

# Comparison of VO<sub>2</sub> Max on Balke Treadmill Test in Light Smokers & Non Smokers

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**Abstract:** Smoking affects multiple organ systems. Mostly affects cardiovascular & pulmonary systems. Cigarette smoking is the most common type of tobacco use. In average, 47.5% of men and 10.3% of women are current smokers. Tobacco continues to be the second major cause of death in the world. By 2030, if current trends continue smoking will kill >9 million people annually. A observational study included 20 people had willing to participate in the study. Pre and post RPP taken for hemodynamic stability. All subject's perform balke treadmill test. After perform test VO<sub>2 max</sub> measured. Level of significant was kept 5%. Mann-Whitney U Test apply and significance ( $p = 0.0001$ ) was founded. Maximal oxygen capacity of light smokers was less compare to non smokers.

**Keywords:** Smokers, Balke treadmill test, VO<sub>2 max</sub>, RPP, Maximal oxygen capacity

## 1. Introduction

Smoking affects multiple organ systems. Mostly affects cardiovascular & pulmonary systems. Cigarette smoking is the most common type of tobacco use. In average, 47.5% of men and 10.3% of women are current smokers. Tobacco continues to be the second major cause of death in the world. By 2030, if current trends continue smoking will kill >9 million people annually.<sup>1</sup> Cigarette smoking is the most well known risk factor for accelerating lung function decline in adults.<sup>2</sup> Smoke related lung damage is characterised by inflammation, airway obstruction and destruction of the lung parenchyma.<sup>3,4</sup> Physical activity is known to improve physical fitness and to reduce morbidity & mortality from numerous chronic conditions.<sup>5</sup> Inactivity is one of major risk factors for coronary artery disease, at par with smoking, unhealthy cholesterol, and high blood pressure. Impaired cardiovascular and respiratory functions are associated with increased mortality and morbidity.<sup>6-9</sup> The balke treadmill test use to measure maximal oxygen consumption. The test has been used in study of the physical fitness. (Balke & ware 1959)<sup>10</sup>  $VO_2 \text{ max} = 1.444 \times T + 14.99 \text{ ml/kg/min}$  (for men)<sup>11</sup>  $VO_2 \text{ max} = 1.38 \times T + 5.22 \text{ ml/kg/min}$  (for women)<sup>12</sup> Thus purpose of present study is to compared VO<sub>2 max</sub> on balke treadmill test in light smokers & non smokers.

## 2. Literature Survey

Andresa Thier de Borba<sup>(13)</sup> studied the influence of active and passive smoking on the cardiorespiratory fitness of adults included 43 participants in study. They perform lung function test, bruce treadmill protocol. They conclude VO<sub>2 max</sub> was significantly higher in non-smokers compared to smokers.

Morton AR<sup>(14)</sup> studied the effects of cigarette smoking on maximal oxygen consumption and selected physiological response of elite team sportsmen studied 40 male, well – trained sportsmen perform a computerised on line gas analysis system (Datex CD- 101 Carbon Dioxide Analyser) and VO<sub>2 max</sub> analyser graded multi-stage continuous treadmill running test. They concluded time taken to

reach exhaustion decreased in non smokers compare to smokers.

## 3. Methods

A observational study included 20 people had willing to participate in one month the study.

### Inclusion criteria

Subjects willing to participate in the study.

- Age group between 20-50 years.<sup>(15)</sup>
- Gender-male
- Light Smokers - currently smokes cigarettes 8-10/day.<sup>(16)</sup>
- Non smokers- who were never smoker

### Exclusion criteria

- Any known Neuromuscular or cardiac disease
- Diabetes
- Any major recent surgery
- Subjects who are doing exercise regularly.

Participants was selected on the basis of inclusion criteria. Before starting procedure subject's resting Rate pressure products (RPP= HR×SBP) was taken. subjects was asked to warm up for 10 minutes & slope of the treadmill is set to 0%, for active and sedentary men the speed is set to 3.3mph (5.3 km/h).<sup>(10)</sup> During walking slope is set 2%(1.2 degree) after 1 minute and then every minute there after the slope is increased by 1% (0.6 degree). Unable to continue the tests because of exertion to stop the tests. Records the time and calculate VO<sub>2 max</sub> according this formula:  
 $VO_2 \text{ max} = 1.444 \times T + 14.99$ <sup>11</sup> (ml/kg/min)  
RPP (Rate pressure product = HR×SBP mmhg/min).

