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Original Research Article

Knowledge about NCD in medical students and screening for their nutritional status

Swati Y. Bhave[1,2]*, Srushti S. Adsul[3], Jitendra S. Bhawalkar[2], Shailaja V. Mane[1,2], Jyoti Landge[2,4]

[1]AACCI Association of Adolescent and Child Care in India, Mumbai, Maharashtra, India
[2]Dr. DY Patil Medical College & research Center, Pimpri, Pune, India
[3]Department of Social and Behavioral Sciences, University of Amsterdam, Amsterdam, Netherlands
[4]Department of Community Medicine, Dr. NYTIMS, Diksal, Karjat, Maharashtra, India

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***Correspondence:**
Dr. Swati Y. Bhave,
E-mail: aacciindia@gmail.com

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ABSTRACT

Background: Creating awareness about NCD prevention and screening medical students' nutritional status will help them to follow a healthy lifestyle. Thus, ensuring that as future doctors, they will be effective in community education of NCD prevention through their own health.
Methods: A two-hour awareness session was taken for 150 medical students to explain importance of assessing their risk factors for NCD. The age range was 18-21 years. They were offered a free health check-up and 89.33% (136) signed up. For screening of obesity - anthropometric measurements were taken 1) weight by electronic weighing scale 2) height- using analog measuring tape 3) waist hip measurement 4) body fat composition measured by Omron (Karada scan- body composition monitor HBF-375). BMI was calculated using both WHO and Asian cut-offs and waist circumference using WHO and ICMR cut-offs.
Results: In 132 (M=55, F=79) participants, significant incidence was seen of overweight (21.21%), obesity (43.18%) by Asia Pacific BMI standards and 36.36% overweight, 36.36% obesity by total body fat measurement. Abdominal obesity measured by waist circumference was seen in 3.22% of males and 21.52% of females by WHO; 15.09% of males and 41.77% of females by ICMR standards. Females showed a higher incidence of obesity and overweight than males according to Asia Pacific BMI, total fat percent and ICMR waist circumference.
Conclusions: These students will benefit from interventions to inculcate a healthy lifestyle and maintain a healthy weight. Healthy medical students tracking into healthy doctors will act as ambassadors for NCD prevention.

Keywords: Anthropometric, Medical students, Non-communicable diseases, Screening for obesity

INTRODUCTION

Non-communicable diseases (NCDs) are a life course issue: from pre-conception to death. World Health Organisation (WHO) has identified four top NCDs for intervention: a) cardiovascular diseases which account for most NCD deaths, (17.9 million people annually), followed by b) cancers (9.3 million people annually), c) respiratory diseases (4.1 million people annually), and d) Type 2 diabetes (1.5 million people annually). These four groups of diseases account for over 80% of all premature NCD deaths.[1]

Non-communicable diseases (NCDs) also include a vast group of chronic diseases which generally have slow progression and are the result of a combination of various factors like genetic predisposition, physiologic, environmental conditions, social conditions, and

unhealthy behavior. Most NCDs have a prolonged course that does not resolve spontaneously, and a complete cure is rarely achieved. As most of the NCDs result from lifestyle factors, they are also called diseases of affluence or lifestyle diseases. An unhealthy lifestyle includes (a) sedentary habits such as physical inactivity, and long hours of screen usage e.g., television, computer, mobile etc. (b) An unhealthy diet that includes eating high fat, high sugar, high salt and high-density food, Sugar-Sweetened Beverages (SSB) and (c) consumption of alcohol and smoking.[2] Obesity forms the nidus of metabolic syndromes and various NCDs. Fortunately, most of the lifestyle risk factors are modifiable by adopting a healthy lifestyle.[3]

A rising incidence in the prevalence of NCDs is a worldwide phenomenon. NCDs kill about 41 million people yearly, contributing to 71% of all deaths globally.[4,5] Each year 15 million people die from NCDs "prematurely" between 30 to 69 years of age. More than 80% of these "premature" deaths occur in low- and middle-income countries.[1,6] The major four NCDs leading to total major morbidity and mortality are cardiovascular diseases, chronic respiratory disease, cancers, and diabetes, contributing to about 82% of all NCD deaths.[7] Cardiovascular diseases account for most NCD deaths, or 17.9 million people annually, followed by cancers (9.0 million), respiratory diseases (3.9 million), and diabetes (1.6 million). Lifestyle diseases which were most prevalent in developed countries in the past, now are also showing a high incidence in developing countries as diverse as India, Mexico, Nigeria, and Tunisia.[8]

