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PEAK EXPIRATORY FLOW RATE IN SEDENTARY PRE-OBESE WOMEN: AN OBSERVATIONAL STUDY

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Abstract:

Peak Expiratory Flow Rate (PEFR) is an important indicator of pulmonary function and reflects the maximum speed of expiration. It is widely used to assess airway function and respiratory health. Sedentary lifestyle and increasing prevalence of overweight and pre-obesity have become major public health concerns worldwide.

Pre-obesity, characterized by increased body mass index (BMI), can affect respiratory mechanics by reducing lung volumes, increasing airway resistance, and limiting chest wall expansion. Sedentary individuals may also have reduced respiratory muscle strength and endurance, which may further influence pulmonary function.

Women with sedentary habits and higher body weight may therefore experience alterations in respiratory parameters such as PEFR. Understanding the relationship between sedentary lifestyle and PEFR in pre-obese women is important for early identification of respiratory impairment and for promoting preventive health strategies.

Keywords:

Peak Expiratory Flow Rate, Sedentary Lifestyle, Pre-Obese Women, Pulmonary Function, Body Mass Index, Respiratory Health.

Introduction:

Sedentary lifestyle, defined as “any waking behaviour characterized by an energy of 1.5 metabolic equivalents (MET), while in a sitting, reclining, or lying posture. Sedentary lifestyle is the practice of living in place for a long time it has become increasingly prevalent in today’s digital and desk-bound world[1,8]

According to a survey report conducted in 2008, by the United States National Health Survey, 36% of adults are totally inactive while 59% have never participated in vigorous physical activity lasting more than 10 minutes per week.

A person living a sedentary lifestyle is often sitting or lying down engaged in an activity like using mobiles phones or computers or television for the rest of the day. Sedentary lifestyle could be associated with less efficient pulmonary function. It is also due to advancements in modern technologies.

A sedentary lifestyle is the most modifiable risk factor for cardiovascular diseases. It is also important for a sedentary population to indulge themselves in regular exercise to maintain proper health as it has been shown that physical inactivity and a negative lifestyle in the sedentary population have seriously threatened the health and it deteriorates the human body[1]

According to the BMI for Asian population if body mass index (BMI) is between 23-24.9 kg/m2 is considered as pre-obese sedentary women[9]

Sedentary behavior and pulmonary function in a women who works for more than half a day i.e. 6-8 hrs continuously in front of technologies (sedentary pre-obese women) with no sign of physical activities. Sedentary living affects people in such a way that it makes them lazy and prone to fatigue. By being inactive muscle tissues are lost which causes muscle atrophy and makes us lose strength, making a person physically weak and fatigue[1]

In sedentary individuals, as fat accumulation in the abdominal region alter respiratory biomechanics. The diaphragm becomes overstretched, and its contractile efficiency is compromised. This leads to decreased pulmonary volumes, increased airway resistance, and a length-tension disadvantage, all of which raise the work of breathing and oxygen demand on the respiratory system[9]

Obesity has many effects on pulmonary function. The respiratory rate is usually increased in order to compensate for the normally depressed tidal volumes. Total respiratory system compliance is decreased; lung volumes and especially Expiratory Reserve Volume (ERV), are the most consistently affected respiratory parameters[2]

Approximately 35% of women are overweight /pre-obese. These women are at increased risk of diabetes, hypertension, hypercholesterolemia, orthopedic disorders, and some malignancies[13]

The study was to evaluate the effects of a sedentary lifestyle on lung function using peak expiratory flow rate in pre-obese women[1]

Although overweight/ pre-obese people tend to develop metabolic disease, an overweight condition does not necessarily equal metabolic disease. so predicting metabolic syndrome by anthropometric measurements only might be problematic. Simple metabolic markers can help identify overweight individuals who meet sufficient metabolic syndrome criteria to be considered at increased cardiovascular risk[14]

Peak expiratory flow rate, the maximum rate of air expelled during a forced expiration[3]

Peak expiratory flow rate (PEFR) is a person's maximum speed of expiration. It measures the airflow through bronchi and thus the degree of obstruction in airways. PEFR is the maximum rate of airflow that can generated during forced expiratory maneuver starting from total lung capacity.

