

PRIMARY HEALTH CARE PHYSICIAN'S KNOWLEDGE, ATTITUDE AND PRACTICE ABOUT METABOLIC SYNDROME IN MAKKAH CITY

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ABSTRACT

Background: The overall age-adjusted prevalence of metabolic syndrome in Saudi Arabia is 39.3%. Low HDL cholesterol plays a major role in the contribution to the Metabolic syndrome in Saudi Arabia.

Objectives: To estimate knowledge of primary health care physicians in Makkah about metabolic syndrome as well as to determine their attitude toward it.

Methodology: A cross-sectional approach was carried out among all primary health physicians, who were available at time of the study at Makkah city. Overall 126 physicians were invited to participate in the study. Overall, 117 of 126 physician who were invited to participate in the study giving a response rate of 92.9 %. Eleven questionnaires were not reliable and were excluded from final analysis. Hence, 106 questionnaires were considered. Self-administered questionnaire was utilized for data collection.

Results: a total of 106 PHC physicians were included in the current study. More than one-third of them (38.7%) were aged over 40 years. More than half of them (56.60%) have MBBS degree,

where about 8.49 % have diploma degree in family medicine. Around 13.21% have Master degree in different specialties where about 17.92 % certified family medicine board and only 3.77% have international MRCGP. Most of the participants⁷⁹ (74.5%) were aware about the proper definition of metabolic syndrome. Contrary to that, most of them (74.5%) were not aware about the age-adjusted prevalence of metabolic syndrome in KSA and 77.4% of them were not aware about the metabolic syndrome diagnosis according to International Diabetic Foundation criteria. Most of the physicians (75.5%) disagreed that metabolic syndrome diagnosis is difficult to be made at PHCC at Makkah. Slightly more than half of the physicians (55.6%) agreed that patients with metabolic syndrome should be managed by specialists. Around 78.3% and 63.2% of the physicians were confident to diagnose and manage metabolic syndrome respectively. The majority of the participants were agreed that they should know more about metabolic syndrome (89.6%) and attend training courses about metabolic syndrome (87.7%). Only 12.3% of the physicians reported a history of attendance training courses about metabolic syndrome.

Conclusions: The current results demonstrate that most of physicians are aware of metabolic syndrome as a clinical syndrome. However, their knowledge regarding its diagnosis and management is insufficient. Their attitude towards metabolic syndrome training and education is adequate.

Keywords: Metabolic syndrome; primary health care; physicians; knowledge; attitude; practice; Saudi Arabia

Running title: Physician's knowledge, attitude and practice about metabolic syndrome

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Introduction

Management of coronary artery disease (CAD) has evolved to include various strategies not limited to interventions after cardiac event secondary to CAD, but addressing the predisposing risk factors for primary interventions as well.⁽¹⁾ The life time individual's risk for the development of CAD is determined by several well-known risk factors that have not accounted fully for all patients presenting with manifestations of CAD.⁽²⁾ Clearly, as living parameters are changing in societies towards Western lifestyle with less physical activity and more prevalence of obesity, the risk for acquiring CAD is likely to increase.⁽³⁾

Metabolic syndrome is a cluster of disorders of metabolism including high insulin levels, excess body weight, high blood pressure and abnormal cholesterol levels that increase the risk for development of CAD.⁽⁴⁾ This disorder is also known as syndrome X and insulin-resistance syndrome.⁽⁴⁾ It is estimated that 20-25% of the world's adult population have this syndrome and as a result, are twice as likely to die from and three times as likely to have a heart attack or stroke compared to people without metabolic syndrome.⁽⁵⁾ In addition, people are five times more likely to develop type 2 diabetes.⁽⁵⁾ The three most current definitions of metabolic syndrome, created by the National Cholesterol Education Program – Third Adult Treatment Panel (NCEP ATPIII), the World Health Organization (WHO), and the International Diabetes Foundation (IDF), provide useful guidelines to identify those individuals at increased risk for development of type 2 diabetes, atherosclerotic cardiovascular disease (CVD) , and cardiovascular death.⁽⁴⁾ Other metabolic abnormalities have been associated with this syndrome , including microalbuminuria , and abnormalities in fibrinolysis and coagulation.⁽⁶⁻⁹⁾

