To Study Body Mass Index (BMI) based Variations in Cardio–Respiratory Parameters in Young Adults of Doda in the Region of Jammu & Kashmir

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ABSTRACT

Introduction: The increasing number of overweight and obese individuals is a serious public health problem that has implications for society and healthcare systems on a global scale. Growing evidence had clearly and consistently evidenced that obesity is an essential and direct predictor of Cardio vascular function. Study aimed to observe BMI based variations in cardio vascular parameters.

Material and methods: The study was carried out on 320 subjects of 18-30 years age group in district Doda of Jammu & Kashmir, India. The anthropometric parameters included age, height, weight and body mass index were measured. The cardio-respiratory parameters include SBP, DBP, MAP and Pulse and PEFR was measured by proper procedures.

Results: The anthropometric parameters like weight & BMI were found statistically very highly significant in total number of subjects ($p <0.001$ ***), whereas age and height was found not significant ($p > 0.05$ #). Cardio-respiratory parameters showed statistically a positive significant association in various groups. The parameters like pulse rate, SBP, PEFR was found to be very highly significant ($p < 0.001$) in all subjects, whereas DBP was found highly significant ($p < 0.01$) and MAP was found significant ($p < 0.05$) in all subjects respectively.

Conclusion: The study demonstrated that BMI is closely associated with MAP. MAP is derived from the combination of standard measures of SBP and DBP. It allows description of BP as a single measurement. Our study concluded that on increasing BMI, the MAP was increased. The weight gain stimulates sympathetic activation, and also that probably insulin and leptin are involved.

Keywords: Cardio-respiratory, Obese, Anthropometric Parameters, Body Mass Index

INTRODUCTION

Obesity stands out as an emerging global public health challenge that is epidemically increasing in both developed & underdeveloped countries. According to the recent report, India ranks the second highest number of obese children in the world, with 14.1 million reported cases.[1] Obesity is the state of excess adipose tissue mass. Although often viewed as equivalent to increased body weight, this need not be the case, lean but very muscular individuals may be overweight by arbitrary standards without having increased adiposity. Body weights are distributed continuously in populations, so that a medically meaningful distinction between lean and obese is somewhat arbitrary. Obesity is therefore more effectively defined by assessing its linkage to morbidity or mortality.[2] Growing evidence had clearly and consistently evidenced that obesity is an essential and direct predictor of respiratory function as lung function depends on the size and specific distribution of connective tissue.[3] The increasing number of overweight and obese individuals is a serious public health problem that has implications for society and healthcare systems on a global scale. The economic consequences of obesity and associated diseases are not limited to high medical costs but also include indirect or social costs such as decreased quality of life, problems in social adjustment, lost productivity, disability associated with early retirement, and death.[4] As obesity is a key risk factor in natural history of many chronic and non-communicable diseases. The adverse effects of obesity to emerge in population in transition are hypertension, hyperlipidaemia and glucose intolerance, while coronary heart disease and long term complications of diabetes , such as renal failure begin to emerge several years or decades later.[5] Although not a direct measure of adiposity, the most widely used method to gauge obesity is the body mass index (BMI), which is equal to weight/height^2 (in kg/m^2). Other approaches to quantifying obesity include anthropometry (skin-fold thickness), densitometry (underwater weighing), computed tomography (CT) or magnetic resonance imaging (MRI), and electrical impedance. Using data from the Metropolitan Life Tables, BMIs for the midpoint of all heights and frames among both men and women have more body fat than men. Based on unequivocal data of substantial morbidity, a BMI of 30 is most commonly used as a threshold for obesity in both men and women. Large-scale epidemiologic studies suggest that all-cause, metabolic, cancer, and cardiovascular morbidity begin to rise (albeit at a slow rate) when BMIs are ≥ 25, suggesting that the cut-off for obesity should be lowered. Some authorities use the term overweight (rather than obese) to describe

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How to cite this article: Dar MA, Charaka G, Bala S, Shekhar S, Qadir M. To study body mass index (BMI) based variations in cardio–respiratory parameters in young adults of Doda in the region of Jammu & Kashmir. International Journal of Contemporary Medical Research 2021;8(12):L1-L6.

