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A questionnaire study on knowledge and awareness of metabolic syndrome and it's components in undergraduate medical students at entry level

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ABSTRACT

Metabolic syndrome is a major and escalating public health crisis among young adults in recent times. Increasing calorie intake, sedentary lifestyle, lack of exercise and chronic stress are the contributing factors for metabolic syndrome. The objective of this study is to evaluate the awareness and knowledge levels of first-year medical students regarding various aspects in metabolic syndrome. The study was conducted among 74 undergraduate medical students at Apollo institute of medical sciences and research. A standardized questionnaire was given to the students and the students were asked to answer the questionnaire independently and the responses obtained were statistically analyzed. In our study, the participants showed a good level of knowledge about different types, the pattern of inheritance and symptoms of diabetes mellitus. They were cognizant about causes, risk factors and treatment of adiposity and hypertension. The majority knew about ill effects of high cholesterol, stroke and arteriosclerosis. Most of them doesn't know the underlying mechanism of heart infraction. The study also identified areas of deficiencies in the knowledge of students about different components of metabolic syndrome. This effort is done in the beginning of their course because being the force of future medical feternity, they can educate themselves and the public about ill-effects of metabolic syndrome and means to prevent it as a part of public health. The study also supports the necessity of early clinical exposure for medical students at the entry-level.

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INTRODUCTION

Metabolic syndrome (MetS) is a clinical challenge worldwide (Kaur, 2014). Sedentary lifestyle, lack of exercise and chronic stress are the contributing factors for metabolic syndrome (Laaksonen, 2002). It is a state of chronic inflammation, a consequence of the complex interplay between genetic and environmental factors with profound systemic effects such as elevated blood pressure, insulin resistance, visceral adiposity, endothelial dysfunction, hypercoagulable state and atherogenic dyslipidemia. (Grundy *et al.*, 2005; Reaven, 2006). Met syndrome is also known as syndrome X or insulin resistance syndrome (Reaven, 1988; Grundy *et al.*, 2004). Met

syndrome confers a greater risk for cardiovascular disease, type 2 diabetes mellitus, and mortality (Galassi *et al.*, 2006; Malik *et al.*, 2004). According to NCEP: ATP III definition, Met syndrome is identified if the subject has three or more of the following criteria. Abdominal obesity: WC$\geq$102 cm in men and $\geq$88 cm in women, Hypertriglyceridemia: $\geq$150 mg/dl (1.695 mmol/l), Low HDL-C: <40 mg/dl in men and <50 mg/dl in women, High blood pressure (BP): >130/85 mmHg, High fasting glucose: >110 mg/dl (Parikh and Mohan, 2012; Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults, 2001). Despite the fact that MetS is common in the adult population, it is becoming a major and escalating public health crisis in young adults in recent times. Data from the National Health and Nutrition Examination Survey (NHANES) from 1988 to 2001 shows that the prevalence of metabolic syndrome increased by more than 35% from 1988–1994 to 2007–2012, increasing from 25.3% to 34.2% among US adults aged 18 years or older (Moore *et al.*, 1988). The prevalence of the metabolic syndrome is 23% between the 19-24 age group in Indians (Ithayamalar *et al.*, 2016; Prasad *et al.*, 2012). Increasing calorie intake, sedentary lifestyle, lack of exercise and chronic stress are the contributing factors. Assessing the awareness and pre-existing knowledge of the medical students at undergraduate level gives us an idea about their level of understanding and helps us to educate them as well as enhance students wellness by motivating them to adopt a healthy eating pattern, regular physical activity, weight management which can reduce the prevalence of MeS in young individuals. It also supports the necessity of early clinical exposure to Medical students. The present study provides an insight to the knowledge, and awareness of Metabolic Syndrome in the medical students at the undergraduate level.

