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Meta-analysis

Meta-analysis on prevalence of cardiovascular diseases in patients with type 2 diabetes mellitus in India

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ABSTRACT

Among various types of diabetes, type 2 diabetes mellitus (DM) is the most common type constituting 90% of the diabetic population. Out of several complications, cardiovascular disease (CVD) is predominant which leads to mortality. Various studies have reported different incidence rates of CVD in patients with type 2 DM. Hence, this meta-analysis study is aimed at determining the prevalence of CVD in patients with type 2 DM in India. In this review, studies were extracted by searching databases from PubMed, ScienceDirect, Google Scholar and Web of Science published between 2001 and 2021. The data collected from the extracted studies were analysed using comprehensive meta-analysis software which employs random effect model to combine the studies. 17 studies reviled 21.1% (95% CI: 17.9-24.7%) prevalence of cardiovascular CVDs in patients with type 2 DM in India. It is evident from literature review that women with DM are more prone CVD. If it is instituted that CVD is a major risk factor for DM in India, suitable scheme should be followed to improve the status of DM patients and should be brought to the note of hospitals.

Keywords: Diabetics mellitus, CVD, Dyslipedemia, Obesity

INTRODUCTION

Diabetes is the most common non-communicable disease globally. It is a metabolic disease in which the body does not produce enough or respond normally to insulin, causing abnormal blood sugar level.[1] The prevalence of diabetes mellitus (DM) among adult population has nearly doubled since year 1980, rising from 4.7 to 8.5%. The estimated number of adults with diabetes in 2007 was 246 million, of these 80% live in developing countries. The greatest increase in the prevalence of diabetes mellitus is reported from low and middle income countries.[2,3] There are many types of diabetes namely type 1, type 2, gestational diabetes, prediabetes, and monogenic diabetes.[4]

The International Diabetes Federation calculates that 415 million people have diabetes worldwide and 91% of the people have type 2 DM which is the commonest form of diabetes. The major burden of diabetes will occur in the developing countries.[5,6] In 2030, the prevalence of diabetes for all age groups were estimated as 4.4%.[7]

The most common complications of type 2 diabetes are high blood pressure, stroke, depression, nerve damage and heart disease viz. cardiovascular diseases (CVD), coronary artery disease (CAD) and coronary heart disease (CHD). Among this, cardiovascular complications are the most common cause of mortality in patients with DM.[8] Patients with DM have two to six fold higher incidence of CVD than non-diabetic population.[9]

In worldwide, the overall CVD affects were estimated approximately 32.2% of all persons with type 2 DM. Identification of patients at high risk for CVD could felicitate the prevention or retardation of cardiovascular events.[5,9] This is the first study aimed at performing meta-

analysis for determining the prevalence of cardiovascular disease in patients with type 2 DM in Indian population.

World's diabetic capital–India

Diabetes has revealed as a major health care problem in India. In 2007, according to the Diabetes atlas published by the International Diabetes Federation 40 million peoples with diabetes were found in India. This number will increase to almost 70 million by 2025.10 In addition, the International Diabetes Federation has stated that India currently has more than 65 million people with type 2 DM and it has been reported that prevalence of diabetes among urban participants in India is highest in the world.[11] As a result of the rapid urbanization and economic development, India will continue to have the largest number of diabetic populations. In rural population the prevalence of type 2 DM is 2.4% and in urban population the prevalence rate is 11.6%.[12] In Tamil Nadu, the prevalence of DM is 10.4% which is the second highest in India and stands next to Chandigarh which is 13.4%.[13]

Risk factors for developing CVD in patients with diabetes

Risk factors for CVD such as obesity, hypertension and dyslipidaemia are common in patients with DM, and are at increased risk for cardiac events.

