GENDER WISE DISTRIBUTION OF BODY COMPOSITION, BLOOD PRESSURE AND HAEMOGLOBIN AMONG STUDENTS OF HOTEL MANAGEMENT INSTITUTE IN INDIA: A PILOT STUDY

***Alok Shivapuri[1], Anshu Singh[2], Sakshi Sharma[3]**
C. Kesavachandran[4], V. Bihari[5], Ritul Kamal[6] and Amarnath Singh[7]

[1]Principal, [2]Senior Faculty, [3]Faculty,
Institute of Hotel Management, Catering and Nutrition, Pusa, New Delhi
[4]Principal Scientist, [5]Consultant and Retired Principal Scientist, [6]Technical Assistant, [7]Research Fellow,
Epidemiology Laboratory, Systems Toxicology and Health Risk Assessment Group, CSIR-Indian Institute of Toxicology Research, Uttar Pradesh.
ashivapuri@rediffmail.com

ABSTRACT

Background: *Change in dietary pattern and a better economic situation in India has resulted in non communicable diseases like heart ailments, diabetes, obesity etc. Irrespective of any age group, children, adults, elderly population are at the risk of these health problems in India.* **Objective:** *To study the gender wise comparison of the health problems among Hotel Management students in India.* **Methodology:** *Subjects (n=94) were selected through random sampling comprising of both male and female in age group 18 to 25 years. A questionnaire was used to collect the data regarding personal history and habits. Blood Pressure was monitored using sphygmomanometer. Hemoglobin was measured using automated Heamoglobinometer. BMI (kg/m^2) and Body Fat (BF%) was measured using a commercially available digital weight scale incorporating a bioelectric impedance analyzer (HBF-352, Omron Health care Co., Kyoto, Japan) based on bioelectric impedance analysis. All statistical calculations were done using STATA IC 13 software.* **Results:** *Body Fat% was higher among females than males. Among both male and female students, dietary habits were mostly non-vegetarian. Male students with non vegetarian dietary habits (88.7%) were significantly higher than females ($p<0.05$). The prevalence of overweight and obese cases according to BMI in male students was 19.1% and 20.6% respectively, whereas in case of female students 26.9% were overweight and 23.1% were obese. Male students had significantly higher mean values of systolic ($p<0.001$) and diastolic ($p<0.001$) blood pressure. Significantly higher anemia cases in moderate category were observed in female students ($p<0.05$).* **Conclusion:** *The present study showed higher prevalence of obesity and hypertension among students in the age group 18-25 years. Interventions are required to combat the obesity related health impairments.*

Key Words: *Obesity, Hypertension, Gender Wise, BMI, Body Composition, Hotel Management*

INTRODUCTION

Change in dietary pattern and a better economic situation in India has resulted in non communicable diseases like heart ailments, diabetes, obesity etc. Irrespective of any age group, children, adults, elderly population are at the risk of these health problems in India. Obesity has reached epidemic proportions according to World Health Organization (WHO), with 1.9 billion adults being overweight, among which 600 million people were obese (WHO, 2016). The prevalence of hypertension and many other conditions (including diabetes) has been considered to be linked with the increasing proportions of obesity (Prentice, 2006). The prevalence of hypertension and obesity are increasing globally. The prevalence of hypertension among adults is predicted to increase by approximately 60% (1.56 billion) by the year 2025 (Kearney et al, 2005). WHO report of 2014 indicated that around 22% of the adults aged 18 and above have high blood pressure, with the prevalence of raised blood pressure among Indians to be 25.4%. In year 2000 hypertension affected 26% of the adult population worldwide and by 2025 this number is expected to reach 29% (Kearney et al, 2005). Major burden of the hypertension attributable diseases occurs in the developing countries, with data suggesting increased prevalence of hypertension in the past two decades (Kearney et al, 2004; Davy and Hall, 2004).

Obesity is widely recognized as the foremost risk factor for hypertension (Davy and Hall, 2004; He, 2009) in adults (Shihab et al, 2012) and children (Robinson et al, 2004). Body Mass Index (BMI) exhibits a direct linear relationship with the risk of hypertension, with the increase in risk per unit increase in BMI higher in men as compared to women (Brown et al, 2000; Gelber et al, 2007; Kaufman et al, 1997; Mufunda, 2007; Tesfaye et al, 2007; Colin, 2002). Being overweight is associated with a two to six fold increase in the risk of developing hypertension (Deshmukh et al, 2006). Obese individuals have increased fatty tissue which increases the vascular resistance resulting in increased workload on the heart (Channanath et al, 2015).

