Assessment of Knowledge and Awareness about Atherosclerosis and Incidence of Cardiovascular Events among Undergraduate Pharmacy Students in Bangladesh

Md. Sahab Uddin[1*], Md. Asaduzzaman[1], Abdullah Al Mamun[1] and Mamunur Rashid[1]

[1]*Department of Pharmacy, Southeast University, Dhaka-1213, Bangladesh.*

Authors' contributions

This work was carried out in collaboration between all authors. Author MSU designed the study, wrote the protocol, managed the analyses of the study and prepared the draft of the manuscript. Author AAM managed the literature searches and helped with author MSU. Authors MR and MA reviewed the scientific contents of the manuscript. All the authors read and approved the final manuscript.

Article Information

Original Research Article

ABSTRACT

Aims: To examine how much knowledge and awareness undergraduate pharmacy students of Bangladesh have about atherosclerosis and incidence of cardiovascular events.
Study Design: The study was conducted on 500 undergraduate pharmacy students randomly selected, in which 48% were males and remaining 52% were females. Nearly 50% of the participants were 3rd year students and remaining 50% were 4th year students. Each willing participant shared their knowledge.
Place and Duration of Study: Department of Pharmacy, Southeast University, Dhaka-1213, Bangladesh, from May to July 2015.
Methodology: A questionnaire was distributed among the students, information on the knowledge and awareness about atherosclerosis and incidence of cardiovascular events were collected.

Corresponding author: Email: msu-neuropharma@hotmail.com;

Results: The present study revealed that 75% students have knowledge and awareness about the general information 69% about the risk factors, 60% about the symptoms, 80% about the treatments and 44% about the diagnosis of atherosclerosis and incidence of cardiovascular events.
Conclusion: Undergraduate pharmacy students have good knowledge about treatments of atherosclerosis and incidence of cardiovascular events, since pharmacists are more prone to drugs. But considerable knowledge and awareness are necessary about the risk factors, symptoms, especially diagnosis of respective diseases in order to be competent pharmacists.

Keywords: Knowledge; atherosclerosis; cardiovascular events; pharmacy students; competent pharmacists.

1. INTRODUCTION

Atherosclerosis is a chronic progressive disease often presenting as clinical cardiovascular disease (CVD) events [1]. This disease is characterized by formation of atherosclerotic plaques consisting of necrotic cores, calcified regions, accumulated modified lipids, inflamed smooth muscle cells (SMCs), endothelial cells (ECs), leukocytes and foam cells in arteries of the brain, the heart, the kidneys and the legs, especially where the vessels divide [2]. Over time, plaque hardens and narrows arteries consequently reducing blood flow to heart, brain, kidneys, legs, arms and other parts of the body. When atherosclerotic plaques are formed a piece of the plaque may break off and or a blood clot (thrombus) may form on the plaque's surface [3]. Atherosclerosis affects large and medium-sized arteries. Coronary heart disease (CHD) occurs when plaque builds up in the coronary arteries that supply oxygen-rich blood to heart [4]. A partial blockage of coronary artery of the heart by atherosclerosis leads to a type of chest pain called angina [5]. If that blockage becomes complete and a part of the heart muscle dies, the result is called a heart attack (HA) also known as a myocardial infarction (MI) [6]. When atherosclerosis causes the total blockage of the carotid artery in the brain, the result is a stroke.

Atherosclerosis is one of the leading causes of morbidity and mortality in the United States and most developed countries. In 2008 about 16 million American people had atherosclerotic heart disease and 5.8 million had stroke [7,8]. Coronary heart disease (CHD) is the most serious atherosclerotic disease. It is manifested by heart attack and angina pectoris, and cerebrovascular disease, as manifested by stroke. In 2010 it caused 380,000 deaths in US. At present, CHD is caused nearly 3.8 million men and 3.4 million women deaths worldwide in each year. In the developing countries it added 3.5 million of the 6.2 million global deaths in 1990 as stated by the Global Burden of Disease Study.

The forecasts estimate that in 2020 these countries will make up 7.8 million of the 11.1 million deaths due to CHD [9,10]. According to American Heart Association in 2010, worldwide prevalence of stroke was 33 million, with 16.9 million people having a first stroke. Stroke is the fifth number cause of death in the US, killing nearly 129,000 people a year. In the US it kills one person per four minutes [11]. CHD and stroke mortality continues to be highest in the black population. The prevalence of atherosclerosis is rapidly increasing in developing countries and as people in developed countries live longer, incidence will increase. By 2020, atherosclerosis is expected to be the leading cause of death worldwide [12].

Atherosclerosis remains in asymptomatic phase for decades [13]. Symptoms of atherosclerosis depend on where the affected artery is located and whether it has gradually become narrowed or suddenly blocked. Chest pain, coughing, angina, difficulty breathing, swelling of the hands and feet, erectile dysfunction etc. are symptoms of atherosclerosis [14]. Sometimes the first symptom of atherosclerosis is a heart attack or stroke [15]. Clinical manifestations of atherosclerosis will occur in 2 of 3 men and 1 in 2 women after age 40 [16]. In developed countries, atherosclerosis is almost universal. Men are at higher risk which increases with age. It tends to run in families having a parent, brother or sister with angina or a heart attack under age 50 increases the risk of atherosclerosis [17]. However, many of the risk factors for atherosclerosis are under control. Smoking is one of the most important causes of atherosclerosis in the coronary arteries, the aorta and the arteries of the legs [18]. Smoking also decreases the level of high density lipoprotein (HDL) cholesterol and increases the level of low density lipoprotein (LDL) cholesterol [19]. Fatty diet especially saturated and trans fats are more likely to cause atherosclerosis [20]. Uncontrolled high blood pressure (diastolic or systolic) is caused by atherosclerosis which finally leads to

heart attack and stroke [21]. Too much alcohol drinking or not enough fruits and vegetables consumption or diet with high cholesterol content can increase the risk of atherosclerosis [22]. Sedentary life style appears to increase the chance of atherosclerosis [20]. Obesity is epidemic in our society and contributes too many of the medical conditions that lead to atherosclerosis, high blood pressure and high blood cholesterol levels [23].

