ECRONICON OPEN ACCESS

EC PULMONOLOGY AND RESPIRATORY MEDICINE

Research Article

Effect of Smoking on Oxygen Saturation in Healthy Sedentary Men and Women

Mustafa Özdal[1]*, Zarife Pancar[2], Vedat Çinar[3] and Murat Bilgiç[4]

[1]Assistant Professor, Physical Education and Sport Department, Gaziantep University, Gaziantep, Turkey

[2]Health Sciences Institute, Gaziantep University, Gaziantep, Turkey

[3]Professor, Sport Sciences Faculty, Fırat University, Elazığ, Turkey

[4]Health Sciences Institute, Kırıkkale University, Kırkkale, Turkey

***Corresponding Author:** Mustafa Özdal, Assistant Professor, Physical Education and Sport Department, Gaziantep University, Gaziantep, Turkey.

Received: August 08, 2017; **Published:** August 24, 2017

Abstract

Objective: The purpose of our study was to investigate differences in oxygen saturation (SpO2) level of smoker and non-smoker healthy sedentary men and women.

Methods: Totally 406 individual who are sedentary and healthy smoker (n = 189) and non-smoker (n = 217) men (n = 179) and women (n = 227) participated in this study as subject. Pulse oximetry was utilized for determination of SpO_2. Independent samples T test was used for analysis of SpO_2 parameter of smoker with non-smoker, and men and women.

Results: Non-smoker individuals had significantly higher SpO_2 value than smoker individuals ($p < 0.05$). Smoker women showed higher SpO_2 value than smoker men ($p < 0.05$). Also, there was no significant difference between non-smoker men and women ($p > 0.05$).

Conclusion: In conclusion, it could be considered that smoking may reduce to oxygen saturation, and the reduction in oxygen saturation may higher in smoker men than women.

Keywords: *Smoking; Oxygen Saturation; Hemoglobin*

Abbreviations

SpO_2: Oxygen Saturation with Pulse Oximeter; O_2: Oxygen; HbO_2: Oxyhemoglobin; Hb: Hemoglobin; CO: Carbon Monoxide

Introduction

The most important task of the respiratory system is oxygenation. Oxygen which reaches the alveoli is largely transported by hemoglobin and a small fraction of it is molten. The amount of dissolved O_2 in the bloodstream 100 ml is 0.003, while one gram of hemoglobin carries 1.34 ml of O_2. The amount of oxygen in the bloodstream which is transported by the hemoglobin is known as oxygen saturation (SpO_2). Alveolar O_2 pressure is the most important determinant of arterial oxygen pressure [1-3]. (In this study, SpO_2 was used rather than SaO_2, which is a more traditional abbreviation to indicate that a noninvasive measurement was made using a pulse oximeter).

Oxygen saturation is a sensitive indicator of disease severity in clinical conditions such as ongoing asthma attacks with ventilator perfusion incompatibility, chronic lung disease, acute bronchiolitis, and pneumonia [4]. Smoking affects the health of both smokers and

passive smokers exposed to cigarette smoke. The most effective components found in cigarette smoke; Nicotine, CO and hydrogen cyanide [5]. Nicotine, which is pharmacologically the most important component, is a weak base and passes through biological membranes depending on pH, absorbed in lower airways and lung alveoli. In addition, nicotine quickly enters the brain. For smokers, an average of 1 mg of nicotine per cigarette is absorbed. After smoking a cigarette, the concentration of nicotine on the arterial blood reaches from 31 ng/ml to 41 ng/ml. Nicotine absorption change depending on the amount of smoke to be inhaled, the depth and duration of smoke inhalation, and the pH of smoke [6].

Prevalence of smoking, which is a major cause of illness and death; 20 - 40% in females and 30 - 40% in males in developed countries while 2 - 10% in females and 40 - 60% in males in developing countries. Smoking prevalence in Turkey; 63% for males and 24% for females [7]. It is known that cigarette, which harm human health in many ways, totally affected all the tissues and organs. The effect of arterial blood hemoglobin on oxygen saturation in male and female smokers is wondered as a current and original research topic. Our study is thought to be important for the contribution of the literature to the effect of smoke on arterial blood and hemoglobin saturation in smoker and non-smoker individuals. The purpose of this study was to examine the effect of cigarette smoking on oxygen saturation in healthy sedentary men and women.

