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ORIGINAL ARTICLE

Cardiovascular Disease Risks Among Medical Students in A Public University

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ABSTRACT

Introduction: Cardiovascular disease (CVD) is a major global health problem, with hazards evident even in children and adolescents. The purpose of this study is to measure the knowledge, attitude and practice of young medical students at the International Islamic University of Malaysia (IIUM) with regards to CVD, their CVD risk score and its associated factors. **Method:** A cross-sectional study was conducted among 247 preclinical students from March to July 2019. Validated self-reported questionnaires were used which includes sociodemographic, socioeconomic, lifestyle, International Physical Activity Questionnaire (IPAQ) and Knowledge, Attitude and Practice of CVD. A standardized scales were used to measure body mass index (BMI), digital sphygmomanometer for measuring blood pressure and blood glucose test kit for random blood sugar. CVD risk score was calculated based on a 30-years risk Framingham simple model of calculation using BMI. Univariate analysis and linear regression were used to identify the significant predictors. **Results:** The mean age was 21 (SD = 1.016) years old. 13.4 % of the students had elevated CVD risk scores. Prevalence central obesity, abnormal random blood glucose and abnormal BMI were 35.2%, 70.4% and 40.5% respectively. The participants scored good marks in KAP (97.6%). The relationship between CVD risk score with increasing age, male gender, smoking, increasing weight, low height, increased BMI and high systolic blood pressure were significant. **Conclusion:**The major risks of cardiovascular disease are widely distributed among students. Despite being in medical school and having a decent KAP score, there are smokers and students who live a sedentary lifestyle.

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INTRODUCTION

Cardiovascular illnesses include coronary heart disease, stroke, peripheral arterial disease, myocardial infarction, and atherosclerosis, and they are a global and local public health problem. For the past 15 years, it has been the top cause of death globally, with 17.7 million deaths attributable to ischemic heart disease and stroke in 2016 (1). Latest National Health Morbidity Survey (NHMS) data in 2019 showed that 30.0 percent of Malaysians over the age of 18 have hypertension (1). Many of them, however, are still undiagnosed. Furthermore, majority of Malaysians had three or more major cardiovascular disease risk factors, including diabetes, hypertension, and hypercholesterolemia. This is concerning since the risk of cardiovascular disease appears to exist even in the younger age range (1).

According to the latest clinical data; age, gender, family history of CVD, diet, smoking habit, sedentary lifestyle, obesity, hypertension, dyslipidemia, and diabetes are all risk factors that contribute to the occurrence of cardiovascular diseases (1). It's critical to stress that risk variables present in early adulthood are substantial indicators of cardiovascular disease risk. According to the National Cardiovascular Disease – Acute Coronary Syndrome (NCVD-ACS) Registry 2015, the number of patients younger than 40 years old who presented with ischemic heart disease is on the rise (2).

Despite this data, efforts to identify risk and prevent illness in this age range are limited. The majority of young individuals are unscreened and unaware of their CHD risk. Despite its great incidence, this results in an underestimating of the danger. The list began with high-fat diet intake, sedentary lifestyle, obesity, habitual fast food consumption, hypercholesterolemia, hypertension, and smoking habit, ranked from the most common to the least frequent risk of CVD (3). Diet and sedentary lifestyles have remained a major subject of concern in Malaysia, since they are known to contribute significantly to Malaysians becoming overweight or obese (4). This is especially concerning because a prior survey of medical students found that about 40% of them were overweight or obese, with more than 15% having hypertension. They also consume less fruits and consume more junk food, as well as having a sedentary lifestyle (4). It's also worth mentioning that poor educational levels might lead to increased CVD risk factors in a given person (5). Despite the fact that young age is sometimes underestimated when it comes to having cardiovascular disease, research reveals that more than half of young individuals aged 18-24 have at least one cardiovascular disease risk factor (2,6). According to a study done utilising the Framingham 30-year risk of CHD based on BMI among total students, the rates of mild, moderate, and severe risk were 10.7%, 2.3 % and 0.5% respectively (3). These figures suggest that young individuals in academic institutions have a greater risk of CHD. Different pressures and academic demands, particularly among medical students in a different academic year, may alter their lifestyle and indirectly contribute to classic CVD risks (7).