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individuals with BMIs between 25 and 30. A BMI between 25 and 30 should be viewed as medically significant and worthy of therapeutic intervention, especially in the presence of risk factors that are influenced by adiposity, such as hypertension and glucose intolerance.[6] Obesity is associated with a state of chronic systemic inflammation that is driven predominantly by the action of substances released by adipose tissue. Chronic inflammation is caused by activation of the innate immune system, which promotes a pro-inflammatory state and oxidative stress and a consequent systemic acute-phase response. Systemic inflammation may play a crucial role in the pathogenesis of various obesity-related complications, including metabolic syndrome, Type 2 Diabetes mellitus (T2DM), cardiac disease, liver dysfunction, and cancer.[7] The dysfunction of adipose tissue can induce systemic oxidative stress and lead to abnormal production of adipokines, which contributes to the development of obesity-related disorders. Furthermore, the level of oxidative damage biomarkers is increased in obese individuals and is directly correlated with BMI, percentage of body fat, and levels of triglycerides and low-density lipoproteins.[8] The accumulation of fat, particularly abdominal visceral fat, impairs antioxidant mechanisms.[9] All these events lead to a chronic and persistent proinflammatory state that results in systemic pathologies. Peak Expiratory Flow Rate (PEFR) as a measurement of ventilator function was introduced by HADORN in 1942, and was accepted in 1949 as an index of spirometry.[10] By definition, it is the maximum or peak flow rate that is attained during a forceful expiratory effort after taking a deep inspiration. It is expressed in liters per minute. It measures airflow through the bronchial tree and provide an idea about bronchial tone. Pulmonary functions are usually determined by respiratory muscle strength, compliance of the thoracic cavity, airway resistance, and elastic recoil of the lungs.[11] Pulmonary function testing provide objective quantifiable measures of lung functions. Ventilatory pulmonary function tests are particularly useful in evaluation of patients with respiratory complaints, screening for presence of obstruction and restrictive lung diseases. It is essential to detect and treat respiratory obstruction at an early and reversible stage for prevention of permanent damage.[12-15] The peak flow meter which is a reliable and safe, bedside instrument fulfils the need of assessing the ventilatory function. The portability and simplicity of the peak flow meter make it particularly suitable for studies of respiratory function.[16-17] Thus, this study was proposed to observe the change in Body Mass Index (BMI) based variations in Cardio-Respiratory parameters in young adults.

MATERIAL AND METHODS

The current research was carried out in the Department of Physiology of Govt. Medical College Doda. The research was carried out on 320 students both males and females between the ages of 18-30 years from various areas.

BMI grading of subjects was done according to WHO criteria. It was developed by Adolphe Quetelet

Body mass index (BMI)	Interpretation
18.5 ≤	Underweight
18.5 – 24.99	Normal weight
25 – 29.99	Overweight
30 ≥	Obese

The subjects were firstly divided into four broad groups based on BMI & each group had 2 subgroups:

Group I: [All Normal weight Subjects]: (80)
Group I M (40) & Group I F (40)

Group II: [All Underweight Subjects]: (80)
Group II M (40) & Group II F (40)

Group III: [All Overweight Subjects]: (80)
Group III M (40) & Group III F (40)

Group IV: [All Obese weight Subjects]: (80)
Group IV M (40) & Group IV F (40)

The subjects were further divided into two broad Groups (A & B) based on gender.

Group A (160) : Group I M (40), Group II M (40), Group III M (40) & Group IV M (40)

Group B (160): Group I F (40), Group II F (40), Group III F (40) & Group IV F (40)

Subject Selection

Subjects fulfilling the following criteria were included in the study:

- All the subjects were physically, socially, mentally fit.
- All the subjects were nonsmoker, nonalcoholic and were not addicted to any habit forming substance.
- Subjects with Cardio-Respiratory disorders (like hypertension, COPD, asthma etc), and diabetes mellitus were excluded from the study.
- Approval from college's ethical committee was taken.
- Informed consent was taken from all subjects.
- All subjects were made familiar with the method & equipment prior to test performed.