Method

Subjects: Totally 406 individual who are sedentary and healthy smoker (n = 189) and non-smoker (n = 217) men (n = 179) and women (n = 227 voluntarily) participated in this study as subject. All participants were informed about the aim of the research and the contents of that. All participant were verbally asked how often they smoke and non-smoker were asked whether they were exposed to cigarette smoke or not. The subjects provided a written permission for participating in the study. The study was performed according to principles of Helsinki Declaration [8].

Design: Comparative method was used in this study. SpO_2 measurements were taken from subjects between 16:00 and 18:00. Subjects were asked about their smoking status. Approval form was taken from the subjects who participated in the study.

Oxygen Saturation Measurement (SpO_2): To record the oxygen saturation of the hemoglobin, the pulse oximeter device is used, recording the changes in the color spectrum of oxyhemoglobin by photoelectric method. Pulse oximeters measure arterial hemoglobin concentration by measuring light transmittance from pulsatile vascular tissue in two wavelengths. Pulse oximeter can be used in the finger, ear and other tissues [9]. Pulse oximetry works with a spectrophotometric method based on the principle that two different kinds of light are absorbed by oxyhemoglobin (HbO_2) and hemoglobin (Hb), depending on the optically visible property of the hemoglobin molecule in the tissue.

The most commonly used method to assess patients' oxygenation was arterial blood gas measurements. Today, pulse oximetry is a simple and reliable method that is used to evaluate oxygenation because it is an alternative to blood take, safe, painless, easy to use and quick-acting. These advantages make the oximeter an important tool in determining the person's need for oxygen and assessing the efficacy of the treatment applied. Values of oxygen saturation above 95% are considered normal, values less than 93% indicate that oxygen therapy is necessary and require closer monitoring of the person [1,10].

Oxygen saturation measurements were made with a pulse oximeter (Nellcor OxiMax Bennett Inc., N-560, Pulseoximeter, Korea). After the subjects sit, the oxygen saturation is measured from the hand, the pulse source of the pulse oximetry must be placed on the fingertip of the hand. Therefore, before the measurement was taken, it was noted that there was no such thing as nail polish, henna, artificial nail in the nails in order for the device to take correct measurements. Before the measurements, information about the pulse oximeter SpO2 test, which is a noninvasive method for the subjects, was given. Each subject was rested at the beginning of the measurement and the oximeter probe was placed on the forefingers in a position where they could sit comfortably [11,12].

The most important limitation of our research is; factors such as the temperature of body part which is placed pulse oximetry, circulating blood temperature, malfunction in fingertip circulation and unhealed wounds cause the SpO_2 measurement be low or to be unable to take measurements. To minimize the effect of these limitations, the subjects whose measurements were not taken were not included in the study.

Statistical Analysis: In this study, data were recorded by using a statistical program (SPSS 22.0 for Windows, Chicago, Illinois, USA). In all the tests the significance level is accepted to be $p < 0.05$. Data were presented as mean and standard deviation. Kolmogorov-Smirnov test was performed for the normal distribution of the data before going the statistical procedures. After it was determined that the data had a normal distribution, the Independent Samples T Test was used to analyze the difference between smoking status and gender groups.

Results

The comparisons of SpO_2 values are shown in table 1. As a result of the comparison, significance difference was found between smokers and non-smokers ($p < 0.05$). The comparison of SpO_2 values of men and women who smoke is shown in table 2. As a result of comparison, significance difference was found between male and female smokers ($p < 0.05$). The comparison of the SpO_2 values of non-smoking men and women is shown in table 3. As a result of the comparison, there was no significance difference between male and female non-smoker individuals ($p > 0.05$).

		n	Mean ± SD	t	p
Smoking Status	Smoker	189	97.28 ± 1.19	-5.627	0.001
	Non-smoker	217	97.92 ± 1.09		

