INDICATORS OF NUTRITIONAL STATUS AMONG MBBS STUDENTS IN A TERTIARY CARE CENTRE, INDORE

Madhuri Inamdar[1], Richa Nigam[2], Ashfaq Modiwala[3], Sonia Tiwari[4], Varsha Singh[5], Rajshekhar R Wavare[6]

Author's Affiliation:
[1]Prof, Community Medicine, SAMC and PGI, Indore; [2]Asso Prof, Community Medicine, CIMS, Bilaspur, Chhattisgarh; [3]Post graduate; [4]Asst Prof, Community Medicine, SAMC and PGI, Indore; [5]Demonstrator, Community Medicine, HIMSR, Delhi; [6]Dean, SAMC and PGI, Indore

Correspondence:
Dr Madhuri Inamdar,
madhuriinamdar@hotmail.com

ABSTRACT

Introduction- BMI can be used to estimate the prevalence of overweight and obesity within a population. It does not, however, account for the wide variations in obesity between different individuals and populations. BMI may not correspond to the same degree of fatness in different populations due to differences in body proportions.

Material and Methods- This was a cross sectional study. The subjects were 232 pre final MBBS students. It was double stage cluster sampling. The students calculated BMI, waist circumference, Waist hip ratio and Calorie consumption of their own.

Results- Mean Waist circumference (Male= 84.76, 7.646 SD; Female= 79.37, 9.343 SD) and waist hip ratio(male=0.880,0.055SD; Female=0.819, 0.067) were below cut off line. Calorie intake as per Indian standard was poor (Male=2098.5. 503.78SD; Female=1759.2, 362.90SD). Females were having increased risk and substantial increased risk of metabolic disorders as per waist circumference measurement (P>0.001, P>0.001). Males were more at risk as per waist hip ratio (P>0.001). At the BMI of pre-obese category, the female waist circumference was higher than cut off value (86.37 cm). Sensitivity found to be highest for waist hip ratio (28%).

Conclusion- The WHR truly finding out the abdominal obesity.

Key words- BMI, waist circumference, waist hip ratio, Calorie intake

INTRODUCTION

It is an established fact that over-weight children are at a high risk of developing obesity as adults. There is a substantial annual increase in the rate of overweight globally. Overweight or obesity is one of the NCDs (Non-communicable diseases) showing worrying trends. Chronic diseases contributed approximately to 60% of the 56.5 million total reported deaths in the world and approximately 46% of the global burden of disease.

The proportion of the burden of NCDs is expected to increase to 57% by 2020. The developing countries contributing to NCD mortalities is 79%.[1]

In India, 1.3 males and 2.5% females aged more than 20 years were obese in the year 2008.[2]

Quitelet Index I.e. Body Mass Index which is known to us since 1869 was explained by a Belgian astronomer. According to him, amongst adults of normal body build, weight was proportional to the square of Height. Overweight and obesity in early adulthood may continue to have risk of chronic diseases in early ages.[3]

BMI can be used to estimate the prevalence of overweight and obesity within a population. It does not , however, account for the wide variations in obesity between different individuals and popu-

lations. BMI may not correspond to the same degree of fatness in different populations due to differences in body proportions.[1]

Alternative measures that reflect abdominal adiposity, such as waist circumference, waist hip ratio and waist Ht. ratio have been suggested to estimate the prevalence of overweight and obesity.

Waist circumference and waist hip ratio as measures of abdominal obesity were correlated with BMI, but the level of association varied, suggesting that these measures may provide different information and thus may not be interchangeable.

Due to the relative ease of measuring waist circumference, its use is favored over waist hip ratio. BMI and abdominal obesity measures may be highly correlated but the joint use of two indicators will be always desirable.[4]

Diet and nutrition are important factors in the promotion and maintenance of good health throughout the entire life course. "Nutrition transition" shows shift in the structure of diet towards a higher energy density diet with a greater role for fat and added sugars in foods.

Availability of calories per capita increased from the 1960s to the 1990s. This increase is over 600 kcals per capita per day in developing countries. The energy intake per capita per day in developing countries is 2681 kcal.[1]

There is still a need to identify the measures of overweight for appropriate public health and clinical actions. There is a need to assess the other measures available in correlation to BMI.

