Cardio-metabolic risk among undergraduate medical students of a selected Faculty of Medicine in Colombo

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Abstract

Introduction : Non-communicable diseases (NCD) are emerging in all ages, with cardio-metabolic diseases being a leading cause of morbidity and mortality.

OBJECTIVE: To determine the prevalence of cardio-metabolic risk among medical students of a selected Faculty of Medicine in Colombo.

METHOD: A cross-sectional study was conducted among medical students (volunteered from all 5 batches) of the selected faculty. Data was collected using a self-administered questionnaire. Anthropometry and body composition were assessed. Blood pressure was measured and after a 12-hour-overnight-fast, blood was drawn for fasting blood glucose (FBG), lipid profile and two-hour oral glucose tolerance test.

RESULTS: Final sample included 188 students (males=66). Mean (SD) age was 23.1yrs (1.7) and mean BMI 22.0 kg/m 2 (3.4). Prevalence of overweight was 35.1% (95%CI 28.3-41.9), obesity 5.9% (95%CI 2.5-9.3) and central obesity 16.9% (95%CI 11.5-22.3). 25.8% of males and 46.7% of females had abnormally high percentage body fat. Impaired FBG and impaired glucose tolerance were seen in 13.8% and 1.1% respectively. 25.4%, 12.2%, 31.6%, 5.3% had hypercholesterolemia, high LDL, low HDL and hypertriglyceridemia respectively. Consumption of alcohol was seen in 9%, low physical activity in 39.5%, sedentary life in 58%, low consumption of vegetables in 83.4% and low consumption of fruits in 86%. Males had higher rate of overweight/obesity (p=0.02), abnormal W/Height ratio (p=0.04), hypertriglyceridemia (p=0.06) while females had higher abnormal fat mass (p=0.005) and W/Hip ratio (p=0.000).

CONCLUSIONS: Medical students (young adults) have high prevalence of cardio-metabolic risk, highlighting the importance of routine screening, proper health education and behaviour modification for these future doctors who should be role models of health.

Introduction

Cardiovascular diseases (CVD) have been identified as the leading cause of morbidity and mortality among adults globally (1). The burden caused by these diseases is the most common health problem around the globe leading to premature death and disability (2). Projections have shown that an estimated 23.3 million people in the world would die annually of CVD by 2030 (3).

Low and middle-income countries contribute significantly to the global burden of CVD accounting for 78% of all deaths (4). South Asian countries such as India, Pakistan, Bangladesh, Nepal and Sri Lanka comprising of twenty percent of the world’s population, have a very high prevalence of CVD (5). South Asians have an increased risk for Type 2 diabetes and this, together with the rapid socio-economic changes and urbanization, has led to an epidemic of diabetes which has become a serious public health problem in the region (6).

Medical students, as the future health care providers, have a greater social responsibility to be healthy and fit to execute their duties and be good role models of health. However, studies determining the prevalence of cardiovascular risk among medical students elsewhere have shown high prevalence of cardiovascular risk among them (7, 8, 9, 10, 11). Prevalence of cardio-metabolic risk factors in a group of individuals receiving health-related university education, can demonstrate the real impact of health education as a measure of health promotion (12).

Although the prevalence of cardio-metabolic risk among medical students has been studied in several other countries, no study has been conducted in Sri Lankan state universities. Evidence from South Asian context in this regard, also remains sparse. The student population of the selected faculty of medicine was about 1020 at the time of data collection and represented all parts of the country. The majority (60%) of students are accommodated in the three hostels situated in close proximity to the faculty and main teaching hospitals, while the rest are staying in close-by boarding places or are day scholars. Hostels have their own arrangements to provide meals but the students who are staying in boarding places buy their meals from outside shops or faculty canteen. The students have easy access to fast foods outlets around the faculty, which would tempt them to consume that food rather than to take the food prepared in their residence.

Therefore, this population could be highly vulnerable to develop NCD despite them being exposed to the highest levels of technical inputs with regard to non-communicable diseases. The present study was conducted to determine the prevalence of cardio-metabolic risk among the medical students of this selected faculty of medicine in Colombo, Sri Lanka.