Remaining totally free of atherosclerosis is impossible for anyone over the age of 50 [24]. For most people, lifestyle choices contribute strongly to the development or reduction of atherosclerosis. One of the most important single factors is stopping smoking [25]. Losing weight is appropriate for most people at risk for atherosclerosis. The other critical part of avoiding atherosclerosis involves physician's checkups. Statins and antiplatelet drugs are effective in preventing the progression of atherosclerosis [20]. To increase the consciousness of the people about the risk factors by various health related programs can be effective to prevent or delay atherosclerosis and incidence of the cardiovascular events.

The present study was designed to analyze how much knowledge and awareness undergraduate pharmacy students of Bangladesh have about atherosclerosis and incidence of cardiovascular events.

2. MATERIALS AND METHODS

The study was conducted on 500 undergraduate pharmacy students randomly selected. A questionnaire was distributed among the students given in Table 1, information on the knowledge and awareness about atherosclerosis and incidence of cardiovascular events were collected and the results were finally compiled and presented. Each willing participant shared their knowledge.

2.1 Participants

Among 500 undergraduate pharmacy students 240 were males and 260 were females. Nearly 50% of the participants were 3rd year students and remaining 50% were 4th year students.

2.2 Variables

1. Number of student's knowledge and awareness about the risk factors.
2. Number of student's knowledge and awareness about the symptoms.
3. Number of student's knowledge and awareness about the treatments.
4. Number of student's knowledge and awareness about the diagnosis.

Table 1. Questionnaire on atherosclerosis and incidence of cardiovascular events

Questions no.	Questions	Answers	Correct answers
General information			
Q1	Atherosclerosis is a chronic disease –	True/False/I don't know	True
Q2	Atherosclerosis happens in –	Heart/Vein/Artery/I don't know	Artery
Q3	Family history contributes to atherosclerosis –	True/False/I don't know	True
Q4	Atherosclerosis is more common among –	Male/Female/I don't know	Male
Q5	Atherosclerosis is associated with men in their 40 years of age –	True/False/I don't know	True
Q6	Atherosclerosis is associated with women in their 50 to 60 years of age –	True/False/I don't know	True
Q7	Atherosclerosis is related to stroke –	True/False/I don't know	True
Q8	Stroke is due to lack of blood supply to –	Heart/brain/I don't know	Brain
Q9	Heart failure (HF) is a syndrome of capillary dysfunction –	True/False/I don't know	False
Q10	During HF the heart is unable to pump sufficient blood to meet the needs of the body –	True/False/I don't know	True
Q11	Congestive heart failure (CHF) is characterized by diminished cardiac output –	True/False/I don't know	True
Q12	Myocardial infarction (MI) is necrosis of heart muscle resulting from –	Ischemia/Hypoxia/I don't know	Ischemia

Questions no.	Questions	Answers	Correct answers
Risk factors			
Q13	Cigarette smoking decreases chance of atherosclerosis –	True/False/I don't know	False
Q14	Diabetes insipidus increases the chance of atherosclerosis –	True/False/I don't know	False
Q15	High blood pressure increases the chance of atherosclerosis –	True/False/I don't know	True
Q16	High level of LDL cholesterol decreases the risk of CVD –	True/False/I don't know	False
Q17	High level of HDL cholesterol level is an important risk factor of atherosclerosis –	True/False/I don't know	False
Q18	Most heart attacks (HAs) result from –	Stroke/Atherosclerosis/I don't know	Atherosclerosis
Q19	Drinking large amounts of alcohol increases the risk of stroke –	True/False/I don't know	True
Q20	Saturated and trans fats are more likely to cause atherosclerosis–	True/False/I don't know	True
Q21	More than 80% of people who die of heart disease are 65 or older –	True/False/I don't know	True
Symptoms			
Q22	Symptoms of atherosclerosis usually come on –	Gradually/Suddenly/I don't know	Gradually
Q23	Atherosclerosis usually does not cause symptoms until the interior of an artery is narrowed by more than –	70%/50%/I don't know	70%
Q24	Difficulty breathing is a symptom of atherosclerosis –	True/False/I don't know	True
Q25	Angina is a symptom of –	Arrhythmics/Atherosclerosis/I don't know	Atherosclerosis
Q26	Swelling of the hand and feet is a symptom of –	Atherosclerosis/HF/I don't know	Atherosclerosis
Q27	Erectile dysfunction is a symptom of atherosclerosis –	True/False/I don't know	True
Q28	Paralysis of the face, arm or leg is a symptom of –	Stroke/MI/I don't know	Stroke
Q29	Dyspnea and fluid retention are symptoms of –	HF/Stroke/I don't know	HF
Q30	The most common symptom of a heart attack is chest pain –	True/False/I don't know	True
Treatments			
Q31	Drugs prescribed for atherosclerosis is –	Statins/Diuretics/I don't know	Statins
Q32	Noncoronary atherosclerosis can be treated by fibric acid derivatives –	True/False/I don't know	True
Q33	Drugs prescribed for stroke are aspirin and warfarin –	True/False/I don't know	True
Q34	Renin angiotensin blockers (RABs) are prescribed drugs for –	HF/Angina/I don't know	HF
Q35	Nitroglycerin is effective during –	Hyperlipidemias/HA/I don't know	HA
Diagnosis			
Q36	Diagnosis of atherosclerosis can be done by –	Blood test/Lipid profile test/I don't know	Lipid profile test
Q37	Blood protein test can be done for diagnosis of atherosclerosis –	True/False/I don't know	False

