ASSESSMENT OF PULMONARY FUNCTION AND CLINICAL FEATURES, AND THEIR COMPARISON BETWEEN OBESE AND NON-OBESE PATIENTS OF BRONCHIAL ASTHMA

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ABSTRACT

BACKGROUND

Asthma is a heterogeneous disease, usually characterized by chronic inflammation. It is characterised by history of respiratory symptoms such as wheeze, shortness of breath, chest tightness and cough that vary over time and in intensity, together with variable expiratory airflow limitation.[1] Obesity may be defined as an abnormal growth of the adipose tissue due to an enlargement of fat cell size or an increase in fat cell number or both.[2] Asthma with obesity is one of the phenotypes of asthma where patients will have multiple consequences related to excess adipose tissue, including mechanical or physiologic effects on lung function and the airways as well as changes in the immune response and metabolic effects. Our study is a hospital based cross sectional observational study to assess the pulmonary function, clinical profile and its correlation between obese and non-obese bronchial asthmatic patients.

METHODS

This was an observational study of stable obese and non-obese bronchial asthma patients undergoing pulmonary function test on inpatient or outpatient basis in Department of Pulmonary Medicine, J.J.M. Medical College, Davangere. The study was carried out on 100 patients with bronchial asthma (50 obese and 50 non-obese patients). Detailed history was obtained, physical examination was done along with correlation of pulmonary function and clinical profile. Sample size was taken for convenience.

RESULTS

In this study, out of 100 patients 55% were males, and 45% were females with higher total cholesterol and triglycerides in obese asthmatics compared to non-obese asthmatics. The most common symptoms were breathlessness followed by cough and wheeze. In this study, it was found that breathlessness, cough, wheeze are more common in obese asthmatics than non-obese asthmatics. There was significant difference of waist circumference (W.C.), hip circumference (H.C.) and waist to hip ratio (W.H.R.) between obese and non-obese asthmatics. Hypertension and diabetes mellitus more prevalent in obese group than non-obese. FVC, FEV1, and FEF25-75 % values were reduced in obese asthmatics compared to non-obese asthmatics in contrast to FEV1/FVC which was higher in obese asthmatics compared to non-obese asthmatics. It was observed that increased in BMI causes impaired pulmonary function.

CONCLUSIONS

The increasing prevalence of asthma and obesity has suggested an association between the two. The most common symptoms observed in this study were breathlessness, cough and wheeze. PR (Pulse Rate) SBP (Systolic Blood Pressure), DBP (Diastolic Blood Pressure), RR (Respiratory Rate), TLC (Total Leucocyte Count), AEC (Absolute Eosinophil Count), LP (Lipid Profile) were higher in obese asthmatics. Diabetes mellitus and hypertension were more prevalent in obese asthmatics. FVC, FEV1 are decreased in obese asthmatics but the amount of reversibility is more for non-obese asthmatics. It was also observed that increased BMI causes impaired pulmonary function.

KEY WORDS

PFT- Pulmonary Function Test, FEV1- Forced Expiratory Volume in 1st Second, FVC- Forced Vital Capacity, BMI- Body Mass Index, WC- Waist Circumference, HC- Hip Circumference, WHR- Waist Hip Ratio, AEC- Absolute Eosinophil Count

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BACKGROUND

Asthma is defined as a clinical syndrome characterized by airway inflammation, variable lung function and airway's hyper-responsive-ness. The rate of asthma increases as communities adopt western lifestyles and become urbanized and with the projected increase in the urban population it is estimated that there may be an additional 100 million persons with asthma by 2025 in the world. The number of disability-adjusted life years (DALYs) lost due to asthma (15 million per year) is similar to that for diabetes, cirrhosis of the liver, or schizophrenia.[3] Factors influencing the development and expression of asthma includes host factors like genetic, obesity, sex and environmental factors like allergens, infections, occupational sensitizers, tobacco smoke, outdoor and indoor pollution, diet. Airflow limitation in asthma is recurrent and caused by a variety of changes in the airway, these include-

1. **Bronchoconstriction:** Allergen-induced acute broncho-constriction results from an IgE-dependent release of mediators from mast cells that includes histamine,

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tryptase, leukotrienes, and prostaglandins that directly contract airway smooth muscle leading to clinical symptoms of asthma.

