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ORIGINAL ARTICLE

Reference Values for Respiratory Parameters in General Adult Population

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ABSTRACT

Background: Reference values for maximum inspiratory pressure are varied among different studies and this variability is generalized by demographic differences and test performance measurement.

Objective: To acquire a comprehensive set of Reference values for respiratory pressures in a general adult population and to evaluate possible associations with sex, age and body mass index (BMI).

Methods: The study design was cross-sectional and sample was drawn through simple random sampling technique. The sample size was calculated using 584 based on parent article, divided on gender 292 participants each. Inclusion criteria was age between 18-40**,** both genders**,** Healthy people and moderately active**.** Exclusion criteria were Signs of ischemia/infarction, Stenosis or insufficiency of the cardiac valve, Systolic and diastolic failures. Data was collected from Sialkot, Pakistan. Basic anthropometric values for age, height, weight and BMI were measured. Spirometry values for FVC, FEV1, FEV1/FVC, VC, and PEF were measured. Descriptive measures were in the form of mean and standard deviation was calculated through SPSS version 25. Pearson Correlation between variables was also found.

Results: Among male gender PEF have significant correlation (P< 0.00) with age while BMI have no significant correlation. FVC, FEV1, FEV1/FVC, VC do not show any significant correlation with age, weight, height and BMI among male gender. Among female gender PEF showed significant correlation (P< 0.00) with age only. FVC, FEV1, FEV1/FVC, VC do not show any significant correlation with age, weight, height and BMI among female gender.

Clinical Significance: this research provided the knowledge about basic respiratory parameters and its correlation with anthropometric measurements. It can help develop the basis for occurrence of respiratory disturbances in long term due to deviation from normal parameters.

Conclusion: Among males age, gender, height weight and BMI doesn't affect normative values for respiratory pressure. While among females' normative values of respiratory pressures are only affected by age.

Keywords: Respiratory Pressure, Adult, Population, Reference values**.**

INTRODUCTION

Measurement of maximum respiratory pressure (MRP) is used widely to assess measure of respiratory muscle strength. Maximum respiratory pressure involved two pressures; maximal inspiratory pressure (MIP) and maximal expiratory pressure (MEP) Maximum inspiratory pressure is defined as measurement of strength of inspiratory muscles mainly diaphragm. [(1)] Maximal expiratory pressure (MEP) is the most broadly involved in measuring expiratory muscle strength in basically sick patients and in severely ill patients. It helps assessment of respiratory diseases, respiratory failure and ventilatory muscle strength.[(2)] Ventilation, gas exchange and oxygenation of tissues are compromised by impairment of ventilatory muscles. Pressure within the thorax generated by inspiratory muscle reflects their strength.[(3)] MIP is more sensitive than MEP as MIP reflects certain respiratory muscle weakness while MEP measurement is very important for patient with neuromuscular disorder.[(4)] Reference values for maximum inspiratory pressure are varied among different studies and this variability is generalized by demographic differences and test performance measurement.[(5)] Many characteristics of individuals can influence the maximum inspiratory pressure values which included test performance method, sex, age, height, weight, BMI.[(6)] Large scale measurements are needed to evaluate the equation and factors by which maximum inspiratory pressure is influenced. [(7)] Spirometry and diaphragmatic ultrasound are being used as one of non-invasive method for measuring MIP and MEP.[(8)] Correlation was fond in values for maximal inspiratory and maximal expiratory pressures with decline in age. [(9)] Respiratory muscle function can affect pulmonary function parameters. Elder population has low peripheral muscle strength and low respiratory muscle function which have adverse effect pulmonary function. [(10)] These people are more prone to suffer from many pulmonary diseases. European Working Group on Sarcopenia in Older People (EWGSOP) found Peak Expiratory Flow (PEF) as an alternative to maximum respiratory pressures for measuring respiratory muscle strength.[(11)] Normal values for maximum inspiratory pressure are in wide range and mild values give us an idea about weakness of inspiratory muscles. European respiratory society and American thoracic society stated MIP of 80cm H2O is considered normal but these values can be higher in older man, women or aged people. This value is not in consideration with age, sex and height of individual. [(12)] Different strength preparing methodologies are accessible to work on cardiopulmonary perseverance and athletic execution. The assessment of respiratory muscle strength, then again, becomes basic during routine clinical assessments since it builds up a pattern and permits the person's fitted preparation program. [(13)] A new report exhibited the strategy for estimating the most extreme respiratory tensions by end expiratory impediment procedure in patients on mechanical ventilation. Factors in pneumonic capacity tests ought to be deciphered utilizing solid populace based reference esteems.[(14)] Besides, the writing on MRP reference esteems is in view of a western populace, bringing about changeability because of an absence of determination models and a little example size.[(15)] IP is estimated from RV or from useful functional residual capacity (FRC). Since there is a backwards connection between lung volume and inspiratory muscle strength, estimations from RV yield module esteems that are 30% higher than those gotten from estimations from FRC.[(16)] Despite the fact that estimations from RV yield higher qualities, a few doctors and analysts use estimations from FRC in light of the fact that they more reproducible and all the more effortlessly performed by patients.[(17)] Notwithstanding, when estimations from FRC are made, it is fundamental that FRC volume be known, on the grounds that this volume will influence the strain produced.[(18)] The estimation of MIP can be made with a simple or computerized pressure manometer. Digital gadgets are liked over simple gadgets, considering that the most noteworthy MIP esteem happens momentarily and may go unrecognized on a simple presentation. Estimations are generally made with patients in a sitting situation, with or without nose piece.[(19)] Patients are approached to breathe out to RV and afterward play out a maximal

