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Original Article

Prevalence of Cardiovascular Risk Factors in Engineering and Medical Students in Madurai, Tamil Nadu

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Abstract

Background : Cardiovascular risk factors are increasingly seen in college-going student population in India

Objectives: To estimate the prevalence of cardiovascular risk factors in medical and engineering students, and to examine gender-wise and stream-wise risk factor distribution

Methods: Consenting students (N=200; 100 medical and 100 engineering students, 50 males and 50 females within each stream) were administered a validated, structured questionnaire to capture data about age, family history and physical activity. Physical examination was done to determine BP, height, weight, waist circumference (WC) and hip circumference. Indian cut-offs were used for BMI (body mass index), WC, and WHR (waist-hip ratio) categories. Chi-square test and Fischer's exact tests were used to analyze significance.

Results: Mean age of participants was 18.57±0.78 years. Overweight and obese BMI was observed in 31% students (29% engineering, 33% medical, 31% male and 31% female students). Number of participants classified under high-risk WC category was significantly higher in engineering stream (38 engineering vs 18 medical students, p=0.001) and female students (38 female vs 18 male students, p=0.001). Hypertension was significantly more prevalent in engineering stream (15 engineering vs 6 medical students, p=0.031) and male students (18 male vs 3 female students, p<0.001). Significantly more female students had inadequate physical activity (82 female vs 50 male students; p<0.001).

Conclusions: Proper education about cardiovascular risk factors and lifestyle modification is essential for reducing and postponing the development of cardiovascular diseases in this population. Further studies with larger population and inclusion of more risk factors are essential.

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Introduction

Worldwide, approximately 17.7 million people worldwide died from cardiovascular diseases (CVDs)

in 2015 (31% of all global deaths) according to the World Health Organization (WHO); among these, 7.4 million were due to coronary heart disease (CHD). Almost 75% of deaths due to CVDs take place in low- and middle-income countries. The major risk factors of CVD include tobacco use, unhealthy diet and obesity, physical inactivity and harmful use of alcohol, hypertension, diabetes and hyperlipidemia (1).

Even in India, CVDs have been the leading cause of morbidity and mortality (2). It has been reported that the prevalence of CVDs is rising in India (3). Further, the prevalence of many cardiovascular risk factors such as diabetes mellitus, hypertension and dyslipidemia has markedly increased in India in the past 30 years (4).

Recent studies indicate a dangerous trend that the disease has started to affect younger individuals as well. A high prevalence of cardiovascular risk factors such as obesity, hypertension, and low physical activities has been observed among the college-going student population in countries such as Poland, USA, and Greece (5-7). Studies have shown that CVDs affecting people in developing countries have earlier age of onset and greater mortality (8). It has been repeatedly reported that CVDs manifest at least a decade earlier in South Asians when compared to people in the Western World (9, 10). In addition, various CVD risk factors also start early in childhood and youth and these risk factors magnify with age (8). Due to the unhealthy lifestyle of the younger population, various CVD risk factors are increasingly seen in young college going student population of our country.

Preventive and interventional strategies to halt this dangerous progression are the need of the hour. As a first step, the prevalence of various CVD risk factors should be known. There is a dearth of studies which estimate the prevalence of various cardiovascular risk factors (such as obesity, hypertension, smoking, family history and inactivity) in medical and engineering students in this geographical region, which prompted us to undertake this study.

Materials and Methods

This cross-sectional, observational study was conducted between April and July 2015, and involved administering a validated and structured questionnaire containing questions (both objective and open-ended, the former being more) that cater to the objectives of the study to consenting medical and engineering students in Madurai, TN aged 18-24 years. Sample size included 100 medical and 100 engineering students; within each stream, 50 male and 50 female students were recruited in the study.

After obtaining ethics committee clearance which worked in accordance with the Helsinki Declaration of 1975, as revised in 2000, permission was also obtained from the relevant college authorities. A list of all students attending respective courses was obtained. Using a random number generator table in MS excel, 50 male and 50 female students aged 18-24 years within each stream were selected. These students were briefly explained about the study and informed consent was obtained. The questionnaire was given to these students, and subsequently physical examination was performed. Variables measured included sitting BP, height, weight, waist and hip circumference; variables derived included body mass index (BMI) and waist-hip ratio (WHR). For measuring physical activity, the WHO Global Physical Activity Questionnaire (GPAQ) was used, with suitable modifications (11).