2. **Airway Oedema:** Persistent inflammation leads to airway edema, inflammation, mucus hyper-secretion and the formation of inspissated mucus plugs, as well as structural changes including hypertrophy and hyperplasia of the airway smooth muscles.
3. **Airway Hyper-Responsiveness:** Airway hyper-responsiveness an exaggerated broncho-constrictor response to a wide variety of stimuli, the mechanisms influencing airway hyper-responsiveness are multiple and include inflammation, dysfunctional neuro-regulation, and structural changes.
4. **Airway Remodeling:** Permanent structural changes like thickening of the sub-basement membrane, sub epithelial fibrosis, airway smooth muscle hypertrophy and hyperplasia, blood vessel proliferation and dilation, and mucous gland hyperplasia and hyper secretion can occur in the airway and are associated with a progressive loss of lung function, airflow obstruction and airway responsiveness and render the patient less responsive to therapy.

Obesity is an increasingly important health problem worldwide including the developing countries. In India obesity is emerging as an important health problem particularly in urban areas paradoxically co-existing with under nutrition. Increasing rates of obesity have paralleled increasing rates in asthma prevalence but the interrelation is uncertain[4].The etiology of obesity is complex, and is one of multiple causation. Obesity can occur at any age, and generally increases with age. Infants with excessive weight gain have increased incidence of obesity in later life. Women generally have higher rate of obesity than men, although men may have higher rates of overweight. There is convincing evidence that regular physical activity is protective against unhealthy weight gain. Whereas sedentary lifestyle particularly sedentary occupation and inactive recreational activities promotes it. There is a clear inverse relationship between socioeconomic status and obesity. The composition of the diet, the periodicity with which food is eaten and the amount of energy derived from it are all relevant to the etiology of obesity: A recent review of studies concluded that the relationship between alcohol consumption and adiposity was generally positive for men and negative for women. Obesity frequently run in families, but this is not necessarily explained solely by the influence of genes. Some endocrine disorders like Cushing's syndrome, growth hormone deficiency have associated obesity. Reports that use of tobacco lowers body weight began to appear more than 100 years ago, but detailed studies have been reported only during the past 10 years or so. Use of certain drugs, e.g. corticosteroids, contraceptives, insulin etc. can promote weight gain[5.] Obesity is associated with systemic inflammation, which may result in airway hyper-reactivity, which is observed in asthmatic individuals[6]. Visceral adipose tissue is the key factor in the formation of low-grade chronic inflammation in obese individuals[7] and plays a role in remodelling, which is characteristic of asthma. High levels of interleukin-6 (IL-6) and tumour necrosis factor-alpha (TNF-α) are observed in individuals with visceral obesity, which exacerbates the inflammatory response.[8] Obesity, even in the absence of intrinsic lung disease, causes physiologic impairment in lung function due to mass-loading of the respiratory system[9]. Three Body mass index (BMI), Waist circumference (WC) and Waist-to-hip circumference ratio (WHR) are the simple measures of obesity which are widely used in clinical practice. Obesity is considered above 30 kg/m^2 according to WHO classification of BMI, (table 1) whereas for Indian population obesity is considered above 23 kg/m^2 according to WHO Asia Pacific perspective for Asians (WHO IOTF 2003)(table 2). Waist circumference more than 90 cms (Men), more than 80 cms (Women) are at high risk of metabolic complications.[10] and reflects changes in risk factors cardiovascular disease and other chronic diseases; waist hip ratio (WHR) more than 1 in men and more than 0.85 in women indicates abdominal fat accumulation. With reference to table 1, obesity is considered above 30 kg/m^2 according to WHO classification of BMI, whereas for Indian population obesity is considered above 23 kg/m^2 according to WHO Asia Pacific perspective for Asians (WHO IOTF 2003) shown in table 2. Obesity can lead to a reduction in pulmonary compliance, lung volumes, and the diameter of peripheral airways, and it can affect the volume of blood in the lungs and the ventilation perfusion relationship. Pulmonary compliance is reduced due to fat compression and infiltration of the thorax or the increase in lung blood volumes. Obesity can also lead to limitations in airflow, with reduction in both FEV1 and FVC[11]. Such changes in lung physiology lead to superficial respiration in obese patients, with a reduction in lung volumes, especially expiratory reserve volume. This reduction in lung volumes is associated with a reduction in the diameter of peripheral airways that can lead to changes in the function of bronchial smooth muscle. This in turn leads to a change in the actin-myosin cross-bridge cycle, which can potentially increase both obstruction and bronchial hyper-reactivity (BHR).[12] Co-morbidities in obesity like dyslipidemia, gastro esophageal reflux disease (GERD), hypertension, obstructive sleep apnea and type 2 diabetes mellitus further aggravate asthma.[13] Many studies on asthma in relation with obesity have been done in the world. These studies show decreased lung functions among obese asthmatics as well as increased morbidity and mortality pattern when compared to non-obese asthmatic patients. In India there are very few studies have been done on obese and non-obese asthmatics. Hence the present study was taken up, to compare differences in pulmonary function test, lipid profile, BMI (body mass index), clinical profile between obese and non-obese asthmatics.