India now suffers a massive obesity epidemic among the middle class, with millions of Indians now morbidly obese as a result of the Western fast food invasion (pinterest.com). The economic boom in the country has ensured that young Indians are able to afford the Western lifestyle and eat fast food such as pizza, burger etc. The Indian fast food industry was worth more than £7 billion in 2013, and this is expected to double by 2016 (pinterest.com). As per a study by ASSOCHAM conducted in 2014, one in 10 school going children between the ages of 13-16 years is overweight, which increases the risk of Cardiovascular Diseases (CVD) by over 35% (firstreport.in, 2015).

Worldwide, at any given moment, more individuals have iron-deficiency anemia than any other health problem (WHO, 2008). Anemia is the most common morbidity among micronutrients and affects health, education, economy, and productivity of the entire nation (Kotecha, 2011). With increasing life expectancy and prevalence of life style diseases, US has seen a 30% increase in prevalence of Chronic Kidney Disease (CKD) in the last decade (Coresh et al, 2007). Unfortunately, from India there is no

longitudinal study and limited data on the prevalence of CKD (Varma, 2015). In western countries, diabetes and hypertension account for over 2/3rd of the cases of CKD (Snyder and Pendergraph, 2005). In India too, diabetes and hypertension today account for 40–60% cases of CKD (Rajapurkar et al, 2012)

To the best of our knowledge, there are limited data available on the prevalence of blood pressure, anemia, body composition factors and urinary parameters among college going students in India, Hence a pilot study was undertaken with the objective to study the gender wise comparison of these health problems among Hotel Management students in India. The study findings will give more in depth views about these health issues and suggest remedial measures to minimize the same.

METHODOLOGY

Study design and subjects

A cross-sectional study was planned and conducted on the students of Institute of Hotel Management, Catering and Nutrition, Pusa, New Delhi, India. Sample comprised of (n= 94) healthy students (not taking any medicine) in age group of 18-25 years both male and female who were randomly selected from 131 students.

Ethical Statement

Ethical clearance was obtained from CSIR-Indian Institute of Toxicology Research- Institutional Human Ethical Committee (IHEC), Lucknow, India before starting the study. The committee follows Indian Council of Medical Research guidelines for biomedical research on human participants according to principles expressed in the Declaration of Helsinki. Written informed consent was obtained from participants. The consent form was prepared in English as well as the local language (Hindi) approved by CSIR-Indian Institute of Toxicology Research - Institutional Human Ethical Committee (IHEC), Lucknow, India. The ethics committee also approved the consent procedure and study-information brochure.

Detailed History

A questionnaire was used to collect the data regarding personal history and habits (smoking and alcohol). The personal details comprised of information regarding age, height, weight, body composition measurements (BMI and BF%), personal habits (smoking and alcohol) and dietary habits.

Blood pressure monitoring, Heamoglobin and Body Composition Measurements

Blood Pressure was monitored using sphygmomanometer. The criterion for hypertension was Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) exceeding 140 mmHg and 90 mmHg respectively. Participants who fell below the hypertension threshold were defined as normal up to systolic (120 mmHg) and diastolic (80 mm Hg) (heart.org).

Hemoglobin was measured using automated Heamoglobinometer (Touch Hb details). The students were categorized as mild, moderate and severe anemic according to guidelines for hemoglobin concentrations for diagnosis of anaemia and assessment of severity (WHO, 2011). BMI (kg/m^2) and Body Fat (BF%) was measured using a commercially available digital weight scale incorporating a bioelectric impedance analyzer (HBF-352, Omron Health care Co., Kyoto, Japan) based on bioelectric impedance analysis. BF% was measured to the nearest 0.1 per cent. Height was measured using portable Stadiometer against a vertical surface. BMI was stratified into underweight, normal, overweight and obese categories, based on the new Indian guidelines (igovernment.in/; Gallagher et al, 2000). Students with BMI<18.0 kg/m^2 were taken as underweight, BMI in the range 18.0 – 22.9 kg/m^2 were taken as normal, BMI in the range 23.0 – 24.9 kg/m^2 were taken as overweight and BMI>25.0 kg/m^2 were taken as obese. Body Fat% was stratified in males and females according to age using the classification given by Gallagher et al.2000.

Statistical analysis

Descriptive statistics (mean, standard deviations and range) were calculated for all quantitative variables. All the categorical variables are presented as frequencies with their percentages. Student's t-test was used to compare the mean values of the quantitative variables. Chi square test was used to test the significance for categorical variables. Age adjusted analysis was conducted to compare the mean systolic, diastolic blood pressure and haemoglobin among the students categorized by body composition factors. The criterion of significance was set at $p<0.05$. All statistical calculations were done using STATA IC 13 software.

