

RESEARCH ARTICLE

LUNG VARIABLES IN THE STUDENTS OF RAJSHAHI UNIVERSITY.

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Abstract

Objectives: The purpose of the present study was to assess lung related variables for the students of Rajshahi University.

Materials and Methods: This study was performed on 862 students (578 males and 284 females) who were selected through stratified random sampling technique from the University of Rajshahi, Bangladesh. The variables in relation to lung [e.g., vital capacity (VC), tidal volume (TV), inspiratory reserve volume (IRV), expiratory reserve volume (ERV), forced vital capacity (FVC), forced expiratory volume in one second (FEV1), forced expiratory volume in one second (FEV1), forced expiratory Flow (MMF), Peak Expiratory Flow Rate (PEFR), Forced Expiratory Flow at 25 Percentage (FEF25%), Forced Expiratory Flow at 50 Percentage (FEF50%), Forced Expiratory Flow at 75 Percentage (FEF75%), Maximal Voluntary Ventilation (MVV) as well as Respiration Rate (RR)] were measured accordingly and analyzed using the software IBM SPSS Statistics 20.

Results: Descriptive statistics of all the lung related variables were less in magnitude compared to other countries. Significant gender differences have found in VC, TV, IRV, ERV, FVC, FEV1, FEV1%, MMF, PEFR, FEF25%, FEF50%, FEF75%, MVV as well as RR. For male, BMI showed significant positive relation with VC, IRV, FVC, FEV1, and MVV, and significant negative relation with FEV1%. For female, BMI showed significant positive relation with VC, TV, IRV, FVC, FEV1, MMF, PEFR, FEF25%, and FEF50%, and significant negative relation with RR. The mean value of lung indices was important determinant and also more reliable in males compare to females and it was also less than the values of other countries. The correlation pattern was different, except VC, IRV, FEV1 in both males and females and it was less significant than other countries and consists of biological inherent disparity in lung indices. The relationship between BMI with lung indices demanded further study for student's health policy and action.

Conclusion: To improve lung capacity, the student should take care of their food quality, health care and health awareness.

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Introduction:-

Lung function tests were used to evaluate how well the lungs work, by determining how much air the lung can hold and how quickly air moves in and out of the lungs (Mohammad et al., 2015), Body mass index (BMI) is a simple index of weight for height that is commonly used to classify malnutrition, healthy, overweight and obesity in adults, e.g., It is defined as a person's weight in kilograms divided by the square of his height in meters (kg/m²)(WHO Update January 2015, <u>http://www.who.int/</u>mediacentre/factsheets/fs311/en/). According to researchers, this is a significant indicator, easily indicates the physical fitness and nutritional status for human beings.

Lung function tests in health might be influenced by a number of factors like age, sex, height and weight along with various environmental pollutants and genetic, ethnic, socioeconomic and technical variations (Vijayan V.K., 1990 and Sharma et al., 1993). Most of students of Rajshahi University come from the middle or low income family and they did not take sufficient vegetables and fruits as well as balance diet. The qualities of food in the residential halls of Rajshahi University have been declining day by day that causes nutritional deficiencies in the students. The increase of weight in the recent years may be due to take high amount of rice, Potatos, Singera, Shamuca, Payaju, poultry egg, boiler chicken, and also due to lack of physical activities due to advancement of IT sector, etc. In many literatures, BMI had revealed to forecast several diseases like hypertension, type-2 diabetes mellitus, Stroke, cardiovascular problem, certain cancers and other chronic disease (Pi-Sunyer 1993; Zhou et al. and Berg et al. 2008 and Mishra et al. 2013). Researchers have linked BMI to change in lung related variables (Sekhri et al., 2008). Steele and his colleagues (2008) suggested that association between BMI and other variables related to lung have been previously investigated and BMI has been described to be negatively associated with the values of dynamic lung volumes. BMI is commonly used to define obesity and also known as Quetelet Index, among the many indices used to assess obesity. BMI has shown strongest correlation with continuous hypertension for both genders (Zhou et al., 2008). Although, BMI had shown its importance in the prediction of various disease, the most important one might be cardiovascular disease (Mishra et al. 2013). However, the link between BMI and lung function test is yet to be explored in India (Jones and Nzekwu, 2006). Roy et al. (2014) reported that BMI was less in males compared to females, and BMI had significant correlation with VC in males, but not in females. Besides, BMI had a significant predictor of VC in males. Some researchers had found that the values of lung function are more in male with compare to the female subjects because for their structural and biological differences and that exist generally for gender variables (Budhiraja et al., 2010; Choudhuri and Choudhuri, 2014; Behera et al., 2014 and Shah et al., 2015). Youssef et al. (2015) studied that increasing of BMI caused in decreased respiratory function in females than that in males.

To the best of our knowledge, status of lung variables are rarely noticed for the students of Rajshahi University as well as for other university students in Bangladesh. Thus, the aim of the present study is to focus the status of lung variables for the students of Rajshahi University.

Materials and Methods:-

Study area and population:-

The study area was the University of Rajshahi, which has different departments as well as different internal infrastructure. The University of Rajshahi is the second biggest university in Bangladesh with about thirty four thousands students from all over Bangladesh. In addition, there is little or no difference in ethnicity. The students in the University of Rajshahi could well be considered as representative part of Bangladesh university students.

