

**REVIEW****The Prevalence of Metabolic Syndrome and Its Related Factors among Adults in Palestine: A Meta-Analysis****Abdel Hamid el Bilbeisi<sup>1</sup>, Sakineh Shab-Bidar<sup>2</sup>, Diane Jackson<sup>3</sup>, Kurosh Djafarian<sup>1\*</sup>****OPEN ACCESS**

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**ABSTRACT**

**BACKGROUND:** *Metabolic syndrome (MetS) is increasingly becoming a challenging public health issue in Palestine. The current burden of MetS in the country is unknown. There has been limited research on the prevalence of MetS. This meta-analysis is the first to estimate the population prevalence of MetS and its related factors among adults in Palestine.*

**METHODS:** *A PRISMA systematic search appraisal and meta-analysis were conducted. A systematic literature search of PubMed, Scopus and Google Scholar was conducted in December 2014 up to February 2015. Generic, methodological and statistical data was extracted from the eligible studies which reported MetS prevalence. A random effect meta-analysis was conducted on crude MetS prevalence rates. Heterogeneity was assessed by Cochran's Q and I<sup>2</sup> tests. Subgroup analyses were also performed according to the predefined criteria.*

**RESULTS:** *The literature search yielded a total of 49 studies. Eight papers were included in the final analysis with sample size ranging 163 to 992. In addition, 2937 cases with MetS among people aged 15 years or more were estimated in Palestine between 2001 and 2014. There was high heterogeneity among studies (I<sup>2</sup> = 95.8% p<0.001). The prevalence of MetS was 37.0% among adult Palestinians population ranging from 17 to 59.5%. Subgroup analysis did not show source of heterogeneity based on subject's health status and MetS criteria.*

**CONCLUSION:** *Our meta-analysis clearly demonstrates that MetS is highly prevalent (37.0%) among Palestinian adults. The high prevalence of MetS in Palestine should be seriously considered and planners should take steps to reduce it.*

**KEYWORDS:** *Prevalence, Metabolic syndrome, Meta-analysis, Palestine*

## INTRODUCTION

It is observable that cardiovascular disease (CVD) and associated premature mortality have become a major concern in adult Palestinian population. In addition, people with MetS carry a much higher risk of CVD. MetS is a cluster of the most dangerous heart attack risk factors: diabetes, raised fasting plasma glucose, abdominal obesity, high cholesterol and high blood pressure (1-3). Based on reports, around 20-25 percent of the world's adult population have the MetS, and mortality rate among these people is twice as likely from heart attack, and three times as likely from stroke compared with people without MetS (3). In addition, the risk of developing type 2 diabetes among people with MetS is a fivefold (4). The clustering of CVD risk factors that typifies MetS is now considered to be the driving force for a new CVD epidemic (5). A number of expert groups have developed clinical criteria for the MetS. The most widely accepted of these were produced by the World Health Organization (WHO), the European Group for the Study of Insulin Resistance, the National Cholesterol Education Program-Third Adult Treatment Panel (NCEP/ATP III) and the International Diabetes Federation definition (IDF) (4-7).

The underlying cause of the MetS continues to challenge the experts but both insulin resistance and central obesity are considered the main causes (8). Genetic and environmental factors such as sedentary lifestyle, unhealthy dietary habits and high rates of cigarette smoking contribute to MetS development (9). In the general population, genetic and geographical environment differences might partially be responsible for the prevalence rates of MetS alter in different countries (9-12). Despite the importance of MetS in the context of metabolic and CVD in Palestine, few studies have described the prevalence of MetS and its related factors, hence restricting the quality of information available on the magnitude of this problem in the country. Gathering reliable information about the prevalence of MetS and its related factors in various populations can be very effective in the planning and use of preventive strategies for such diseases. Moreover, the current burden of MetS in Palestine is unknown.

Therefore, to help provide a clearer picture of the current situation in Palestine, we conducted a meta-analysis with an objective to clarify the prevalence rate of MetS and its related factors among the adult Palestinian population. The findings of this study will give baseline information about the prevalence of MetS and its related factors among the adult Palestinian population.