In 2014, WHO reported that NCDs contribute to around 60% of deaths in India which shares more than two-thirds of total NCD deaths in the South-East Asia Region (SEAR) of WHO.[9] Indian Council of Medical Research (ICMR) and WHO have predicted that cardiovascular diseases would be the most important cause of morbidity and mortality in India.[9] WHO world health statistics confirm the burden of NCDs and report that there is a more than 25% probability of dying from the four main-NCDs (cardiovascular diseases, diabetes, chronic respiratory disease and cancer) between ages 30-70 years in India. Major metabolic risk factors are obesity, raised blood glucose and raised cholesterol levels. Cardiovascular diseases contribute to 45% of all NCD deaths in India, followed by chronic respiratory disease (22%), and cancer (12%).[9]

NCDs in adolescents and young people

World Health Organization (WHO) has defined the age of adolescents as between 10 to 19 years, and 'youth' from 15 to 24 years of age. The term 'young people' covers the age range from 10 to 24 years of age.[10] India has 34% of young people which is the highest percentage at present in the world according to the 2011 census.[11]

The rising prevalence of NCDs among youth is attributed to various factors like sedentary lifestyles, unhealthy food habits, cultural practices/ acculturation, and the increasing affluence of the middle-class population. WHO has identified four modifiable behaviors, in adolescence such as 1) tobacco use, 2) physical inactivity, 3) unhealthy diet and 4) harmful use of alcohol; all increase the risk of NCDs.[1]

Lifestyle-related risk factors leading to NCDs are all modifiable. Early recognition of the risk factors in adolescence is important to plan necessary preventive strategies for NCDs, which can pave the way for a better and healthier life in the long run. Hence, there is a definite need to monitor the magnitude of these risk factors in this age group and plan appropriate, feasible, and effective intervention measures for the same. Adolescence is the last and best chance to build positive health habits and limit damaging ones. There is a need to study the pattern of NCDs in adolescents in schools and colleges and community with a view of instituting adequate preventive measures against them.[12-15] Adolescence is a time when the influence of peers and parents, as well as the targeted marketing of unhealthy products and unhealthy lifestyles, is significant. Thus, there is an urgent need to curb the progression of NCDs in adolescents to prevent the socio-economic burden on society.

If we focus on the medical students who are AYA-adolescents (17-19 years) and young adults (20-24) to promote healthy lifestyles and screen them for risk factors of NCD such as obesity we can promote healthy doctors who can become ambassadors of NCD prevention in the community and role models for patients to follow.

Objectives of the study

AACCI- Association of Adolescent and Childcare in India has been working since its inception in 2007 for creating awareness among school and college students about the risk factors for NCDs and prevention of NCDs by adopting a healthy lifestyle. AACCI teamed up with the community medicine Dept at Dr. D. Y. Patil Medical College, Pimpri for a project for medical students. The first and fourth authors are active workers of AACCI and work in this medical college.

Medical students are the healthcare providers of tomorrow. It is very important to ensure that they are aware of the NCD risk factors and prevention. The best way to do this is to engage budding doctors and guarantee that they are given proper information and knowledge about NCDs. They can also prevent the risk factors for themselves and in case they already are in the high-risk category they can start appropriate management. A healthy doctor, free from NCDs can be be a role model to his/her patients and motivate them to listen to his/her advice about the prevention and/or management of their NCDs. To achieve this objective the following was done:

An awareness program was conducted for NCD prevention for 150 medical students who were evaluated on their NCD knowledge- the impact of pre and post post-evaluation was observed. We employed volunteers for the peer educator program for school workshops on NCD prevention. We also employed volunteers for their screening for NCD and assessment of nutritional status in the medical students.

