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RESEARCH ARTICLE

EVALUATION OF METABOLIC SYNDROME AMONG DM TYPE 2 AND HYPERTENSIVE PATIENTS IN SANA'A, YEMEN

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ABSTRACT

Background: Metabolic syndrome (MS) present in type 2 diabetic and hypertensive patients greatly increases the risk of strokes and cardiovascular diseases. Timely detection of MS facilitates appropriate preventive and therapeutic approaches to minimize these risks. Our study aimed to determine the prevalence of MS among Yemeni type 2 diabetic and hypertensive patients using AHA/NHLBI definition. **Methods:** This study was a cross-sectional study conducted from April 2018 to June 2018. A total of 168 of patients with type 2 Diabetes, hypertensive, and DM type 2 with hypertensive were selected from the various out-patient departments of Al-thawra hospital and hospital of university of sciences and technology in Sana'a, Yemen. Components of MS were collected for these patients. The data was analyzed in order to identify prevalence of MS in these patients. Statistical analysis included usage of Chi-square tests using the software package SPSS 21.0. Results: The total prevalence of MS among the study patientswas81.0% and the prevalence increased with the age; 59.3 of patients were aged up 50 years old. The prevalence of MS among patients with diabetes type 2 was 75.9 of all total MS. Moreover, its prevalence in hypertensive patients as compared to non-hypertensive was 87.5%. The highest prevalence was observed among patients with both hypertensive and diabetes type 2. **Conclusions:** The prevalence of MS among Yemeni type 2 diabetic and hypertensive patients was very high and it is associated with increased morbidity and mortality. This emphasizes the need for more attention to investigate this condition to decreasing the prevalence of cardiovascular morbidity and mortality in these patients.

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INTRODUCTION

The metabolic syndrome (sometimes also known as syndrome X or insulin resistance syndrome) has been recognized since the late 1980s (Reaven, 1988). It is a cluster of the most dangerous heart attack risk factors: diabetes and raised fasting plasma glucose, abdominal obesity, high triglyceride, low HDL cholesterol, and high blood pressure (Lone, 2017). Insulin resistance has been proposed as the underlying pathophysiology of the syndrome and hypertensionis one of the most prevalent of its components (Salagre, 2016). MS has been shown to increase the risk of cardiovascular diseases by two fold and type 2 diabetes mellitus (DM) by about five folds over 5 to 10 years (Kassi, 2011). Majority of the type 2 diabetic patients with MS are predisposed to higher risk of cardiovascular diseases, strokes and premature death compared to both non-diabetic individuals and diabetic individuals without MS (Pokharel, 2014). Moreover, presence of MS in the type 2 diabetes patients has been shown to decrease the survival rate at least by 10 years (Protopsaltis, 2007). There are several definitions for MS was reported by different international regulatory bodies (Kassi, 2011). World Health Organization (WHO) defines the MS as the presence of glucose intolerance or insulin resistance or diabetes mellitus with any two of the following components: obesity, high serum triglycerides, low HDL cholesterol and hypertension (Alberti, 1998). The National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) describes MS as the presence of any three of the following components: abdominal obesity, dyslipidemia (high levels of triglycerides, low HDL), hypertension, and elevated fasting glucose (Expert Panel on Detection, 2001). The International Diabetes Federation (IDF) takes central obesity as a mandatory component for the diagnosis of MS along with any two of the other components: hypertension, abnormal blood glucose, high serum triglycerides and low high density lipoprotein cholesterol (Alberti, 2005).

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Recently, IDF, National Heart, Lung and Blood Institute (NHLBI), American Heart Association (AHA), World Heart Federation (WHF), International Atherosclerosis Society (IAS) and International Association for the Study of Obesity (IASO) have proposed a new harmonized definition which requires any three of the five components included in the IDF definition for the diagnosis of MS and do not consider central obesity as an obligatory component (Alberti, 2000). Early diagnosis and management of MS has become a medical priority to prevent complications of metabolic disturbances. There are limited previous published studies on MS among Yemeni populations. In Yemen, we found two previous studies investigate MS among patients with Type 2 Diabetes and patients with Chronic Hepatitis C (Ahmed, 2009 and Bin Selm, 2010). Previous two studies were conducted on the southern part of the country but limited published studies from northern part about MS among Yemeni DM type 2 and hypertensive patients. We designed this study to obtain the prevalence of MS and each of its components among Yemeni DM type 2 and hypertensive patients in order to stimulate further research on its actual prevalence among the general population.