Height was measured using a stadiometer (indosurgicals) to the nearest 0.5 cm, and weight was measured by a standard weighing machine (GVC Virgo Fitness Weighing Scale), to the nearest 0.5 kg, with the student having removed his/her footwear for both measurements. BMI was calculated by dividing weight (kg) by square of height (m). Waist circumference was measured using a non-stretchable tape, to the nearest 0.1 cm, at the midpoint between tip of iliac crest and last costal margin in the back, and at umbilicus in the front, at the end of normal expiration, with subject standing erect in a relaxed position. BP was measured as per the JNC-7 recommendations, using a mercury sphygmomanometer (Diamond) by applying the cuff

on the right arm, with the student in sitting position after five minutes of rest. BP was measured three times with an interval of 30 seconds, and the average of the three measurements was used in analysis (12).

For the purpose of this study, the definition of BMI selected was <18.0 kg/m^2: underweight; 18.0-22.9 kg/m^2: normal; 23.0-24.9 kg/m^2: overweight; ≥25 kg/m^2: obese (13). The cut-offs selected for waist circumference (WC) was ≥85 cm for men and ≥80 cm for women as having low risk, and for waist-hip ratio (WHR) was ≥0.89 for men and ≥0.81 for women as having low risk (14). The JNC-7 classification of hypertension was used to determine cut-offs for hypertension (systolic blood pressure (SBP) ≥140 mmHg and/or diastolic blood pressure (DBP) ≥90 mmHg) (12). For analysing the physical activity, the WHO GPAQ analysis guidelines were used. The physical, recreational and sports activities were classified as 'vigorous' and 'moderate' based on the elevation of heart rate they produced according to the students, and details of the minutes per week in which the student was involved in such activities was collected. Information about whether the student walked or used a bicycle for at least 10 minutes a day was collected under 'transport' activities. The total weekly duration (in minutes) of 'vigorous' activities was multiplied by 8, and the total weekly duration (in minutes) of 'moderate' and 'transport' activities was multiplied by 4 to obtain the final MET (metabolic equivalent) score of the student. A MET score <600 was considered to be inadequate physical activity (11).

All data was electronically recorded. Chi-square test and Fischer's exact test were used to analyze significance between various groups of participants belonging to different stream of study and gender. Statistical software used was SPSS version 22.0. Values were expressed as Mean±SD, and p value <0.05 was considered as significant for all the tests applied.

Results

The mean age of the participants was 18.57±0.787 years (range 17-21 years; median age = 18 years). The anthropometric data is summarised in Table I. Significantly more engineering students than medical students belonged to high WC risk category and had hypertension, and significantly more female students than male students belonged to high risk WC and WHR categories, and had hypertension ($p<0.05$ in all cases). None of the students with hypertension were on any treatment for the same. Physical inactivity was similar between medical and engineering students, but was significantly higher in female students than males ($p<0.001$).

Family history of CV risk factors:

More medical students reported family history of

TABLE I: Anthropometric values and their comparison between engineering and medical students, and between male and female students.

Risk factor	*Total (n=200) (%)*	*Engineering students (n=100) (%)*	*Medical students (n=100) (%)*	*P value*	*Male students (n=100) (%)*	*Female students (n=100) (%)*	*P value*
Obese BMI	30 (15%)	15 (15%)	15 (15%)		15 (15%)	15 (15%)	
Overweight BMI	32 (16%)	14 (14%)	18 (18%)	0.182	16 (16%)	16 (16%)	0.338
Normal BMI	107 (53.5%)	50 (50%)	57 (57%)		49 (49%)	58 (58%)	
High risk WC (>85 cm for men, >80 cm for women)	56 (28%)	38 (38%)	18 (18%)	**0.001**	18 (18%)	38 (38%)	**0.001**
High risk WHR (>0.89 for men, >0.81 for women)	180 (90%)	91 (91%)	89 (89%)	**0.407**	84 (84%)	96 (96%)	**0.004**
Hypertension	21 (10.5%)	15 (15%)	6 (6%)	**0.031**	18 (18%)	3 (3%)	**<0.001**
Physical inactivity (<600 MET score)	132 (66%)	64 (64%)	68 (68%)	**0.327**	50 (50%)	82 (82%)	**<0.001**

Note: WC: waist circumference; WHR: waist-hip ratio; MET: metabolic equivalent

hypertension (28/42, 66.67%), type 2 diabetes (47/73, 64.38%), and obesity (14/17, 82.35%) than engineering students; all three were significantly higher than those in engineering students (p=0.012, 0.02 and 0.05 respectively). However, a significant difference was not obtained in family history of 'any cardiac disease' (Fig. 1). There was no statistically significant difference in the distribution of family history of CV risk factors between male and female participants.