## METHODS

Literature searches of PubMed, Scopus and Google scholar for publications in English were conducted in December 2014 up to February 2015 for all published data related to MetS in Palestine. Unpublished studies were not retrieved. To maximize the possibility of including all relevant studies, the following search strategy was used: ("Metabolic syndrome" OR "Syndrome of Affluence" OR "Plurimetabolic syndrome" OR "Syndrome X" OR "Metabolic syndrome X" OR "Reaven syndrome" OR "Insulin resistance syndrome" OR "Insulin resistance/hyperinsulinemia syndrome" OR "Atherothrombogenic syndrome" OR "Metabolic cardiovascular syndrome" OR "Syndrome X plus" OR "Deadly quartet" OR "Cardiovascular and metabolic syndrome" OR "Dysmetabolic syndrome X" OR "MetSyn" OR "Wohlstands syndrome" OR "Android obesity syndrome" OR "Dysmetabolic syndrome" OR "Hypertriglyceridemic syndrome" OR "Obesity syndrome" OR "Obesity dyslipidemia syndrome" OR "Hypertriglyceridemic waist") AND (Palestine OR West Bank OR Jenin OR Tubas OR Tukarml OR Nablus OR Qalqilya OR Salfit OR Ramallah OR Jericho OR Jerusalem OR Bethlehem OR Hebron OR Gaza Strip OR North Gaza OR Gaza Governorate OR Deir Al Balah OR Khan Yunis OR Rafah)). Thirteen, thirty-three and six articles were found in the databases PubMed, Google scholar and Scopus, respectively. To satisfy the analysis requirements and reduce selection deviation, the selected studies were required to meet the following criteria: 1) a population-based study conducted in Palestine; 2) studies with random sampling and sufficient information of sample size, 3) crude prevalence of MetS, 4)

participants aged of 15 years or above and 5) use of MetS diagnostic criteria. The total number of articles found was 49. According to the PRISMA flow chart, ten of the articles after duplicates were removed, twenty-one of articles were excluded because their title and abstract were not related to prevalence of MetS and not compatible with the study objective while eighteen of full text articles were assessed for eligibility. Only eight papers were included in the final analysis. After determining the qualified papers, data were extracted according to a standard protocol. To improve accuracy and critical appraisal, data extraction was conducted by two independent researchers, and disputes between researchers were resolved through consensus. Generic, methodological and statistical information was extracted from the eligible studies which reported MetS prevalence including age, sex, geographical location, year of publication, sample size and prevalence of MetS. A random effect meta-analysis was conducted on crude MetS prevalence rates, and heterogeneity was assessed by Cochran's Q and  $I^2$  tests(13,14). The presence of heterogeneity was determined by the  $\chi^2$  test with a significance level of  $<0.1$  combined with an  $I^2$  statistic for estimates of inconsistency within the meta-analyses. The  $I^2$  statistics estimates the percent of observed between-study variability due to heterogeneity rather than chance; ranges from 0 to 100 percent. For this review, we determined that  $I^2$  values above 75% were indicative of significant heterogeneity warranting analysis with a random effect model as opposed to the fixed effect model to adjust for the observed variability between studies. Subgroup analyses were also performed according to the predefined criteria including health status, age and criteria used for MetS. Egger test was conducted to examine potential publication bias.

## RESULTS

Flow chart of the study is shown in Figure 1. A total of 49 articles were found in the initial search

and after removing duplicates and screening, eight articles were included in the study. Included studies were from 2001 to 2013 in West Bank, Jerusalem and Gaza Strip. The total sample size of the eight included studies was 2937 subjects (ranging 163-992). The age range of the participants was 16 to 65, and the criteria used to assess MetS in these studies were NCEP/ATP III, WHO and IDF criteria; NCEP/ATP III was the most often used. Characteristics and data of the articles are presented in Table 1. The prevalence of MetS by random effect was 37.0% (95% CI=0.25%-0.45%) (Figure 2). The heterogeneity was  $I^2 = 95.8\%$ ,  $p = 0.000$ ). The subgroup analysis by subject health status and MetS criteria (IDF vs. NCEP/ATP III) did not remove heterogeneity among studies. There was no evidence of publication bias (Egger's test  $\beta_0$ : 11.8;  $p=0.07$ ). With respect to factors associated with MetS, our results showed that the prevalence of MetS varied depending on the definition used for diagnosing MetS. IDF's definition provided significantly higher prevalence (mean = 43.7%) of MetS in Palestinian adults compared to NCEP/ATP III's definition (mean = 37.27%) and WHO's definition (mean = 17%). In addition, the MetS is more prevalent in women (mean = 42.55%) than men (mean = 35.41%). Also, the prevalence of overall obesity was 51.95% and 37.8% in women and men respectively. Furthermore, in our meta-analysis, the studies which used IDF criteria for MetS showed that the prevalence of MetS increased by age. Moreover, our results showed that the prevalence of MetS appeared to be high among unhealthy participants (studies were done on patients) (mean = 48.67%) compared to healthy participants (mean = 25.62%) in all included studies. Finally, our results showed that the prevalence of MetS in Palestinian's adults residing in northern Palestine (West Bank governorates (mean = 38.05%)) was higher than those residing in southern Palestine (Gaza Strip governorates (mean = 36.25%)).