Methods

This was a cross sectional descriptive study conducted at a selected Faculty of Medicine in Colombo, Sri Lanka. Basic data collection was done at the University Medical Officer's office and the biochemical tests were analysed at the Clinical Laboratory of the Professorial Paediatric Unit, at the Lady Ridgeway Hospital for Children, Colombo, Sri Lanka.

Study population

All medical students, in both clinical and preclinical years, aged 20 years or above were given an open invitation to participate in the study by way of notices put out on faculty notice boards and by distribution of leaflets to students. All medical students who volunteered to participate were recruited to the study based on consecutive sampling technique. Recruitment was carried out till the necessary sample size was obtained

Sample size

The sample size for the study was calculated to detect the prevalence of major modifiable cardiovascular risk factors. Sample size, calculated using an expected prevalence of 13.8% for vigorous physical activity

(11), a confidence level of 95% and a margin of error of 5% was 183. Allowing for non-response rate of about 10% the final sample size was calculated as 200.

Study variables and Data collection

A standardized semi-structured questionnaire was used to capture demographic information and selected cardiovascular disease risk factors including: history of smoking cigarette, consumption of alcohol, involvement in aerobic exercises, personal and family history of CVD and risk factors. Adequate fruit consumption was defined as consumption of 3 or more servings of fruits and adequate vegetables consumption as 5 or more servings per day as defined by food-based guidelines of Sri Lanka (13). Level of physical activity was taken adequate if subject was engaged in at least 2.5 hours per week as recommended. Recommended physical exercise for an adult is moderate exercise of 30 minutes at least five days a week (14). Sedentary life was defined as 8 or more hours of sitting per day.

The anthropometric measurements that were assessed are weight, height, waist circumference (WC) and hip circumference. The weight of the participants was measured using a calibrated weighing scale to the nearest 0.1 kg with the participant with minimum light weight clothes. The height was taken using a stadiometer to the nearest 0.1 cm with the participant standing upright with five points touching the vertical plane and the head in the Frankfurt plane. Body mass index (BMI) was calculated by dividing the weight in kilograms by the square of the height in meters. Overweight and obesity were defined as a BMI between 25kgm^{-2} and 30 kgm^{-2} and BMI of 30 kgm^{-2} and above, respectively. WC of the participant was measured using a non-stretchable tape placed horizontally at a point midway between the lowest part of the costal margin and the iliac crest in the mid axillary line, on bare skin. Hip circumference was measured horizontally at the level of the greater trochanter using a non-stretch tape. The waist-hip ratio (WHR) and waist to height (WHtR) ratio was calculated. Central obesity was calculated based on waist circumference with more than 90 cm in males and more than 80 cm in females. High WHR was defined as above 0.85 in females and above 0.9 in males while high WHtR was defined as above 0.5 (15)

Body fat was measured by BIA technique using In Body 230 (InBody Inc, South Korea). Excessive body fat was defined as percentage fat mass above 28.6% in males and 33.7% in females respectively (16). Blood pressure (BP) was measured using a calibrated mercury sphygmomanometer. Three consecutive readings of blood pressure were taken following a 10 minute rest. The BP was taken to the nearest millimeter of mercury with the participant seated, and a mean reading was calculated from the 3 readings. Hypertension was defined as SBP ≥ 140 mmHg and/or DBP ≥ 90 mmHg, while pre hypertension is defined as a SBP 130–139 mmHg and/or a DBP 85–89 mmHg, according to the 7th Joint National Committee of High BP (17).

After a 12-hour overnight fast, blood was drawn for fasting blood glucose (FBG) and lipid profile followed by an OGTT after administering 75 g of anhydrous glucose and blood was drawn for random blood glucose(RBG) after 2 hours. Metabolic Syndrome was diagnosed based on International Diabetes Federation Criteria (18). Central obesity with any two of the following; raised triglycerides (> 150 mg/dL), reduced HDL cholesterol (< 40 mg/dL in males, < 50 mg/dL in females), raised BP (systolic ≥ 130 mmHg

and/or diastolic ≥ 85 mmHg) or treatment for previously diagnosed hypertension and raised FPG (> 100 mg/dl) or raised RBG (> 140 mg/dl) or previously diagnosed type 2 diabetes mellitus.