Total lung capacity refers to the total amount of air in the lungs after taking the deepest breath possible which is about 6,000 ml[1]

PEFR is one of the important parameters in pulmonary function testing that has evolved as a clinical tool for the diagnosis and prognosis of respiratory diseases due to airflow limitations, its severity and variations.

The PEFR of healthy young Indian males and females is around 500and 350 L/min, respectively[2]

Pulmonary functional status was assessed by recording peak expiratory flow rate (PEFR). PEFR was selected because it is widely accepted as a reliable parameter of pulmonary functions and is simple to perform as a bed-side test. Hadorn introduced PEFR in 1942 and it was accepted as a parameter of pulmonary function test (PFT) in 1949.

The simplicity of the method is its main advantage. It is measured by using a standard Wright Peak Flow meter or mini Wright meter[4]

It is a small handheld device internationally recognized "GOLD STANDARD" in peak flow measurement which measures the speed at which air is exhaled from your lungs, giving you a measurement of how well your airways are working.

Peak expiratory flow is typically measured in units of litres per minute. Lung studies give a good estimate of physical endurance and PEFR is one of the most sensitive parameters to assess lung function[9]

PEFR in postmenopausal women is lower than in premenopausal women. In addition, PEFR decreases with age due to degenerative changes in the musculoskeletal system, resulting in a decrease in respiratory muscle strength. Furthermore, PEFR shows some deterioration with increasing BMI in the senior age group[5]

women experience early fatigue, respiratory discomfort, and a reduced capacity for physical activity, which further perpetuates inactivity and deconditioning. Physical fitness appears to be similar to the physical activity in its relation to morbidity and mortality but is more strongly predictive of health outcomes than physical activity[9,10]

Hence to create awareness among the population to lower down the risk of cardiovascular diseases with increasing age due to no sign of any aerobic activity, this study is necessary.

NEED OF THE STUDY:

Very less study occurred on PEFR in sedentary pre-obese women and to check the lung function status in sedentary pre-obese women.

Evaluate the effect of a respiratory efficiency in sedentary women.

Understanding PEFR values in sedentary women and comparing them with standard reference values can provide insight into the impact of inactivity of lung function.

Increase in sedentary behavior among urban population – especially in sedentary women due to occupational and lifestyle modification.

To promote the importance of regular physical activity for respiratory health in sedentary women

3.1 Population and sample size

The study population consists of pre-obese women residing in Latur city, with a Body Mass Index (BMI) ranging from 23.0 to 24.9 kg/m². Participants within the age group of 30 to 45 years.

A total sample size of 136 subjects will be included in the study. The participants will be selected using a simple random sampling method to ensure equal representation and to minimize selection bias. Only sedentary women meeting the inclusion criteria will be considered for participation.

This observational cross-sectional study will be conducted over a period of six months.

3.2 Data and Sources of Data

The data for this study will be collected from Latur city. Participants will be recruited from Latur city based on the predefined inclusion criteria.

Anthropometric measurements such as height and weight will be recorded to calculate BMI and confirm pre-obese status. Peak Expiratory Flow Rate (PEFR) will be measured using a peak flow meter under standardized conditions.

Additional relevant information, including demographic details and physical activity levels (to confirm sedentary lifestyle), will be collected through interviews. All data will be collected directly from participants during the study period.

3.3 Theoretical Framework

The theoretical framework of this study is based on the relationship between increased body mass and respiratory function. Pre-obesity is associated with physiological changes such as reduced chest wall compliance, increased fat deposition around the thoracic and abdominal regions, and decreased lung expansion.

These changes can lead to reduced pulmonary function, including a decrease in Peak Expiratory Flow Rate (PEFR). Sedentary lifestyle further contributes to reduced respiratory efficiency and muscle strength, and decline in lung function.

Thus, this study is grounded in the concept that pre-obesity combined with physical inactivity negatively impacts respiratory parameters, and PEFR can serve as a simple, reliable indicator to assess pulmonary function in this population.

Methodology:

- **Study design**-Observational study
- **Study type**-Cross sectional study
- **Study duration**-6 month
- **Study population-** Pre-obese Women (23.0-24.9 BMI) in the age group of 30-45 years.
- **Sampling method**- Simple random sampling
- **Study setting**- Latur city
- **Sample size**- 136
- **Sample formula -** Sample size $n = \frac{Z1^2S^2}{d^2}$

Descriptive Statistics:

It is used to summarize and present the collected data in a meaningful and organized manner. The basic statistical measures will include mean, standard deviation, frequency, and percentage.

