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Original Article

Trends of Blood Pressure and Body Mass Index Among Adolescents and Young Adults of a Government Medical College in India

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Abstract

Context: Medical undergraduates are an important health resource for the country in the future. Their health status and risk for the development of non-communicable disease need to be studied. Early diagnosis and management of these physiological risk factors among adolescents and young adults are of utmost importance for a healthy world in the future. **Aims:** The study was performed to assess the trend of non-communicable disease risk factors among adolescents and young adults of a government medical college in Delhi over 13 years from 2000 to 2013. **Subjects and Design:** A record-based cross-sectional study was conducted in a medical college in Delhi. The records of the routine health screening of MBBS students from 2000 to 2013 were analyzed. The data related to the student's age, sex, height, weight, blood pressure, family history of diabetes, family history of hypertension were utilized for the study. **Results:** Among 1350 study participants 63.5% were males. Female MBBS students were constantly lesser than males with a minimum of 20% in 2006. The trends of obesity among MBBS students were increasing from 11.3% in 2000 to a maximum of 31.7% in 2013. The prevalence of hypertension was 8.1% in the year 2000 which increased to 16.4% in 2001, 10.6% in 2002, 15.3% in 2006, 14.% in 2007 and then it decreased to 1.5% in 2013. **Conclusion:** Our study has found that there was an alarming increase in the trend of prevalence of obesity among medical undergraduates which indicates the need for urgent interventions to minimize unhealthy behaviours among future doctors.

Keywords: Adolescents, hypertension, NCD risk factors, obesity, students

Key Messages: The MBBS undergraduate students are the future doctors of India who are going to manage patients with non-communicable diseases (NCD). But, they themselves are at high risk of having NCDs in future. This study assessed the trend of NCD risk factors over 13 years and found that the prevalence of obesity has increased alarmingly.

Introduction

According to World Health Organization (WHO), 71% of the 56.9 million global deaths in 2016 are due to non-communicable diseases (NCD) including heart disease, stroke, cancer, diabetes and chronic lung disease.[1] Out of these, 40 million global deaths were premature deaths and occurred before the age of 70.[2] Almost three-quarters of all NCD deaths, and 82% of the 16 million people who died prematurely, or before reaching 70 years of age, occur in low- and middle-income countries.[3] In India, the age-

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standardized NCD death rate is as high as 597.5 per 100,000 population and 56% of these deaths occurre before the age of 70 years.[1,2] India is experiencing the dual burden of disease due to epidemiological transition, which in turn is because of the increase in the burden of NCDs.[4] The rise of NCDs has been driven primarily by four major risk factors, namely tobacco use, physical inactivity, the harmful use of alcohol and unhealthy diets.[3] These behavioural risk factors increase the occurrence of physiological risk factors like obesity, hypertension, diabetes mellitus and hypercholesterolemia which in turn lead to NCDs.

Globally, 1.13 billion adults are affected by raised blood pressure in 2016 and the number of hypertensive individuals is anticipated to double from 118 million in 2000 to 213 million by 2025.[5,6] In India, 25.8% of adults are suffering from raised blood pressure.[5] According to the National Family Health Survey (NFHS), in 2015, the prevalence of hypertension was 8.8% among adult women and 13.6% among adult men.[7] The global prevalence of obesity among adults was 39% in 2016.[8] In India, the prevalence of obesity was 20.6% among adult women and it was more in the urban population, 31.3% when compared to the rural population, 15% in 2015.[7] Among men, it is slightly less 18.9%, but the urban rural-difference is still there.[7] The behavioural risk factors for hypertension and obesity start during the adolescence and it continues to the adulthood leading to hypertension in later life. Various studies from diverse population all over the world have shown that raised blood pressure in younger age is associated with raised blood pressure in later life.[9] Therefore, early diagnosis and management of these physiological risk factors among adolescents and young adults are of utmost importance for a healthy world in the future.

