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Clinical Profile of Obese Individuals with Special Reference to Pulmonary Function Test Including Blood Glucose, Serum Creatinine and Blood Urea

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Abstract: ***Background: Obesity and overweight is defined as a chronic medical condition characterized by excessive accumulation of fat in various part of human body that causes a generalized increase in body mass. Obesity has many deleterious effect on respiratory functions due to changes in respiratory mechanics. Obesity is one of the significant global health risk factor and has been associated with an increased incidence of diabetes mellitus, dyslipidemia, cerebral stroke, cardiovascular diseases, hypertension, increased risk of coronary artery disease, osteoarthritis, gall stones, polycystic ovarian disease, cancerous condition like Carcinoma endometrium, Carcinoma breast, Carcinoma prostate and Carcinoma of colon with increased morbidity and mortality. Objective: The aim of present study was to study the clinical profile of obese individuals in relation to their pulmonary function test, blood glucose, serum creatinine and blood urea levels. Material and Method: The study group, comprised100 individuals, aged between 18 -60years. They were subjected to Pulmonary function test and various pathological test which were compared with control groups and significantly modulated, statistically by using student's t test. Result: Significantly decreased values of Pulmonary function test and increased values of blood glucose, serum creatinine and blood urea levels were found among overweight and obese individuals (P <.001). Conclusion: We concluded that regular physical activity, high intake of diet rich in fiber and non-starchy foods and good eating habits have been recommended as preventive measures against decreased values of Pulmonary function test and increased values of blood glucose, serum creatinine and blood urea levels in overweight and obesity.***

Keywords: Obese, Pulmonary Function Test, Blood glucose, Serum creatinine, Blood urea

1. Introduction

Obesity has affected numerous aspects of human life and society. The health hazards associated with obesity were well known to ancient Greek physician Hippocrates who stated that sudden death is more common in natural fat than in lean. Ancient clinical observation suggest that obesity was already recognized in association with diabetes and sudden death, although the significance of morbidity and excess mortality conferred by overweight and obesity has been appreciated much more recently. Excess weight around abdomen was associated with decreased life expectancy. The adipocyte was recognized as specific cell type and growth and development of fat cell, was described by Hasall. The risk has been confirmed by large number of systematic studies in numerous population. BMI has shown to correlate with body fat content and risk of co-morbidities in obesity [1]

WHO classification of obesity which stratifies increasing degree of risk with increasing BMI. Pulmonary function in obese subjects with normal FEV1/FVC found that there are reductions in FEV 1 and FVC. Both FEV 1 and FVC were similarly reduced, the FEV1 to FVC ratio was normal and static lung volumes were reduced.[2]

Study on effects of overall obesity and fat distribution on ventilatory function found that Body fat distribution has independent effects on ventilatory function, the FEV1 to FVC ratio decreases with increasing BMI in overweight and obese individuals.[3,4,5] Alterations in the components of the vital capacity suggest damage to the chest mechanics caused by obesity probably due to a reduction of the maximal voluntary ventilation.[6] WHR had the strongest relationship with type 2 diabetes, dyslipidaemia (women only) and hypertension whereas BMI had a stronger association and dyslipidaemia in women and type 2 diabetes in men[7]

Study on relation of Waist circumference with pulmonary function was carried found WC was negatively associated with forced vital capacity and forced expiratory volume in 1s, and the associations were consistent across sex, age and BMI categories.[8]

Anthropometric studies in relation to Renal Function observed that subjects with increased BMI, WC and WHR had significantly higher levels of serum creatinine than the subjects with normal measurements. The level of fasting plasma glucose were significantly higher in subjects with increased BMI and WC.[9] The increased physical activity can reduce the risk of type 2 diabetes with both normal and impaired blood glucose regulation.[10] Now WHO has developed, "Global Action Plan" for prevention and control of non-communicable diseases 2013-2020 which aims to achieve 25% relative reduction in premature mortality from non-communicable diseases by 2025 and a halt in rise of global obesity. The implementation plan to guide countries in taking action to implement the recommendations of the Commission was welcomed by the World Health Assembly in 2017.[11] The aim of our study is to assess the lung function and its changes as compared to non obese apparently normal individuals, which can be prevented at an early stage in overweight and obese persons, thus we can reduce the global burden of diseases in obese and subsequent co-morbid conditions in our society

2. Material and Method

Study group were selected from overweight and obese individuals with body mass index BMI more than 24.9 Kg/m2, attending the Medicine Outpatient, Department of our institution. The study comprised of 100 individuals. Physically fit, obese and overweight persons, aged 18 to 60 year, of both sexes, comprised 55 male and 45 female subjects, presenting with minor ailments like cough, cold and body ache etc were screened and selected from general population after anthropometric measurements. Careful detailed history was taken and thorough clinical examination was done and individuals were subjected to Pulmonary function test and routine investigation. The study protocol was explained to the subjects and written consent obtained. Approval by ethical committee of S.S. Medical College, Rewa, M. P., was obtained. All the volunteers were clinically examined to rule out any systemic diseases. All subjects were non-alcoholic and non-smokers.

