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RESEARCH ARTICLE

PULMONARY FUNCTION TESTS AMONG THE STUDENTS OF SIKKIM MANIPAL INSTITUTE OF MEDICAL SCIENCES, GANGTOK.

Abhishek Ghosh Biswas and Dr. Dheeraj Khatri.

Student Sikkim Manipal Institute of Medical Sciences Gangtok Tadong East Sikkim 737101.

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Abstract

Pulmonary Function Tests are designed to measure how well the lungs are working. Differences in lung function is observed among people residing at high altitudes and those belonging to plain terrains. A number of researchers in India have investigated the use of drugs and smoking among medical students. The study aimed at finding out the regional differences in the lung function between students of the North Eastern States and the students from the rest of the country and to find out the differences between lung function among smokers and non-smokers in people from the two groups. **Methods:** The research was carried out among 326 young healthy individuals in the age group of 17- 35 years of the college. The students were asked to fill a questionnaire asking their demographic details and details of smoking habits. Following which they were asked to fill Fagerstorm Questionnaire if they were smoking currently. A spirometric analysis was performed thereafter on them using a computerised Spirometry. **Results:** The results of this study suggest that smokers had lower lung function values as compared to non- smokers and maximum of the smokers had moderate dependence on nicotine. There was no significant difference among the students of northeastern states and those from other parts of the country. **Conclusion:** There was no significant difference in lung functioning in the two groups because of the presence of migratory population in the hilly areas and since the ethnic difference was not taken into account. The lower FVC value in smokers could be attributed to weakened muscles and lung changes as compared to non smokers.

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Introduction:-

Pulmonary Function Tests are a group of tests that are designed to measure how well the lungs are working.⁽¹⁾ Spirometry is a physiological test that measures how an individual inhales or exhales volumes of air as a function of time, and it is invaluable as a screening test of general respiratory health⁽²⁾. The essential indices of spirometric analysis used in the study are assessing the Forced Expiratory Volume in one second (FEV1), Forced Vital Capacity (FVC), the ratio of Forced Expiratory Volume in one second and Forced Vital Capacity (FEV1/FVC)^{(1),(3)}.

Corresponding Author:- Abhishek Ghosh Biswas.

Address:- Student Sikkim Manipal Institute of Medical Sciences Gangtok Tadong East Sikkim 737101.

Differences in pulmonary function in normal people may be due to ethnic origin, physical activity, environmental conditions, altitude, tobacco smoking, age, height, sex, and socioeconomic status⁽⁴⁾. Permanent residents at high altitudes usually have larger lungs than dwellers of comparable stature at lower altitudes. This explains the relatively large lungs of the mountain people of the Himalayas including the Borders of Ladakh in Kashmir, the high altitude natives of Nepal and the inhabitants of Lumana region of Bhutan⁽⁴⁾.

The picture in Northern India is further complicated by a mongoloid component and this also contributes to ethnic differences in South East Asia and elsewhere. Mongoloids have mainly been found to have lung volumes which are intermediate between those of Caucasians on one hand and negroes and South Indians on the other⁽⁴⁾. The wide range of geographical and climatic conditions in a large country such as India may be associated with regional differences in lung function in healthy individuals, as shown in previous studies^{(5),(6)}. In this study the investigators shall measure pulmonary function, including spirometric indices and static lung volumes, in healthy young adults in the medical college premises where people come from different corners of the country.

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The UN health agency reports that about 4.9 million people die each year across the globe due to cigarette smoking⁽⁷⁾. The overall death rate for male smokers is 70% greater than that for male non-smokers. In United States 4,40,000 premature deaths are attributed to tobacco smoking, trends are reversed, the figure expected to rise to 10 million deaths per year by 2020 or early 2030 with 70% of those death occurring in developing countries⁽⁸⁾.

Cigarette smoking is by far the most important risk factor for COPD and most important that tobacco contributes risk of COPD. Smoking leads to rapid decline in pulmonary function test specially those indicating diameters of airways such as forced expiratory flow in one second (FEV₁)⁽⁹⁾. In India tobacco kills 8-10 lakh people each year and many of the deaths occur in people who are very young⁽¹⁰⁾. Here, approximately 5500 children and adolescents starts using tobacco daily, some as early as 10 years⁽¹¹⁾. Teaching about the use of tobacco is essential for college students, both medical and non- medical, because they would be physicians, future teachers and other responsible citizens of the country. So they should not be sanctimonious⁽¹²⁾.

India is the third largest producer and consumer of tobacco in the world. A number of researchers in India have investigated the use of drugs and smoking among medical students^{(13),(14),(15)}. Roy and Chakravarty in a survey of 557 new male entrants to medical schools in West Bengal found that 17.6% had a smoking experience and 3.2% were regular smokers⁽¹⁶⁾. Another survey of 1600 medical students from the northern state of Uttar Pradesh found that the number of smokers increased with the increase in period of stay in the medical school⁽¹⁷⁾. The factors found significant in leading to a higher tobacco consumption included lack of family supervision among hostels, peer influence, lack of awareness about the harmful effects of different tobacco products, no exposure to clinical cases of tobacco related disorders, and easy availability of these products^{(18),(19)}.