Data Analysis

Data were entered and analyzed using, SPSS for windows. Continuous data were first summarized using means and standard deviations, medians and interquartile ranges depending on the distribution of the data and then the categorical data were summarized using percentages and proportions. Comparisons for continuous variables were made using the student t test, while categorical data were compared using the Chi square test. Logistic regression was used to establish the association between the risk factors and cardio-metabolic outcomes.

Ethics clearance was obtained from Ethics Review Committees of Faculty of Medicine, University of Colombo. Written informed consent was obtained from the study participants prior to participation into the study. Individual medical records were given to the respective individuals and appropriate referrals were made for further follow up.

Results

A total of 200 medical students participated in the study, which was a little over a fifth of the total population of medical students in the selected faculty of medicine (n = 900). Data of 188 (66 males) students were used in the final analysis. Seventy three (38.8 %) subjects were from pre-clinical years. The mean age was 23.1 ± 1.7 years. The demographic characteristics of the study population are shown in Table 1.

Distribution of BMI, WC, WHR and body fat is as shown in Table 2. Mean weight (SD) of the participants was 58.0 ± 22.0 kg and mean BMI (SD) was 22.0 ± 3.5 kgm^{-2}. Prevalence of overweight and obesity in the total sample were 16% and 1.6% respectively, with no significant difference between males (18.2%) and females (14.8%). Of the sample, 18% had high WHR while 23.8% had high WHtR. Percentage of males (33.8%, n=22) with high WHtR was significantly higher in the males compared to females (19.8%, n=23).

Twenty five (13.2%) were in pre-diabetic state while one had diabetes mellitus (Table 3). About one fourth (n=48, 25.4%) had hypercholesterolemia while 10 (5.3%) had hypertriglyceridemia which was significantly more common in the males (12.3% vs 1.6%, p=0.006). About one third of participants (n=59; 31.6%) had low HDL levels and 23 (12.2%) had high LDL levels. Mean HDL levels were significantly higher in the females (55.3 ± 12.4) compared to males (46.8 ± 10.2). Systolic BP of prehypertension level was seen in 4 (2.1%) while prehypertensive diastolic BP was seen in 6 (3.2%) subjects, all of whom were males. Central obesity, increased SBP or DBP, increased FBG or high OGTT (RBG) and abnormalities in the lipid profile were considered as metabolic abnormalities. The participants were categorized according to the number of abnormalities that they had. Only 32.2% (n=58) of the total sample was free of any metabolic abnormality, 41.1% had one metabolic abnormality while 26.8% had two or more metabolic abnormalities. Table 4 shows the distribution of NCD related risk factors in the study population. Hundred

and twenty (63.5%) participants and 122 (64.6 %) participants had a family history of hypertension and diabetes mellitus respectively. Only 8 (4.4 %) had a family history of both illnesses. Sixteen students (9.0%) admitted consuming alcohol but no one was smoking. About 40% (n=73) of the subjects did not engage in adequate physical activities, which was significantly higher in the females (47.1% vs 25.8%, p=0.005). About one third (35.1%) were leading a sedentary lifestyle. Sedentary lifestyle was significantly associated with dyslipidaemia (58% vs 42%, p=0.038). Majority (80.1%, n=121) did not consume sufficient amounts of fruits while vegetable intake was inadequate in about half of the sample (48.9%, n=85). Inadequate vegetable consumption was significantly associated with dysglycaemia (19% vs 9%, p=0.048).

Table 5 shows the distribution of the participants having dylipidaemia, dyglycaemia and one or more metabolic abnormality according to their anthropometric characteristics. More than 75% of those having dyslipidaemia have normal or low BMI levels, normal WC, normal WHR and normal WHtR. Similarly, more than 75% of those having dysglycaemia and more than 74% of those with at least one metabolic abnormality also had normal anthropometric parameters.