MBBS students as future preventive expert should learn and apply the norms of nutritional status to general population. How far their own nutritional status is maintained as adults will determine how well they will apply the preventive aspects in future.

This study will be able to find out "apart from BMI" the other measures of obesity that should be for population of India. Very less number of studies are done in India to assess the indicators of nutritional status.

The aim is to assess waist/hip, BMI and calorie intake among the pre final students and to compare the waist circumference, waist/ Hip ratio, BMI and calorie intake as guide of obesity/ overweight.

MATERIAL AND METHODS

This was a cross sectional study. The subjects were pre final MBBS students. The sampling was done by double stage cluster sampling. The study was conducted in the department of community medicine during practical hours. The total no. of students were 304, out of which 232 did all the practicals that were needed for the study. The students were given demonstrations of taking Ht., Wt., Waist circumference, hip circumference and 24 Hours dietary assessment. The students were asked to make pairs of two, and do all the measurements of each other. They were asked to calculate BMI, Waist/hip ratio and calorie consumption of their own.

The Ht. was measured by stadiometer and Weight was measured by bathroom weighing scale. While taking circumferences the subjects were asked to stand with arms at the sides, feet positioned close together, and weight evenly distributed across the feet. The waist circumference was measured at the end of a normal expiration. The subject was asked to relax and take a few deep natural breaths. The waist circumference was measured at the approximate midpoint between the lower margin of the last palpable rib and the top of the iliac crest. The hip circumference was measured around the widest portion of the buttocks. The position of the measuring tape was to be kept parallel to the floor at the level at which the measurement is made.[4]

The formula used for calculation of BMI was[2] Weight in kilograms/ (Ht. in meters)^2

The classification of BMI as-Underweight <18.50; Normal range 18.50-24.99; Overweight ≥25.00; Pre obese 25.00- 29.99; Obese class I 30.00- 34.99; Obese class II 35.00- 39.99; and Obese class III ≥40.00

The median BMI for the adult population should be in the range 21- 23 kg/m^2 , while the goal for individuals should be to maintain BMI in the range 18.5- 24.9 kg/m^2.[1] The subjects having BMI 21- 23kg/m^2 were categorized as optimum and those above and below the optimum, but within normal range as low grade normal and high grade normal.

The waist circumference cut off points taken were-

Waist circumference	Risk of metabolic Complications
>94cm (men); >80cm (women)	Increased
>102cm (men); >88cm (women)	Substantially increased

Waist- hip ratio measurement was done by- waist circumference in centimeters / hip circumference in centimeters

Waist- hip ratio should be >/= 0.90cm (men); 0.85cm (women). These values were taken as cut off points above which the risk of metabolic complications increases substantially.[4]

The calorie intake was calculated taking 24 hour recall questionnaire method. The total calorie in-

take was calculated by the subjects themselves after training.[5]

RESULTS

Out of total 232, the normal BMI was of 166 students. But students with optimum BMI were only 52. Fifty five pre-obese and obese while 11 were underweight. There were only two categories of BMI, where the difference between male and female was statistically different. These were low grade normal (18.50-20.99) and high grade normal (23-24.99). Rest of the categories having difference may be by chance.

There were 107 males and 125 females in this study. The mean BMI was in the normal range both for male and female. The waist circumference was below cut off line. Even the waist-hip ratio was also below cut off line. Calorie intake as per the Indian standard was poor.

There was a significant difference between male and female students for waist circumference measurement as far as increased risk of metabolic disorders is concerned. Females were more at risk. Even the substantially increased risk of metabolic disorders by waist circumference was more for females and significant. But the observation was reversed for waist hip ratio. That was also significant but males were more at risk.

Amongst those who were underweight (<18.5 BMI), the mean waist circumference was 79.66 cms. for males and 68.25 cms. for females. For optimum BMI, it was 83.11 and 80.62 cms. for males and females respectively. These findings were corresponding to the BMI status. But for pre-obese category it was 89.17 which was much less than the cut off of 94cms for males. However in case of females the mean waist circumference was 86.37, the cut off value being 80cms. Thus, at the same BMI of pre-obese category, the female waist circumference was higher than the cut off while male finding was lower than the cut off.