Smoking and passive smoking:

Only one participant gave history of smoking, and only two participants (one each in medical and engineering streams, and one each in either gender) admitted to being affected by passive smoking. None of these values was statistically significant.

Subgroup analyses:

We analysed the distribution of risk factors among subgroups of participants, namely: (a) male engineering students; (b) female engineering students; (c) male medical students; and (d) female medical students. We excluded smoking and passive smoking from subgroup analyses due to less number of responses. The significant results are explained below:

1. *BMI* : There was no significant difference in the distribution of BMI categories between medical and engineering students, or between male and female students.

2. *Waist Circumference* : More female engineering students were classified under the high risk waist circumference category than other subgroups (Fig. 2).

3. *Waist-Hip Ratio* : When WHR was taken for classifying participants under risk categories, 180 out of 200 participants were classified as having a higher CV risk. Females were at a higher risk

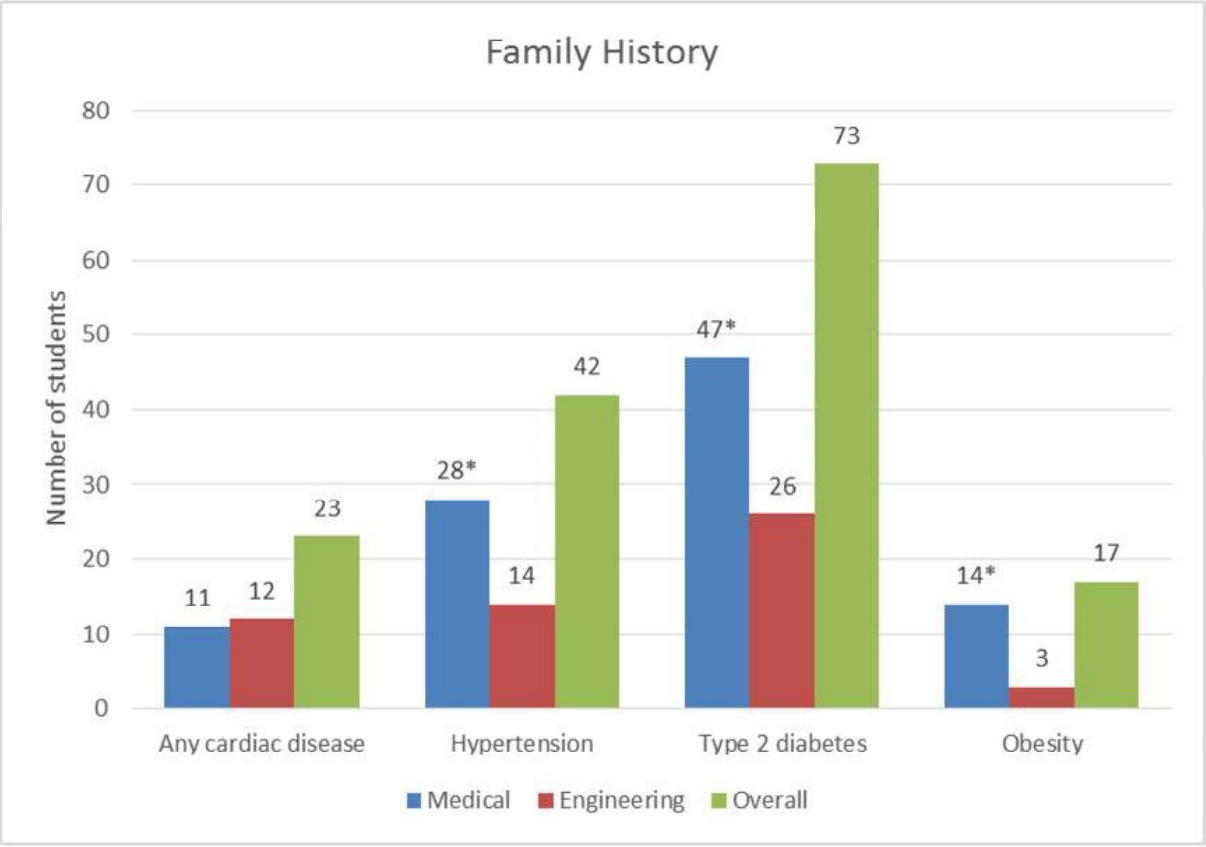

Fig. 1 : Family history of cardiovascular risk among medical and engineering students.

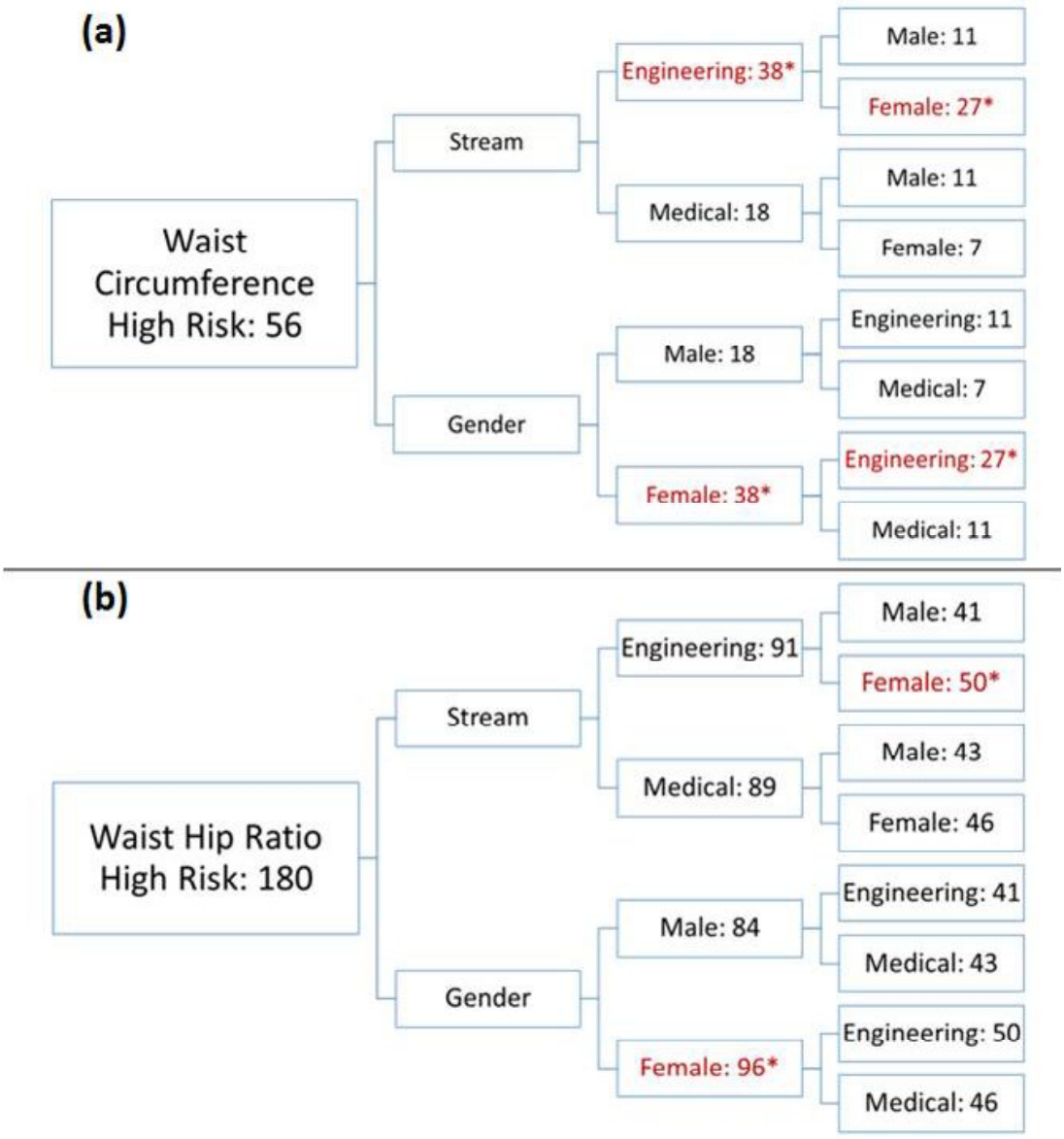

Fig. 2 : Distribution of Participants Classified as Having Higher CV Risk Based on (a) Waist Circumference and (b) Waist-hip Ratio.