Medical students are the future leaders and experts in a variety of professions in medicine (8). Before they can serve the public, they must be competent and well-developed in order to set a good example of illness prevention and a healthy lifestyle, starting with themselves. There is still a scarcity of local data on the CVD risks among this crucial research group. As a response, our research intends to measure cardiovascular risk among medical students in order to provide a genuine picture of the disease's future burden and, as a result, improve health promotion and behaviour modification among them. The presence of cardiovascular risk among medical students is a reality that need prompt and significant attention in order to prevent the disease from becoming widespread. Previous research has found that medical students are at risk for at least one type of cardiovascular disease. To address this issue, we conducted a study among International Islamic University Malaysia (IIUM) preclinical medical students to determine the level of their knowledge, attitude and practice with regards to CVD, measure the cardiovascular disease risk score among them and investigate the relationship between variables and the score, so that future interventions to improve medical students' health awareness and status can be implemented.

MATERIALS AND METHODS

The goals of this study were to determine the level of knowledge, attitude and practice of the preclinical medical students at the IIUM Kuantan Campus on CVD, their level of CVD risk score and associated factors. The study was conducted among first and second-year medical students at the International Islamic University Malaysia (IIUM) Kuantan Campus in the capital city of Pahang. Preclinical students are chosen because their age is closest to that of the late adolescent group. The first-year batch consists of 145 students, and the second-year batch of 143 students. The students' ages ranged from 19 to 23 years old. A single proportion formula was used to calculate the sample size. The expected true proportion (P) of 0.40 was chosen based on the prevalence of abnormal BMI among university students in Malaysia (9). Considering the non-response rate of 15%, the final sample size was 186.

This is a cross-sectional study with convenience sampling performed from March to July 2019 at IIUM Kuantan Campus. The medical students had been approached by the researchers, and a verbal explanation of the study was given before the data collection began. The printed questionnaires were used for the data collection. The information regarding the survey was disseminated among the medical students prior to data collection to explain the study objectives. Then, informed consent was obtained from the respondents. The questionnaires were self-administered by the respondents during the data collection process at IIUM Kuantan Campus.

Following are the research tools used in this study:

The Questionnaire

The questionnaire was designed into five parts. Each part was divided based on its own objectives.

Part One – Sociodemographic factors on age, gender, year of study, race, marital status, parents' education and occupation and lastly the family history of CVD of each respondent.

Part Two – Socioeconomic factors of household income of each of the participants.

Part Three – Lifestyle factors. This section consists of three items which are smoking, vegetables and fruits intake and physical activity (International Physical Activity Questionnaire (IPAQ).

Part four - Knowledge, Attitude and Practice of Malaysian Public University Students on Risk Factors for Cardiovascular Diseases.

Part five - Measurement of BMI, Blood Pressure, Waist Circumference, and Random Blood Sugar.

With regards to lifestyle factors (part three), vegetable and fruit intake refers to the consumption of all types of vegetables and fruits. A serving of fruit is defined as one medium piece or two small pieces of fruit or one cup of diced pieces. A serving of vegetables is defined as half

cup cooked vegetables or one cup of salad vegetables. This variable then categorized into the adequate or inadequate daily intake (10).
i. Adequate intake - ≥ 5 servings
ii. Inadequate intake - < 5 servings

For physical activity, this variable was assessed by the International Physical Activity Questionnaire (IPAQ) short-form which consist of seven questions. It was then categorized into low, moderate and high physical activity (11, 12).

i. High = any of the two following criteria
a. Vigorous-intensity activity on at least three days and accumulating at least 1500 Metabolic equivalent (MET) - minutes per week.
b. Seven or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum of at least 3000 MET - minutes per week

ii. Moderate = any of the three following criteria
a. three or more days of vigorous activity of at least 20 minutes per day
b. five or more days of moderate-intensity activity or walking of at least 30 minutes per day
c. five or more days of any combination of walking, moderate-intensity or vigorous activity achieving a minimum of at least 600 MET - minutes per week
iii. Low = not meeting criteria for moderate and high.