The mean and standard deviation will be calculated for continuous variables such as age, Body Mass Index (BMI), and Peak Expiratory Flow Rate (PEFR) to understand the central tendency and variability of the data.

The collected data will be presented in the form of tables, charts, and graphs wherever appropriate for better visualization and interpretation.

This is an observational cross-sectional study. The analysis will primarily on descriptive statistical methods to describe the characteristics of the study population and the distribution of PEFR among sedentary pre-obese women.

Procedure:

Ethical clearance will be taken from the institutional ethical committee.
Participants will be selected according to the inclusion and exclusion criteria.
Consent will be taken from all the participants on consent form.

Using peak flow meter PEFR was calculated. The subjects were instructed to take maximum inspiration and blow into the mouthpiece as rapidly, forcefully and completely as possible. They were trained well to blow into the instrument maintaining a tight sealing between the lips and mouthpiece of the peak flow meter. Standing height was recorded without shoes, with light clothes on a wall by measuring tape. Weight was recorded without shoes and with light clothes on a weighing machine. Body mass index was calculated a BMI=weight in kg / height in m2.

Collection of data and statistical analysis will be done and answer to the research questions will be noted with result

RESULT:

Organization of findings

This section presents the analysis and interpretation of data collected from sedentary pre-obese women from Latur city. The present study was designed to explore the prevalence of obesity among pre-obese women from Latur city. Data collected in this study were tabulated, analyzed and interpreted by using descriptive and inferential statistics. The findings are presented under following sections.

SECTION I : Description of personal variables of Samples.

SECTION II: Description of Mean PEFR scores of the samples.

SECTION I : Description of personal variables of Samples.

The study sample composed of 136 Pre-obese women selected randomly from Latur city.

TABLE 1

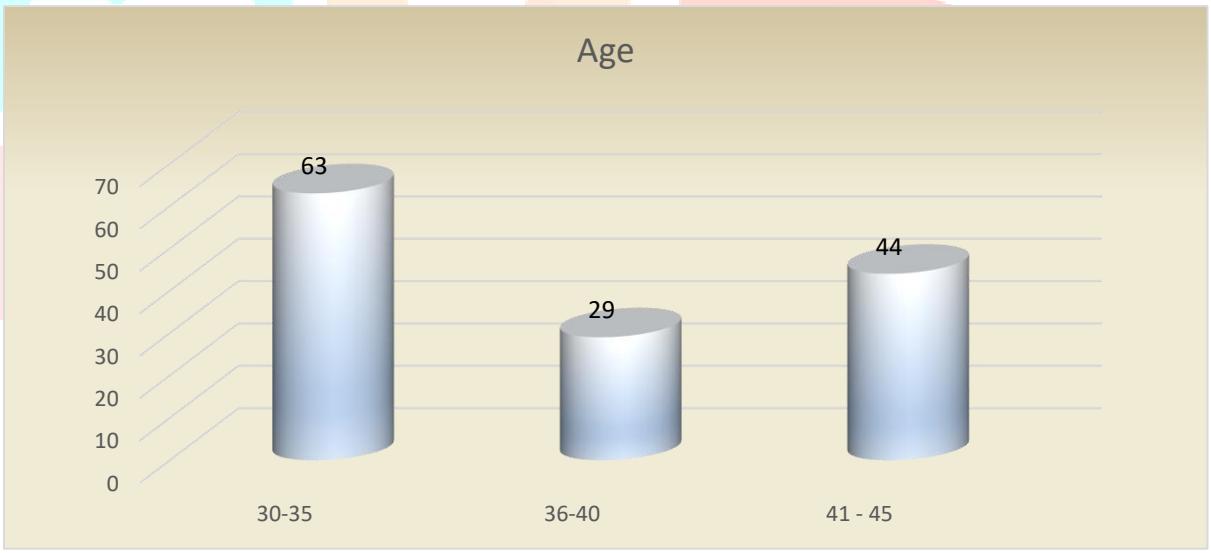
Frequency and Percentage distribution of Samples according to their Personal variables.