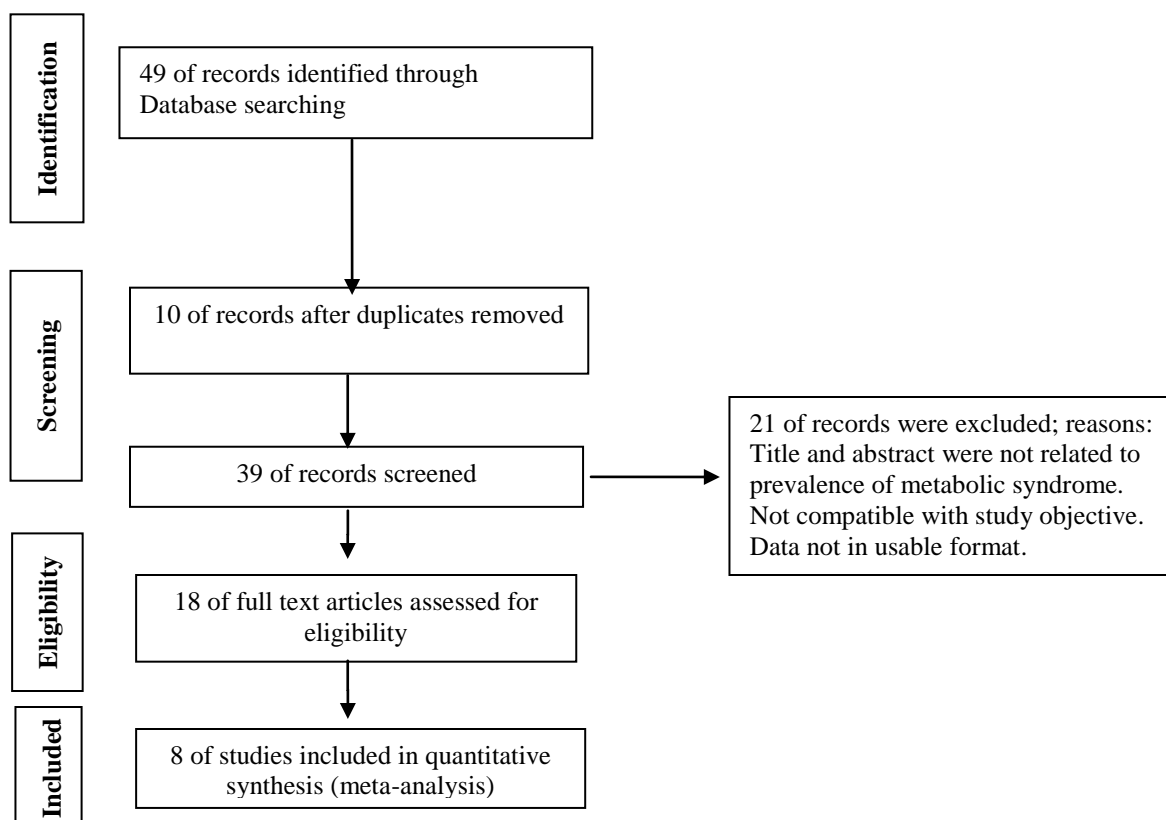


Figure 1: Results of the systematic literature search

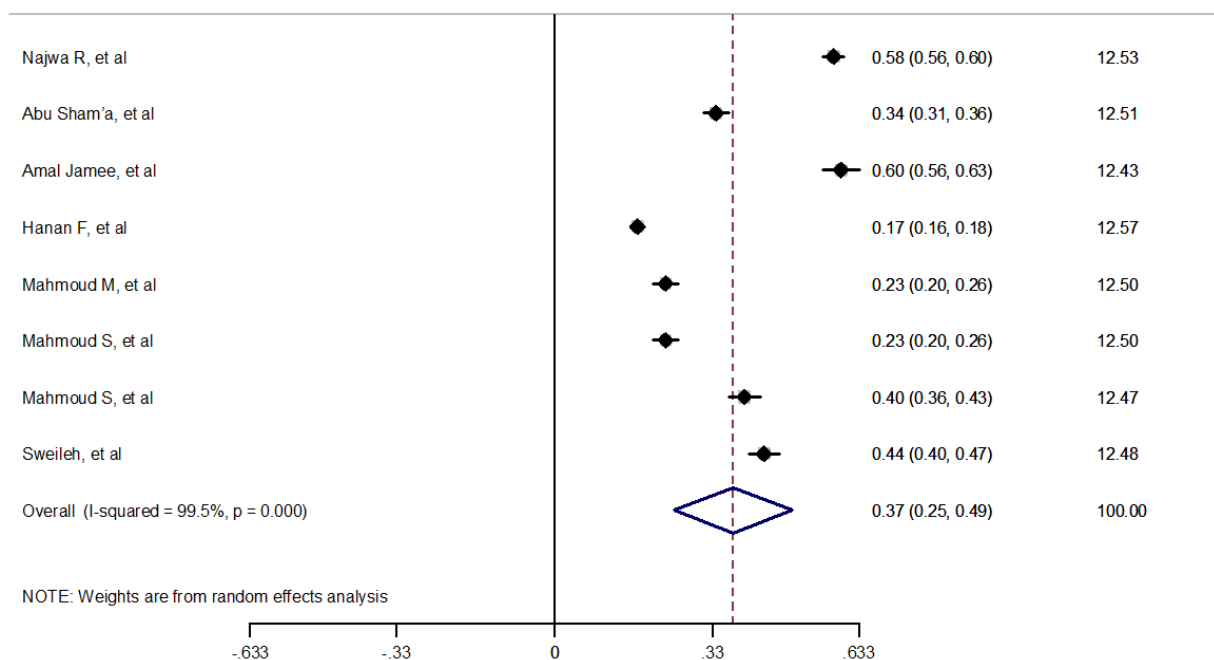


Figure 2: The prevalence of MetS.

Table 1: Characteristics of MetS included studies in meta-analysis

ID	1 (13)	2 (14)	3 (15)	4 (16)	5 (17)	6 (18)	7 (18)	8 (19)
	risk factors for coronary heart disease in Palestinian women in two refugee camps in West Bank: a population based cross-sectional	MetS and cardiovascular risk factors among Palestinians of East Jerusalem	Risk Factors of Metabolic Syndrome among Clinic Patients in Gaza - Palestine	The Metabolic Syndrome in the West Bank Population	metabolic syndrome and associated socioeconomic and demographic factors among Palestinian adults (20-65 years) at the	the (NCEP/ATP III) and the (IDF) definitions in diagnosing metabolic syndrome (MetS) among Gaza	the (NCEP/ATP III) and the (IDF) definitions in diagnosing metabolic syndrome (MetS) among Gaza	Prevalence of metabolic syndrome among patients with Schizophrenia in Palestine
	Amal Jamee, et al	Abu Sham'a, et al	Amal Jamee, et al	Hanan F, et al	Mahmoud M, et al	Mahmoud S, et al	Mahmoud S, et al	Sweileh, et al