MATERIALS AND METHODS

This study was a cross-sectional study conducted from April 2018 to June 2018. A total of 168 of patients with type 2 Diabetes, hypertensive, and DM type 2 with hypertensive were selected from the various out-patient departments of Al-thawra hospital and hospital of university of sciences and technology in Sana'a, Yemen. The study protocol was approved by the institutional ethical committee and informed consent was obtained from all the enrolled study patients for their inclusion in the screening and participation in the research. In the effort to introduce the MS into clinical practice, several scientific organizations have attempted to formulate working definition of the syndrome. In the present study, the diagnosis of MS based on the American Heart Association/National Heart, Lung, and Blood Institute (AHA/NHLBI) and to a joint statement from several large organizations. The patients must meet at least three of the following criteria for diagnosis of MS (Alberti, 2009):

- Increased waist circumference (40 inches [102 cm] or greater in men and 35 inches [89 cm] or greater in women).
- Triglycerides of 150 mg/dL(1.70 mmol/L) or greater or active treatment to lower triglycerides.
- Low high-density lipoprotein (HDL) cholesterol (less than 40 mg/dL[1.03 mmol/L] in men and less than 50 mg/dL [1.29 mmol/L] in women) or active treatment to raise HDL cholesterol.
- Systolic blood pressure (BP) of 130 mm Hg or greater, diastolic BP of 85 mm Hg or greater, or active treatment with antihypertensive therapy.
- Fasting blood glucose of 100 mg/dL (5.6 mmol/L) or greater or active treatment for diabetes.

In the current study, the presence of more than or equal to any three of the above mentioned factors is required for the diagnosis of MS including those under treatment for the mentioned condition. Patients with established coronary artery diseases, thyroid dysfunction, current psychiatric treatment and pregnancy were excluded to homogenize the study subjects.

All the study patients were personally interviewed by the trained interviewers within the hospital. The following variables were evaluated: age, sex, waist circumference, HDL cholesterol, triglycerides, fasting glucose, and blood pressure. Statistical analysis was done by SPSS software version 21.0 by using Pearson's Chi-square test and unpaired t-test. *P-value* of less than 0.05 was considered significant.

RESULTS

In the present study, the mean age of patients was 50.63 years (with SD ± 10.98 years) and ranged between 28 and 93 years. In addition, 60.1% of patients were males and (39.9%) female. According to study results, 81.0% of sample had MS and 59.3 of patients were aged up 50 years old.

Table 1. Prevalence of metabolic syndrome among the study patients

Variable	Level of variable	N	%
Metabolic Syndrome	Yes	136	81.0
	No	32	19.0
	Total	168	100.0