For part four, the Knowledge, Attitude and Practice of Malaysian Public University Students on Risk Factors for Cardiovascular Diseases questionnaire was use. This questionnaire was previously developed and validated by Ibrahim et al in 2016 among IIUM undergraduate students. This set of questionnaire was used to assess the knowledge, attitude, and practice of the medical students regarding the CVD risk. The overall result was classified into the poor, moderate and good score of KAP (13).

i. Poor KAP – if students achieve a total score of < 50%
ii. Moderate KAP – if students achieve a score of 51% - 69%
iii. Good KAP – if students scored ≥ 70%

In terms of part five (measurements), body mass index (BMI), blood pressure, waist circumference, and blood sugar level of particpants were measured as follows:

BMI was measured by taking height and weight of the respondents [BMI = weight (kg) / Height^2 (m^2)]. After calculating the BMI, it was then classified into underweight, normal, overweight and obese (14).
i. Underweight < 18.5 kg/m^2
ii. Normal 18.5 - 22.9 kg/m^2
iii. Overweight - 23 – 27.4 kg/m^2
iv. Obese - ≥ 27.5 kg/m^2

Waist circumference was measured using the measuring tape at and it was then categorized into normal and abnormal waist circumference (14).
i. Normal - if WC of female < 80cm and male < 90cm
ii. Abnormal - if WC of female ≥ 80cm, male ≥ 90cm

Blood pressure was measured using a digital sphygmomanometer. It was classified into hypotensive, normotensive, and hypertensive (15).
i. Hypotensive – is defined as SBP < 90 mmHg or DBP < 60 mmHg
ii. Normotensive – did not fit in both criteria
iii. Hypertensive – is defined as SBP ≥ 140 mmHg or DBP ≥ 90 mmHg

Capillary random blood sugar was taken using the blood glucose test kit and was categorized into normal and abnormal blood sugar readings (16).
i. Normal < 5.2.mmol/L
ii. Abnormal ≥ 5.2 mmol/L
Further variable definitions are attached in the appendix.

The outcome of this study was the 30-year risk of cardiovascular disease (CVD) among medical students. This variable was assessed based on the Framingham Heart Study (FHS) with the simple model of risk calculation using body mass index (BMI), instead of total cholesterol level. This variable was analyzed in both categorical and numerical data (17).
i. Elevated CVD risk = "Your risk score" > "Normal risk score"
ii. Normal CVD risk = "Your risk score" is equal or less than "Normal risk score"

In this study, the CVD risk score among young medical students was calculated using the validated Framingham Heart Study (FHS) with the simple model of risk calculation using body mass index (BMI). Even though most local guidelines would recommend a cut-off age of 30 to initiate the CVD risk calculation (15,16), this verified FHS CVD risk calculator is still justifiable to study younger populations as it was validated by Pencina et al. in 2009 research with a population as young as 20 years old. As a result, because the average age of the medical students who participated in this study is 21, this formula may still be used (18).

The analysis was performed using SPSS software version 25. Categorical variables were recorded as frequencies and percentages, and numerical variables were recorded as means and standard deviation (SD) unless otherwise stated. Bivariable analysis of categorical variables was analysed by using Chi-Square and Kruskal Wallis Test. Meanwhile, numerical variables were analysed using the Independent Sample T-test. Multiple linear regression was used to measure the significant predictors. A p-value of 0.05 was considered statistically significant.

Ethical Consideration
All participants had given informed consent prior to their participation in this study. They were told that their data would be kept private and confidential. No payment was required for this study. This study also successfully received approval from the IIUM Research Ethic Committee (IREC) with IREC 2018-305. Participants with abnormal clinical parameters are also given appropriate channel to be follow up at the IIUM Primary Care Clinic for further management.

RESULT

A total of 247 from a total population of 288 preclinical medical students at IIUM involved in this study, comprising almost equal number of the first-year and second-year medical students. The total response rate was 85.8%. As showed in Table I, the majority of the students were female (68%), Malay (99.6%) and single (100%). The mean income of the participants was within B40 group. More than half of their parents are both working with tertiary education background. Surprisingly, all students have at least one CVD risk, and almost one fifth of them had elevated CVD risk score even at young age. Minority of them also a current smoker (0.8%).

