

## Original Research Article

# Age and sex variation in the distribution of visceral fat among healthy doctors

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### ABSTRACT

**Background:** Non Communicable Diseases (NCDs) are a mushrooming problem and accounts for majority of deaths. Paradoxically the population of Kerala is increasingly susceptible to NCDs despite having good access to health care. Doctors work in highly stressful conditions and often adopt sedentary lifestyles thereby forming a subset of the NCD prone population. The objective of this study was to assess the health status of the doctors which would provide an insight into their health and level of awareness regarding the role of lifestyle in prevention of NCDs.

**Methods:** Sixty five doctors participated in this Cross-Sectional Observational study conducted at a CME in Kerala. After obtaining Institutional Ethical clearance, demographic profile was collected, and fat levels were estimated using body composition analyzer (OMRON-HBF375). The results were tabulated using Microsoft Office Excel, analyzed using SPSS version 20.

**Results:** On classifying the study group based on BMI, only 34 were normal, 26 were Overweight, and 4 were Obese. Gender wise distribution of body fat revealed only 4 had normal body fat composition. The study also showed that as age advances the amount of total and visceral fat shows a significant upward trend in males.

**Conclusions:** BMI alone cannot be used as a predictor of health status. Body Fat percentage analysis should be included in routine screening programs. Men have a tendency to develop visceral adiposity with age. Females depend more on fat as primary source and hence females will respond better to a properly programmed exercise regime and men to a well guided diet program with exercise.

**Keywords:** BMI, BFP, Doctors, NCD, Visceral fat

### INTRODUCTION

Non Communicable Diseases (NCD) are a mushrooming problem in all the developing countries, and accounts for 60% of all deaths in India and two thirds of deaths in South East Asia.<sup>1</sup> The current reported deaths due to cardiovascular diseases, diabetes mellitus, cancer to name a few NCDs are 45%, 12% and 3% of all deaths. Kerala being a state with high literacy rate, high life expectancy and good economic status with good access to health care services, faces the paradoxical problem of being

susceptible to NCDs.<sup>2</sup> Kerala has undergone nutritional and lifestyle transition putting it in the highest risk bracket for development of non communicable diseases.<sup>3</sup> The lifestyle transition seen is mainly in the form of energy dense food consumption coupled with low physical activity.

Doctor population in Kerala is 1:1000 while the rest of the country has a ratio of 7 doctors / 10000 population.<sup>4</sup> The alarming fact here is that despite having a literate population with easy access to health care, the NCDs

show a rising trend. The only conclusion to be drawn from this fact is a global lack of awareness in public and doctors alike regarding the role of healthy lifestyle as a mainstay of preventive medicine.

So, the need of the hour was to assess the health status of the doctors which would provide an insight into their health status and thereby provide a level of awareness regarding the role of lifestyle in prevention of Non Communicable Disease. In assessment of a healthy lifestyle, parameters like body mass index, body fat, visceral fat, level of physical activity and food habits are considered. A solitary assessment of Body Fat provides information about all the above factors linked with lifestyles. High fat levels also form the main etiological cause of NCDs which is a key modifiable risk factor.<sup>5</sup> The levels of fat need not cause panic, but rather the distribution of fat is more relevant in acting as risk factor of NCDs.<sup>6,7</sup>

The difference in fat distribution across genders has been well documented by researchers. Men have an android type of fat distribution, while the gynoid distribution in women is cardioprotective.<sup>8,9</sup> Although females have higher fat distribution as compared to males, they are at the least risk for NCDs till they attain menopause, after which the risk equalizes.<sup>10</sup> In the back drop of these established facts, the problems are twofold. One, to consider whether the health care providers are aware of the implications of fat levels and its effects in causing comorbidities and second, whether this awareness has a practical application in their own lives.

## METHODS

This cross sectional observational study was conducted at a Continuing Medical Education program in Thrissur after obtaining institutional ethical clearance which was attended by a diverse group of doctors of both genders. Using complete sampling method, all doctors (36 males and 29 females) willing to participate in the study and having no documented history of NCDs were included. A proforma collecting basic demographic profile was filled and fat levels were estimated using body composition analyzer (OMRON-HBF 375) and the important parameters estimated were Body Mass Index, Total Body Fat and Visceral Fat.

### Body fat composition

Body fat composition analysis was performed using body composition analyzer (OMRON-HBF 375) general information such as date of birth, gender and height have to be fed to the device earlier. Height was measured to the nearest 0.1cm using a wall-mounted stadiometer. The analyzer determines the body composition using bioelectrical impedance or biological resistance method by using weak current (50KHz, 500 $\mu$ A) flowing through both hands and feet.<sup>11,12</sup> The device provides us

with weight, body mass index and total body fat percentage.

