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RESEARCH ARTICLE

Knowledge and Awareness of Metabolic Syndrome Relevant Conditions among College Students in University of Tabuk, KSA.

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Abstract

Background: Metabolic syndrome (MS) is a major public-health and clinical challenge worldwide, it has gained increasing interest due to its association with type II diabetes mellitus and increased risk of cardiovascular diseases as well as causing mortality.

Aim: Is to assess knowledgeand awareness of MSand conditions associated with it among a sample of college students in the University of Tabuk to design health care promotion schemes for improving MS knowledge and awareness in the community.

Materials and Methods: An online questionnaire was administered to 97college students of the University of Tabuk. The questionnaire includes questions related to six conditions: diabetes, hypertension, obesity, serum cholesterol level, atherosclerosis and stroke. Students' answers were scored and statistically analyzed.

Results: Most of students could correctly recognized symptoms and complications of diabetes, hypertension, serum cholesterol level and obesity. Lower scores were observed in the students' knowledge about manifestations, complications and treatment of atherosclerosis and stroke. There was a significant statistical relationship between students' knowledge about MS relevant conditions and students' education major ($p< 0.05$).

Conclusion: Students' knowledge and awareness about conditions relevant to MS can be improved especially among non-medical college students in order to promote a healthy lifestyle and to prevent metabolic syndrome relevant conditions complications.

Introduction:-

Metabolic syndrome (MS) is a major public-health problem worldwide as consequences of urbanization, consumption of fatty diet, increasing obesity, and sedentary life habits **[1].** The WHO definition in 1998 was the first to tie together the key components of insulin resistance: obesity, dyslipidemia and hypertension. The definition mandates that insulin resistance must be present; without it, even if all the other criteria were met, the patient would not have metabolic syndrome **[2].**

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According to the National Cholesterol Education Program's Adult Treatment Panel III (NCEP ATP III) report in 2005, MS is identified in individuals when at least three of the following five risk factors are present simultaneously: increased waist circumference, elevated blood pressure, elevated serum triglyceride, reduced HDL cholesterol (HDL-C) and elevated fasting plasma glucose **[3].** The underlying cause of this syndrome is not yet known, but its manifestation has been linked to obesity (especially abdominal obesity) and insulin resistance **[4].** Worldwide prevalence of MS ranges from <10% to as much as 84%, depending on the region, urban or rural environment, composition (sex, age and race) of the studied population **[5,6].** In general, the international diabetes federation estimates that one-quarter of the world's adult population has MS **[7].**

Studies on the prevalence of MS among Arab populations are limited, but the available data suggest that it is an increasingly a common problem **[8-10].** In Saudi Arabia the first study was published in 2002, and included patients with diabetes treated at King Abdulaziz University Hospital in Jeddah. The study reported the prevalence of MS which was 56% in men and 57% in women, with hypertension being the most common component **[11].**

MS increases the risk of type 2 diabetes mellitus by about 5-fold and the risk of developing cardiovascular disease (CVD) by about 2-fold over 5 to 10 years **[12].** Further, patients with the MS are at 2- to 4-fold increased risk of stroke, a 3- to 4-fold increased risk of myocardial infarction, and 2-fold the risk of dying from MS relevant conditions compared with those without the syndrome **[13].** Thus, early risk factor detection and intervention is essential to prevent and reduce the development of MS and, eventually, cardiovascular health problems later on **[2].**

In this context, college students should be aware of MS relevant conditions hence appropriate lifestyle choices can be made. However, a lack of awareness and knowledge might hinder such a change. Therefore, students who are unaware of MS or lack knowledge about MS may not perceive themselves at risk for this condition and, consequently, may go undiagnosed until cardiovascular and diabetes complications occur **[2].**

Thus, the aim of this study is to assess knowledge and awareness of MS relevant conditions among a sample of college students in University of Tabuk. As the outcomes of this study may have implications for designing health promotion programs based on students' knowledge to improve students' and community health.