Discussion

Our study assessed the cardio-metabolic risk among medical students in a selected Faculty of Medicine in Colombo. We found a significantly high prevalence of hypercholesterolemia, low HDL levels, prehypertension, physical inactivity with sedentary life style and inadequate fruit and vegetable consumption.

While no one was having hypertension in our study sample, 4% had pre-hypertension, which marks a risk of developing hypertension in future and this could be a result of unhealthy diet and stressful lifestyle as well as familial tendency. When compared to results from other studies done in the region and the world (8, 19, 20, 21, 22, 23), this prevalence is not high. According to these studies, the prevalence of hypertension among medical students and other undergraduates with ages ranging from 18 to 36 years, varied between 1.3% and 17% while the prevalence of pre-hypertension was much higher. Relatively low prevalence in the current study could be due to the subjects being very young and of a narrow age range (mean age 23 years SD ± 1.7 years) and belonging a different ethnicity. This could be considered as a warning that hypertension and other associated CVD risk factors are health problems beginning from a young age group and with time it could adversely affect the health of future generations. This would not only increase morbidity and decrease productivity of the work force, but also adversely affect the longevity of the population by way of reducing the high level of life expectancy at birth that had been achieved.

Dyslipidemia was the most prevalent modifiable risk factor for CVD among the respondents (46.6%, n = 88). This would be an unexpected result as it is not the practice to screen for dyslipidemia in a healthy group of young adults like our study population. The studies that have assessed the CVD risk among medical students and other university students report prevalence of 8–9% of hypertriglyceridaemia, 14–

24% of low HDL and 9.1–26% of hypercholesterolaemia (8, 9, 19, 20). The prevalence of hypercholesterolaemia and low HDL reported in the current study are higher than the previous studies. The significantly high prevalence (28%) of hypercholesterolemia associated with other dyslipidemias in this young age group shows the need to begin screening from a younger age. An important observation made in these students with dyslipidemia, is that 86% were having normal BMI while only 14% were overweight or obese. Other anthropometric indices like WC, WHR and WHtR were also normal in a large majority. However, most of them had a family history of dyslipidemia. Therefore, it highlights the importance of initiation of early screening in those with a family history of dyslipidemia, rather than waiting for later age or development of abnormal anthropometric indices. This highlights the importance of adopting healthy lifestyle (diet and physical activity) in all ages and in all nutritional status as people who would be considered otherwise 'normal' could go undetected and present with a life-threatening event such as myocardial infarction later in life. Screening can help early detection of any adverse health state and help to take remedial measures in advance thus enabling to prevent the occurrence of such adverse health events.

Dysglycaemia (diabetic and prediabetic states) was seen in 14.4% of the study population and this is somewhat high compared to previous findings of 9% (20) and 1% (9) among college students and medical students, however, the latter study using a cut off of 110 mg/dl. A majority with dysglycaemia were either normal or underweight and had normal WC, WHR and WHtR. These were young healthy persons without features of type I diabetes mellitus. This means these young persons are at risk of type II diabetes mellitus despite having normal BMI and central obesity related parameters. This highlights the importance of actively screening young adults for diabetes and other metabolic diseases (24).

Prevalence of any metabolic abnormality in this population was very high, with only 38% (n = 71) being free of metabolic abnormalities. Forty percent (n = 74) had one metabolic abnormality while 22% (n = 41) had two or more metabolic abnormalities with majority having normal anthropometric markers. This denotes its limitation under the present cutoff values. There were three students (two males and one female) having metabolic syndrome. All of them had family history of CVD showing that individuals with high risk shows that onset of illness is from a younger age. This study shows that even the so called 'knowledgeable' sectors of the community are at risk of developing NCDs from a very younger age thus contributing to this ever increasing disease burden.

The prevalence of alcohol consumption was 9%, which is less in comparison to other studies (11, 22). We expected it to be so, since medical students have knowledge about the adverse health outcomes associated with alcohol. Zero rate of smoking in our study is a factor that could be hailed with the control measures operating in the country. However, the alcohol consumption and prevalence of smoking could have been underestimated due to selection bias, non divulgence or due to majority of sample being females.

