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DIURNAL VARIATION IN SPIROMETRIC PARAMETERS WITH BODY MASS INDEX AND MEAN ARTERIAL PRESSURE AMONG APPARENTLY HEALTHY ADULTS

Physiology

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ABSTRACT

Introduction: The purpose of the study was to identify diurnal variations in forced expiratory volume in 1 second (FEV1), Mean Arterial Pressure (MAP) and Body Mass Index (BMI) and a possible association between them. **Materials and methods:** 40 healthy adults fulfilling the eligibility criteria were recruited. Spirometric analysis of FEV1 was performed. **Results:** FEV1 showed statistically significant differences according to time of day. FEV1 values in the morning was 2.83 ± .62 and in the evening, raised to 2.95 ± .522 in study population. The highest value was noted in the evening as compared to morning. MAP mean values in the morning was 87.37 ± 5.204. MAP mean values in the evening was 88.40 ± 7.519, which again showed an increase in the evening. **Conclusion:** The present study indicated a definite diurnal variation in the pulmonary function and cardiovascular parameter.

KEYWORDS

Diurnal variability, pulmonary function, FEV1, mean arterial pressure, body mass index

INTRODUCTION:

Forced expiratory volume in one second (FEV1) reflects the caliber of both proximal and peripheral airways. Total variability is lowest & maximum variability is less than 10% therefore clinically most suitable.[1]

Circadian variation occurs in different organs of the human body, including the pulmonary system wherein physiological functions are regulated as per a particular cycle, and also in blood pressure and hormonal values.[2,3] Diurnal variations exists in pulmonary function, and is termed as "morning dip" phenomenon.[4,5] Literature shows values peaking in the evening time and dipping in the morning hours.

Contradictory viewpoints are are put up by earlier studies regarding diurnal variation in respiratory assessment. While Hetzel et al[6] appreciated variations in pulmonary function across time intervals, Aguilar et al[7] found no significant difference at al.

Blood pressure (BP) fluctuates from beat-to-beat, throughout the course of the day and over longer periods of time. .Similar to reduced lung function, high BP variability (BPV) has been associated with increased CVD risk. . Studies have suggested that an association exists between reduced lung function and increased BPV. Hence, the present study was done to assess the correlation of FEV1 with MAP and BMI.

MATERIALS AND METHODS:

An observational, cross sectional study was conducted to assess the correlation of pulmonary function with anthropological(BMI) and cardiovascular variable (MAP). 40 individuals in the age group of 18 – 35 years attending Out patient department of King George Medical University, Lucknow was randomly recruited. Informed consent of all participants were obtained. Institutional ethical committee clearance was taken before the start of the study.

Study individuals recruited fulfilled the inclusion criteria of being apparently healthy, with no history of allergy, surgery, respiratory illness or chest deformity. Exclusion criteria was any recent cardiac or lungs ailments suffered within one month, Acute respiratory illness, Stress incontinence, Dementia or confused state, Tobacco or alcoholic, Pregnancy or Patients not consenting to participate.

Variables assessed –

1.Spirometric analysis of pulmonary indicator – FEV1

Proper instruction and demonstration of method of spirometry was given to all subjects. Spirometry was done in standing position and after a resting period of 10 minutes. First both the nostrils were blocked with the help of nasal clip. Then, subjects would do maximum inspiration through mouth and expire forcefully as much as they can in a single blow.i.e.Forced Expiratory Volume in 1 second was obtained from all participants twice daily (at 8 am and at 4 p.m.).

2.Body mass index

For measuring BMI, height and weight was recorded. Height was measured by rigid stadiometer in standing position.Height was measured in centimeters. Height recorded after taking in a deep breadth for maximum measurement. Weight was measured by digital weighing machine.Subject was clad in minimum clothes. Weight taken before having their lunch or atleast 2 hours, after lunch and to the nearest decimal fraction. Weight was recorded after taking in a deep breadth.BMI was calculated by using the formula Weight / Height ^{2}[Expressd as kilogram per meter square].

3. **Blood pressure measurement**

Blood pressure was recorded diurnally using Sphygmomanometer. The formula for calculating Mean arterial pressure (MAP) = [systolic blood pressure + (2 X diastolic blood pressure)] / 3

The reference range is 70-100 mm Hg.

SPSS version 21.0 was used for statistical analysis. (IBM; Chicago). Paired t test was used to test for any significant differences among study population at two intervals for variables of FEV1 and MAP. P value lesser than 0.05 was considered to be statistically significant.

RESULTS AND OBSERVATION

A total of 40 subjects were assessed, with a maximum of 22 years and a minimum of 18 years. The mean age of the study subjects were 19.22 ± .97 years.62.5% of the study participants were males while females comprised of 37.5% of the study population.

