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Original Research Paper

Pulmonary Medicine

RESPIRATORY DYNAMICS IN SUMMER AND WINTER SEASONS

Dr Amit R Dedun* Assistant Professor, Department of Pulmonary Medicine, Civil Hospital and B J Medical College, Ahmedabad *Corresponding Author

Dr Mina D Varlekar Tutor, Department of Physiology, Dr. M.K. Shah Medical College and Research Centre, Chandkheda, Ahmedabad.

Dr Pradip H Damor Assistant Professor, Department of Pulmonary Medicine, Smt SCL Hospital and Smt NHL Municipal Medical College, Ahmedabad.

ABSTRACT Background: Global warming is the long term rise in the average temperature of the earth's climate system. Environmental changes temperature and humidity may affect on respiratory dynamics. Aims and Objectives: The aim of this study is to see the seasonal effect on pulmonary function. Materials and Methods: This study based on the seasons using result from spirometry, questionnaires to investigate the participants' respiratory system problem/symptom related to sedentary life style and smoking habit, etc. Anthropometric parameter has been taken. All participants were subjected to performe spirometry. Spirometry values were tabulated with mean and median. Results: Forced vital capacity (FVC), forced expiratory volume in 1-s (FEV_1), and peak expiratory flow rate values were significantly increase in winter, but FEV_1/FVC and forced expiratory flow between 25% and 75% decrease with increasing environmental temperature. Conclusion: lung capacity and respiratory rate change with seasons.

KEYWORDS : Global warming, summer; winter Spirometry; Forced Vital Capacity,

INTRODUCTION

Global warming is the long term rise in the average temperature of the earth's climate system. It is a major aspect of climate change and has been demonstrated by direct temperature measurements and by measurements of various effects of the warming [1]. It is the extremely likely that human influence has been the dominant causes of the observed warming since mid 20th century [2]. The largest human influence has been the emission of greenhouse gases such as carbon dioxide, methane and nitrous oxide. Due to global warming worldwide, environmental changes like snow fall, ice melt, rising sea levels, heat waves, heavy downpours, increase flooding etc, which causes sudden changes in temperature and humidity. All of the above environment change may affect on human. Therefore, the study of seasonal changes is important. It is acknowledged that the system of external respiration, regular changes related to the seasonal dynamics of climatic factors occur during the year[3]. Previous studies available on seasonal changes in the intensity of energy processes in body and the volume of pulmonary ventilation[4-8]. Forced expiratory volume in 1-s (FEV_1) is a measure of primarily proximal airway status and is dependent on vigorous and rapid exhalation. A good evalution of FEV1/forced vital capacity (FVC) is dependent on complete exhalation[9,10].

Seasonal variation may seen on lung resistance as in summer it decrease and in winter it increases[11,12]. Air contents of the lungs increase[11,13] or decrease according to season. Severity of the climate at the site of the human residence also responsible for the direction and extent of manifestation of functional changes[14].

MATERIALS AND METHODS

The study was carried out at the Department of Pulmonary medicine, in Civil Hospital and B J Medical College Ahmadabad after taking permission from head in winter and summer season of years 2015 and 2016. A total of 100 volunteer's subjects both male and female with the age group of 20–50 years were recruited. Volunteers have history of acute or chronic respiratory disease, history of smoking were excluded from study. Volunteers consent, history and anthropometry including height, weight, and body mass index (BMI) was noted. The Spirometry was done with FEV, FEV_1, FEV_1/FVC, forced expiratory flow between 25% and 75% (FEF_{25-75}), and peak expiratory flow rate (PEFR) values. Spirometry had been recorded in sitting position after at least 10 min of rest in winter and summer seasons.

RESULTS

Total 100 volunteers include 65 male and 35 female with average age in years 33.16 and 33.53 respectively. Mean anthropometric parameters including height and weight was more in male while Body mass Index was more in female.

Table 1: Physical characteristics of subjects in male and female

Average Parameters	Male (n=65)	Female (N=35)
Age (years)	33.16	33.52
Height (cm)	170.85	155.19
Weight (kg)	66.02	56.10
Body mass index (kg/m^2)	22.6	23.3

Respiratory parameters changed by two different seasons. FVC, FEV_1, FEF_{25-75} and PEFR values were high in winter compare to summer. The values for FEV_1/FVC were not so much changed according to seasons.

Table 2: The effect of cold and hot seasons on respiratory parameters of subjects

Parameters	Seasons (mean±SD)	
	Winter	Summer
FVC	90.14±12.79	67.16±8.46
FEV1	87.17±12.50	66.99±8.10
FEV_1/FVC	97.08±6.21	96.13±13.45
FEF_{25-75}	95.46±13.97	76.48±19.07
PEFR	98.57±21.57	65.65±13.01

SD: Standard deviation, FVC: Forced vital capacity, FEV_1: Forced expiratory volume in 1-s, FEF_{25-75}: Forced expiratory flow between 25% and 75%, PEFR: Peak expiratory flow rate values.

DISCUSSION

Global warming causes increase in environment temperature which may affect on respiratory system. Respiratory rate may depend on environmental temperature / humidity which

increase and decrease in summer and winter respectively. The maximum seasonal variation was found in the FVC and PEFR. Respiratory rate may directly proportional to body temperature, environmental temperature / humidity. Liener K et al shows that sudden decrease in temperature and humidity could be related to altered airways function [15]. Pulmonary capacity decrease in summer its maybe increase of environmental temperature and humidity. Mourtzoukou EG et al. and Conlon KC et al. demonstrates that winter time cold temperatures increase respiratory morbidity and mortality[16,17]. Pulmonary functions are usually determined by the strength of respiratory muscles, compliance of the thoracic cavity, airway resistance and elastic recoil of the lungs[18].

PEFR monitoring remains an important tool in the diagnosis and monitoring of reversible airway disease. PEFR determines to prevent conditions from worsening. Variation of PEFR depends on such factors may include prolonged exposure of the airways and lung tissues to insults, environmental hazards, and stresses and so forth, resulting in loss of muscle elasticity, increase in body fat content in relation to protein, and increase in reaction time to stimuli and so on[19].

CONCLUSION

Spirometry value not only depends on anthropometric determinants but also increases or decreases with environmental temperature and humidity.

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