

Effect of Smoking on Breath Holding Time

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ABSTRACT

Introduction- Breath holding time (BHT) may be considered as one of the indicators of efficiency of breathing function. Tobacco smoking is highly prevalent throughout the world Smoking tobacco causes impairment of lung functions. Hence the present study was done to know the effect of smoking on BHT among healthy males.

Methodology- Study was conducted on 47 apparently healthy male smokers and 47 healthy non smokers between the age group of 20-50yrs. The subject was instructed to hold his breath by pinching the nose with thumb and index finger as long as possible at the end of deep inspiration. The breaking point time was noted in seconds using a stop watch.

Results - The mean breath holding time among smokers was 34.85 seconds, whereas the mean breath holding time was 46.61 seconds among non smokers.

Conclusion - The present study showed that BHT was lower among smokers than non-smokers and the difference was statistically highly significant.

Keywords – *Breath holding time, Smoker, Tobacco.*

INTRODUCTION

There are several pulmonary function tests available to assess the respiratory functions of an individual. Breath holding time (BHT) is one of them and can be applied easily, even in field settings to assess the pulmonary function. BHT is defined as the time taken by the subject to hold his breath as long as he can. Normal voluntary BHT is 45 – 55 seconds.¹

The point at which breathing can no longer be voluntarily inhibited is called the breaking point. It is due to increased arterial pCO₂ and decreased arterial pO₂.²

Breath-holding induces the dyspneic sensation, and BHT gives information about overall efficiency of respiratory system to sustain dyspnea. In normal individuals, breath holding at functional residual

capacity, initially there is no sensation for about 15 – 20 sec where oxygen in the residual volume is used to maintain pO₂ level of arterial blood. When all oxygen is used the pO₂ in arterial blood falls gradually inducing dyspneic sensation. Dyspneic sensation increases until the person can no longer hold his breath voluntarily. This point is defined as breaking point of breath holding. The measurement of the period of no respiratory sensation provides us with information about the threshold of dyspneic sensation whereas the measurement of the total breath-holding time is a behavioral measure of the tolerable limit of dyspneic sensation.³ The breath holding time varies from person to person and with different environmental conditions.⁴

Prevalence of smoking is very high throughout the world and India is no exception. Smoking tobacco causes irritation of the respiratory tract which in turn causes hypertrophy of mucosal cells resulting in increased secretion of mucus and formation of mucosal plugs, which leads to impairment of lung functions.⁵

Literature search revealed that there are very few studies on effect of smoking on BHT. Hence the present

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study was done to know the effect of smoking on BHT among healthy males.

MATERIALS AND METHOD

Study was conducted on 47 apparently healthy male smokers and 47 healthy non smokers between the age group of 20-50yrs. Ethical clearance was obtained by Institutional ethical committee. Informed consent was taken from subjects after explaining the purpose and procedure size of the study.

Inclusion criteria:

Cases – Healthy male subjects with a history of smoking for more than one year and those who smoke five or more than five cigarettes per day.

Controls- healthy male subjects with no past, present or passive history of smoking.

Exclusion criteria:

1. Female subjects to avoid sex bias.
2. Subjects with any illness and those who are exposed to dust or fumes occupationally.
3. Subjects having allergic, endocrine, neuromuscular, musculoskeletal disorders etc. which are likely to affect respiratory function.

Breath holding time was recorded after a period of rest for 10 minutes in morning hours between 11

– 12 pm to avoid any diurnal variation. The subject was instructed to hold his breath by pinching the nose with thumb and index finger as long as possible at the end of deep inspiration. The breaking point time was noted in seconds using a stop watch. The procedure was repeated three times at 5 minutes interval. The highest of the three readings was taken.

Statistical analysis was done by calculating mean breath holding time and standard deviation. Statistical significance was calculated by unpaired t test using SPSS software.

RESULTS

Table-1 shows, the comparison of anthropometric parameters between smokers and non-smokers. The mean \pm 2SD age of smokers was 36.77 ± 11.02 , while that of non-smokers was 38.61 ± 12.10 . The P value was more than 0.05 indicating that the difference in mean age between smokers and non-smokers was statistically not significant.