METHODS

Study design

It was a cross-sectional observational study conducted at a teaching institute Dr. DY Patil Medical College and research center, Pimpri, Maharashtra, India, among 132 medical students learning in the MBBS course.

The study was conducted at Dr. DY Patil Medical College and research Center, Pimpri, India from June 2018 to August 2018.

Criteria of sample selection

A study by Gautam et al found that overall prevalence of obesity among adolescents was 10.8%. With this prevalence at 95% confidence interval, using prevalence study sample size formula n = $4pq/l^2$. Where P=10.8%, q=100-p, l= allowable error; 6% of p calculated sample size using WinPepi software was 105 considering 10% no response rate a total of 132 students were enrolled as a study participant.[2]

Inclusion criteria

Students who attended the awareness session and were willing to be part of study.

Exclusion criteria

Students suffering from endocrinological disorder or preexisting illnesses and not willing to be part of the study were excluded.

Consent

Informed written consent was obtained from students after explaining the purpose and benefit of study in a language they can understand.

Procedure

Awareness program

In June 2018, a two-hour interactive session on awareness of NCDs was conducted by the first and third author for 150 medical students aged 1821 years from the undergraduate MBBS course. The contents included basic information about NCDs, the risk factors, complications such as metabolic syndrome and PCOS etc. A structured questionnaire regarding various aspects of NCD was designed by AACCI (Table 1).

Table 1: AACCI pre and post-session questionnaire for the impact of the 2-hour awareness session.

Q. no.	Questions
1	What is the meaning of NCD?
2	Which diseases come under this category? Put as many as you want
3	Which are the four main NCDs which have been identified globally for intervention?
4	According to WHO- what is the age range in the definition of Adolescence
5	What is the age range of extended adolescence?
6	Why is the prevention of NCD important in adolescents and young people
7	In which year did the WHA- World Health Assembly endorse a resolution calling upon member states to address the needs of youth in the context of NCDs?
8	Which four behaviors are identified by WHO as high-risk behaviors in adolescents which tracks into youth and adulthood leading to NCDs in adults?
9	Why is obesity, a precursor of many NCDs?
10	a) What is the metabolic syndrome or Syndrome X? b) What are its features?
11	What are the features of PCOS- polycystic ovary syndrome?
12	What is BMI? How do you calculate it?
13	What are the various categories of BMI?
14	What should be the normal abdominal girth in males and females?
15	What is meant by waist /hip ratio-WHR?
16	What is the normal value of WHR in men and women?
17	For what screening is the following used? a) BMI b) abdominal girth c) waist /hip ratio
18	How does breastfeeding prevent NCD?
19	How is low birth weight related to adult NCD?
20	How do we prevent risk factors in NCD in school children?

Impact of the session

The pre and session questionnaire was filled by the students before the interactive session and immediately at the end of the session to see the impact (Table 2).

Volunteers for the peer educator program for school programs for NCD awareness

Out of the 150 students, 56.66% (85) signed up for a peer educator training program.

Table 2: Impact of the awareness session scores of the AACCI questionnaire pre and post-session before the 2 hour awareness session conducted.

Q. no	Question	P value
14	What is the Normal abdominal girth in males and females?	p<0.05
19	Co-relation of low birth weight and risk of adult NCD	p<0.05
20	How to prevent risk factors of NCD in school children	p<0.05

Paired T-test was applied, and the significant improvement was considered at 95% confidence interval with p<0.05. There was a significant improvement in most of the answers. But statistical significance was seen in 3 out of 20 questions

Volunteers for screening for nutritional status

Out the 150 students 90.66 % (136) signed up.

The screening was done over 3 days in the month of July 2018 in batches of 40-50 medical students per day by the fifth co-author, helped by a team of interns and post graduate students from the college.

For or screening of obesity the following anthropometric measurements were taken: weight was measured to the nearest 0.1 kg by an electronic weighing scale, height was measured to the nearest 0.1 cm with a mounted stadiometer with participants standing in bare feet and upright, BMI was calculated using the formula weight in kg/m in meter square. Both WHO standard and Asia Pacific standard for BMI were considered, waist circumference (WC) and hip circumference (HC) were taken with an analogue measuring tape. Both WHO and ICMR cut-offs were considered for waist circumference, body fat measured by Omron Karada Scan- body composition monitor HBF-375.