than males. Finally, all 50 female engineering students enrolled in the study were classified as having high CV risk based on WHR (Fig. 2).

4. *Family history* : More male medical students gave family history of cardiovascular risk factors when compared to other subgroups.

5. *Hypertension* : More male engineering students were found to be having hypertension than other subgroups (Fig. 3).

6. *Inadequate physical activity* : More female students had inadequate physical activity than males; there was no difference between medical and engineering female students (Fig. 3).

Discussion

The present study was undertaken with the objectives of finding out the prevalence of various cardiovascular risk factors in a sample of engineering and medical students of either gender belonging to the age group

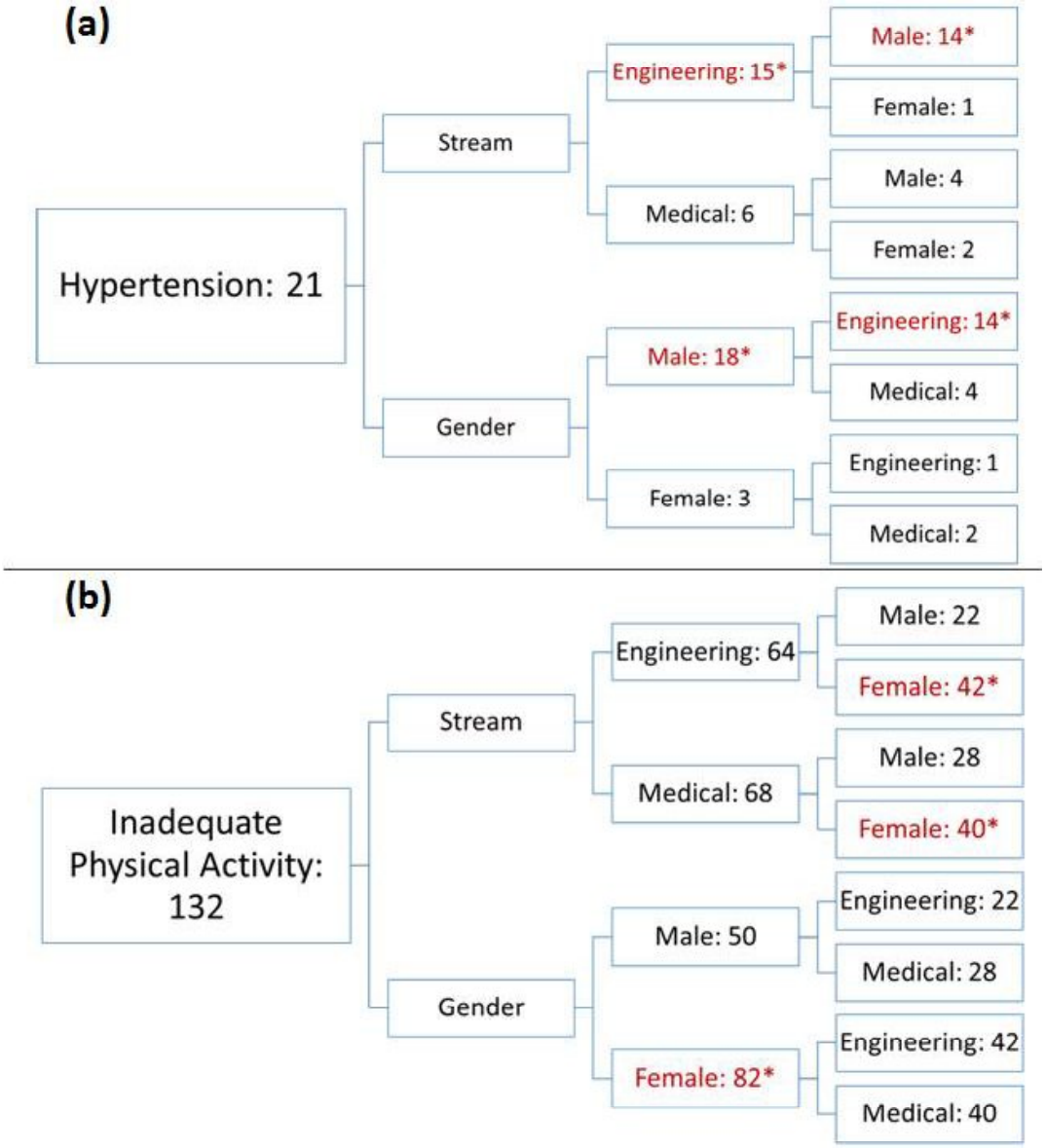

Fig. 3 : Distribution of Participants with (a) Hypertension and (b) inadequate physical activity.

of 18-24 years in the city of Madurai. A total of 200 consenting apparently healthy students (100 medical, 100 engineering; 50 males and 50 females within each stream) were involved in the study. Though some studies in the past have evaluated the prevalence of CV risk factors in medical students in various regions of India, to our best knowledge no study published till date has evaluated the prevalence of CV risk factors in engineering students in India, and in medical students in this region.

We found that 32% of participants (29% engineering students, 33% medical students, 31% male students and 31% female students) had BMI of more than 23. There was no statistically significant difference in the distribution of BMI categories between students belonging to different streams of study or different genders. In contrast, a study reported from Kerala had found that significantly more male medical students were having a BMI of more than 25 (15).

We also found that more female students, and more engineering students were classified under the high risk waist circumference category. In comparison, the study by Kurian S et al also reported that more

female medical students belonged to a higher WC risk category (15).

When WHR was taken as the parameter for assessing risk, we found that 90% of the participants were classified as having a high risk of developing cardiovascular diseases. Further, the incidence of high-risk WHR was significantly higher among female students, and all 50 female engineering students were classified as having high risk WHR. This contrasting results between WC and WHR categories has to be interpreted cautiously because it has been reported that WC is more sensitive than WHR as an index of upper body adiposity, (14) and that Asian Indians have higher upper body adiposity and higher visceral fat for a given BMI than the Western population (16). With this background, our study revealed that in the selected population sample, female students, especially those studying engineering, have a higher degree of upper body adiposity and thus are at a higher cardiovascular risk than other subgroups.