Table I: Participants demographic data and variables prevalence

		Mean	N	%
Age		21		
Income		8890		
Gender	Male		79	32.0
	Female		168	68.0
Year of study	1		125	50.6
	2		122	49.4
Race	Malay		246	99.6
	Other		1	0.40
Number of risk factors present among students	1		89	36.0
	2		88	35.6
	3		29	11.7
	4		22	8.9
	5		8	3.2
	6		4	1.6
	7		5	2.0
	8		1	0.4
	9		1	0.4
Categories of CVD risk score	Normal		214	86.6
	Elevated		33	13.4

CONTINUE

Table I: Participants demographic data and variables prevalence (cont.)

		Mean	N	%
Smoking	Never		243	98.4
	Ex-smoker		2	0.8
	Smoker		2	0.8
Dietary habit	Inadequate		66	26.7
	Adequate		181	73.3
Family History of CVD	Yes		135	54.9
	No		111	45.1
Physical Activity	Low		127	51.4
	Moderate		77	31.2
	High		43	17.4
Waist Circumference Status	Normal		160	64.8
	Abnormal		87	35.2
BMI	Underweight		34	13.8
	Normal		113	45.7
	Overweight		64	25.9
	Obese		36	14.6
BP Status	Hypotensive		100	40.5
	Normotensive		135	54.7
	Hypertensive		12	4.9
RBS	Normal		73	29.6
	Abnormal		174	70.4
Knowledge	Poor		0	0.0
	Moderate		7	2.8
	Good		240	97.2
Attitude	Poor		1	0.4
	Moderate		5	2.0
	Good		241	97.6
Practice	Poor		14	5.7
	Moderate		193	78.1
	Good		40	16.2
KAP	Poor		0	0.0
	Moderate		6	2.4
	Good		241	97.6

This study also shows that most of the students had a positive family history of CVD with a prevalence of 54.7%. The participants scored good marks in KAP (97.6%) with good knowledge (97.2%) and attitude (97.6%), but scored moderately in practise (78.1%) as presented in the table.

Table II demonstrates the relationship of KAP score categories with sociodemographic factors. There was a significant relationship between KAP categories and the father's education of the students (p = 0.024) as well as a family history of CVD (p = 0.034). However, there was no association with other variables studied.

Table II: Relationship of KAP Scoring Category with Variables

		KAP							
		Moderate			Good			X^2	P-value
		Mean	N	%	Mean	N	%		
Age		20			21				.089
Income		7767			8919				.384
Gender	Male		1	16.7		78	32.4		.667#
	Female		5	83.3		163	67.6		
Year of study	1		4	66.7		121	50.2		.684#
	2		2	33.3		120	49.8		
Race	Malay		6	100.0		240	99.6		1.000#
	Other		0	0.0		1	0.4		
Family History of CVD	Yes		6	100.0		129	53.8		**.034#***
	No		0	0.0		111	46.3		
Smoking	Never		6	100.0		237	98.3	2.637	1.000#
	Ex-smoker		0	0.0		2	0.8		
	Smoker		0	0.0		2	0.8		
Dietary habit	Inadequate		2	33.3		64	26.6		.659#
	Adequate		4	66.7		177	73.4		
Physical Activity	Low		4	66.7		123	51.0	3.287	.186#
	Moderate		0	0.0		77	32.0		
	High		2	33.3		41	17.0		
CVD Risk	Elevated		1	16.7		32	13.3	-	.581#
	Normal		5	83.3		209	86.7		
Number of risk factors present	1		3	50.0		86	35.7	10.888	.806#
	2		1	16.7		87	36.1		
	3		1	16.7		28	11.6		
	4		0	0.0		22	9.1		
	5		0	0.0		8	3.3		
	6		0	0.0		4	1.7		
	7		1	16.7		4	1.7		
	8		0	0.0		1	0.4		
	9		0	0.0		1	0.4		

#Chi Square test *Significant (p<0.05)

Table III demonstrates the significant predictors for KAP score in multiple logistic regression. Based on the analysis, only age is the significant factors contributing to the KAP score of the medical students on cardiovascular disease.