Various studies in India have found that the prevalence of hypertension among adolescents, the ranges from 1% to 24% and among obese adolescents range increases to 26%.[10,11] The prevalence of obesity among adolescents varies from 1% to 16.4%.[12] In South India, the prevalence of overweight and obesity among adolescents was 9.7% and 4.3% respectively.[13] However, reports showing their trends over the years in India are limited.

MBBS aspirants pass through a stressful period during preparation for their entrance exam (National Eligibility cum Entrance Test) in the preceding years. At this time they are least bothered about their own health. They have sleepless nights, sedentary lifestyles, untimely food intake and frequent consumption of junk foods which ultimately puts them at the risk of NCD. Medical undergraduates are an important health resource for the country in the future. Hence, their health status and risk for the development of non-communicable disease need to be studied. Timely interventions are necessary for encouraging them to adopt a healthy lifestyle. With this background, the study was aimed to assess the trend of non-communicable diseases risk factors among adolescents and young adults of a government medical college in Delhi over 13 years from 2000 to 2013.

Subjects and Method

Study design and setting

A record-based cross-sectional study was conducted in Maulana Azad Medical College (MAMC), New Delhi. With a recent increase in seats, 290 undergraduate students are recruited every year through NEET. They are taught by 250 post-graduate and post-doctoral students, 426 faculty members and 810 resident doctors.[14]

Study period and population

This study included all first-year MBBS students who were admitted in MAMC, New Delhi and undergone routine health screening during the years 2000–2007, 2013. The health screening was performed by a medical board consisting of Faculty from medicine, surgery, gynaecology, ophthalmology and ENT.

Study procedure

Records of the routine health screening of MBBS students were analyzed. One of the authors (corresponding author) was the faculty in-charge of the screening board. The data related to the student's age, sex, height, weight, blood pressure, family history of diabetes, family history of hypertension were utilized for the study. After collecting these details, the student's blood pressure and anthropometries like height and weight were measured. Anthropometry and blood pressure were measured as per the guidelines mentioned in the World Health Organization (WHO) STEPwise approach for NCDs surveillance was used.[15]

Operational definition

Family history of diabetes and hypertension: At least one of the first or second-degree relative having diabetes and/or hypertension.

First-degree relative: A close blood relative which included the student's parents, siblings, or children.

Second-degree relative: A blood relative which included the student's grandparents, grandchildren, aunts, uncles, nephews, nieces or half-siblings.

Study variables

The Quetelet's Index also called as the Body Mass Index (BMI) was calculated with their height and weight for each student using the formula weight in kilograms divided by the square of height in meters. BMI was categorized into underweight, normal, overweight and obese based on the WHO recommended BMI categories for Asian populations.[16,17] Blood pressure of the students was categorized into normal,

prehypertension, stage 1 hypertension and stage 2 hypertension based on the Eighth Joint National Committee (JNC-8) guidelines recommendations.[18]

Data entry and analysis

The data were entered in Microsoft Excel and analysed using STATA v14 software (StataCorp LP. College Station, TX).[19] The continuous variables which followed normal distribution like age, height, weight, BMI, systolic and diastolic blood pressure were summarized as mean and standard deviation. The categorical variables like sex, family history of diabetes and hypertension, BMI categories, blood pressure categories and blood group were summarized as percentages. Statistical significance of the trends of categorical variables over the years was tested using the Chi-square test for trend. Since there was very less number of participants in stage 2 hypertension, this category was clubbed with stage 1 hypertension while doing the Chi-square test for trends. Statistical significance of the trend of continuous variables over the years was tested using ANOVA. A *P*-value of less than 0.05 was considered significant.

