Prevalence of Diabetic Nephropathy in Patients with Type 1 Diabetes in Iran: A Systematic Review and Meta-Analysis

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Abstract

Background: Diabetic nephropathy (DN) is one of the complications of diabetes. The present study was conducted with the aim of determining the prevalence of DN in patients with D1T in Iran.

Methods: This meta-analysis and systematic review included the articles published from 2000 to 2022, in domestic (Iran) and international journals. Search keywords included diabetes, type 1 diabetes, D1T, nephropathy, Iran, children, and adolescents, which were searched in Persian and English. The search was conducted by two members of the research team independently and the outcomes were finally approved by the third person who was considered as the manager of the research team. The extracted data was analyzed by CMA3 software.

Results: The overall prevalence of DN was found to be 10% (confidence interval (CI) = 3.4-26.1). The lowest and highest prevalences of DN were found to be reported as 0.04% and 30.8%, respectively.

Conclusion: Considering the high prevalence of DN in patients with T1DM, it is suggested that the necessary preventive measures be taken to reduce the complications of diabetes in these patients.

Key Words: Adolescents, Children, Diabetic nephropathy, Iran, Type 1 diabetes.

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1- INTRODUCTION

Diabetes is a chronic endocrine glands disease that is associated with persistent hyperglycemia and is often caused by an absolute or relative lack of insulin secretion or insulin resistance. This disease, as a chronic disease, considerably affects the patients' lifestyle (1-3). According to the World Health Organization, the prevalence of diabetes will increase to more than 360 million people by 2030. The goal of treatment in diabetic patients is to achieve HbA1c at a normal level or close to normal (4, 5).

One of the types of diabetes is Type 1 Diabetes (D1T), which occurs in children and adolescents (6). When it is diagnosed in the early years of the child's life, the complications of the disease can be aggravated during his/her life (7, 8). D1T is caused by the destruction of B cells in the pancreas by the body's immune system, and genetic predisposition is the main reason for it. Other factors such as oxidative stress, inflammation, viral infection, and chemical exposure can also play a role in the initiation and progression of D1T (9, 10).

Complications of diabetes are psychological and physical. One of the physical complications is kidney disease; and diabetes is the most important cause of end-stage renal failure, as the most important cause of premature death of diabetic patients in the world (11, 12). In a study by Garey et al., it was reported that about 30% of D1T patients experienced mild or moderate depression, and with the increase of depression symptoms, the level of HbA1c increased (13). Also, in a review study by Smith-Palmer et al., it was shown that the D1T patients' quality of life is lower than that of healthy people (14). Also, in addition to the mentioned cases, D1T can lead to complications such as retinopathy, neuropathy, and nephropathy in patients with D1T.

DN is a clinical syndrome characterized by persistent microalbuminuria with insulin-dependent or non-insulin-dependent diabetes (17). DN is present in 15-40% of D1T patients, and excretion of Albumin from urine and reduction of glomerular filtration rate are determined (18). In fact, when long-term hyperglycemia exists in D1T patients, it can cause disorders in various organs, including the kidney. Also, in order to cause damage, the level of urinary protein should be more than 300 mg per day to diagnose Diabetic Nephropathies (DN). Different factors such as gender, age, high blood pressure, dyslipidemia, family history of DN, duration of diabetes, and genetics are effective in aggravating the symptoms (18 and 21).

In addition to identifying the pathological factors related to a disease, it is necessary to plan the prevalence of disease complications in order to reduce these complications. In fact, knowing the necessary information about the prevalence of a disease helps health policy makers to identify factors affecting the disease. Conducting meta-analysis studies can help identify the prevalence of a disease in a specific group (22, 23).

2- METHODS

Despite the importance of DN, especially in D1T patients, no systematic review and meta-analysis have been conducted on the prevalence of DN in D1T patients in Iran. Thus, the present study was conducted with the aim of determining the prevalence of DN in patients with D1T in Iran.

