

*SHORT COMMUNICATION*

ACUTE EFFECTS OF FORMALIN ON PULMONARY FUNCTIONS  
IN GROSS ANATOMY LABORATORY

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**Abstract :** Formaldehyde is a common indoor pollutant with irritant properties. The present study was undertaken in first year medical students to study the acute effects of it on their first exposure in gross anatomy laboratory. Twenty randomly selected subjects aged between 18 to 20 years and non smokers had undergone pulmonary function testing thrice. First being baseline values then immediately after their first dissection class (2 hrs.) and lastly 24 hrs after their first exposure. All the tests were performed on Siblemed 120 B portable spirometer with inbuilt computer programme under standard laboratory conditions. It was observed that FVC decreased in subjects immediately after their first exposure but reverted back to normal within 24 hrs. While all other lung function parameters remained unchanged, indicating some mild transient bronchoconstriction on acute exposure to formalin. The study needs to be extended with larger number of subjects.

**Key words :** formaldehyde  
medical student's

pulmonary functions  
anatomy laboratory

INTRODUCTION

Formaldehyde is a ubiquitous industrial and air pollutant to which millions are daily exposed. It is used for disinfection or sterilization of instruments used for medical purposes. It is also used as a preservative of biological specimens as well as cadavers. It has been suggested that formaldehyde may produce physiological alterations of respiratory system. Occupational data suggests that small but significant changes

may occur in lung functions following prolonged exposure in the work place (1-3). Upper airway irritation is the most common respiratory effect reported by the workers and occur over a wide range of concentrations, most frequently above 1 ppm. However airway irritation has occurred in some workers with exposures to formaldehyde as low as 0.1ppm. Symptoms of upper airway irritation include dry or soar throat, itching and burning sensations of the nose and nasal congestion. Tolerance to this level of

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exposure may develop within 1-2 hours. This tolerance can permit workers remaining in an environment of gradually increasing formaldehyde concentrations to be unaware of their increasingly hazardous exposure. Various studies have revealed the effect of formalin by artificial exposures of volunteers under controlled environmental conditions (4-8).

The evaporation of formaldehyde from cadavers in gross anatomy laboratories can produce high exposures among students and instructors (9, 10). A few studies have characterized formaldehyde emission rates in gross anatomy laboratory (11). We plan to study the acute effects of formalin in first year medical students who are exposed to it routinely during their anatomy dissection for at least two hours every day throughout the year.

#### METHODS

The study was carried out in pulmonary function laboratory, department of physiology, UCMS and GTB hospital, Delhi. Twenty, MBBS students were randomly selected from a batch of newly admitted students (first year). All these students were nonsmoker males of age between 18-20 years and none had a previous exposure of formalin. The pulmonary functions were tested in three sittings

- 1) On admission to medical college during their orientation programme before they have started their dissection classes.
- 2) Immediately after their first dissection class (2 hours duration).

- 3) Twenty four hours after their first dissection class (they didn't had a dissection period that day).

Subjects suffering from any acute or chronic respiratory disorder or any systemic illness that directly or indirectly affects respiratory system were excluded. Past or present smokers and those who had any previous exposure of formalin were also excluded.

The pulmonary function tests were carried out using Sibelmed datospir 120 B precision spirometer with built in computer programme using standard laboratory methods. The apparatus provides a detailed analysis of predicted and derived values. Informed consent was taken from subjects before starting the study and anthropometric measurements like height, weight and chest circumference was taken for these subjects. The pulmonary function tests were repeated thrice for each subject each time and the best result was selected for analysis.

The three sets of readings were compared by f test (Repeated measure ANOVA) and multiple comparisons were obtained by tukey's test at 5% level of significance for all the parameters.

#### RESULTS

The mean age of the subjects in the present study was  $18 \pm 0.51$  years. The mean height of these subjects was  $177.63 \pm 9.30$  cm and weight being  $68.38 \pm 13.02$  kg. All the subjects complained of mild irritation in the nose. Tears in the eyes were also felt by 60% of the subjects. Their PFT reports showed a significant decrease in FVC

immediately after 2 hr exposure to formalin (Table I). This value came down to normal after 24 hrs. All the other volumes and flow rates did not show significant change in three readings.