Sr.No	Demographic variables	Frequency	Percentage (%)
1.	Age		
	a. 30 -35 Yrs	63	46.32
	b. 36 – 40 Yrs	29	21.00
	c. 41 - 45 Yrs	44	32.35
2.	Occupation		
	a. Bank Employee	29	21.32
	b. House Wife	60	44.12
	c. I.T Professional	10	07.35
	d. Office Worker	12	08.82
	e. Receptionist	13	09.56
	f. Teacher	27	19.85
3.	Place of Residence		
	a. Urban	69	50.74
	b. Rural	67	48.26
4	Weight		
	a. Below 50 Kgs	01	00.74
	b. 50 – 55 Kgs	62	45.59
	c. 56 – 60 Kgs	64	47.06
	d. 61 – 65 Kgs	08	05.88
	e. 66 – 70 Kgs	01	0.74
5	Height		
	a. 145 – 150 cms	39	28.68
	b. 151 – 155 cms	58	42.65

	c. 156 – 160 cms **d. 161 – 165 cms**	**36** **03**	**28.47** **02.21**
6.	**BMI** **a. 23 – 23.5** **b. 23.6 – 24** **c. 24.1 – 24.5** **d. 24.6 – 25**	 **41** **32** **28** **35**	 **30.15** **23.53** **20.59** **25.74**
7.	**Rate of Excretion** **a. 11** **b. 12** **c. 13**	 **47** **39** **50**	 **34.56** **28.68** **36.76**
8.	**PEFR** **a. Mild** **b. Moderate** **c. Severe**	 **61** **41** **34**	 **44.85** **30.15** **25.00**

Age :-

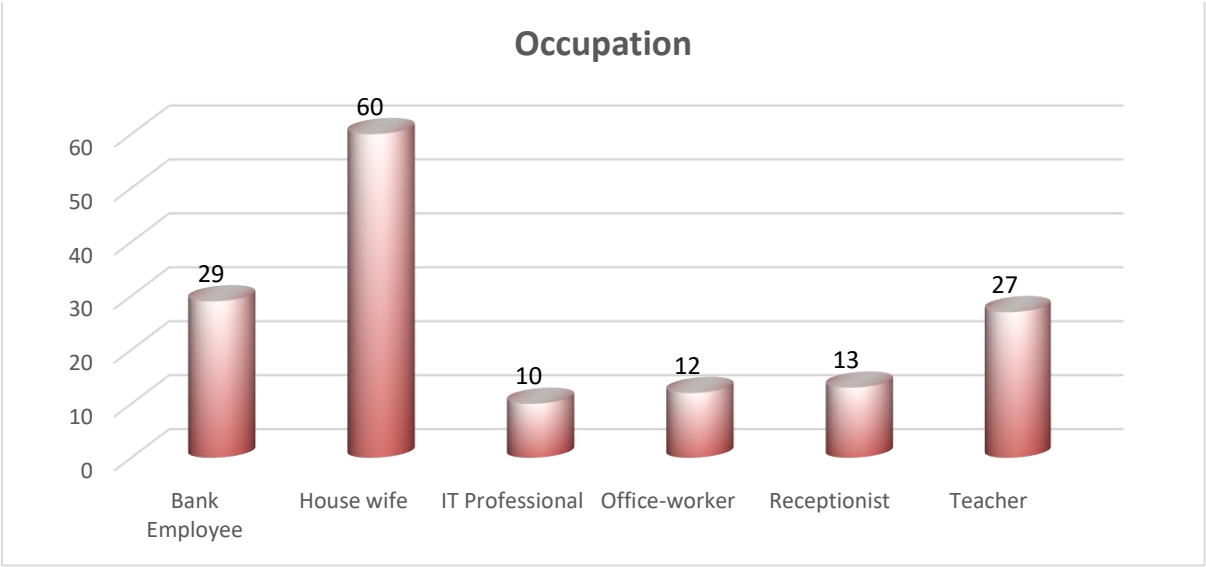
The data presented in the Table.no-1 and Figure.no-01 shows the age of the samples varied from 30 - 45 years, Majority of the samples i.e 63 (46.32 %) were aged between 30 to 35 yrs followed by 44 (32.35 %)were aged from 41 to 45 years and the least 29 (21.00 %) were aged between 36 to 40 yrs.