Ethical approval

This study was approved by the Ethics committee of AACCI.

Statistical analysis

Data collected were entered into Microsoft excel and analyzed by SPSS version 28.0.

RESULTS

Out of the total 136 participants, we had to omit 4 because each had some missing data and one outlier for age. Hence, the statistical analysis was done on 132 participants.

The number of male participants was 53 (40.2%) whilst the number of female participants was 79 (59.8%) and the age range was 19 to 22 years.

We assessed the nutritional status by taking height and weight measurements and calculating the BMI. The mean BMI of males was 25.02±4.33 whilst the mean BMI for females was 24.47±4.52.

We classified the participants for obesity and overweight based on the cut-offs for the Asia Pacific BMI categories and the WHO BMI categories.[16]

As expected, on comparing the two, we found that in males the percentage of overweight decreased from 39.62% according to the WHO standards to 22.64% in Asia Pacific and in females from 27.85% to 20.25%. In contrast in males, the percentage of obese participants increased in the WHO BMI category from 11.32% to 49.06% in the Asia Pacific BMI category. In female participants, the percentage of obese participants increased from 11.39% according to the WHO BMI to 39.24% according to Asia Pacific BMI categories.

Table 3: BMI categories- WHO guidelines (n=132).

Gender	Underweight (<18.5)	Normal (18.5–24.9)	Overweight (25–29.9)	Obese (≥30)	Total
Male -53	6 (11.32%)	20 (37.74%)	21 (39.62%)	6 (11.32%)	53 (100%)
Female-79	5 (6.33%)	43 (54.43%)	22 (27.85%)	9 (11.39%)	79 (100%)
(n=132)	11 (8.33%)	63 (47.73%)	43 (32.58%)	15 (11.36%)	132 (100%)

Table 4: BMI categories- Asia Pacific guidelines (n=132).

Gender	Underweight (<18.5)	Normal (18.5–22.9)	Overweight (23–24.9)	Obese (≥25)	Total
Male- 53	6 (11.32%)	9 (16.98%)	12 (22.64%)	26 (49.06%)	53 (100%)
Female-79	5 (6.33%)	27 (34.18%)	16 (20.25%)	31 (39.24%)	79 (100%)
(n=132)	11 (8.33%)	36 (27.27%)	28 (21.21%)	57 (43.18%)	132 (100%)

Assessment of nutritional status was done by both WHO cutoffs (Table 3) and Asia Pacific cutoffs (Table 5). In both BMI cutoffs, underweight BMI is classified as below 18.5 hence, we have 8.33% in both cutoffs.

Table 5: Mean waist circumference (WC) and mean waist to hip ratio and mean total body fat (%).

	Mean waist circumference -WC	Mean waist to hip ratio W/H ratio	Mean total body fat MTBF (%)
Males- 53	82.26±8.76 cm	0.88±0.05	24.07±6.96
Females-79	79.42±10.38 cm	0.81±0.07	32.15±6.31

Table 5 shows (a) the mean waist circumference for males was 82.25±8.76 cm and the mean waist circumference for females was 79.42±10.38 cm, (b) the mean waist-to-hip ratio for males was 0.88±0.05 whereas the mean waist-to-hip ratio for females was 0.81±0.07, (c) the mean total body fat percent on gender comparison showed that it was 24.07±6.96% in males and 32.15±6.31% in females.

On comparing waist circumference by WHO versus ICMR guidelines: the percentage of ma kkles classified as obese increased from 3.77% to 15.09% and from 21.52% to 41.77% in females (Table 6).[17,18]

32.74% of males were overweight and 41.51% were obese out of the total male population in the sample. While 35.44% were overweight and 35.44% were considered to be obese from the female population in the sample

Table 6: A comparison of obesity by waist circumference (WC) according to the WHO and ICMR guidelines n=132.

WHO waist circumference cutoff		ICMR waist circumference cutoff	
Male (>102.00 cm)	**Female (>88.00 cm)**	**Male (>90.00 cm)**	**Female (>80.00 cm)**
3.77%	21.52%	15.09%	41.77%

Table 7: Nutritional status as per Asia Pacific BMI Guidelines and total body fat % (n=132).