This meta-analysis and systematic review included the articles published from 2000 to 2022, in domestic (Iran) and international journals. Congress articles, dissertations, books, and reference sites were not entered into the study. Search keywords included diabetes, type 1 diabetes, D1T, nephropathy, Iran, children,

and adolescents, which were searched in Persian and English. Both domestic databases of Iran and the international databases were searched by 2 researchers who are proficient in the subject of the research (Msc of nursing & pediatrics specialist). Articles with incomplete data were excluded from the study.

The search was conducted by two members of the research team independently and the outcomes were finally approved by the third person who was considered as the manager of the research team. The extracted data was analyzed by CMA3 software.

3- RESULT

According to **Fig. 1**, the search was done by two people, and 248 articles were extracted. Then, the title and abstract of all the articles were studied independently by both members of the research team and according to the inclusion and exclusion criteria, 5 articles were entered into the meta-analysis stage. The total number of male and female patients was mentioned separately in 3 studies, which was 285 males, 343 females; in total 692 patients. The lowest prevalence of DN was reported as 0.04% in the study of Mostofizadeh et al., and the highest rate was 30.8% in Arad et al.
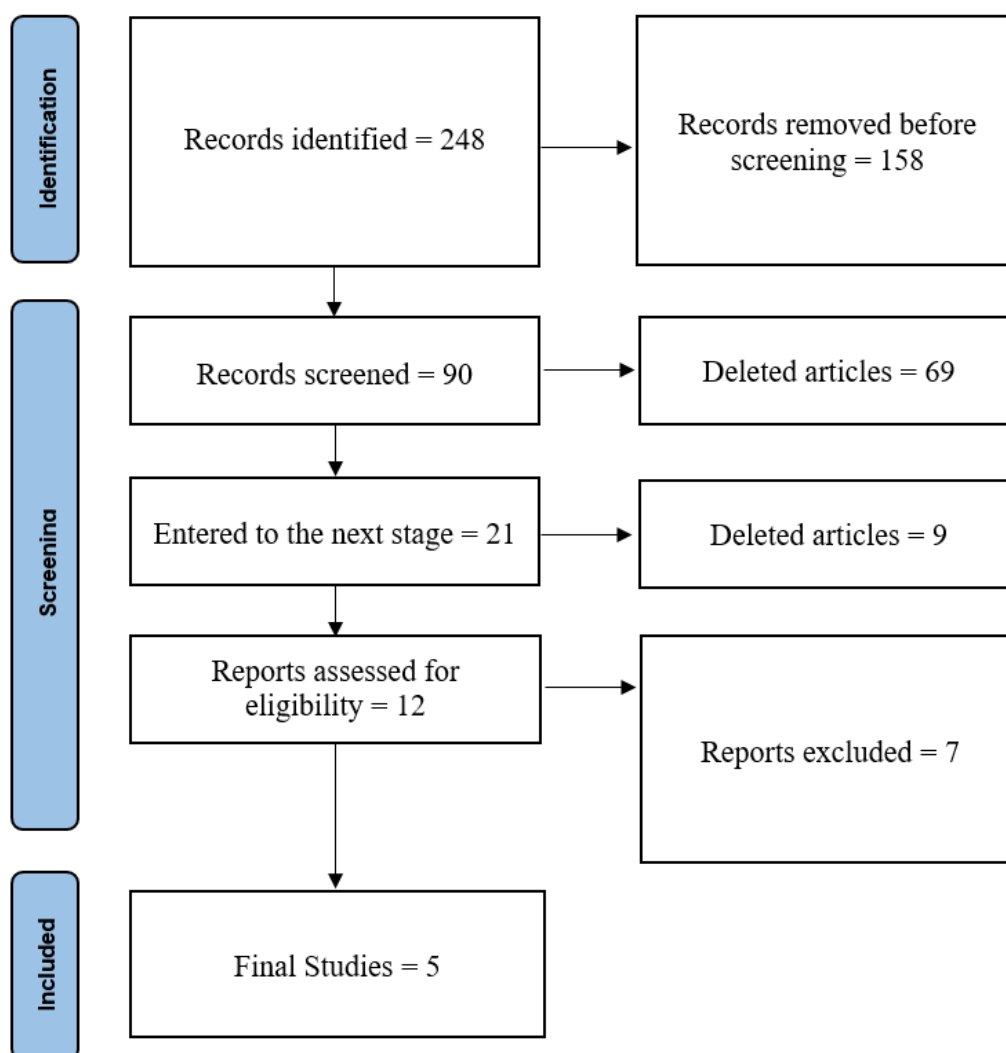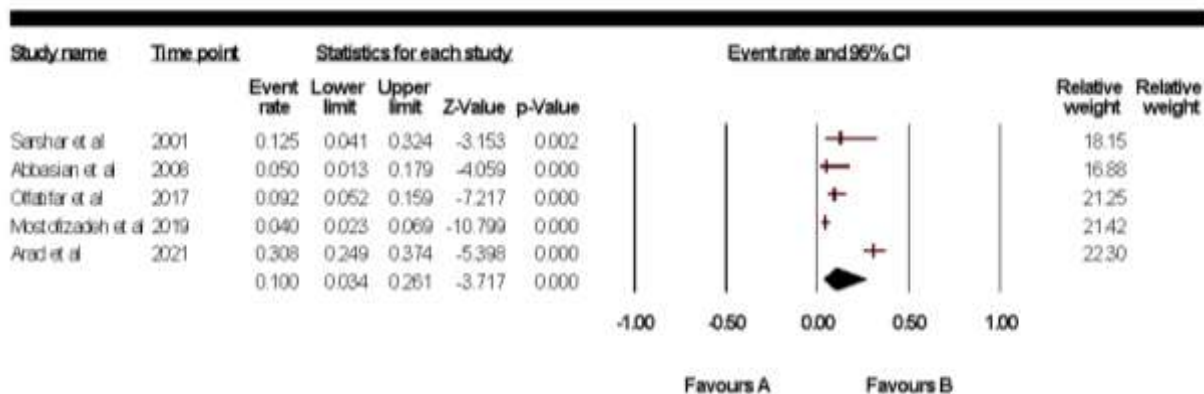