Subjects:-

Almost, there are about 37000 students who study in Rajshahi University. There are 57 departments under 9 faculties. Among these faculties, two are selected at random and they were namely Faculty of Science and Faculty of Arts. Fifty percent of the departments from the selected two faculties were further considered and they were namely department of Mathematics, Chemistry, Statistics and Pharmacy from the Faculty of Science, and the department of Philosophy, Bengali, Fine Arts, Islamic Studies and Islamic history & Culture from the Faculty of

Arts. Twenty five percent students from each academic year of the selected departments were randomly selected. This consist of a sample of size 862 (578 males and 284 females) students (who completed the lung function test).

Ethical Clearance:-

Proper permission from all participants was taken after explaining the experimental procedure. The students who participated in the present study gave their consent to have the data from them. The ethical clearance in this study was acquired from the competent authority of the institute of biological sciences in the University of Rajshahi, Bangladesh (Memo No. 56/320/IAMEBBC/IBSc).

Measurements:-

The Chestgraph HI-101 was used for measuring vital capacity and other lung related variables. All tests were conducted by the trained technicians. Every measurement was taken at least three times and their average value was considered as the final measurement. The measurement variables were: vital capacity (VC), tidal volume (TV), inspiratory reserve volume (IRV), expiratory reserve volume (ERV), forced vital capacity (FVC), forced expiratory volume in one second (FEV1), maximum mid-expiratory flow (MMF), peak expiratory flow Rate (PEFR), forced expiratory flow at 25% (FEF25%), forced expiratory flow at 50% (FEF50%), forced expiratory flow at 75% (FEF75%), maximum ventilatory volume (MVV), and respiratory rate (RR). The study was performed during April 2015 to April 2016.

Method:-

Mean (M), standard deviation (SD), standard error of mean (SE), 5% trimmed mean (TM), 95% confidence interval (CI), skewness (Υ), and kurtosis (β_2), were calculated using Statistical Software IBM SPSS 20. Kerl Pearson Correlation coefficients between BMI and lung related variables were also investigated. Student t-test was applied for testing the significance of the correlation coefficients.

Results:-

Mean (M), standard deviation (SD), standard error of mean (SE), 5% trimmed mean (TM), 95% confidence interval (CI), skewness (Y), and kurtosis (β_2), were calculated for BMI and lung variables and are shown in Table 1.

Varia	ables	Sample	Mean±SE	Tr. Mean	SD	95% CI	for mean	Skewness	Kurtosis
		Size (n)				LB	UB		
BMI	Μ	578	21.65±0.12	21.54	2.87	21.41	21.88	0.60	0.97
(Kg/sqm)	F	284	21.25±0.19	21.10	3.23	20.87	21.62	0.65	0.57
VC (L/S)	М	578	3.50±0.02	3.50	0.54	3.46	3.55	-0.02	0.38
	F	284	2.49 ± 0.02	2.49	0.42	2.44	2.54	-0.08	0.46
TV (L/S)	М	578	0.52 ± 0.01	0.51	0.23	0.50	0.54	1.32	3.53
	F	284	0.41 ± 0.01	0.40	0.16	0.39	0.42	0.83	1.06
IRV (L/S)	М	578	1.83±0.02	1.83	0.49	1.78	1.87	-0.13	0.06
	F	284	1.27±0.02	1.27	0.35	1.23	1.31	0.01	0.68
ERV (L/S)	Μ	578	0.95 ± 0.02	0.93	0.48	0.91	0.99	0.70	0.25
	F	284	0.71±0.02	0.69	0.32	0.67	0.75	0.72	0.62
FVC (L/S)	Μ	578	3.26±0.03	3.27	0.65	3.21	3.31	-0.21	-0.07
	F	284	2.34±0.03	2.35	0.50	2.29	2.40	-0.26	-0.01
FEV1	М	578	2.70±0.03	2.71	0.60	2.65	2.75	-0.37	-0.16
(L/S)	F	284	1.94±0.03	1.95	0.49	1.88	2.00	-0.32	-0.26
FEV1%	Μ	578	83.68±0.60	84.88	14.35	82.51	84.85	-1.12	1.10
	F	284	83.51±0.88	84.81	14.80	81.79	85.24	-1.22	1.36
MMF	Μ	578	2.90 ± 0.04	2.90	0.99	2.82	2.99	0.11	-0.44
(L/S)	F	284	2.09 ± 0.05	2.07	0.78	1.99	2.18	0.44	0.71
PEFR	М	578	3.62±0.05	3.57	1.30	3.52	3.73	0.61	0.57
(L/S)	F	284	2.51±0.06	2.47	0.94	2.40	2.62	0.70	0.76
FEF25	Μ	578	3.02±0.06	2.95	1.33	2.91	3.13	0.81	0.77
(L/S)	F	284	2.13±0.06	2.07	0.95	2.02	2.24	0.91	0.89
FEF50	Μ	578	3.19±0.05	3.16	1.17	3.09	3.28	0.23	-0.40

Table 1:-Descriptive Statistics

(L/S)	F	284	2.24±0.052	2.21	0.88	2.13	2.34	0.44	0.45
FEF75	М	578	2.31±0.03	2.29	0.81	2.24	2.37	0.30	-0.04
(L/S)	F	284	1.71±0.04	1.70	0.61	1.64	1.79	0.27	0.36
MVV	Μ	578	81.78±0.75	81.46	17.97	80.32	83.25	0.27	0.29
(L/S)	F	284	54.77±0.82	54.78	13.78	53.16	56.38	0.01	-0.27
RR (L/S)	М	578	36.61±0.41	35.76	9.76	35.81	37.40	1.57	3.81
	F	284	32.88±0.46	32.50	7.83	31.96	33.79	0.92	1.96