Al-Nozha et al 1995 to 2000 reported that the overall age-adjusted prevalence of metabolic syndrome in Saudi Arabia is 39.3%. Low HDL cholesterol plays a major role in the contribution to metabolic syndrome in Saudi Arabia.⁽³⁾ The risk factors associated with this syndrome are primarily well known - hypertension, dyslipidemia (high triglycerides and lower HDL), elevated fasting blood glucose and central obesity.⁽¹⁰⁾

Among various names given to this syndrome (including metabolic syndrome, the insulin resistance syndrome and the plurimetabolic syndrome, "insulin resistance syndrome" has been commonly used and implies that insulin resistance is an important factor of the syndrome.⁽¹¹⁻¹⁸⁾ Due to its heterogeneity, an emerging need for a unifying definition of the metabolic syndrome lead the World Health Organization (WHO) to establish its criteria and proposed the components of metabolic syndrome in 1998.⁽¹⁹⁾ Obviously, despite the precise criteria set by the WHO, the difficulty in applying such criteria in clinical practice as well as epidemiological studies urged the National Cholesterol Education Program(NCEP) Adult Treatment Panel (ATP) III in 2001 to provide a more practical criteria to clinically apply the definition for metabolic syndrome that does not include measuring urinary micro-albuminuria or performing an oral glucose tolerance test.⁽²⁰⁾

Guidelines from ATP III suggest that the clinical diagnosis of the metabolic syndrome is based upon the presence of any 3 of the following: abdominal obesity defined as waist circumference >102 cm (40 inch) in male and >88cm (35 inch) in female, triglyceride \geq 150 mg/dl (1.69 mmol/L), high-density lipoprotein (HDL)cholesterol <40 mg/dl (1.03 mmol/L) in male and <50 mg/dl (1.29 mmol/L) in female, blood pressure \geq 130/85 mm Hg , fasting glucose \geq 110 mg/dl (6.1mmol/L).^(4, 20)

The current study aimed to assess knowledge, attitude and practice of primary health care physicians in Makkah about diagnosis, management and preventive measures of metabolic syndrome.

Subjects and methods

A cross sectional study included all primary health care physicians (males and females) working in Makkah was implemented. Makkah is the holy city for all Muslims, it is located in the western region of Saudi Arabia. Almasjid AL-haram (the holy mosque) which contains Alkaa'ba representing the Qibla, the guidance for all Muslims in their prayers. The city is divided into three health regions. Makkah has 29 primary health care centers inside the city. Overall 126 physicians were invited to participate in the study.

Self-administered questionnaire was utilized for data collection including four sections. Section one included socio-demographic data of the participants (age, gender, nationality, educational level, and experience). Section two: It included 6 questions to evaluate knowledge of the participants about Metabolic Syndrome. Section three: it included 9 questions to assess their attitude towards Metabolic Syndrome. Section four: it included 4 questions to explore physicians` practice regarding metabolic syndrome.

Questionnaires were distributed to all physicians at each primary health care center after explanations how they can fill them. Then, the medical director at each center collects the questionnaires on the same day, then the researcher collects the questionnaires from medical directors on the same day if was possible or within maximum 3 days. The researcher tested the reliability of the questionnaire by repeating three questions by different ways and if the

participants answered 2 out of three questions by different answers, then the questionnaire was considered not reliable. The pilot study was conducted at Aljamoom primary health care centre due to similarity to the target population using same questionnaire. The deficit were identified and modified after reassessing with two consultants of Family Medicine.

The data were collected and verified by hand then coded before entry. Statistical Package for Social Sciences (SPSS) software version 16.0 was used for data entry and analysis. Descriptive statistics (e.g. number, percentage) and analytic statistics using Chi Square tests (χ^2) to test for the association and /or the difference between two categorical variables were applied. P value equal or less than 0.05 was considered statistically significant.

Participants' knowledge score regarding Metabolic Syndrome was calculated as follows, the participated physicians were asked to answer 6 questions about definition, prevalence, diagnosis and management of metabolic syndrome. The overall score was calculated in the way that the higher the score, the higher the knowledge regarding various aspects of metabolic syndrome. The median value of the overall score was utilized as a cut-off point for knowledge categorization (it was 3 with a range of 0-6). Participated physicians were classified as having sufficient knowledge regarding metabolic syndrome if they have overall score >3 and as having unsatisfied knowledge if they have a score ≤ 3 . Regarding participants' attitude towards metabolic syndrome, it was calculated as follow; the participated physician, were asked to answer 9 questions about their attitude towards diagnosis, management and further training about metabolic syndrome. The overall score was calculated in the way that the higher the score, the higher the attitude. The median value of the overall score was utilized as a cut-off point for attitude categorization (it was 35 with a range of 9-45). Participated physicians were classified as having positive attitude towards metabolic syndrome, if they have overall score >35 and as

having negative attitude if they have a score ≤ 35 . Pearson's correlation coefficient was applied to test for the association between total attitude score and physicians age, level of education and experience . Permissions from Makkah joint program of family and community medicine, directorate of health affairs of Holy Capital Primary Health Care were obtained.

