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CORRELATI ON OF PULMONARY FUNCTION TEST WITH THE RESPIRATORY ENDURANCES OF THE SANITARY WORKERS IN KANCHIPURAM

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ABSTRACT

Background: *Municipal solid waste handling and disposal is a growing environmental and public health concern. Sanitary workers exposure to ambient particulate air pollution is associated with increase in morbidity and mortality from respiratory diseases. Working in dusty environment face the risk of inhaling particulate materials that may lead to adverse respiratory effects. These workers are exposed to a number of pathogens, toxic substances, chemicals that come from the waste itself and from its decomposition, as well as vehicle exhaust fumes, noise, extreme temperatures and ultraviolet radiation. As a result of their exposure to multiple risk factors, they suffer high rates of occupational health problems, which would definitely alter the pulmonary functions and respiratory endurances.*

Aim: *This study was aimed to correlate the pulmonary function test and respiratory endurances of the sanitary workers in Kanchipuram.*

Method: *The study was done on 106 sanitary workers of Kanchipuram Municipality by the Department of Physiology, MMCH &RI. The sanitary workers were compared with their matched control. Respiratory endurances test such as 40 mmHg respiratory endurances test, Breath Holding Time (BHT) and chest expansion was done. Pulmonary function test such as Forced Expiratory Flow Rate (FEF_{25-75}), Peak Expiratory Flow Rate (PEFR) was done with computerized RMS spirometer-HELIOS 701 and respiratory rate along questionnaire related to their occupational health hazards.*

Result: *The pulmonary function test values and respiratory endurances of the sanitary workers, showed a significant decrease with significant increase in respiratory rate.*

Conclusion: *The finding of our study clearly showed that there was a significant alteration s in pulmonary functional parameters and respiratory endurances value showing micro-airway obstruction with a reduction in the functioning of the respiratory muscles.*

KEYWORDS : PFT, respiratory endurances, micro-airway obstruction, sanitary workers.

INTRODUCTION:

Municipal solid waste generation varies across countries in relation to income level and rate of urbanization ,where according to the statistical data of many countries shows nearly for 44% of the 1.3 billon tonnes of waste generated yearly world-wide.[1] Inhalation accidents accounted for 22% of acute occupational respiratory illness reported by Chest and Occupational Physicians to the United Kingdom SWORD project from 1989 to 1991, and the incidence seems to be rising.[2-3] Inhalation accidents are an acute injury, and acute episode without neurological sequelae, complete recovery usually occurs. However, exposure to irritant gases may occasionally result in the long term respiratory illnesses like bronchiolitis, reactive airways dysfunction syndrome, and pulmonary fibrosis [4].

Exposure to toxic gas is a well-recognised hazard for sanitary workers who work in enclosed spaces where gas arising from the decomposition of waste material and from industrial effluent may be encountered. The main risks involve hypoxia and exposure to poisons-such as hydrogen sulphide. Standard safety procedures include gas analysis to ensure the presence of adequate oxygen and the absence of methane or hydrogen sulphide. Monika M watt et al reported that an episode of inhalation injury in sewer workers, which resulted in sub-acute and chronic respiratory and other symptoms not previously described and which has important implications for the safety of all such workers [5].

In many countries municipal solid waste is collected manually by traditional methods[6].There is increasing evidence that exposure to bioaerosols is associated with health effects such as respiratory diseases[7]. In a study on the pattern of lung disease among street sweepers of Nagpur, India, chronic bronchitis was significantly more prevalent among garbage collectors than in a control group[8].The incidence of work-related pulmonary problems seems to be greater in waste collectors than in the general workforce[9]. This occupation is physically strenuous, resulting in workers breathing through their mouth rather than their nose. Individuals who breathe through their mouth have higher pulmonary ventilation rates when comparing to those who breathe through their nose[10].

This is likely to be attributed to the occupational exposure of this group to workplace contaminants, particularly, bioaerosols.[11] Each year, some workers will suffer from at least one episode of work-related illness. Many studies has been done in many metropolitan cities in large scale regarding the respiratory problems of the sanitary workers but least importance is given to sanitary workers in urban area for their respiratory problems, so this study was aimed to assess the effect of damage caused by the irritant chemicals on the respiratory parameters.

MATERIALS AND METHOD:

The study was done on 256 subjects of which 106were sanitary workers of Kanchipuram Municipality. It was conducted by the

Department of Physiology, MMCH & RI. The study protocol was ethically approved by the Institutional Ethical Committee. All subjects were explained about the procedure to be undertaken and informed consent of the subjects was obtained.