Table-1 Sex-wise distribution of BMI categories

BMI	Male (n=107) (%)	Female (n=125) (%)	Total (n=232) (%)	P value
Under weight (<18.50)	3 (2.8)	8 (6.4)	11(4.74)	0.231
Low grade Normal (18.50-20.99)	22 (20.56)	44 (35.2)	66(28.44)	0.013
Optimum (21-22.99)	23 (21.5)	29 (23.2)	52(22.41)	0.756
High grade Normal (23-24.99)	30 (28.04)	18 (14.4)	48(20.68)	0.010
Pre-obese (25-29.99)	27 (25.23)	20 (16)	47(20.25)	0.081
Obese I&II (30-39.99)	2 (1.87)	6 (4.8)	8(3.01)	0.456

Table 2 Sex-wise distribution of indicators of nutritional status

Sex	BMI Mean (SD)	Waist circumference Mean (SD)	Waist-Hip Ratio Mean (SD)	Calorie Intake Mean (SD)
Male (n=107)	23.39 (3.037)	84.76 (7.646)	0.880 (0.055)	2098.5 (503.78)
Female(n=125)	22.53 (3.602)	79.37 (9.343)	0.819 (0.067)	1759.2 (362.90)

Table 3 Morbidity risk as per waist circumference and waist hip ratio

Morbidity risk	Level of Risk	Male (n=107) (%)	Female (n=125)(%)	P value*
Waist Circumference	Increased Risk@	12 (5.17)	36 (15.51)	0.001
	Substantially Increased Risk#	2 (0.84)	21 (9.05)	0.001
Waist Hip Ratio	Substantially Increased Risk$	36 (15.51)	9 (3.87)	0.001

*P value by Chi square and FE test; @ Waist Circumference for male 94-101cm and for female 80-87cm
Waist Circumference for male 102 & above and for female 88 & above)
$Waist Hip Ratio for male 0.90cm & above and for female 0.85cm & above

Table – 4 Mean values of waist circumference, waist hip ratio and calorie intake as per BMI categories

BMI	Males (n=107)			Females (n=125)		
	Mean WC	Mean Waist/Hip	Mean Calorie	Mean WC	Mean Waist/hip	Mean Calorie
Under weight (< 18.5)	79.66	0.89	2101	68.25	0.80	1613
Low Normal (18.50-20.99)	78.90	0.84	2195	74.01	0.79	1772
Optimum (21-22.99)	83.11	0.86	1981	80.62	0.82	1795
High Normal (23-24.99)	85.70	0.88	2297	84.67	0.83	1731
Pre obese (25-29.99)	89.17	0.91	1874	86.37	0.83	1772
Obese I class (30-34.99)	99	0.93	2173	89.6	0.86	1780.8
Obese II class (35-39.99)	0	0	0	80	0.8	1850

WC=Waist Circumference

The sensitivity was found to be highest for Waist-hip ratio. This test can measure 28% true obese cases. The specificity was highest of calorie intake (86.20%). This was the test which can measure true negatives i.e. those who do not have obesity. There was overlapping as these were quantitative results. The predictive value of positive test was highest for calorie intake. Percentage of false negative was highest for waist circumference to be 93.33%. It gives false reassurance of not having obesity. Percentage of false positive was highest for waist- hip ratio (48.27%), where those who do not have obesity were told to be having obesity.

