

Prevalence of Metabolic Syndrome in Iranian Hemodialysis Patients: A Systematic Review and Meta-analysis

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Abstract

Introduction: Metabolic syndrome as one of the risk factors for cardiovascular diseases has recently been the focus of clinical studies. This study was conducted to determine the prevalence of metabolic syndrome in hemodialysis patients in Iran.

Methods: The present systematic review was done using Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist. Case-control, cohort and cross-sectional studies conducted in Iran were included. Clinical trials, case reports, letters to editors, systematic reviews, study protocols, narrative reviews, and case series were excluded. Subgroup analysis was conducted for determining the heterogeneity based on the participants as well as their gender. Meta-analysis was conducted using STATA version 14.0.

Results: The prevalence of metabolic syndrome among 799 patients was 50% (95% CI: 47.0, 53.0, $I^2=50.6$). The analysis of subgroups was conducted for determining the heterogeneity based on the participants as well as their gender. Based on the analysis of the subgroups using a random effects model, the prevalence of metabolic syndrome was found to be 44% and 55% in Iranian men and women undergoing hemodialysis, respectively.

Conclusion: Given the high prevalence of metabolic syndrome in hemodialysis patients, it is advisable and logical that patients with chronic renal failure should be regularly evaluated for metabolic syndrome and cardiovascular risk factors both at the diagnosis time and afterwards.

Keywords: Metabolic syndrome, Hemodialysis, Dialysis, Kidney failure

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Introduction

Despite recent achievements in the treatment of cardiovascular diseases, these diseases still are the major death causes (nearly 50%) in patients undergoing hemodialysis. The high prevalence of cardiovascular complications in renal transplant recipients depends on the presence of pre-transplantation cardiovascular diseases as well as the formation of new post-transplantation risk factors exacerbating the previous conditions. The relative risk of death in these patients is 30 to 40 times higher compared to the general population of the same age and gender. Metabolic syndrome has recently been reported as a risk factor for cardiovascular diseases and became the focus of clinical studies.¹⁻⁴

Metabolic syndrome includes the risk factors of diabetes and cardiovascular diseases including clinical findings such as low high-density lipoprotein (HDL-C) level, obesity, elevated triglyceride level, impaired glucose tolerance, and hypertension.⁵ Although the main physiopathological cause of this syndrome is still unknown, the available evidence introduces insulin resistance as the main cause of metabolic disorders.⁶ According to Adult Treatment Panel III (ATP III) criteria, the diagnosis of this syndrome is based on the presence of three or more of these symptoms. Obesity and hyperlipidemia are the prevalent findings in kidney transplant recipients that can be independent risk factors for post-kidney transplant atherosclerosis and nephropathy.⁷ The prevalence of metabolic

syndrome is directly associated with weight gain; as many as 60% of patients suffering from metabolic syndrome are fat.⁸ Even in the presence of normal blood pressure, high body mass index increases the risk of kidney failure.⁹

The relationship between metabolic syndrome and end-stage renal disease has been well recognized,¹⁰ and there is a high prevalence of metabolic syndrome among patients undergoing hemodialysis.^{11,12} However, there is little data and information on the frequency and specific features of this syndrome in hemodialysis patients in Iran. This study attempted to fill the aforementioned gap and was conducted to evaluate the prevalence of metabolic syndrome in hemodialysis patients in Iran.

Materials and Methods

Eligibility Criteria

The present systematic review and meta-analysis was done using Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) checklist.¹⁴ Case-control, cohort and cross-sectional studies conducted in Iran were included. Clinical trials, case reports, letters to editors, systematic reviews, study protocols, narrative reviews, and case series were excluded.

Participants

We included studies which were conducted on patients undergoing hemodialysis.

Outcome

The aim of the present study was to determine the prevalence of metabolic syndrome in patients undergoing hemodialysis.

Sampling Method

Observational studies conducted in Iran with any design of sampling and surveying were included. The minimum sample size required was a sample size of more than or equal to 25.