More male students were found to be having hypertension than females. This result is similar to that reported in previous studies (15). Interestingly, among the streams, the engineering students had a higher prevalence of hypertension than the medical students. While it is known that both engineering and medical studies can be considerably stressful, this finding needs to be confirmed by repeating a similar study with a higher sample size. It is also required to investigate the factors contributing to this high prevalence of hypertension in engineering students, and preventive and/or corrective actions are to be planned.

More male medical students gave significant family history of cardiovascular risk factors than other subgroups. This may be explained on the basis that medical students are more aware about the importance of risk factors, and how to look for them in their immediate surroundings.

We found that more female students had inadequate physical activity than male students. This finding was similar in both engineering and medical streams of study. Similar results have been reported in previous studies (15, 17).

A prominent factor in our study is that only one out of the 200 students gave history of smoking, and only two students (one each in medical and engineering streams, and one each in either gender) admitted to being affected by passive smoking. The major contributor for this outcome is the fact that both the campuses where this study was conducted were strictly smoking-free campuses. Further, a possibility of wilfully withholding information due to the stigma associated with smoking cannot be ruled out confidently.

Studies similar to ours have been reported from outside India as well, with somewhat similar outcomes. Among pharmacy students from Poland, the prevalence of obesity, overweight BMI, hypertension and smoking was higher among males, whereas female students reported lower physical activity.[5]Among third year medical students from Greece, male students had higher BMI (overweight and obese) than female students, and the presence of obesity was correlated to the presence of hypertension and dyslipidaemia (7).

Limitations of the present study include insufficient sample size and omission of risk factors such as glycemic status, lipid profile, and diet. Further studies of longer duration and involving larger sample size will provide a more comprehensive outcome.