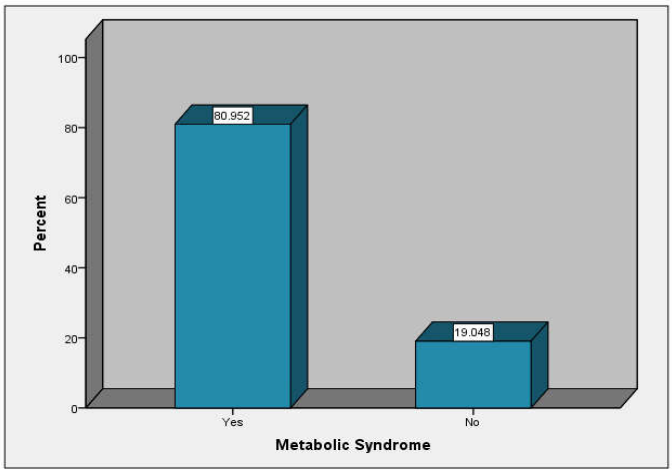

Figure 1. Prevalence of Metabolic Syndrome among study patients

According to our study findings, the relationship between MS and gender was not statistically significant. However, out of 101 male patients, 78 (77%) had MS and 58 (86.6%) of 67 female patients had MS (Table 2). The relationship between MS and waist circumference was analyzed in the table 3. Results in this table showed that there was significantly relationship between the prevalence of waist circumference and MS ($p< 0.001$), 97 of patients with increased waist circumference had MS, in comparison, only 10 of them did not have the syndrome. In the present study, there was statistically significant between diagnosis variables and MS prevalence. The prevalence of MS among hypertensive patients was 87.5%. In addition, the patients with diabetes type 2 were 75.9 of all total MS. However, the MS was the highest prevalence among patients with hypertensive and diabetes type 2. Table 5 showed the distribution of MS by Triglyceride. Results in this table indicated that the relationship between MS and prevalence of triglyceride was significant (*P-value*< 0.001). In addition, out of 168 patients, 86 of them had high triglyceride with MS. Table 6 showed that the relationship between MS and HDL cholesterol level was statistically significant (P-value = 0.001). 93 of total patients had low HDL (<40 mg/dL in male or <50 in female).

Table 2. The prevalence of Metabolic Syndrome among gender

Variable		Metabolic Syndrome		Total	*P-value*	95% Confidence Interval	
		Yes	No			Lower	Upper
Gender	Male	78 (77.2%)	23 (22.8%)	101	0.131	0.227	1.222
	Female	58(86.6%)	9 (13.4%)	67 (100%)			
	Total	136	32	168			

Table 3. The prevalence of waist circumference among patients with Metabolic Syndrome

Variable		Metabolic Syndrome		Total	*P*-value
		Yes	No		
Waist circumference	No	39	22	61	0.001
	Yes	97 (71.3%)	10	107	
	Total	136	32	168	

Table 4. The distribution of metabolic syndrome according to diagnosis

Variable		Metabolic Syndrome		Total	P-value
		Yes	No		
Diagnosis	HTN	14 (87.5%)	2 (12.5%)	16 (100%)	0.036
	DM type 2	88 (75.9%)	28 (21.1%)	116 (100%)	
	HTN+DM type 2	34 (94.4%)	2 (5.6%)	36 (100%)	

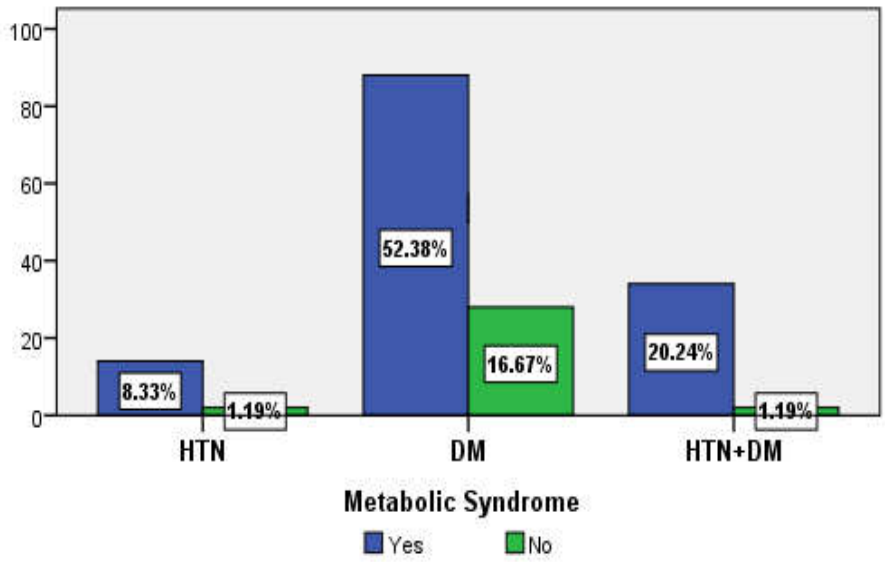

Figure 2. Distribution of metabolic syndrome according to diagnosis

Table 5. The prevalence of TG among patients with Metabolic Syndrome

Variable		Metabolic Syndrome		Total	*P-value*
		No	Yes		
Triglyceride	No	28	28	56	0.000
	Yes	4	108 (79.4%)	112	
	Total	32	136	168	

In the present study, 88 of total patients (94.6%) were with low HDL cholesterol and 19 of study patients, on active treatment, had MS. However, 29 of total patients had normal HDL cholesterol level. The association between MS and blood pressure was analyzed in the table 7. Results in this table showed that high significantly relationship (*P-value* = 0.002). According to the study findings, 73 (72.22%) of low blood pressure patients (N=101) had MS. However, 46 (92%) of patients on drug treatment for hypertension had MS. In the current study, the relationship between MS and age group was not statistically significant (*P-value* = 0.55).similarly, there was not any relationship between MS and FBG (*P-value* = 0.069).