Searching Strategy

Two independent reviewers performed the search in international databases (including Web of Science, PubMed, Google Scholar, and Scopus) as well as the national databases (including Magiran and SID) for finding the related studies conducted until March 2019 (without any time limitations) in Persian and English. To achieve data saturation, the reviewers also investigated the reference lists of the investigated studies or other related reviews found in the searching process. Special searching strategies were adopted by a medical sciences librarian with the expertise in conducting systematic reviews using MESH phrases and free phrases corresponding to PRESS standard.¹⁵ After finalizing MEDLINE search strategy, it was adapted for searching in other databases. Likewise, we searched PROSPERO for finding recent or ongoing

systematic reviews. Keywords applied in searching strategy included “metabolic syndrome”, “hemodialysis”, “dialysis”, “fragile X syndrome”, “kidney failure”, and “Iran”.

Study Selection and Data Extraction

The eligibility criteria of titles and abstracts were investigated by two independent reviewers. The full texts of studies were investigated based on the eligibility criteria after excluding the duplicate studies. When needed, the essential information was acquired from the authors. General information (e.g., publication year, province, and corresponding author) and study characteristics (questionnaire design, data collection method, risk of bias, sample size, and sampling method), and output scales (frequency) were collected.

Quality Evaluation

The risk of bias assessment tool developed by Hoy et al was applied in order to evaluate the risk of bias and quality of methodology in any given observational study.¹⁶ This 10-item tool is applied for evaluating the quality of studies in terms of external validity (items 1-4; target population, sampling framework, minimum participation bias) and internal validity (items 5-9; data collection, statement of the problem, research scale, and data collection method). Item 10 evaluates data analysis bias. Two reviewers evaluated the risk of bias independently. Using a consensus method, the disagreements were resolved.

Data Aggregation

All eligible studies entered the aggregation process of the systematic review. The data were combined using a forest plot. The random effects model was evaluated with the intended frequency. The heterogeneity of the initial studies was analyzed by conducting two tests. The analysis of subgroups was conducted for determining the heterogeneity based on the participants as well as their gender. STATA version 14.0 was used to conduct the meta-analysis.

Results

Study Selection

Overall, 483 studies were obtained from the initial search. Among them, 399 non-duplicate studies were retrieved in the process of investigating the titles and abstracts, and 294 studies were excluded for having irrelevant titles. From the remaining 18 articles, 5 studies were eligible. From the 13 excluded studies, 2 were letters to editors, 6 were reviews, and 5 did not have the minimum criteria to be included (Figure 1).

Study Characteristics

The studies were done on 799 kidney failure patients undergoing hemodialysis. The patients' age ranged from 15 to 90 years. All five studies provided cross-sectional

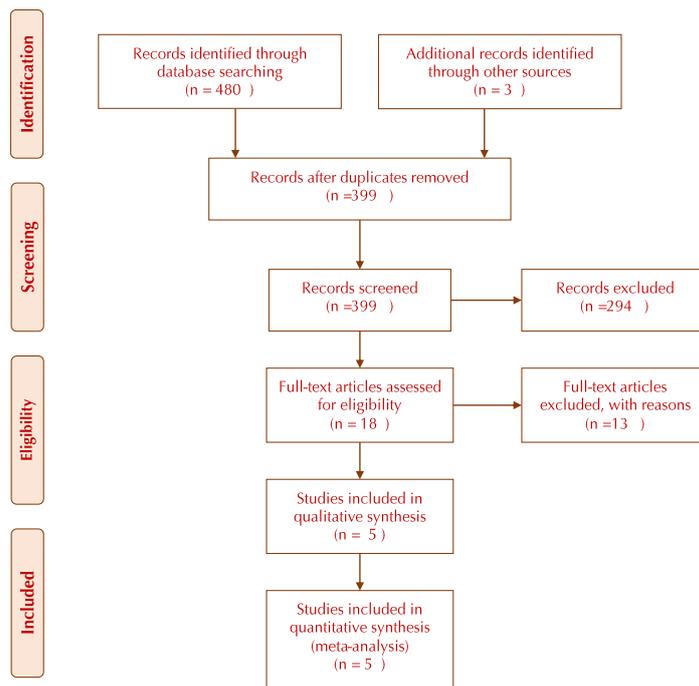


Figure 1. PRISMA Flow Diagram.

data. The studies were conducted in four provinces, and they had the required conditions to be reviewed. From these five studies, two were conducted in Tehran, and the other three studies were conducted in Gorgan, Urmia, and Zanjan. The studies used either convenience (n=4) or purposeful (n=1) sampling. Most of the studies had a low risk of bias. The most common methods of data collection were interviews and referring to the patients’ medical records. The setting used for all of the included studies was the hospital (Table 1).

