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Screening of potentially modifiable risk factors associated with myocardial infarction among university students of RAKMHSU

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Abstract
Introduction: Cardio-vascular diseases (CVD) are the leading cause of death in most developed countries. The INTERHEART study found 9 modifiable risk factors of CVD which could explain over 90% of the risk of myocardial infarction (MI) globally. This study was aimed to determine the association between potentially modifiable risk factors & myocardial infarction among RAKMHSU students.
Materials and Methods: This was a cross-sectional study. Pre-validated structured knowledge questionnaire along with CVD risk profile assessment was done to collect the data from university students.
Results: Gender distribution out of 110 students' average weight was between 22+2years. 75% were females and 25% were male students. 51.5% of students had inadequate consumption of fruits and vegetables and 74.5% were physically inactive. Psychosocial stress was prevalent in 85.75%. 37.3% had abdominal obesity. 1/3rd of all respondents had normal blood glucose level. Lipid profile revealed 10% had elevated total cholesterol. 41.8% had above optimal LDL. 34.5% females had low HDL. 11.8% had elevated triglyceride. Our study showed that, Castelli's index 1 and 2 were statistically significant with BMI of subjects in risk group. Atherogenic Index of Plasma (AIP) In our study 51% of students were having abnormal atherogenic index of plasma and are at risk. The study also compared with BMI and found to have a statistically significant with BMI more than 25 ($p<0.001$). This is one of the alarming finding we found in the study as various studies have shown that in situations where other atherogenic risk parameters like TG and HDL-C appear normal, AIP may be a diagnostic alternative.
Conclusion: This pilot study revealed that 4 main modifiable risk factors prevalent among RAKMHSU students were unhealthy diet, physical inactivity, psychosocial stress and abnormal lipid profile. This study concludes the need for effective lifestyle modification awareness programs to be initiated in the university to prevent the risk of developing premature MI.

Keywords: interheart study, atherogenic indices, anthropometric measurements, cardio-vascular diseases

1. Introduction

Non-communicable diseases (NCDs), which generally include cardiovascular disease (CVD), diabetes, respiratory disease and cancer, are a major health reasons of global mortality [1]. The world health organization (WHO) estimated that NCDs annually claim approximately 15 million lives within the age group of 30–70 years [2].

In 2016 CVD was the major contributor of morbidity and mortality among NCD claiming 17.6 million lives globally [3]. The majority of CVD-related deaths comes from ischemic heart disease, which is composed of acute myocardial infarction (MI) and ischemic heart failure [4].

The present life styles have been one of the major contributors for the development of Myocardial infraction. The young generation are at risk of developing the NCD and must be screened. There are limited studies done on younger population correlating the risk factors and MI. The study by INTERHEART showed that the population attributable risk has nine risk factors (lifestyle factors (smoking; consumption of fruit and vegetables; exercise; consumption of alcohol; psychosocial stress); clinical risk factors (hypertension; diabetes; abdominal obesity) and, biomarkers (ratio of blood levels of apolipoprotein B/apolipoprotein A1 (apoB/apoA)) was higher among younger (≤55 years for men and ≤65 years for women) versus older adults [5].

In addition to lifestyle factors, a study done in middle east showed that younger individuals have higher levels of low-density lipoprotein (LDL) cholesterol and triglycerides, and lower levels of high-density lipoprotein (HDL) cholesterol were observed in younger versus older individuals with ACS [6].

Despite the high prevalence of cardiovascular disease (CVD), knowledge of its risk factors and corresponding preventative interventions may be inadequate in a younger population. Possessing knowledge about the non-modifiable and modifiable risk factors of CVD is essential for the prevention of its development. Prevention may begin with alterations to modifiable factors to reduce the risk of development, especially if one has a significant risk because of non-modifiable factors. Understanding this at any age is

important for optimal cardiovascular health.

2. Objectives

The main purpose of the study was to determine college students' knowledge of risk factors related to CVD.

RAKMHSU has more than 1000 students from 42 different nationalities and religion pursuing with commitment their professional careers. The study investigated the prevalence of cardiovascular risk factors among susceptible educated young individuals using questionnaire and various biochemical tests. A unique aspect of this study was the fact that a young adult population was specifically targeted to look at cardiovascular risk factors. The overall aim was to educate them, know their risk status and have preventive measures to decrease the risk of NCD.

3. Materials and methods

The study was a cross-sectional study, carried out in RAKMHSU university over a period of 6 months with the approval of institutional ethical committee. The students of 3 colleges, medical, nursing and pharmacy were involved in the study after their consent.

