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Impact Of Continuous Sitting On Pulmonary Function In Healthy College Going Students - A Pre-Post Experimental Study

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Abstract

BACKGROUND:

AIM: To study changes in pulmonary function after exposure to prolonged sitting.

Methodology: In this study 46 patients were selected according to inclusion and exclusion criteria. The Pulmonary function test was performed by using a spirometer, to assess FVC, FEV1 and FEV1/FVC ratio. The subjects were asked to sit patiently for 10 minutes before taking the first reading of PFT. During first reading of PFT, the subjects were instructed to inhale deeply then put the mouth piece of the spirometer in to the mouth and exhale rapidly and forcefully for as long as flow can be maintained and then asked them to inhale rapidly and forcefully. This was repeated for three times and the best of three was included in the study. 5 minutes of rest was given in between the 3 readings. This procedure was repeated for 3 readings of PFT; before continuous sitting, after 1 hour of continuous sitting and after 2 hours of continuous sitting.

Result: The pulmonary function was tested pre and post sitting. The data collected was entered in Instat software for statistical analysis. After applying repeated measures of ANOVA, following results were generated. FVC before sitting was (2.673 ±0.6510), after 1 hour of sitting (2.512 ±0.5949) and after 2 hour of sitting it was (2.421 ±0.5991).The P value found was <0.0001 which indicates that FVC decreases as exposure to sitting increases.FEV1 before sitting was (2.656 ± 0.6400), after 1 hour of sitting (2.460 ± 0.5919) and after 2 hour of sitting it was (2.346 ± 0.5886).The P value found was <0.0001 which indicates that FEV1 decreases as exposure to sitting increases. FEV1/FVC before sitting was (99.484 ±1.639), after 1 hour of sitting (97.869 ±2.430) and after 2 hour of sitting it was (96.897 ±4.430). The P value found was <0.0001 which indicates that FEV1/FVC decreases as extremely significant exposure to sitting increases. The results clearly indicated that there was reduction in pulmonary function
as the time duration for continuous sitting increased.

CONCLUSION: From this study we can conclude that pulmonary function reduces due to continuous sitting.

Key words: Sitting, Pulmonary function test, FVC, FEV1, FEV1/FVC.)

Introduction

Any waking behavior with low energy expenditure is considered to be a sedentary behavior. Sitting, which is a fundamental position, is usually done in a reclined posture. It is the most typical position for inactivity. Whether they're at work or school, driving, watching TV, or something else, a lot of individuals spend a lot of time sitting down. Certain occupations such banking, IT, administration etc. demand prolonged periods of sitting[1]. Long-term sitting has been linked to a number of illnesses identified as the "disease of inactivity"[2].

When James A. Levine originally claimed that "sitting is the new smoking," it appeared as though he was being dramatic and exaggerated. However, more and more facts served to show that he was not entirely wrong.[3,] Long periods of sitting raises the risk of developing cardiovascular disease, metabolic diseases including diabetes mellitus (DM), hypertension, dyslipidemia, obesity, cancer, osteoporosis, and musculoskeletal disorders like osteoarthritis, which affect the neck, low back, and shoulder ligament and disc strain[4, 5].

Long periods of sitting can alter people's postures in many ways. It is also commonly known that changes in posture have an impact on lung function. More precisely, it is well-documented that non-obese patients who adopt a supine position experience a decrease in sitting to supine FRC[6].

The exchange of gases is the lungs' primary function. In the process of moving mixed venous blood via the pulmonary circulation, the lungs take up extra carbon dioxide and release oxygen.

Different techniques are employed to evaluate the alterations in lung function. The most popular test for determining different lung capacities and volumes is the pulmonary function test (PFT). The ability of the lungs to hold air, move air in and out, and absorb oxygen is measured by pulmonary function tests.

PFT is indicated for a variety of conditions, such as interstitial fibrosis, COPD, asthma, pulmonary surgery, abdominal surgery, cardiothoracic surgery, cough, wheeze, dyspnea, and crackles on an abnormal chest x-ray. PFT is contraindicated in cases of recent myocardial infarction, unstable angina, recent thoracic or abdominal aneurysm, recent ocular surgery, pneumothorax, etc.[7]