The response is dose dependent, so heavy and long term smokers and those who inhale tobacco smoke incur more damage than subjects whose exposure is less. The Nicotine dependence is analysed on the basis of the Fagerstrom Tolerance Questionnaire⁽²⁰⁾.

Such kind of study on medical students have not been performed in this region and the study would help in comparing the pulmonary function between smokers and non-smokers from northeast and other parts of the country and outside. The study will include regional differences and also effect of smoking on lung capacities.

Materials And Methods:-

Study Type :-

Descriptive, Cross Sectional Study.

Study Site:-

Respiratory Medicine Unit, Department of Medicine , Central Referral Hospital.

Study Population:-

Students of the college in the age group of 17-35 years.

Period of Study:-

13th May 2016 – 13th July 2016

Sample Size: A total of 326 subjects, both males and females in the age group of 17-35 years from different regional background and both smokers and non-smokers were drawn from students of the institute after their approval and informed consent (appendix 1).

Students who took part in the study were pursuing Bachelor of Medicine and Bachelor of Surgery (MBBS), Bachelor of Physiotherapy (B.PT) and Bachelor of Science in Nursing (B.Sc Nursing) courses in the college during the time of study and they were randomly selected for the study.

420 students were given the questionnaire, out of which 354 students consented for the study and 326 healthy individuals with no respiratory or cardiovascular illness for the past 3 months prior to the study were finally appointed in the study, with or without a history of smoking.

The individuals chosen were engaged in mild to moderate physical activity, with rice or wheat as the staple diet. Detailed procedure of the study will be explained to all the subjects and an informed written consent will be obtained as per attached proforma.

The Body Mass Index is calculated by obtaining weight and height of the subject. $\text{Body Mass Index (BMI)} = \frac{\text{Weight of the subject in kilograms}}{(\text{Height of the subject in metres})^2}$.

Inclusion Criteria:-

Healthy subjects with a) No previous history of upper respiratory tract infection within 3 months. b) No other clinically detected medical illness. c) No history of asthma or bronchitis in the family. d) Subjects with a BMI of 18.5- 24.9 (Normal Weight).

Exclusion Criteria:-

Subjects who have had history of respiratory disorders or diseases like tuberculosis, congenital cardiac disorders and musculoskeletal deformity of chest wall were excluded. All those who refuse to give consent, and the ex-smokers or past smokers will be excluded.

Primary Questionnaire:-

The students, willing to participate in the study are subjected to a set of questions asking the demographic details, i.e. name, age, sex, permanent address, community, height, weight, and also a note of allergy history, history of past respiratory illness in the family, history of alcohol, history of smoking, is made (appendix 2). For Ethnicity, Racial and Regional Differences.

A detailed history of the caste, place of stay, permanent residential address is considered and the population is divided into two groups, Group A: Individuals from the North Eastern States of India (Assam, Manipur, Meghalaya, Arunachal Pradesh, Sikkim, Tripura, Nagaland)., Group B: Individuals from rest of the country and outside (Non Residentials of India).

The two groups A and B are further sub classified into smokers and nonsmokers.

GROUP A :- People belonging to the Northeastern States --- Smoker
--- Non –Smoker

GROUP B:- People belonging to other parts of the country
And Non- Residentials of India --- Smoker
--- Non- Smoker

For Smoking Habits, the following criteria is accepted.

Classification Criteria As Suggested By WHO(1998) Smoker:-

Someone who, at the time of the study, smokes any tobacco product either daily or occasionally. Non-smoker: Someone who, at the time of the study, does not smoke at all. Ex-smoker: Someone who was formerly a daily or occasional smoker but currently does not smoke at all (for a period of 3 months). In this study a detailed record of smoking with reference to duration of smoking (in years) and number of cigarettes / bidis smoked per day will be taken.

Fagerström Tolerance Questionnaire is used to find the Nicotine Tolerance among smokers. (appendix 3).

The Fagerström Tolerance Questionnaire is a widely used screening instrument for measuring nicotine dependence related to smoking. The Fagerström Tolerance questionnaire consists of 10 questions. Scoring per item is either a three or four level response with values 0,1,2,3. Scores are added and a total score of 7 and above indicates a high dependence.

Spirometry:-

All participants will then be subjected to detailed examination and assessment of lung vital capacity by Spirometric Analysis using a computerised RMS Med-spirometer manufactured by Technocare Med systems, Surat.

Keeping the importance of clinical tests in mind, Spirometric Analysis will be done for more specific evaluation of lung vital capacity as it requires no additional equipment. Although many tests are available, vital capacity is the simple and most useful measurement for assessing ventilatory functions of the lungs in health and disease. The functional expiratory volume and ratio of Forced Expiratory Volume in one second and Forced Vital Capacity (FEV1/FVC) is also evaluated.