Questions no.	Questions	Answers	Correct answers
Q38	Angiography (AG) is a special X ray to show the inside of –	Arteries/Heart/I don't know	Arteries
Q39	Echocardiography (ECG) provides information about the size and shape of –	Arteries/Heart/I don't know	Heart
Q40	Diagnosis of atherosclerosis can be done by magnetic resonance imaging (MRI) –	True/False/I don't know	True

2.3 Scope for Error

Since the survey is based on the answers provided by the students not based on any laboratory test, there is no scope for error.

2.4 Statistical Analysis

Results are expressed as error bar with 5 percentages. Microsoft Excel 2010 (Roselle, IL, USA) was used for the statistical and graphical evaluations.

3. RESULTS

The knowledge and awareness of 500 undergraduate pharmacy student's about general information, risk factors, symptoms, treatments and diagnosis of atherosclerosis and incidence of cardiovascular events are given in Table 2.

From the 500 students 86% students know that atherosclerosis is a chronic disease, 75% students know that atherosclerosis occur in artery. 45% of students found that family history contribute to atherosclerosis. 83% students know that the incidence of atherosclerosis is more common for male than female. 69% students identified that atherosclerosis is associated with men in their 40 years of age and 42% of students do not know the link of atherosclerosis between female and age. The relationship between atherosclerosis and stroke were recognized by 83% of students and 17% of students had no idea about this. 89% students know that stroke is due to lack of blood supply in brain and 11% of students not even aware that the stroke happens in brain. 73% students know that HF is a syndrome of ventricular dysfunction and 86% students aware that during HF the heart is unable to pump sufficient blood. 81% of students know that the diminished cardiac output is responsible for CHF. Ischemia is the causative agent for MI was identified by 68% of students and remaining 22% students were not aware about this matter (Table 2, Fig. 1). Total number of under graduate pharmacy student's knowledge and awareness about symptoms of atherosclerosis and incidence of cardiovascular events are given in Fig. 6.

Smoking is more common among students. Only 56% students alert that smoking increases the chance of atherosclerosis. 44% students aware that diabetes insipidus is not a risk factor of atherosclerosis. 11% students were unaware that high blood pressure increases the chance of atherosclerosis. 74% students recognized that LDL is bad cholesterol and 69% students know that HDL is good cholesterol. The link between atherosclerosis and HA was known by 63% students. In this study 59% students were alerts that alcohol as a risk factor of atherosclerosis 75% as saturated and trans fats. Maximum number of students (95%) identified that aged peoples are more prone to heart diseases (Fig. 2). Total number of under graduate pharmacy student's knowledge and awareness about symptoms of atherosclerosis and incidence of cardiovascular events are given in Fig. 6.

84% students identified that symptoms of atherosclerosis usually come on gradually and 57% students aware that symptoms of atherosclerosis appear after 70% blockage of respective artery. 61% students identified angina as a symptom of atherosclerosis, 52% as swelling of the hands and feet, 55% as difficulty breathing and 56% as erectile dysfunction. 67% students were aware that paralysis of the face, arm or leg is symptoms of stroke. 46% students were unaware that dyspnea and fluid retention are symptom of HF and 65% students identified chest pain as symptom of heart attack (Table 2, Fig. 3). Total number of under graduate pharmacy student's knowledge and awareness about general information, risk factors, symptoms, treatment and diagnosis of atherosclerosis and incidence of cardiovascular events are given in Fig. 6.

87% of students identified that statins are the most widely prescribed drugs for atherosclerosis and 44% students had no idea about the treatment of noncoronary atherosclerosis. 86% of students identified that drugs prescribed for

stroke were aspirin and warfarin. Only 17% of students were unaware about the prescribed drugs for HF and 89% of students were conscious about the prescribed drugs (nitroglycerin) for HA (Fig. 4). Total number of under graduate pharmacy student's knowledge and awareness about treatments of atherosclerosis and incidence of cardiovascular events are given in Fig. 6.

59% of students identified that lipid profile test for diagnosis of atherosclerosis and 62% of students gave wrong answer about the blood protein test. Most of the student had no idea about the angiography, echocardiography and magnetic resonance imaging. 45% of students identified that angiography, 41% of students recognized that echocardiography and 35% of students identified that magnetic resonance imaging can be done for diagnosis of atherosclerosis (Table 2, Fig. 5). Total number of under graduate pharmacy student's knowledge and awareness about diagnosis of atherosclerosis and incidence of cardiovascular events are given in Fig. 6.