Table 1: *Comparison of SpO_2 values between smokers and non-smokers.*

		n	Mean ± SD	t	p
Smoking	Male	97	97.08 ± 1.27	-2.377	0.018
	Female	92	97.49 ± 1.11		

Table 2: *Comparison of SpO_2 values between male and female smokers.*

		n	Mean ± SD	t	p
Non-smoking	Male	82	97.83 ± 1.25	-0.918	0.333
	Female	135	97.98 ± 0.99		

Table 3: *Comparison of SpO_2 values between male and female non-smokers.*

Discussion

There is 15 gr hemoglobin in 100 ml blood of mature person. This hemoglobin sample found in arterial blood as connected 19.5 ml oxygen and from this reason arterial blood hemoglobin saturated with oxygen at 97%. Dissolved oxygen amount in 100 ml arterial blood is 0.3 ml. From this point, high amount of oxygen is carried with hemoglobin. Arterial blood releases an amount of oxygen in order to cell-usage. Thus, amount of oxygen-carried hemoglobin is decrease 15.1 ml and dissolved oxygen is decreased 0.1 ml in venous blood. Result of this reason venous oxygen saturation is 75% [1].

Oxygen saturation is a clinical data. Oxygen saturation is used as early diagnosis of hypoxia that is source of vital problems such as oxygen deficiency of inhalation air, respiratory activation decrement about of muscular diseases, respiratory diseases due to decrement in airway resistance, reduced diffusion capacity, anemia, circulatory inadequate, poisoning. Saturation of arterial blood to oxygen is vital important for patient, athlete, sedentary and all individuals [11,13].

Smoking is a habit that threaten humanity as an important cause of premature deaths and preventable diseases [14]. Cigarette with the psychological effect of nicotine on the central nervous system, which is the main component, the person starts to habit firstly and then to addiction after the first use. Every smoke drawn into the respiratory tract contains 1017 reactive oxygen species. X radical reducing O_2 to O_2 which is a compound contained in the cigarette plays the most important role. This radical also participates in the formation of long-lived radicals. Oxidants that take electrons from molecules such as nucleic acids, proteins, lipids, lipoproteins and carbohydrates change the structure and function of these biomolecules. Cigarette with consumption of antioxidant compounds also leads to impaired oxidant/antioxidant balance and oxidative damage [15,16].

Smoking is one of the most important causes of cardiovascular diseases and deaths from these diseases. Cigarette smoking increases the risk of coronary heart disease by 2 - 4 folds, which accounts for more than 70% of deaths from this disease and acts as a risk-raising factor in sudden deaths. In the first year following the release of the cigarette, there is a 50% reduction in the risk of death from coronary heart disease. The most effective components of cigarette smoke in the cardiovascular system are nicotine and CO. Both molecules affect myocardial O_2 requirement and supply negatively [17]. CO reduces O_2 supply to all tissues of the body by binding to proteins such as hemoglobin, myoglobin, and cytochrome oxidase, including myocardium. In smokers, carboxyhemoglobin level is 2 to 15 times greater than non-smokers [18].

When the SpO_2 values of the smokers and non-smokers were examined in our study, SpO_2 values of smokers were 97.28 ± 1.19, while the percentage of SpO_2 values of non-smokers was 97.92 ± 1.09. Statistical analysis between smokers and non-smokers showed a significance $p < 0.05$ level in favor of non-smokers in terms of percentage of SpO_2. This high level of non-smoking can be thought that the continuation of oxygen transport capacity of hemoglobin without exposure to harmful effects of cigarette, reduction of diffusion capacity which is a source of vital problems, anemia, circulatory insufficiency, poisoning which means that tissue oxygenation is inadequate.

When the SpO_2 values of smoking men and women are examined; the mean SpO_2 values of male smokers were 97.08 ± 1.27, while those of female smokers were 97.49 ± 1.11. Statistical analysis of SpO_2 percentiles for male and female cigarette smokers showed a significance $p < 0.05$ level between SpO_2 values of females compared to males. It can be thought that the reason for this high value in females is that the use of cigarettes is less, and the exposure to cigarette smoke is less.