MATERIALS AND METHODS

The present study was a cross-sectional study conducted during the academic year 2017-18, among the 1^{st} year MBBS students of Apollo Institute of Medical Sciences & Research, Jubilee Hills, Hyderabad. Out of 100 students joined in 1^{st} year MBBS, a total of 74 students (28 male & 46 female), between 18-24 years, were voluntarily enrolled in the present study. The study was approved by the Research Committee of the Apollo Institute of Medical Sciences And Research (AIMSR). Adequate information about the study was given to all the students. After taking written consent from the students agreeing to participate in the study, a self-administered questionnaire, which includes a total of 90 questions, was given to the students. The questions were adapted from previous studies by (Becker *et al.*, 2008; Yahia *et al.*, 2014).The questionnaire was pretested, structured and standardized and was also used among university students in previous studies (Becker *et al.*, 2008; Yahia *et al.*, 2014). Further, the questionnaire was also validated by subject experts. A pilot study was done on a group of 30 students to ensure an adequate understanding of the adapted questions. The questions were about student's knowledge regarding definition, types, risk factors, physical changes significant to Met S, consequences and management of these conditions. These 90 questions related to diabetes (16 questions), hypertension (12 questions), adiposity (9 questions), high blood cholesterol(6 questions), arteriosclerosis(17 questions), stroke(12 questions) and myocardial infarction (18 questions) were given to the students and their response was analyzed (Becker *et al.*, 2008; Yahia *et al.*, 2014). The response options to the questions will be 'True' or 'False'. Students were instructed to fill the questionnaire truthfully. Scores are given based on their correct answers. The "correct" answer was awarded one point and the "incorrect" and "do not know" answers were awarded zero points. The maximum achievable total score for the MetS questions was 90. The percentage of correct answers was calculated. If the scores are between 81 -100% defined as good knowledge, between 51-80% scores -as fair knowledge and $\leq$50% scores–considered as poor knowledge (Becker *et al.*, 2008; Yahia *et al.*, 2014). Fisher's exact test was used to examine differences in students' responses to the questionnaire by using "MedCalc Statistical Software version 16.4.3 (MedCalc Software bvba, Ostend, Belgium)". *P* values were reported as 2 -sided and the statistical significance was defined by *P*-value <0.05.

RESULTS

In the present study, we assessed the level of knowledge and awareness of metabolic syndrome in undergraduate MBBS students at entry-level during the academic year 2017-18 at Apollo Institute of Medical Sciences & Research, Jubilee Hills, Hyderabad. Out of 100 students joined in 1 st year MBBS, 74 students, 28 (38%) male 46 (62%) female were voluntarily enrolled in our study. The highest overall individual score obtained was 77 out of 90. The maximum and minimum scores obtained in each component of Metabolic syndrome, Mean & SD, were represented in Table 1 and Graph 1.

The number and percentage of the student's response to a questionnaire for Diabetes mellitus

Table 1: Maximum, minimum scores obtained by students, Mean & SD

Questionnaire topic	Max	Min	Mean	SD
DM(16)	16	5	11.16	2.21
Adiposity(9)	9	1	6.84	1.35
HT(12)	12	5	8.09	1.84
H.cholesterol(6)	6	1	4.08	0.99
AS(17)	17	7	13.05	2.14
Stroke(12)	11	4	8.03	1.68
MI(18)	16	1	11.3	2.38

Table 2: The number and percentage of the students with the correct response to questionnaire for Diabetes mellitus

Questions	key	male (N=28) & %	Female (N=46)& %	total number (N=74) & %	P-value
There are several different types of diabetes	TRUE	27(96.4)	42(91.03)	69(93.24)	0.64
Hereditary factors play a major role in the development of diabetes	TRUE	28(100)	45(98)	73(99)	1
Increased alertness is a frequent symptom of diabetes.	FALSE	15(53.57)	22(47.83)	37(50)	0.81
Hereditary factors play only a minor role in the development of diabetes.	FALSE	15(53.57)	27(58.69)	42(56.76)	0.81
Pregnant women have a reduced risk of acquiring diabetes.	FALSE	20(71.42)	37(80.43)	57(77.03)	0.4
Eye disorders can be a consequence of diabetes.	TRUE	24(85.71)	40(86.96)	64(86.48)	0.23
For some diabetics, it is not advisable to take insulin.	TRUE	25(89.28)	38(82.61)	63(85.13)	0.52
Diabetics may only eat special sweets for diabetics.	TRUE	16(57.19)	25(54.35)	41(55.4)	1
With diabetes, sugar cannot enter the cells sufficiently.	TRUE	25(89.28)	39(84.78)	64(86.48)	0.73
Poor appetite is a frequent symptom of diabetes.	FALSE	15(53.57)	33(71.74)	48(64.86)	0.14
With Diabetes, too much sugar enters the cells.	FALSE	18(64.28)	38(82.61)	56(75.67)	0.1
Pregnant women have an increased risk of acquiring diabetes.	TRUE	23(82.14)	34(73.91)	57(77.03)	0.57
Frequent urination is a frequent symptom of diabetes.	TRUE	26(92.85)	44(95.65)	70(94.59)	0.63
Diabetes patients must have insulin shots.	FALSE	10(35.71)	28(60.87)	38(51.35)	0.05*
Arteriosclerosis is one of the sequalae of diabetes.	TRUE	23(82.14)	31(67.39)	54(72.97)	0.19
With Diabetes, sugar cannot diffuse in the blood.	TRUE	26(92.85)	34(73.91)	60(81.08)	0.07

**P-value* <0.05-statistically significant

was shown in Table 2 and Graph 2.

The number and percentage of the student's response to a questionnaire for Adiposity was shown in Table 3 and Graph 3. More than ninety percent of the students (78.59% male & 100% female), thought that Adipose individuals are more likely to suffer from arteriosclerosis and the difference in response between male and females, is statistically highly significant (P=0.002).