Prevalence of other risk factors of NCD was high in this population. A majority did not consume adequate amounts of fruits while about half of the population did not consume the recommended amount of

vegetables. The poor diversity in their dietary behavior highlight the importance of introducing nutritious food at affordable cost in the faculty canteens and hostels. About 40% of the total sample and nearly half of the females did not engage in adequate physical activities. About one third of the sample had a sedentary lifestyle. Unavailability of facilities for physical activity within the faculty premises could have intensified this situation. Although we didn't identify significant associations between sedentary life style and metabolic markers, the curricular and lack of space within the premises may promote sedentary behavior. Special awareness campaigns would be advantageous to improve physical activities among medical students in order to maintain a healthy life.

Our study had some limitations. Some variables like diet, physical activity and substance use were assessed using self-report information which could be subjected to reporting bias, especially given the high level of knowledge on the expected healthy behaviours. Recruitment of participants into the study was purely voluntary, which could have created a selection bias. It would be interesting to carry out such screening program in other medical schools of the country and among university students of other streams.

Conclusions

This study showed that this young adult population had a high prevalence of dyslipidemia, dysglycemia and other metabolic abnormalities even among those with normal anthropometric parameters. Therefore, this young adult population has a high burden of NCDs, and this metabolic burden is not reflected by their anthropometric parameters. Therefore, it is important to actively screen for these diseases even at a younger age and irrespective of their nutritional status. Additionally, public health awareness on prevention of NCDs should be expanded to all age groups More studies including national surveys should be conducted especially among the young age groups, to identify dysglycemia, dyslipidemia and prehypertension to prevent the burden of NCD in Sri Lanka.

Declarations

- **Ethics approval and consent to participate**

This research study was approved by the Ethics Review Committee of Faculty of Medicine, University of Colombo.

- **Consent for publication**

Not applicable.

- **Availability of data and materials**

Data related to the study will be available from the corresponding author upon reasonable request.

- **Competing interests**

All authors declare that there are no competing interests.

- **Funding**

This study was self-funded.

- **Authors' contributions**

JTNS –wrote proposal, conducted the study and wrote the manuscript

AGM, WAPSW, WAAMW, MMM, - conducted the study, data entry.

DBDLS - wrote proposal, data analysis and wrote the manuscript

VPW – Conceived the idea, wrote proposal, conduct study, data analysis and wrote the manuscript

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References

1. Murray CJ and Lopez AD, Mortality by cause for eight regions of the world: Global Burden of Disease Study. *The Lancet* 1997; 349: pp.1269–1276.
2. Kones R. Primary prevention of coronary heart disease: integration of new data, evolving views, revised goals, and role of rosuvastatin in management. A comprehensive survey. *Drug Design, Development and Therapy* 2011; 5: pp.325–80. Available at: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3140289&tool=pmcentrez&rendertype=abstract [Accessed February 22, 2016].
3. Mathers CD and Loncar D, Projections of global mortality and burden of disease from 2002 to 2030. *PLoS Med*. 2006; 3(11):e442.
4. The World Health Report. Making a difference. Geneva: World Health Organization.1999
5. Goyal A and Yusuf S. The burden of cardiovascular disease in the Indian subcontinent. The *Indian Journal of Medical Research* 2006; 124(3): pp.235–44. Available at: http://www.ncbi.nlm.nih.gov/pubmed/17085827 [Accessed March 23, 2016].
6. Katulanda P, Constantine GR, Mahesh JG, Sheriff R et al. Prevalence and projections of diabetes and pre-diabetes in adults in Sri Lanka–Sri Lanka Diabetes, Cardiovascular Study (SLDCS). *Diabetic Medicine : Journal of the British Diabetic Association* 2008; 25(9): pp.1062–9. Available at: http://www.ncbi.nlm.nih.gov/pubmed/19183311 [Accessed February 17, 2016].