Results

Overall, 117 of 126 physicians, invited to participate in the study by filling out the research questionnaire, returned questionnaires, giving a response rate of 92.9%. Eleven questionnaires were not reliable and were excluded from final analysis. Hence, 106 questionnaires were considered.

A total of 106 PHC physicians were included in the current study. Their socio-demographic characteristics are presented in table 1. More than one-third of the respondents (38.7%) were aged over 40 years and 24.5% of them were in the age group 25-30 years. About 60.4% were males. Most of them 74.5% were non-Saudi. More than half of them 56.6% had MBBS and only 17.9% had FM Board. 27 physicians had more than 10 years of experience in PHC (25.5%).

Table 1: Socio-demographic characteristics of the study participants (n=106)

Variables	Categories	Number (%)
Age (in years)	25-30	26 (24.5)
	31-40	39 (36.8)
	>40	41 (38.7)
Gender	Male	64 (60.4)
	Female	42 (39.6)
Nationality	Saudi	27 (25.5)
	Non-Saudi	79 (74.5)
Educational level	MBBS	60 (56.6)
	Diploma	9 (8.5)
	Master	14 (13.2)
	FM Board	19 (17.9)
	MRCGP	4 (3.8)
Experience at PHC	<5 years	42 (39.6)
	5-10 years	37 (34.9)
	>10 years	27 (25.5)

Physicians' knowledge about Metabolic Syndrome:

Six questions with five responses were designed to elicit physician`s' knowledge of definition, prevalence in KSA, criteria for diagnosis, and management of metabolic syndrome. Table 2 shows the participants` knowledge of various aspects of metabolic syndrome. In response to the question on the definition of metabolic syndrome, most of the participants 79 (74.5%) were aware about the proper definition of metabolic syndrome. Contrary to that, most of the participants (74.5%) were not aware about the age-adjusted prevalence of metabolic syndrome in KSA and 77.4% of them were not aware about the metabolic syndrome diagnosis according to International Diabetic Foundation criteria. More than half of the participants 57.5%

were not aware that increased waist circumference is the necessary criteria for metabolic syndrome diagnosis. Most of the participants 72.6% were aware that the primary aims for metabolic syndrome management with lipid lowering agents are decreasing LDL, increasing HDL, and lowering TG. Almost two-thirds of PHC physicians who participated in the study 68.9% recognized that in patients with established diabetes, antihypertensive therapy goal is to keep blood pressure less than 130/80 mmHg.

Table 2: PHC physicians` knowledge of various aspects of Metabolic Syndrome (n=106)

MS aspects	Correct answer Number (%)	Incorrect answer Number (%)
Definition: (central obesity, dyslipidemia, increased blood pressure and impaired glucose tolerance)	79 (74.5)	27 (25.5)
Overall-age adjusted prevalence of metabolic syndrome in KSA according to Al-Nozha et al study: (around 40%)	27 (25.5)	79 (74.5)
The following criteria is consistent with diagnosis of metabolic syndrome according to International Diabetic Foundation: (FBS > 100 mg/dl including diabetic patient)	24 (22.6)	82 (77.4)
Necessary criteria for MS diagnosis: (Increased waist circumference “specific population”)	45 (42.5)	61 (57.5)
Primary aim for metabolic syndrome management with lipid lowering agents: (decrease LDL, increased HDL, lowering TG)	77 (72.6)	29 (27.4)
In patients with established diabetes, antihypertensive therapy goal to keep blood pressure less than: (130/80)	73 (68.9)	33 (31.1)

Table 3 shows that physicians` knowledge about metabolic syndrome was higher among those in the age group 25-30 and >40 than those in the age group 31-40 (42.3%, 39% versus 25.6%). However, the difference was not statistically significant. Physicians` knowledge about metabolic syndrome was significantly higher among females compared to males (45.2% versus 28.1%). The metabolic syndrome knowledge was higher among Saudi than non-Saudi physicians (44.4% versus 31.6%). However, the difference was not statistically significant. There were no significant associations between physicians` knowledge about metabolic syndrome and their educational level or experience at PHC.