Material and Methods:-

A cross-sectional study was carried on 97 medical and non-medical college students (60 females, 37 males) to assess the knowledge and awareness of MS among them, University of Tabuk, during the period from April 2015-January 2016. The questions about knowledge and awareness of MS relevant conditions was collected through a designed online questionnaire including 34 questions: 6 questions related to their knowledge regarding diabetes mellitus, 6 questions about symptoms, risk factors and complications of hypertension, 6 questions related to hazards and complication of obesity, 4 questions about serum cholesterol level, 7 questions about the effect and complications of arteriosclerosis and 5 questions related to risk factors, manifestations and relation of stroke to diabetes **[2].** The response options to the questions were "Yes", "No", or "Do not know".

The MS questionnaire:

Diabetes	• There are different types of diabetes. • Pregnant women have a reduced risk of acquiring diabetes • Eye disorders can be consequences of diabetes • Hereditary factors play a major role in the development of diabetes in all types • Poor appetite is a frequent symptom of diabetes. • Frequent urination is a classic symptom of diabetes.
Hypertension	• Hypertension can cause dizziness. • Hypertension is associated with heredity. • Medication can usually be discontinued after hypertension has lowered. • Individuals with hypertension are less likely to suffer from atherosclerosis. • Hypertension can cause renal damage. • Hypertension can lead to eye disorders.
Obesity	• Obese individuals have an elevated risk of myocardial infarction. • Obese individuals have an elevated risk of atherosclerosis.

	• A fatty high-caloric diet is the only risk factor that of obesity. • Obese individuals have the same risk as non-obese ones of stroke attack. • Cessation of breathing during sleeping is a possible consequence of obesity. • Obesity is a risk factor of diabetes.
High serum cholesterol	• High serum cholesterol causes arteriosclerosis • High serum cholesterol is treated with medication only. • A low cholesterol diet can add in therapy for high serum cholesterol. • Diabetes usually associated with high serum cholesterol level.
Atherosclerosis	• Atherosclerosis increases the risk of stroke. • People with high blood pressure are more liable for atherosclerosis. • Arteriosclerosis can cause renal damage. • Atherosclerosis increases the risk of thrombosis. • Medications can remove completely the atherosclerotic plaques from the arteries. • Chest and leg pains are frequent symptoms of atherosclerosis. • Diabetics are of great risk of atherosclerosis.
Stroke	• Individuals with diabetes are more liable to suffer from a stroke. • Stroke is associated with difficulty in moving arms and legs. • Permanent speech defects are possible consequences of stroke. • A stroke is often followed by memory disturbances. • Hypertension is a major risk factor of stroke.

Statistical analysis:-

Data were statistically analyzed using SPSS (Statistical Package for Social Sciences version 20, IBM, Armonk, NY, USA). Mean and standard deviation (SD) were calculated for continuous variables and frequencies and percentages for categorical variables. Chi-square ($\chi 2$) test was used to determine the significance of association between students' knowledge and their age group, gender and education group (medical or non-medical). The results were considered as statistically significant if the P value was less than 0.05.

Results:-

People Demographics:-

A total sample of 97 college students in the University of Tabuk had completed the questionnaire survey, 37 students were males and 60 were females (38.1% and 61.8% respectively). The age of the students ranged between 16-25 years, with a mean of years (20.28±2.7). 62 students were in medical colleges (63.9%) and most of them were last years of education and the remaining participating students were in non-medical colleges (36.1%) as shown in

Table 1: Demographic data of respondents

	Number	Percent
Age		
Mean ±SD	20.28±2.7	
16-20	47	48.5%
21-25	50	51.5%
Gender		
Male	37	38.1%
Female	60	61.8%
College		
Medical	62	63.9%
Non-medical	35	36.1%

Knowledge and awareness of conditions associated with metabolic syndrome among students

Diabetes mellitus knowledge and awareness:-

Out of total 97 respondents, 83 (85.6%) could correctly answered that there are several types of diabetes, most of them were females (88.3%) and of medical students (96.8%). Also, the majority of students could recognize that diabetes can cause eye disorders and frequent urination, most of them was of older age group (72% and 88% respectively) and in medical colleges (77.4% and 80.6%). While only 42 students (43.3%) were be able to answer

that hereditary factors play a major role in the development of diabetes in all types, also 53 (54.6%) students could correctly answered that poor appetite is a frequent symptom of diabetes correctly. There was a statistical significant difference between medical and non-medical students regarding their knowledge of diabetes (p=0.04), whereas no statistical significant difference was found between the age and gender of the students in relation to their answers (p= 0.22 and 0.5 respectively). Table 2