**Fig. 1:** Flowcharts for systematic review

According to the findings in **Fig. 2**, the overall prevalence of DN was equal to 10% (confidence interval (CI) = 3.4-26.1).

Fig. 3 shows the status of the Funnel plot of the included studies, and in **Fig. 4** and

Fig. 5, the prevalence of diabetic nephropathy is shown in correlation with the year of conducting the studies and the sample size.

Fig. 2: Meta-analysis of the prevalence of nephropathy in Iran (I-squared=93.773, Z value= -3.71, T au Squared=1.54)
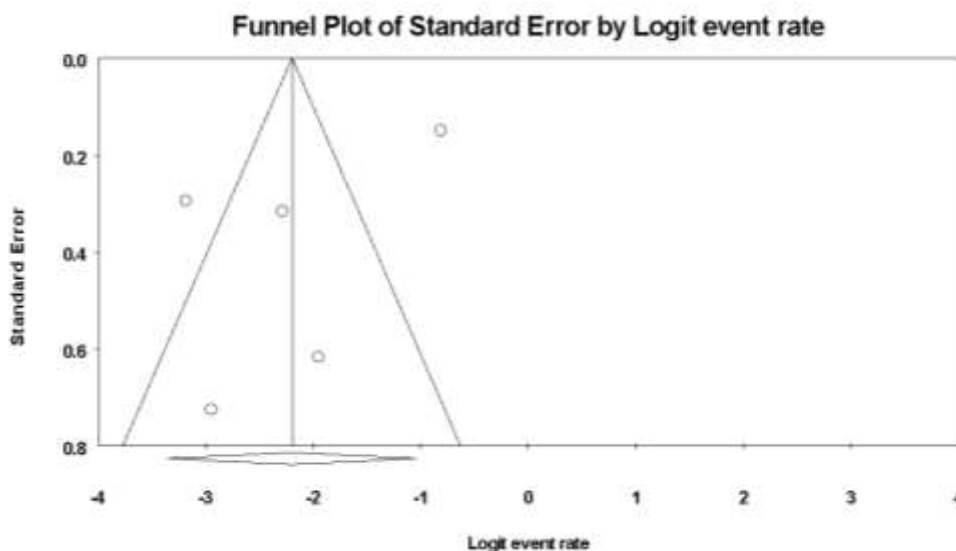
Fig 3: Funnel plot of the study (Z-value= -13.69, Event rate= 0.18)