Results

A total of 1350 students were included in this study. The trends of various characteristics among the first year MBBS students were over 13 years from 2000 to 2013 is depicted in Table 1. Most of the MBBS students in MAMC were males (63.5%). Female MBBS students were constantly lesser than males with a minimum of 20% in 2006. The mean age of the students ranged between 17 and 18 years for all the years. The mean (SD) height of the study participants was 1.69 (0.9), which remained almost constant over the 13 years. The mean (SD) weight of the study participants was 63 (13.3) kilograms and many variations were not there over 13 years. The mean BMI of the MBBS students was constantly 21 kg/m^2 for all the years. The trend of BMI among the students is shown in Figure 1 .

The trend of BMI categories among students over 13 years is represented in Figure 2. On average, the prevalence of obesity among the study participants was 19.8%. The trends of obesity among MBBS students were increasing from 11.3% in 2000 to a maximum of 31.7% in 2013. Only 44.8% of the study participants were having BMI in the

Table 1: Trends of various characteristics among the first year MBBS students over the years, *N* = 1350

S. No	Characteristics	2000 *N* = 184	2001 *N* = 152	2002 *N* = 187	2005 *N* = 193	2006 *N* = 182	2007 *N* = 185	2013 *N* = 267	*P* value
1	Age (yr)*	18.1 (1.0)	17.8 (0.9)	17.8 (1.1)	17.9 (0.9)	18.1 (1.2)	18.0 (1.0)	18.9 (1.3)	<0.001
2	Height (meters)*	1.7 (0.1)	1.69 (0.1)	1.68 (0.1)	1.70 (0.1)	1.72 (0.1)	1.73 (0.1)	1.64 (0.1)	<0.001
3	Weight (kg)*	62.5 (12.1)	61.8 (14.1)	61.6 (13.0)	64.2 (13.5)	64.4 (14.8)	63.5 (12.9)	63.2 (13.1)	0.291
4	BMI*	21.5 (3.1)	21.4 (4.1)	21.6 (3.9)	21.9 (3.7)	21.5 (4.0)	21.1 (3.5)	23.3 (4.0)	<0.001
5	Systolic BP*	123.3 (11.6)	122.3 (9.8)	123.4 (9.0)	125.5 (8.8)	122.7 (10.3)	122.5 (9.6)	121.1 (7.5)	<0.001
6	Diastolic BP*	77.0 (7.1)	81.2 (6.0)	79.6 (6.0)	80.3 (6.1)	80.2 (6.6)	79. 8(6.1)	74.8 (7.0)	<0.001
7	Gender#								
	Male	109 (59.2)	88 (57.8)	102 (54.5)	133 (68.9)	145 (79.6)	120 (64.8)	161 (60.3)	<0.001
	Female	75 (40.7)	64 (42.1)	85 (45.4)	60 (31.0)	37 (20.3)	65 (35.1)	106 (39.7)	
8	Family history of diabetes#								
	Present	22 (11.9)	25 (16.4)	42 (22.4)	38 (19.6)	20 (10.9)	18 (9.7)	44 (16.4)	0.004
	Absent	162 (88.0)	127 (83.5)	145 (77.5)	155 (80.3)	162 (89.0)	167 (90.2)	223 (83.5)	
9	Family history of hypertension#								
	Present	27 (14.6)	23 (15.1)	39 (20.8)	30 (15.5)	29 (15.9)	18 (9.7)	31 (11.6)	0.068
	Absent	157 (85.3)	129 (84.8)	148 (79.1)	163 (84.4)	153 (84.0)	167 (90.2)	236 (88.3)	
10	BMI categories#								
	Underweight	30 (16.3)	40 (26.3)	39 (20.8)	41 (21.2)	48 (26.3)	47 (25.4)	25 (9.3)	<0.001
	Normal	95 (51.6)	72 (47.3)	87 (46.5)	75 (38.8)	76 (41.7)	87 (47.0)	114 (42.7)	
	Overweight	38 (20.6)	13 (8.5)	27 (14.4)	34 (17.6)	25 (13.7)	25 (13.5)	43 (16.1)	
	Obese-stage 1	18 (9.7)	22 (14.4)	28 (14.9)	38 (19.6)	25 (13.7)	22 (11.8)	65 (24.3)	
	Obese-stage 2	3 (1.6)	5 (3.2)	6 (3.2)	5 (2.5)	8 (4.4)	4 (2.1)	20 (7.4)	
11	BP Categories#								
	Normal	42 (22.8)	14 (9.2)	25 (13.3)	26 (13.4)	32 (17.5)	41 (16.0)	75 (28.0)	<0.001
	Prehypertension	127 (69.0)	113 (74.3)	142 (75.9)	139 (72.0)	122 (67.0)	117 (63.2)	188 (70.4)	
	Stage 1 hypertension	15 (8.1)	23 (15.1)	18 (9.6)	24 (12.4)	23 (12.6)	26 (14.0)	4 (1.5)	
	Stage 2 hypertension	0	2 (1.3)	2 (1.0)	4 (2.0)	5 (2.7)	1 (0.5)	0	