Conclusions

Prevalence of adolescent students having overweight and obese BMI according to Indian standards in the selected sample was ranged from 29% to 33%. More female students, and more engineering students were classified under the high-risk WC category. Hypertension was more prevalent among male students and engineering students, and more female students had inadequate physical activity than males.

Proper education about cardiovascular risk factors and lifestyle modification is essential to reduce modifiable cardiovascular risk factors and thereby to postpone the development of cardiovascular diseases in this population, thus paving way for a healthier population. Further studies with larger population and inclusion of more risk factors are essential.

References

1. World Health Organization. Cardiovascular diseases (CVDs) Fact sheet. [Online]. 2017 May [cited 2018 Jan 23]; Available from: URL:http://www.who.int/mediacentre/factsheets/fs317/en/]
2. Park K. Parks textbook of preventive and social medicine. 24th Ed. Jabalpur (MP): Banarsidas Bhanot; 2017
3. Chauhan S, Aeri BT. Prevalence of cardiovascular disease in India and its economic impact - a review. Intl J of Scientific and Research Publications [serial online] 2013 October [cited 2018 Jan 23]; 3(10);1-5. Available from: URL:http://www.ijsrp.org/research-paper-1013/ijsrp-p2234.pdf
4. Kasliwal RR, Kulshreshtha A, Agrawal S, Bansal M, Trehan N. Prevalence of cardiovascular risk factors in Indian patients undergoing coronary artery bypass surgery. *J Assoc Physicians India* 2006; 54: 371–375.
5. Ilow R, Różańska D, Regulska-Ilow B. Prevalence of cardiovascular disease risk factors among pharmacy students from Wroclaw Medical University (Poland). *Adv Clin Exp Med* 2017; 26: 843–850.
6. So WY, Swearingin B, Robbins J, Lynch P, Ahmedna M. Relationships between Body Mass Index and Social Support, Physical Activity, and Eating Habits in African American University Students. *Asian Nurs Res (Korean Soc Nurs Sci)* 2012; 6: 152–157.
7. Bertsias G, Mammas I, Linardakis M, Kafatos A. Overweight and obesity in relation to cardiovascular disease risk factors among medical students in Crete, Greece. BMC Public Health 2003; 3: 3.
8. Gupta R, Misra A, Vikram NK, Kondal D, Gupta SS, Agrawal A, et al. Younger age of escalation of cardiovascular risk factors in Asian Indian subjects. *BMC Cardiovasc Disord* 2009; 9: 28.
9. Gupta R, Joshi P, Mohan V, Reddy KS, Yusuf S. Epidemiology and causation of coronary heart disease and stroke in India. *Heart* 2008; 94: 16–26.
10. Prasad DS, Kabir Z, Dash AK, Das BC. Cardiovascular risk factors in developing countries: A review of clinico-epidemiological evidence. *CVD Prev Control* 2010; 5: 115–123.
11. WHOGlobal Physical Activity Questionnaire. [Online]. [cited 2015 Jan 22]; Available from: URL:http://www.who.int/chp/steps/resources/GPAQ_Analysis_Guide.pdf.
12. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr, et al. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. *JAMA* 2003; 289: 2560–2572.
13. Misra A, Chowbey P, Makkar BM, Vikram NK, Wasir JS, Chadha D, et al. Consensus statement for diagnosis of obesity, abdominal obesity and the metabolic syndrome for Asian Indians and recommendations for physical activity, medical and surgical management. *J Assoc Physicians India* 2009; 57: 163–170.
14. Snehalatha C, Viswanathan V, Ramachandran A.Cutoff values for normal anthropometric variables in Asian Indian adults. *Diabetes Care* 2003; 26: 1380–1384.
15. Kurian S, Manjula VD, Annamma, Zakariah J. A study on cardiovascular risk factor profile of medical students in a tertiary care hospital of Central Kerala. *Natl J Med Res* 2015; 5: 11–17.
16. Banerji MA, Faridi N, Atluri R, Chaiken RL, Lebovitz HE. Body composition, visceral fat, leptin and insulin resistance in Asian Indian men. *J Clin Endocrinol Metab* 1999; 84: 137–144.
17. Rao CR, Darshan B, Das N, Rajan V, Bhogun M, Gupta A. Practice of Physical Activity among Future Doctors: A Cross Sectional Analysis. *Int J Prev Med* 2012; 3: 365–369.