Table 2. Responses of undergraduate pharmacy students

| Parameters	Questions no.	Responses		
		Right answers	**Wrong answers**	**Ignored**
General information	Q1	86% (430)	14% (70)	0
	Q2	75% (375)	25% (125)	0
	Q3	45% (225)	55% (275)	0
	Q4	83% (415)	17% (85)	0
	Q5	69% (345)	31% (155)	0
	Q6	58% (290)	42% (210)	0
	Q7	83% (415)	17% (85)	0
	Q8	89% (445)	11% (55)	0
	Q9	73% (365)	27% (135)	0
	Q10	86% (430)	14% (70)	0
	Q11	81% (405)	19% (95)	0
	Q12	68% (340)	32% (160)	0
Risk factors	Q13	56% (280)	44% (220)	0
	Q14	44% (220)	56% (280)	0
	Q15	89% (445)	11% (55)	0
	Q16	74% (370)	26% (130)	0
	Q17	69% (345)	31% (155)	0
	Q18	61% (305)	34% (170)	5% (25)
	Q19	59% (295)	41% (205)	0
	Q20	75% (375)	25% (125)	0
	Q21	95% (475)	5% (25)	0
Symptoms	Q22	84% (420)	16% (80)	0
	Q23	52% (260)	37% (185)	11% (55)
	Q24	61% (305)	39% (195)	0
	Q25	52% (260)	48% (240)	0
	Q26	55% (275)	45% (225)	0
	Q27	52% (260)	41% (205)	7% (35)
	Q28	67% (335)	33% (165)	0
	Q29	54% (270)	46% (230)	0
	Q30	65% (325)	35% (175)	0
Treatments	Q31	87% (435)	13% (65)	0
	Q32	56% (280)	44% (220)	0
	Q33	86% (430)	14% (70)	0
	Q34	83% (415)	17% (85)	0
	Q35	89% (445)	11% (55)	0
Diagnosis	Q36	55% (275)	39% (195)	6% (30)
	Q37	34% (170)	57% (285)	9% (45)
	Q38	40% (200)	47% (235)	13% (65)
	Q39	41% (205)	54% (270)	5% (25)
	Q40	32% (160)	61% (305)	7% (35)
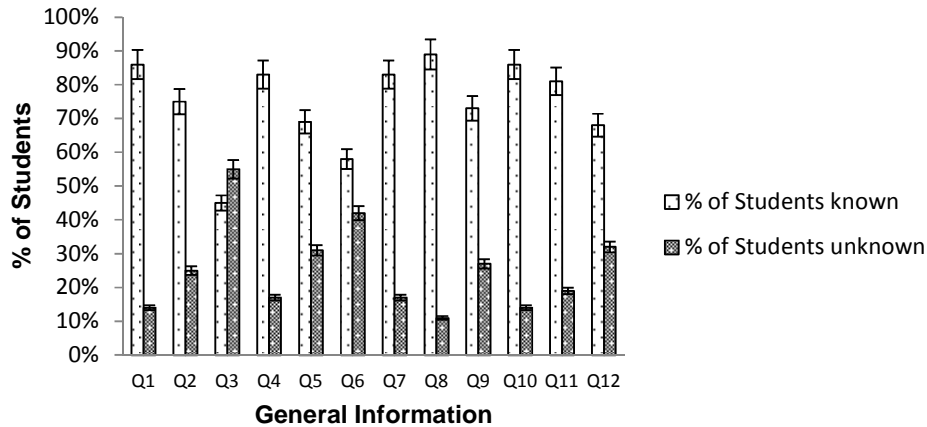
Fig. 1. Percentage of knowledge and awareness about general information of atherosclerosis and incidence of cardiovascular events among students

Results are expressed as error bar with 5 percentages. Here, % of Students known = % of Students give right answers. % of Students unknown = % of Students give wrong answers. Q1, Q2, Q3, ….. = Questionnaire given in Table 2

Total number of under graduate pharmacy student's knowledge and awareness about general information, risk factors, symptoms, treatments and diagnosis of atherosclerosis and incidence of cardiovascular events are given below in Fig. 6.

4. DISCUSSION

In this study percentage of knowledge and awareness of students about general information of atherosclerosis and incidence of cardiovascular events is given in Fig. 1. Among 500 pharmacy students maximum number of students, 89% identified that lack of blood supply in brain is responsible for stroke and 86% students identified that during HF the heart is unable to pump sufficient blood. In the study on knowledge and awareness about stroke among second year dental student, Laakshmi GM showed that 71% students know that stroke is due to lack of blood supply in brain [26].
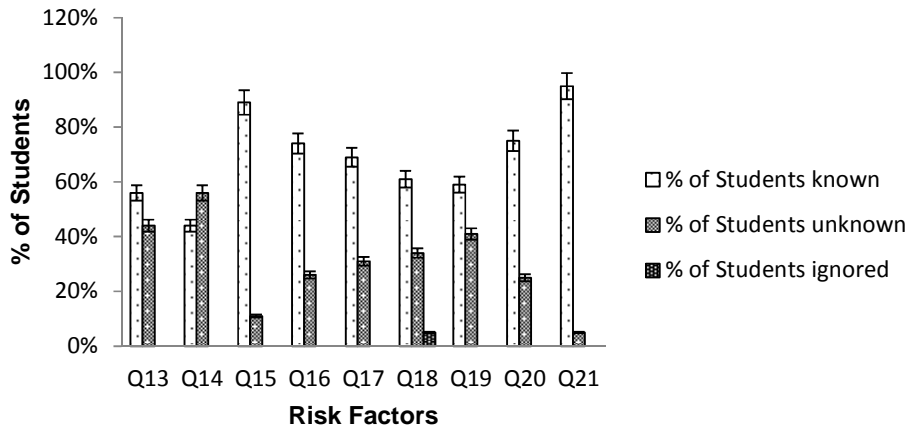

Fig. 2. Percentage of knowledge and awareness about risk factors of atherosclerosis and incidence of cardiovascular events among students