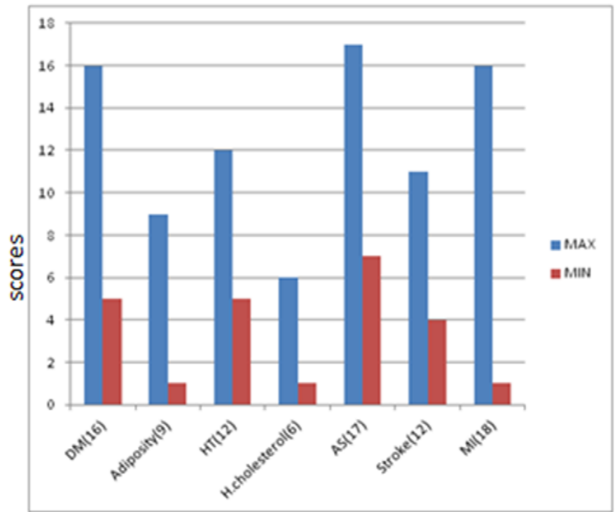
The number and percentage of the student's response to the questionnaire for Hypertension was shown in Table 4 and Graph 4. Only 44.59% (67.86% male and 30.43% female) could relate the association of Hypertension and arteriosclerosis and the difference in response between male and females is statistically significant (P=0.003).

The number and percentage of the student's response to a questionnaire for Cholesterol levels

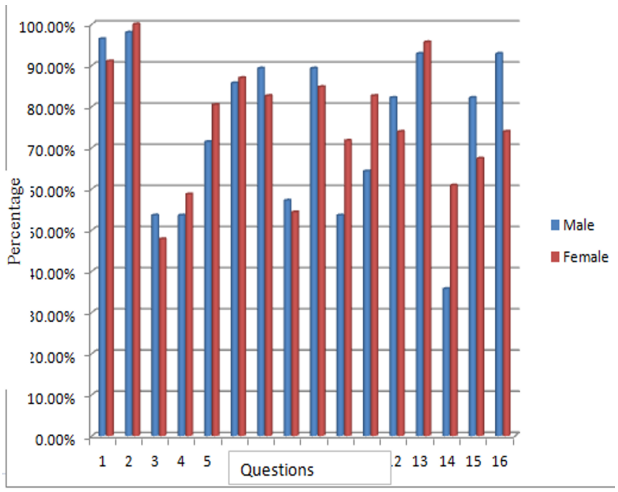
Table 3: The number and percentage of the students with the correct response to the questionnaire for Adiposity

Questions	key	male (N=28) & %	Female (N=46)& %	total number (N=74) & %	P-value
Adipose individuals have an elevated risk of suffering heart infarction	TRUE	26(92.85)	46(100)	72(97.3)	0.62
Adiposity is not only caused by nutrition. Other factors contribute, as well.	TRUE	27(96.42)	44(95.65)	71(96)	0.65
An excessively fatty, high-caloric is the only factor that determines adiposity.	FALSE	19(67.86)	37(80.43)	56(75.67)	0.27
The terms 'overweight' and 'adiposity' are synonyms.	FALSE	16(57.12)	28(61.35)	44(59.45)	0.81
Cessation of breathing while sleeping is a possible consequence of adiposity.	TRUE	21(75)	28(61.35)	49(66.22)	0.31
Adipose individuals have the same risk than non-adipose individuals of suffering a stroke.	FALSE	21(75)	36(72.23)	57(77.03)	0.78
Adipose individuals are more likely to suffer from arteriosclerosis.	TRUE	22(78.57)	46(100)	68(91.89)	0.002*
Liposuction is a state-of-the-art treatment in adiposity therapy.	FALSE	24(85.71)	41(89.13)	65(87.84)	0.72
Adiposity can be treated surgically.	TRUE	27(96.43)	45(97.83)	72(97.3)	1

**P-value* <0.05-statistically significant



Graph 1: Maximum, minimum scores obtained by students



Graph 2: Gender-based comparison of percentages of the correct response to a questionnaire for Diabetes

was shown in Table 5 and Graph 5.

The number and percentage of the student's response to a questionnaire for Arteriosclerosis was shown in Table 6 and Graph 6.

Most of the students were familiar with the causes, types and consequences of stroke. The number and percentage of the student's response to the questionnaire for stroke was shown in Table 7 and Graph 7. A total of 67.57% (78.57% male and 60.87% female) acknowledged that stroke is preceded frequently by speech problems (P=0.008).

The number and percentage of the student's response to the questionnaire for Myocardial infarction was shown in Table 8 and Graph 8.