The mean body mass index (BMI) in the present study for male (21.65 kg/sq m) and female students (21.25 kg/Sq m) are not quite similar and correspondingly related for 5% trimmed mean (male 21.54 kg/sq m and female 21.10 sq m). The standard error of mean in BMI of male is 0.12 kg/sq m and that of female it is 0.19 kg/sq m, indicating the sampling variabilities in BMI is consistent among the deviation of 0.10 kg/ sq m nearly. The male (2.87 kg/sq m) and female (3.23) as a standard deviation in BMI are consistent, i.e., the BMI for all students are gathered closely everywhere from their average. It aspects that the 95% confidence interval in BMI for male is (21.88 kg/ sq m, 21.41 kg/ sq m) and that for female is (21.62 kg/ sq m, 20.87 kg/ sq m). The distribution of BMI in male (0.60) and that in female (0.65) are moderately positively skewed, i.e., if we draw the curve of the given BMI distribution, it will have longer tail towards the right. The distributions have leptokurtic curve for the given BMI in male (0.97) and female students (0.57) (i.e., $\beta_2>3$, or Y>0), i.e., it will be more peaked than the normal curve. The male (1.64 Sq m) and female students (1.47 Sq m) on average body surface area (BSA) (s) are mild higher in male than female and quite same for 5% trimmed mean also (male 1.64 Sq m and female 1.47 Sq m). These values are extra consistent with sampling fluctuations as the standard error of mean in BSA is very poor. Although, this values of male (0.10 Sq m) and female students (0.10 Sq m) are same. The male (0.13 Sq m) and female students (0.13 Sq m) as standard deviation in body surface area which is so small, i.e., the data points are clustered nearly around their central value. It looks that the 95% confidence interval for body surface area of male is (1.63 Sq m, 1.65 Sq m) and that of female is (1.45 Sq m, 11.48 Sq m) which have so poor range. The distributions are positively skewed of body surface area in male (0.29) and female students (0.55), i.e., if we draw the curve in the given BSA distribution, it will have longer tail towards the right. It indicates that the distributions have leptokurtic for the given BSA in male (0.27) and female students (0.25) (i.e., $\beta_2>3$, or $\Upsilon>0$), i.e., it will be more peaked than the normal curve. The mean vital capacity (VC) for male (3.51 L/S) and female students (2.49 L/S) are moderately higher in male than female but almost equal for 5% trimmed mean also (male 3.50 L/S and female 2.49 L/S) in this study. The standard error of mean in vital capacity of male is 0.02 L/S and that of female it is 0.02 L/S, signifying the sampling fluctuation in VC is still consistent within the range of 0.20 L/S. The standard deviation of male (0.54 L/S) and female students (0.42 L/S) in vital capacity are small, i.e., the vital capacity of all students are clustered closely around their average. It shows that the 95% confidence interval for vital capacity of male is (3.46 L/S, 3.55 L/S) and that of female is (2.44 L/S, 2.54 L/S which have so poor range. The distributions are negatively skewed in vital capacity for male (-0.02) and female (-0.08), i.e., if we draw the curve for the given VC distribution, it will have longer tail towards the left. The distributions have leptokurtic for vital capacity in male (0.38) and female (0.46) (i.e., $\beta_2>3$, or $\Upsilon>0$), i.e., it will be more peaked than the normal curve. The average tidal volume of male (0.52 L/S) and female students (0.41 L/S) are mild higher in male than female and almost constant for 5% trimmed mean also (male 0.51 L/S and female 0.40 L/S). The standard error of mean for tidal volume in male (0.01 L/S) and female (0.01 L/S) are same which is ignorable, i.e., these values are extra consistent with sampling variabilities. The dispersion in tidal volume of male (0.23 L/S) and female (0.16 L/S) are so small, i.e., the data points are clustered nearly from their mean. It appears that the 95% confidence interval for tidal volume of male is (0.50 L/S, 0.54 L/S) and that of female is (0.39 L/S, 0.42 L/S) have too small range. The distribution in tidal volume for male (1.32) and that for female (0.83) are positively skewed, i.e., if we draw the curve for the given distribution, it will have longer tail towards the right. The distribution for tidal volume in male (3.53) and that in female (1.06) are leptokurtic (i.e., $\beta_2 > 3$, or $\Upsilon > 0$), i.e., it will be more peaked than the normal curve. The male (1.83 L/S) and female (1.27 L/S) on average inspiratory reserve volume in the present study are mild higher in male than female and just constant for 5% trimmed mean also (male 1.83 L/S and female 1.27 L/S). These values are more stable with sampling abnormalities as the standard error of mean in inspiratory reserve volume. This value for male (0.02 L/S) and female (0.02 L/S) are quite same which is also immaterial. It indicates that the absolute dispersion in inspiratory reserve volume of male (0.49 L/S) and female (0.35 L/S) are not same which is so minor, i.e., the inspiratory reserve volume of all students are clustered closely around from their central location. It appears that the 95% confidence interval of inspiratory reserve volume for male is (1.79 L/S, 1.87 L/S) and that for female is (1.23 L/S, 1.31 L/S) have ignorable range. The distribution is negatively skewed in inspiratory reserve volume for male (-0.13), i.e., if we draw the curve for the given distribution, it will have longer tail towards the left whereas the distribution is positively skewed for female (0.01),