In the present study, there was significant relationship between gender and waist circumference (*P-value* = 0.000). On other hand, there were not statistically significant between the gender and other MS criteria (Table 9). According to study results, there was significant relationship between diagnosis and number of MS criteria (*P-value* = 0.000).In addition, HTN+DM type 2 had the highest criteria number (n=5). However, DM type 2 had the highest prevalence for four and three criteria number of MS (see Table 10). Table 11 showed that there was significant relationship between MS and the clusters of metabolic abnormalities (*P-value* = 0.000).

Table 6. The prevalence of HDL among patients with Metabolic Syndrome

Variable		Metabolic Syndrome		Total	*P-value*
		Yes	No		
HDL Cholesterol	Yes	86 (63.2%)	6	92	
	No	50	26	76	0.001
	Total	136	32	168	

Table 7. The prevalence of HDL among patients with Metabolic Syndrome

Variable		Metabolic Syndrome		Total	*P-value*
		Yes	No		
Blood Pressure	No	74 (54.4%)	28	102	0.001
	Yes	62	4	66	
	Total	136	32	168	

Table 8. The prevalence of age group & FBS among patients with metabolic syndrome

Variable		Metabolic Syndrome		Total	*P-value*
		Yes	No		
Age group	20-29	1	0	1	
	30-39	21	8	29	
	40-49	28	10	38	0.324
	50-59	51	9	60	
	Up 60	35	5	40	
	Total	136	32	168	
	No	3	2	5	
Fasting Blood Glucose (FBG)	Yes	133	30	163	0.226
	Total	136	32	168	

Table 9. Distribution of metabolic syndrome criteria according to gender

AHA Criteria		Male	Female	Total	P-value
Increased WC	Yes	53	54	107	0.000
	No	48	13	61	
Decreased HDL-C	Yes	69	44	113	0.721
	No	32	23	55	
Increased TG	Yes	72	40	112	0.119
	No	29	27	56	
Increased FBG	Yes	100	63	163	0.063
	No	1	4	5	
Hypertension	Yes	39	27	66	0.827

Table 10. Distribution of criteria number according to diagnosis

Variable		Diagnosis			Total	*P-value*
		HTN	DM type 2	HTN+DM type 2		
Number of Criteria	1	2	9	0	11	
	2	0	19	2	21	0.000
	3	4	51	7	62	
	4	3	33	12	48	
	5	7	4	15	26	
Total		16	116	36	168	

Table 11. Prevalence of criteria number among patients with metabolic syndrome

Variable		Metabolic Syndrome	Total	P-value
Criteria Number	3	62 (45.6%)	62	
	4	48 (35.3%)	48	0.000
	5	26 (19.1%)	26	
		136	136	

Moreover, number three of criteria number had the highest prevalence (45.6%) among MS, followed by number 4 (35.3%) then number five (19.1%). However, DM type 2 had the highest prevalence for four and three criteria number of MS. There was no significant relationship between number of MS criteria and gender (*P-value* = 0.82). However, majority of the subjects had the cluster of three metabolic abnormalities (45.6%) among both male and female (21.4%, 15.5%; respectively).

(see table 12). According to the study results, Majority of patients with MS had high prevalence of most metabolic abnormalities (see Table 13). There was no significant relationship between waist circumference, TG, HDL cholesterol, and diagnosis (*P-value* = 0.99, 0.60, 0.89; respectively). However, metabolic abnormalities of BP and FBG had statistically significant differences with diagnosis (*P-value* = 0.000, 00.1; respectively). In addition, DM type 2 had the highest prevalence for four clusters of MS (see Table 14).