Table 3: Association between knowledge of Metabolic Syndrome and relevant variables (n=106)

Variables	MS Knowledge		χ^2 (P-value)
	Insufficient (n=69) No. (%)	Sufficient (n=37) No. (%)	
Age in years			
25-30 (n=26)	15 (57.7)	11 (42.3)	2.41 (0.300)
31-40 (n=39)	29 (74.4)	10 (25.6)	
>40 (n=41)	25 (61.0)	16 (39.0)	
Gender			
Males (n=64)	46 (71.9)	18 (28.1)	3.27 (0.045)
Females (n=42)	23 (54.8)	19 (45.2)	
Nationality			
Saudi (n=27)	15 (55.6)	12 (44.4)	1.45 (0.166)
Non-Saudi (n=79)	54 (68.4)	25 (31.6)	
Educational level			
MBBS (n=60)	40 (66.7)	20 (33.3)	1.08 (0.897)
Diploma (n=9)	5 (55.6)	4 (44.4)	
Master (n=14)	8 (57.1)	6 (42.9)	
FM Board (n=19)	13 (68.4)	6 (31.6)	
MRCGP (n=4)	3 (75.0)	1 (25.0)	
Experience at PHC			
< 5 years (n=42)	26 (61.9)	16 (38.1)	3.09 (0.213)
5-10 years (n=37)	28 (75.7)	9 (24.3)	
> 10 years (n=27)	15 (55.6)	12 (44.4)	

Physicians` attitude towards Metabolic Syndrome (MS)

From table (4), it is obvious that the majority of the participants 85.9% agreed that metabolic syndrome is common worldwide, especially in KSA. Most of the physicians 75.5% disagreed that metabolic syndrome diagnosis is difficult to be made at PHCC at Makkah. The majority of the participants 93.4% agreed that metabolic syndrome patient need to be seen on regular basis for screening of diabetes, hypertension, and dyslipidemia even if not developed yet. 48 physicians (79.2 %) agreed that management of metabolic syndrome generally is effective. Slightly more than half of the physicians 55.6% agreed that patients with metabolic syndrome should be managed by specialists. Around 78.3% and 63.2% of the physicians were confident to diagnose and manage metabolic syndrome respectively. The majority of the participants were agreed that they should know more about metabolic syndrome 89.6% and attend training courses about metabolic syndrome 87.7%.

It is obvious from table (5) that the positive attitude towards metabolic syndrome was more encountered among older physicians than younger, females than males, Saudi than non-Saudi, those having FM Board than those with other educational levels and among less experienced physician than those with greater experience. However, these differences were not statistically significant.

There was a positive correlation between physician's age and total attitude score ($r = 0.627$, $p < 0.001$) while there was no significant correlation between physician's experience nor educational level with total attitude score.

Table (4): Responses of the physicians to the questions about their attitude towards Metabolic Syndrome (n=106)

Statements	Strongly agree	Agree	Undecided	Disagree	Strongly Disagree
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Metabolic syndrome is common worldwide especially in KSA.	43 (40.6)	48 (45.3)	6 (5.7)	7 (6.6)	2 (1.9)
MS diagnosis is difficult to be made at PHCC at Makkah.	2 (1.9)	15 (14.2)	9 (8.5)	58 (54.7)	22 (20.8)
MS patient need to be seen on regular basis for screening of diabetes, hypertension, dyslipidemia even if not developed yet.	36 (34.0)	63 (59.4)	3 (2.8)	2 (1.9)	2 (1.9)
Management of MS generally is effective.	21 (19.8)	63 (59.4)	17 (16.0)	3 (2.8)	2 (1.9)
Patients with MS should be managed by specialists.	8 (7.5)	51 (48.1)	3 (2.8)	32 (30.2)	12 (11.3)
I am confident to diagnose patient with MS.	20 (18.9)	63 (59.4)	13 (12.3)	8 (7.5)	2 (1.9)
I am confident to manage patient with MS.	12 (11.3)	55 (51.9)	21 (19.8)	16 (15.1)	2 (1.9)
I feel that I should know more about MS.	31 (29.2)	64 (60.4)	5 (4.7)	5 (4.7)	1 (0.9)
I need to attend training about MS.	35 (33.0)	58 (54.7)	6 (5.7)	5 (4.7)	2 (1.9)