i.e., if we draw the curve for the given inspiratory reserve volume distribution, it will have longer tail towards the right. The distributions have leptokurtic for inspiratory reserve volume in male (0.06) and female students (0.68)(i.e., $\beta_2 > 3$, or $\gamma > 0$), i.e., it will be more peaked than the normal curve. The central location in expiratory reserve volume for male (0.95 L/S) and female (0.71 L/S) in our study are little higher in male than female and almost similar for 5% trimmed mean also (male 0.93 L/S and female 0.69 L/S). These values are more established with sampling abnormalities as the standard error of mean in expiratory reserve volume. Although this values of male (0.02 L/S) and female (0.02 L/S) are not variable. It indicates that the standard deviation in expiratory reserve volume of male (0.48 L/S) and female (0.32 L/S) are not same which is so minor, i.e., the expiratory reserve volume of all are spreaded from their mean. It shows that the 95% confidence interval for expiratory reserve volume in male is (0.91 L/S, 0.99 L/S) and that in female it is (0.67 L/S, 0.75 L/S) have ignorable range. The distributions are positively skewed in expiratory resave volume for male (0.70) and female students (0.72), i.e., if we draw the curve for the given distribution, it will have longer tail towards the right. The distributions have leptokurtic for expiratory reserve volume in male (0.25) and female students (0.62) (i.e., $\beta_{3}>3$, or $\Upsilon>0$), i.e., it will be more peaked than the normal curve. The central location of forced vital capacity for male (3.26 L/S) and that for female (2.34 L/S) are moderately higher in male than female students and very nearly equal for 5% trimmed mean also (male 3.27 L/S and female 2.35 L/S). The standard error of mean for forced vital capacity in male (0.03 L/S) and female (0.03 L/S) are constant which is irrelevant, i.e., these values are extra consistent with sampling fluctuations. The absolute dispersion of male (0.65 L/S) and female (0.50 L/S) in forced vital capacity are not same which is small, i.e., the forced vital capacity of all students are clustered nearly from their mean. It aspects that the 95% confidence interval for forced vital capacity of male is (3.21 L/S, 3.32 L/S) and that of female is (2.29 L/S, 2.40 L/S) have slight range in this study. The distributions are negatively skewed in forced vital capacity for male (-0.21) and female (-0.26), i.e., if we draw the curve for the given distribution, it will have longer tail towards the left. The distributions have platykurtic for forced vital capacity in male (-0.07) and female (-0.01) (i.e., $\beta_2 < 3$, or $\Upsilon < 0$), i.e., it will be less peaked than the normal curve. The average FEV1 in male (2.70 L/S) and female students (1.94 L/S) are moderately different and nearly same for 5% trimmed mean also (male 2.71 L/S and female 1.95 L/S). The standard error of mean for FEV1 in male (0.03 L/S) and female (0.03 L/S) are not variable which is irrelevant, i.e., these values are extra consistent with sampling nonconformities. The male (0.60 L/S) and female (0.49 L/S) as standard deviation in FEV1 which are so small, i.e., the FEV1 of all students are clustered closely around the central location. It indicates that the 95% confidence interval for FEV1 of male is (2.65 L/S, 2.75 L/S) and that of female is (1.88 L/S, 2.00 L/S) have slight range. The distributions are negatively skewed in FEV1 for male (-0.37) and female (-0.32), i.e., if we draw the curve for the given distribution, it will have longer tail towards the left. The distributions have platykurtic for FEV1 in male (-0.16) and female (-0.26) (i.e., $\beta_2 < 3$, or $\Upsilon < 0$), i.e., it will be less peaked than the normal curve. The male (83.68) and female (83.51) on average FEV1% in our study are almost same and similar for 5% trimmed mean also (male 84.88 and female 84.81). The standard error of mean for FEV1% in male (0.60) and female (0.88) are not too large in male than female, i.e., these values are extra consistent with sampling fluctuation. The male (14.35) and female (14.80) as standard deviation in FEV1% which are mild higher, i.e., the FEV1% of all students are spreaded from their mean. It looks that the 95% confidence interval for FEV1% of male is (82.51, 84.85) and that of female is (81.79, 85.24) have a range. The distributions are negatively skewed in FEV1% for male (-1.12) and female students (-1.22), i.e., if we draw the curve for the given FEV1% distribution, it will have longer tail towards the left. The distributions have leptokurtic of FEV1% for male (1.10) and female students (1.36) (i.e., $\beta_2>3$, or $\Upsilon>0$), i.e., it will be more peaked than the normal curve. The central location of MMF for male (2.90 L/S) and female students (2.09 L/S) are mild different and closely equal for 5% trimmed mean also (male 2.90 L/S and female 2.07 L/S). The standard error of mean for MMF in male (0.04 L/S) and female (0.05 L/S) are too small which are irrelevant, i.e., these values are extra consistent with sampling variabilities. The standard deviation in MMF of male (0.99 L/S) and female (0.78 L/S) are similar which are so small, i.e., the MMF for all students are clustered nearly around their average in the present study. It shows that the 95% confidence interval for MMF of male is (2.82 L/S, 2.99 L/S) and female is (1.99 L/S, 2.18 L/S) have so poor range. The distributions are positively skewed in MMF for male (0.11) and female students (0.44), i.e., if we draw the curve for the given MMF distribution, it will have longer tail towards the right. The distribution has playtikurtic for MMF in male (-0.44) (i.e., $\beta_2 < 3$, or $\Upsilon < 0$), i.e., it will be less peaked than the normal curve whereas that has leptokurtic in female (0.71) (i.e., $\beta_2>3$, or $\Upsilon>0$), i.e., it will be more peaked than the normal curve. The central location in PEFR for male (3.62 L/S) and female (2.51 L/S) are mild higher in male than female in this study and almost similar for 5% trimmed mean also (male 3.57 L/S and female 2.47 L/S). These values are almost steady with sampling fluctuations as the standard error of mean is very small. Although this values for male (0.05 L/S) and female students (0.05 L/S) are constant. The values of male (1.30 L/S) and female (0.94 L/S) as standard deviation in PEFR which are so small, i.e., the PEFR of all are clustered around their central location. The 95% confidence interval for PEFR of male is (3.52 L/S,