The sanitary workers were assessed for their respiratory endurances by making them to perform a 40mmHg respiratory endurance, breath holding time and chest expansion.the mean of two trail was taken into consideration. A proper anthropometric assessment which includes height and weight were assessed on the sanitary workers and were then trained to do the PFT procedure. The best value of the three attempt was taken and a complete flow loop curve was obtained. Pulmonary function test (PFT) were performed using portable spirometer (HELIOS) 701which works with the miniflow sensor. Disposable mouth piece and other suitable precaution were taken as per the equipment specification of the American thoracic society. The best values of forced expiratory rate (FEF_{25-75} and PEFR) was recorded to assess for any small airway obstruction. Respiratory rate was recorded along with their detailed medical history about their occupation related health condition.

Sanitary workers working for more than 10 years within the age limit of 20 to 60 years were included for the study while Post-surgery sanitary workers, workers with respiratory disorders, and with cardiovascular problems were excluded from the study. The data was statistically evaluated by using SPSS version 16.0.

RESULT

Table-1 : Comparison of PFT(FEF_{25-75}),PEFR, breath holding time, respiratory endurances, chest expansion, respiratory rate of the sanitary workers with their matched control.

S.NO	PARAMETER	SUBJECT	CONTROL	P.VALUE
1	$FEF_{25-75\%}$	76.54±2.313	85.39±1.887	0.0031**
2	CHEST EXPANSION	1.250±0.059	1.550±0.052	0.0002**
3	40 mmHg RESP.ENDURANCES	20.73±1.149	37.15±1.555	0.0001**
4	PEFR	233.4±7.826	391.1±7.423	0.0001**
5	BREATH HOLDING TIME	26.54±1.186	42.45±1.728	0.0001**
6	RESPIRATORY RATE	21.46±0.3672	16.58±0.321	0.0001**
The P.VALUE is significant at P <0.05 ** Highly significant * Significant				

In table-1, The respiratory endurances and pulmonary function parameters of sanitary workers were compared with their matched control. It showed that there was a significant decrease in $FEF_{25-75\%}$, chest expansion, respiratory endurances (40 mmHg),PEFR and breath holding time and a significant increase in respiratory rate in the sanitary workers

Table-2: Correlation of the respiratory endurances and PEFR of the sanitary workers and with their matched control.

GROUPS	MEAN+SD		MEAN DIFFERENCE	CONFIDENTIAL INTERVAL	P.VALUE
	RESP.END	PEFR			
CONTROL	106.1 ± 4.442	98.28+ 2.313	98.28±2.313	-3.383 to 19.12 =15.738	0.1718
SUBJECT	59.22 ± 3.283	58.35 ± 1.957	0.867±3.804	-6.589 to 8.323 =1.734	0.8199
The P.VALUE is significant at P <0.05 ** highly significant * significant					

In Table-2, It show that there was a correlation of respiratory endurances values with the PEFR on comparing the confidential interval of the control and subject the range of interval is more in control than in the subject. Moreover on comparing the respiratory endurances and PEFR, the p.value was not significant in both the groups of control and subject.

Table-3: Occupational health status evaluation of the sanitary workers of Kanchipuram municipality of 106 sanitary workers

S.NO	COMPLAINTS	PERCENTAGE
1	Shoulder pain	80%
2	Back pain	78.3%
3	Cough and cold	36%
4	body pain	23.6%
5	Breathlessness	23%
6	Rhinitis	20.8%
7	Joint pain	17%
8	Trauma	16%
9	Hyper-tension	15%
10	Diabetes mellitus	15%
12	Neurological	10.4%
13	GIT problems	7%
14	Angina	6%
15	Eye problem	2.8%

In Table-3, The statistical evaluation of the health status of the sanitary workers were calculated amoung 106 sanitary workers and the percentage status of problems were given above of which importantly nearly 70- 80% of the workers were suffering from musculoskeletal problems and 20-30% of the workers showed respiratory symptoms.