Figire.no-01: Distribution of Samples according to their Age

Occupation:-

The data presented in the Table.no-01 and Figure.no-02 reveals the distribution of Samples according to their Occupation, Majority of the samples i.e 60 (44.12 %) reported to be House- wife followed by 29 (21.32 %) were reported to be Bank employee while 27 (19.85 %) were reported to be Teachers, while 13 (09.58 %) were reported to be Receptionists and the least i.e., 10 (07.35 %) were reported be I.T professionals.



Figire.no-02: Distribution of Samples according to their Occupation.

Place of Residence:-

The data presented in the Table.no-01 and Figure.no-03 reveals the distribution of Samples according to their place of Residence, Majority of the samples i.e 69 (50.74%) were reported to be residents of Urban area, followed by 67 (49.26 %) were reported to be from Rural area and No samples reported to be from semi-urban area.

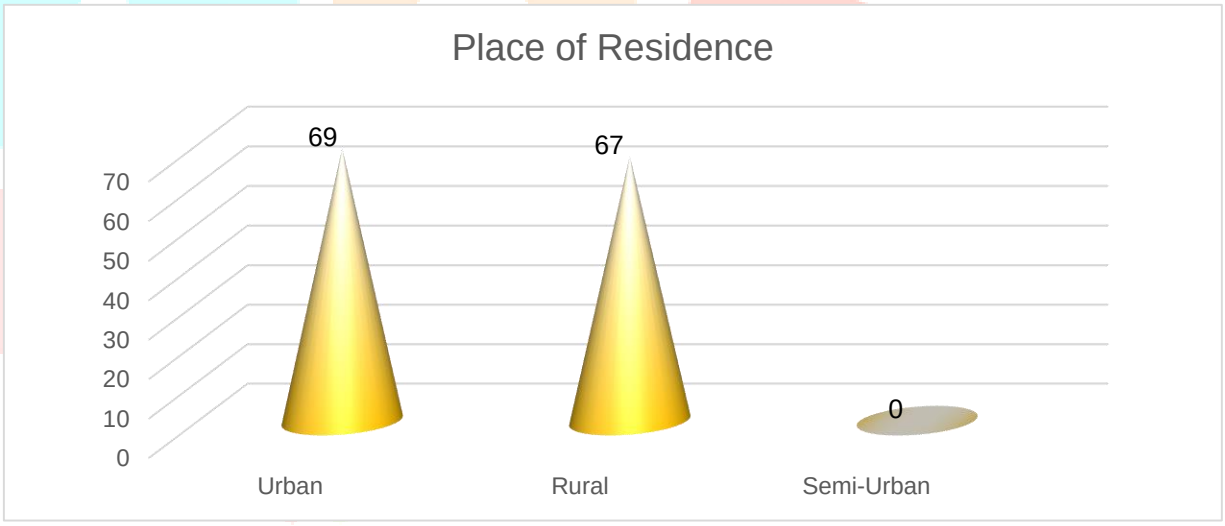


Figure.no-03 : Distribution of Samples according to their Place of Residence.

Weight:-

The data presented in the Table.no-01 and Figure.on-04 revels the distribution of samples according to their Weight, Majority of the samples, 64 (47.06 %) reported to weigh ranging between 56 to 60 Kgs, followed by 62 (45.59 %) reported to be weighing between 50 to 55 Kgs, while 08(05.88 %) were reported to be weighing between 61 to 65 Kgs and the least 01 (0.74%) were reported to be weighing between 66 to 70 kgs and similar samples reported to be weighing below 50 kgs.