inspiratory exertion, supporting it for 1 to 2 seconds.[20] MEP is estimated with a tension manometer. Estimations are normally made with patients in a sitting position and with a nose cut, albeit the utilization of a nose cut isn't required. MEP can be estimated from TLC or from FRC.[21]

Respiratory pressures are to measures for assessing health of respiratory muscles. Normal values among population give us basics for diagnosis and clinical correlations in case of various diseases of respiratory system. Many diseases of pulmonary system which commonly affect inspiratory and expiratory muscle strength can be assessed through measuring respiratory pressures. Age, gender, height, BMI, weight and sociodemographic values can affect the normal values of maximum inspiratory and expiratory pressure.

MATERIALS & METHOD

Study Design: Study design was cross-sectional epidemiologic survey.

Study Settings: Data was collected from cardiology ward of Imran Idress Teaching Hospital, Sialkot.

Duration of Study: The study was completed within 6 months after approval of synopsis.

Sampling technique: Sampling technique was non-probability convenience sampling.

Screening: We selected moderately active participants.

Sample Size: 584 total sample sizes were calculated by using Epitol. Divided into two groups on base of gender.

Inclusion Criteria:

- Age between 18-40
- Both genders
- Healthy people
- Moderately active individuals. (38)

Exclusion Criteria:

- Signs of ischemia/infarction.
- Stenosis or insufficiency of the cardiac valves.
- Systolic and diastolic failures as well as a cardiac shunt.
- Pulmonary diseases.
- Neuromuscular or musculoskeletal disorders.
- Any history of cancer. (39)

Tools: Normal Pulmonary Function Test (PFTs):

A. Forced expiratory volume in 1 s (FEV1):
Maximum amount of air that a person can exhale during first second following maximum inspiration.(40)

B. Forced vital capacity (FVC):
The maximum amount of air that can be exhaled when blowing out as fast as possible. (40)

C. FEV1/FVC ratio:
It is proportion of patient's vital capacity that can be exhaled in first second of forced exhalation to the full forced vital capacity. (41)

D. Vital capacity (VC):
Total amount of air that can be exhaled from lungs by maximum exhalation.(42)

E. Peak expiratory flow (PEF):
It is maximum speed of exhalation with steady flow.(42)

Data Collection Procedure: After approval from the university ethical committee Riphah, participants were approached and selected depending on inclusion criterion. Pulmonary function test was performed for each participant. Normative values like smoking, BMI and physical activity, and their relation with respiratory values were calculated.

Data Analysis: Data was analyzed by using SPSS 25. All qualitative data including gender was presented in the form of frequency and quantitative data like age, BMI, was presented in the form of mean ± S.D. and Pearson correlation was applied between different variables to check significant relation.

RESULTS

Among male gender FEV1, FVC and FEV1/FVC have significant correlation (P< 0.05) with age and weight while no significant correlation (P> 0.05) with height and BMI. VC and PEF do not show any significant correlation with age, weight, height and BMI among male gender. Mean weight for female gender is 36.40 with standard deviation of 3.582. Mean height for male gender is 143.27 with standard deviation of 4.345. Mean height for female gender is 142.99 and standard deviation of 3.957. Mean BMI for male gender is 17.21 with standard deviation of 1.008. Mean BMI for female gender is 17.19 with standard deviation of 0.973. Among female gender PEF showed significant correlation (P< 0.05) with age only. While weight, height and BMI showed no significant correlation (P> 0.05) with PEF, VC, EFV1/FVC ratio and FVC do not show any significant correlation with age, weight, height and BMI among female gender.