FEV1 values assessed in the morning (2.83 ± .62) and in the evening (2.95 ± .522) in study population (Figure 1 and Table 1). The highest value was noted in the evening as compared to morning. MAP mean values in the morning was 87.37 ± 5.204. MAP mean values in the evening was 88.40 ± 7.519. MAP values increased in the evening.

(Figure 3 and Table 1)

Table 1: Table showing diurnal values

Variables	Morning	Evening
FEV1	2.83 ± .620	2.95 ± .522
MAP	87.37 ± 5.204	88.40 ± 7.519

Mean height of the study participants was 170.08 + 6.627. Mean weight of the study participants was 63.25 + 10.765. Mean BMI of the study participants was 21.53 + 3.020. Gender wise distribution of BMI is depicted in Figure 2

An increase in MAP showed a decrease in FEV1 values. A Pearson correlation was run to determine the relationship between MAP and FEV1.

There was a negative correlation observed with r = -.647 and significant at p=0.043. With increase in BMI values, FEV1 also increased. A Pearson correlation was run to determine the relationship between BMI and FEV1. There was a negative correlation observed with r = -.549 and significant at p=0.038.

DISCUSSION

The present study evaluated the effect of FEV1 on MAP & BMI.
Brook et al[8] published his first scientific statement regarding air pollution and cardiovascular disease.Short term exposure to particulate matter air pollution contributes to acute cardiovascular morbidity and mortality.Increasing air pollution levels in urban areas can deteriote pulmonary function tests.[9]

Circadian rhythms is a form of biological survival response evolved for environmental adaptation to the environment. The field of pulmonary physiology also follows dirurnal variability. Diurnal rhythm is regulated in the Suprachiasmatic nucleus situated in the hypothalamus, serving the part of a principal circadian pacemaker regulating body organs and human behaviours.[10]

The current study showed a morning dip phenomenon in the FEV1, with evening values ranging higher than the morning values. FEV1 values assessed in the morning (2.83 ± .62) and in the evening (2.95 ± .522) Teramoto et al[11] who evaluated diurnal variations in FVC and FEV1 also displayed similar results with morning dip phenomenon with significantly reduced values being observed in the morning. Medarov et al [12]also found that FVC and FEV1 values measured in the afternoon showed highest values.

The results of the present study demonstrate that pulmonary function and pulmonary strength show changes with time of day, confirming the morning dip phenomenon.

A strong correlation was found in our study which was similar to the study done by Banna Ram Pawar et al[13] who found a linear relationship between FEV1 and MAP in sand stone mine workers. The probable justification for compromised pulmonary function with increased blood pressure could be impairment of smooth muscle tonus regulation, vascular remodeling, adverse effects of therapy, and genetic factors overlapping on a contrast pattern of systemic inflammation.

Some studies have reported that pulmonary evaluation measurements are influenced by gender, ethnicity, age, and height, and thus these factors should be taken into account in testing[14,15].

The study had limitations of small number of the recruited sample. Further studies employing longitudinal study design on a larger sample size will strengthen the generalizability of results.

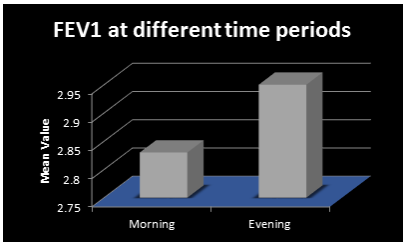

Figure 1: FEV1 – Diurnal values

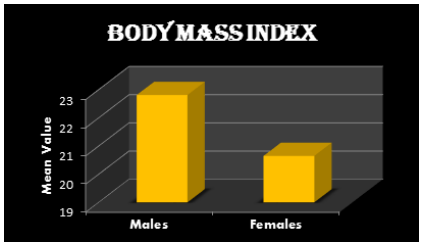

Figure 2: Distribution of Body mass index based on gender

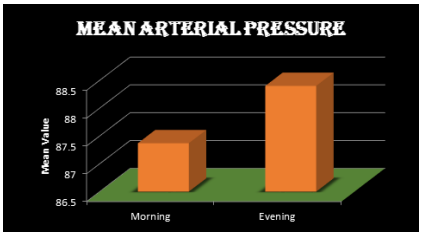

Figure 3: Mean arterial pressure – Diurnal values

CONCLUSION:

Physicians, as health care providers are blessed with the opportunity to identify and diagnose conditions, even when present in subclinical forms.An individual with compromised pulmonary function must be diagnosed for cardiovascular disorders and vice versa.

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