Table 2: Questions related to diabetes mellitus knowledge answered correctly by the respondents

	Age		Gender		Education		Total
	16-20 No (%)	21-25 No (%)	Male No (%)	Female No (%)	Medical No (%)	Non-medical No (%)	No (%)
There are different types of diabetes	38 (80.9)	45 (90)	30 (81.1)	53 (88.3)	60 (96.8)	23 (65.7)	83 (85.6)
Pregnant women have a reduced risk of acquiring diabetes	31 (66)	39 (78)	28 (75.7)	42 (70)	50 (80.6)	20 (57.1)	70 (72.2)
Eye disorders can be consequences of diabetes	27 (57.4)	36 (72)	24 (64.9)	39 (65)	48 (77.4)	15 (42.9)	63 (64.9)
Hereditary factors play a major role in the development of diabetes in all types	13 (27.7)	29 (58)	17 (45.9)	25 (41.7)	30 (48.4)	12 (34.3)	42 (43.3)
Poor appetite is a frequent symptom of diabetes	22 (46.8)	31 (62)	23 (62.2)	30 (50)	38 (61.3)	15 (42.9)	53 (54.6)
Frequent urination is a classic symptom of diabetes	40 (85.1)	44 (88)	30 (81.1)	54 (90)	50 (80.6)	34 (97.1)	84 (86.6)
Chi-square	2.86		0.575		7.582		
P value	0.22		0.5		0.04*		

Hypertension knowledge and awareness:-

Most of the students were able to answer correctly the questions related to symptoms and complications of hypertension. 80 students (82.5%) knew that hypertension can cause dizziness; most of them were of older age group (92%), females (88.3%), and medical students (93.5%). Similarly, the majority of the responders could realize that hypertension is associated with heredity factors (60.8%), medication should not discontinued after hypertension has lowered corrected (66%), hypertension can be cause renal damage (75.3%), and hypertension can lead to eye disorders (68%). However, only 56.7 % of students were able to identify that individuals with hypertension are more likely to suffer from arteriosclerosis (56.7%).a statistical significant relation was found between the age and education of students (p= 0.04 and 0.03 respectively) and their knowledge, while no significant difference was found in relation to gender (p=0.31). Table 3

Table 3: Questions related to hypertension knowledge answered correctly by the respondents

	Age		Gender		Education		Total
	16-20 No (%)	21-25 No (%)	Male No (%)	Female No (%)	Medical No (%)	Non-medical No (%)	No (%)
Hypertension can cause dizziness	34 (72.3)	46 (92)	27 (73)	53 (88.3)	58 (93.5)	22 (62.9)	80 (82.5)
Hypertension is associated with heredity factors	21 (44.7)	38 (76)	22 (59.5)	37 (61.7)	45 (72.6)	14 (40)	59 (57.7)
Medication can usually be discontinued after hypertension has lowered	24 (51.1)	40 (80)	21 (56.8)	43 (71.7)	45 (72.6)	19 (54.3)	64 (66)
Individuals with hypertension are less likely to suffer from arteriosclerosis	19 (40.4)	36 (72)	25 (67.6)	30 (50)	42 (67.7)	13 (37.1)	55 (56.7)
Hypertension can cause renal damage	31 (66)	42 (84)	24 (64.9)	49 (81.7)	50 (80.6)	23 (65.7)	73 (75.3)
Hypertension can lead to eyedisorders	29 (61.7)	37 (74)	26 (70.3)	40 (66.7)	46 (74.2)	18 (51.4)	64 (66)
Chi-square	6.87		2.089		7.632		
P value	0.04*		0.31		0.03*		