Male (n=53)				Female (n=79)			
BMI				**BMI**			
Underweight (<18.5)	**Normal (18.5-22.9)**	**Overweight (23-24.9)**	**Obese (≥25)**	**Underweight (<18.5)**	**Normal (18.5-22.9)**	**Overweight (23-24.9)**	**Obese (≥25)**
6(11.32%)	9 (16.98%)	12 (22.64%)	26 (49.06%)	5 (6.33%)	27 (34.18%)	16 (20.25%)	31 (39.24%)
Total Body Fat %				**Total Body Fat %**			
Underweight (<10.0)	**Normal (10.0-19.99)**	**Overweight (20.0-24.99)**	**Obese (≥25.0)**	**Underweight (<20.0)**	**Normal (20.0-29.99)**	**Overweight (30.0-34.99)**	**Obese (≥35)**
1 (1.89%)	10 (18.87%)	20 (37.74%)	22 (41.51%)	4 (5.06%)	19 (24.05%)	28 (35.44%)	28 (35.44%)

21.97% of the total participants had normal weight and 3.79% were underweight based on total body fat percent. Gender analysis showed that, 18.87% males and 24.05% females were normal weight and 1.89% males, and 5.06% females were underweighted (Table 7).[19]

Correlations:

We analysed the correlations between various measurements

There was a significant correlation between BMI and total body fat (%) r=0.551, n=132, which was significant p<0.001 (Figure 1).

There was a positive correlation between BMI and waist circumference r=0.601, n=132 which was significant p<0.001 (Figure 2).

There was a positive correlation between waist circumference and waist to hip ratio r=0.542, n=132, the relationship was significant p<0.001 (Figure 3).

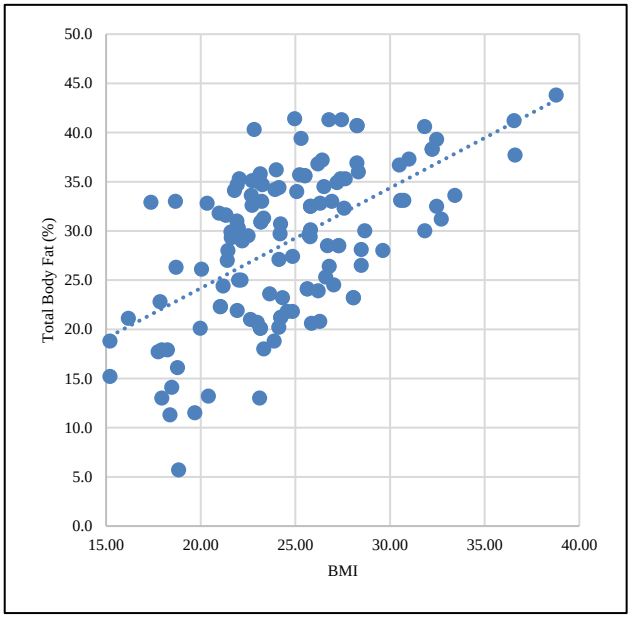

Figure 1: Correlation between BMI (kg/m^2) and total body fat (%).

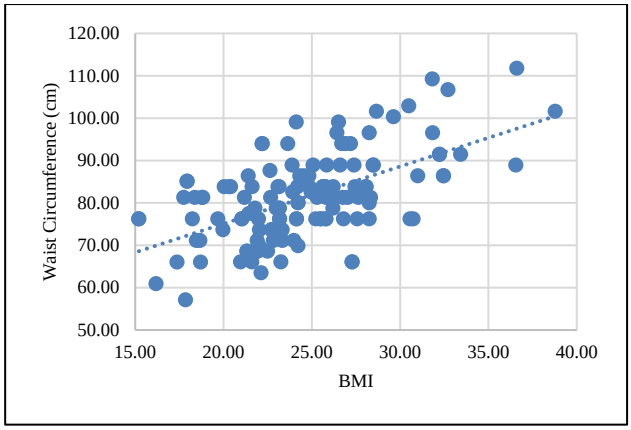

Figure 2: Correlation between waist circumference (cm) and BMI (kg/m^2).