Table III Predictors of KAP Score of Medical Students on CVD

Model	B[1]	SE	Beta[2]	t	P	95% Confidence interval	
						upper	lower
(Constant)	**3.954**	**1.406**		**2.811**	**0.005***	**1.181**	**6.727**
Age	**0.051**	**0.022**	**0.324**	**2.342**	**0.020***	**0.008**	**0.093**
Family history of CVD	0.039	0.022	0.121	1.751	0.081	-0.005	0.082
Smoking	0.047	0.063	0.061	0.750	0.454	-0.077	0.172
Physical activity	-0.016	0.016	-0.074	-0.956	0.350	-0.048	0.017
BMI	0.037	0.029	0.210	1.259	0.210	-0.021	0.094
BP	0.032	0.050	0.118	0.648	0.518	-0.066	0.131

* Significant P value < 0.05 for multiple linear regression

Table IV identify the significant predictors for CVD risk score via multiple logistic regression. The significant factors include increasing age, male gender, smoking, increasing weight, low height, increased BMI and high systolic blood pressure. Other variables are not significantly associated with CVD risk score.

Table IV: Predictors of CVD risk Score of Medical Students

Model	B[1]	SE	Beta[2]	t	P	95% confidence interval	
						Upper	Lower
(Constant)	12.856	3.792		3.390	0.001*	4.635	19.880
Age	0.287	0.056	0.198	5.131	0.000*	0.172	0.399
Gender	-1.458	0.122	-0.463	-11.916	0.000*	-1.986	-1.509
Smoking	1.128	0.149	0.170	8.179	0.000*	0.942	1.533
Weight	0.166	0.028	1.609	6.008	0.000*	0.106	0.217
Height	-13.098	2.136	0.683	-6.133	0.000*	-17.097	-8.530
BMI	-0.284	0.079	-0.903	-3.622	0.000*	-0.428	-0.144
SBP (mm Hg)	0.042	0.005	0.374	8.486	0.000*	0.032	0.051

* *Significant P value < 0.05 in Multiple linear regression
Dependent variable CVD Risk score

DISCUSSION

CVD is a disease that is well-known to have a very close relationship with the activities of daily life. In other words, lifestyle plays a big role when it comes to the development of cardiovascular disease. This is why one of the objectives of this study was to analyse the relationship between several lifestyle factors, such as smoking habits, physical activity, dietary habits, and family history of CVD with CVD risk score. Cardiovascular diseases are the most common cause of death among men and the second most common cause of death among women in Malaysia, in which the early detection of its riks factors among young population should be initiated. It is expected that the prevalence of CVD risk among adolescents and teenagers will be much lower. However, this study proved the assumption to be wrong. Preclinical students had a high CVD risk as the prevalence of them having a elevated CVD risk score was 13.4%.

This study showed an alarming high prevalence of hypertension, central obesity, and abnormal random blood glucose in some of the students, some of whom are still active smokers (Table I). Half of them were also inactive physically. Even if they are future medical doctors and leaders in society, they are physically at risk of CVD similar to other groups of the population. Starting now, these might affect their credibility as healthcare providers in the future, when huge lifestyle changes need to be initiated.

In this study, it was found that the mean difference and standard deviation of knowledge, attitude, and practise (%) were 86.02 (6.83), 81.95 (6.64), and 62.16 (7.23), respectively. From this, we can conclude that the respondents had high knowledge and attitude on CVD risks but with inadequate practise towards CVD prevention. This result was consistent with several other studies in which the level of knowledge and attitude did not reflect actual practise (19–22). It was commendable and expected that the scores for knowledge and attitude were high considering the medical background of the respondents. They were exposed to health-related information and therefore had a higher awareness of the disease and prevention. However, it was worrisome to realise that the students only scored moderately on the practice. This alarming figure indicates that the students might have a sedentary lifestyle and it was evidenced by over half of the respondents (51.4%). This could be due to the busy schedule and multiple assignments in their daily routine as medical students, which can limit their involvement in outdoor activities. Shen et al. stated that the relationship between knowledge and both attitude and practise exists, but it may be influenced by many other factors such as family background and education (20). A further explanation might be related to the health behaviour theories, namely the social cognitive theory and the theory of reasoned action (23). Based on these theories, an individual's health behaviour is affected not only by knowledge and attitude but also by personal and environmental components.