A stratified random sampling was used to select the study population sample size was calculated a total of 330 students were selected for the study. Biochemical parameters were analyzed in 110 students.

These students were approached by one of the investigators with a structured, self-administered and pre-tested questionnaire to collect the information

The questionnaire consisted of 6 sections, 1 (Demographic details) 2 (Life style) 3 (Psychosocial risk factors) 4 (Family history) 5 (Anthropometric measurements) 6 (Cardiovascular risk profile) with items related to the current study.

The various parameters were assessed in the study subject which included blood pressure (BP), blood sugars (FPS), Body Mass Index (BMI), waist to hip ratio and lipid profile. A minimum of 3 blood pressure readings were collected and average was taken.

Each subject was required to fast for a minimum of 8 hours prior to the cardiovascular risk profile assessment. Fasting plasma glucose and lipid profile was done using a point of care testing device. Body weight and height were taken and BMI was calculated (weight in kilograms divided by the square of height in meters)

The data collected and statistical analysis was performed using SPSS version 18 software, a P value less than 0.05 was considered significant. Descriptive statistics included mean with standard deviation for continuous variables and frequency with percent for categorical variables. One-way ANOVA was used.

4. Results

4.1 Demographic data

The oral response rate for the questionnaire was 100%. Gender distribution out of 110 students' average weight was between 22±2years. 75% were females and 25% were male students. Ethnic background, 73% of the students were of South Asian origin, 19% were Middle Eastern (including Nationals) and 8% were African origin.

4.2 Lifestyle and Social habits

48.18% of the students had inadequate consumption of fruits and vegetables (41% females and 68% males). 82.72% of the students do not do enough exercise (85% females and 68% males). Only 8.18% of the students are smokers and a mere 2.72% consume alcohol. A large number of students (83.63%) admitted on having a stressful life.

4.3 Anthropometric Measurements

Around 36.3% of the students were overweight (BMI > 25) and the mean BMI was 24.12 (SD +/- 4.5). The waist circumference was increased in 43.6% of the students (WF> 94cm in males and WF>80 in females) and the mean circumference was 82.37cm (SD +/-13.45).

Blood pressure (taken through manual Sphygmomanometer) was elevated in about 9% of the students.

4.4 Biochemical Investigations

The fasting blood glucose taken through Glucometer/OneTouch (fasting minimum of 8hours) was elevated in only 1.8% of the students.

The lipid profile taken after minimum of 8 hours of fasting (using Cardio Check PA Blood Analyzer) showed the following results: the Total cholesterol was increased in 10% of the student population, High-density lipoprotein (HDL) was abnormal in 27.3% of the population, Low-Density Lipoprotein (LDL) was elevated in 13.6% of the population and the Triglyceride was elevated in 11.8% of the students. Normal values are Total cholesterol <200mg/dl; HDL <40mg/dl; LDL <129mg/dl and Triglyceride <150mg/dl.

Table 1: Tabular representation of the lipid profile showed increase levels of total cholesterol, LDL cholesterol, Triglycerides

Parameters	Normal	Abnormal
BMI	NORMAL (<24.9) 63.63%	OVERWEIGHT (>25) 36.36%
Waist and hip ratio	NORMAL (<94(M) <80(F)) 56.36%	INCREASED (>94(M) >80(F) 43.63%
Total Cholesterol	NORMAL (≤200mg/dl) 90.0%	ELEVATED (>200mg/dl) 10.0%
HDL	NORMAL (>40mg/dl) 72.72%	ABNORMAL (<40mg/dl) 27.27%
LDL	NORMAL (≤129mg/dl) 86.36%	ELEVATED (>129mg/dl) 13.63%
Triglycerides	NORMAL (≤150mg/dl) 88.18%	ELEVATED (>150mg/dl) 11.81%

4.5 Atherogenic Indices

Atherogenic indexes are new biochemical parameters which are being used for identifying individuals at higher risk of CVD despite having normal lipid profile.

The Atherogenic ratios calculated as follows:

1. Castelli's Risk Index (CRI-I) = TC/ HDLc
2. Castelli's Risk Index (CRI-II) = LDLc / HDLc
3. Atherogenic Index of Plasma (AIP) = log (TG / HDLc)
4. Atherogenic Coefficient (AC) = (TC–HDLc) /HDL

Table 2: Tabular representation of the Atherogenic indexes.