Table 12. Prevalence of metabolic syndrome criteria number among gender

Variable	Gender		Total	P-value
	Male	Female		
Number of Criteria	1 8 (4.8%)	3 (1.8%)	11 (6.6%)	
	2 14 (8.3%)	7 (4.2%)	21 (12.5%)	
	3 36 (21.4%)	26 (15.5%)	62 (36.9%)	0.82
	4 27 (16.1%)	21 (12.5%)	48 (28.6%)	
	5 16 (9.5%)	10 (6%)	26 (15.5%)	
Total	101	67	168	

Tbale 13. Distribution of criteria among metabolic syndrome patients

Variable		Frequency	%
Waist Circumference	Yes	97	71.3
	No	39	28.7
	Total	136	100
TG	Yes	108	79.4
	No	28	20.6
	Total	136	100
HDL-C	Yes	108	79.4
	No	28	20.6
	Total	136	100
BP	Yes	62	45.6
	No	74	54.4
	Total	136	100
FBS	Yes	133	97.8
	No	3	2.2
	Total	136	100

Table 14. Prevalence of Metabolic syndrome criteria according to diagnosis

Variable		Diagnosis			*P-value*
		HTN	DM Type 2	HTN+DM Type 2	
Waist Circumference	Yes	10	63	24	
	No	4	25	10	0.99
	Total	14	88	34	
TG	Yes	11	72	25	
	No	3	16	9	0.60
	Total	14	88	34	
HDL-C	Yes	11	69	28	
	No	3	19	6	0.89
	Total	14	88	34	
BP	Yes	14	15	33	
	No	0	73	33	0.000
	Total	14	88	66	
FBG	Yes	12	87	34	0.001
	No	2	1	0	
	Total	14	88	34	

DISCUSSION

Our study is a hospital-based study; the findings could not be generalized to the whole population. Furthermore, there was a limited study about the MS from northern parts of Yemen especially among patients with chronic diseases. We found a substantially high frequency of MS in people with hypertensive; diabetes and hypertensive + diabetes type 2 in Yemeni populations (81%). There is strong epidemiological evidence that, regardless of the criteria used, the prevalence of MS is high and rising in all western society and in Asia, very likely as a result of obesity epidemic (Kahn, 2017 and Konecny, 2014). This prevalence is higher than the 32.2 % prevalence that found southern part of Yemen in patients with Type 2 Diabetes (Ahmed, 2009) and higher the 61.97% prevalence among Yemeni patients with Chronic Hepatitis C (Bin Selm, 2010). In general, it has been estimated that approximately 10%-30% of the world's adult population has the MS (Grundy, 2008). In the current study, the prevalence of MS sharply increased with the age and remained highest in 50–59 years age group. This is expected because predisposition of MS is strongly favored by age related processes such as gradual decrease in the basal metabolic rate, decreased growth hormone secretion, hypogonadism, stress induced hypercortisolism, abdominal fat deposition and concomitant insulin resistance (Kassi, 2011). Data regarding gender effect on MS prevalence are conflicting with the majority of the studies finding the highest prevalence in women compared to men (Mulè, 2014). In contrast to their study, we found no significant difference in the prevalence of MS with respect to gender. Some studies found that the prevalence is similar among males and females e.g. in Saudi Arabia (Al-Nozha, 2005), some found higher prevalence in females e.g. in Tunis (Harzallah, 2006), and others found higher prevalence among males e.g. in Lebanon (Sibai, 2008).

Tjepkema (Tjepkema, 2006), showed that obesity rates increase steadily in women until age 65 years. The changes in prevalence that we observed may agree with reported increased rates of MSin peri- and post-menopausal women (Polotsky, 2010). MSis commonly associated with prediabetes. It is also associated with characteristics such as prothrombotic state and dyslipidemia, which may account for its link to cardiovascular risk. The increased risk of type 2 diabetes and of a fatal CVD event in individuals with MSis thus not surprising, surprising, given the research demonstrating these associations (Mottillo, 2010 and Ford, 2004). Our findings demonstrated a higher prevalence of chronic disease in individuals with MS.A previous study has described MS as more predictive of future disease (Kip, 2004). The greater association between chronic disease and MS in our study may, therefore, further signify a public health utility for MS as a key indicator of disease risk. The high prevalence of M Samong our patients was expected as they were suffering from type 2 diabetes which itself was an entity of the MS.