We wanted to determine the baseline pulmonary function in obese and non-obese asthmatics using a computerized office spirometer (Vitalograph) and correlate the clinical and laboratory parameters with the pulmonary function.

Classification	BMI (Kg/m^2)	Risk of Comorbidities
Underweight	Less than 18.5	Low- but risk of other clinical problems increased
Normal range	18.5-24.9	Average
Over weight	>25	
Pre obese	25-29.9	Increased
Obese class I	30-34.9	Moderate
Obese class II	35-39.9	Severe
Obese class III	>40	Very severe

Table 1. WHO Classification of BMI (2003).[9]

Classification	BMI (kg/m2)	Risk of Comorbidities
Underweight	< 18.5	Low
Normal range	18.5-22.9	Average
Over weight	>23	-
At risk	23-24.9	Increased
Obese I	25-29.9	Moderate
Obese II	>30	Severe

Table 2. WHO Asia Pacific Perspective for Asians (WHO IOTF 2003)[10]

	Obese			Non-Obese		
PFT Values	**Predicted**	**Observed**	**% of Observed FVC**	**Predicted**	**Observed**	**%**
FVC	2.44 ± 0.49 l/s	1.61 ± 0.38 l/s	66.87± 13.69%	2.82 ±0.73l/s.	2.26± 0.88l/s.	79.76± 22.04%
FEV1	2.10 ± 0.40.	1.13 ± 0.24	55.04± 11.35%	2.47 ± 0.66	1.50 ± 0.65.	59.72± 18.80%
FEV1/ FVC	86.10 ± 4.84	70.40 ± 8.01	86.10 ± 4.84%	87.08 ± 4.42	65.03 ± 7.34.	87.08± 4.42%
FEF (25-75)	3.20 ± 0.55	1.31 ± 0.62	42.23± 21.05%	3.87 ± 0.78	1.59 ± 0.76	40.80± 17.14%

Table 3. Comparing PRE FVC, FEV1, FEV1/FVC, FEF (25-75) in Obese and Non-Obese Asthmatics

	Obese		Non-Obese	
PFT Values	**Observed**	**% of Observed**	**Observed**	**% of Observed**
FVC	1.92 ± 0.45 l/s	79.58 ± 13.83 %	2.56±0.80 l/s.	91.65 ± 21.26 %
FEV1	1.47 ± 0.33	70.85 ± 13.04 %	1.94 ± 0.72	78.20 ± 21.26 %
FEV1/FVC	77.07 ± 7.92	-	74.38 ± 9.41	-
FEF(25-75)	1.93 ± 0.68	61.35 ± 21.01 %	2.76 ± 1.01	71.92 ± 24.00 %

Table 4. Comparing POST FVC, FEV1, FEV1/FVC, FEF (25-75) in Obese and Non-Obese Asthmatics

METHODS

Patients treated under Department of Pulmonary Medicine, attached to JJM Medical College, with bronchial asthma, fulfilling the inclusion & exclusion criteria were included in the study after obtaining written informed consent. Demographic data, history, clinical examination and details of investigations like Pulmonary function test, Complete hemogram (Hemoglobin, Total leukocyte count and Differential leukocyte count), Chest X-ray (Postero-anterior view), Electrocardiogram, Lipid profile - Triglyceride, Total cholesterol, High density lipoprotein (HDL) and low density lipoprotein (LDL),Sputum AFB, Renal function test. Sample size taken for convenience.

Source of Data

The study was conducted in Department of Pulmonary Medicine, JJM medical college, Davangere, Karnataka on patients with Stable obese and non-obese Bronchial Asthma patients who were diagnosed with bronchial asthma as per GLOBAL Initiative for Asthma (GINA) guidelines[1] undergoing pulmonary function test on inpatient or outpatient basis.

Study Design

A Hospital based cross sectional observational study.

Place of Study

JJM Medical College, Davangere.

Duration of Study

One year and six months (December 2014 – May 2016).