1. Measurement of Anthropometric Parameters:

Age: Age was calculated in years to the nearest birthday.

Height: Height was measured in centimeters (cms) using Stadiometer (Avery Pvt. Ltd.).Calibration of Stadiometer was done using a standardized rod. Stadiometer was checked once in two weeks for any error.

Procedure: Subjects were instructed to stand straight on a flat surface with feet flat, heels almost together, arms at side and looking straight ahead. Heels, hips, shoulder blades and occiput pressing against the vertical bar then the slider was brought down to rest on the top of the head pressing the hair. The arrow accurately measured the height to an accuracy of + 0.5 cm

Body weight: Body weight was recorded in kilograms, using digital weighing machine Crown Electronic Weighing Machine.

Procedure: The subject was made to stand upright on the scale wearing minimum clothing after taking off his/her shoes. The weight was recorded to an accuracy of + 0.1 kg. The BMI of each subject was obtained mathematically using the formula called as Quetelet formula

$$BMI = \frac{\text{Body Weight (kg)}}{\text{Height}^2\,(m^2)}$$

2. Measurement of Cardiovascular Parameters:

Blood presure: Blood pressure was recorded in mmHg using digital blood pressure monitor (Model REF CH – 432, Citizen System Japan Co. Ltd.).

Procedure: All subjects was allowed to sit down and relax atleast for 15 minutes. To record the blood pressure the subjects brachial artery was palpated and the centre of the bladder length of the cuff was placed such that it is over the arterial pulsation of the subjects bare upper arm. The lower end of cuff was placed above 2-3 cm above the antecubital fossa.The BP and pulse was recorded in the sitting down position

Pulse rate: Pulse was taken in beats/min in radial artery.

Mean arterial blood preasure (MAP): Mean Arterial Pressure (MAP) was calculated from measured systolic blood pressure (SBP) and diastolic blood pressure (DBP) in mmHg by using
formula
MAP = DBP + 1/3 (SBP-DBP) Or equivalent

$$MAP = \frac{(2 \times DBP) + SBP}{3}$$

3. Measurement of Respiratory Parameters:

Peak expiratory flow rate (PEFR): The PEFR was recorded in L/min using Mini-Wright Peak Flow Meter (Breathe-O-meter, as per EU Scale) by CIPLA, Cipla Mumbai Ltd.

Procedure: The subject was asked to stand in an upright position with the peak flow meter held horizontally in front of his/her mouth and allowed to take a deep breath. Further he/she was asked to close her lips firmly around the mouthpiece, making sure that no air leaks around the lips. The subject was asked to breathe out as hard and as fast possible and the reading indicated by the cursor on the peak flow meter scale was noted and the sequence was repeated thrice. The highest PEFR among three trials was recorded as the peak flow rate
The equipment (Breathe-O-meter's) was sterilized by time to time and individual to individual to maintain the health dimension of subjects.

STATISTICAL ANALYSIS

All the parameters recorded were analyzed using Microsoft Excel Software.

Test Applied:

- Student's T-Test.
- Chi - square Test
- Pearson's Correlation Test

DISCUSSION

The study was conducted in the department of physiology of GMC DODA JAMMU & KASHMIR on 320 subjects of 18-30 years age group. The main aim was to observe variations in cardio-respiratory parameters like (Pulse rate, SBP, DBP, MAP & PEFR) with BMI in different groups (Gr I, Gr II, Gr III, and Gr IV).
The data was statistically analyzed by using Excel and applying Students T-Test, Chi-square test and Pearson Correlation Test. The study showed a strong positive correlation among cardio-respiratory parameters with BMI variation.
On BMI based comparison the anthropometric parameters like weight & BMI were found statistically very highly significant in total number of subjects ($p < 0.001^{***}$), whereas age and height was found not significant ($p > 0.05^{\#}$),
Statistically, taking into consideration total subjects (n-320) the BMI based comparison of cardio-respiratory parameters showed a positive significant association in various groups (Gr I, Gr II, Gr III & Gr IV). The parameters like pulse rate, SBP, PEFR was found very highly significant ($p < 0.001$) in all subjects (n-320), whereas DBP was found highly significant ($p < 0.01$) and MAP was found significant ($p < 0.05$) in all subjects respectively
In total male subjects (n-160) the BMI based comparison of cardio-respiratory parameters was significant. The pulse rate & PEFR was found very highly significant ($p < 0.001$) whereas SBP, DBP was found highly significant ($p < 0.01$) and MAP was found statistically significant ($p < 0.05$) in all groups of male subject
In total female subjects (n-160) The parameters like SBP, MAP, PEFR were found very highly significant ($p < 0.001$) whereas DBP was found highly significant ($p < 0.01$) and pulse rate was found not significant ($p > 0.05$) in all groups female subjects
The gender based comparison of cardio-respiratory parameters of Group A and B also showed positive association statistically. The parameters like SBP, MAP, PEFR were found statistically very highly significant ($p < 0.001$) whereas DBP was found highly significant ($p < 0.01$) while pulse rate was found not significant ($p > 0.05$) in comparison of group A with group B
The gender based comparison of cardio-respiratory parameters like SBP, MAP, PEFR between all groups (all male groups and all female groups), showed very highly significant (p- value $< 0.001^{***}$). The pulse rate & DBP between same groups were found not significant ($p > 0.05^{\#}$) except obese group, it was found highly significant in obese group ($p < 0.01^{**}$) respectively.
Further it was observed that the correlation of BMI with MAP were found statistically very highly significant. The correlation coefficient (r) between BMI with MAP was found = 0.31, denotes partial positive correlation. Thus the study showed that on increasing BMI the MAP increases. The result of our study were coincides with results following studies.
Perusse L et al. in 2005 study compared several CVD risk factors between four BMI and fitness groups using median split. In agreement with the findings, unfit males and females had higher MAP than their fit counterparts within BMI

categories.

Huang et al. in 1998 showed the association between change in body weight and incident cases of hypertension and found that weight gain substantially increased the risk of hypertension

The exact underlying pathophysiological mechanisms between change in BMI and blood pressure are still not clear. What is known is that weight gain stimulates sympathetic activation, and also that probably insulin and leptin are involved. Also activation of the rennin – angiotensin system as well as physical compression of kidney may be important factors in linking body weight and elevated blood pressure

In the present study the correlation of BMI with PEFR was found statistically very highly significant.

The correlation coefficient (r) between BMI with PEFR was partial negative correlation Thus the study showed that on increasing BMI the PEFR decreases. The result of my study coincides with following study results.

Jena, et al. Study showed that with increase in BMI, the PEFR decreases. He stated that subjects with high BMI have higher chance of bronchial asthma

Garg, et al. study showed that PEFR substantiated with anthropometric & respiratory parameters can ascertain the level of physical fitness of given population & make a baseline for their pulmonary function in health

Mafort et al. study showed that obesity causes mechanical compression of the diaphragm, lungs, and chest cavity, which can lead to restrictive pulmonary damage. Furthermore, excess fat decreases total respiratory system compliance, increases pulmonary resistance, and reduces respiratory muscle strength. It is interesting that metabolic syndrome also changes lung function and that the combination of obesity and metabolic syndrome seems to impair lung function even further. In obese and overweight patients, a strong correlation exists between lung function and body fat distribution, with greater impairment when fat accumulates in the chest and abdomen .

This study has helped to make the students aware of their health status in the region of DODA JAMMU & KASHMIR and it will also benefit them as they have been volunteered to modify their lifestyle.