	The lancet	Journal of Health	American Journal of CVD Research	Diabetes Care Journal	Elsevier Journal	Elsevier Journal	Elsevier Journal	BMC Psychiatry
	2010	2009	2013	2001	2011	2012	2012	2012
	West Bank	Jerusalem	Gaza Strip	West Bank	Gaza Strip	Gaza Strip	Gaza Strip	West Bank
	500	342	163	992	230	230	230	250
	IDF	IDF	NCEP/ATP III	WHO	NCEP/ATP III	NCEP/ATP III	IDF	NCEP/ATP III
	40-65	≥ 20	20-83	30-65	20-65	20-65	20-65	≥ 16
	5800%	33.6%	59/500%	17/100%	23/100%	23/100%	39/500%	43/600%
	PMS1	PMS1	PMS1	PMS1	PMS1	PMS1	PMS1	PMS1
	.5800	.3360	.5950	.1700	.2300	.2300	.3950	.4360
	.0220726074	.0255411604	.0384496324	.0119263533	.0277488738	.0277488738	.0322338601	.0313626529
	5811	5118	1864	0794	5102	5102	3388	4901
	.5579273925	.3104588395	.5565503675	.1580736466	.2022511261	.2022511261	.3627661398	.4046373470
	4189	4882	8136	9206	4898	4898	6612	5099
	.6020726074	.3615411604	.6334496324	.1819263533	.2577488738	.2577488738	.4272338601	.4673626529
	5811	5118	1864	0794	5102	5102	3388	4901
	52.50	38.00	51.50	47.50	42.40	42.50	42.50	41.90
	Mean of age	Mean of age	Mean of age	Mean of age	Mean of age	Mean of age	Mean of age	Mean of age