Sampling Technique

Convenient sampling.

Ethical Issues

The study was approved by the ethical and research committee of J. J. M. Medical College, Davangere. The selected patients were briefed about the study and written informed consent was obtained.

Sample Size

A total of 100 study subjects- 50 obese and 50 non-obese asthmatic adults. BMI <22.9 is taken as Non-Obese and >23 as Obese as per WHO Asia Pacific perspective for Asians (WHO IOTF 2003)[10]

Inclusion Criteria

1. All individuals above 18 years of age.
2. All adults diagnosed with Bronchial asthma as per GINA[1] guidelines.
3. All asthmatic adults who are obese (which included at risk, Obese I and Obese II) and non-obese (underweight and normal) as per WHO Asian pacific perspective for Asians.
4. Patients who are willing to participate.

Exclusion Criteria

1 Unstable inpatients/out-patients. (i.e. Acute exacerbation of asthma)

2 Patients with chronic obstructive pulmonary disease, Bronchiectasis and other respiratory diseases.

3 Patients with malignancies, cardiac complications or neuromuscular diseases.

4 Post-operative patients, individuals with serious systemic illnesses like chronic renal failure or complicated diabetes mellitus etc.

Statistical Methods

Data was entered in Microsoft excel and analyzed using EPI INFO version 6 software. Descriptive statistics like proportions, percentages and standard deviation are used. For comparison between the groups chi square test, Independent 't' test, ANOVA were used. P value of less than 0.05 is considered as statistically significant.

RESULTS

1) Demographic Data

A total of 100 bronchial asthma patients diagnosed as per GINA guidelines were taken up for the study. Out of 100 patients, 50 were obese bronchial asthma patients (n =25) and remaining 50 were non-obese bronchial asthma patients (n=25). In this study of 100 patients, the age of patients ranged from 20-59 years, the age of patients in obese group ranged from 28-59 years with a mean of 40.27±8.395 years, in non-obese group it ranged from 20-50 years with a mean of 32.57±7.583 years. Out of total 100 asthmatic patients studied, in obese asthmatic group 18 (36.6%) were male patients and 32 (63.4%) were female patients and in non-obese asthmatic group 36 (73.3%) were males and 14 (26.7%) were females. The association between the groups is statistically significant. (p=0.009)

2) Anthropometry

a) Height- The height of the patients in obese group ranged from 140 to 170 cms and the mean value is 155.33 ± 8.066 cms. Non obese were taller compared to obese asthmatics but there is no statistical difference of height between the two groups. (p= 0.075)

b) Weight- The weight of the patients in the obese group ranged from 53 to 109 kilograms with a mean of 72.53 ± 12.822 kilograms. The weight of the patients in the non-obese group ranged from 40 to 70 kilograms with a mean of 54.13 ± 9.464 kilograms. The difference between the two groups is statistically significant. (p= < 0.0001).
c) BMI- The BMI of the patients in the obese group ranged from 23.4 to 48.4 kg/m^2 and the mean value for the group is 30.16 ± 4.63 kg/m^2. The BMI of the patients in the non-obese group ranged from 15.15 to 22.86 kg/m^2 and the mean value for this group is 20.55 ± 2.689 kg/m^2 and the difference between these groups is found to be statistically significant (p= <0.0001).

3. Symptoms
a) Cough- In this study of 100 patients cough is more among non-obese compared to obese asthmatics, and the association is found to be statistically significant. (p=<0.05)
b) Breathlessness- In this study of 100 patients, breathlessness is present in all 50 obese asthmatics and 45 non-obese asthmatics, the difference between groups is not statistically significant.
c) Wheeze- Of the total 100 asthmatic patients studied, obese asthmatics (60%) have more wheeze compared to non-obese asthmatics (53.4%), there is no statistical significance.
d) Seasonal Variation- Of the total 100 asthmatic patients, seasonal variation is more among non-obese (66.6%) compared to obese asthmatics (40%). Significant association is seen among the groups.

4) Past History
a) Atopy- Of the total 100 asthmatic patient's history of atopy is found to be more among non-obese asthmatics (56.6%) compared to obese asthmatics (33.3%). There is no statistical significance between the groups.
b) Bronchial Asthma- Out of 100 patients studied, 20 obese asthmatics and 10 non obese asthmatics had previous history of asthma.