RESULTS AND DISCUSSION

A total of 94 eligible students were included in the study. Among those, 26 were female and 68 were male. The demographic profile of the students is shown in Table 1. No significant difference in age group was observed among male and female students. The male students were significantly taller than females ($p<0.001$), however for weight no significant difference was found in the groups. BF% was higher among females than males. Among both male and female students, dietary habits were mostly non-vegetarian. Male students with non vegetarian dietary habits (88.7%) were significantly higher than females ($p<0.05$). Although the obesity development mechanism is not fully understood, it is evident that obesity is caused due to excess energy intake as compared to energy expenditure. There is not one single etiology for this imbalance, hence one single factor cannot be assumed to be associated with the prevalence of obesity (Dehghan et al, 2005). Other factors like socio-economic, demographic and lifestyle factors can lead to higher prevalence of overweight and obesity among adults (Ogden et al, 2007). Obesity related co-morbidities include CVD, cancer diabetes and hypertension (Sira and Pawlak, 2010).

Table 1: Demographic profile of the subjects

Parameter	Male (n = 68)	Female (n = 26)	Significance
Age (yrs) Mean ± SD (Range)	20.8 ± 1.8 (18 – 25)	21.2 ± 2.1 (18 – 25)	p = 0.35
Height (cms) Mean ± SD (Range)	170.7 ± 7.2 (156 – 187)	160.5 ± 6.7 (146 – 171)	p<0.001
Weight (kg) Mean ± SD (Range)	65.6 ± 13.2 (44.8 – 105.5)	60.6 ± 14.1 (44.4 – 108)	p = 0.09
BMI (kg/m^2) Mean ± SD (Range)	22.6 ± 4.4 (15.6 – 35.5)	23.4 ± 4.8 (17.6 – 36.9)	p = 0.43
Body Fat (%) Mean ± SD (Range)	19.8 ± 6.5 (7 – 36.4)	31.9 ± 4.8 (20.6 – 42.9)	p<0.001
Diet Vegetarian n (%) Non Vegetarian n (%)	 8 (11.8) 60 (88.2)	 11 (42.3) 15 (57.7)	 p<0.05

Table 2 shows the distribution of students based on BMI classification, BF% categories, blood pressure variations and anemia. The prevalence of overweight and obese cases according to BMI in male students was 19.1% and 20.6% respectively, whereas in case of female students 26.9% were overweight and 23.1% were obese. The prevalence of high (25%) and very high body fat% (23.5%) was observed among male students and 38.5% were high and 7.7% very high BF% category among female students. Data from Table 2 shows that 39.7% of the male students and 50% of the female students were either overweight or obese according to their BMI. Additionally, 48.5% of male students and 46.2% of the female students had high or very high BF%. Approximately, 40-50% students irrespective of male or female were either overweight or obese and their BF% also ranges between 46-49%. The study has also related to overweight/obesity with hypertension among male and female students. Among both the type of students, non-vegetarians are more at the risk of hypertension and anemia. In an earlier cross sectional study on young students (18-25 years), the prevalence of overweight and obesity and dieting attitudes among Caucasian and African American in Eastern North Carolina, was found to be 21.3% overweight and 10.8% obese respectively (Sira and Pawlak, 2010).

Male students had significantly higher mean values of systolic ($p<0.001$) and diastolic ($p<0.001$) blood pressure (Table 2). Hypertension is a disease that afflicts approximately 30% of the population of industrialized nations (Martin, 2012). The exact mechanisms responsible for the gender differences in blood pressure control are not clear, there is significant evidence that androgens (e.g. testosterone) play important roles in the gender-associated differences in blood pressure regulation (Reckelhoff, 2001). Despite the knowledge of the association between increase rates of CVD and hypertension in India, little studies have specifically assessed the obesity of the effect on BP and hypertension by gender. In

the present study, it was found that the risk of developing hypertension is significantly related to the BMI by gender. BMI is significantly correlated with adiposity and can predict the BF% adequately when age and gender are considered. In the study the BP monitoring have shown that blood pressure is higher in men than in women at similar age group. During childhood, blood pressure increases with the increasing age in both the sex. However, after the onset of puberty, boys have higher BP than do age-matched girls. In a study conducted by Narkiewicz (2006) hypertension and increased risk of cardiovascular diseases has been consistently associated with central obesity, with around two third of the risk of hypertension associated with obesity according to estimated from population studies (Krause et al, 2000). Abdominal adiposity has also been known to be implicated in the pathogenesis of coronary artery disease, sleep apnoea, stroke and congestive heart failure (Haslam and James, 2005). SBP and DBP levels were higher in men than in women at similar ages, after adjusting for covariates. Similar findings were reported by Chen et al, 2014 in a Hakka-majority Taiwanese sample.