Table 4: The number and percentage of the students with the correct response to a questionnaire for Hypertension

Questions	key	male (N=28) & %	Female (N=46)& %	total number (N=74)& %	P-value
Hypertension is associated with heredity.	TRUE	23(82.14)	34(73.91)	57(77.03)	0.57
For the most part, a single concrete reason of why a patient suffers from hypertension can be determined.	FALSE	17(60.71)	37(80.43)	54(72.97)	0.1
Pregnant women are less likely to suffer from hypertension.	FALSE	22(78.57)	35(76.09)	57(77.03)	1
After the medication has lowered hypertension, the medication can usually be discontinued.	FALSE	27(96.42)	38(82.61)	65(87.84)	0.14
People with hypertension are as likely to suffer from arteriosclerosis as those with normal hypertension.	FALSE	19(67.86)	14(30.43)	33(44.59)	0.003*
Pregnant women are as likely to suffer from hypertension as non-pregnant women.	FALSE	13(46.43)	25(54.35)	38(51.35)	0.63
Individuals with hypertension are less likely to suffer from arteriosclerosis.	FALSE	22(78.57)	35(76.89)	57(77.03)	1
Hypertension can cause dizziness.	TRUE	21(75)	37(80.43)	58(78.38)	1
Hypertension can be caused by disorders of the thyroid gland.	TRUE	28(100)	42(91.3)	70(94.59)	0.29
Hypertension can cause renal damage.	TRUE	27(96.43)	42(91.3)	69(91.89)	0.64
Hypertension can lead to eye disorders.	TRUE	25(89.28)	34(73.91)	59(79.73)	0.14
Hypertension can be caused by cerebral tumors.	TRUE	26(92.85)	38(82.61)	64(86.48)	0.3

**P-value* <0.05-statistically significant

Table 5: The number and percentage of the students with the correct response to a questionnaire for Cholesterol levels

Questions	key	male (N=28) & %	Female (N=46) & %	total number (N=74) & %	P value
A low cholesterol diet can supplement therapy for high blood cholesterol.	TRUE	24(85.71)	39(84.78)	63(85.13)	1
High blood cholesterol can be treated with medication.	TRUE	25(89.28)	41(89.13)	66(89.19)	1
High blood cholesterol does not cause acute ailments.	TRUE	7(25)	4(8.69)	11(14.86)	0.09
High blood cholesterol is not associated with hereditary factors.	FALSE	16(57.12)	27(58.69)	43(58.11)	1
High blood cholesterol promotes arteriosclerosis.	TRUE	25(89.28)	45(97.83)	70(94.59)	1
Fatigue is a frequent symptom of high blood cholesterol.	FALSE	3(10.71)	1(2.17)	4(5.4)	0.15

**P-value* <0.05-statistically significant

Table 6: The number and percentage of the students with the correct response to the questionnaire for Arteriosclerosis

Questions	key	male (N=28) & %	Female (N=46) & %	total number (N=74) & %	P-value
Arteriosclerosis increases the risk of suffering a stroke.	TRUE	27(96.43)	46(100)	73(98.65)	1
Leg pains are a symptom of arteriosclerosis.	TRUE	19(67.86)	30(65.22)	49(66.22)	1
With arteriosclerosis, arteries become softer.	FALSE	20(71.42)	30(65.22)	50(67.57)	0.62
Arteriosclerosis can be cured completely.	FALSE	25(89.28)	35(76.07)	60(81.08)	0.22
With arteriosclerosis, arteries contract.	FALSE	8(28.57)	16(34.78)	24(32.43)	0.62
With arteriosclerosis, arteries become less elastic.	TRUE	25(89.28)	41(89.13)	66(89.19)	1
As a result of arteriosclerosis, blood pressure is likely to decline.	FALSE	23(82.14)	43(93.48)	66(89.19)	0.15
As a result of arteriosclerosis, blood pressure is likely to increase.	TRUE	26(92.85)	44(95.65)	70(94.59)	0.63
High blood pressure and arteriosclerosis are not linked with each other.	FALSE	24(85.71)	45(97.83)	69(93.24)	0.06
In arteriosclerosis, a sustainer can be inserted into the artery in order to stabilize it.	TRUE	28(100)	44(95.65)	72(97.3)	0.5
The risk of suffering from arteriosclerosis is not hereditary.	FALSE	8(28.57)	21(45.65)	29(39.19)	0.22
Arteriosclerosis can cause renal damage.	TRUE	26(92.85)	37(80.43)	63(85.13)	0.19
With arteriosclerosis, blood platelets accumulate on the arterial walls.	TRUE	19(67.86)	30(65.22)	49(66.22)	1
With arteriosclerosis, fat accumulates on the arterial walls.	TRUE	28(100)	46(100)	74(100)	1
Individuals with high blood pressure are more likely to suffer from arteriosclerosis.	TRUE	20(71.42)	39(84.78)	59(79.73)	0.23
Medication can remove completely sediments from the arteries.	FALSE	16(57.12)	25(54.35)	41(55.41)	1
With arteriosclerosis, arteries become brittle.	TRUE	22(78.57)	30(65.22)	52(70.27)	0.3

**P-value*<0.05-statistically significant

Around 90.54% of the students (78.57% male and 97.83% of female, P=0.01) identified radiating pain into the arms as a symptom for a myocardial infraction (MI) and they were also aware of the fact that oxygen supply to the heart is affected by a Myocardial infarction.