**DISCUSSION**

To the author's knowledge, the present meta-analysis is the first to demonstrate the prevalence of MetS in Palestinian's adults. In this meta-analysis, after

random effect model meta-analysis, results showed that the prevalence of MetS in Palestinian adults is about 37.0%. There was a considerable heterogeneity among the included studies. In order to reduce the heterogeneity, we divided the studies into



subgroups by subject's health status and MetS criteria to achieve homogeneity. Nonetheless, homogeneity was not achieved. MetS is a global problem, approximately around a quarter of the world's adult population has MetS (15), and one fourth of the European adult population was estimated to have MetS (15). In the Middle East, the MetS affects about one in four people and its prevalence increases with age (16). In our meta-analysis, the prevalence of MetS was relatively high compared to US (17), Europe (18), China (19) and Iran (20) and varied depending on the definition used for diagnosing MetS. IDF's definition provided significantly higher prevalence (mean = 43.7%) of MetS in Palestinian adults compared to NCEP/ATP III's definition (mean = 37.27%) and WHO's definition (mean = 17%) (10-12, 21-24). The high prevalence of MetS may be related in part to differences in the definitions used and the populations studied. Therefore, the use of a single criterion would identify the prevalence of MetS with greater sensitivity. Other factors that could explain the difference include different lifestyles and different socioeconomic status. According to previous studies in Jordan (25), Turkey (26), Tunisia (27), Saudi (28), and Iran (20), the prevalences of MetS were 36.3%, 33.9%, 24.3%, 21%, and 34.7% respectively. The prevalence of MetS in those studies is approximately the same as what was found in this review. Furthermore, the prevalence of MetS was higher among females in these countries (20, 25-28). Our results showed that the MetS is more prevalent among women (mean = 42.55%) than among men (mean = 35.41%) which is a common finding in previous studies (29-32). In Arab countries, women had a higher prevalence of MetS compared to men (33-35). This also fits with the Palestinians and is related to the higher incidence of obesity among women (36-38).

In our meta-analysis, the prevalence of overall obesity was 51.95% and 37.8% in women and men respectively. Multiple pregnancies, high unemployment, over-eating, little physical activity and a loss of interest in body shape after marriage and childbirth (which is related to cultural and social restrictions) are associated with increased prevalence of obesity in women (36). Age is another important and strongly associated risk factor for MetS (39). In our meta-analysis, the studies which used IDF's criteria for MetS showed that the prevalence of MetS increased by age (11, 12, 23). The positive associations of aging with hypertension, diabetes and

obesity were illustrated among Palestinian adult population (21). Moreover, continuously increasing weight in women with age could in part be an effect of premenopausal and menopausal disturbances which was found to be associated with visceral fat accumulation and acute increase of insulin resistance (40). In addition, our results showed that the prevalence of MetS appeared to be high among unhealthy participants (studies were done on patients) (mean = 48.67%) compared to healthy participants (mean = 25.62%) in all included studies. Furthermore, our results showed that the prevalence of MetS in Palestinian adults residing in northern Palestine (West Bank governorates (mean = 38.05%)) was higher than those residing in southern Palestine (Gaza Strip governorates (mean = 36.25%)) indicated that the prevalence of MetS may be affected by different geographical area.

One limitation of this meta-analysis was the heterogeneity in the criteria used to define MetS among studies. The strength of this study is that it is the first study which shows the prevalence of MetS in Palestinian adults. The present meta-analysis study may provide a baseline data on the prevalence of MetS in Palestinian's adults and can guide other researchers to design new studies.

In conclusion, our meta-analysis clearly shows that MetS is highly prevalent (37.0%) among Palestinian adults. The high prevalence of MetS in Palestine should be seriously considered by stakeholders to reduce it. Future prospective studies investigating the prevalence of MetS and its components among Palestinian population would benefit from using a single, universally accepted diagnostic tool for MetS. This would enable prevalence estimates to be compared and monitored.

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