DISCUSSION

In this study the majority of students were having normal BMI, as expressed by many observers also.[.6,7,8,9,10,11,12,13,14,15,16,17, 18] The optimum BMI for Asians as 21-22.99 was found among 21.49% males and 23.2% females. Similarly higher percent of females than males were having optimum BMI in an urban population. [19]

Overweight or pre-obese BMI had been seen as second majority (20.25%). Amongst these 25.23% were males and 16% were females. So more of males were at risk of obesity then were females. Other investigators working on this subject found similar results. [7,17,20,21] There were three studies showing higher percent of females overweight than males. The difference between this study and the others may be by chance.[18,22]

One of the study was on urban and rural population and rural males were usually hard physical workers, which might be the reason having lower percent of males as overweight.[19]

The mean BMI in table 2 is 23.39 for males with SD, 3.037 and for females 22.53 (3.602 SD), similarly observed by many researchers.[13,17,23]

The mean caloric intake for males was 2098.5 with SD 503.78 but that of 1759.2 (362.90 SD) for female students. Similar results were found out by many observers. [8,24,25,26]

The mean WHR and waist circumference was less than the cut off values both among males and females. It was similarly described by P.R. Deshmukh et al. But in their study SD was high, which may be because of the study population of both rural and urban background with different age groups. [21]

The students identified at risk for metabolic diseases were higher in number by waist circumference then by WHR. The women were more at risk by waist circumference but by WHR measures the males are more at risk of metabolic disorders. Simi-

lar findings have been explained in many studies.[16,18,20,22,27]

Eleven percent males and 28.8% female students have values of waist circumference higher then cut off while these values were 7.6 and 8.7% in a study in rural Wardha. The values for WHR above cut off line were 33.64% (males) and 7.2% (female). In the Wardha study the reverse was true. The time of study conducted may be the reason for this difference. Rural males were agricultural workers doing physical labour, thus lesser at risk.[21]

Similar to the alarming situation in north India with 40% population having WHR values above cut off line, in this study also males having values above cut off line were 33.64%.[19]

Cut off points for waist circumference and waist hip ratio were based on studies undertaken predominantly in populations of European origin. There can be ethnic differences in the amount of body fat associated with waist circumference or waist hip ratio at different BMI levels.

There may be systematic differences in body composition, that is the relative amounts or types of fat, reflected in the waist circumference or waist hip ratio measurement. The studies found a higher percentage of body fat in Asians. (Chinese, Japanese, Koreans and South Asians) at lower BMI as well as increased prevalence of truncal fat, compared to Caucasians.

A higher percentage of body fat across a range of waist circumference values has been documented in East Asians. Australian Aboriginals living in a remote area were reported to have higher waist hip ratios with lower BMIs than urban Australians of European origin.

Sex differences in deposition of body fat are evident even at the foetal stage, but they become much more pronounced during puberty. Women have substantially more total adipose tissue than men, and these whole body sex differences are complemented by major differences in tissue distribution. Men have greater arm muscle mass, larger and stronger bones, less limb fat and a relatively greater central distribution of fat. Women have a more peripheral distribution of fat in early adulthood. Sex differences in body composition are primarily attributed to the action of sex steroid hormones. In men, a reduction in free testosterone levels is associated with increase in fat mass.[4]

Similar sex differences have been noticed in this study. The difference of waist circumference at pre-obese level as per the cut off value can be explained by the aforementioned reason.

Visceral fat has been observed to be high in obese and overweight students. This study got similar

results (waist circumference of pre-obese female=86.37, obese female= 89.6 and obese male= 99)[9]

The percentages of obese identified under this study according to BMI, waist circumference and WHR respectively were 3.44, 30.17 and 19.39. However, in a study for obesity, the sequence, in an increasing order of percentage, was BMI, waist circumference and the WHR. WHR is a ratio which balances the size of hip circumference with waist circumference, thus justifying the findings of this study.[14]

Similar to a study conducted among Asian Indians it was observed that with a rise in BMI group in men, the mean waist circumference increased sharply from the normal to the pre-obese group. The mean WHR also increased steadily till the obese group. In women, the mean waist circumference increased steadily with the rise in BMI group. The mean WHR remained fairly constant at 0.82-0.83 with an increase in the pre-obese BMI group.

As per waist circumference, all women were abdominally obese whether they were normal, pre-obese or obese BMI category. WHR, however, showed abdominally obese women to be only of obese class I. This finding was also explained elsewhere.[15,27]

The energy intake was higher at obesity as observed at the University of the Free State.[22]

CONCLUSION

Abdominal obesity as measured by waist circumference was found even at normal BMI among female. The WHR was truly finding out the abdominal obesity. Calorie intake could not be reliable measure of obesity.

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