DISCUSSION

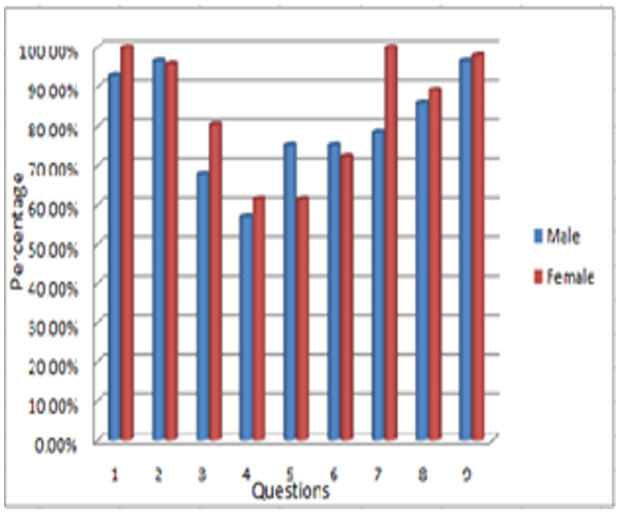
In our present study, it was observed that students were more knowledgeable about Adiposity, hypertension, atherosclerosis and least knowledgeable about cholesterol and myocardial infarction. More than 90% of the students showed good knowledge about the types of Diabetes, the role of hereditary factors and complications of Diabetes. They also have a better understanding about the increased risk of diabetes during pregnancy. Ninety-four percent of the students correctly identified frequent urination as a symptom of Diabetes Mellitus but they were not familiar with other symptoms as 64.86% of the participants identified poor appetite also as a common symptom. Whereas half of the students falsely acknowledged increased alertness as a frequent symptom of diabetes.

The participants showed an average level of knowledge about the process involved in the absorption and diffusion of glucose across cells and blood. In addition, students also showed some misbeliefs about diet and treatment. Such as 55% of the students have a misbelief that Diabetics may only eat special types of sweets. And 51 % of students, especially male (35.71%), when compared to females (60.87%), have a correctly understood that all the

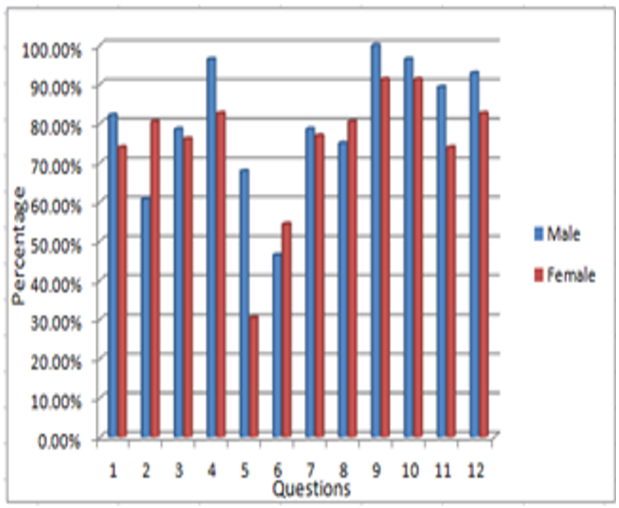
Table 7: The number and percentage of the students with the correct response to the questionnaire for Stroke

Questions	key	male (N=28) & %	Female (N=46) & %	total number (N=74) & %	P-value
A stroke affects the brain.	TRUE	26(92.85)	42(91.03)	68(91.89)	1
If a patient survives a stroke, there are usually no permanent consequences.	FALSE	25(89.28)	32(69.57)	57(77.03)	0.08
Permanent speech defects are possible consequences of a stroke.	TRUE	21(75)	34(73.91)	55(74.32)	1
A stroke is often followed by memory dysfunction.	TRUE	14(50)	30(65.22)	44(59.46)	0.23
There are different types of strokes.	TRUE	27(96.42)	42(91.03)	69(93.24)	0.64
A stroke is caused by artery obstruction.	TRUE	26(92.85)	40(91.02)	66(89.19)	0.7
The nutrient supply to the brain is not affected by a stroke.	FALSE	19(67.86)	39(84.78)	58(78.38)	0.14
A stroke is characterized by a sudden dysfunction of the heart.	FALSE	3(10.71)	7(15.22)	10(13.51)	0.73
A stoke is caused when overexcited cells produce too much electricity.	FALSE	5(17.86)	14(30.43)	19(28.67)	0.28
A stroke is preceded frequently by chest pains.	FALSE	4(14.28)	7(15.22)	11(14.86)	1
A stroke is preceded frequently by speech problems.	TRUE	22(78.57)	28(60.87)	50(67.57)	0.13
Diabetics are more likely to suffer a stroke.	FALSE	22(78.57)	35(76.09)	57(77.03)	1