The SpO_2 values of non-smoker males were 97.83 ± 1.25 and those of non-smoker females were 97.98 ± 0.99. As a result of the statistical analysis, there was no significant difference $p > 0.05$ between male and female non-drinkers. Statistically, this insignificance is thought to be due to the fact that gender has no effect on SpO_2 in healthy individuals [19].

Conclusion

It is thought that our study will contribute to the literature on the effects of smoking on the O_2 saturation in arterial blood in smoker and non-smoker individuals. As a result; it can be said that the use of cigarette in the direction of the results obtained in our study has negative effects on the oxygen saturation in sedentary male and female individuals.

Bibliography

1. Özdal M., *et al*. "Aerobik antrenmanın arteriyel hemoglobin oksijen satürasyonu üzerine etkisi". *Spor ve Performans Araştırmaları Dergisi* 5.1 (2014): 27-34.

2. Sarnaik AP and Heidemann SM. "Respiratory pathophysiology and regulation". In: Behrman RE, Kliegman RM, Jenson HB (eds). Nelson Textbook of Pediatrics (18th edition). Philadelphia: WB Saunders (2007): 1719-1726.

3. Karaböcüoğlu M and Demirkol D. "Çocuklarda solunum sıkıntısı ve yetmezliği". Çocuk Yoğun Bakım Esaslar ve Uygulamalar 20 (2008): 255-275.

4. Callahan JM. "Pulse oximetry in emergency medicine". *Emergency Medicine Clinics of North America* 26.4 (2008): 869-879.

5. Silverstein P. "Smoking and wound healing". *American Journal of Medicine* 93.1 (1992): 22S-24S.

6. Endoh K and Leung FW. "Effects of smoking and nicotine on the gastric mucosa: A review of clinical and experimental evidence". *Gastroenterology* 107.3 (1994): 864-878.

7. Bozdemir N., *et al*. Sigara ve sağlık. Türkiye'de kanser sıklığı, Çukurova Üniversitesi Basımevi, Adana (1994): 178-185.

8. "World Medical Association General Assembly. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects". *Journal International de Bioéthique* 15.1 (2004): 124.

9. Yetkin U., *et al*. "Klinik uygulamada pulse oksimetre". *Van Tıp Dergisi* 9.4 (2002): 126-133.

10. Akansel N and Yıldız H. "Pulse oksimetre değerlerinin güvenilir olması için neleri bilmeliyiz?" *Türkiye Klinikleri Journal of Anaesthesiology and Reanimation* 8.1 (2010): 44-48.

11. Hakverdioğlu G. "Oksijen saturasyonunun belirlenmesinde pulse oksimetre kullanımı". *C.Ü. Hemşirelik Yüksekokulu Dergisi* 11.3 (2007): 45-49.

12. Andersson JPA., *et al*. "Diving response and arterial oxygen saturation during apnea and exercise in breath-hold divers". *Journal of Applied Physiology* 93.3 (2002): 882-886.

13. Altuğ ME and Gönenci R. "Pulse oksimetre ile arteriyel oksijenasyonun izlenmesi". *Veteriner Cerrahi Dergisi* 9.3-4 (2003): 58-62.

14. Fielding JE. "Smoking: Health effects and control". *New England Journal of Medicine* 313.8 (1985): 491-498.

15. McCusker K. "Mechanisms of respiratory tissue injury from cigarette smoking". *American Journal of Medicine* 93.1 (1992): 18S-21S.

16. Yıldız L and Kılıç H. "Sigaranın klinik ve biyokimyasal etkileri". *Türkiye Klinikleri Tıp Bilimleri Dergisi* 20.5 (2000): 306-312.

17. Lakier JB. "Smoking and cardiovascular disease". *American Journal of Medicine* 93.1 (1992): 8S-12S.

18. Noronha-Dutra AA., *et al*. "Effect of cigarette smoking on cultured human endothelial cells". *Cardiovascular Research* 27.5 (1993): 774-778.

19. Colodny N. "Effects of age, gender, disease, and multisystem involvement on oxygen saturation levels in dysphagic person". *Dysphagia* 16.1 (2001): 48-57.

Volume 4 Issue 6 August 2017
©All rights reserved by Mustafa Özdal., *et al*.