*Mean (SD) is represented in the table. #Frequency (percentage) is represented.

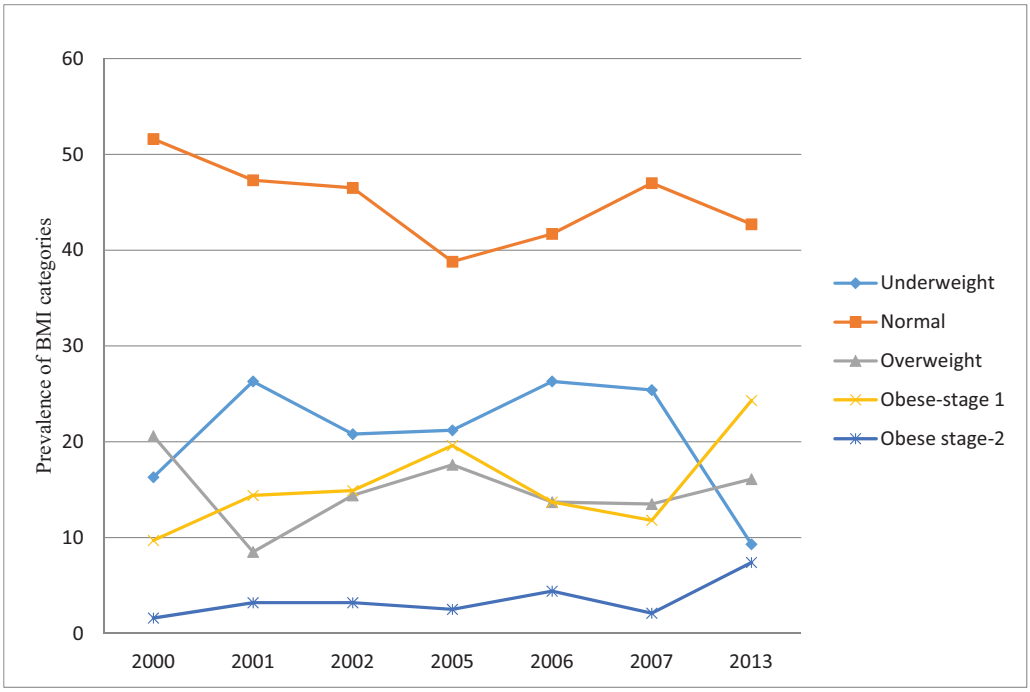

Figure 1: Trend of BMI over 13 years among MBBS students, $N = 1350$

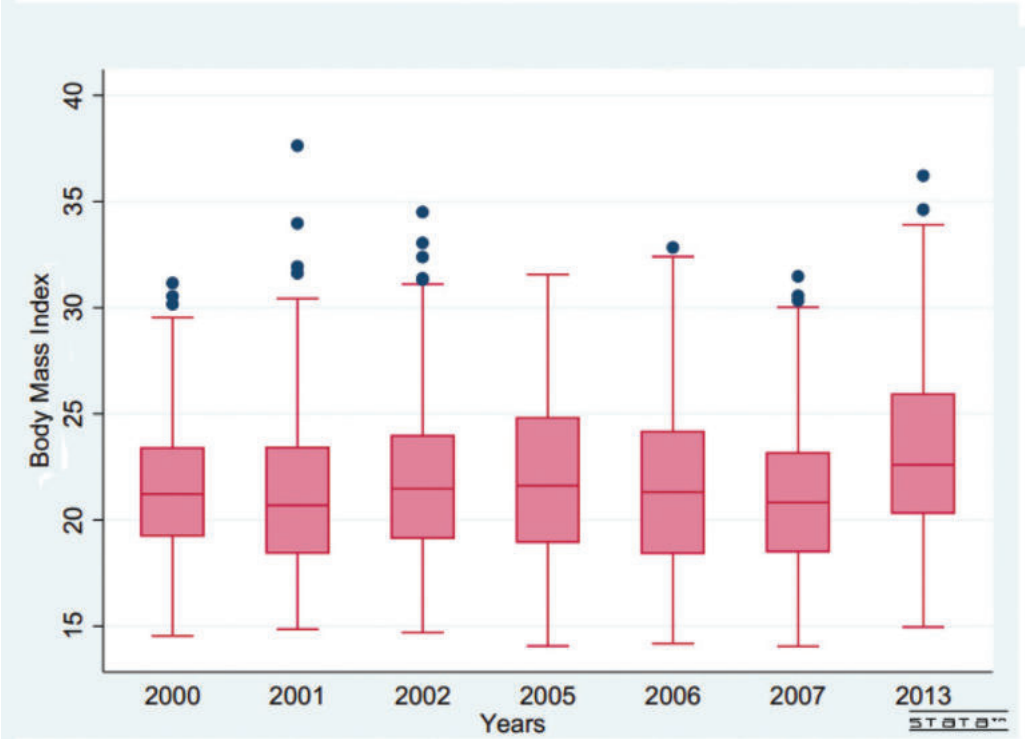

Figure 2: Distribution of BMI categories among the study participants over the years, $N = 1350$

normal range. Rest of the students were either underweight or overweight/obese. The trends of underweight prevalence were ranging from a minimum of 16.3% in the year 2000 to a maximum of 26.3% in the year 2006 and then the prevalence decreased to 9.3% in 2013. During the year 2013, the prevalence of underweight was minimum (9.3%) and that of obesity was maximum (31.7%).

The trend of systolic blood pressure among the students over 13 years is depicted in Figure 3. The mean systolic blood