Results are expressed as error bar with 5 percentages. Here, % of Students known = % of Students give right answers. % of Students unknown = % of Students give wrong answers. % of Students ignored = % of Students don't know. Q1, Q2, Q3, ….. = Questionnaire given in Table 2
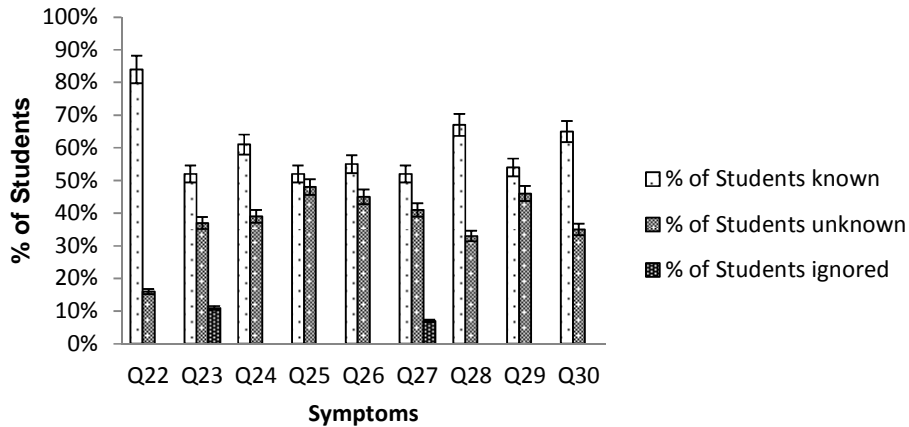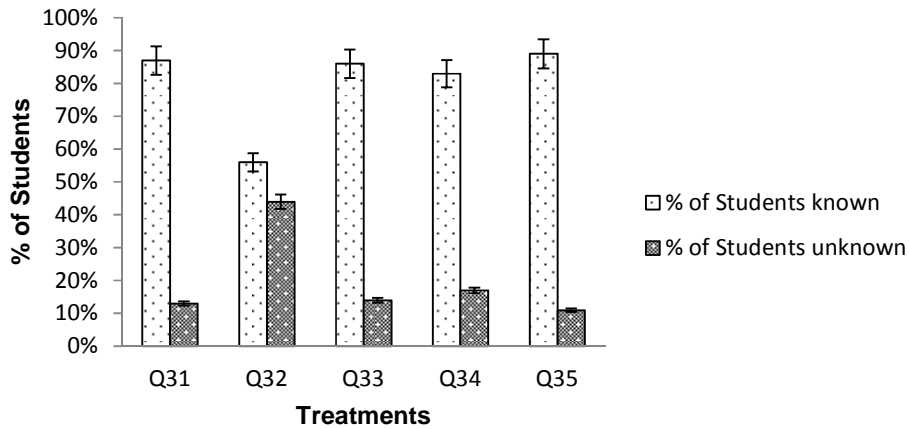
Fig. 3. Percentage of knowledge and awareness about symptoms of atherosclerosis and incidence of cardiovascular events among students

Results are expressed as error bar with 5 percentages. Here, % of Students known = % of Students give right answers. % of Students unknown = % of Students give wrong answers. % of Students ignored = % of Students don't know. Q1, Q2, Q3, ….. = Questionnaire given in Table 2

Fig. 4. Percentage of knowledge and awareness about treatments of atherosclerosis and incidence of cardiovascular events among students

Results are expressed as error bar with 5 percentages. Here, % of Students known = % of Students give right answers. % of Students unknown = % of Students give wrong answers. Q1, Q2, Q3, ….. = Questionnaire given in Table 2

Atherosclerosis is typically multifactorial, most often dependent on risk factors such as smoking, diabetes mellitus, hypercholesterolemia, hypertension and obesity. Smoking can damage and tighten blood vessels, increases LDL and decreases HDL levels. It also promotes vasoconstriction and raise blood pressure [27]. Diabetes mellitus is a major risk factor for atherosclerosis. Hyperglycemia increases the production of reactive oxygen species (ROS) as a consequence of mitochondrial dysfunction, which in turn induced endothelial dysfunctions, along with hypercoagulable, hasten the process of atherothrombotic complications. Patients with diabetes mellitus (DM) have an over tenfold risk for cardiovascular disease in their lifetime [28,29]. LDL cholesterol is highly atherogenic and it correlates with the risk of cardiovascular events in human. Individuals with LDL above 190 mg/dL and HDL below 40 mg/dL are at high risk, while individuals with LDL below 100 mg/dL and HDL above 50 mg/dL are at no risk [30,31]. Excessive amount of alcohol drinking can cause hypertension and hypercholesterolemia, consequently increasing the risk of developing atherosclerosis and cardiovascular disease [32,33]. Several epidemiological studies suggest that moderate alcohol intake, especially red wine,

decrease cardiac mortality due to atherosclerosis [34]. Fig. 2. represents the risk factors of atherosclerosis and cardiovascular diseases. In our study only 44% students recognized the link between diabetes and atherosclerosis. 74% students known that LDL cholesterol are bad and 69% students know that HDL cholesterol is good for health. Previous study conducted by Laakshmi GM recommend that 5% dental students were conscious that diabetes as a risk

factor of stroke, 49% as high blood pressure and 30% as high cholesterol [26].