Awareness and knowledge of the students about obesity:-

Most of the students whether medical and non-medical have good knowledge of obesity risk factors and complications. In which 84.5% of the students knew that obese individuals have an elevated risk of myocardial infarction, 86.6% could identify obesity as risk factor of atherosclerosis and 70% of the students realized that obese individuals have not the same risk as non-obese ones of a stroke attack. However, only 58.8% of the responders showed good knowledge regarding fatty high-caloric is the only risk factor of obesity. No significant statistical difference was found between students' knowledge about obesity related conditions and their age, gender or education (p=0.16, 0.34 and 0.31 respectively). Table 4

Table 4: Questions related to obesity knowledge answered correctly by the respondents

	Age		Gender		Education		Total
	16-20 No (%)	21-25 No (%)	Male No (%)	Female No (%)	Medical No (%)	Non-medical No (%)	No (%)
Obese individuals have an elevated risk of myocardial infarction	38 (80.9)	44 (88)	33 (89.2)	49 (81.7)	48 (77.4)	34 (97.1)	82 (84.5)
Obese individuals have an elevated risk of atherosclerosis	39 (83)	45 (90)	30 (81.1)	54 (90)	50 (80.6)	34 (97.1)	84 (86.6)
A fatty high-caloric diet is the only risk factor of obesity	24 (51.1)	33 (66)	21 (56.8)	36 (60)	40 (64.5)	17 (48.6)	57 (58.8)
Obese individuals have the same risk as non-obese ones of a stroke attack	28 (59.6)	40 (80)	23 (62.3)	45 (75)	44 (71)	24 (68.6)	68 (70.1)
Cessation of breathing during sleeping is a possible consequence of	33 (70.2)	46 (92)	29 (78.4)	50 (83.3)	47 (75.9)	32 (91.4)	79 (81.4)

obesity							
Obesity is a risk factor of diabetes	39 (83)	46 (92)	28 (75.7)	57 (95)	54 (87.1)	31 (88.6)	85 (87.6)
Chi-square	3.076		2.119		2.994		
P value	0.16		0.34		0.31		

Awareness and knowledge of the students about serum cholesterol level

All questions related to serum cholesterol level were answered correctly by most of the responders where 74.2% of students recognized that high serum cholesterol causes arteriosclerosis, 73.2% correctly answered both that high serum cholesterol is not treated with medication only and diabetes usually associated with high serum cholesterol level. 92.8% of students knew that a low cholesterol diet can add in therapy for high serum cholesterol. A statistical significant difference was found between education of the students and their knowledge (p=0.02), whereas no statistical significance difference between age or gender and students' knowledge about cholesterol level associated conditions (p= 0.319 and 0.41respectively). Table 5

Table 5: Questions related to serum cholesterol level knowledge answered correctly by the respondents

	Age		**Gender**		**Education**		**Total**
	16-20 No (%)	21-25 No (%)	Male No (%)	Female No (%)	Medical No (%)	Non-medical No (%)	No (%)
High serum cholesterol causes arteriosclerosis	34 (72.3)	38 (76)	30 (81.1)	42 (70)	51 (82.3)	21 (60)	72 (74.2)
High serum cholesterol is treated with medication only	31 (66)	40 (80)	27 (73)	44 (73.3)	50 (80.6)	21 (60)	71 (73.2)
A low cholesterol diet can add in therapy for high serum cholesterol	42 (89.4)	48 (96)	33 (89.2)	57 (95)	60 (96.8)	30 (85.7)	90 (92.8)
Diabetes usually associated with high serum cholesterol level	28 (59.6)	43 (86)	30 (81.1)	41 (68.3)	54 (87.1)	17 (48.6)	71 (73.2)
Chi-square	3.164		1.130		7.916		
P value	0.319		0.41		0.02*		

Awareness and knowledge of the students about atherosclerosis:-

Most students showed fair good knowledge about atherosclerosis manifestations and complications and most of them were medical students, while the majority of non- medical students showed poor knowledge about atherosclerosis risk and complications. There was a statistical difference between students' knowledge and their age, gender and education (p= 0.002, 0.0001 and 0.0001 respectively). Table 6

Table 6: Questions related to atherosclerosis level knowledge answered correctly by the respondents