Anthropometric Measurements Like
Weight
Height
Body Mass Index
Waist circumference
Hip circumference
Waist Hip ratio
Pulse and Blood Pressure were determined.

1) **Weight:** The weight of subjects was taken by weighing machine with casual wear without shoes or foot wear in kilograms.
2) **Height:** The standing height was measured without shoes with the subjects back to a vertical back board. Both the heels were placed together, touching the base of vertical board.
3) **Body Mass Index (BMI)** BMI= weight (kg)/height (m^2)[1]. Weight was classified according to BMI as per WHO classification: [12]

Table 4.1

S.No	Weight	Body Mass Index (Bmi), In Kg/M^2
01	Underweight	Less than or equal to 18.5
02	Normal Range	18.5 to 24.9
03	Over weight	25.0 to 29.9
04	Obese	Equal or more than 30
	Class I	30 to 34.9
	Class II	35 to 39.9
	Class III	Equal or more than 40

4) **Waist circumference:** It was measured in centimetres midway between lower rib and iliac crest in a horizontal plane while the Subject was standing with the abdomen relaxed, at the end of normal expiration by using non elastic measuring tape. (WC ≥ 102 cm in men and ≥ 88 cm in women)[12]
5) **Hip circumference:** It was measured in centimetres at widest girth of hip by using non elastic measuring tape.[12]
6) **Waist Hip ratio:** It was calculated from above as a ratio of Waist Hip circumference (≥ 0.9 in males and ≥ 0.85 in females). [12]
7) **Examination of Pulse:-** The right forearm of the subject was held in the semi prone position and the radial pulse is felt for, with the middle three fingers of the examiner's right hand. [13]
8) **Measurement of Blood pressure** In each subject blood pressure was measured on the right arm with standard mercury sphygmomanometer. The instrument was kept at the level of heart. The subjects were asked to rest in supine posture for at least 5 minutes. The upper arm was thoroughly relaxed and cuff was tied snugly to the arm.[14]

Table 4.2: JNC 7 Classification of blood pressure levels[15]

Blood pressure classification	SBP mmHg	DBP mmHg
Normal	≤120	≤80
Prehypertension	120-139	80-89
Stage 1 hypertension	140-159	90-99
Stage 2 hypertension	≥160	≥100

[Classification as per Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC 7)]

Spirometry Pulmonary function test by computerised spirometer "Spiroexcel PC Based Pulmonary Function Test, (Medicaids)" in Department of Physiology.The various parameters measured are as follows:
1) Forced expiratory volume in 1 second (FEV1)
2) Forced vital capacity (FVC)
3) FEV1/FVC ratio
4) Peak expiratory flow (PEF)
5) Maximum voluntary ventilation (MVV)
6) Mid forced expiratory flow

Measurement of Fasting & Post Prandial Blood glucose, Serum creatinine and Blood urea Estimation of Fasting & Post Prandial Blood glucose , Serum creatinine and Blood urea was done by A 25 Semi automatic Biochemical Analyser at Pathology Department of our institution.

Classification of Blood Glucose as per WHO[16]

	Fasting blood Glucose in mg/dl	2 hours Post Glucose load in mg/dl
Normal	≤ 110	≤ 140
Impaired Glucose	110-125	140-199
Diabetes Mellitus	≥ 126	≥ 200

Normal Serum Creatinine and Blood Urea levels

	Creatinine levels in mg/dl	Blood Urea levels in gms/dl
Male	0.6-1.2	19-40
Female	0.5-1.1	

3. Statistics

The data was analyzed statistically by using statistical software Graph Pad in Stat vs. 3.10 and MS Excel (2003). Statistical analysis of Forced expiratory volume in 1 second (FEV1), Forced vital capacity (FVC), FEV1/FVC ratio, Peak expiratory flow (PEF), Maximum voluntary ventilation (MVV), Mid forced expiratory flow, Fasting & Post Prandial Blood glucose, Serum creatinine and Blood urea were done using student't test and $p < 0.01$ was considered as significant.

