



## Respiratory Muscle Strength Test in Petrol Station Workers in the Rangsit Municipality Area

Suwattana Tongear<sup>\*</sup>, Premwit Inthachit, Thanakorn Buriphakdi, Tidarat Sreeprang and Pornnapat Kitapiban

<sup>1</sup>Faculty of Physical Therapy and Sport Medicine, Rangsit University, Pathum Thani, Thailand

<sup>\*</sup>Corresponding author, E-mail:suwattana.t@rsu.ac.th

### Abstract

Petrol station workers had a higher opportunity to be exposed to the petrol and related pollution around petrol station than general population. The pollution affected the structure of the respiratory system, including decreased lung capacity caused by the respiratory tract thickening. It also decreased the strength of respiratory muscles that lead to other respiratory diseases. *Objective:* This study evaluated the strength of the respiratory muscles of petrol station workers by using the maximal inspiratory and expiratory pressures. *Methods:* Sixty healthy male petrol station workers in Rangsit municipality area, who had a normal body mass index (BMI), not a current smoker and work period at least 1-2 years, were recruited to the study. The strength of the respiratory muscles were tested in maximal inspiratory pressure (MIP) and maximum expiratory pressure (MEP) used by micro respiratory pressure meter, and the best values were used for analysis. *Results:* The petrol station workers had the maximal expiratory pressure statistically significant decreased ( $79.96 \pm 25.66$  cmH<sub>2</sub>O, reference =  $150.25 \pm 7.11$ ,  $p < 0.001$ ), while the maximal inspiratory pressure was not statistically significantly affected ( $105.17 \pm 35.23$  cmH<sub>2</sub>O, reference =  $108.27 \pm 3.51$ ,  $p = 0.508$ ). *Conclusion:* The petrol station workers in Rangsit municipality area had a risk of decreased strength of the respiratory muscles.

**Keywords:** *Respiratory muscles strength, Petrol station workers, Maximal inspiratory pressure, Maximum expiratory pressure*

### 1. Introduction

The concentration of benzene in the air in Bangkok is higher than the safety standards. (Ministry of Natural Resources and Environment, 2015) Petrol station workers have a higher opportunity to be exposed to benzene than the general population because they have the highest frequency of benzene inhalation (Pimpasaeng, & Chaiklieng, 2014). The previous study showed that the petrol station workers who were exposed to the benzene may be affected in regards to change in the structure of the respiratory system such as decreased lung capacity, increased thickening of the respiratory tract, induce the red blood cell abnormally and had low hemoglobin, which could be due to decreased oxygen delivery to muscles (Tunsaringkarn, Soogarun, Rungsiyothin, Zupuang, & Chapman, 2011). It could make cell hypoxia also play a role in muscle dysfunction and decreased exercise capacity (Gea, Agusti, & Roca, 2013). Therefore the respiratory muscles may be affected in this group.

However, there are an insignificant number of reports on the strength of the respiratory muscles of petrol station workers. The current study measures the respiratory muscle strength in petrol station workers in the Rangsit municipality area.

### 2. Objectives

This study aims to evaluate the strength of the respiratory muscles of petrol station workers and compared with the normal predicted value.

### 3. Materials and Methods

This study was a cross-sectional analytic study and approved as an exemption research by the Ethical Committee of research Institute of Rangsit University (RSEC 50/2560). A total of 60 healthy male petrol station workers in Rangsit Municipality area, with a normal body mass index (BMI), not a current smoker and worked for a period of at least 1-2 years, were recruited to this study. The subjects signed the



informed consent form and completed a questionnaire about the years working at the petrol station. The vital signs (Heart Rate, Blood Pressure, Respiratory Rate, Oxygen saturation) were measured and recorded.

The respiratory muscle strength measured from the two values had maximal inspiratory pressure (MIP) and a maximum expiratory pressure (MEP). Each parameter was measured by the same observer and measured 3 times per parameter. The best values in each parameter were used for analysis. The normal predicted value of MIP and MEP in each person used the formula derived from the study of Evans in 2009 for calculation (Evans, & Whitelaw, 2009) (Table 1). Statistical analysis was carried out by paired samples t-test with  $p < 0.05$  as the significant level.

**Table 1** The formula from the study of Evans study

MIP	MEP
$120 - (0.41 \times \text{age})$	$174 - (0.83 \times \text{age})$

#### 4. Results and Discussion

A total of 60 male petrol station workers mean age was  $28.61 \pm 8.56$  years from 21 stations in Rangsit Municipality, Thanyaburi, Pathumthani. The average length of work is  $2.4 \pm 2.5$  years and the shortest length of working time is 1 year. The longest length of work hour is 12 hours per day and 7 days per week (Table 2).