4- DISCUSSION

Epidemiological studies on the complications of diabetes can provide policy makers and health workers with important measures. For this reason, this study was conducted with the aim of investigating the prevalence of NP in patients with type 1 diabetes in Iran by the meta-analysis method. Considering that no study has been conducted on the group of patients with type 1 diabetes in Iran, the findings are compared with the studies conducted in the field of complications caused by type 1 diabetes or the prevalence of NP in T2DM patients and T1DM of other countries.

Regression of Logit event rate on Time
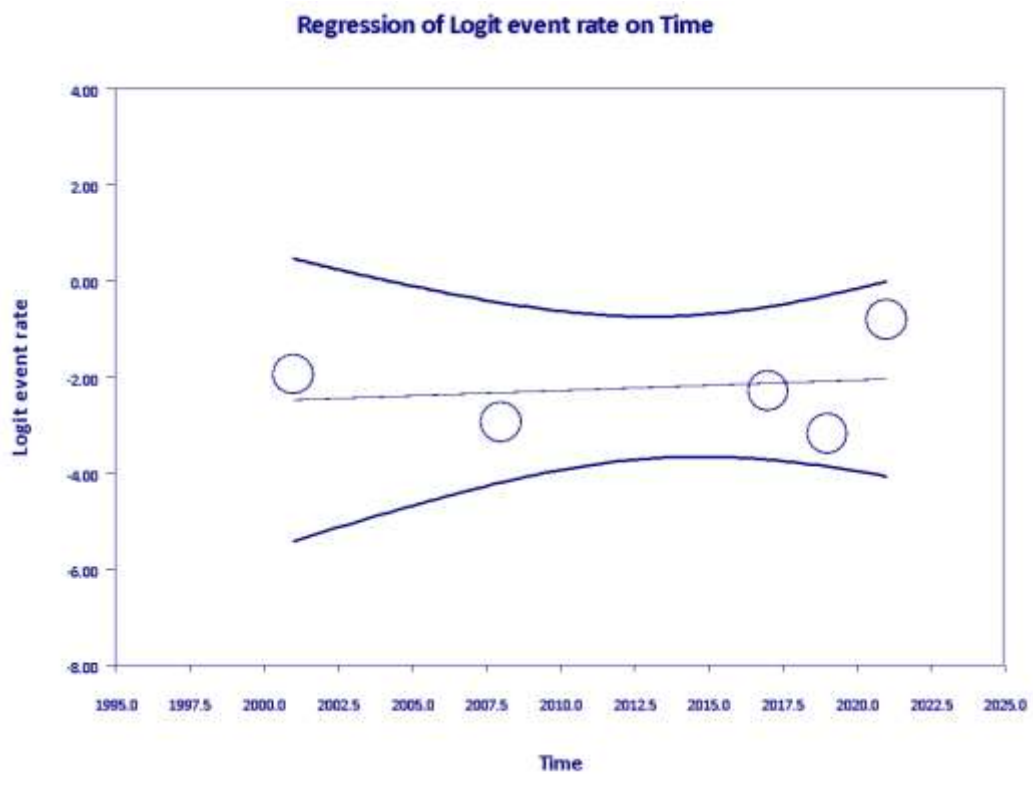

Fig. 4: Regression of publication time of the articles and prevalence of nephropathy