3.73 L/S) and female is (2.40 L/S, 2.62 L/S) which have so poor range. It indicates that the distributions are positively skewed in PEFR for male (0.61) and female students (0.70), i.e., if we draw the curve for the given PEFR distribution, it will have longer tail towards the right. The distributions have leptokurtic of PEFR for male (0.57) and female students (0.76) (i.e., $\beta_2>3$, or $\Upsilon>0$), i.e., it will be more peaked than the normal curve. It looks that the male (3.02 L/S) and female students(2.13 L/S) on average FEF25 for our study are mild higher in male than female and closely equal for 5% trimmed mean also (male 2.95 L/S and female 2.07 L/S). The standard error of mean in FEF25 for male (0.06 L/S) and female students (0.06 L/S) which are small constant, i.e., these values are extra consistent with sampling fluctuations. The standard deviation in FEF25 of male (1.33 L/S) and female students (0.95 L/S) which are too small, i.e., the FEF25 of all students are clustered closely around their mean. It aspects that the 95% confidence interval for FEF25 of male is (2.91 L/S, 3.13 L/S) and that of female is (2.02 L/S, 2.24 L/S) which have so poor range. The distributions are positively skewed in FEF25 for male (0.81) and female students (0.91), i.e., if we draw the curve for the given distribution, it will have longer tail towards the right. The distributions have leptokurtic for FEF25 in male (0.77) and female (0.89) (i.e., $\beta_2>3$, or $\Upsilon>0$), i.e., it will be more peaked than the normal curve. The central location in FEF50 for male (3.19 L/S) and female (2.24 L/S) are mild higher and almost same for 5% trimmed mean also (male 3.16 L/S and female 2.21 L/S). These values are almost steady with sampling fluctuations as the standard error of mean is very small. This values for male (0.05 L/S) and female students (0.05 L/S)L/S) are also constant. The standard deviation in FEF50 of male (1.17 L/S) and female (0.88 L/S) which are so small, i.e., the FEF50 of all students are spreaded from their central value. It shows that the 95% confidence interval for FEF50 of male is (2.91 L/S, 3.13 L/S) and female is (2.02 L/S, 2.24 L/S) which have small range. The distributions are positively skewed of FEF50 for male (3.28) and female students (2.34), i.e., if we draw the curve for the given distribution, it will have longer tail towards the right. The distribution has platykurtic for FEF50 in male (-0.40) (i.e., $\beta_2 < 3$, or $\Upsilon < 0$), i.e., it will be less peaked than the normal curve whereas that has leptokurtic in female students (0.89) (i.e., $\beta_2 > 3$, or $\Upsilon > 0$), i.e., it will be more peaked than the normal curve. The central location of FEF75 for male (2.31 L/S) and female students (1.71 L/S) are not so large and just same for 5% trimmed mean also (male 2.29 L/S and female 1.70 L/S). The standard error of mean for FEF75 in male (0.03 L/S) and female students (0.04 L/S) are too small which are irrelevant, i.e., these values are extra consistent with sampling fluctuations. The standard deviation in FEF75 of male (0.81 L/S) and female (0.61 L/S) which are so small, i.e., the data points can spread far from their mean themselves. The 95% confidence interval for FEF75 of male is (2.24 L/S, 2.37 L/S) and female is (1.64 L/S, 1.79 L/S) which have so poor range. The distributions are positively skewed in FEF75 for male (0.30) and female students (0.27), i.e., if we draw the curve for the given FEF75 distribution, it will have longer tail towards the right. The distribution has platykurtic for FEF75 in male (-0.40) (i.e., $\beta_2 < 3$, or $\Upsilon < 0$), i.e., it will be less peaked than the normal curve whereas that has leptokurtic in female (0.36) (i.e., β_2 >3, or Y>0), i.e., it will be more peaked than the normal curve. The mean MVV for male (81.78 L/S) and female students (54.77 L/S) in this study are moderately higher in male than female and just similar for 5% trimmed mean also (male 81.46 L/S and female 54.78 L/S). The standard error of mean for MVV in male (0.75 L/S) and female (0.82 L/S) are too small which are irrelevant, i.e., these values are extra consistent with sampling fluctuations. The male (17.97 L/S) and female students (13.78 L/S) as standard deviation in MVV which are not so small, i.e., the MVV of all students are spreaded from their central location. It appears that the 95% confidence interval for MVV of male is (80.32 L/S, 83.25 L/S) and that of female is (53.16 L/S, 56.38 L/S) which have not so poor range. The distributions are positively skewed in MVV for male (0.27) and female students (0.01), i.e., if we draw the curve for the given MVV distribution, it will have longer tail towards the right. The distribution has leptokurtic for MVV in male (0.29) (i.e., $\beta_2>3$, or $\Upsilon>0$), i.e., it will be more peaked than the normal curve whereas that has platykurtic of female (-0.27) (i.e., β_2 <3, or Υ <0), i.e., it will be less peaked than the normal curve. The central location of RR for male (36.61 L/S) and female students (32.88 L/S) are moderately different and almost same for 5% trimmed mean also (male 35.76 L/S and female 32.50 (L/S) in our study. These values are almost steady with sampling fluctuations as the standard error of mean is very small. This values for male (0.41 L/S) and female students (0.46 L/S) are also constant. The absolute dispersion of RR for male (9.76 L/S) and female students (7.83 L/S) are not so small, i.e., the RR of all students are spreaded from their average. It indicates that the 95% confidence interval for RR of male is (35.81 L/S, 37.40 L/S) and female is (31.96 L/S, 33.79 L/S) have range. The distributions are positively skewed in RR for male (1.57) and that for female (0.92), i.e., if we draw the curve for the given RR distribution, it will have longer tail towards the right. The distributions have leptokurtic of RR for male (3.81) and female students (1.96) (i.e., β_2 >3, or Y>0), i.e., the Kurtosis of RR in male students implies that the values are more condensed than that in female.