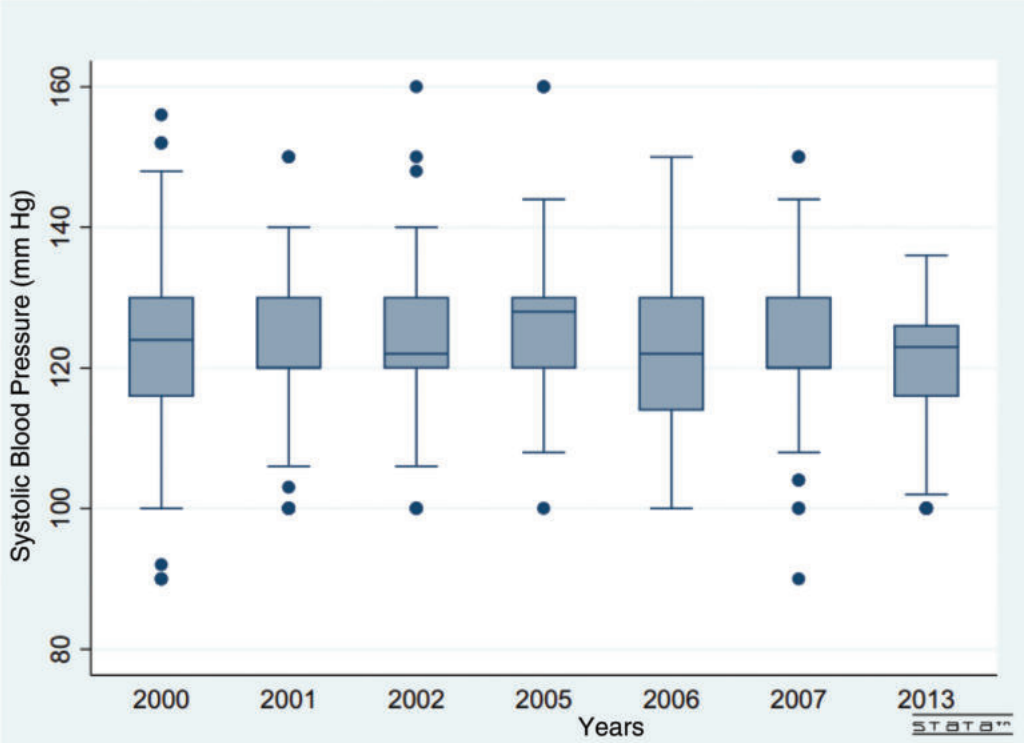

Figure 3: Trend of systolic blood pressure (mm Hg) over 13 years among MBBS students $N = 1350$

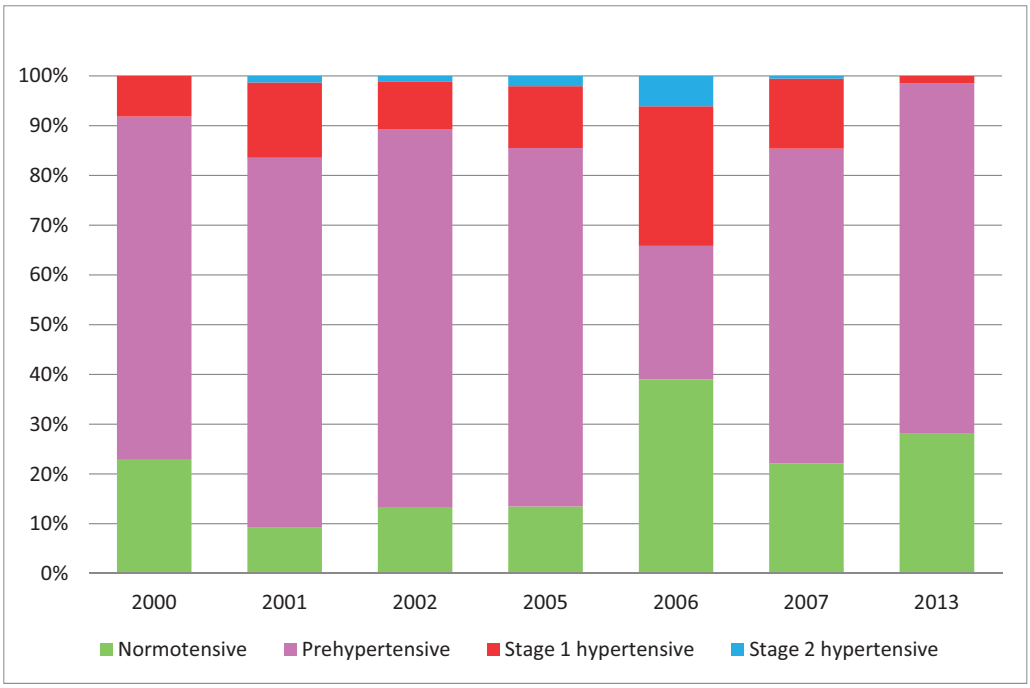

Figure 4: Distribution of blood pressure among the study particpants over years, $N = 1350$

pressure was constantly around 122 mmHg. The trend of blood pressure categories is represented in Figure 4. The prevalence of hypertension was 8.1% in the year 2000 which increased to 16.4% in 2001, 10.6% in 2002, 14.4% in 2005, 15.3% in 2006, 14.% in 2007 and then it drastically decreased to 1.5% in 2013. The proportion of students who were having prehypertension was ranging from a minimum of 63.2% in 2007 to a maximum of 75.9% in 2002. The trends of prevalence of prehypertension among the first year MBBS students was constantly increasing from 69% in 2000 to