7. Adams-Campbell LL. Nwanko MU, Omene JA, Ukoli FA et al, Assessment of cardiovascular risk factors in Nigerian students. *Arteriosclerosis (Dallas, Tex.)* 1988; 8(6): pp.793–6. Available at: http://www.ncbi.nlm.nih.gov/pubmed/3196223 [Accessed March 23, 2016].
8. Rahlenbeck SI and Gebre-Yohannes A, [Cardiovascular risk factors in Ethiopian medical students]. *Annales de Biologie Clinique* 1988; 56(6): pp.705–9. Available at: http://www.ncbi.nlm.nih.gov/pubmed/9853029 [Accessed March 23, 2016].
9. Bertsias G, Mammas I, Linardakis M and Kafatoset A. Overweight and obesity in relation to cardiovascular disease risk factors among medical students in Crete, Greece. *BMC Public Health* 2003; 3: p.3. Available at: http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=12517305.
10. Aslam, F., Mahmud, H. and Waheed, A. Cardiovascular health–behaviour of medical students in Karachi. JPMA. *The Journal of the Pakistan Medical Association* 2004; 54(9): pp.492–5. Available at: http://www.ncbi.nlm.nih.gov/pubmed/15518377 [Accessed March 23, 2016].
11. Giri S, Sharma SR, Timalsina S, Yadav V, Koirala S et al. Cardiovascular health risk behavior among medical students in a teaching hospital. *Journal of Nepal Health Research Council* 2012; 10(22): pp.187–191.
12. Jardim TV, Sousa ALL, Povoa TR, Barroso WB et al., 2014. Comparison of cardiovascular risk factors in different areas of health care over a 20-year period. *Arquivos Brasileiros de Cardiologia*, 103(6), pp.493–501. Available at: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4290740&tool=pmcentrez&rendertype=abstract [Accessed February 19, 2016].
13. Jayatissa R, Wickramasinghe VP, Mahamithawa S, Withana C eds. Food Based Dietary Guidelines, Sri Lanka (English). Ministry of Health, 2011.
14. Global recommendations on physical activity for health. Geneva: World Health Organization, 2010.
15. Waist Circumference and Waist–Hip Ratio: Report of a WHO Expert Consultation. Geneva: World Health Organization 2008.
16. Wickramasinghe VP, Arambepola C, Bandara P, Abeysekera M, Kuruppu S, Dilshan P, Dissanayake BS. Defining Obesity Using a Biological End Point in Sri Lankan Children. *Indian J Pediatr*. 2017; 84(2):117–123. DOI 10.1007/s12098-016-2191-2
17. US Department of Health & Human Services, The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. NIH Publication No. 04-5230 August 2004.
18. Alberti KGMM, Zimmet P, Shaw J. Metabolic syndrome a new world-wide definition. A consensus statement from the International Diabetes Federation. *Diabet Med* 2006; 23:469–480.
19. Girotto CA, Vacchino MN, Spillmann CA and Soria [Prevalence of cardiovascular risk factors in first year university students]. *Revista de saúde pública* 1996; 30(6): pp.576–86. Available at: http://www.ncbi.nlm.nih.gov/pubmed/9302828 [Accessed March 23, 2016].

20. Huang TT-K, Shimel A, Lee RE, Delancey W, Strother ML, Metabolic Risks among College Students: Prevalence and Gender Differences, *Metabolic Syndrome and related Disorders* 2007; Vol 5(4): 365-371 https://doi.org/10.1089/met.2007.0021
21. Racette SB, Inman CL, Clark BR, Royer NK, Steger-May K & Deusinger SS, Exercise and Cardiometabolic Risk Factors in Graduate Students: A Longitudinal, Observational Study, *Journal of American College Health* 2014; 62:1, 47-56, DOI: 10.1080/07448481.2013.843535
22. Nyombi KV, Kizito S, Mukunya D, Nabukalu A et al. High prevalence of hypertension and cardiovascular disease risk factors among medical students at Makerere University College of Health Sciences, Kampala, Uganda. *BMC Res Notes* 2016; 9:110
23. Lebbie A, Wadsworth R, Saidu J, Bangura C, Predictors of Hypertension in a Population of Undergraduate Students in Sierra Leone, *International Journal of Hypertension* 2017; Article ID 8196362, https://doi.org/10.1155/2017/8196362
24. Boo S, Waters CM and Froelicher ES, Coronary heart disease risk estimation in asymptomatic adults, *Nursing Research* 2012; 61(1): pp.66–9. Available at: http://www.ncbi.nlm.nih.gov/pubmed/22166911 [Accessed March 23, 2016].