5) Comorbid Conditions
a) Hypertension- Out of 100 patients studied, 15 (30%) obese asthmatics and 4 (6.66%) non obese asthmatics had previous history of hypertension. There was significant association seen between the groups (p=0.02)
b) Diabetes Mellitus- Out of 100 patients studied, 23.3% obese asthmatics and 6.66% non-obese asthmatics had previous history of diabetes mellitus.

6) Vitals
a) Pulse Rate- The mean value of pulse rate among the patients in obese group is 90.8 bpm and in non-obese group is 77.07 bpm respectively. The student t test observed that this variable between the groups is statistically significant. (p=<0.0001)
b) SBP- The mean systolic blood pressure in obese group and non-obese group is 129.2 mm Hg and 118 mm Hg respectively. The student t test observed that this variable between the groups is statistically significant. (p=<0.0001)
c) DBP- The mean diastolic blood pressure in obese group and non-obese group is 83.53 mm Hg and 77.93 mm Hg respectively. The student t test observed that this variable between the groups is statistically significant. (p=0.001)
d) Respiratory rate- The mean respiratory rate in obese group and non-obese group is 17.4 cycles per minute and 16.33 cycles per minute respectively. The student t test observed that this variable between the groups is statistically significant (p=<0.0001).

7) Complete Hemogram
a) Haemoglobin- The mean value of haemoglobin for obese group is 13.5 gm/dl with standard deviation of 0.99. The mean value of haemoglobin for non-obese group is 13.96 gm/dl with standard deviation of 1.31. The student t test applied found that the difference of variable between the groups is not statistically significant.
b) Total Leukocyte Count- The mean value of Total leukocyte count for obese group is 10,600 cells/mm^3 with standard deviation of 2381.05. The mean value of total leukocyte count for non-obese group is 9310 cells/mm^3 with standard deviation of 1835.59. The student t test applied found that the difference of variable between the two groups is statistically significant. (p=0.025).
c) Neutrophils- The mean value of neutrophil for obese group is 67.53% with standard deviation of 10.38. The mean value of neutrophil for non-obese group is 66.9% with standard deviation of 10.29. The student t test applied found that the difference of variable between the groups is not statistically significant.
d) Monocytes- The mean value of monocytes for obese group is 6.77% with standard deviation of 2.27. The mean value of monocytes for non-obese group is 7.57% with standard deviation of 1.98. The student t test applied found that the difference of variable between the groups is not statistically significant.
e) Eosinophils- The mean value of eosinophils for obese group is 4.27% with standard deviation of 2.72. The mean value of eosinophils for non-obese group is 5.43% with standard deviation of 3.89. The student t test applied found that the difference of variable between the groups is not statistically significant.
f) Lymphocytes- The mean value of lymphocytes for obese group is 20.3% with standard deviation of 8.61. The mean value of lymphocytes for non-obese group is 16.47% with standard deviation of 8.42. The student t test applied found that the difference of variable between the groups is not statistically significant.
g) Basophils- The mean value of basophils for obese group is 0.2% with standard deviation of 0.41. The mean value of basophils for non-obese group is 0.43% with standard deviation of 0.68.
h) AEC (cells/mm^3)- The mean value of absolute eosinophil count for obese group is 449.5 cells/mm^3 with standard deviation of 246.16. The mean value of Absolute eosinophil count for non-obese group is 600.72 cells/mm^3 with standard deviation of 300.96. There was significant difference between the groups (p=0.05)

8) Lipid Profile
a) Total Cholesterol- The mean value of Total cholesterol for the obese group is 201.97 ±32.41 mg/dl. The mean value of total cholesterol for the non-obese group is 172.27 ±25.03 mg/dl. There is significant difference of this variable between obese and non-obese asthmatics (p=<0.001).

b) Triglycerides- The mean value of triglycerides for the obese group is 147.48 ±61.00 mg/dl. The mean value of triglycerides for the non-obese group is 115.13 ±40.01 mg/dl. There is significant difference of this variable between obese and non-obese asthmatics. (p=0.02).

c) HDL- The mean value of HDL for the obese group is 43.46 ±11.47 mg/dl. The mean value of HDL for the non-obese group is 48.77 ±11.96 mg/dl. There is no significant difference of this variable between obese and non-obese asthmatics.

d) LDL- The mean value of LDL for the obese group is 114.12±32.74 mg/dl. The mean value of LDL for the non-obese group is 111.04±34.44 mg/dl. There is no significant difference of this variable between obese and non-obese asthmatics.

e) VLDL- The mean value of VLDL for the obese group is 31.36 ±11.90 mg/dl. The mean value of VLDL for the non-obese group is 27.16 ±7.74 mg/dl. There is no significant difference of this variable between obese and non-obese asthmatics.