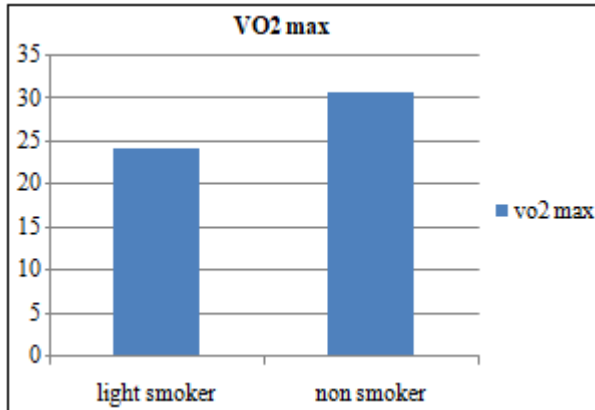
## 4. Result

The Level of significant was kept 5% The result of 20 subjects were analyzed using SPSS software version 16.0 use for statistical analysis. Kolmogorov smirnov test used for distribution of the data and it was found that the data was not normally distributed. Light smokers and non smokers comparison of VO<sub>2 max</sub> use Mann-Whitney U

test. Pre and Post RPP value comparison on light smokers and non smokers use wilcoxon signed ranks test

**Table 1:** Compare  $VO_{2\max}$  in light smokers and non smokers.

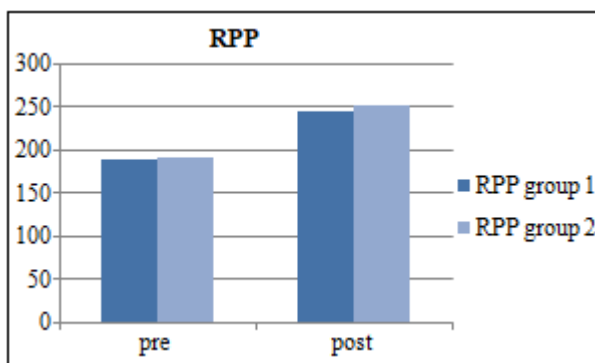
| Category      | Mean $\pm$ SD    | Difference     | U value | P value     |
|---------------|------------------|----------------|---------|-------------|
| Light smokers | 24.10 $\pm$ 0.85 | 6.5 $\pm$ 0.28 | 0.0001  | 0.0001      |
| Non smokers   | 30.60 $\pm$ 1.13 |                |         | significant |



**Graph 1:** Compare  $VO_{2\max}$  in light smokers and non smokers

**Table 2:** Compare pre and post RPP in light smokers and non smokers

|               | Light Smoker      |                  | Non smoker        |                  |
|---------------|-------------------|------------------|-------------------|------------------|
|               | RPP               |                  | RPP               |                  |
|               | pre               | post             | pre               | post             |
| Mean $\pm$ SD | 188.8 $\pm$ 2.48  | 244.3 $\pm$ 3.94 | 191.2 $\pm$ 8.53  | 250.4 $\pm$ 4.14 |
| P value       | 0.005 significant |                  | 0.005 significant |                  |
| Z value       | -2.807            |                  | -2.812            |                  |



**Graph 2:** Compare pre and post RPP in light smokers and non smokers

## 5. Discussion

The present study conducted with a purpose to compare the maximal oxygen consumption in light smokers and non smokers. Balke treadmill test use to measure the maximal oxygen consumption to know the physical fitness. The power of the study was kept at 80% with 5% level of significance. The maximal oxygen consumption lower in light smokers (24.10 $\pm$ 0.85) than non smokers (30.60 $\pm$ 1.13). In present study there was significant difference  $p=0.0001$  (6.5 $\pm$ 0.28) between light smokers and non smokers. Then significant difference of light smokers and non smokers ( $p=0.005$ ) in pre and post RPP (Rate

pressure product)=SBP $\times$ HR.  $VO_{2\max}$  reflects the maximum capacity of absorption, transportation and consumption of oxygen. In present study light smokers maximum oxygen absorption capacity is low compare to non smokers. The main mechanism by which CO causes heart disease is through hypoxia. Inhalation of cigarette smoke, by either active or passive smokers, increases the levels of carboxyhaemoglobin in the blood, decreasing the supply of oxygen to the tissues. Smoking was associated with lower exercise levels and lower physical endurance-both cardio respiratory (1.5-mile run) and muscular (sit-ups). After controlling for exercise activity, smoking remained significantly associated with lower physical endurance but was not related to overall body strength (lean body mass) or percentage body fat. Smoking is a detriment to physical fitness even among relatively young, fit individuals. This study shows that smokers will have lower physical endurance than non smokers<sup>17</sup>. (conway in 1992)

## 6. Conclusion

There is significantly lower maximal oxygen consumption in light smokers compare to non smokers.

## 7. Future Scope

Pack years of smoking is included the study.

Life style of the subjects was taken into consideration whether physically active or sedentary.

Body mass index is included the study

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