4. Results

In study group (Table No. 1),

1) In Overweight subjects -results showed that the values of **Mean Forced Expiratory Volume in one second** were significantly changed ($p < 0.0056$) as compared to normal subjects likewise in obese subjects the results showed that the values of **Mean Forced Expiratory Volume** in one second were more significantly changed ($p < 0.0009$) as compared to normal subjects.
2) In Overweight subjects -results showed that the values of **Mean Forced Vital Capacity** were significantly changed ($p < 0.0199$) as compared to normal subjects likewise in obese subjects the results showed that the values of **Mean Forced Vital Capacity** were more significantly changed ($p < 0.0054$) as compared to normal subjects.
3) 3. In Overweight subjects-results showed that the values of **Mean FEV 1 / FVC Ratio** were significantly changed ($p < 0.086$) as compared to normal subjects likewise in obese subjects the results showed that the values of **Mean FEV 1 / FVC Ratio** were more significantly changed ($p < 0.0122$) as compared to normal subjects.

In study group (Table No. 2),

1) In Overweight subjects-results showed that the values of **Mean Maximum Voluntary Ventilation** were significantly changed ($p < 0.849$) as compared to normal subjects likewise in obese subjects the results showed that the values of **Mean Maximum Voluntary Ventilation** were more significantly changed ($p < 0.347$) as compared to normal subjects.
2) In Overweight subjects-results showed that the values of **Mean Peak Expiratory Flow Rate** were significantly changed ($p < 0.024$) as compared to normal subjects likewise in obese subjects the results showed that the values of **Mean Peak Expiratory Flow Rate** were more significantly changed ($p < 0.0008$) as compared to normal subjects.
3) In Overweight subjects -results showed that the values of **Mean Mid forced Expiratory Flow** were significantly changed ($p < 0.011$) as compared to normal subjects likewise in obese subjects the results showed that the values of **Mean Mid forced Expiratory Flow** were more significantly changed ($p < 0.0005$) as compared to normal subjects.

In study group (Table No. 3),

1) In Overweight subjects -results showed that the values of **Fasting blood glucose in mg/dl** were significantly changed ($p < 0.0049$) as compared to normal subjects likewise in obese subjects the results showed that the values of **Fasting blood glucose in mg/dl** were more significantly changed ($p < 0.0001$) as compared to normal subjects.
2) In Overweight subjects -results showed that the values of **Post prandial blood glucose in mg/dl** were significantly changed ($p < 0.0247$) as compared to normal subjects likewise in obese subjects the results showed that the values of **Post prandial blood glucose in mg/dl** were more significantly changed ($p < 0.0001$) as compared to normal subjects
3) In Overweight subjects -results showed that the values of **Blood urea in gm/dl** were significantly changed ($p < 0.02$) as compared to normal subjects likewise in obese subjects, the results showed that the values of **Blood urea in gm/dl** were more significantly changed ($p < 0.0001$) as compared to normal subjects.
4) In Overweight subjects -results showed that the values of **Serum creatinine in mg/dl** were significantly changed ($p < 0.0364$) as compared to normal subjects likewise in obese subjects the results showed that the values of **Serum creatinine in mg/dl** were more significantly changed ($p < 0.0008$) as compared to normal subjects.

Table 1: Showing Mean Forced Expiratory Volume in one second, Mean Forced Vital Capacity in Normal, Overweight and Obese subjects

	Normal (n=33)	Overweight (n=33)		Obese (n=34)	
		Mean Value S. D.	P Value	Mean Value S. D.	P Value
Mean Forced Expiratory Volume in one second	1.93 ± 0.60	1.54 ± 0.50	0.0056	1.42 ± 0.60	0.0009
Mean Forced Vital Capacity	2.31± 0.70	1.91 ± 0.66	<0.0199	1.80 ± 0.75	0.0054
Mean FEV 1 / FVC Ratio	84.03 ± 8.67	80.46 ± 8.00	0.086	79.29 ± 6.21	0.0122

Table 2: Showing Mean Maximum Voluntary Ventilation, Mean Peak Expiratory Flow Rate and Mean Mid forced Expiratory Flow in Normal, Overweight and Obese subjects