Tables

Table 1: The demographic characteristics of the study population

Socio-demographic Characteristics		N (%)*
Sex	Male	66 (35.1%)
	Female	122 (64.9%)
Mean age (yrs) ± SD	Mean – Total	23.1 ± 1.7
	Mean – Males	22.9 ± 1.9
	Mean - Females	23.2 ± 1.6
Year of study	1st year	36 (19.1%)
	2nd year	37 (19.7%)
	3rd year	29 (15.4%)
	4th year	82 (43.6%)
	5th year	5 (2.1%)

*For continuous variables Mean and SD are given

Table 2: Distribution of Anthropometric characteristics among male and female medical students

Anthropometric Characteristics		Total (n=188) Number (%)*	Males (n=66) Number (%)*	Females (n=122) Number (%)*	Sig.**
BMI		22.0 ± 3.4	22.9 ± 3.7	21.5 ± 3.2	0.408
BMI category	Normal	155 (82.4)	52 (78.8)	103 (84.2)	
	Overweight	30 (16.0)	12 (18.2)	18 (14.8)	
	Obese	3 (1.6)	2 (3.0)	1 (0.8)	
Waist Circumference (cm)		75.2 ± 10.0	81.3 ± 10.6	71.7 ± 7.8	0.000
High WC		32 (17.0)	13 (20.0)	19 (16.0)	0.523
Waist-Hip Ratio		0.804 ± 0.074	0.9 ± 0.06	0.8 ± 0.04	0.000
High Waist-Hip Ratio		34 (18.7)	16 (24.6)	18 (15.4)	0.126
Waist-Height Ratio		0.48 ± 0.27	0.47 ± 0.05	0.48 ± 0.3	0.749
High Waist-Height Ratio		45 (24.9)	22 (33.8)	23 (19.8)	0.036
Percentage Body Fat		30.2 ± 8.3	23.4 ± 6.9	33.8 ± 6.4	0.000
High % Body Fat		74 (39.0)	17 (25.8)	57 (46.7)	0.005

*For continuous variables mean ± SD are given

*Significance of the difference between males and females assessed using Independent samples T test for continuous variables and chi-square teat for categorical variables.

Table 3: Distribution of metabolic parameters among male and female medical students