RESULTS

The mean ± standard error of mean (SEM) of all the anthropometric parameters. The mean ± SEM for age was 20.57 ± 0.91 years, height was 165.86 ± 0.64 cms, weight was 68.46 ± 9.55 kgs and BMI was 21.78 ± 3.32 kg/m^2 respectively. The mean ± SEM of age for Group I was 19.44 ± 0.17 years, Group II was 18.97 ± 0.15 years, Group III was 20.83 ± 0.22 years and Group IV was 23.03 ± 0.22 years respectively and it was found not significant ($p > 0.05$ #). The mean ± SEM of height for Group I was 165.59 ± 1.22 cms, Group II was 164.25 ± 1.01cms, Group III was 165.59 ± 0.97 cms and Group IV was 167.67 ± 1.07 cms respectively and it was found not significant ($p > 0.05$ #).

The mean ± SEM of weight for Group I was 60.68 ± 1.15 kgs, Group II was 47.14 ± 0.68 kgs, Group III was 74.18 ± 0.95 kgs and Group IV was 91.86 ± 1.06 kgs respectively and it was found highly significant ($p < 0.01$ **). The mean ± SEM of BMI for Group I was 21.86 ± 0.19 kg/m^2, Group II was 17.39 ± 0.19 kg/m^2, Group III was 27.11 ± 0.09 kg/m^2 and Group IV was 32.77 ± 0.22 kg/m^2 respectively and it was found very highly significant ($p < 0.001$ ***).

The mean ± SEM of age for Group I M was 19.73 ± 0.26 years, Group II M was 18.93 ± 0.19 years, Group III M was 21.35 ± 0.34 years and Group IV M was 23.2 ± 0.36 years respectively and it was found not significant ($p > 0.05$ #). The mean ± SEM of height for Group I M was 172.64 ± 1.24 cms, Group II M was 169.95 ± 1.19 cms, Group III M was 169.75 ± 1.33 cms and Group IV M was 173.08 ± 1.01 cms respectively and it was found not significant($p >0.05$ #).

The mean ± SEM of weight for Group I M was 66.35 ± 1.27 kgs, Group II M was 51.45 ± 0.71 kgs, Group III M was 77.39 ± 1.15 kgs and Group IV M was 97.43 ± 1.15 kgs respectively and it was found very highly significant ($p < 0.001$ ***). The mean ± SEM of height Group I F was 158.53 ± 1.39 cms, Group II F was 158.55 ± 1.05 cms, Group III F was 161.43 ± 1.07 cms and Group IV F was 162.03 ± 1.44 cms respectively and it was found not significant ($p > 0.05$ #).

The mean ± SEM of weight for Group I F was 53.01 ± 1.45 kgs, Group II F was 42.83 ± 0.66 kgs, Group III F was 70.76 ± 0.96 kgs and Group IV F was 85.98 ± 1.25 kgs respectively and it was found very highly significant ($p < 0.001$ ***). The mean ± SEM of BMI for Group I F was 21.75 ± 0.27 kg/m^2, Group II F was 16.99 ± 0.13 kg/m^2, Group III F was 27.21 ± 0.2 kg/m^2 and Group IV F was 32.9 ± 0.33 kg/m^2 respectively and it was found very highly significant to obese Group ($p < 0.001$ ***), highly significant to overweight Group ($p < 0.01$**) and not significant to underweight Group ($p > 0.05$ #).

The mean ± SEM for Pulse Rate was 85.39 ± 1.19 beats/min, SBP was 118.88 ± 1.62 mmHg, DBP was 76.98 ± 1.31 mmHg, MAP was 91.05 ± 1.36 mmHg and PEFR was 338.94 ± 18.2 L/min respectively. The mean ± SEM of Pulse Rate for Group I was 82.51 ± 1.18 beats/min, Group II was 86.02 ± 1.47 beats/min, Group III was 84.77 ± 1.26 beats/min and Group IV was 88.24 ± 1.22 beats/min respectively and it was found very highly significant ($p < 0.001$ ***).