Alterations in Cardiovascular function and metabolic abnormalities attributed to obesity may be found at young age and progress for long time without manifestation resulting in to development of hypertension and arthrosclerosis. The future development of hypertension and atherosclerosis may be facilitated independently by young obese subjects, independently of other traditional risk factors (Cassidy et al, 2005). The mechanism of obesity associated hypertension and cardiovascular diseases may involve activations of renin–angiotensin–aldosterone system, increasing sympathetic activity, promoting insulin resistance and leptin resistance, increased procoagulatory activity and endothelial dysfunction (Wofford and Hall, 2004). Obesity-related hypertension is commonly associated with further elements of the metabolic syndrome, such as insulin resistance and glucose intolerance (Verdecchia et al, 2004). Results from several population studies suggest that future development of hypertension may be predicted by excess weight gain and that an almost linear relationship exists between BMI and BP in diverse populations around the world (Hall et al, 2003). Nearly 65-75% of the hypertension may be accounted for by excess weight gain, as suggested by several studies (Garrison, 1987).

The worldwide prevalence of obesity and cardiovascular disorders has risen dramatically. Excess weight gain may be responsible for the risk for essential hypertension and increases the risk for renal disease. Hypertension also damage blood vessels in the kidneys. Obesity raises blood pressure by increasing renal tubular reabsorption, impairing pressure natriuresis, causing volume expansion due to activation of the sympathetic nervous system and renin-angiotensin system. The intra renal fat and extracellular matrix compress the kidneys resulting in to increasing intra renal pressures and tubular reabsorption leading to structural changes in the kidneys and loss of nephron function (Hall et al, 2003). Due to damaged arteries the nephrons do not receive the essential oxygen and nutrients resulting in to impairment in kidney function (heart.org). But the exact cause is remains enigmatic.

The mean haemoglobin levels were significantly lower in females as compared to males ($p<0.001$). Anemia cases were significantly ($p<0.05$) more among males (61.8%) compared to females (38.5). Significantly higher anemia cases in moderate category were observed in female students ($p<0.05$).

Table 2: Distribution of BMI classification, Body fat% categories, blood pressure variations and anemia in males and females

	Male (n = 68)	Female (n = 26)	Significance
BMI categories			
Normal n (%)	35 (51.5)	12 (46.2)	NS
Overweight n (%)	13 (19.1)	7 (26.9)	NS
Obese n (%)	14 (20.6)	6 (23.1)	NS
Body Fat% categories			
Normal n (%)	35 (51.5)	14 (53.8)	NS
High n (%)	17 (25.0)	10 (38.5)	NS
Very High n (%)	16 (23.5)	2 (7.7)	p=0.08
Blood pressure			
Systolic (mm of Hg) Mean ± SD (Range)	130.6 ± 10.92 (110 – 160)	119.2 ± 10.6 (100 – 146)	p<0.001
Diastolic (mm of Hg) Mean ± SD (Range)	90.1 ± 7.3 (78 – 110)	84.4 ± 7.8 (70 – 110)	p<0.001
Haemoglobin (mg/dl) Mean ± SD (Range)	12.9 ± 1.4 (9 – 14)	10.8 ± 1.9 (8 – 14)	p<0.001
Anemia category			
Normal n (%)	42 (61.8)	10 (38.5)	p<0.05
Mild n (%)	24 (35.3)	7 (26.9)	p = 0.72
Moderate n (%)	2 (2.9)	9 (34.6)	p<0.001

INTERVENTION

Despite considerable progress in understanding the pathophysiology of obesity, there are still no specific guidelines for the treatment of obesity and hypertension other than weight reduction. Clinical studies have also shown that weight loss is effective in prevention of hypertension and reducing blood pressure (Stevens et al, 2001). Weight reduction is an essential first step in the management of obesity, hypertension and renal diseases.

CONCLUSION

The present study showed higher prevalence of obesity and hypertension among students in the age group 18-25 years. The obesity has reached epidemic proportions according to World Health Organization. Interventions are required to combat the obesity related health impairments. Weight reduction is an essential first step in the management of obesity. Further research is needed to determine the mechanisms by which excess weight gain activates the neurohumoral systems and alters renal structure and functions.

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