9) Spirometric Values

a) FVC- The mean value of predicted FVC for the obese group is 2.44 ± 0.49 l/s and mean value of predicted FVC for the non-obese group is 2.82 ± 0.73 l/s. The student t test applied found that the difference between the two groups for this variable is statistically significant. (p=0.023). The mean value of observed FVC for the obese group is 1.61 ± 0.38 l/s and mean value of observed FVC for the non-obese group is 2.26 ± 0.88 l/s. The difference between the two groups is statistically significant. (p=0.001). Percentage of Observed FVC in obese and non-obese asthmatics is 66.87 ± 13.69 % and 79.76 ± 22.04 % respectively. The mean value of post FVC for the obese group is 1.92 ± 0.45 l/s and mean value of post FVC for the non-obese group is 2.56 ± 0.80 l/s. The difference between the two groups is statistically significant. (p=<0.0010). Percentage of Post FVC in obese and non-obese asthmatics is 79.58 ± 13.83 % and 91.65 ± 21.26 % respectively. The mean value of predicted FVC for at risk, obese I and obese II groups are 2.66 ± 0.28 l/s, 2.48 ± 0.47l/s and 2.35 ± 0.55l/s respectively. The mean value of Observed FVC for the at risk, obese I and obese II groups are 1.80 ± 0.17 l/s, 1.61 ± 0.30 l/s and 1.58 ± 0.49 l/s respectively. Percentage of Observed FVC in at risk, obese I, obese II asthmatics is 68.50 ± 13.51 %,66.39 ± 12.90 %,67.23 ± 15.80 % respectively. Post FVC for at risk group, obese I and obese II is 2.01 ± 0.13 l/s, 1.96 ± 0.44 l/s, 1.87 ± 0.52 l/s respectively. Percentage of Post FVC in at risk, obese I, obese II asthmatics is 76.37 ± 12.73 %, 79.90 ± 13.84 %, 79.69 ± 15.05 % respectively. The difference of Observed FVC and Post FVC between all three obese asthmatics group is statistically significant. FVC was decreased in Obese II asthmatics compared to at risk and obese I asthmatics.

b) FEV1- The mean value of predicted FEV1 for the obese group is 2.10 ± 0.40 and mean value of predicted FEV_1 for the non-obese group is 2.47 ± 0.66. The difference of predicted FEV1 between the groups is statistically significant. (p=0.01). The mean value of observed FEV_1 for the obese group is 1.13 ± 0.24 and mean value of observed FEV_1 for the non-obese group is 1.50 ± 0.65. The difference between the two groups is statistically significant. (p=0.006). Percentage of Observed FEV 1 in obese and non-obese asthmatics is 55.04 ± 11.35 % and 59.72 ± 18.80 % respectively. The mean value of post FEV_1 for the obese group is 1.47 ± 0.33 and mean value of post FEV_1 for the non-obese group is 1.94 ± 0.72. The difference between the groups is statistically significant. (p=0.002). Percentage of Post FEV 1 in obese and non-obese asthmatics is 70.85 ± 13.04 % and 78.20 ± 21.26 % respectively. The mean value of predicted FEV1 for at risk group, obese I and obese II is 2.27 ± 0.18 l/s, 2.15 ± 0.40 l/s, 2.00 ± 0.43 l/s respectively. The mean value of Observed FEV1 for at risk group, obese I and obese II is 1.29 ± 0.13 l/s, 1.12 ± 0.22 l/s, 1.13 ± 0.27 l/s respectively. The difference of Observed FEV1 between the sub-groups is statistically significant. Percentage of Observed FEV1 in at risk, obese I, obese II asthmatics is 57.24 ± 10.24%,53.40 ± 12.22 %,56.86 ± 10.88 % respectively. Post FEV1 for the at-risk group, obese I and obese II is 1.69 ± 0.18 l/s, 1.48 ± 0.33 l/s, 1.41 ± 0.35 l/s respectively. The difference of post FEV1 between the sub-groups is statistically significant. Percentage of Post FEV1 in at risk, obese I, obese II asthmatics is 75.02 ± 14.18 %,70.09 ± 13.51 %, and 71.16± 13.30 % respectively.