**P-value* <0.05-statistically significant



Graph 3: Gender-based comparison of percentages of the correct response to the questionnaire for Adiposity



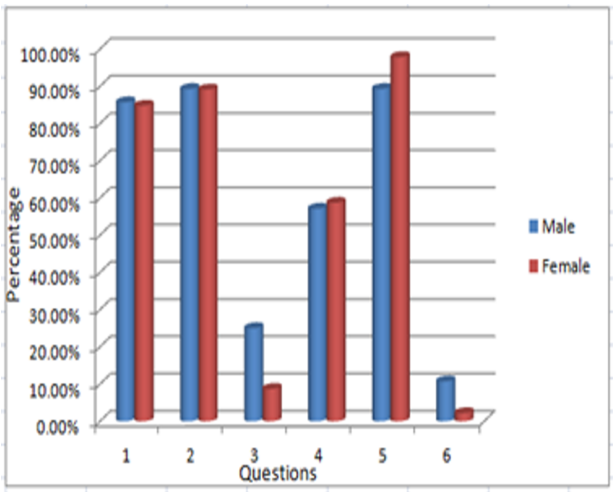
Graph 4: Gender-based comparison of percentages of the correct response to the questionnaire for Hypertension.

Diabetic patients must not have insulin shots (P = 0.05). Similar findings were observed in the work done by (Becker *et al.*, 2008; Yahia *et al.*, 2014). Diabetes Mellitus is occurring at a relatively younger age due to changes in lifestyle and the economic boom (Kaveeshwar, 2014). According to the Indian Council of Medical Research (ICMR) data, 25.3 % of cases diagnosed as diabetes under the age of 25 years were Type 2 Diabetes Mellitus (Unnikrishnan *et al.*, 2016).

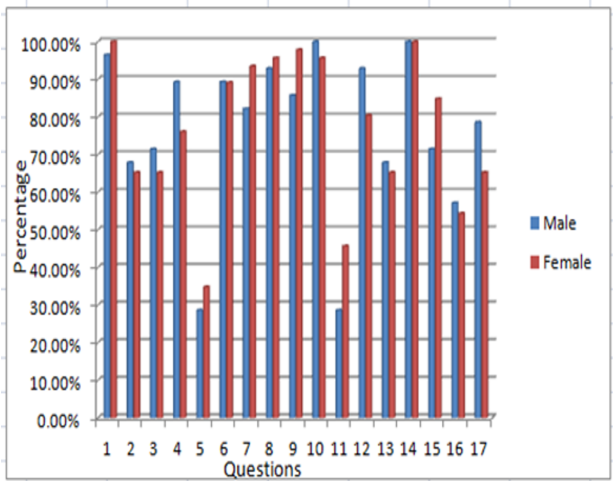
Table 8: The number and percentage of the students with the correct response to a questionnaire for Myocardial infarction.

Questions	key	male (N=28) & %	Female (N=46) & %	total number (N=74) & %	P-value
Smoking is a minor risk factor with respect to a Myocardial infarction.	FALSE	16(57.12)	26(56.52)	42(56.76)	1
When suffering a Myocardial infarction, pain may radiate into the arms.	TRUE	22(78.57)	45(97.83)	67(90.54)	0.01*
The oxygen supply to the heart is not affected by a Myocardial infarction.	FALSE	22(78.57)	45(97.83)	67(90.54)	0.01*
Hereditary factors play a role in the risk of suffering a Myocardial infarction.	TRUE	16(57.12)	32(69.56)	48(64.86)	0.32
After Myocardial infarction, anticoagulants are administered.	TRUE	23(82.14)	43(93.48)	66(89.19)	0.15
Myocardial infarction is caused by cerebral dysregulation of the heart.	FALSE	13(46.42)	22(47.83)	35(47.3)	1
Myocardial infarction is often preceded by shortness of breath.	TRUE	24(85.71)	42(91.3)	66(89.19)	0.48
Myocardial infarction is caused by arterial obstruction.	TRUE	25(89.28)	41(89.13)	66(89.19)	1
Damage caused by Myocardial infarction is not usually permanent.	FALSE	21(75)	33(71.73)	54(72.97)	0.79
After Myocardial infarction has occurred, parts of the cardiac muscle tissue can die.	TRUE	25(89.28)	43(93.48)	68(91.89)	0.67
A heart infarction must be treated surgically.	FALSE	11(39.26)	9(19.56)	20(27.03)	0.1
With Myocardial infarction, cardiac muscle tissue dies.	TRUE	22(78.57)	41(89.13)	63(85.13)	0.31
Diabetes is a predisposing factor for Myocardial infarction	TRUE	18(64.29)	34(73.91)	52(70.27)	0.44
A heart infarction is typically followed by some degree of paralysis.	FALSE	13(46.42)	19(41.3)	32(43.24)	0.81
When suffering from Myocardial infarction, pain may radiate into the stomach.	TRUE	6(21.43)	11(23.91)	17(22.97)	1
Myocardial infarction is caused by malfunction of one or more heart valves.	FALSE	6(21.43)	14(30.43)	20(27.03)	0.43
Myocardial infarction is usually preceded by loss of sensation and numbness.	FALSE	7(25)	9(19.56)	16(21.62)	0.57
Myocardial infarction can manifest itself through nausea and vomiting.	TRUE	11(39.29)	26(56.52)	37(50)	0.23