Cardio-metabolic parameters		Total (n=188)	Males (n=66)	Females (n=122)	Sig.
		Number (%)	Number (%)	Number (%)	
Fasting blood glucose (mean ± SD)		86.4 ± 13.4	85.6 ± 13.4	86.8 ± 13.4	0.567
Fasting blood glucose category	Normal	162 (85.7%)	60 (91%)	102 (83.6%)	0.161
	Impaired	25 (13.2%)	6 (9%)	19 (15.6%)	
	Diabetes mellitus	1 (0.5%)	0 (0%)	01 (0.8%)	
2-hour random blood glucose (OGTT) (mean ± SD)		81.5 ± 15.2	80.1 ± 13.1	82.1 ± 16.2	0.392
2-hour OGTT category	Normal	186 (98.4%)	66 (100%)	120 (98.4%)	0.420
	Impaired	2 (1.1%)	0 (0%)	2 (1.6%)	
Total Cholesterol (mean ± SD)		182.9 ± 34.1	179.6 ± 32.2	184.7 ± 35.1	0.333
Total cholesterol category	Normal	140 (74.1%)	52 (78.8%)	88 (72%)	0.318
	High (>200mg/dl)	48 (25.4%)	14 (21.2%)	34 (28%)	
Triglycerides (mean ± SD)		74.1 ± 37.4	86.8 ± 49.4	67.3 ± 26.8	0.001
Triglycerides category	Normal	177 (93.7%)	57 (87.7%)	120 (98.4%)	0.006
	High (>150mg/dl)	10 (5.3%)	8 (12.3%)	2 (1.6%)	
HDL (mean ± SD)		52.4 ± 12.4	46.8 ± 10.2	55.3 ± 12.4	0.000
HDL category	Normal	128 (67.7%)	49 (75.4%)	79 (64.8%)	0.136
	Low*	59 (31.2%)	16 (24.6%)	43 (35.2%)	
LDL (mean ± SD)		116.1 ± 31.6	116.4 ± 29.3	115.8 ± 32.8	0.912
LDL category	Normal	165 (87.3%)	58 (87.9%)	107 (87.7%)	0.972
	High (>150mg/dl)	23 (12.2%)	8 (12.1%)	15 (12.3%)	
Systolic blood pressure (mean ± SD)		105.6 ± 10.7	112.5 ± 9.7	102.9 ± 9.3	0.000
Systolic blood pressure category	Below 130	184 (97.9%)	62 (93.6%)	122 (100%)	0.014
	130 - 139	4 (2.1%)	4 (6.4%)	0 (0%)	
	140 and above	-	-	-	
Diastolic blood pressure (mean ± SD)		71.0 ± 8.8	76.2 ± 7.7	68.3 ± 8.1	0.000
Diastolic blood pressure category	Below 85	182 (96.8%)	60 (90.1%)	122 (100%)	0.002
	85 - 89	6 (3.2%)	6 (9.9%)	0 (0%)	
	90 and above	-	-	-	
Number of metabolic abnormalities	None	58 (32.2%)	23 (36.5%)	35 (29.9%)	0.303
	1	74 (41.1%)	22 (34.9%)	52 (44.4%)	
	2	37 (20.6%)	12 (19.0%)	25 (21/4%)	
	3 or more	11 (6.2%)	6 (9.5%)	5 (4.3%)	

*<40mg/dl in males, <50mg/dl in females

Table 4: Distribution of risk factors of metabolic abnormalities among male and female medical students

Risk factors	Total n (%)	Males n (%)	Females n (%)	Sig.
Lack of physical activity	73 (39.5%)	17 (25.8%)	56 (47.1%)	0.005
Sedentary life style	66 (35.1%)	22 (33.3%)	44 (36.1%)	0.708
Inadequate consumption of fruits	121 (80.1%)	33 (73.3%)	88 (83.0%)	0.172
Inadequate consumption of vegetables	85 (48.9%)	17 (29.3%)	68 (58.6%)	0.000
Family history of dyslipidaemia	89 (47.3%)	33 (50.0%)	56 (45.9%)	0.591
Family history of Diabetes	122 (64.9%)	40 (60.6%)	82 (67.2%)	0.365
Family history of Hypertension	120 (63.8%)	43 (65.2%)	77 (63.1%)	0.781
Alcohol consumption	16 (9.0%)	11 (17.5%)	5 (4.3%)	0.003

Table 5: Distribution of subjects with dyslipidaemia, dysglycaemia and one or more metabolic abnormality according to anthropometric parameters

Anthropometric parameters		Dyslipideamia* (n=88)	Dysglycaemia** (n=27)	One or more metabolic abnormalities (n=115)
BMI	Normal / Wasted	76 (86.4)	23 (85.2)	94 (81.7)
	Overweight	10 (11.4)	4 (14.8)	20 (17.4)
	Obese	2 (2.3)	0 (0.0)	1 (0.9)
WC	Normal	73 (88.0)	21 (80.8)	94 (83.2)
	High	10 (12.0)	5 (19.2)	19 (16.8)
W/HT Ratio	Normal	64 (78.0)	21 (80.8)	84 (74.3)
	High	18 (22.0)	5 (19,2)	29 (25.7)
W/H Ratio	Normal	70 (84.3)	20 (76.9)	90 (79.6)
	High	13 (15.7)	6 (23.1)	23 (20.4)

N=2 missing values for waist circumference

*Dyslipidaemia defined as TC>200mg/dl or LDL>150mg/dl or TG>150mg/dl or HDL<40mg/dl in males or <50mg/dl in females

**Dysglycaemia defined as pre-existing diabetes mellitus or FPG>100mg/dl