S.NO	Atherogenic indexes	Mean ± SD	Optimal	Risk group
1.	Castelli's Risk Index (CRI-I) = TC/ HDLc	Mean ± SD	Optimal (<4.0)	Risk group (≥ 4.0)
		3.638 ± 1.133	62.72% (n=69)	37.27% (n=41)

2.	Castelli's Risk Index (CRI-II) = LDLc / HDLc	Mean ± SD	Optimal (<3.0)	Risk group (≥ 3.0)
		2.187 ± 0.946	80.90% (n=89)	19.09% (n=21)
3.	Atherogenic Index of Plasma (AIP) = log (TG / HDLc)	Mean ± SD	Low risk (≤ 0.24)	Risk group (> 0.24)
		2.638 ± 1.133	49.09% (n=54)	50.90% (n=56)
4.	Atherogenic Coefficient (AC) = (TC–HDLc) /HDL	Mean ± SD	Optimal (≤ 0.24)	Risk group (> 0.24)
		0.293 ± 0.223	88.18% (n=97)	11.81% (n=13)

4.6 Correlational study and Discussion

4.6.1 Castelli's Risk Index I (CR-I) Interpretation

We found a statistically significant relationship between 3 group of students and elevated CR-I; these were (1) students who had BMI>25; (2) students who had increased waist circumference >94cm and (3) had Diastolic blood pressure >80mmHg.

Also, student's further discussion found that students who admitted of stressful life had were 1.4times more likely to high elevated CR-I (Relative risk= 1.438). Students who smoke and those who do not exercise enough were also found to have higher risk (RR=2.718 and RR=1.545 respectively).

Table 3: Tabular representation of P-value of different factors in relation to elevated CR-I

S. No	Factor		Castelli's Risk Index I (CR-I)		P-Value
			Normal	Abnormal	
1.	BMI	<25	56	15	0.000
		>25	13	26	
2.	Waist circumference	<94 (M) < 80 (F)	44	18	0.042
		>94 (M) > 80 (F)	25	23	
3.	Diastolic blood pressure	<80 >80	66	34	0.022
			3	7	
	CR I – Relative Risk				
	Factor	CR I			RR (95% CI)
4.	Stress	Absent	9	9	1.438 (0.84 –2.47)
		Present	60	32	
5.	Smoking	Non-smoker	63	38	2.718 (0.436 – 1.96)
		Smoker	6	3	
6.	Physical activity	Adequate	9	10	1.545 (0.925 – 2.58)
		Inadequate	60	31	

4.6.2 Castelli's Risk Index II (CR-II) Interpretation

We found a statistically significant relationship between 3 group of students and elevated CR-II, these were (1) students who had BMI>25; (2) students who had inadequate fruits and vegetables and (3) had Systolic blood pressure >120mmHg.

Also, students who had stressful life and those who lack adequate exercise had a higher risk of elevated CR-II (RR=1.597 and RR=1.127 respectively).

Table 4: Tabular representation of P-value of different factors in relation to elevated CR-II

S.NO	Factor		Castelli's Risk Index II (CR-II)		P-Value
			Normal	Abnormal	
1.	Inadequate fruits and vegetables	Adequate	51	6	0.018
		Inadequate	38	15	
2.	BMI	<25	65	5	0.000
		>25	24	16	
3.	BP: Systolic	<120 >120	84	16	0.009
			5	5	
	CRI- II – Relative Risk				
	Factor	CR II			RR (95% CI)
4.	Stress	Absent	13	5	1.597 (0.671 – 3.80)
		Present	76	16	
5.	Physical activity	Adequate	15	4	1.127 (0.427 – 2.97)
		Inadequate	74	17	
			60	31	

4.6.3 Atherogenic Index of Plasma (AIP) interpretation

We found a statistically significant relationship between students who had BMI> 25 and elevated AIP (P-value = 0.000). Also, students who had stressful life and those who lack adequate exercise had a higher risk of elevated AIP (RR=1.111 and RR= 1.171 respectively).

Table 5: Tabular representation of P-value of different factors in relation to elevated Atherogenic Index of Plasma (AIP)

S. No	Factor		Atherogenic Index of Plasma (AIP)		P-Value
			Normal	Abnormal	
1.	BMI	<25	45	25	0.000

		>25	9	31	
	Atherogenic Index of Plasma (AIP)– Relative Risk				
	FACTOR	CR II			RR (95% CI)
2.	Stress	Absent	8	10	1.111
		Present	46	46	(0.701 - 1.76)
3.	Physical activity	Adequate	8	11	1.171
		Inadequate	46	45	(0.757 – 1.81)

4.6.4 Atherogenic Coefficient (AC) interpretation

We found a statistically significant relationship between 2 group of students and elevated AIP; these were (1) students who had BMI>25 and (2) had Systolic blood pressure >120mmHg. Also, on further analysis – students who smoked and those who had increased waist circumference were at a higher risk of elevated AC (RR=1.069 and RR=1.239 respectively).