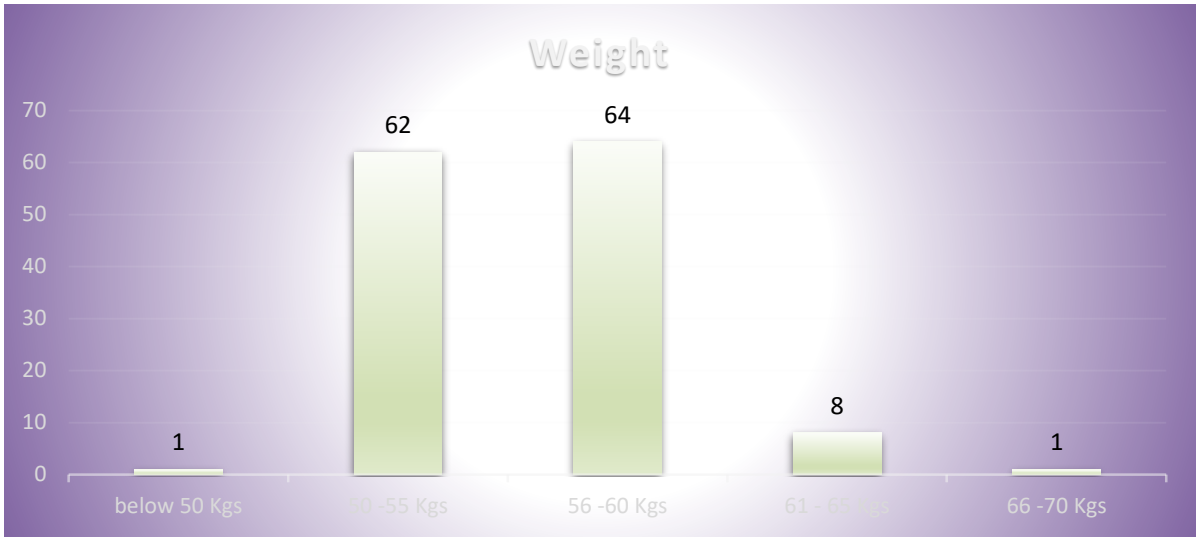


Figure.no-04 : Distribution of Samples according to their Weight.

Height : -

The data presented in the Table.no-01 and Figure.no-05 reveals the distribution of samples according to their height, Majority of the samples 58 (42.65 %) height ranged between 151 to 155 cms followed by 39 (28.68 %) reported their height ranging between 145 to 150 cms, while 36 (26.47 %) reported their height ranging between 156 to 160 cms and the least 03 (02.21 %) reported their height ranging between 161 to 165 cms

Figure.no-05 : Distribution of Samples according to their Height.

BMI :-

The data presented in the Table.no-01 and Figure.no-06 reveals the distribution of samples according to their Height, Majority of the samples 41 (30.15 %) reported their ranging between 23 to 23.5, followed by 35 (25.74 %) reported their BMI ranging between 24.6 to 25 while 32 (23.53 %) reported their BMI ranging between 23.6 to 24 and the least 28 (20.59 %) reported their BMI ranging between 24.1 to 24.5.

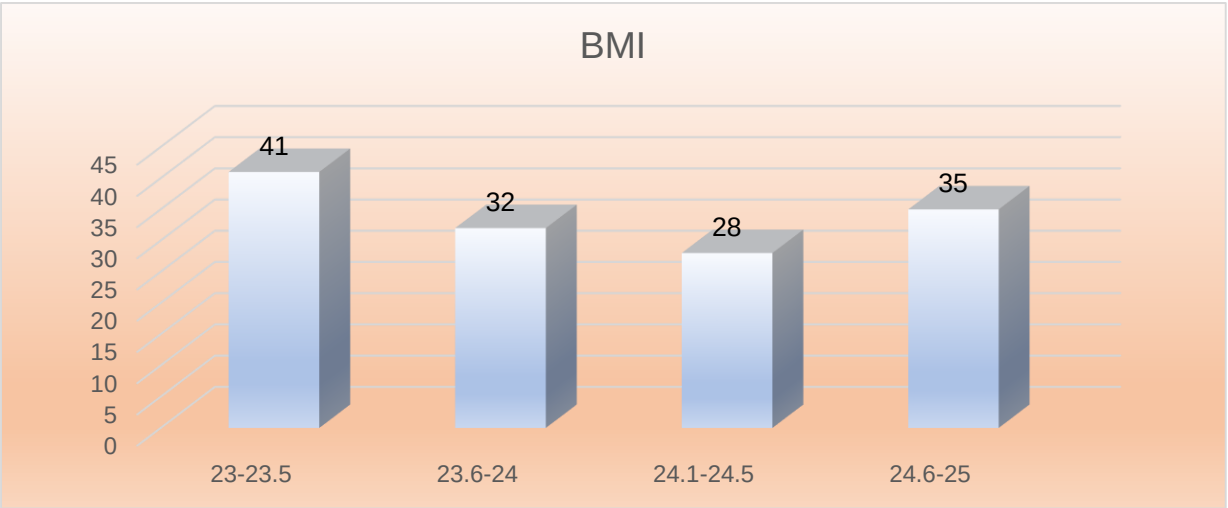


Figure.no-06 : Distribution of Samples according to their BMI.