Obesity

Obesity is frequent in DM, particularly type 2 diabetes mellitus.[15] It has long been established as an independent risk factor for CVD. One possible mechanism linking DM and obesity with subsequent CVD is low grade inflammation.[5]

Hypertension

Hypertension is very frequent among patients with type 2 DM, with prevalence rate of 60%.[14] Chronic activation of the renin angiotensin system (RAS) often progresses to hypertension, placing added stress on the glomeruli and causing additional damage to the nephrons.[15]

Dyslipidemia

Diabetic patients are at increased risk of developing dyslipidemia, which may lead to CVD also. One mechanism underlying this connection is increased free fatty acid release present in insulin resistant fat cells. High levels of free fatty acids promote triglyceride production, which in turn stimulates the secretion of apolipoprotein B (apo B) and very low density lipoprotein (VLDL). High levels of apo B and VLDL have both been tied to increased risk of CVD.[16]

METHODS

In this meta-analysis study, the prevalence of CVDs was evaluated in patients with type 2 DM in India based on the studies published in peer reviewed journals between 2005 and 2021. Initially, studies referring to the prevalence of CVDs in patients with type 2 DM were collected based on inclusion and exclusion criteria.

Table 1: Inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
Complications-CVD, diabetes	Unclear methodology
	Unrelated case reports
	Inaccessibility of the full text of the study

Flowchart of article selection

Out of 60 research articles selected initially only 17 articles were fruitfully for meta-analysis.

Study design

Meta-analysis was done using comprehensive meta-analysis-a clear and friendly interface software. For data extraction, all studies finally entered into meta-analysis process were prepared using checklist (Table 2). Out of multiple packages in this software, forest plot and funnel plot were performed. Study design includes 17 articles from 2001 to 2021.

Table 2: Characteristics and prevalence of CVD in patients with type 2 DM.

Author's name	Year	Sample size	Male	Female	Prevalence of CVD (%)
Mareeswaran et al	2018	400	202	198	29.5
Umamagesh	2014	249	149	200	24.5
Tungdim	2014	81	39	42	24.7
Gupta et al	2014	1669	918	751	15.7
Singh	2017	160	78	82	38.7
Ram et al	2008	2192	1053	1138	18.6
Jasmine	2020	390	97	293	29.7
Chythra et al	2010	1239	405	834	16
Gaidhane	2020	192	120	72	15
Sameena et al	2015	1412	662.228	748.36	12.7
Ramachandran et al	2001	11,216	5288	5928	12.1

Continued.

Author's name	Year	Sample size	Male	Female	Prevalence of CVD (%)
Jacob et al	2019	235	109	126	44.8
Misra et al	2017	300	142	158	25.2
Mohammed et al	2021	250	139	111	25.6
Singh	2017	569	247	322	16.3
Umesh et al	2018	1003	420	583	14.6
Sing et al	2017	4244	2548	1696	18.1

