complaints. During the tanning process, risk of exposure to biological agents is ever-present, since the hide serves as a medium for numerous microorganisms

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### Conclusion

There is moderate restriction and mild obstruction in the study group when compared to the normal subjects and also shows progressive decrement in FVC as well as FEFmax with their age and duration of occupation in the tannery factories. The study recommends breathing exercises to improve the deteriorated lung functions. The study can further be extended in near future by the monitoring in addition the diffusion capacities.

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