c) FEV1/FVC- The mean value of predicted FEV1/FVC for the obese group is 86.10 ± 4.84 and mean value of predicted FEV1/FVC for the non-obese group is 87.08 ± 4.42. The student t test applied found that the p value between the two groups for this variable is not statistically significant. The mean value of observed FEV1/FVC for the obese group is 70.40 ± 8.01 and mean value of observed FEV1/FVC for the non-obese group is 65.03 ± 7.34. The student t test applied found that the p value between the two groups for this variable is statistically significant. (p=0.009) The mean value of post FEV1/FVC for the obese group is 77.07 ± 7.92 and mean value of post FEV1/FVC for the non-obese group is 74.38 ± 9.41. The student t test applied found that the p value between the groups for this variable is not statistically significant. The mean value of predicted FEV1/FVC for at risk, obese I, obese II is 85.56 ± 2.03%, 86.62 ± 4.68 % and 85.49 ± 5.53 % respectively. The mean value of observed FEV1/FVC for at risk, obese I, obese II is 70.35 ± 1.52 %, 69.62 ± 7.85 %and 71.45 ± 9.09 % respectively. The mean value of post FEV1/FVC for at risk, obese I, obese II is 83.96 ± 3.83 %, 76.89 ± 7.99 %and 76.17 ± 8.20 % respectively.

d) FEF 25-75%- The mean value of Predicted FEF 25-75 for the obese group is 3.20 ± 0.55 and mean value of Predicted FEF 25-75 for the non-obese group is 3.87 ± 0.78. The student t test applied found that the p value between the two groups for this variable is statistically significant. (p=<0.0010). The mean value of observed FEF 25-75 for the obese group is 1.31 ± 0.62 and mean value of observed FEF 25-75 for the non- obese group is 1.59 ± 0.76. The student t test applied found that the p value between the two groups for this variable is not statistically significant. Percentage of observed FEF 25-75 in obese and non-obese asthmatics is 42.23 ± 21.05 % and 40.80 ± 17.14 % respectively. The mean value of post FEF25-75 for the obese group is 1.93 ± 0.68 and mean value of post FEF 25-75 for the non-obese group is 2.76 ± 1.01. The student t test applied found that the p value between the two groups for this variable is statistically significant. (p=<0.0010). Percentage of Post FEF 25-75 in obese and non-obese asthmatics is 61.35 ± 21.01 % and 71.92 ± 24.00 % respectively. The mean value of Predicted FEF 25-75 for at risk, obese I and obese II is 3.71 ± 0.19 l/s, 3.26 ± 0.58 l/s and 3.03 ± 0.52 l/s respectively. The mean value ± SD of Observed FEF 25-75for at risk, obese I and obese II is 1.81 ± 0.91 l/s, 1.24 ± 0.56 l/s and 1.31 ± 0.69 l/s respectively. Percentage of observed FEF 25-75 in at risk, obese I and obese II is 48.15 ± 22.14 %, 39.72 ± 19.48 % and 44.58 ± 24.17 % respectively. The mean value ± SD of post

FEF25-75 for at risk, obese I and obese II is 2.60 ± 0.87 l/s, 1.99 ± 0.57 and 1.73 ± 0.76. The difference of Post FEF 25-75 between the subgroups is statistically significant.Percentage of Post FEF 25-75 in at risk, obese I and obese II is 69.53 ± 19.89 %, 62.67 ± 18.37 % and 58.22 ± 25.34 % respectively.

E) Bronchodilator Response

The mean percentage change in reversibility of spirometric values in non-obese population is 34.07% whereas in obese population it is 29.24%. The student t test applied found that the p value between the groups for this variable is not statistically significant. (p=0.23776) Bronchodilator response is found to be more in non-obese asthmatic group compared to obese asthmatics, however it was not statistically significant.

DISCUSSION

In this study of 100 patients with bronchial asthma, the age of patients ranged from 20-59 years, the mean age of patients in obese group was 40.27 ±8.395 years, in non-obese group was 32.57±7.583 years. Nearly two thirds in obese group were female and male in non-obese group. The mean weight of the patients in the obese group was 72.53 ± 12.822 kgs. and in the non-obese group with a mean of 54.13 ± 9.464 kgs. Castro-Rodriguez et al.,[14] (2001) demonstrated that girls becoming overweight or obese between 6 and 11 years of age had increased odds of developing new asthma symptoms. The mean BMI of the patients in the obese group was 30.16 ± 4.63 kilograms/metre^2 and in the non-obese group was 20.55 ± 2.689 kg/m^2. The study findings is similar to the study done by Dosi R et al.[15]