Frequency of Metabolic Syndrome in Dialysis Patients

The findings of the random effects model indicated that the prevalence of metabolic syndrome among 799 patients was 50% (95% CI: 47.0- 53.0, I²= 50.6) with the degree of heterogeneity quantified by chi-square as 80.65. The analysis of subgroups was conducted for determining the heterogeneity based on the participants as well as their gender. Based on the analysis of the subgroups using a random effects model, the prevalence of metabolic syndrome was found to be 44% and 55% in men and

women, respectively (Figure 2, Table 2).

The middle point of each line segment is an estimate on the frequency and the length of the lines indicates the associated 95% confidence interval in each study. The rhombus indicates the frequency of metabolic syndrome in hemodialysis patients for all studies.

Discussion

Several studies indicated that metabolic syndrome not only is a risk factor for renal dysfunction but also is associated with the development of such diseases. The results of these studies also demonstrate a high prevalence of hypertension, low HDL, abdominal obesity, and elevated fasting blood sugar in chronic kidney disease patients undergoing hemodialysis.^{21,22} The present systematic review was conducted to evaluate the frequency of metabolic syndrome in Iranian hemodialysis patients using data sets related to the studies conducted until March 2019. Five studies were conducted on 799 patients including those with the end-stage renal disease. The

Table 1. Characteristics of the Studies

First Author	Publication Year	City or Province	Number of Participants	Prevalence	Age (Mean±SD)	Risk of Bias
Ahmadi ¹⁷	2016	Tehran	145	53.1%	58.2±16	Low
Jalalzadeh ¹⁸	2015	Tehran and Zanjan	300	50.3%	61.7±14.2	Low
Ghanei ¹⁹	2011	Urmia	132	57.6%	56.3±12.3	Moderate
Jalalzadeh ²⁰	2011	Zanjan	80	28.7%	55.6±15.6	Low
Marjani ¹⁵	2013	Gorgan	142	47.14%	Not reported	Low

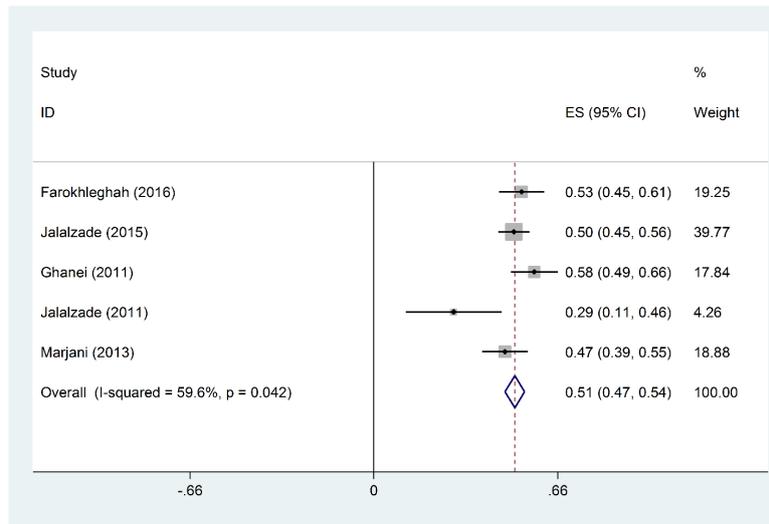


Figure 2. The Prevalence of Metabolic Syndrome in Hemodialysis Patients Based on the Random Effects Model.