Table 5: Association between physicians` attitude towards metabolic syndrome and relevant variables (n=106)

Variables	MS attitude		χ^2 (P-value)
	Negative (n=66) No. (%)	Positive (n=40) No. (%)	
Age in years			
25-30 (n=26)	19 (73.1)	7 (26.9)	1.72 (0.424)
31-40 (n=39)	23 (59.0)	16 (41.0)	
>40 (n=41)	24 (58.5)	17 (41.5)	
Gender			
Males (n=64)	40 (62.5)	24 (37.5)	0.04 (0.555)
Females (n=42)	26 (61.9)	16 (38.1)	
Nationality			
Saudi (n=27)	16 (59.3)	11 (40.7)	0.14 (0.440)
Non-Saudi (n=79)	50 (63.3)	29 (36.7)	
Educational level			
MBBS (n=60)	38 (63.3)	22 (36.7)	3.40 (0.493)
Diploma (n=9)	5 (55.6)	4 (44.4)	
Master (n=14)	9 (64.3)	5 (35.7)	
FM Board (n=19)	10 (52.6)	9 (47.4)	
MRCGP (n=4)	4 (100.0)	0 (0.0)	
Experience at PHC			
< 5 years (n=42)	26 (61.9)	16 (38.1)	0.008 (0.996)
5-10 years (n=37)	23 (62.2)	14 (37.8)	
> 10 years (n=27)	17 (63.0)	10 (37.0)	

History of Physicians' practice of Metabolic Syndrome:

As displayed from figure (1), slightly less than half of the physicians (48.1%) reported that immediately after diagnosis of essential hypertension, they always screened patients for metabolic syndrome.

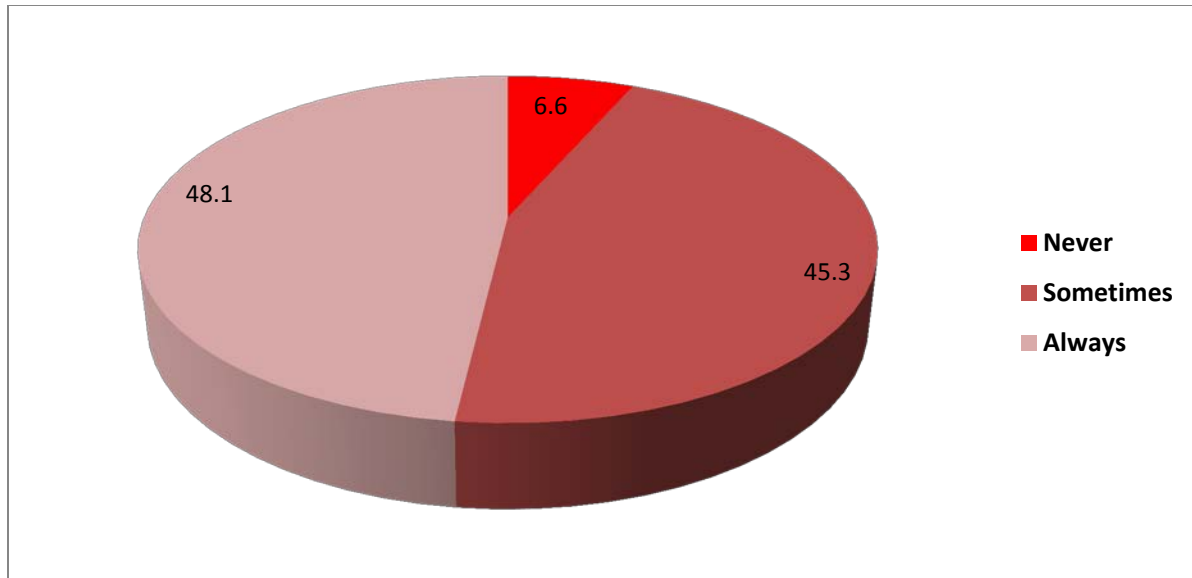


Figure (1): Physicians’ practice after diagnosis of essential hypertension regarding screening for metabolic syndrome.

Approximately two-thirds (66%) of the physicians reported a history of managing patients with metabolic syndrome (figure 2).