**Table 2** The petrol station workers work time

Work time	N (%)
Work times periods	
- 1 year	36 (60%)
- 2-5 years	17 (28.3%)
- >5 years	7 (11.7%)
Hours per day	
- 8 hours per day	2 (3.3 %)
- 9 hours per day	8 (13.3 %)
- 10 hours per day	2 (3.3 %)
- 12 hours per day	47 (78.3 %)
- 14 hours per day	1 (1.7 %)
Days per week	
- 6 days per week	9 (15 %)
- 7 days per week	51 (85 %)

The petrol station workers have a statistically significant decrease of their maximal expiratory pressure (MEP) as shown in Table 3. The present study reveals decreasing of the MEP in employees of petrol stations in Rangsit municipality. The MEP related to the expiratory muscles strength and forced expiratory volume in one second (FEV1) corresponded to the study of Hulke, Patil, Thakare and Vaidya (2012) and Dube, Mungal and Kulkarni (2013)

**Table 3** Comparison of respiratory muscle strength in petrol station workers between normal values

Respiratory muscle strength test	Respiratory muscle strength in petrol station workers	Normal value of inspiratory pressure and expiratory pressure	p-values
Maximal Inspiratory Pressure (cmH <sub>2</sub> O)	105.17± 35.23	108.27± 3.51	0.508
Maximum Expiratory Pressure (cmH <sub>2</sub> O)	79.96±25.66	150.25±7.11	< 0.001*

\*significantly different



While the reason for non-significance of the MIP is not known, it might be due to the work time period of the subject. In the present study, we didn't have the petrol station workers who had a long work period. The study of Begum and Rathna (2012) presented the worker who worked 8 hours a day more than one year was going to change the properties of the surfactant of the lungs, which lead to chronic inflammation of the respiratory tract and a decrease in pulmonary function tests (PFT) (Begum, & Rathna, 2012).

The present study has limitations that must be mentioned. One of the limitations of the present study is its cross-sectional aspect that we didn't know about the respiratory muscle strength before the start of the employment for the petrol station workers. It remains unclear of the effect of benzene in reference to respiratory muscle strength. In the future, we recommend studying petrol station workers from the start of work and follow up on long-term results.

## 5. Conclusion

The present study demonstrated the petrol station workers in Rangsit Municipality area may have risk of decreased strength of expiratory muscles. Information from this study will give benefits for petrol station workers to prevent disease from work and promote health.

## 6. Acknowledgements

This work is supported by the faculty of Physical Therapy and Sport Medicine at Rangsit University.

## 7. References

- Begum, S., & Rathna, M. B. (2012). Pulmonary function tests in petrol filling workers in Mysore city. *Pakistan Journal of Physiology*, 8(1), 12-14.
- Dube, S., Mungal, S. U., & Kulkarni, M. (2013). Evaluation of respiratory functions in petrol pump workers at Nanded. *International Journal of Recent Trends in Science and Technology*, 8(2), 149-52.
- Evans, J. A., & Whitelaw, W. A. (2009). The assessment of maximal respiratory mouth pressures in adults. *Respiratory Care*, 54(10), 1348-1359.
- Gea, J., Agusti, A., & Roca, J. (2013). Pathophysiology of muscle dysfunction in COPD. *Journal of Applied Physiology (Bethesda, Md: 1985)*, 114(9), 1222-34.
- Hulke, S. M., Patil, P. M., Thakare, A. E., & Vaidya, Y. P. (2012). Lung function test in petrol pump workers. *National Journal of Physiology, Pharmacy and Pharmacology*, 2(1), 71.
- Ministry of Natural Resources and Environment. (2015) Thailand state of pollution report 2015. ISBN 978-616-316-327-1. PCD. No. 06-062.
- Pimpasaeng, C., & Chaiklieng, S. (2013). Exposure to gasoline among workers in gasoline stations at Muang Khon Kaen. In *Proceeding of Graduate Research Conference, Khon Kaen University, Khon Kaen, Thailand*, 963-970.
- Tunsaringkarn, T., Soogarun, S., Rungsiyothin, A., Zapuang, K., & Chapman, R. S. (2011). Health status of gasoline station workers in Pathumwan Area, Bangkok, Thailand, in 2004 and 2009. *Journal of Health Research*, 25(1), 15-19.