There are few terminologies involved in the PFT interpretation such as Forced Expiration Volume in one second (FEV1), Forced Vital Capacity (FVC), Peak Expiratory Flow Rate (PEFR) etc. Among this, the ratio of FEV1 and FVC (FEV1/FVC) indicates how much air you can take in and out of your lungs with force. Lung disease diagnosis and therapy monitoring frequently involve the use of the FEV1/FVC ratio. It assists in determining the nature of your ailment and whether it is obstructive or restricted. This test is frequently used to track lung disease, particularly in those with obstructive conditions like asthma. Regularly monitoring your FEV1/FVC ratio can assist in determining how well your medication is working and how your disease is developing. The amount of air that may be forcefully exhaled in a specific amount of time is known as the forced expiratory volume, or FEV after a deep inhalation. FEV1 is forced expiration volume of air in one second. Similarly, FVC is the maximum amount of air that can be forcefully exhaled from maximum inhalation.[8]

These lung volumes and capacities are affected by individual's age, height, gender, weight, Body Mass Index (BMI), history of allergy, presence of any disease/disorder/sign/symptom etc.

It is not known whether sitting affects pulmonary function or not so this research was undertaken with the aim to study the effect of continuous sitting on pulmonary function. Because prolonged sitting has become the necessity in many work environments. The present era has revolutionized technology which has impacted the sedentary behavior of everyone. Increased use of mobile, laptop, television has increased the time spent in sitting position; also, most of the occupations are demanding prolonged sitting position. Students also spent most of their daily hours in sitting posture during lectures, study hours, in library, while using smart phones and laptops etc. The various effects of prolonged sitting have been studied previously but the effect of continuous sitting on pulmonary function in students has not well established.

Materials and Methods:

- PC
- PFT software
- Spirometer with mouthpiece
- Chair
- Pen
- Paper
- Nose clip
- Cotton
- sterilizer

Study design: pre-post experimental study.
Study setting: Physiotherapy OPD, A tertiary care multispecialty hospital, Jalgaon
Type of sampling: Convenient sampling
Calculated Sample size: 46
Study duration: 6months

Inclusion criteria:

- College going students with age group 18-25 year.
- Individual who will be ready to sit continuously for minimum 2 hours.
- Both genders.

Exclusion criteria:

- Individual with known case of cardiovascular / musculoskeletel / metabolic / respiratory disease / disorder
- Diseases/disorders/deformities of spine
- Individual with known case of allergy to pollutants/smell and other allergen etc

- Individual with BMI greater than 25 and waist circumference more than 37 in male and 31.5 in female
- Individuals who are smoker or ex-smoker
- Individual who are involved in any kind of sports.
- Individual who are involved in regular exercise programs
- Individuals who are not willing to participate.

Outcome measures: Pulmonary function test before sitting, after 1 hour and after 2 hours of sitting.

Procedure:

Pulmonary function test was performed by using a spirometer, to assess FVC, FEV1 and FEV1/FVC ratio. The subjects were asked to sit patiently for 10 minutes before taking the first reading of PFT. During first reading of PFT, the subjects were instructed to inhale deeply then put the mouth piece of the spirometer in to the mouth and exhale rapidly and forcefully for as long as flow can be maintained and then asked them to inhale rapidly and forcefully. This was repeated for three times and the best of three was included in the study. 5 minutes of rest was given in between the 3 readings. This procedure was repeated for 3 readings of PFT; before continuous sitting, after 1 hour of continuous sitting and after 2 hours of continuous sitting.

Ethical clearance was obtained from the institutional ethical committee. The study was registered with Clinical Trial Registry India (CTRI). The participants were selected based on inclusion and exclusion criteria and provided with information, written consent form and procedure was explained to them. PFT was recorded three times, before sitting, after sitting continuously 1 hour, again after sitting continuously 2 hours. Data was analyzed statistically and results were generated.

Results:

The study was aimed at finding impact of continuous sitting on pulmonary function in healthy college going students. There were 46 participants included in the study. They underwent 2 hours of continuous sitting and their pulmonary function was tested pre and post sitting. The data collected was entered in Instat software for statistical analysis. After applying repeated measures of ANOVA, following results were generated.

Discussion:

The present research was conducted on 46 subjects and pulmonary function was recorded before sitting, after 1 hour of sitting and after 2 hours of sitting. The pulmonary function was found to be reduced after 1 hour and after 2 hours of continuous sitting.

FVC before sitting was (2.673 ±0.6510), after 1 hour of sitting (2.512 ±0.5949) and after 2 hour of sitting it was (2.421 ±0.5991). After applying repeated measures of ANOVA, the P value found was <0.0001 which indicates that FVC decreases as exposure to sitting increases.

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FEV1/FVC before sitting was (99.484 ±1.639), after 1 hour of sitting (97.869 ±2.430) and after 2 hour of sitting it was (96.897 ±4.430). After applying repeated measures of ANOVA the P value found was <0.0001 which indicates that FEV1/FVC decreases as extremely significant exposure to sitting increases. The results clearly indicated that there was reduction in pulmonary function as the time duration for continuous sitting increased.