Table 6: Tabular representation of P-value of different factors in relation to elevated AC

S. No	Factor		Atherogenic Coefficient (AC)		P-Value
			Normal	Abnormal	
1.	Inadequate fruits and vegetables	Adequate	55	2	0.05
		Inadequate	42	11	
2.	BMI	<25	65	5	0.044
		>25	32	8	
3.	BP: Systolic	<120	91	9	0.004
		>120	6	4	
	Atherogenic Coefficient (AC) - Relative Risk				
	Factor	Atherogenic Coefficient (AC)			RR (95% CI)
4.	Smoker	Non-smoker	89	12	1.069 (0.156 – 7.31)
		Smoker	8	1	
5.	Waist circumference	<94(M <80(F)	54	8	1.239
		>94(M) >80(F)	43	5	(0.433 – 3.55)

Table 7: Comparison of lipid profiles and Atherogenic Indices

S. No	Lipid Profile	Affected Subjects (%)	Atherogenic Indices	Affected Subjects (%)
1.	Total Cholesterol	10.0%	Castelli's Risk Index-I	37.27%
2.	High-Density Lipoprotein	27.27%	Castelli's Risk Index -II	19.09%
3.	Low-Density Lipoprotein	13.63%	Atherogenic Index of Plasma	50.90%
4.	Triglycerides	11.81%	Atherogenic Coefficient	11.81%

5. Discussion

The study focused on various risk factor analysis in medical students who will be future general physician. Its apt for them to have a proper knowledge and practicing the same in preventing and advising about myocardial infraction risk factors to patients.

The study found that 43% of student were overweight as compared to other studies which showed 33% [7], 11.7% [8] and 17.5% [9] of overweight respectively.

In terms of physical activity, a study found that 43.5% of medical students of Tehran had inadequate physical activity [10] as compared to 83% in our study. Which really gives us a sense how our younger colleagues neglecting the physical activity due to various factors like lack of time, inability to manage time, examination stress etc.

Another important protective factor against the development of CVD is maintaining healthy eating behaviors. Studies have shown that the Mediterranean diet, which is rich in fruits, whole grains, fish, vegetables, and especially olive oil, has beneficial effects on cardiovascular protection [11]. In the present study the role of diet was assessed in terms of having healthy diet and we found that 48.18% of students were conclude to have inadequate consumption of fruits and vegetables.

The Castelli's Risk Indexes I and II can also be used for assessment of cardiovascular risk [12]. Our study showed that, Castelli's index 1 and 2 were statistically significant with BMI of subjects with 37% and 19% of students respectively in risk group. To the best of our knowledge, there are no studies involving Castelli's indexes and BMI done on medical students.

The clinical studies have shown that AIP predicts cardiovascular risk and that it is an easily available cardiovascular risk marker as well as a useful measure of the response to treatment [13]. In our study 51% of students were having abnormal atherogenic index of plasma and are at risk. The study also compared with BMI and found to have a statistically significant with BMI more than 25 ($p<0.001$). This is one of the alarming finding we found in the study as various studies have shown that in situations where other atherogenic risk parameters like TG and HDL-C appear normal, AIP may be a diagnostic alternative [14]. Studies have shown its role in predicting cardiovascular risk and effectiveness of therapy [15].

6. Conclusion

The findings of the research study showed Statistically significant contributing factors for abnormal Atherogenic indices were found to be: (1) Inadequate consumption of fruits and vegetables (2) Increased waist circumference (3) Presence of psycho-social stress in life and (4) Smoking.

Lifestyle habits were seen as important contributing factors to increased risk of atherosclerosis and possible CVD in future and hence, preventive programs focusing on lifestyle changes is relevant and important for the overall population.

Lastly, modern medicine should also use ATHEROGENIC

INDICES along with Lipid profile to predict the analyze/predict risk of CVD in subjects.

7. Limitations

- This study only included a single medical school with a limited sample size, and results can't be applied across all population.
- Food quantity was not measured.
- Body fat content was not measured.
- There could be the problem of reporting bias especially with the lifestyle behaviors.

8. Acknowledgement

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9. Conflict of Interest

Authors have declared that no competing interest exists

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