Atherosclerosis does not usually produce symptoms until the blood circulation becomes restricted or blocked, leading to cardiovascular diseases [35]. Symptoms of moderate to severe atherosclerosis depend on which arteries are affected. Chest pain or pressure is the symptoms of atherosclerosis in the heart arteries [36].
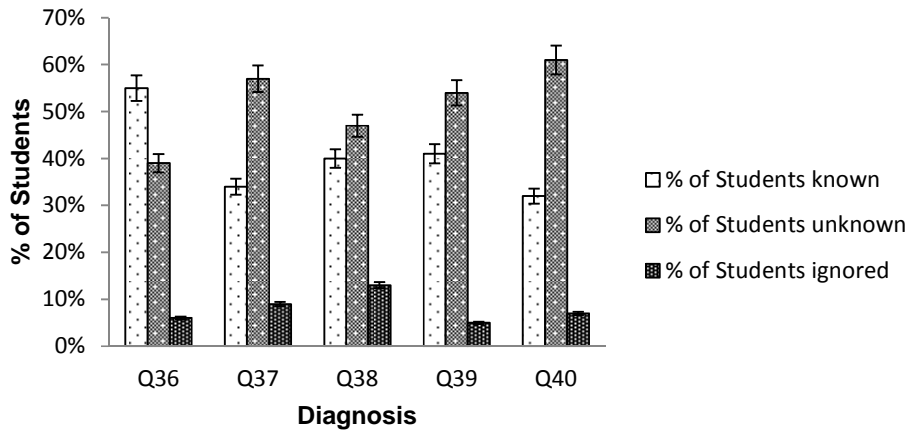

Fig. 5. Percentage of knowledge and awareness about diagnosis of atherosclerosis and incidence of cardiovascular events among students
Results are expressed as error bar with 5 percentages. Here, % of Students known = % of Students give right answers. % of Students unknown= % of Students give wrong answers. % of Students ignored= % of Students don't know. Q1, Q2, Q3, ….. = Questionnaire given in Table 2
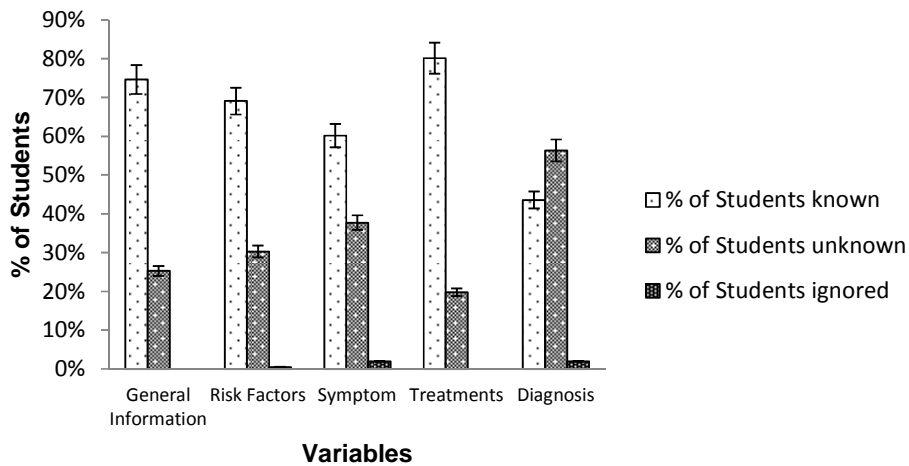

Fig. 6. Total number of student's knowledge and awareness about general information, risk factors, symptoms, treatments and diagnosis of atherosclerosis and incidence of cardiovascular events
Results are expressed as error bar with 5 percentages. Here, % of Students known = % of Students give right answers. % of Students unknown= % of Students give wrong answers. % of Students ignored= % of Students don't know. Q1, Q2, Q3, ….. = Questionnaire given in Table 2

When atherosclerosis narrows brain arteries, it can cause weakness or paralysis on one side of the body, difficulty walking and slurred speech [37]. Among these students 61% students recognized angina as a symptom of atherosclerosis, 52% as swelling of the hands and feet. 67% students were conscious that paralyses of the face, arm or leg are symptoms of stroke. 54% students were aware that dyspnea and fluid retention are symptoms of HF and 65% students identified chest pain as symptom of heart attack (Fig. 3). According to the study of Laakshmi GM on dental students showed that 50% students identified that slurred speech as a symptom of stroke and 50% as weakness in arms and legs [26].

There is no cure for atherosclerosis, but treatment can slow or halt the worsening of the disease [38]. The treatment of atherosclerosis aims to relieve symptoms and reduce the risk factors in an effort to slow, stop, or reverse the build-up of plaque. There are several medications available to treat many of the underlying causes of atherosclerosis. Statins are type of cholesterol lowering medication used to lower blood cholesterol levels by inhibiting the key enzyme HMG-CoA reductase which plays a central role in the production of cholesterols [38]. Angiotensin-converting enzyme (ACE) inhibitors work by blocking the actions of some of the hormones that help regulate blood pressure [39-41]. Anti-platelet medications, such as aspirin, may use to reduce the likelihood that platelets will clump in narrowed arteries, form a blood clot and cause further blockage by reducing the stickiness of platelets [42]. In this study for the treatment of atherosclerosis, maximum number of students (87%) identified statins and 56% as fibric acid derivatives. 86% of students recognized that drugs prescribed for stroke were aspirin and warfarin. 83% students were conscious about the prescribed drug for HF, RABs and 89% as HA, nitroglycerin (Fig. 4). Earlier finding showed that 62% of dental students identified that drugs prescribed for stroke are aspirin and warfarin [26].