findings of the present study indicated a high prevalence of metabolic syndrome in Iranian hemodialysis patients. The frequency of metabolic syndrome among 799 patients was 50% (95% CI: 47.0-53.0, $I^2= 50.6$). These findings are in line with the study conducted in the United States by Young et al. In a recent study, the prevalence of metabolic syndrome in 202 hemodialysis patients was measured to be 69.3%.²³ However, in a study conducted in Saudi Arabia by Alswat et al, the prevalence of this syndrome has been reported to be 38.2%.²⁴ This difference is likely to be resulted from the mean duration of hemodialysis in patients and different healthcare settings. According to the analysis of the subgroups using a random effects model, women were at a higher risk of suffering from metabolic syndrome. The prevalence of metabolic syndrome in men and women was found to be 44% and 55%, respectively. This is in line with the findings of the previous studies. A previous meta-analysis reported that the components of metabolic syndrome can negatively affect renal function. Moreover, hypertension was reported to be the most effective component, followed by hypertriglyceridemia,

low HDL, abdominal obesity, and impaired glucose intolerance, respectively.²¹ Metabolic syndrome increases the risk of cardiovascular disease in hemodialysis patients, which can cause more morbidity and mortality. The most prevalent associated factors in hemodialysis patients were reported to be low HDL level and hypertension, which are also well-established metabolic factors.²⁵

One of the main limitations of the present study was the limited number of studies conducted on metabolic syndrome in hemodialysis patients in Iran. However, the main contribution of the present study was a systematic revision of statistical analysis. Moreover, the present study is recognized as the first study conducted for evaluating the prevalence of metabolic syndrome in hemodialysis patients in the Iranian population. The other limitation of the present study is that the present study includes only four provinces (out of 31 Iranian provinces); this makes it difficult to generalize the findings of this study to the entire Iranian population. Although the investigators did not ignore the authors, institutes, journals, and other related information, two independent reviewers studied

Table 2. The gender-based Frequency of Metabolic Syndrome in Iranian Hemodialysis Patients

First author	95% CI (Women)				95% CI (Men)				95% CI (All)			
	Up	Down	ES	Weight	Up	Down	ES	Weight	Up	Down	ES	Weight
Ahmadi (2016, n=145)	0.65	0.48	0.57	18.05	0.51	0.45	0.43	18.12	0.61	0.45	0.53	17.55
Jalalzadeh (2015, n=300)	0.62	0.51	0.57	37.54	0.48	0.37	0.43	37.51	0.55	0.44	0.50	36.26
Ghanei (2011, n=132)	0.60	0.43	0.516	16.19	0.57	0.40	0.48	16.17	0.66	0.49	0.57	16.27
Jalalzadeh (2011, n=80)	0.69	0.48	0.588	10.08	0.52	0.30	0.41	10.07	0.38	0.18	0.28	12.03
Marjani (2013, n=142)	0.61	0.45	0.53	18.14	0.55	0.39	0.47	18.12	0.64	0.48	0.56	17.89
All	0.59	0.52	0.55	100	0.47	0.41	0.44	100	0.47	0.53	0.50	100

ES, Effect size.

the process of subject selection, and the third reviewer resolved all disagreements and the probability of bias was minimized.

To the best of our knowledge, this study is the first systematic review conducted on the frequency of metabolic syndrome in Iranian hemodialysis patients. The present study was conducted based on a systematic review plan and all information sources were searched. In the final analysis, population-based studies were also included. The method applied for evaluating metabolic syndrome was ATP III criteria that resulted in a better performance of meta-analysis.

Conclusion

The findings of this study indicated that metabolic syndrome is relatively common in Iranian hemodialysis patients, with higher frequency among women. Therefore, given the high prevalence of metabolic syndrome in hemodialysis patients, it is advisable and logical that patients with chronic renal failure should be regularly evaluated for metabolic syndrome and cardiovascular risk factors both at the diagnosis and afterwards. It is essential to conduct the interventions required to reduce these factors especially through making changes in one's lifestyle.

Ethical Approval

Not applicable.

Conflict of Interest Disclosure

There are no competing interests.

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