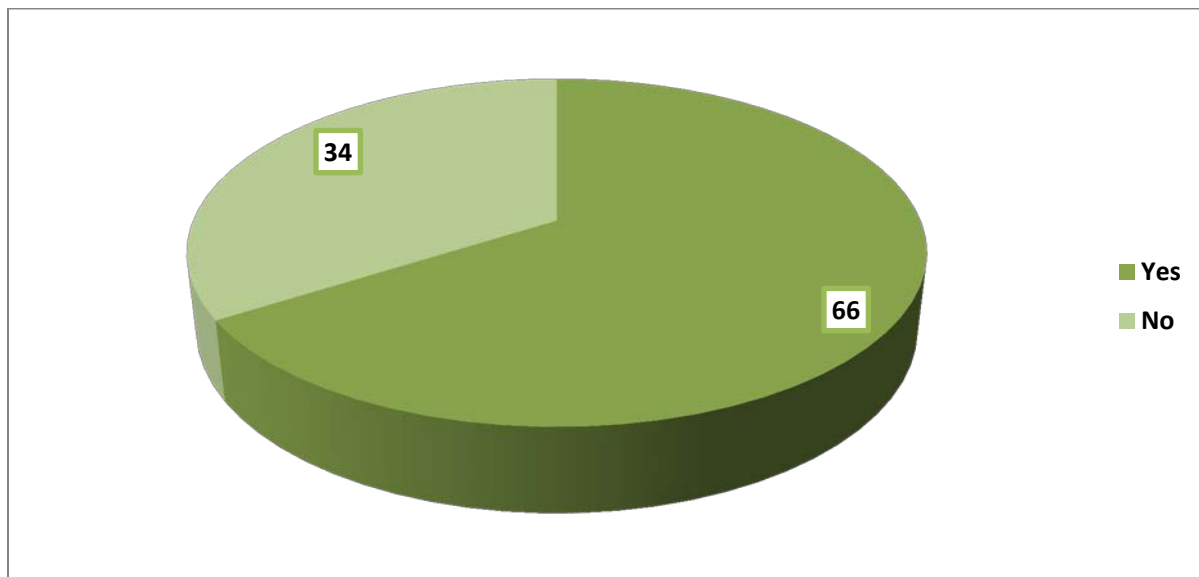


Figure (2): History of management of patients with metabolic syndrome.

As illustrated in figure (3), education, diet advice, exercise advice, and medication were lines of metabolic syndrome management reported by 57.5%, 52.8%, 52.8% and 47.2% of the physicians respectively. More than half of the participants (56.6%) reported that they are managing their patients by all measures including general education, diet advice exercise advice and medications.

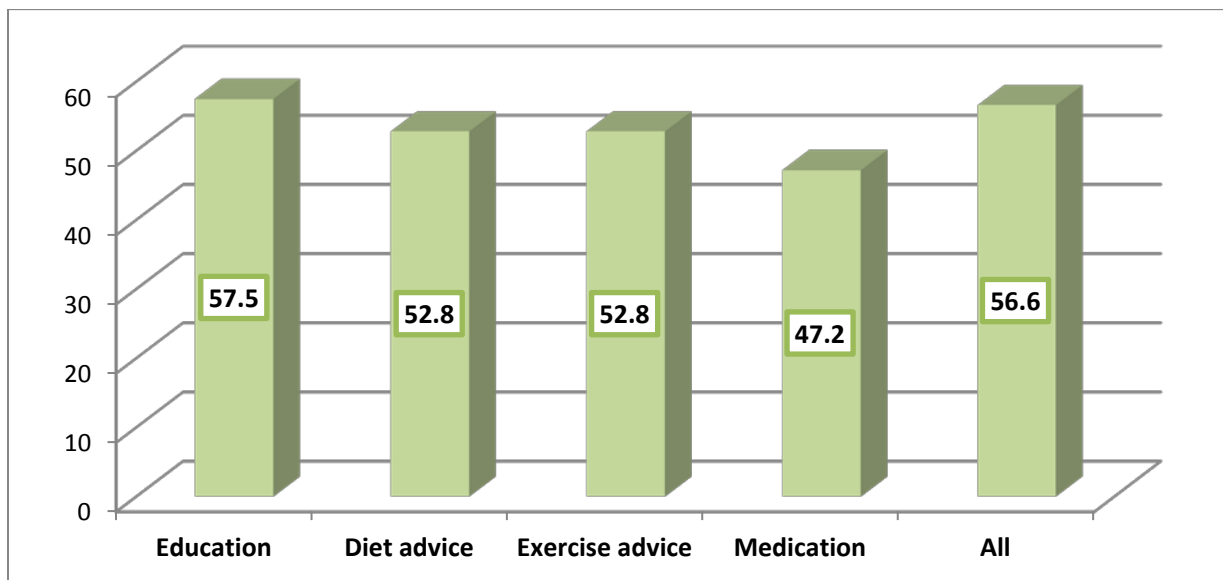


Figure (3): Type of management done for patients with metabolic syndrome.