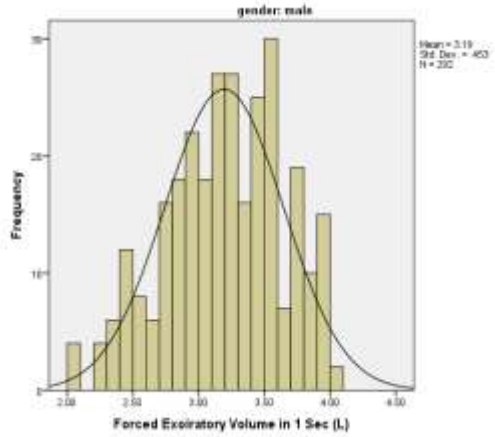

Figure 1: Histogram Forced Expiratory Volume Male Gender

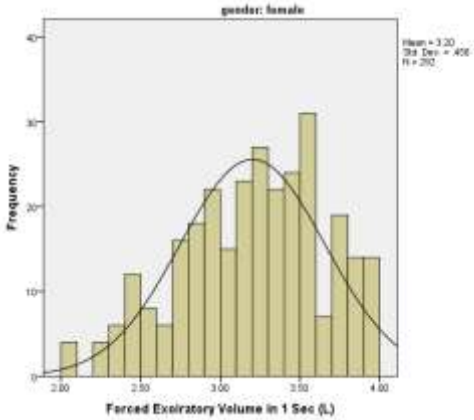

Figure 2: Histogram Forced Expiratory Volume Female Gender

Table 1:

Correlations Male Gender		Pearson Correlation	Sig.
Age (years)	Forced Expiratory Volume in 1 Sec (L)	-.125*	0.00
BMI (kg/m2)	Forced Expiratory Volume in 1 Sec (L)	.054	1.606
Correlation Female Gender			
Age (years)	Forced Expiratory Volume in 1 Sec (L)	.123*	0.00
BMI (kg/m2)	Forced Expiratory Volume in 1 Sec (L)	.065	1.10

Among female gender PEF showed significant correlation (P< 0.00) with age only. While weight, height and BMI showed no significant correlation (P> 0.00) with PEF, VC, EFV1/FVC ratio and FVC do not show any significant correlation with age, weight, height and BMI among female gender.

DISCUSSION

Pulmonary pressures are essential to the diagnosis of many lung conditions and help to identify numerous non-pulmonary disease processes. Understanding the basic interpretation of the components of this valuable test is crucial for primary care physicians to aid in the diagnosis of patients with respiratory symptoms. The present study provides us a wide range of reference values among young healthy males and females between 18 to 40 years of age. Our reference values for PFTs do not show significant relation with anthropometric values. Reference values for maximum inspiratory pressure are varied among different studies and this variability is generalized by demographic differences and test performance measurement. [24] Reference values in our data showed a gradual decline with increase in age which is in concordant with previous findings stated that values for respiratory pressures begin to fall with age.[1] men were found to have more lung capacities than women. Young adults generate more pressures than children and older adults.[25] Among female gender PEF showed significant correlation (P< 0.05) with age only. Higher peak expiratory flow values are associated with younger age and lung ageing affects the airflow which causes lower peak expiratory flow values.[26] Maximal respiratory pressures values were found higher among male gender as compared to female gender. Maximum inspiratory pressure values were found higher among male gender in literature also.[27] This study explored weight, height and BMI showed no significant correlation (P> 0.05) as described in a study that all respiratory parameters have negative correlation with body mass index. Present study found PEF, VC, EFV1/FVC ratio and FVC do not show any significant correlation with age, weight, height and BMI among female gender. According to previous findings weight affects the normal respiratory pressures values as compared to other anthropometric parameters.[28] Among male gender FEV1, FVC and FEV1/FVC have significant correlation (P< 0.05) with age and weight while no significant correlation (P> 0.05) with height and BMI. VC and PEF do not show any significant correlation with age, weight, height and BMI among male gender. Among females peak expiratory flow rate was significantly correlated with VC, FEV1, FVC and PEF while among male it was only correlated significantly with BMI, males have weak correlation as compared to females. [29] Including airflow measures such as PFTs in standard voice evaluation may allow recognition of underlying respiratory disease contributing to voice dysfunction. [30] Further research on different and large-scale population needed to find more best set of values for respiratory pressure values. Comparative cross-sectional study can be done with different respiratory values and anthropometric variables. Further research is recommended to establish indications and diagnostic criteria for the use of respiratory pressures in clinic patients. Due to pandemic conditions (COVID-19) participants were not easily available. Data from healthy population, so values obtained cannot be clinically correlated for patients with cardiopulmonary disorders

CONCLUSION

Normative values provided a comparison for therapists to determine the level of impairment should they assess maximal inspiratory and expiratory pressures in their population. These pressures are important outcome measures in individuals with respiratory muscle weakness and fatigue. Among males age, gender, height weight and BMI doesn't affect normative values for respiratory pressure. While among females' normative values of respiratory pressures are only affected by age.

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