	Age		Gender		Education		Total
	16-20 No (%)	21-25 No (%)	Male No (%)	Female No (%)	Medical No (%)	Non-medical No (%)	No (%)
Atherosclerosis increases the risk of stroke	22 (57.4)	37 (74)	17 (45)	42 (70)	48 (77.4)	11 (31.4)	59 (60.8)
People with high blood pressure are more liable for atherosclerosis	21 (44.7)	43 (86)	13 (35.1)	51 (85)	46 (74.2)	18 (51.4)	64 (66)
Arteriosclerosis can cause renal damage	19 (40.4)	38 (76)	10 (27)	47 (78.3)	44 (71)	13 (37.1)	57 (58.8)
Atherosclerosis increases the risk of thrombosis	30 (63.8)	46 (92)	26 (70.3)	50 (83.3)	57 (92)	19 (54.3)	76 (78.4)
Medications can remove the atherosclerotic plaques from the vessel	15 (31.9)	32 (64)	11 (27.8)	36 (60)	40 (64.5)	7 (20)	47 (48.5)
Chest and leg pains are frequent symptoms of atherosclerosis	19 (40.4)	36 (72)	12 (32.4)	43 (71.7)	45 (72.6)	10 (28.6)	55 (56.7)
Diabetics are of great risk of atherosclerosis	20 (42.6)	40 (80)	14 (37.8)	46 (76.7)	48 (77.4)	12 (34.3)	60 (61.9)
Chi-square p value	12.021 0.002*		13.631 0.0001*		15.331 0.0001*		

Awareness and knowledge of the students about stroke causes and complications:-

Seventy four students (76.3%) could correctly recognize that hypertension is a major risk factor of stroke (83.9% were of medical and 62.9% of non medical students). Less scores were obtained in the remaining questions in which only 63 students (65%) were able to answer that Individuals with diabetes are more liable to suffer from stroke, 54 students (55.7%) correctly realized that stroke is associated with difficulty in moving arms and legs, 68 students (70.1%) knew that permanent speech defects are possible consequences of stroke, and 64 students answered correctly that stroke is often followed by memory disturbances (66%). There was a significant statistical difference between awareness and knowledge of medical and non medical students (p=0.03), while no significant statistical difference was found between their age or gender and knowledge (p= 0.11 and 0.61 respectively). Table 7

Table 7: Questions related to stroke knowledge answered correctly by the respondents

	Age		Gender		Education		Total
	16-20 No (%)	21-25 No (%)	Male No (%)	Female No (%)	Medical No (%)	Non-medical No (%)	No (%)
Individuals with diabetes are more liable to suffer from stroke	27 (57.4)	36 (72)	24 (64.9)	39 (65)	44 (71)	19 (54.3)	63 (65)
Stroke is associated with difficulty in moving arms and legs	20 (42.6)	34 (68)	22 (59.4)	32 (53.3)	40 (64.5)	14 (40)	54 (55.7)
Permanent speech defects are possible consequences of stroke	30 (63.8)	38 (76)	29 (78.4)	39 (65)	49 (79)	19 (54.3)	68 (70.1)
A stroke is often followed by memory disturbances	28 (59.6)	36 (72)	25 (67.6)	39 (65)	48 (77.4)	16 (45.7)	64 (66)
Hypertension is a major risk factor of stroke	30 (63.8)	44 (88)	27 (73)	47 (78.3)	52 (83.9)	22 (62.9)	74 (76.3)
Chi-square P value	3.963 0.11		0.545 0.61		6.039 0.03*		

Discussion:-

Metabolic syndrome is a worldwide public health problem and its prevalence is constantly increasing **[14].** The presence of metabolic syndrome is associated with increased the risk for both atherosclerotic cardiovascular disease and type 2 diabetes mellitus and therefore it should be addressed as an important clinical issue. While there are several definitions nevertheless, all of them include the following factors: Abdominal obesity, elevated blood pressure, high triglycerides, low high-density cholesterol (HDL cholesterol) and signs of insulin resistance, such as high fasting plasma glucose level **[3].**

The aim of this study is to assess knowledge and awareness of conditions relevant to MS namely diabetes mellitus, hypertension, obesity, serum cholesterol level atherosclerosis and stroke, among a sample of college students in the University of Tabuk.