Only 12.3% of the physicians reported a history of attendance training courses about metabolic syndrome (Figure 4).

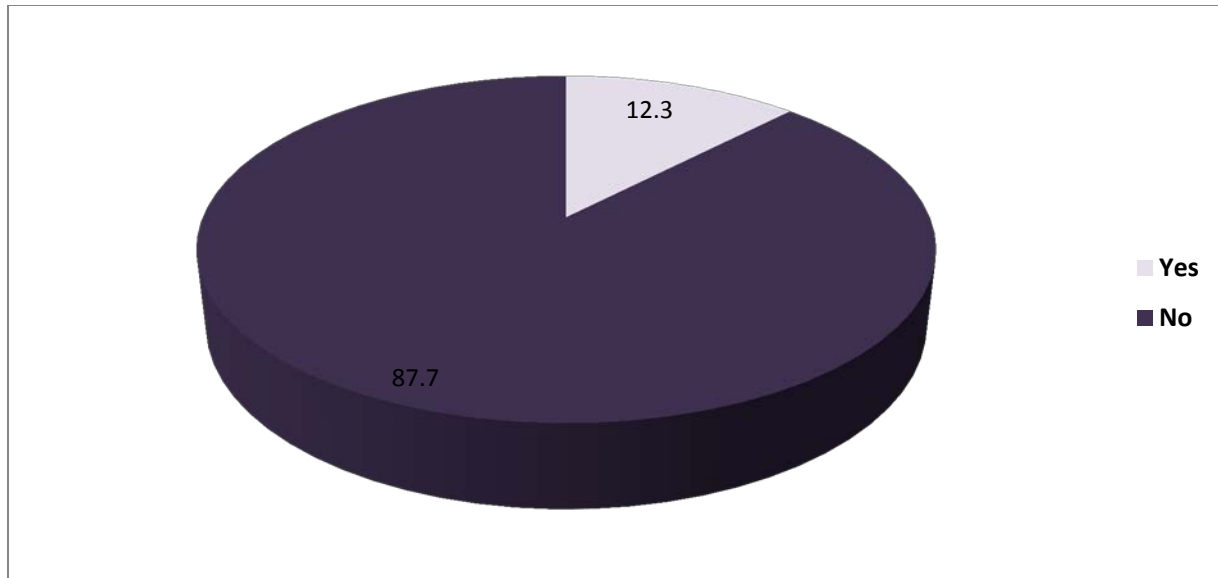


Figure (4): History of attendance of training courses about metabolic syndrome.

Discussion

The study included 106 physicians with a response rate of 92.9%. This high response rate can probably be ascribed to the personal contact with the physicians as well as to the explanation of the purpose of the study, scientific importance and value of the study to each physician. According to Rosnow and Rosenthal (1999)⁽²¹⁾ these techniques (e.g. personal contact, using reminders and explaining the scientific importance and value of the study, ensuring the participants confidentiality) are linked to increase participation in surveys.

The major characteristics of metabolic syndrome include insulin resistance, abdominal obesity, elevated blood pressure, and lipid abnormalities (i.e., elevated levels of triglycerides and low levels of high-density lipoprotein [HDL] cholesterol). Initially defined by an expert panel of the World Health Organization in 1998,⁽²²⁾ the NCEP-ATP III⁽⁵⁾ has created an operational definition of metabolic syndrome: the co-occurrence of any three of the abnormalities mentioned

above.^(5, 22)In the current study , 74.5% of PHC physicians in Makkah recognized correctly the proper definition of metabolic syndrome .