Having regular preventive health checkups will allow a chance to diagnose problems such as diabetes, high blood pressure, and high levels of cholesterol from blood [43].The lipid profile test is used for determination of total cholesterol , LDL cholesterol, HDL cholesterol, triglycerides etc. This test helps to determine an individual's risk of heart disease [44]. AG is a special X ray to show the inside of the arteries. This test can show whether plaque is blocking the arteries as well as the severity of the blockage [45]. ECG uses sound waves to create a moving picture of the heart. This test provides information about the size and shape of the heart and how well the heart chambers and valves are working. It also can identify areas of poor blood flow to the heart, areas of heart muscle that aren't contracting normally, and previous injury to the heart muscle caused by poor blood flow [46]. MRI is another imaging test use for noninvasive assessment of blood vessel wall structure and characterization of plaque composition [47]. In this study most of the student had no idea about the diagnosis of the atherosclerosis. 59% of students identified that lipid profile test for diagnosis of atherosclerosis, 48% as blood protein test, 45% as angiography, 41% as ECG and 35% as MRI (Fig. 5).

Total number of under graduate pharmacy student's knowledge and awareness about general information, risk factors, symptoms, treatments and diagnosis of atherosclerosis and incidence of cardiovascular events are given below in Fig. 6. Our existing study suggests that among 500 undergraduate pharmacy students most of the students (80%) have superior knowledge about the treatments of atherosclerosis and incidence of cardiovascular events, high to moderate knowledge about the risk factors, general information and symptoms and sufficient knowledge and awareness is necessary for diagnosis.

5. CONCLUSION

From the present study it was clearly demonstrated that 75% pharmacy students had knowledge and awareness about the general information 69% about the risk factors, 60% about the symptoms, 80% about the treatments and 44% about the diagnosis of atherosclerosis and incidence of cardiovascular events. A pharmacist is not only drug specialist but also disease specialist, so considerable education is needed to increase knowledge and awareness in modern concepts of particularly about the risk factors, symptoms and diagnostic measures. Awareness and knowledge can be increased among under graduate pharmacy students by updating the curriculum for incorporation of pathological knowledge. In addition to this various health related seminar, symposium, assignment, presentation etc. are also effective to generate competent pharmacists.

6. LIMITATION

The present study was conducted in a particular university of Bangladesh. It would be better if we could perform this study in several institutions all over the country.

CONSENT

It is not applicable.

ETHICAL APPROVAL

The study protocol was approved by the ethics committee of the Department of Pharmacy, Southeast University, Dhaka, Bangladesh. The study was conducted in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

ACKNOWLEDGEMENTS

The authors wish to thank the Department of Pharmacy, Southeast University, Dhaka-1213, Bangladesh.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Robinson JG, Fox KM, Bullano MF, Grandy S. Atherosclerosis profile and incidence of cardiovascular events: A population-based survey. BMC Cardio Dis. 2009;9(46):1.
2. Galkina E, Ley K. Immune and inflammatory mechanisms of atherosclerosis. Annu Rev Immunol. 2009; 27:165-66.
3. Shah SR. An innovative solution for the problem of blood flow through stenosed artery using generalized bingham plastic fluid model. Int J of Res in Appl, Nat and Soc Sci. 2013;1(3):97-98.
4. Hansson GK. Inflammation, atherosclerosis, and coronary artery disease. New Eng J Med. 2005;352:1685-86.
5. Cohn JK, Cohn PF. Chest pain. Circulation. 2002;106:530-31.
6. Julian RJ. The response of the heart and pulmonary arteries to hypoxia, pressure, and volume. Poul Sci: Oxf J. 2007;86: 1006-07.
7. Jules YT. Atherosclerosis. Available:http://www.merckmanuals.com/professional/cardiovascular-disorders/arteriosclerosis/atherosclerosis. (Accessed 15 October 2015)
8. Anonymous. Prevalence of coronary atherosclerosis in asymptomatic population. Available:http://eurheartj.oxfordjournals.org/content/ehj/21/1/13.full.pdf (Accessed 15 October 2015)
9. Backer GGD. The global burden of coronary heart disease. Available:http://www.medicographia.com/2010/07/the-global-burden-of-coronary-heart-disease/ (Accessed 15 October 2015)
10. Anonymous. Coronary artery disease. Available:https://en.wikipedia.org/wiki/Coronary_artery_disease (Accessed 15 October 2015)
11. Anonymous. Heart Disease and Stroke Statistics: At a glance. Available:https://www.heart.org/idc/groups/ahamah-public/@wcm/@sop/@smd/documents/downloadable/ucm_470704.pdf (Accessed 15 October 2015)
12. Anonymous. Disease statistics. Available:http://www.nhlbi.nih.gov/about/documents/factbook/2012/chapter4 (Accessed 15 October 2015)
13. Toth PP. Subclinical atherosclerosis: what it is, what it means and what we can do about it. Int J Clin Prac. 2008;62:1246-54.
14. Chaikriangkrai K, Kassi M, Bala SK, Nabi F, Chang SM. Atherosclerosis burden in patients with acute chest pain: Obesity paradox. Int Schol Res Noti. 2014;2014:1-2.
15. Weisfeldt ML, Zieman SJ. Advances in the prevention and treatment of cardiovascular disease. Health Affairs. 2007;26(1):26.
16. Faxon DP, Creager MA, Smith SC, Pasternak RC, Olin JW, Bettman MA, Criqui MH, Milani RV, Loscalzo J, Kaufman JA, Jones DW, Pearce WH. American Heart Association. Atherosclerotic vascular disease conference: Executive summary. Circulation. 2004;109:2595-04.

