Prevalence of Metabolic Syndrome in Saudi Arabia: A Meta-Analysis of Cross-sectional Studies

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Abstract

Metabolic syndrome is a cluster of health problem that lead to health condition. An individual with metabolic syndrome may higher risk of cardiovascular or neurological disorder. The aim of this study was review and provides the prevalence of metabolic syndrome in Saudi Arabia. Literature searches were performed on PubMed, Google scholar, and Web of Science Core Collection for English language articles for population-based of national studies. The following search terms were used during search; "prevalence of metabolic syndrome in Saudi Arabia," "metabolic syndrome in Saudi Arabia." Nineteen studies were selected for final review out of 50 studies. The weighted pooled prevalence of metabolic syndrome was 30.0% with high heterogeneity (I^2=99.22%; Cochran Q-test p<0.001). The result showed comparatively high and rising rate of metabolic syndrome in Saudi Arabia. Preventative strategy should be considered to reduce the risk of morbidity or mortality related to metabolic syndrome.

Keywords: Prevalence of metabolic syndrome; Meta-analysis; Saudi Arabia

Introduction

The metabolic syndrome is common metabolic disorders that result from changing lifestyle and increasing obesity. Various metabolic factors involve in development of cardiovascular disease, such as type 2 diabetes (insulin resistance, glucose intolerance, impaired glucose tolerance, or impaired fasting glycaemia), central obesity, dyslipidemia, and hypertension. [1] These conditions co-occur in an individual more often than might be expected by chance. When grouped together, they are associated with increased risk of cardiovascular disease. [2] There are four most used definitions of metabolic syndrome including World Health Organization (WHO), European Group for Study of Insulin Resistance, National Cholesterol Education Program (NCEP) Adult Treatment Panel III (ATP III), and International Diabetes Foundation (IDF). The components of theses definitions relatively are the same, and generally include Impaired Fasting Glucose (IFG), Impaired Glucose Tolerance (IGT), HOMA-IR, obesity, dyslipidemia, hypertension (WHO criteria), waist circumference, blood pressure. Fasting triglyceride, fasting high density lipoprotein (HDL), Fasting Blood Glucose (FBS) (NCEP ATP III criteria). [3]

The prevalence of Mets in the Saudi Arabia and other Middle East countries range from 18% to 40% depending on the definition used, studied population and another sociodemographic characteristic. [4-12] In Saudi Arabia, economic and social transformations have brought about a change in a sedentary lifestyle resulting in increasing prevalence of obesity and an estimate expected rise of Mets. There are serious implications of this trend on morbidity, mortality, and health services expenditure. This study is the first to provide a Meta-Analysis of the overall prevalence of the Mets in the Saudi Arabia. Providing evidence-based prevalence rate could provide fundamental foundation to provide scientifically supportive evidence for metabolic syndrome prevention campaign.

Literature Review

This study is a systemic review and accompanied by meta-analysis according to the PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis protocol). [13,14]

Data sources and search phrases

Electronic literature searches of PubMed database, Google Scholar, and Web of Science collection and analysis were conducted for English-language articles without time filtering and for the population-based or national studies on the prevalence of metabolic syndrome in Saudi Arabia. Following search terms were used simultaneously to find articles in the databases: "prevalence of metabolic syndrome in Saudi Arabia" and "Metabolic syndrome in Saudi Arabia".

Study selection procedure

Selected articles were considered for inclusion if they reported data from an original study and reported on the prevalence of metabolic syndrome. Review articles were excluded. This study used broad inclusion criteria to provide comprehensive systemic reviews of the topic. There were no restrictions on study type of study which included cohort study and cross-sectional study, geographic region (urban, rural) or age range. Studies that reported the prevalence of metabolic syndrome in the general population were also included. Studies which reported on specific clinical population that included individuals with diabetes, hypertension, acute coronary syndrome, or ovary syndrome were excluded. In addition, studies that did not report on the prevalence of metabolic syndrome and review papers for

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prevalence of metabolic syndrome were also excluded. During the final stage of the inclusion and exclusion process, initially selected articles were screened and reviewed based on the full text.

Data extraction

The following were extracted from each study: information on the authors, year of publication, country of origin, sample size, gender and age of the subjects, and study design (case-control, cross-sectional or prospective cohort), Metabolic syndrome identification criteria, prevalence of metabolic syndrome, adjustment variables. Regarding considerable expected heterogeneity, random-effect model was applied for the analysis of data. In addition, Cochran Q-test was used to assess the heterogeneity among the studies.

Data synthesis and statistical analysis

Management and edition of data, estimation of standard error, and calculation of the pooled mean effect size were estimated using Comprehensive Meta-Analysis Software (CMA) Version 2.0 (Biostat, Englewood, NJ, USA). Pooled estimate of prevalence was determined by the definition of metabolic syndrome (ATP III, IDF). Finally, fixed effects and random effects meta-analysis were calculated to obtain the weighted average prevalence with 95% CI (confidence interval) for the selected studies.