In univariate analysis (Table II), the family history of CVD was found to have a significant relationship with the KAP score. This result supports the previous studies that showed individuals with a positive family history of CVD attained a higher level of knowledge compared to those who had no family history of CVD. Those with a positive family history were said to be more aware of the disease and to engage in healthy behaviour more frequently (24–26). Further multivariate analysis, however, proved that only age is the determining factor for KAP score (Table III). This can be explained as, with increasing age and duration of study in medical school, the students are receiving more input and education pertaining to non-communicable diseases. This indirectly increased their awareness and, therefore, practised preventing themselves from developing CVD risks (27).

Gender was found to have no significant association with the KAP score. It is consistent with the prior studies which showed that there was no difference in the level of knowledge, attitude, and practise between the genders (25,26,28). Nevertheless, the current result was the opposite of the findings from different studies whereby females scored higher mean scores in knowledge and attitude compared to males (29). It was said that higher awareness in females might be because of health-seeking behaviour being more prone in women, or it could be due to the fewer working hours in females, which gives them more time to access the media, thus improving their health-related knowledge (24). The imbalance between the number of females and males in our study population might have contributed to the current insignificance result.

Inadequate knowledge, attitude, and practise towards healthy behaviours can increase the chance of developing CVD in the future. This is in line with the findings and recommendations from several studies whereby the researchers mentioned that in order to have better control and management of cardiovascular risk, there is a need to improve the level of knowledge and action of the individual towards a healthy lifestyle (30). A study by Amarasekara et al. among metabolic syndrome patients in Sri Lanka found that participants who achieved a high mean score of knowledge and practise had lower body mass index, waist circumference, and random blood sugar readings (31). This demonstrates that KAP was associated with anthropometric and biochemical parameters which in turn can lead to CVD risk reduction in the respondents. However, in our study, no significant relationship between KAP score and Framingham 30 years CVD risk score can be observed. The majority of students who achieved good KAP had a low score of CVD risk. One possible explanation is that most of them had a normal health status (normal BMI, waist circumference and blood pressure status) which then lead to a low CVD risk.

Based on the multiple logistic regression analysis (Table IV), a significant relationship of CVD risk with gender was found in this study, in which among 13.4% of students who were classified as having elevated CVD risk, the males contributed as much as 69.7%, with a p-value of less than 0.001. This was supported by the World Health Organisation, where it was found that in 2015, higher numbers of males were detected to have high blood pressure, which is one of the most renowned risk factors for CVD. There were several studies that also supported this finding, such as by Ghazi et al. in 2017, which found that several biological substances, such as levels of high-density lipoprotein, play an important role in providing the link between CVD risk differences between genders (32).

With regards to age, an increasing trend of Framingham 30 years CVD risks score was observed as the age increase ($p < 0.001$). This finding shows that even though this study was done among preclinical medical students of IIUM which were also classified as a young adult, the increasing trend in risk score is not something to be taken lightly. Arts, Fernandez and Lofgren (2014) stressed that young adults often perceived to be less likely to have CVD but it was proven that more than 50% of people ranging from 18 to 24 years old have at least one CVD risk even though they were still considered young. The mechanism as to how age can affect the likelihood of a person developing CVD was still debated but a clearer explanation was possible with the understanding of the role of certain hormones as aging is a normal biological process that will occur in all human beings (33).