The mean ± SEM of SBP for Group I was 118.62 ± 0.94 mmHg, Group II was 120.86 ± 0.78 mmHg, Group III was 120.86 ± 0.78 mmHg and Group IV was 121.71 ± 0.61 mmHg respectively and it was found very highly significant ($p < 0.001$ ***). The mean ± SEM of DBP for Group I was 77.89 ± 1.01 mmHg, Group II was 73.22 ± 0.83 mmHg, Group III was 78.07 ± 0.86 mmHg and Group IV was 79.32 ± 0.6 mmHg respectively and it was found highly significant

Parameters	Mean ± SEM
Age (years)	20.57±0.91
Height (cm)	165.86±0.64
Weight (kg)	68.46±9.55
BMI (Kg/m^2)	21.78±3.32

Table-1: Anthropometric parameters of all subjects (n=320)

Parameters	Group-I n - 80 Mean ±SEM	Group-II n- 80 Mean ± SEM	Group-III n-80 Mean ± SEM	Group-IV n-80 Mean ± SEM	P value
Age (years)	19.44±0.17	18.97± 0.15	20.83±0.22	23.03±0.22	> 0.05 #
Height (cm)	165.59±1.22	164.25±1.01	165.59±0.97	167.67±1.07	> 0.05 #
Weight (kg)	60.68±1.15	47.14±0.68	74.18±0.95	91.86±1.06	< 0.01 **
BMI (Kg/m^2)	21.86±0.19	17.39±0.19 #	27.11±0.09	32.77±0.22	<0.001***

Table-2: BMI based comparison of anthropometric parameters of all subjects (n-320).

Parameters	Group- I F n - 40 Mean ±SEM	Group-II F n- 40 mean ± SEM	Group-III F n-40 mean ± SEM	Group- IV F n-40 mean ± SEM	P Value
Age (years)	19.15±0.21	19±0.23	20.33±0.28	22.95±0.31	> 0.05 #
Height (cm)	158.53±1.39	158.55±1.05	161.43±1.07	162.03±1.44	> 0.05 #
Weight (kg)	55.01±1.45	42.83±0.66	70.76±0.96	85.98±1.25	<0.001***
BMI (Kg/m^2)	21.75±0.27	16.99±0.13 #	27.21±0.2 *	32.9±0.33	<0.001***

Table-3: BMI based comparison of anthropometric parameters of all female Subjects (n-160).

Parameters	Mean ± SEM
Pulse Rate (beats/min)	85.39 ± 1.19
SBP (mmHg)	118.88 ± 1.62
DBP (mmHg)	76.98 ± 1.31
MAP (mmHg)	91.05 ± 1.36
PEFR (L/min)	338.94 ± 18.2

Table-4: Cardiorespiratory parameters of all subjects (n-320).

Parameters	Group- I n – 80 Mean ±SEM	Group- II n- 80 Mean ± SEM	Group-III n-80 Mean ± SEM	Group- IV n-80 Mean ± SEM	P value
Pulse Rate (beats/min)	82.54±1.18	86.02±1.47	84.77±1.26	88.24±1.22	<0.001 ***
SBP (mmHg)	118.62±0.94	114.41±1.01	120.86±0.78	121.71±0.61	<0.001***
DBP (mmHg)	77.29±1.01	73.22±0.83	78.07±0.86	79.32±0.6	<0.01**
MAP (mmHg)	91.17±0.89	87.2±0.87	92.37±0.76	93.44±0.58	< 0.05 *
PEFR (L/min)	382.13±9.98	312±9.19	355.75±7.92	305.13±8.65	<0.001***

Table-5: BMI based comparison of cardio respiratory parameters of all subjects (n-320)

(p < 0.01 **).

The mean ± SEM of MAP for Group I was 91.17 ± 0.89 mmHg, Group II was 87.2 ± 0.87 mmHg, Group III was 92.37 ± 0.76 mmHg and Group IV was 93.44 ± 0.58 mmHg respectively and it was found significant (p < 0.05 *). The mean ± SEM of PEFR for Group I was 382.13 ± 9.98 L/min, Group II was 312± 9.19 L/min, Group III was 355.75 ± 7.92 L/min and Group IV was 305.13 ± 8.65 L/min respectively and it was found very highly significant

(p < 0.001***).