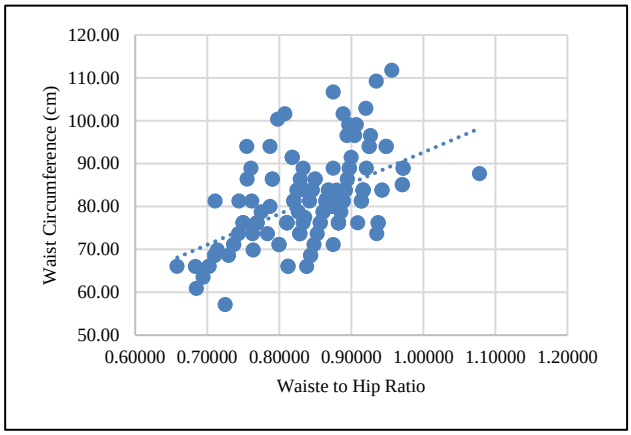

Figure 3: Correlation between waist circumference (cm) and waist to hip ratio.

DISCUSSION

Because of variations in body proportions, BMI may not correspond to the same body fat in different populations. The Southeast Asian population including India is genetically prone to getting metabolic syndrome or syndrome X which leads to NCDs, and these occur at a lower BMI as compared to the Western population Asian Indians exhibit unique features of obesity; excess body fat, abdominal adiposity, increased subcutaneous fat, increased intra-abdominal fat and deposition of fat in ectopic sites like liver, muscle. Insulin resistance is noted among Asian Indians at normal BMI levels. This has led to the need for Asia Pacific BMI cut-offs to be used for screening this population instead of the use of WHO cut-offs. We have analysed our data in both WHO and Asian Cut off data.[2,20,21] The incidence of obesity comes much higher in Asian cut-offs which is more applicable to our population.

Our nutrition assessment showed that there were a sizable number of participants who were considered underweight according to BMI (male: 11.9% and female 6.33%) according to both the Asia Pacific and WHO cut-offs.

Based on the total fat percent estimation done we found the incidence of being underweighted to be lower in females (5.06%) but more significantly lower in males (1.89%) (Table 7). Furthermore, the disparity in the BMI and total fat measurements further brings up questions about BMI as an authentic representative of health risks related to weight.

47.73% of the total sample had normal weight (males: 54.43% and females: 37.74%) according to the WHO BMI standards. 27.27% of the total sample had normal weight according to the Asia Pacific BMI standards (males: 34.18% and females: 16.98%).

This shows the need of making these future doctors aware of a healthy lifestyle to have a healthy normal weight.

We found very few studies that screened medical students with the primary objective of assessing obesity. A study from Greece assessed 989 third-year medical students from Crete in 1989-2001. Approximately 40% of men and 23% of women had BMI≥25.0 kg/m^2. Central obesity was found in 33.4% of male and 21.7% of female students. Central obesity levels were significantly higher in men than women, using the WC and waist to hip ratio cut-offs.[22] In our study we had a higher incidence- 49.06% of males and 39.24% of females had a BMI≥25.0 kg/m^2. In our sample, central obesity using the waist circumference indicated that a higher percentage of females were obese- 21.52% of females versus 3.77% of males. In the other studies, more males than females were found to be overweight and obese.

In India where there is a genetic predisposition to metabolic syndrome and NCDs. Waist-hip ratio and BMI are very easy ways of screening of adolescents and young adults to identify at-risk individuals for NCDs and start preventive measures. NFHS-5 data released (2019-2021) by the Ministry of Health and Family Welfare, Government of India shows following facts: this data includes adolescents above 15 years of age and adults.[23] A total of 33.2% of women are overweight or obese (BMI 25.0 kg/m^2) in urban areas and 19.7% in rural areas. 29.8% of men in urban areas and 19.3% of men in rural areas are overweight or obese (BMI 25.0 kg/m^2). A high-risk waist-to-hip ratio (0.85) affects 59.9% of women in cities and 55.2% of women in rural areas. A high-risk waist-to-hip ratio (0.90) (%) affects 50.1% of men in cities and 46.4% of men in rural areas. It was 28.8% in urban men and 42.7% in rural men. Alcohol consumption was 0.6% among women in urban areas and 1.6% in rural areas. This data indicates the magnitude of problem of obesity and NCDs in India.