Rate of Excretion : -

The data presented in Table.no-01 and Figure.no-07 reveals the distribution of samples according to their Rate of Excertion, Majority of samples 50 (36.76%) reported 13 as their excretion rate followed by 47 (34.56 %) reported 11 as their rate of Excretion and the least 39 (28.58 %) reported 12 as their rate of Excretion

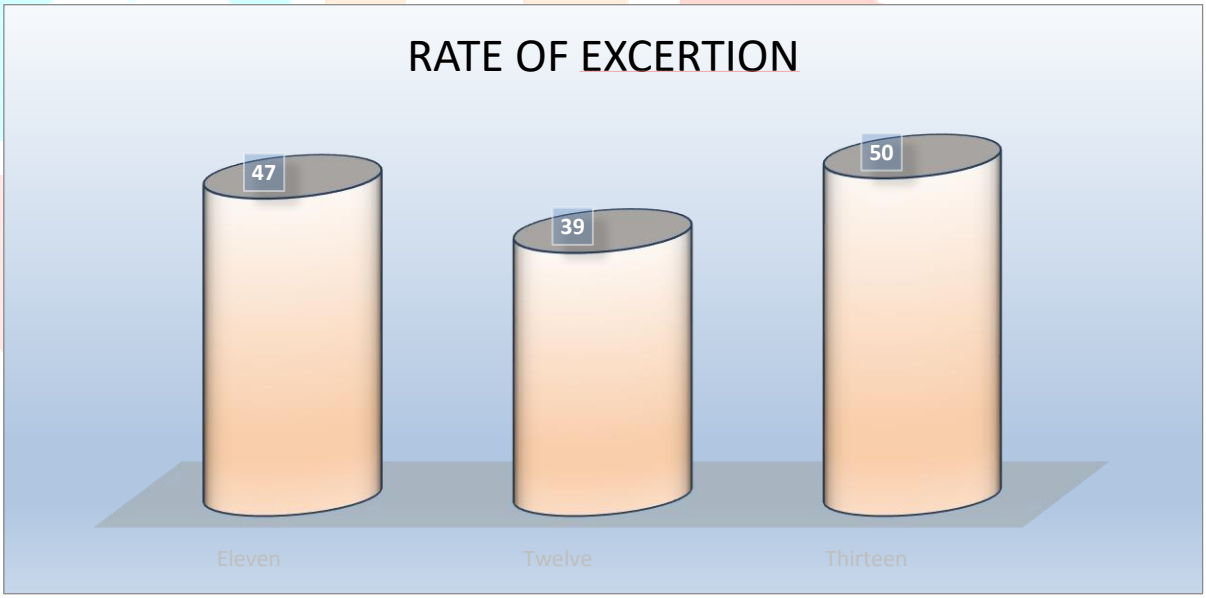


Figure.no-07 : Distribution of Samples according to their Rate of Excretion.

Levels of PFER :-

The data presented in the table.no-01 and Figure.no-08 reveals the distribution of samples according to their PFER levels, majority of the samples 61 (44.85 %) were reported to be in the the Mild range followed by 41 (30.15%) were found to be in the Moderate range and the least 34 (25 %) were found to be in the Severe levels of PFER.