Several studies around the globe have reported very high prevalence of MS in type 2 diabetic patients regardless the definitions used, ethnicity and geographical area (Ogbera, 2010 and Kengne, 2012). The high prevalence of the MS among DM type 2 is of considerable concern. In our study, the patients with diabetes type 2 were 52.8%of all total MS (75.9 % of patients with DM type 2). However, the MS was the highest prevalence among patients with hypertensive and diabetes types 2.Majority of our patients had a cluster of three components of MS. In addition, the high waist circumference, high serum TG or patient on active drug to lower TG, low serum HDL-C or patient on active drug to increase HDL-C and high FBG or patient on active drug to lower blood glucose were more prevalence in patients with DM type 2. In this study, DM type 2 had the highest prevalence of four clusters of MS (see table 13). Thus is commonly observed among type 2 diabetic patients which significantly increases the risk of CVDs[27,28].In general, visceral obesity and insulin resistance are at the core of most cases of MS(16).In the present study, there was statistically significant between diagnosis variables and MS prevalence. The prevalence of MS among hypertensive patients was 87.5% (n=14/16). Since high BP is a key component of MS, it is expecting that hypertension is highly prevalent in MS patients. The Pressioni Arteriose Monitorate E Loro Associazioni (PAMELA) population study revealed that high normal BP values and hypertension were present in 80%

of individuals with MS(29).The largest component of the total annual economic burden of hypertensive patients with MS was the treatment and management of the consequence of disease rather than the management of hypertension (Scholze, 2010). Several mechanisms have been hypothesized to explain why the MS may be considered as a prohypertensive state (Gupta, 2010). According to the study findings, there was high prevalence of MS among patients with hypertensive and DM type 2. About 94.4% of patients with hypertensive and DM type 2 had MS. There is general agreement with 50% of hypertensive patients are insulin-resistant, in response to states of over-nutrition, stimulates the sympathetic nervous system (SNS) to promote thermo genesis and to minimize weight gain. The insulin-mediated hyper adrenergic state, however, leads to an increase in heart rate, and BP (Mulè, 2014).

Conclusion

The prevalence of metabolic syndrome is significantly high in DM type 2 and hypertensive subjects. MS is associated with increased morbidity and mortality especially in diabetes type 2 and hypertension. This emphasizes the need for early screening and appropriate timely management of metabolic disturbances in these patients to prevent the progression towards this syndrome among type 2 diabetics and hypertension.

Conflict of interest: The authors declare that they have no competing interests.

REFERENCES

Kip KE, Marroquin OC, Kelley DE. Clinical importance of obesity versus the metabolic syndrome in cardiovascular risk in women: a report from the Women's Ischemia Syndrome Evaluation (WISE) study. *Circulation.* 2004; 109:706-13.

Ahmed AM, Bin Selm S. Prevalence of Metabolic Syndrome among Patients with Type 2 Diabetes in Aden Governorate. MEJFM. 2009; 7: 15-17.

Alberti KG, Eckel RH, Grundy SM, Zimmet PZ, Cleeman JI, Donato KA: Harmonizing the metabolic syndrome. A joint interim statement of the international diabetes federation task force on epidemiology and prevention; national heart, lung, and blood institute; American heart association; World heart federation; International atherosclerosis society; and International association for the study of obesity. Circulation 2009, 120:1640–1645.

Alberti KG, Zimmet P, Shaw J: IDF epidemiology task force consensus group. The metabolic syndrome: a new worldwide definition. Lancet. 2005; 366:1059–1062.

Alberti KG, Zimmet PZ: Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: diagnosis and classification of diabetes mellitus provisional report of a WHO consultation. Diabet Med. 1998, 15:539–553.

Al-Nozha MM, Al-Khadra A, Arafah MR, Al-Maatouq MA, Khalil MZ, Khan NB, et al. Metabolic Syndrome in Saudi Arabia. *Saudi Med J.* 2005; 26: 1918-1925.

Bin Selm S. Prevalence of Metabolic Syndrome in Patients with Chronic Hepatitis C (CHC), Aden. MEJFM 2010; 8: 12-15

EA, Mohan V, Deepa M, Farooq S, Pazhoor S, Chennikkara H: Metabolic Syndrome among Asian Indians: A population with high rates of diabetes and premature heart disease. *J CardiometabSyndr.* 2007; 2:267–275

Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III): Executive summary of the third report of the national cholesterol education program (NCEP). JAMA 2001, 285:2486–2497.

Ford ES. The metabolic syndrome and mortality from cardiovascular disease and all-causes: findings from the National Health and Nutrition Examination Survey II Mortality Study. Atherosclerosis. 2004; 173:309-14.