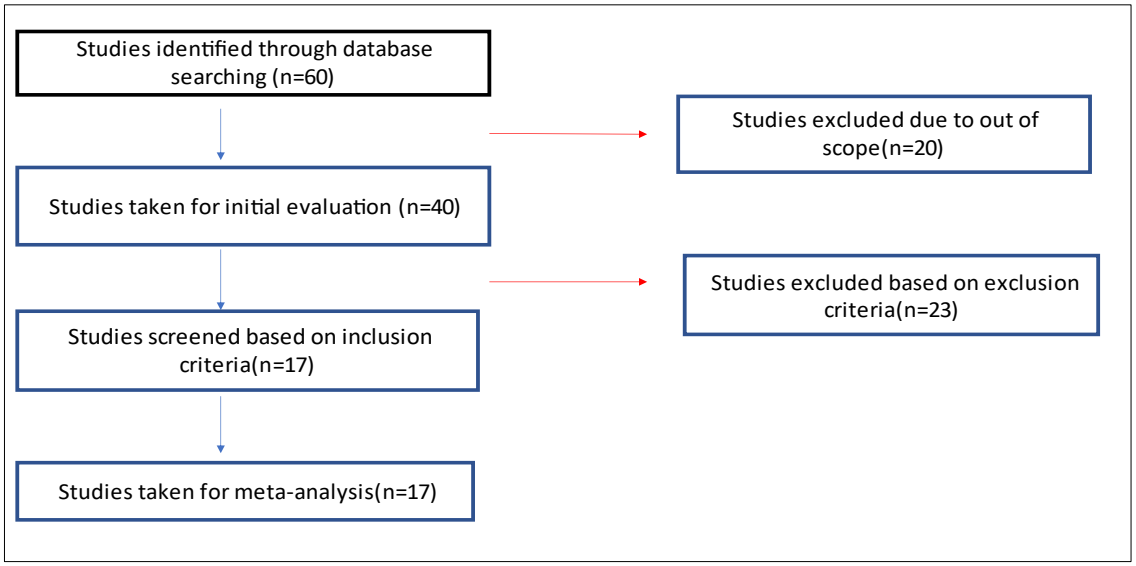

Figure 1: Flowchart of article selection process.

RESULTS

We analysed data from 17 studies with sample size of 26173 having type 2 DM. Forest plot and funnel plot of comprehensive meta-analysis software was employed for this study. Forest plot showed 21.1% (95% CI: 17.9-24.7%) (Figure 2) prevalence of CVDs in patients with type 2 DM in India. Funnel plot is a scatter plot which is primarily used for detecting bias or heterogeneity. It revealed no publication bias since 5% of the study included for this comprehensive meta-analysis lies away from the symmetrical triangle (Figure 3).

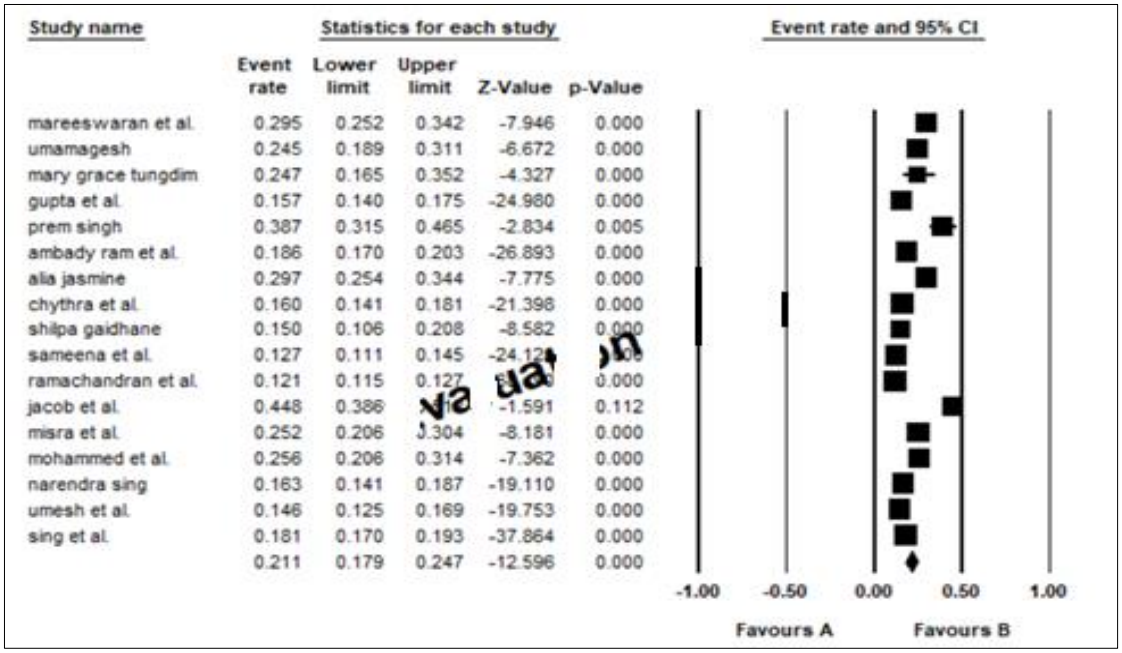

Figure 2: Random effect model of forest plot.