The results found in our study are consistent with the results found in a study done by Kyung Woo Kang, Sang In Jung, Do Youn Lee, Kyoung Kim, and Na Kyung Lee. They conducted research on effect of sitting posture on pulmonary function while using smartphone. They have divided the subjects in two groups. One group spent time of continuous one hour using smartphone in sitting posture whereas other group spent time as they liked for one hour of continous sitting. They found that there was a decrease pulmonary function after sitting of one hour but there was more decrease in smartphone group[1].

Another study, done by Baghery Hojat and Esmaeilzadeh Mahdi, supports the results of current study. The authors tested the hypothesis that pulmonary function changes with change in posture. They concluded that FVC and FEV1 was affected by sitting posture, particularly in slumped sitting posture[9].

One more study done by Haque MF, Akhter, Tasnim, Haque, Paul S, Begum M concluded that FVC is significantly decreased in slumped sitting posture in healthy school children. They investigated the effects of different sitting postures on forced vital capacity (FVC) in healthy school children and found reduction in FVC[10].

Previous researches have proven that continuous sitting predispose to sustained reduction in activities of muscles of upper and lower back. These muscles including trapezius, scalene, intercostals etc. have to hold the posture continuously in prolonged sitting. Also, these muscles contribute to the respiration. Sustaining a sitting posture for prolonged period of time reduces the elastic properties of these muscles. Taking this into consideration pulmonary function reduces due to reduction in action of these muscles on rib cage during inspiration and expiration. Also sitting posture results in increased intra-abdominal pressure by approximating the ribs to the pelvis. This makes it difficult for the diaphragm to descend caudally during inspiration and thus reduction in pulmonary function[6]. This contributed to reduction in pulmonary function.[11]

Limitation:

Impact of continuous sitting was short term as there was no follow-up taken later.

Conclusion:

From this study we can conclude that pulmonary function reduces due to continuous sitting.

Clinical Implication:

The impact of continuous sitting can be hazardous and one should avoid the complications of continuous sitting by taking frequent breaks in between.

References:

1. Kyung Woo Kang a, Sung Min Son b, Yu Min Ko c,Time-varying Changes in Pulmonary Function with Exposure to Prolonged Sitting(2016,November 10).
2. Chang ju Kim,Sung Min Son,Kyung Woo Kang. The effect of chair backrest on respiratory function in prolonged sitting position (2018 June 19)
3. Priscila Marconcin, Pedro B. Júdice, Gerson Ferrari, André Werneck and Adilson Marques,Methods of Assessing Sedentary Behaviour,(2021 August 24)
4. Hadi Daneshmandi, Alireza Choobineh,, Haleh Ghaem, Mehran Karimi,Adverse Effects of Prolonged Sitting Behaviour on the General Health of Office Workers.(2017,July 12)
5. Jung Ha Park, Ji Hyun Moon, Hyeon Ju Kim, Mi Hee Kong, Yun Hwan Oh1, Sedentary Lifestyle: Overview of updated evidence of potential health risks.
6. Mustapha Sebbane MD PhD, Moez El Kamel MD, Alice Millot MD, Boris Jung MD PhD etal,Effect of Weight Loss on Postural Changes in Pulmonary Function in Obese Subjects: A Longitudinal Study.(2015,July)
7. Harpreet Ranu, Michael Wilde, Brendan Madden,Pulmonary Function Tests(2010,December 16).
8. Deborah Leader, RN, FEV1/FVC Ratio in Spirometry (2021 September 22)
9. Baghery Hojat and Esmaeilzadeh Mahdi* Effect of different sitting posture on pulmonary function in students. Journal of Physiology and Pathophysiology Vol. 2(2), pp. 29-33, July 2011.
10. Mohammad Fazlul Haque, Shahin Akhter, Nnayeema Tasneem, Mahmudul Haque. Effects of different sitting postures on forced vital capacity in healthy school children**.** August 2019 Bangladesh Medical Research Council Bulletin 45(2):117-121.
11. Pooriput Waongenngarm [1], Bala S Rajaratnam [2], Prawit Janwantanakul Internal Oblique and Transversus Abdominis Muscle Fatigue Induced by Slumped Sitting Posture after 1 Hour of Sitting in Office Workers. Saf Health Work 2016 Mar;7(1):49-54. doi: 10.1016/j.shaw.2015.08.001. Epub 2015 Aug 21.