DISCUSSION

This is the first study to assess the respiratory changes among the sanitary workers of Kanchipuram Municipality. In this study, we observed a highly significant changes in parameter related to respiratory function. There was a significant decrease in FEF_{25-75} in sanitary workers, which might be due to airway obstruction (zuskin et al 2016) resulting with accumulation of inflammatory dust ,smoke, bioaerosoles and circulation of other inflammatory mediators which can led to tissue remodelling like fibrosis and hypertrophy in the micro airway of the lung. These sanitary workers are prone to exposure to the environmental pollution [19-20].Similar to tobacco smoke, dust induced lesions tend to produce more fibrosis and pigmentation in the membranous and respiratory bronchioles. This parenchymal fibrosis caused by a variety of dusts such as asbestos, coal, silica, talc, mica, aluminium, and iron oxides leads to thickening of small airways with luminal narrowing and ultimately to airflow obstruction. The restrictive ventilatory defect may also be produced by interstitial fibrosis (as in asbestosis) or nodular lesions (as in silicosis),which can led to dust macule which ultimately results into mineral dust induced airways disease because of collagen deposition and distortion of airway, with surrounding emphysema in the late stages. This indicates that the probability of fibrosis is directly proportional to number of dust particles [12-15]

Likewise, PEFR was significantly decreased in sanitary workers which might be due to decreased in respiratory muscle strength (Symth et al 1984) or also could be due to pain in the shoulder, back and generalised body pain which was observed in the sanitary workers as observed in the Table-3,. The typical respiratory function abnormalities in skeletal muscles are those of a restrictive defect[16]. Studies by Feltelius (1986) have shown an association between the limitation of chest expansion and restriction of vital capacity associated with the respiratory symptoms. The chest expansion of the sanitary workers were significantly reduced, that could be due decreased chest circumference at the axillary level and associated with reductions in the anterio-posterior and medio-lateral diameters which further reduces the chest wall movement and flexibility.This produces decrease in performance and work of breathing which leds to dyspnea[17]

Similarly in our study breath holding time (BHT) and 40mm Hg

respiratory endurances of the sanitary workers was significantly decreased. This could be due to a relative hypercapnia which can result from airway obstruction, which leading to more carbon-di-oxide saturation and less oxygen perfusion in the blood this in turn led to early break point. which further triggers the central and peripheral chemoreceptors and lung receptors and increases the alveolar ventilation[18] This could have led to a significant increase in the respiratory rate of the sanitary workers. BHT is an indicator of efficiency of breathing function and is a measure of ventilatory response. The commonest complication seen in sanitary workers is bronchitis, which paralyzes the cilia lining the bronchi. This, along with mucus accumulation, serves as a nidus for infection and inflammation, leading to edema and blockage of airways restricting the entry of oxygen into the alveoli. Though the direct patho-physiological mechanisms of smoking affecting BHT is not clear, sanitary workers show a reduction in lung volumes, their respiratory muscle strength and their capacity to endure physical discomfort is limited.

Table-2 indicates the correlation between respiratory endurances and PEFR and it shows both are highly correlating since the ventilatory parameters(PEFR) and the respiratory muscles strength (respiratory endurances) support each other in the mechanism of respiration, these two parameters are directly proportional to each other. When their is a decrease in respiratory muscle strength ultimately, there is a decreases ventilator parameter and vice versa. It also specifically shows that the range of respiratory endurances and ventilatory parameters are decreased in the sanitary worker on comparing with their matched control mainly due airway obstruction on inhalation of their occupation hazards such as dust, chemicals and other bio-aerosols which decreases ventilatory functions. Also as noted in Table-3 presences of back, shoulder and other body ach can also decreases the strength of the respiratory muscles strength and respiratory movement which ultimately reduces the respiratory endurances.

As per (table-3) the prevalence of back, shoulder and generalized body pain was high in workers probably due to the fact that they were engaged in hard laborious work involving sharp heavy metal equipment. As described by Tuller (2000) [21], similar to other professions that require physical labour, garbage collecting can put tremendous strain on the body. Prevalence of chronic cough and allergic rhinitis could be high due to the fact that they are exposed to irritant gases, fumes and weather changes during their work in the fields. In a study by Mustajbegovic et al (1995) on respiratory function in street cleaners and garbage collectors, the prevalence of most of the chronic respiratory symptoms was statistically higher among the sanitation workers than the controls [22]. This was reiterated by Tuller (2000) in his monograph, where he states that garbage collectors are many more times likely to suffer allergies, infections, and respiratory problems [21].

CONCLUSION

In our study we observed that these sanitary worker are highly prone for hypoxia and hypercapnia due to low O_2 perfusion and high CO_2 saturation in the blood. These workers are also presented with abnormal respiratory symptoms. Finally this study also showed that along with the altered PFT parameters and the respiratory endurances parameters will support to the finding shows the sanitary workers of Kanchipuram population are also prone for the small airway obstruction likly because of chronic exposure to environmental pollution, chemicals and other bio-areosol on a long term basis.

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