Al-Nozha, et al, 2005 ⁽³⁾ found that the metabolic syndrome to be highly prevalent in males and females in KSA. The overall prevalence of metabolic syndrome in Saudi Arabia is affecting slightly more than one third of Saudi population. In the current study, only 25.5% of PHC physicians in Makkah recognized this fact. These alarming figures place a large proportion of the Saudi community at increased risk for the development of CAD, DM, and hypertension. The metabolic syndrome is considered a risk factor for incident CAD as has been shown by several studies. ⁽²³⁻²⁸⁾ In addition, researchers established association with other disorders including fatty liver disease , polycystic ovary syndrome , and chronic kidney disease.⁽²⁹⁻³²⁾

In 2005, the International Diabetes Foundation (IDF) published new criteria that again modified the ATP III definition. ⁽³³⁾ They liked the ATP III definition because of its clinical simplicity. Furthermore, they considered that abdominal obesity was so highly correlated with insulin resistance that other more laborious measures of insulin resistance were unnecessary. The IDF clinical definition thus makes the presence of abdominal obesity necessary for diagnosis. When this is present, additional factors originally listed in the ATP III definition are sufficient for diagnosis. IDF recognized and emphasized ethnic differences in the correlation between abdominal obesity and other metabolic syndrome risk factors. For this reason, the criteria of abdominal obesity were specified by nationality or ethnicity based on the best available population estimates. A growing body of evidence shows that excess abdominal (visceral) fat is one of the most important predictors of cardiometabolic risk.^(34, 35) In the current study, more than

half of the participants 57.5% were not aware that increased waist circumference is the best available population criteria for metabolic syndrome diagnosis

Most of the participated physicians in the present study agreed that management of metabolic syndrome is generally effective and more than half of them reported that effective management of metabolic syndrome should include education, diet advice, exercise advice in addition to medication. A recently reported study revealed that effective control of metabolic syndrome and its components, with strict lifestyle counseling and multitargeted drug treatment, may reduce the associated vascular risk by up to 76%, to a level not higher than that of the general population.⁽³⁶⁾ Thus, the means to reduce metabolic syndrome -related morbidity and mortality are at hand and reducing this risk is achievable. The main issue is that we should focus on the identification and effective treatment of metabolic syndrome. This will require the education of the general population and physicians.

Athyros et al.,⁽³⁷⁾ in their cross-sectional analysis of a large sample of 9,669 adults (age 46±18 years), found that only one-third of the subjects were aware of the components of metabolic syndrome and only 5% were cognizant of metabolic syndrome as a disease entity. In this study, a low level of awareness about metabolic syndrome was observed among physicians. Arguably, it is not surprising to observe a low level of awareness about metabolic syndrome parameters among physicians, since metabolic syndrome is a recently defined disorder with varying diagnostic criteria used by individual organizations.^(20, 38-41)

The absence of universally accepted diagnostic criteria and the ongoing debate regarding the actual existence of this syndrome⁽⁴²⁾ may be partially responsible for low levels of awareness among physicians. Nevertheless, metabolic syndrome has been receiving growing interest

worldwide, resulting in a consistence increase in the annual number of publications, searched by the keyword “metabolic syndrome”, from 1,144 to 21,577 between 2000 and 2007. Therefore, higher levels of awareness could be expected for a diagnostic entity defined by similar criteria by important organizations such as ATP III and International Diabetes foundation (IDF).^(20, 40)

In the current study, almost two-thirds of PHC physicians reported that they managed metabolic syndrome patients, slightly more than half of them managed them completely (education, diet advice, exercise advice and medication). These findings are similar to other studies reporting differences in management approach by physicians.^(43, 44) The recognition and appropriate management of low- and high-risk patients is critical especially by primary care physicians because in many cases, especially in underserved areas, they serve as the only source of care. Approximately half of PHC physicians in the present study gave dietary advices to their patients. This finding is consistent with other studies showing a lack of guideline-based dietary recommendations by primary care physicians.⁽⁴³⁾ A plausible cause for this finding may be contributed to the fact that physicians may consider their knowledge and skills to provide dietary recommendations is a significant barrier in their practice. Innovative educational interventions may be useful to overcoming this barrier.

Among limitations of this study; first, this study used a survey as a surrogate measure of primary care physicians' knowledge and attitudes that was self-reported. Secondly, the practitioners were from one city and the impact of a managed care environment on adherence to guidelines was not evaluated.

Among strengthens of the current study, studies evaluating the levels of knowledge about metabolic syndrome and its control among health care workers are scarce. In addition, the response rate of physicians was very high.

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