17. Alpert JS. What you need to know if you have coronary artery disease. Circulation. 2011;124:176-77.

18. Bentzon JF, Otsuka F, Virmani R, Falk E. Mechanisms of plaque formation and rupture. Circ Res. 2014;114:1853.

19. Neufeld EJ, Snyder MM, Beiser AS, Baker AL, Newburger JW. Passive cigarette smoking and reduced HDL cholesterol levels in children with high-risk lipid profiles. Circulation. 1997;96:1403-07.

20. Anonymous. Atherosclerosis. Available:https://umm.edu/health/medical/altmed/condition/atherosclerosis (Accessed 15 October 2015)

21. Olafiranye O, Zizi F, Brimah P, Louis GJ, Makaryus AN, McFarlane S, et al. Management of hypertension among patients with coronary heart disease. Int J of Hype. 2011;2011:1-2.

22. Kanter MM, Etherton PMK, Fernandez ML, Vickers KC, Katz DL. Exploring the factors that affect blood cholesterol and heart disease risk: Is dietary cholesterol as bad for you as history leads us to believe. Adv in Nutri: An Int Rev J. 2012;3:711-12.

23. McGill HC, McMahan CA, Herderick EE, Zieske AW, Malcom GT, Tracy RE, et al. Obesity accelerates the progression of coronary atherosclerosis in young men. Circulation. 2002;105:2712.

24. Golledge J, Norman PE. Atherosclerosis and abdominal aortic aneurysm cause, response, or common risk factors. Arterioscler Thromb Vasc Biol. 2010;30: 1075-76.

25. Pryde MM, Kannel WB. Efficacy of dietary behavior modification for preserving cardiovascular health and longevity. Cardio Res and Prac. 2011;2011:1-6.

26. Laakshmi GM. Survey of knowledge and awareness about stroke among second year dental student. J of Pharmace Sci and Res. 2015;7(9):788-791.

27. Hegele RA. The genetic basis of atherosclerosis. Int J Clin Lab Res. 1997; 27:2-13.

28. Maiti R, Agrawal NK. Atherosclerosis in diabetes mellitus: Role of inflammation. Indian J Med Sci. 2007;61(5):292.

29. Giacco F, Brownlee M. Oxidative stress and diabetic complications. Circ Res. 2010;107(9):1058-70.

30. Hao W, Friedman A. The LDL-HDL profile determines the risk of atherosclerosis: a mathematical model. Plos One. 2014; 9(3):1.

31. Libby P, Ridker PM, Hansson GK. Progress and challenges in translating the biology of atherosclerosis. Nature. 2011; 473:318.

32. Di Castelnuovo A, Costanzo S, Bagnardi V, Donati MB, Iacoviello L, de Gaetano G. Alcohol dosing and total mortality in men and women: An updated meta-analysis of34 prospective studies. Arch Intern Med. 2006;166:2437-2445.

33. Rehm J, Mathers C, Popova S, Thavorncharoensap M, Teerawattananon Y, Patra J. Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders. Lance. 2009;373:2223-2233.

34. da Luz PL, Coimbra SR. Wine, alcohol and atherosclerosis: Clinical evidences and mechanisms. Brazil J of Med and Biol Res. 2004;37:1275.

35. Anonymous. Symptoms of atherosclerosis. Available:http://www.nhs.uk/Conditions/Atherosclerosis/Pages/Symptoms.aspx (Accessed 8 October 2015)

36. Stern S, Behar S, Gottlieb S. Aging and diseases of the Heart. Circulation. 2003; 108:99-101.

37. Anonymous. What are the signs and symptoms of atherosclerosis. Available:http://www.nhlbi.nih.gov/health/health-topics/topics/atherosclerosis/signs (Accessed 8 October 2015)

38. Roche LD, Hernández DA. New alternatives for atherosclerosis treatment based on immunomodulation. Inter Schol Res Net. 2012;6:1-2.

39. Lewington S, Whitlock G, Clarke R, Sherliker P, Emberson J, Halsey J, et al. Blood cholesterol and vascular mortality by age, sex, and blood pressure: A meta-analysis of individual data from 61 prospective studies with 55,000 vascular deaths. Lancet. 2007;370(9602):1829-39

40. Nelson CR, Knapp DA. Trends in antihypertensive drug therapy of ambulatory patients by US office-based physicians. Hypertension. 2000;36:600-603.

41. Gu Q, Paulose-Ram R, Dillon CF, Burt VL. Antihypertensive medication use among US adults with hypertension. Circulation. 2006;113:213-221.

42. Hennekens CH, Dyken ML, Fuster V. Aspirin as a therapeutic agent in cardiovascular disease: A statement for

healthcare professionals from the American heart association. Circulation. 1997;96(8):2751-2753.

43. Gotto AM. Statins: Powerful drugs for lowering cholesterol advice for patients. Circulation. 2002;105:1515-16.

44. Birtcher KK, Ballantyne CM. Measurement of cholesterol: A patient perspective. Circulation. 2004;110:296-297.

45. Anonymous. How Is Atherosclerosis Diagnosed. Available:http://www.nhlbi.nih.gov/health/health-topics/topics/atherosclerosis/diagnosis (Accessed 8 October 2015)

46. Flavell C, Stevenson LW. Take heart with heart failure. Circulation. 2001;104:89-90.

47. Dieleman N, van der Kolk AG, Zwanenburg JJM, Harteveld AA, Biessels GJ, Luijten PR, et al. Imaging intracranial vessel wall pathology with magnetic resonance imaging current prospects and future directions. Circulation. 2014;130: 192-201.