The values of relationship were considered the lung indices with body mass index (BMI) to evaluate which indices were influenced by change in BMI. The values for Pearson's correlation coefficient (r) between the lungs indices.

The values of Pearson's correlation coefficient (r) between BMI with lung related variables for male and female students are shown in Table 2.

=					8 10									
Lung	VC	TV	IRV	ER	FVC	FE	FEV1	Μ	PEF	FEF	FEF	FEF	MV	RR
variab				V		V1	%	MF	R	25	50	75	V	
les \rightarrow														
Male	0.18	0.07	0.16	0.0	0.17	0.08	-	0.03	0.06	0.06	0.04	-	0.13	0.03
	4**	9	0^{**}	21	4**	3*	0.094	9	8	7	4	0.02	7^{**}	9
							*					3		
Femal	0.17	0.21	0.16	0.0	0.06	0.10	0.042	0.10	0.09	0.11	0.08	0.05	0.05	-
e	5^{**}	3**	8^{**}	34	0	0^{*}		0^{*}	0^{*}	9^{**}	6^*	8	3	0.11
														6^{**}

 Table 2:-Correlation between BMI and lung variables for male and female students

**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).

Students are positive (p<0.01) with VC, IRV and that is also positive (p<0.05) with FEV1, that for male are positive (p<0.01) with FVC, MVV and that for only male is negative (p<0.05) with FEV1% but that for female are positive (p<0.01) with TV, FEF25 and is also negative (p<0.01) with RR and that for female are positive (p<0.05) with FEV1, MMF, PEFR, FEF50 and that are variation with remaining lung variables (Table 2). The relationship between BMI and VC for male is higher than compared to other variables but that and TV for female is also higher than compared to other variables (Table 2).

Discussion:-

World-wide comparative study on mean and standard deviation of BMI and lung related variables for male (M) and female (F) students are shown in Table 3. Age groups are almost same for all races/ ethnicities, i.e., the variables are for the adolescence groups whose growth is much closer to complete showed in Table 3.

Table 3:-World-wide comparative study on Mean and Standard deviation of Anthropometric and Lung related variables of Male (M) and Female (F). The open value is for Mean and the value of Standard deviation is in the parenthesis. The column Method/Machine is for Lung related variables only

Aut	Stude	Method/	BMI(VC(Т	IR	ERV	FVĆ	FEV1	FEV1	PEFR	MVV
hors	nts	Machine	k/m^2)	L/S	(L/S	V	(L/S	(L/S)	(\mathbf{L}/\mathbf{S})	%	(L/S)	(L/S)
	for)	~,)	Д)	()	()		(_,~)	(_,~)
	differ				,	(S)	,					
	ent		Μ	Μ	М	M	Μ	М	Μ	Μ	Μ	М
	ethnic		F	F	F	F	F	F	F	F	F	F
	/race											
Ahm	Iran	Zan	21.9	4.8				4.69	3.95	84.4		
adia		plethysmo	22.2	5.2				3.76	3.12	87.8		
et al.		graph	(2.7)	(.22)				(0.40)	(0.36)			
(200			(2.7)	(.40)				(0.42)	(0.44)			
6)												
Bak	Maidu	Micr Peak	22.4								518.8	
ki et	guri	T M PFM	22.2								369.2	
al.	Univ.,		(3.6)								(99.2)	
(201	Nigeri		(4.8)								(60.4)	
2)	a											
Nep	KIST	MEDSPIR	22.8					3.58	3.34	94.4	8.41	142
al et	MC,	OR	21.6					2.52	2.44	95.9	6.72	107
al.	Nepal		(3.2)					(0.72)	(0.61)	(5.6)	(1.2)	(18.5)
(201	-		(3.0)					(.50)	(0.44)	(11.0)	(0.82)	(12.5)
4)												
Roy	Calcut	9-1 closed-	22.03	3.97				3.74	3.36	89.51	668.3	
et al.	ta	circuit	24.16	2.20				2.05	1.81	89.34	461.0	
(201	Univ.	-type	(3.1)	(.53)				(.51)	(.63)	(7.98)((69.76)	