Regarding students' knowledge about diabetes, it was found that more than half of the total sample of students correctly reported that there are several types of diabetes (85.6%), diabetes can cause eye disorders (65%), frequent urination (86.6%) and poor appetite (54.6%), while less than half of the students correctly answered that hereditary factors play a major role in development of all types of diabetes (43.3%). A statistical significant relationship was found between students' knowledge and their education major (medical versus non-medical students) (p=0.04), whereas, no statistical significant difference was found between students' knowledge and their age or gender (p=0.22 and 0.5 respectively).

When analyzing students' answers for hypertension symptoms, complications and treatment related questions, it was observed that more than half of the students have good knowledge about hypertension this may be attributed to hypertension is a common health problem and most of students are familiar with its symptom, complications and treatment. Most of the correct answers was found between medical students and older students age group with statistical significant difference (p=0.04 and 0.03 respectively).

The same finding was observed regarding the students' knowledge about obesity risk, complications and prevention. As the majority of them could correctly answered the obesity related questions. No statistical significant difference was found between students' knowledge and their age (p=0.16), gender (p=0.34) or their education major (p=0.31) this may be due to that knowledge about obesity related conditions are well known among most of students whether medical or non-medical as many students are usually concerned about their body shapes.

Also, in the present study, it was found that most of the students realized that high cholesterol level can cause atherosclerosis (74.2%), not treated with medications only (73.2%) and diabetes is associated with high cholesterol level. Most of the correct answers was detected among medical students with statistical significant difference (p=0.02). While, no statistical significant difference was found between students' knowledge and their age (p=0.319) or gender (p=0.41).

Regarding students' knowledge and awareness about atherosclerosis symptoms, complications and treatment, a fair good understanding of atherosclerosis related conditions was significantly found among medical rather than non-medical students (p=0.0001), in older age group students more than younger age 9p=0.002) and in females more than males (p=0.0001).

Finally we studied the college students' knowledge about stroke related conditions, and it was found that more than half of students are aware of stroke symptoms and causes. There was a statistical significant difference between students' knowledge and their major (p=0.03), on the other hand no statistical significant relation was found between students' knowledge and their age (p=0.11) or gender (p=0.61).

Findings from this study suggest that type of education (medical versus non-medical college) may be a significant factor in awareness and knowledge of MS relevant conditions.

Although not reaching statistical significance, younger students aged 16–20 years were less likely than older students 21–25 years to identify diabetes mellitus, obesity, serum cholesterol level, atherosclerosis and stroke manifestations and complications; this was the same in relation to gender as female students were able to recognize the MS related conditions more adequately than male students. One possible explanation for this difference in results might be that female students are more interest in health issues than male students at college age, or may be due to that male students, in general, have more interest in extracurricular activities than in health issues.

It was found that, the majority of students were most knowledgeable about most of diabetes mellitus, hypertension, obesity and cholesterol serum level associated manifestations and complications and least and knowledgeable about atherosclerosis and stroke. In spite of their good knowledge about diabetes, hypertension and obesity, there were some misconceptions acquired by students on some questions especially among younger age group and non-medical college students, this may most probably due to media like television magazines, and internet and how they could affect most college students' health knowledge consequently this will have implications for future health education efforts to correct the misconceptions among college students about major health problems.

The results of this study recommended that health education programs is need to designed and targets the non-medical college students to improve their knowledge and awareness. Also, educating college students about cardiovascular diseases and stroke is very important; especially risk factors for heart disease that can occur at an early age. Colleges especially non-medical ones should emphasize not only on students' course curriculum teaching but also on students' health education to promote good health and minimize the development of MS risk factors among students at an early age.

Conclusion:-

Students' knowledge and awareness of conditions relevant to metabolic syndrome differed among medical and non-medical students, with few age group and gender differences and few false beliefs. Thus, educating students about this disease as a first step in awareness and knowledge is important method that could lead to actual behavior changes to reduce their personal risk of developing diabetes or metabolic syndrome later in life.

Conflict of interest:-

The authors have no conflicts of interest to report.

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