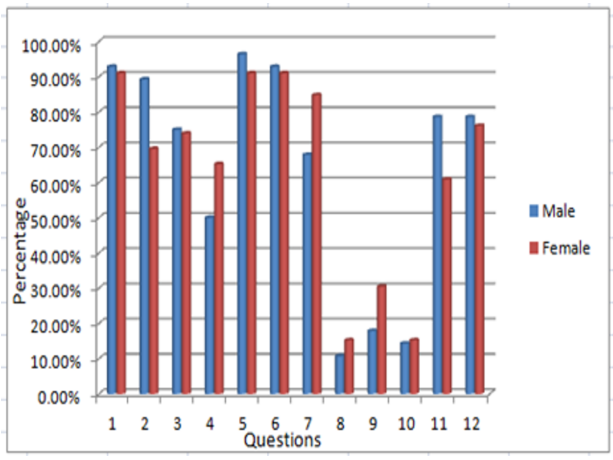
*P-*value*<0.05-statistically significant



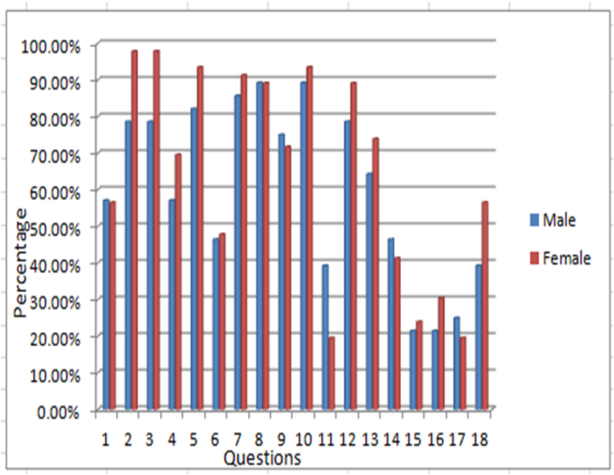
Graph 5: Gender-based comparison of percentages of the correct response to a questionnaire related to Cholesterol levels.



Graph 6: Gender-based comparison of percentages of the correct response to a questionnaire for Arteriosclerosis



Graph 7: Gender-based comparison of percentages of the correct response to the questionnaire for Stroke



Graph 8: Gender-based comparison of percentages of the correct response to the questionnaire for Myocardial infarction

Diabetes mellitus and its complications causes significant mortality and morbidity. So, though the students are at entry level, knowledge of the students regarding signs and symptoms, metabolism and treatments aspects should be improvised to avoid the misbeliefs and to reduced the number of cases.

The majority of the students showed a good level of knowledge about adiposity. Most of the students (96%) understood that adiposity is multifactorial and also recognized myocardial infarction, stroke and arteriosclerosis as the long term complications of adiposity, whereas 66.22% of the participants considered cessation of breathing while sleeping as an effect of adiposity. Only 59.75% of students didn't consider 'overweight' and 'adiposity' as synonyms.

On the other hand, students didn't acknowledge liposuction as the best possible therapy in adiposity treatment but except few all most all the students thought that obesity can be treated surgically. All of the females were able to understand the link between adiposity and arteriosclerosis when compared to male students (P=0.002). Hypertension is one of the most important modifiable risk factors for cardiovascular disease (Farag *et al.*, 2014).

According to the World Health Organization (WHO) data, the global burden of hypertension will increase by 60% to be 1.56 billion individuals worldwide and higher in the developed nations by 2025. The prevalence of hypertension in India has been estimated to be 3% to 34.5% in males and 5.8% to 33.5% of females (Das *et al.*, 2005).

According to the Global burden of diseases, the study reports the number of deaths has increased

from 0.78 millions in 1990 to 1.63 millions in 2016 in India.