Results

Electronic search retrieved 50 papers on the Prevalence of Metabolic Syndrome in Saudi Arabia. After removing duplicates, reviewing title and abstracts, 22 articles remained for full text screening; main reason for exclusion was irrelevance with study objective. Of the 22 articles screened (titles and abstracts), 8 were excluded for the following reason: 7 were conducted on subject with diseases. 2 diabetic patients, 2 polycystic ovary syndrome, 1 kidney disease, 1 overweight subject and 1 chronic disease. Therefore 14 studies were finally selected for the present systematic review. The selection processes for the articles are shown in Figure 1.

Within 14 articles, 19 different studies were identified and include for the review. Among 19 studies, 4 were published before 2009 and 14 were published in the years 2011 or later. Different criteria were used to diagnose the metabolic syndrome. Nine studies used the criteria proposed by the NCEP ATP III for diagnosing the metabolic syndrome. Nine studies used the criteria and the IDF and one study used the criteria by both NCEP ATP III and IDF [Table 1]. [15-28] The metabolic syndrome prevalence rate is also shown as a forest plot for in Figure 2.

Table 2 shows pooled estimates for the prevalence rate of the metabolic syndrome. Fixed and random, Heterogeneity in the prevalence of Metabolic syndrome (I^2=99.22%; Cochran Q-test p<0.001). The prevalence of metabolic syndrome Rate was 0.30 (95% CI, 0.25-0.37).

Moreover, the pooled prevalence rate of the metabolic syndrome was estimated for the subgroups of studies [Table 3].

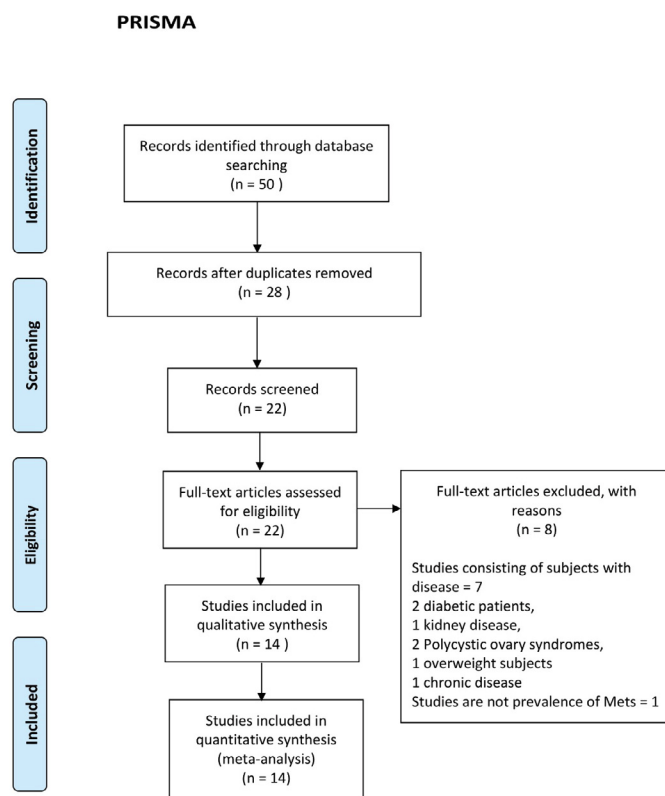The random pooled sample of the studies reported before 2013

PRISMA

Figure 1: PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis protocol) diagram for the metabolic syndrome prevalence rate in Saudi Arabia.