Many studies have surveyed cardiovascular health behaviors in medical students.[6-13] Most of these studies are focused on cardiovascular risk factors- screening. However, some of these studies also measured BMI. Comparing the results of BMI and weight categories from these studies in males and females in our study we find

that we had a much higher incidence of overweight and obese participants according to the BMI measurements.

In a Nepal study of 159 medical students, 15.7% were overweight, and in a Pakistan study of 203 medical students, 9% were overweight.[24,25] A study in Saudi Arabia of 223 female university students showed that 8.5% were obese and 22.4% were overweight.[26] Another study investigating the risk factors of coronary heart disease among 214 medical students in Saudi Arabia showed that 18.9% of males and 10.6% of females were obese.[27] A study in Colombia which investigated cardiovascular and diabetes risk factors in 450 medical students showed that only 10% of the whole sample was overweight.[10] Another 2016 study measured the prevalence of hypertension and cardiovascular disease risk factors among 180 medical students, out of which 7.8% were overweight and 2% were obese.[28] A study analysing the lipid profile of 153 medical students showed that 15% were overweight and 2.6% were obese.[29] A study investigating the prevalence of cardiovascular disease risk factors among 433 medical students from east India showed that 70% of the sample were obese.[30]

We had 47.73% normal weight according to WHO BMI standards and 27.27% normal weight according to Asia Pacific standards and 8.33% underweight according to both. On conducting gender analysis, we had 37.74% males and 54.43% females who were normal weight according to the WHO BMI and 16.98% males and 34.18% females who were normal weight according to Asia Pacific BMI. There were 11.32% of males and 6.33% of females underweight. In a descriptive study that measured various weight groups among medical students, 7% of students were underweight while 52% were normal weight.[31] A similar descriptive study was conducted in Dhaka, India that measured the BMI of 264 medical students. In this study, 63.6% of the total students has normal weight while 11.3% were underweight. In the gender analysis for this study, 9.35% of males were underweight and 76.97% were normal weight while 13.6% of females were underweight and 48.8% were normal weight.[32] Another study measured the prevalence of underweight and overweight in a hundred medical students with BMI in Maharashtra. The outcomes of this study showed that 38% of the total participants were underweight, while 34% had normal BMI.[33]

This study gives insight that the medical students in this sample are having high incidence of overweight and obesity and are at risk of developing NCDs and need interventions. However, a key limitation of the study would be the fact that this was a single-centre study that has a small sample size. This poses further questions about generalizing these results to other samples like the cohort used. Furthermore, the small sample size also limits the validation of the study results. As a future recommendation, further research needs to be done with a multicentric cohort and a large sample.

CONCLUSION

Our sample showed a significant incidence of Overweight, Obesity both by Asian and WHO cuffs of BMI. Abdominal obesity, which is a nidus for NCDs, especially type 2 diabetes and cardiovascular diseases, as measured by waist-to-hip ratio and visceral fat was also significant. Fortunately, the participants are in an environment where interventions are easily possible to reduce these risk factors. We will screen this group for metabolic syndrome for further management and do motivation workshops for them to make a change in their lifestyle to maintain good health. We had students who were underweight as shown by BMI according to both the Asia Pacific and WHO BMI guidelines, normal weight was seen in only 27.27% of the total sample. 34.18% of males and 16.98% of females were normal weight according to Asia Pacific standards. This emphasises the need of making these future doctors aware of a healthy lifestyle to maintain a healthy normal weight and healthy ways of losing weight if they are overweight and obese. The results underscore the urgent need to promote preventive knowledge and practices among medical students if they are to become prevention-oriented physicians and practice counselling patients on preventive strategies to counter the rapidly increasing burden of NCDs cardiovascular diseases effectively.

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Ethical approval: The study was approved by the Institutional Ethics Committee AACCI

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