The mean ± SEM of Pulse Rate for Group I M was 81.9 ± 1.55 beats/min, Group II M was 82± 1.76 beats/min, Group III M was 86.98 ± 1.52 beats/min and Group IV M was 90.2 ± 1.86 beats/per respectively and it was found very highly significant (p < 0.001 ***). The mean ± SEM of SBP for Group I M was 121.55 ± 1.2 mmHg, Group II M was 118.13 ± 0.63 mmHg, Group III M was 123.43 ± 1.05 mmHg and Group IV M was 124.13 ± 0.9 mmHg respectively and it was found not significant (p > 0.05 #).

The mean ± SEM of DBP for Group I M was 79.48 ± 1.27 mmHg, Group II M was 74.38 ± 0.83 mmHg, Group III M was 79.7 ± 1.16 mmHg and Group IV M was 81.55 ± 074 mmHg respectively and it was found not significant

(p > 0.05#). The mean ± SEM of MAP for Group I M was 93.75 ± 1.12 mmHg, Group II M was 89.45 ± 0.72 mmHg, Group III M was 94.25 ± 1.05 mmHg and Group IV M was 95.73 ± 0.75 mmHg respectively and it was found not significant

(p > 0.05#).

The mean ± SEM of PEFR for Group I M was 435.75 ± 13.48 L/min, Group II M was 365.25 ± 12.12 L/min, Group III M was 390.75 ± 12.66 L/min and Group IV M was 362.5 ± 10.85 L/min respectively and it was found very highly significant (p < 0.001 ***).

The mean ± SEM of Pulse Rate for Group I F was 83.18 ± 1.79 beats/min. The mean ± SEM of DBP for Group I F was 75.1 ± 1.57 mmHg, Group II F was 72.05 ± 1.43 mmHg, Group III F was 76.25 ± 1.25 mmHg and Group IV F was 76.87 ± 0.85 mmHg respectively and it was found highly significant

($p < 0.01$ **).

The mean ± SEM of MAP for Group I F was 88.57 ± 1.28 mmHg, Group II F was 84.95 ± 1.53 mmHg, Group III F was 90.28 ± 1.06 mmHg and Group IV F was 90.93 ± 0.77 mmHg respectively and it was found significant ($p < 0.05$ *) and highly significant to underweight Group ($p < 0.01$ **). The mean ± SEM of PEFR for Group I F was 328.5 ± 8.64 L/min, Group II F was 260.25 ± 7.36 L/min, Group III F was 320.75 ± 5.56 L/min and Group IV F was 297 ± 5.96 L/min respectively and it was found very highly significant

($p < 0.001$ ***). The mean ± SEM for PEFR of Group A subjects was 388.56 ± 6.53 L/min, and Group B was 301± 4.05 L/min respectively and it was found very highly significant ($p < 0.001$ ***).

CONCLUSION

The study demonstrated that BMI is closely associated with MAP & PEFR. MAP is derived from the combination of standard measures of SBP and DBP. It allows description of BP as a single measurement. Our study concluded that on increasing BMI, the MAP was increased. The weight gain stimulates sympathetic activation, and also that probably insulin and leptin are involved. Also activation of the rennin – angiotensin system as well as physical compression of kidney may be important factors in linking body weight and elevated blood pressure.

Also the study concluded that with increase BMI, the PEFR decreases which signifies that there is bronchoconstriction due to various mechanisms like direct action of adipose tissue on the airways via a decrease in the luminal diameter of the airway and an increase in the probability of airway collapse.

Thus, in subjects of higher BMI the chance of bronchial asthma is more. The mechanisms involved in this association include increased BHR, functional respiratory decline with decreased respiratory volume and flow, chronic systemic inflammation triggered by increased levels of inflammatory cytokines and chemokines, and factors derived from adipocytes, including leptin, adiponectin, and plasminogen activator inhibitor. Therefore, we advised of counseled the subjects regarding the adverse effect of high BMI and to practice regular weight loss by regular exercise and suitable diet pattern to live free of asthma.

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Source of Support: Nil; **Conflict of Interest:** None

Submitted: 21-10-2021; **Accepted:** 24-11-2021; **Published:** 31-12-2021