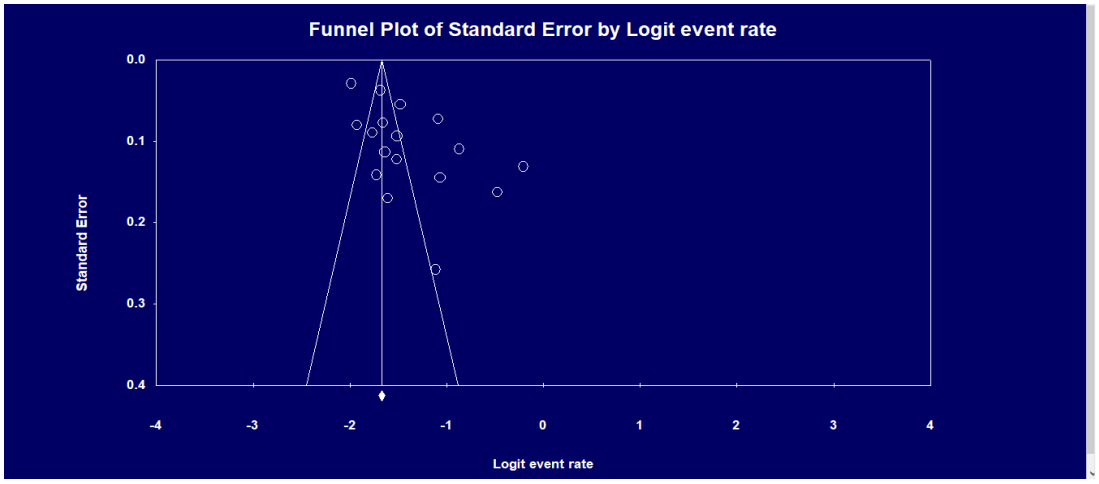

Figure 3: Funnel plot for prevalence of CVDs in patients with type 2 DM.

DISCUSSION

The aim of this study was to determine the prevalence of CVD in patients with type 2 DM in India. This disease has an increasing trend and has been predicted to rise from 171 million to 366 million in 2030.[6] This meta-analysis estimates 21.1% (95% CI: 17.9-24.7%) (Figure 2) prevalence of CVDs in patients with type 2 DM in India. In the forest plot, middle point shows the prevalence of cardiovascular disease in each study and the rhombic figure shows the prevalence of cardiovascular disease in patients with type 2 DM in India for the entire study. Due to the heterogeneity of the selected studies, random effect model was conducted to combine the studies and the prevalence estimation. According to funnel plot, no publication bias is evident since 5% of the studyincluded for this comprehensive meta-analysis lies away from the symmetrical triangle (Figure 3).

In the present study, the prevalence of CVD in patients with type 2 DM in India was 21.1% whereas Mohsen et al 2021 reported 37.4% prevalence of CVDs in patients with type 2 DM in Iran and in South Korea Moon et al 2010 reported 26% prevalence of CVDs in patients with type 2 DM.[16,17] Further Einerson et al 2018 reported 46% prevalence of CVDs in patients with type 2 DM in North America and 33.6% was in western pacific including China.[4]

The results of this study revealed that there is less prevalence rate of CVD disease in patients with type 2 DM in India which is contradictory to the statement "Worlds Diabetic capital–India". This may be due to less number of studies within a limited period is included. Perhaps if we enhance our count for a decade or more the saying diabetic capital India will be satisfied!

CONCLUSION

It is evident from literature review that women with DM are more prone CVD. If it is instituted that CVD is a major risk factor for DM in India, suitable scheme should be followed to improve the status of DM patients and should be brought to the note of hospital.

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