4)	India	expiromete r	(3.98)	(.35)				(.31)	(.25)	10.11)	(31.0)	
Shah et al. (201 5)	Coll. Studen ts Gujara ti, India	Omron HBF302	19.79 20.41 (3.3) (3.35)						2.51 1.82 (0.55) (0.46)		527.4 400.7 (73.2) (53.5)	
You ssef et al. (201 5)	Taibah Univ. Saudi Arab	BC418,M A Tanita, Japan	25.5 23.7 (.74) (.61)					4.4 2.8 (.21) (.07)	3.9 2.6 (.14) (.49)	90.5 93.1 (2.43) (1.02)		
Pres ent Stud y	RU Stude nts Bangl adesh	Chestgrap h,HI101, Tokyo, Japan	21.7 21.3 (.12) (.19)	3.5 2.49 (.02) (.03)	0.52 .41 (.01) (.01)	1. 83 1. 27 (.0 2) (.0 2)	.95 0.71 (.02) (.02)	3.26 2.34 (.07) (.03)	2.70 1.94 (.03) (.03)	83.7 83.5 (.60) (.88)	3.62 2.51 (.05) (.06)	81.8 54.8 (.75) (.82)

Table 3 revealed all respondents are the university students in the World. A simple index of weight for height that is commonly used to classify overweight and obesity in adults i.e., a person's weight in kilograms divided by the square of his height in meters (kg/m²) is defined as Body Mass Index (BMI) for our both male and female students RU are, on average, normal and also other countries but males of Saudi Arab are suffering from obese. The volume of air breathed out after the deepest inhalation is called vital capacity (VC) of our male students in RU is, on average, normal; same as that of Calcutta University students, India but about 1 L/S shorter than that of Iranian student whereas VC for our female students of RU is, on average, same as that for Calcutta University students and that are lower than normal; about 3 L/S shorter than that for Iranian students which is, on average, normal. The determination of the vital capacity from a maximally forced expiratory effort is defined as Forced vital capacity (FVC) for the male students of RU are, on average, normal and also almost same as that of KIST Medical College, Nepal and Calcutta University, Indian Student; about 1 L/S shorter than that of Taibah University, Saudi Arab and Iranian students but the female students of RU are, on average, less than normal, almost equivalent with that of Calcutta University and KIST Medical College student; about normal, that of Taibah University students; about 1 L/S shorter than that of Iranian students (Table 3). The Volume that has been exhaled at the end of the first second of forced expiration is called forced expiratory volume in first second (FEV1) of both the male students in RU are, on average, normal; greater than that in Gujarati students; about 1 L/S shorter than that in Calcutta University, KIST Medical College, Taibah University and Iranian students but FEV1 for the female student of RU are, on average, less than normal which is greater than that of Gujarati and Calcutta University female students; about 0.5 liter shorter than that of KIST Medical College and Taibah University; about 1 L/S shorter than that of Iranian students in Table 3. The ratio of the FEV1 to the FVC expressed as a percentage and also written as FEV1% for our male students of RU are, on average, normal; similar as Iranian students; about 6% shorter than Calcutta University; about 7% shorter than Gujarati Student; about 12% shorter than KIST Medical College students whereas FEV1% for our male students of RU are, on average, normal; about 4% shorter than Iranian students; about 6% shorter than Calcutta University; about 10% shorter than Taibah University; about 12% smaller than KIST Medical College, Nepal. Maximum expiratory flow rate recorded during a forced expiratory maneuver is known as Peak expiratory flow (PEFR or PEF) of our male students for RU are, on average, normal; about 5 L/S shorter than that of KIST Medical College whereas of our female students for RU are, on average, less than normal; about 4 L/S shorter than that of KIST Medical College, Nepal. In this study the volume of air expired in a specified period during repetitive maximal effort is defined as Maximal voluntary ventilation (MVV) for the male students of RU are, on average, normal which is shorter than that of KIST Medical College but that for the female students of RU are, on average, less than normal which is shorter than that of KIST Medical College, Nepal in Table 3. In the above discussion we indicate that only BMI of the male students in Taibah University, Saudi Arab is higher than that of normal that is why the male students are suffering from obese but as a whole exist gender disparity.

The Worldwide comparative study for the value of Pearson's correlation coefficient (r) between lung function parameters (VC, TV, IRV, ERV, FVC, FEV1, FEV1%, PEFR, MVV) with BMI are presented in Table 4.

The relationship with BMI is the least documented with VC for Iranian male (negative) and female students (Ahmadia et al., 2006), while a significant positive correlation was found between BMI and VC for Sri Lankan Tamil (Balasubramaniam et al., 2014) and Rajshahi University male and female students but that for Calcutta University male (negative) and female students, Indian (Roy et al., 2014). The linear relation with BMI is negatively observed with TV for Iranian Male (Significant) and female students but that is positively observed with TV for the male (not significant) and female students in Rajshahi University in Table 4. Association between BMI and IRV was measured positively significant for both male and female students of Rajshahi University but that was also measured for the male (negative) and female (positive significant) Iranian students reported by Ahmadia et al. (2006). Although BMI was negatively correlated with ERV of male (significant) and female Iranian students but significant relation with BMI was observed positively for both male and female students in the present study. Highly negative association was observed between BMI with FVC for both male and female students in India. Significant correlation with BMI was initiated with FVC of male (negative) and female students in KIST Medical College, Nepal and that of both positive in Calcutta University students. Though BMI was negative correlation with FVC in male (significant) and female Iranian students, otherwise that was positive correlation with FVC in male and female (significant) Sri Lankan Tamil and that in male (significant) and female of Rajshahi University students in Bangladesh.