Increasing the awareness of hypertension will help in preventing disease progression. In our study, students' responses show that they were well – informed about Hypertension. Most of the students (78.28%) identified dizziness as a symptom of hypertension. Students showed fair to a good level of knowledge about causes, the role of genetic factors and complications of Hypertension.

Around half of the students(51.35%), including females, didn't show a good understanding of the elevated risk of hypertension in pregnancy. On the other hand, only 44.59% of the students could understand the association between hypertension and arteriosclerosis and the difference in response between male and females is statistically significant (*P*=0.003). Surprisingly, the majority of the students know that after the medication has lowered hypertension, the medication should be continued.

In our present study only about 58%of the students responded correctly for the question asked to understand the association between high blood cholesterol and hereditary factors. This finding is in agreement with the study done by (Becker *et al.*, 2008).

Conversely, in the study by (Yahia *et al.*, 2014) more than two-thirds of the students were aware that family history is a risk factor for high serum cholesterol. More than 85% of the participants were aware that high serum cholesterol can be treated with a low cholesterol diet and medication. Interestingly, 94.59% of the students considered high blood cholesterol as a promoting factor for arteriosclerosis.

Only a few of the students knew that fatigue is not a symptom of high blood cholesterol. Most of the students have a misconception that fatigue is a frequent symptom of high blood cholesterol. Only very few students (14.86%) knew that high blood cholesterol does not cause acute ailments.

In regard to arteriosclerosis questions, most of the students showed knowledge about the manifestations, complications and treatment of arteriosclerosis. The majority of the participants (93.24%) responded correctly to the question asked to understand the correlation between High blood pressure and arteriosclerosis. But only 39% of the students identified heredity as a risk factor for arteriosclerosis. The participants were knowledgeable about the changes that occur in the blood vessels in arteriosclerosis.

Almost all the students answered that with arteriosclerosis, blood platelets accumulate on the arterial walls. On the other hand, most of the students have a misbelieve that with arteriosclerosis, arteries contract, this shows a lack of knowledge about the underlying mechanism.

Most of the students were knowledgeable about the precipitating causes, types and complications of a stroke. The majority of them recognized stroke as an end result of arterial obstruction, and they have a clear understanding of stroke affects brain. Almost half of the students considered memory dysfunction as a consequence of stroke and female students when compared to male thought that stroke is preceded frequently by speech problems. (P=0.008).

Unexpectedly very few students know that stroke is not an end result of sudden dysfunction of the heart and only a few (14.86%) of the students correctly interpreted that chest pains is not the indication of stoke. These findings show that the medical students were lacking the clinical knowledge and were confused about stoke and myocardial infarction.

In another study by (Becker *et al.*, 2008). More than one-third of the laypersons thought that a stroke announces itself through chest pains. Similar results were observed in the study done by (Yahia *et al.*, 2014) where almost half of the students assumed that a stroke was frequently preceded by chest pain and is characterized by a sudden dysfunction of the heart. Just about twenty-eight percent of the participants understood that stoke is not caused due to over excitation of the cells.

Students showed a better level of knowledge about only a few symptoms of Myocardial infarction. Especially females knew that in most of the cases with myocardial infarctions, chest pain can radiate into the right or left arm (*P*=0.01) and also identified shortness of breath as a preceding symptom. All the students were also clear about the fact that MI is due to artery obstruction, which can permanently damage the heart tissue.

Most of the students were aware of the importance of anticoagulant administration in MI. Surprisingly only a small number of the students could make out that there is no relation between MI and paralysis and more than half of the participants thought that there will be some degree of paralysis after MI so, this shows that students were not able to differentiate myocardial infarction and stroke.

Similar results were observed in the previous studies done by (Becker *et al.*, 2008; Yahia *et al.*, 2014). And very few students know that in MI, pain may radiate to the stomach; this shows inadequate clinical knowledge to identify the emergency condition

which requires immediate attention. Students were also not clear about the underlying mechanism.

CONCLUSIONS

This study will help us in the assessment of the adequacy of the present knowledge of the undergraduate MBBS students and could be utilized in designing the curriculum of the MBBS students and also health promotion programs. The study also supports the necessity of early clinical exposure for medical students at the beginning of their medical school. Upgrading the present knowledge of the students at an undergraduate level by conducting Health education programs can motivate them to change their attitude towards the lifestyle so that they can prolong the onset of these diseases and also help in motivating the patients, family and community in future. Thus plays a vital role in early detection and treatment

Limitations of the study

The study included only a small number of participants. It can be done in a large group for effective results. As it is a self-reported questionnaire, biasing is common.

Authorship criteria

The study was designed and conceptualized by Soundarya and Dr.Krishnaveni. Data collection Data analysis, Literature search and manuscript preparation, was also done by them. Editing and reviewing was done by Dr.Krishnaveni. Neha contributed to Data collection, analysis and manuscript preparation. Shravya Reddy assisted in a literature search.

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