and after 2014 showed the metabolic syndrome prevalence of 0.28 (95% CI, 0.17-0.27) and 0.39 (95% CI, 0.31-0.48), respectively. Nine studies used the ATP III definition and the prevalence rate in the random pooled estimate was 0.26 (95% CI, 0.20-0.33). Nine studies used the IDF definition and prevalence rate in the random pooled estimate was 0.33 (95% CI, 0.23-0.46). One study used ATP III and IDF both and the prevalence rate in random pooled estimate was 0.40 (95% CI, 0.35-0.46).
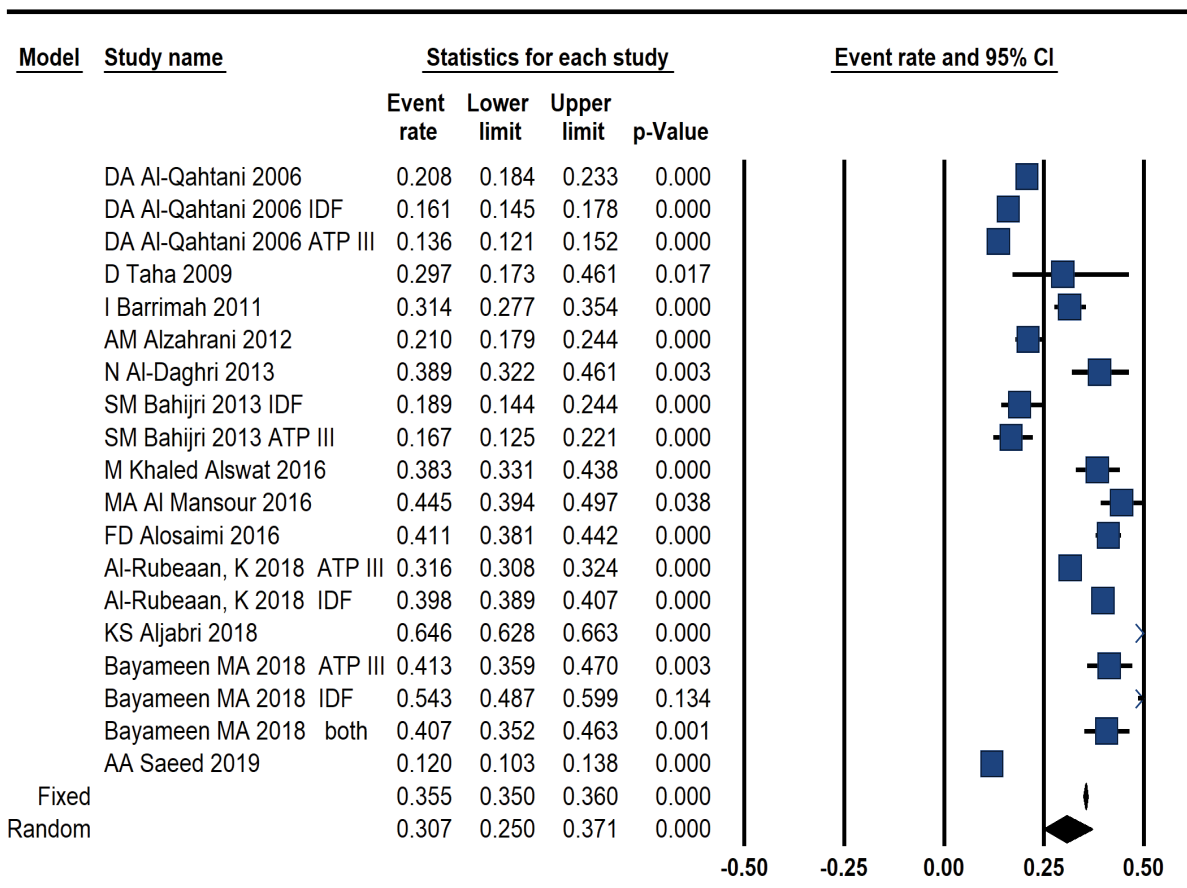
Discussion

This study was conducted to observe the prevalence rate of metabolic syndrome in Saudi Arabia. in this meta-analysis review 19 studies and 37,745 subjects were analyzed for the prevalence of metabolic syndrome. Overall, the pooled estimate of the metabolic syndrome prevalence rate in Saudi Arabia 0.30 (95% CI, 0.25-0.37) such metabolic syndrome prevalence rate in Saudi Arabia was greater than that of the other regions such as Latin America, Europe, Africa, and Asia. For example, a systematic review of the countries in the Latin America region showed the metabolic syndrome prevalence rate of 24.9% with the ATP III's the metabolic syndrome definition. [29] A combined prospective cohort study on the prevalence rate of the metabolic syndrome reports of 15.0% in Europe with WHO's metabolic syndrome definition. [30]

The prevalence rate of metabolic syndrome in the Sub-Saharan African region range from 0% to 7.3% [31] with modified WHO, ATP III and IDF definition of metabolic syndrome. A systematic review that reported the prevalence rate in the Asia-pacific region was 11.9% and 49.0% according to the definition by ATP