Similarly the mean \pm 2SD for height was 165.04 ± 12.16 among smokers and 164.29 ± 10.64 among non-smokers. Again the difference in mean height between smokers and non-smokers was statistically not significant.

The mean \pm 2SD for weight was 61.04 ± 16.34 among smokers and 68.31 ± 15.20 . The difference was statistically significant. Non-smokers had more weight than smokers.

Table-1: Anthropometric parameters of smokers and non-smokers.

Parameters	Smokers Mean \pm 2SD	Non-smokers Mean \pm 2SD	t- statistic	P value
Age (yrs)	36.77 \pm 10.02	38.61 \pm 12.10	-1.5499	0.1246, >0.05
Height (cms)	165.04 \pm 12.16	164.29 \pm 10.64	0.6314	0.5294, >0.05
Weight (Kgs)	61.04 \pm 16.34	68.31 \pm 15.26	-4.4688	0.000, <0.001

Table-2 shows, that the mean breath holding time among smokers was 34.85 seconds, whereas the mean breath holding time was 46.61 seconds among non smokers. Smokers had a shorter BHT when compared to non smokers. When the difference was analyzed using t test, the difference was found to be statistically highly significant (P<0.001).

Table-2: Mean \pm SD of breath holding time among Smokers and Non- smokers

Group	No.	Breath holding time. Mean \pm 1SD	t- statistic	P value
Smokers	47	34.85 \pm 11.22	-8.1311	0.000, <0.001
Non – Smokers	47	46.61 \pm 16.36		

DISCUSSION

Breath holding test is used as a rough Index of Cardiopulmonary Reserve.⁶ BHT is dependent on the volume of oxygen at the beginning of the test i.e., on functional residual capacity and also on diffusing capacity of lungs in a particular individual. Respiratory centers control respiration by sensing $p\text{CO}_2$ and $p\text{O}_2$ levels in the blood. An increase in $p\text{CO}_2$ or decrease in $p\text{O}_2$ stimulates respiration.⁷ The Breaking point is generally reached when alveolar $p\text{O}_2$ drops to 56mmHg and alveolar $p\text{CO}_2$ rises above 49 mmHg.¹ The time taken to reach breaking point decides the BHT. Maximal BHT is used in Respiratory physiology as a measure of ventilator response.^{7,8,9}

The present study showed that BHT was lower among smokers than non-smokers and the difference was statistically highly significant.

Similar to the present study low BHT values were observed in smokers when compared to non-smokers in a study by Sudha et.al in 2012.¹⁰ Similarly lower values of BHT were recorded in smokers exposed to dust and fumes when compared to non-smokers in a study by Mhase VT et.al in 2002.¹¹ Study by Zvolensky MJ has revealed that breath holding time was longer in sustained smoking quitters.¹²

Tobacco smoking is highly prevalent throughout the world and India is no exception. Smoking causes loss of cilia of respiratory tract, mucus gland hyperplasia, converts pseudostratified ciliated epithelium to squamous metaplasia, carcinoma, smooth muscle hypertrophy, inflammation, peribronchiolar fibrosis, alteration in alveoli etc.¹³ Numerous studies have shown that smokers have about 6 – 20 % lower diffusing capacity when compared to age matched non smokers.¹⁴ The exact mechanisms of smoking affecting BHT is not clear. Smokers show a reduction in all lung functions and their capacity to tolerate physical discomfort is also less compared to non-smokers. It is a known fact that smoking raises the CO_2 levels in blood. The CO present in

cigarette smoke is more than 600 times the concentration of CO in automobile exhaust. The high levels of CO_2 in the blood of smokers bind with hemoglobin and form carboxyhemoglobin. Carboxyhemoglobin affects the oxygen carrying capacity of the blood. Hence, a smoker has high susceptibility for hypoxia and hypercapnia compared to a non-smoker causing the rapid attainment of the break point, and in turn reducing the BHT.¹

Limitations of the present study were small size of the study population and not considering possible effects of physical activities, duration of smoking, number of cigarettes per day, type of smoking (beedi, cigarette, or any other form), and other confounding factors like psychological factors and motivation. Hence a large scale study considering above points needs to be carried out.

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