.	Normal (n=33)	Overweight (n=33)		Obese (n=34)	
		Mean Value S. D.	P Value	Mean Value S. D.	P Value
Mean Maximum Voluntary Ventilation	40.14 ± 21.68	38.99 ± 26.94	0.849	35.45 ± 18.82	0.347
Mean Peak Expiratory Flow Rate	3.60 ± 1.39	2.91 ± 1.01	0.024	2.50 ± 1.16	0.0008
Mean Mid forced Expiratory Flow	2.51 ± 1.07	1.90 ± 0.81	0.011	1.68 ± 0.75	0.0005

Table 3: Showing Fasting and Post prandial Blood glucose in mg/dl, Blood urea in gm/dl, Serum creatinine in mg/dl in Normal, Overweight and Obese subjects

Parameters	Normal (n=33)	Overweight (n=33)		Obese (n=34)	
	Mean±SD	Mean±SD	P- Value	Mean±SD	P- Value
Blood glucose (Fasting)in mg/dl	80.78 ± 10.71	89.16 ± 12.57	0.0049	112.61 ± 19.36	<0.0001
Blood glucose (Post prandial) in mg/dl	129.9 ± 9.84	136.93 ± 14.54	0.0247	172.36 ± 32.15	<0.0001
Blood urea in gm/dl	25.23 ± 3.38	27.32 ± 4.15	0.02	32.62 ± 4.67	<0.0001
Serum creatinine in mg/dl	0.99 ± 0.14	1.05 ± 0.08	0.0364	1.11 ± 0.14	0.0008

5. Discussion

The **mean forced expiratory volume in one second, Mean Forced Vital Capacity and mean FEV1/FVC ratio** was found to be decreased in overweight and obese subjects, there was a high significant difference in obese subject but significant difference in overweight subject(Table no 01). Forced expiratory volume in the 1st second and FVC were significantly decreased in the obese group **Paralikar(2012)**[17]. Dynamic lung functions like FEV1 and FVC were decreased with increase in BMI. Significant reduction in the pulmonary functions observed in obese subjects **Kohli (2017)** [18].

Decreased mean FEV1 and FVC suggested restrictive pattern **Prajapati (2016).**[19] Reduction in forced vital capacity and forced expiratory volume after one second both suggested restrictive respiratory pattern in obesity **Melo (2014)** [20]
The mean maximum voluntary ventilation, peak expiratory flow rate Mid forced Expiratory Flow Rate were found to be decreased in overweight and obese subjects (Table no 02) Significant differences in MVV have been observed only in gross obesity **Jnaneshwar Shenoy (2011).**[21] Adiposity the pattern of fat distribution has suggested as a predictor of decreased PEFR, restricting the descent of the diaphragm and limiting lung expansion. There is negative correlation between BMI and FEF **Paralikar (2012)** [17]

The **mean blood glucose, serum creatinine and blood urea** were found to be increased significantly in overweight and highly significant in obese subjects, (Table No 03). Increase in blood glucose might be due to increase in insulin resistance in obesity, there is decreased ability of insulin to move glucose into fat and muscle and shut off glucose release from liver.[22] Insulin resistance is recognized as a low- grade inflammatory condition, and pro-inflammatory cytokines (*ie* adiponectin leptin, tumor necrosis factor, and interleukin- 6) are associated with adiposity. Insulin resistance and inflammation that arise from abdominal adiposity may mediate the relation of pulmonary function and increase mortality. Blood glucose was significantly associated with BMI as observed by **Walsh (2018)**[23] A significant positive correlation between BMI and fasting blood glucose as observed by **Agrawal *(2017).***[24] Overweight or obese men with a higher BMI were at increased risk for diabetes as observed by **Arnlov (2011).**[25]

Increased blood urea and creatinine might be due to structural changes and increased metabolic demands by the kidney resulting in renal hyper-perfusion and hyperfiltration which leads to glomerular re-absorption of blood urea, creatinine, uric acid. Thus it should be regarded as a precursor of loss of renal function in obese condition resulting in renal damage and nephron loss leading further ischemic and atrophic renal damage Regular evaluation of renal function tests can help in detection of early renal damage and abrupt deterioration of renal function in obese subjects, Obesity and physical inactivity leads to progressive chronic renal function damage due to insulin resistance, hypoleptinemia and mild inflammation as observed by **Koc (2006).**[09] **and Khan (2017).**[26] Thus DM type 2 showed elevated serum urea levels and serum creatinine levels which is a condition associated with obesity as observed by **Kanwar (2015).**[27]

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