Grundy SM. Metabolic syndrome pandemic. Arterioscler ThrombVasc Biol. 2008; 28: 629-636

Gupta AK,Dahlof B, Sever PS, Poulter NR. Metabolic syndrome, independent of its components, is a risk factor for stroke and death but not for coronary heart disease among hypertensive patients in the ASCOT-BPLA. Diabetes Care. 2010; 33: 1647-1651

Harzallah F, Alberti H, Ben Khalifa F. The metabolic syndrome in an Arab population: a first look at the new International Diabetes Federation criteria. *Diabet Med.* 2006; 23, 441–444

Kahn R. Metabolic syndrome: is it a syndrome? Does it matter? Circulation 2007; 115: 1806-1810

Kassi E, PanagiotaPervanidou P, Kaltsas G, Chrousos G: Metabolic syndrome: definitions and controversies. *BMC Med.* 2011; 9:48. 18-7

Kengne AP, Limen SN, Sobngwi E, Djouogo CFT, Nouedoui C: Metabolic syndrome in type 2 diabetes: comparative prevalence according to two sets of diagnostic criteria in sub-Saharan Africans. *DiabetolMetabSyndr.* 2012, 4:22

Konecny T, Kara T, Somers VK. Obstructive sleep apnea and hypertension: an update. Hypertension 2014; **63**: 203-209

Lone S, Lone K, Khan S, Pampori RA. Assessment of metabolic syndrome in Kashmiri population with type 2 diabetes employing the standard criteria's given by WHO, NCEPATP III and IDF.*J Epidemiol Glob Health.* 2017; 7(4):235-239.

Mancia G,Bombelli M, Corrao G, Facchetti R, Madotto F, Giannattasio C, Trevano FQ, Grassi G, Zanchetti A, Sega R. Metabolic syndrome in the Pressioni Arteriose Monitorate E Loro Associazioni (PAMELA) study: daily life blood pressure, cardiac damage, and prognosis. Hypertension. 2007; 49: 40-47

Mottillo S, Filion KB, Genest J, et al. The metabolic syndrome and cardiovascular risk a systematic review and meta-analysis. *J Am CollCardiol.* 2010; 56:1113-32. 5,41

Mulè G, Calcaterra I, Nardi E, Cerasola G, Cottone S. Metabolic syndrome in hypertensive patients:An unholy all iance. *World J Cardiol. 2014;* 26; 6(9): 890-907.

Ogbera OA. Prevalence and gender distribution of the metabolic syndrome. *DiabetolMetabSyndr.* 2010; 2:1.

Pokharel et al.: Prevalence of metabolic syndrome in Nepalese type 2 diabetic patients according to WHO, NCEP ATP III, IDF and Harmonized criteria. *Journal of Diabetes & Metabolic Disorders.* 2014; 13:104.

Polotsky HN, Polotsky AJ. Metabolic implications of menopause. *SeminReprod Med* 2010; 28:426-34.

Protopsaltis I, Nikolopoulos G, Dimou E, Brestas P, Kokkoris S, Korantzopoulos P, Melidonis A: Metabolic syndrome and its components as predictors of all-cause mortality and coronary heart disease in type 2 diabetic patients. *Atherosclerosis.* 2007; 195:189–194.

Reaven GM. Banting lecture 1988 role of insulin resistance in human. *Diabetes* 1988; 37:1595–607.

Salagre SB, Itolikar SM, Churiwala JJ. Prevalence and Clinical Profile of Metabolic Syndrome in Hypertensive Subjects. *J Assoc Physicians India.* 2016 ;64(4):22-24

Scholze J, Alegria E, Ferri C, Langham S, Stevens W, Jeffries D, Uhl-Hochgraeber K. Epidemiological and economic burden of metabolic syndrome and its consequences in patients with hypertension in Germany, Spain and Italy; a prevalence- based model. BMC Public Health 2010; 10: 529

Sibai AM, Obeid O, Batal M, Adra N, El Khoury D, Hwalla N. Prevalence and correlates of metabolic syndrome in an adult Lebanese population. *CVD Prevention and Control.*2008; 3: 83-90.

Tjepkema M. Adult obesity. Health Rep. 2006;17:9-25

Tong PC, Kong AP, So WY, Yang X, Ho CS, Ma RC, Ozaki R, Chow CC, Lam CW, Chan JC, Cockram CS: The usefulness of the International Diabetes Federation and the National Cholesterol Education Program's Adult Treatment Panel III definitions of the metabolic syndrome in predictin coronary heart disease in subjects with type 2 diabetes. Diabetes Care. 2007; 30:1206–1211.

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