Authors	Type of study	Publish year	Sample size	Sex	Mets Definition	Mets Prevalence (%)	Adjustments
DA Al-Qahtani [15]	Cross-sectional	2005	1079	Male	ATP III	20.8	Age
DA Al-Qahtani [16]	Cross-sectional	2006	1922	Female	IDF	16.1	Age
					ATP III	13.6	Age
D Taha [17]	Cross-sectional	2009	37	Male/Female	ATP III	29.7	
I Barrimah, [18]	Cross-sectional	2011	560	Male	ATP III	31.4	
AM Alzahrani [19]	Cross-sectional	2012	600	Male/Female	ATP III	21.0	
N Al-Daghri [20]	Cross-sectional	2013	185	Male/Female	IDF	39.0	
SM Bahijri [21]	Cross-sectional	2013	233	Male/Female	IDF	18.9	
					ATP III	16.7	
M Khaled Alswat [22]	Cross-sectional	2016	313	Male/Female	IDF	38.4	
MA Al-Mansour [23]	Cross-sectional	2016	353	Male/Female	ATP III	44.5	
FD Alosaimi [24]	Cross-sectional	2016	992	Male/Female	IDF	41.2	
Al-Rubeaan K. [25]	Cross-sectional	2018	12126	Male/Female	ATP III	31.6	
					IDF	39.8	
KS Aljabri [26]	Cross-sectional	2018	2810	Male/Female	IDF	64.6	
					IDF	54.3	
Bayameen MA [27]	Cross-sectional	2018	300	Male/Female	ATP III	41.3	
					IDF/ATP both	40.7	
AA Saeed [28]	Cross-sectional	2019	1354	Male/Female	IDF	12.0	

Table 1: Characteristics of reviewed studies.

Model	Study name	Event rate	Lower limit	Upper limit	p-Value	Event rate and 95% CI
	DA Al-Qahtani 2006	0.208	0.184	0.233	0.000	
	DA Al-Qahtani 2006 IDF	0.161	0.145	0.178	0.000	
	DA Al-Qahtani 2006 ATP III	0.136	0.121	0.152	0.000	
	D Taha 2009	0.297	0.173	0.461	0.017	
	I Barrimah 2011	0.314	0.277	0.354	0.000	
	AM Alzahrani 2012	0.210	0.179	0.244	0.000	
	N Al-Daghri 2013	0.389	0.322	0.461	0.003	
	SM Bahijri 2013 IDF	0.189	0.144	0.244	0.000	
	SM Bahijri 2013 ATP III	0.167	0.125	0.221	0.000	
	M Khaled Alswat 2016	0.383	0.331	0.438	0.000	
	MA Al Mansour 2016	0.445	0.394	0.497	0.038	
	FD Alosaimi 2016	0.411	0.381	0.442	0.000	
	Al-Rubeaan, K 2018 ATP III	0.316	0.308	0.324	0.000	
	Al-Rubeaan, K 2018 IDF	0.398	0.389	0.407	0.000	
	KS Aljabri 2018	0.646	0.628	0.663	0.000	
	Bayameen MA 2018 ATP III	0.413	0.359	0.470	0.003	
	Bayameen MA 2018 IDF	0.543	0.487	0.599	0.134	
	Bayameen MA 2018 both	0.407	0.352	0.463	0.001	
	AA Saeed 2019	0.120	0.103	0.138	0.000	
Fixed		0.355	0.350	0.360	0.000	
Random		0.307	0.250	0.371	0.000	

Meta Analysis

Figure 2: Forest plot for the metabolic syndrome prevalence rate of Saudi Arabia.

Table 2: Overall pooled estimation of the metabolic syndrome prevalence rate.					
Model	No. of studies	Sample size	Pooled prevalence	95% Confidence interval	P-value
Fixed	19	37745	0.35	0.35-0.36	<0.00*
Random	19	37745	0.30	0.25-0.37	<0.00*

*P<0.05

Table 3: Summary of the main result reviewed article.					
Variables	No. of studies	Sample size	Effect size (95% CI)	Effect size (95% CI)	P-value
			Fixed pooled prevalence	Random pooled prevalence	
Year of study					
2005-2013	9	6771	0.19 (0.18-0.20)	0.21 (0.17-0.27)	<0.00*
2016-2019	10	30974	0.38 (0.37-0.38)	0.39 (0.31-0.48)	<0.00*
Diagnostic Criteria					
ATP III	9	17210	0.29 (0.28-0.30)	0.26 (0.20-0.33)	<0.00*
IDF	9	20235	0.40 (0.39-0.41)	0.33 (0.23-0.46)	<0.00*
ATP III/IDF	1	300	0.40 (0.35-0.46)	0.40 (0.35-0.46)	<0.00*

*P<0.05

III and modified ATP III, respectively. [32] On other hand, the prevalence rates reported by national survey in the Unites States were 35% and 39% according to the definitions by the ATP III and IDF, respectively. [33] Therefore, the prevalence rate for the metabolic syndrome was high in comparison to some for the regions such as Africa or Asia while still lower than the region such as the United States [34].

Conclusion

Over the few decades, may of the City of Saudi Arabia have experienced rapid wealth and corresponding urbanization. Such changes have led to a sedentary lifestyle by the general population due to rapid increase in the usage of motored vehicles for commuting. In addition, the working environment and facilities have changed to promote reduction in physical activity. The dietary patterns also changed in association with the environmental changes to promote inactivity and corresponding adult-onset diseases.

Competing Interests

The authors declare that they have no competing interests.

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