75.9% in 2002 after which it gradually decreased to 63.2% in 2007 and then again it increased to 70.4% in 2013.

Positive family history for diabetes among the students was ranging from 9.7% to 22.4%. In the initial three years from 2000 to 2002, it was increasing and then in the next three years from 2005 to 2007 the trend of positive family history was decreasing. This same trend was also observed in the positive family history for hypertension.

Discussion

The prevalence of obesity in the current study was 19.8%, which similar to other studies conducted in various parts of the world.[12] An Indian study performed in 2014 has also reported that the prevalence of obesity among adolescents was 19% which is similar to the current study, whereas another study performed in 2016 has identified a lesser prevalence of obesity of around 9%.[13,20] The difference in the results might be due to study setting because the staple food and other feeding practices vary widely in different parts of India. Obesity among the study participants was increasing from 11.3% in 2000 to a maximum of 31.7% in 2013 and it was statistically significant. This increase of 280% in the prevalence of obesity among adolescents and young adults from 2000 to 2013 seems to be alarming. This can be attributed to the eating behaviour and physical activity practices of the adolescents which are in turn affected by the robust marketing, easy availability of the unhealthy foods and paucity of safe areas for physical activity.[21] Adolescent lifestyle, especially among young doctors, has undergone a drastic change in terms of skipping meals, eating junk foods and also sedentariness with more time spent in studying, using gadgets.[22] It is expected that if this trend continues to increase at the same pace, then the morbidity and mortality due to NCDs will increase certainly. Thus, there is an urgent need to implement a cost-effective intervention to change the dietary pattern and physical activity of the adolescents. We need to consider the best buy intervention suggested by WHO to implement community-wide public education and awareness campaign for physical activity including mass media campaign combined with other community-based education, motivational and environmental programmes aimed at supporting a behavioural change of physical activity level. The average prevalence of hypertension among MBBS students was 10.8%. This was relatively lower as compared to a few other studies (21%–24%) performed in India among adolescents.[11,23] The difference in results could be due to the difference in the study setting and difference in the definition of hypertension used in the study. The overall prevalence of hypertension was low in spite of the constantly increasing prevalence of hypertension from 8% in 2000 to 14% in 2007. This can be attributed to the increasing awareness about hypertension and also the dietary habits in this study setting where they add salt only in the side dish, not in the chappati. Increased salt intake is a well-established causative factor for hypertension.[24]

There are few strengths to the study. First, this is the first study of its kind to assess the trends in the prevalence of obesity and hypertension among adolescents over 13 years from 2000 to 2013. Second, the study included the adolescents and young adults from seven batches of MBBS students and the sample size was 1350. Third, the anthropometry and blood pressure measurements were according to WHO guidelines for STEPS surveillance. There are few limitations also. Although there are so many other risk factors for NCDs, we included only gender, obesity, hypertension, family history of diabetes and hypertension. Since it was a record based study the variables available were limited. Generalizability of the results among adolescents and young adults should be performed cautiously since most of the study participants were from affluent socioeconomic status in and around Delhi. Since most of them were residing in hostel their dietary patterns might also be different from adolescents and young adults in other community.

Conclusion

Our study has found that there was an alarming increase in the trend of prevalence of obesity among medical undergraduates which indicates the need for urgent interventions to minimize unhealthy behaviours and adopt a healthy lifestyle in order to decrease the development of risk factors for NCDs among the doctors in future.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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