Table 4:-Worldwide comparative study for the value of Pearson's correlation coefficient (r) between Body Mass Index (BMI) and lung function parameters

Authors	Stu de nts for	Meth od/ Mac hine	BMI with VC		BN wit TV	1I :h '	BM wit IR	II h V	BN wit EF	AI th XV	BM wit FV	II h C	BM wit FE	II h V1	BN wi FH 1%	MI th EV 6	BMI with FR	PE	BMI with VV	М
	diff ere nt eth nic /ra ce		M F		M F	M F		F		F		F		F			M F		M F	
Ahmadia et al. (2006)	Ira n	Zanpl ethys mo graph	- 0. 0 5	0. 0 7	- 0. 1 0 *	- 0. 0 6	- 0. 0 7	$0.1 \\ 8^* \\ *$	- 0 0 5	- 0. 1 8* *	- 0. 1 3* *	- 0. 0 1	- 0. 1 5* *	- 0.02	- 0 4 1	0. 0 2				
Roy et al. (2014)	Cal cutt a Uni v., Ind ia	9-1 clos- cir -type expir	- 0. 3 4* *	0. 1 0*							- 0. 1 5* *	0. 0 9*	- 0. 0 7	- 0.08 *	- 0 0 9 *	- 0. 2 0* *	- 0.2 2**	0. 1 7* *		
Balasubr amaniam et al.(2014)	Sri La nka n Ta mil	Micr oquar k electr Spiro met	0. 1 3* *	0. 2 7* *							0. 0 3	0. 1 3* *	- 0. 0 5	0.03	- 0 0 5	- 0. 1 3*	0.0	- 0. 1 0*		
Nepalet al. (2014)	KI ST Me dic	MED SPIR OR									0. 2 2* *	$0.1\\6^{*}_{*}$	0. 0 7	0.12	- 0 1	0. 0 2	- 0.0 1	0. 3 3* *	- 0.0 1	$0.2 \\ 0^*_*$

	al Col leg e, Ne pal														5 *					
Shah e al. (2015)	t Col leg e St. Guj a, Ind ia	Omro n HBF 302											0. 4 8* *	- 0.14 **			0.6 3 ^{**}	0. 1 8* *		
Present Study	Ra jsh ahi Un i., Ba ngl ade sh	Ches tgrap hHI- 101, Tok, Jap	0. 1 8* *	0. 1 8* *	0. 0 8	0. 2 1* *	0. 1 6* *	0. 1 7* *	0 0 2	0. 0 3	0. 1 7* *	0. 0 6	0. 0 8*	0.10 *	- 0 0 9 *	0. 0 4	0.0 7	0. 0 9*	0.1 4**	0. 0 5
		1					1	I	Both	Sex	1		1							**
Bakki et al. (2012)	Maid uguri Univ., Nigeri a	Micr o Peak TM PFM																	C	0.15**
Christ ian et al. (2014)	India	Spiro excel									-0.4	40**	-0.4	12**	0.05		-0	.52**		

The relationship with BMI was showed negative with FEV1 for male (significant) and female Iranian and that for male and female (significant) Calcutta University student but that positive with FEV1 for male and female (significant) Nepali and also that for male (significant) and female (significant) Bangladeshi students. The relation with BMI was measured significantly with FEV1 of male and female (negative) Gujarati College but that not significant with FEV1 of male (negative) and female Sri Lankan students and highly significant negative relation with BMI was evaluated with FEV1 for both male and female Indian students. Although positive nonsignificant relation with BMI was evaluated with FEV1% for both male and female Indian students, significant negative correlation with BMI was found with FEV1% for both male and female in Calcutta University students but negative correlation with BMI was also found with FEV1% for the male and female (significant) Sri Lankan students. Although the relationship with BMI was observed with FEV1% for the male (negative) and female Iranian, that for the male (significantly negative) and female Nepali and that for the male (significantly negative) and female Bangladeshi students. In our study BMI was significant correlation with PEFR of the male (negative) and female Calcutta University but that of the male and female Gujarati College students. Correlation with BMI was detected with PEFR in male and female (negatively significant) Sri Lankan Tamil, that in male (negative) and female (significant) Nepali but that in male and female (significant) Rajshahi University students and also that in both male and female Indian student negatively significant reported by Christian et al. (2014). This is supported by Bakki et al. (2012) while a significant positive correlation was obtained between BMI and MVV for both male and female but correlation with BMI was observed with MVV of male (negative) and female (significant) in KIST Medical College, Nepal and that of male (significant) and female students in Rajshahi University. Discussion on Worldwide comparison for coefficient of correlation is kept limited due to the unavailability of the study of others.

Conclusion:-

The mean value of lung indices was important determinant and also more reliable in males compare to females and it was also less than the values of other countries. Further investigation is necessary for this. Based on these results, it can be concluded that BMI, which did not same and effect independently on lung indices for both male and female students. The correlation pattern was different, except VC, IRV, FEV1 in both males and females and it was less significant than other countries and consists of biological inherent disparity in lung indices. The relationship between BMI with lung indices demanded further study for student's health policy and action. We may draw a recommendation that the authority of Rajshahi University might have to develop the food quality at Hall to improve lung capacity and also to introduce health related course for health awareness.

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