BMI (Body Mass Index) was categorized based on Asian Standards (WHO) which shows:

- <18.5kg/m<sup>2</sup> (Underweight)
- 18.5-22.9kg/m<sup>2</sup> (Normal)
- 23.0-24.9kg/m<sup>2</sup> (Overweight)
- $\geq$ 25kg/m<sup>2</sup> (Obese)<sup>12</sup>

Total body fat levels were categorized based on gender (male (M)/ female (F) provided by the device;

- $\geq$ 25% (M)/ $\geq$ 35% (F)-very high
- 20-25 % (M)/30-35% (F)-high
- 10-20% (M)/20-30% (F)-normal
- <10% (M)/<20% (F)-low.

Visceral Fat levels were distributed as:

- N (Normal) - 0.5-9.5
- H (High) - 10.0-14.5
- VH (Very High) - 15.0-30.0

The results were tabulated using Microsoft Office Excel spreadsheet and analyzed using SPSS version 20.0. The correlation and significance values have been explained in each table.

## RESULTS

The present study, out of the 65 doctors, 36 were males and 29 were females aged between 35-65 years. Table 1 shows the classification of the study group according to the BMI. 34 were found to be normal, while 26 were overweight and 4 were obese and 1 was underweight.

**Table 1: Classification according to BMI.**

BMI classification	Frequency	Percentage
Underweight (<18.5kg/m <sup>2</sup> )	1	1.5
Normal (18.5-22.9kg/m <sup>2</sup> )	34	52.3
Overweight (23.0-24.9kg/m <sup>2</sup> )	26	40.0
Obese ( $\geq$ 25kg/m <sup>2</sup> )	4	6.2

BMI- Body Mass Index

In Table 2, the total fat and visceral fat distribution in various age groups and genders were studied. 24 of the participants were under 40, 31 were in the age group of 41-60 while only 10 participants were above 61. The total fat distribution in males and in females was in the oldest age group. Visceral fat levels was the highest in the age group above 61 years in men while it was the highest in 41-60 age group in women. The age wise distribution of total fat and visceral fat in both the genders is statistically significant.

Table 3 shows the gender wise distribution of body fat. Out of the 36 males the fat levels are as follows: very high (23), high (12), normal (1), and low (0). Among the

29 females, 14 had very high (VH), 12 high (H) and 3 had normal (N) distribution of fat.

**Table 2: Total and Visceral Fat distribution in various age intervals and genders.**

Age	Total Fat	Male	Female	Visceral Fat	Male	Female
<=40 (n = 24)	27.19	24.84	32.91	9.62	10.70	7.00
41-60 (n = 31)	29.69	27.11	35.12	9.55	10.62	7.30
>=61 (n = 10)	31.38	29.55	38.70	13.60	15.68	5.25
Pvalue	0.089	0.009**	0.382	0.068	*0.026	0.541

Anova, Kruskal Wallis Test, Independent Samples T-Test. \*\*p<0.01 \*p<0.1

**Table 3: Gender wise distribution of body fat.**

Fat	Male	Female
Very high (VH)	23 (63.9%)	14 (48.27%)
High (H)	12(33.33%)	12(41.39%)
Normal (N)	1(2.77%)	3(10.34%)
Low (L)	0(0.0%)	0(0.0%)
Total	36(100%)	29(100%)

## DISCUSSION

To control the global Non Communicable Disease epidemic a constant vigilant monitoring of the trends in NCDs risk factors is needed.<sup>13</sup> BMI was considered the gold standard in reporting the incidence of NCDs in various studies. Many studies have positively linked BMI with Non Communicable Disease occurrence. Since Asians have a shorter stature and a different structural framework, BMI standards which applied to the European cannot be applied to Asians. Hence the Asian standards of BMI has been revised.<sup>14</sup> While it is easy to assume that a high BMI means higher amount of fat, this may not be the case since muscle mass also contribute to body weight. Hence to get a better assessment of the doctor population, whose health status was the point of focus, body fat percentage was also taken into account.

In Table 1, the study population was classified based on the body weight into Underweight, Normal, Overweight and Obese categories, using BMI as a parameter. Of the 65 participants, only 34 were found to be Normal, while 26 were Overweight and 4 were Obese.