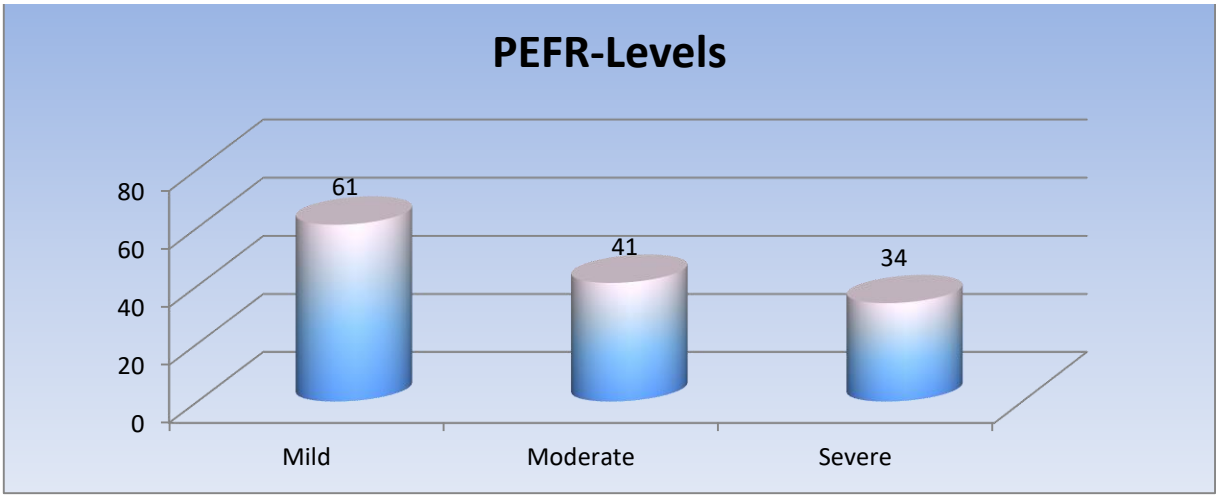


Figure.no-08 : Distribution of Samples according to their PFER levels.

SECTION II: Description of Mean PEFR scores of the Samples.

The mean PEFR scores obtained by the samples was tabulated to a master sheet. Mean, standard deviation, median and range of PEFR were computed. The findings were presented in the Table 2.

Table – 2

Mean, Standard Deviation, Median, and Range of PEFR among Samples.

N=136

PEFR SCORES				
Mean	**Median**	**Mode**	**Range**	**Standard Deviation**
26.03	**25**	**350**	**90 - 410**	**±10.058**

The data presented in Table 2 shows the PFER scores among the samples, The PEFR scores ranged from 90-410, while the mean PEFR score was26.03, Median was 25 and Mode was 350 with standard deviation ±10.058.

DISCUSSION:

The study was conducted find out the peak expiratory flow rate in sedentary pre-obese women from Latur city. The present study includes 136 samples which includes Pre-obese sedentary women's, Samples responded which was based on PEFR.

In our study, Majority samples belonged to the age category of 30 to 35 years which constituted around 46.32 % (63) and the least 21.32 % (29) belonged to the age group of 36 to 40 years.

Occupation wise majority 44.12 % (60) were house wife and the least 07.35 % (10) were I.T professionals, Place of Residence, majority 50.74 %(69) were residing in Urban area,.

Weight wise majority 47 % (64) weighted between 56 to 60 Kgs, Height wise majority 42.56 % (36) stood 156 to 160 cms and the least 02.21 % (03) stood 161 to 165 cms.

BMI wise majority 30.15 % (41) had BMI range between 23 to 23.5 and the least 20.59 % (28) had BMI range between 24.1 to 24.5.

Female who were aged between 41 to 45 were prone with the prevalence rate 44.11 according to their PFER levels, majority of the samples 61 (44.85 %) were reported to be in the the Mild range followed by

41 (30.15%) were found to be in the Moderate range and the least 34 (25 %) were found to be in the Severe levels of PFER%.

Occupation wise Receptionsts were more prone with prevalence rate 26.47%, Residence wise Urban dwellers had higher prevalence rate with 91.71 % and BMI wise samples whose BMI ranged between 24.6 to 25 had higher prevalce rate 48.35%.

The study found that women aged 41–45 years showed a higher prevalence of reduced PEFR (44.11%). This trend may be explained by age-related physiological changes such as:

- Decreased lung elasticity
- Reduced chest wall compliance
- Gradual decline in respiratory muscle strength

With increasing age, these changes may be exacerbated by excess body weight, leading to further compromise in pulmonary function.

CONCLUSION:

This study suggests that sedentary lifestyle and increasing BMI may have a negative impact on pulmonary function among pre-obese women.

Therefore, the study highlights the importance of early lifestyle modifications, regular physical activity, and weight management to improve respiratory health and prevent further decline in pulmonary function among pre-obese women.

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