TABLE I: PFT before and after formalin exposure.

	<i>1st reading (baseline)</i>	<i>2nd reading (immedi- ately after exposure)</i>	<i>3rd reading (24 hrs. after exposure)</i>
n	20	20	20
FVC (L)	3.86±0.49	3.74±0.50*	3.91±0.42
FEV1 (L)	3.47±0.48	3.39±0.40	3.50±0.46
FEV0.5 (L)	2.52±0.37	2.59±0.30	2.61±0.37
FEV3 (L)	3.75±0.47	3.73±0.49	3.79±0.31
FEV0.5/FVC (%)	67.74±9.81	70.32±9.61	68.92±7.68
FEV1/FVC (%)	91.27±7.89	91.36±7.16	91.27±7.89
FEV3/FVC (%)	99.73±0.60	99.60±0.95	99.73±0.60
PEF (L/S)	6.73±1.44	7.00±1.20	6.70±1.25
MEF25% (L/S)	2.76±1.02	2.63±0.97	2.80±0.85
MEF50% (L/S)	4.45±1.01	4.70±0.84	4.55±0.92
MEF75 (L/S)	6.21±1.38	6.68±1.15	6.134±1.27
FEF25%-75% (L/S)	4.15±0.98	4.33±0.94	4.21±0.87
FEF75%-85% (L/S)	2.26±1.01	2.01±0.76	2.35±0.89
VC (L)	4.15±0.43	4.16±0.40	4.13±0.42
TV (L)	0.88±0.45	0.95±0.43	0.95±0.39
ERV (L)	1.39±0.42	1.46±0.32	1.45±0.28

\*P<0.05, L-litres, L/S-litres per second.

## DISCUSSION

The present study has shown a decrease in FVC of our subjects immediately after 2 hr exposure of formalin. But this value reverted back to normal when evaluated after 24 hrs. A trend towards decrease in the values of FEV1 immediately after exposure is observed but this could not reach the level of significance. This indicates that there may be a transient mild bronchoconstriction which can be confirmed by studying the exposure on larger number of subjects. Similarly the other volumes and flow rates

also did not show a significant change with acute exposure to formalin.

Various studies done earlier showed confounding results. Exposure to formaldehyde in work place had shown decreased FEV 1, MEF and diffusion capacity in people employed in carpenter shop (5) and also in bat makers (1). The reason for derangement of PFT in these workers may be their longer periods of work i.e., at least eight hours of work per day. Secondly these workers were in their profession for years together. While our subjects were exposed to formalin for the first time.

A single study done in wood workers exposed to formaldehyde showed a transient impairment of lung function over a work shift (3). A dose response relationship was found between exposure to formaldehyde and decrease in lung function. It was concluded that there is transient lung function impairment over a work shift, with cumulative affect over the years. The impairment can be reversed with four weeks of no exposure.

In the above studies there is variation in the recording techniques. The subjects were of varying ages and hence reference material for predictive data may not be accurate. While our subjects were all of the same age groups (18–20 years) and none belong to low socio economic status. Since same subjects were followed and examined thrice the chances of their individual variations were also eliminated.

Few studies done by exposing the subjects under controlled environmental chambers have seen varied effects on pulmonary

functions (4–8). Decrease in FEV<sub>1</sub>, FVC, FEV<sub>3</sub>, is reported on 1 hour exposure to 3 ppm formaldehyde whereas a 40 min. Exposure to 2 ppm formaldehyde had shown no changes in lung function of healthy individuals. But eye, nose, throat irritation was prominent in these subjects.

Environmental evaluation conducted in the anatomy laboratory showed formaldehyde levels ranging from 0.02 ppm to 2.7 ppm, indicating exposure significant to cause symptoms of irritation in most of the exposed subjects (9). PFT was observed to be normal in these subjects. Similarly our subjects also

experienced the symptoms and most of the parameters in PFT remained unchanged.

The exact concentration of formaldehyde to which our subjects were exposed can not be determined but it is definitely at a concentration causing severe eye and nose irritation (2–3 ppm) (11). The study needs to be extended in a larger number of subject and these should be followed for one year to see the chronic effects of formalin on lung functions. Moreover the air sampling of dissection hall needs to be done to derive a relationship between the concentration of formalin and its effects.

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