The same study population was also grouped into Low (L), Normal (N), High (H) and Very High (VH) categories of body fat percentage as given in Table 3. Since body fat percentage is gender specific the group was further classified based on the sex. Females have higher body fat composition compared to male as shown in many studies.<sup>15-18</sup> For the same BMI, females present with 10% higher body fat when compared to men as per the work of Kalypso et al.<sup>19,20</sup>

In Table 2, the participants were classified based on age and gender into 3 groups: Age<40, between 41-60 and those above 61. As age advances the amount of total fat shows an upward trend. The change in lifestyle along with decreased physical activity is a major contributor to this.. As fat deposition increases it infiltrates into the muscle leading onto the release of proinflammatory cytokines which can result in muscle atrophy. This finding is in line with the previous studies carried out in different population.<sup>21</sup> Declining sex steroids levels coupled with Growth hormone deficiency reduce the lean muscle mass and the incorporation of poor lifestyle increases fat infiltration into the muscles in males accounting for the age related upward shift in Body Mass Index.<sup>22</sup>

When the lifecycle and the location of the accumulated fat is studied, pre pubertal boys and girls don't defer much in this regard. After menarche girls tend to accumulate more fat particularly in the thigh and gluteal region and this kind of fat distribution is called "gynoid". Gynoid fat distribution is not linked to development of NCDs. The male pattern of distribution is "android" where in a preferential accumulation of fat occurs in the upper body and is known to be linked with NCDs. Compared to women, men accumulate large amounts of lean mass that is bone and muscle and less of fat.<sup>23</sup> The clinical significance of this difference in fat distribution has been extensively studied by multiple epidemiological studies that confirm the protective effect of gynoid pattern of fat distribution on cardiovascular risks.

Body fat distribution is sexually dimorphic with males having more visceral fat as also seen in this study in Table 2. As age advances, decrease in physical activity occurs with an increased uptake of energy dense diet leading to an increase in weight. However, fat deposition with age is more visceral than subcutaneous. The likely differences in deposition pattern may be attributed to the hormone estrogen. Estrogen directly or through the activation of the receptors on adipocytes augments the sympathetic tone favouring lipid accumulation in subcutaneous areas than in visceral areas. However, in

peri and postmenopausal females, the distribution of fat is similar to male, that is, it is more visceral. Hyperandrogenism in female having Polycystic Ovary Disease shows a male pattern of fat distribution as seen in several studies, adding strength to the fact that sex steroids are responsible for the differential distribution of fat.<sup>24</sup>

Further epinephrine brings about lipolysis through receptors present on adipocytes. The distribution of receptors for epinephrine, that is alpha and beta, differs according to the site, with more beta receptor in adipocytes and alpha in hip and thigh region. The action of epinephrine through beta receptors is to stimulate lipolysis. Females have more alpha than beta receptors which inhibits lipolysis.<sup>25</sup> Estrogen stimulate epinephrine and Nitric Oxide (NO) production. NO intensifies interaction between epinephrine and beta receptors, hence accelerating lipolysis from abdominal adipocytes.<sup>26</sup>

Visceral Fat can induce insulin resistance leading to metabolic obesity.<sup>27</sup> The spectrum of disorders that may result from high Visceral Fat include Diabetes Mellitus, Hypertension, Cardiovascular Diseases, cancers etc.<sup>28-32</sup> Males have an enhanced post prandial meal derived FFA uptake by visceral adipose tissues, while females have preferential post absorptive direct FFA by subcutaneous fat could also be another reason to explain the same.<sup>15,33</sup> In this study an age related change in Visceral Fat was noted in males, but was not seen in females, the likely reason may be an inadequate sample size. More studies in postmenopausal female is needed in this field.

Table 3 classifies the study participants according to the gender wise distribution of fat. The striking observation is that only 4 (1 male and 3 female) out of 65 participants had normal body fat. This is in striking contrast to the BMI classification. Hence BMI cannot be taken as an appropriate reflection of fat mass. Our findings are in accordance to the findings of other researchers stating that BMI cannot distinguish between fat and muscle and hence more toned individuals might move into the overweight status even if their fat levels are low.<sup>34</sup> Despite these findings, the use of BMI as a gold standard continues to be rampant as seen in many studies. Asian Indians have a characteristic obesity phenotype consisting of a relatively lower BMI, excess body fat percentage, abdominal and truncal obesity and less lean tissue.<sup>35,36</sup> Weight being a combination of lean mass, fat mass, water etc and a deeper understanding of the factors favoring fat mass deposition could help in both the classification and management of obesity. Resting fat metabolism is lower in females and hence they have higher stores which might offer a likely explanation.

## CONCLUSION

In the back drop of the above findings and bearing in mind that these changes in fat deposition are modifiable, we would like to put forth certain suggestions. Body

Mass Index cannot, in isolation be used as a predictor of health status. Body Fat Percentage analysis should be included in routine screening programs. The fuel utilization differs in males and females with women depending more on fat as primary source and men depending more on carbohydrates. Hence females will respond better to a properly programmed exercise regime and men to a well guided diet program in addition to exercise.

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