The subjects were asked to perform the PFT at least three times to observe FVC, FEV1, FEV1/FVC. After appropriate coaching, the best of the three technically acceptable attempts were recorded and the best of the three results were considered for analysis. Subjects were instructed to perform the manoeuvre before being attached to the instrument. To achieve good results before the test, the subjects were familiarised with the machine and the detailed instructions and demonstration up to the satisfaction were done. The subjects were asked to loosen tight clothing and were seated comfortably erect with feet firmly on the floor. A nose clip was applied to the subjects' nose. Then the subject was asked to breathe in fully.

The lips were sealed around the disposable mouth piece. 2) The subject was asked to blast air out 'As fast as he can' until the lungs are completely empty. 3) The subject is asked to breathe in air again as forcibly and fully as possible.

Inspiration should be full and unhurried and expiration once begun should be continued without a pause. Of the several blows ranging from 3 to 4, the best reading was selected for the study and recorded.

At least 3 technically acceptable manoeuvres were obtained ideally with less than 0.2 L variability for FEV1 between the highest and second highest result. The largest of the three FVC and FEV1 values were accepted even if the two volumes do not come from the same curve. The ratio of FEV1 to FVC were expressed as percentage. The largest volume was quoted.

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The values for FEV1, FVC, FEV1/FVC ratio for each subject thus obtained were entered in the proforma and tabulated. Suitable statistical methods were applied using Microsoft Excel to analyze the data, such as mean, standard deviation, unpaired T test.

Results And Discussion:-

A total of 326 individuals took part in the study out of which 128 (39.26%) were males with a mean age of 20.77 years (SD = 1.881 years) and 198 were females (60.73%) with a mean age of 20.21 years (SD = 1.277 years).

A total of 198 females and 128 males took part in the study with the highest number of females (72) in 20 years of age and the highest number of males (31) in 19 years of age.

Much difference in the mean values of PFT parameters was not observed between individuals belonging to the North East part of the country and those belonging to the other parts of the nation and outside. This can be attributed to the fact that only the residential address was used for classification and not the geography of the place of stay or the ethnicity of the population. Students participating in the study belonged to a wide range of geographic variation, ranging from hilly areas, plains, terrains etc. which was not considered in the study. Also the ethnicity varied from region to region. The presence of migrant population in the North Eastern states (Mongoloids, Aryan, Dravidians) could also be the reason for the insignificant differences. Intake of tobacco is widely prevalent all over the world and it continues to rise in the developing countries. By 2030 the developing world is expected to have 7 million deaths annually from tobacco use⁽¹³⁾.

In the present study history of cigarette smoking was taken. Students with any other form of substance abuse were excluded from the study. In a similar study by Arora et al on substance abuse among medical students in a

developing country, various substances used by the study participants included alcohol (44, 19.13%), cigarettes (23, 10%), cannabis (smoking) (10, 4.34%), bhang (8, 3.48%), tobacco (chewing) (5, 2.17%) and other substances (gel and drugs) (5, 2.17%). Most of the abusers used more than one substance⁽²¹⁾.

In our study, smokers from both the study groups had a decreased value of FVC and FEV1 values (FVC=2.76 ± 0.67, FEV1= 2.69 ± 0.59 in Group A, FVC=2.74 ± 0.65, FEV1= 2.67± 0.62 in Group B) as compared to non – smokers (FVC=3.27±0.77, FEV1=3.12±0.69 in Group A, FVC=3.05±0.81, FEV1=2.97±0.75 in Group B).

A similar study conducted in a rural area between smokers and non- smokers by Rubeena et al revealed a decrease in PFT values among the smokers who were having low to moderate nicotine dependence⁽²⁵⁾.

The results for FVC may have been influenced by the instructions given to subjects, to perform maximal inhalation and then perform maximal exhalation as rapidly and as completely as possible. Hence, the FVC test relies on the strength of respiratory muscles. Cigarette smoking affects the respiratory muscles through the influence of free radicals on the vascular system⁽⁴⁾, leading to a reduction in respiratory muscle blood supply which adversely impacts respiratory function.

The study by Vijayan et al also showed lung volumes are about 15-20% lower in South Indians than in Western subjects⁽²⁴⁾. Their findings are similar to those of other studies from India and in highlanders from New Guinea⁽⁴⁾. Our study findings also correlate to other studies conducted by Jain et al and Amit et al on young healthy adults in other parts of the country^{(22),(23)}.

Conclusion:-

This study method employed used a simple questionnaire based approach to classify students into two broad groups based on their smoking habits and regional variations. From the above study we can conclude that the PFT values were lower among smokers as compared to non- smokers among the healthy population of subjects of both the study groups. This was attributed to the classification of subjects based on their place of stay made and not on the basis of topographical or ethnic differences. Although smokers exhibited a decrease in lung function as compared to non- smokers, a long term monitoring in those subjects is needed. Most of the smokers studied upon were having low to moderate dependence on Nicotine. There was no region specific influence on smoking, i.e. the number of smokers from both the group were almost the same.

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