Smoking habits and physical activity are noted to have a significant association with higher CVD risk scores. In fact, 87.7% of medical students who never smoke were recorded to have normal full CVD risk ($p = 0.008$). This indicates that students who never smoke have a lower risk of developing CVD. This is supported by several studies which establish that smoking is known to have the ability to fasten the onset, increase the chances of developing CVD, as well as cause one in every four deaths due to CVD (34,35). It is also important to note that the risk of smokers developing CVD depends on the dose and duration of exposure, even though this was not explored in this study (36). It was also said that smoking reduces high-density lipoprotein and increases the risk of cardiovascular events. Along with that, physical activity was also significantly associated with CVD risk. It was found that 69.8% of students who performed a high level of physical activity had a normal CVD risk ($p = 0.002$). The previous study stated that physical inactivity was also identified as the second most common CVD risk factor among other lifestyle factors (10). At this point in time, it is undeniable that physical activity is also one of the most recognised protective factors against CVD, which is why consultation given to patients who wish to improve their cardiovascular health almost always includes a medical prescription for physical activity.
All physical measurements measured in this study namely BMI, waist circumference, blood pressure and random blood sugar are significantly associated with CDV risk score. Overall obesity and abdominal obesity equally important as a major risk factor for cardiovascular disease. It is shown that obese people had increased risks to develop type 2 diabetes, hypertension, elevated LDL and cholesterol, low HDL and atherosclerosis as compared to those with normal BMI (37). Similar to BMI, abdominal obesity also imposes multiple health risks. Abdominal obesity has been reported to be a strong predictor for insulin resistance than overall obesity insulin and increases the future risk of diabetes mellitus and cardiovascular diseases (38).

Other than that, blood pressure has been widely established as one of the most powerful indicators for CVD development. Pooled data from the Framingham Heart Study exhibit that there is a risk increment of two fold of developing cardiovascular disease in people with prehypertension (130-139/85-89 mmHg) compared to those with blood pressure lower than 120/80 mmHg (39). Furthermore, the prevalence of risk factors was seen to be higher in prehypertensive individuals compared to normotensive subjects (40). In fact, there is a strong and linear relationship between systolic and diastolic blood pressure and incidence of CVD (40). This is in line with the findings from our study in which a significant association is found between the blood pressure status and full CVD risk score ($p = 0.006$).

On the other hand, despite being repeatedly linked to CVD, this study was unable to prove the association of full CVD risk with dietary habits and family history of CVD. In view of the study questionnaires that rely fully on the respondents' memory, this might happen due to the inability of the respondents to completely recall the presence of CVD in their family. However, the study done by Tada et al. and Vornanen et al. supported that there was no significant association between family histories of CVD (41,42). In terms of diet, the importance of consuming high-fiber foods and vegetables in their natural form has been demonstrated to reduce CVD risks (43). Although the findings in this study contradict the cardioprotective role of a healthy diet, it was believed that the reliance of the questionnaire on the respondents' memory alone might explain the inability to prove their association.

LIMITATION OF THE STUDY

The limitations of this study include self-reported data gathered in this study, which is vulnerable to recall bias. The respondents were also prone to underreporting bias, such as smoking status, family history of cardiovascular disease, physical activity, and dietary habits. However, we tried to minimise this limitation by using validated and reliable questionnaires. The quality of data and measurement variables was also maintained with repeated training among the researchers prior to data collection. In addition, causality cannot be determined directly in our study due to the cross-sectional study design.

CONCLUSION

In conclusion, a study proved that CVD risks can still be elevated even in young age groups in which screening still brings benefit in the prevention of morbidity and mortality if it is done earlier rather than delaying it until 40 years old. Although less than a quarter of the preclinical medical students have an elevated full CVD risk as predicted by the Framingham 30 year CVD risk, the major risks of cardiovascular disease, especially central obesity, overweight, and obesity, abnormal blood glucose, and family history of CVD, are still worryingly abundant among the students. Despite being in medical school and having a good KAP score, there is a presence of smokers and sedentary lifestyles among the students.

Thus, the authority should plan early screening and preventive plans to counter these problems before those who are at risk develop CVD. Further research is recommended to improve the limitation of this study. Earlier education regarding lifestyle modification should begin during preschool age and be initiated at home. Even minor changes can have a significant impact on the long-term health of the adolescent.

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