Beuther et al[16] (2007) have demonstrated a clear dose–response relationship between BMI and asthma, suggesting that asthma risk increases further as body weight increases. In addition, he had shown that the odds of incidence of asthma in overweight and obese men and women were similar. Most common symptom in both groups was breathlessness which was present in all patients in obese group and 90% of non-obese group, which was followed by cough and wheeze. The present study showed significant association of cough and seasonal variation between obese and non-obese asthmatic patients as comparable with the study done by Aruna G et al.[17] The presence of comorbid condition like diabetes and hypertension was more common in obese compared to non-obese which was consistent with the study by Pakhale S et al.[18] (2010).Our study shows there is significant difference of Absolute eosinophil count between the groups. (p=0.05) but it was contrast with the finding of the study done by Aruna G et al. The mean of Forced expiratory volume in 1st second (FEV1) and Forced vital capacity (FVC), in obese asthmatics is 1.13 ± 0.24 l/s and 1.61 ± 0.38 l/s respectively and in non-obese it is 1.50 ± 0.65 l/s and 2.26 ± 0.88 l/s. In the present study FEV1, FVC is lower in obese asthmatics compared to non-obese asthmatics which is comparable with the studies done by Pakhale s et al. (2010) Dosi R et al, Razi et al.[19]

The mean percentage change of reversibility in spirometric values (FEV1) among non-obese population is 34.07%, whereas in obese population it is 29.24%. but was not statistically significant. (p=0.23776) which was in contrast with the study done by Sharma L, et al which showed highly significant difference found in the spirometric variables in obese and non-obese asthmatics. Our study also compared mean value of FEV1/FVC % observed for the obese and non-obese groups which was 70.40 ± 8.01 and 65.03 ± 7.34 respectively. This finding is similar to the study done by Sharma et al[20] whereas it is contrast with the findings of the study done by Dosi et al. The mean of FEF 25-75% in the present study among obese asthmatics is 1.31 ± 0.62 l/s and in non-obese it is 1.59 ±0.76 l/s. The values were lower compared to non-obese asthmatics which was comparable with the study done by Zied et al.[21] Earlier studies showed (Sharma L, et al) the mean percentage change in reversibility of spirometric values in non-obese population highly significant, but our study shows the contrast.

CONCLUSIONS

- In this study, out of 100 patients 55% were males and 45% were females with higher total cholesterol and triglycerides in obese asthmatics was (201.97 ± 32.41 mg/dl and 147.48 ± 61 mg/dl respectively) as compared to non-obese asthmatics (172.27 ± 25.03 mg/dl and 115.13 ± 40.01 mg/dl respectively).
- Total cholesterol, triglycerides, HDL and VLDL were increased in Obese II asthmatic group compared to Obese I and at-risk asthmatic group.
- The most common symptoms were breathlessness followed by cough and wheeze.
- There was significant difference of waist circumference (W.C.), hip circumference (H.C) and waist to hip ratio (W.H.R.) between obese and non-obese asthmatics.
- Peripheral blood eosinophilia was higher in non-obese asthmatics (600.72 ± 300.96 cells/mm^3) compared to obese asthmatics (449.5 ± 246.16 cells/mm^3) whereas total count was higher among obese asthmatics (10600 ± 2381.05 cells/mm^3) compared to non-obese asthmatics (9310 ± 1835.59 cells/mm^3).
- Moderate and severe grade of asthma were found to be slightly higher in the obese group (60% and 23.33%) compared to non-obese group (46.67% and 13.33%) respectively, however, these values are not statistically significant.
- FVC, FEV1, and FEF25-75 % values were reduced in obese asthmatics (1.61 ± 0.38 l/s, 1.13 ± 0.24 l/s and 1.31 ± 0.62 l/s respectively) compared to non-obese asthmatics (2.26 ± 0.88 l/s, 1.50 ± 0.65 l/s and 1.59 ± 0.76 l/s respectively) in contrast with FEV1/FVC which was higher in obese asthmatics (70.40 ± 8.01%) compared to non-obese asthmatics (65.03 ± 7.34%).
- Among obese asthmatics FVC values are much lower in Obese II compared to obese I and at-risk asthmatics. Whereas FEV1, FEV1/FVC and FEF 25-75 % values are much lower among obese asthmatics compared to at risk and Obese II asthmatics.
- It was observed that increase in BMI causes impaired pulmonary function.

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