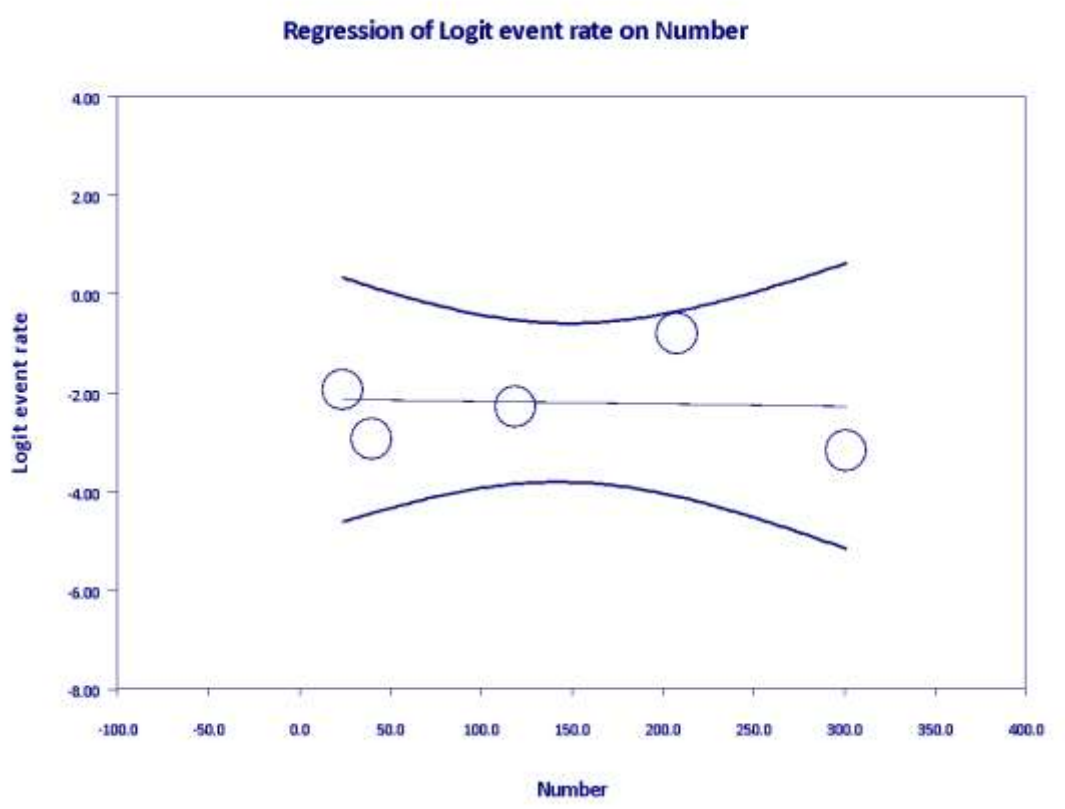**Regression of Logit event rate on Number**

Fig. 5: Regression of the number patients in articles and prevalence of nephropathy

Table-1: Articles related to DN included in the systematic review stage

Author	year	N	Location	Male, N	Female, N	Age, M(SD)	Prevalence N	%
Mostofizadeh et al. (24)	2019	301	Isfahan	138	163	12.91(3.25)	12	0.4
Arad et al. (25)	2021	208	Ghazvin	85	123	12.52(3.92)	64	30.7
Olfatifar et al. (26)	2017	119	Hamedan	62	57	16.37(8.71)	11	9.48
Abbasian et al. (27)	2008	40	SHahroud	-	-	-	2	0.5
Sarshar et al. (28)	2001	24	Gonabad	-	-	-	3	12.5

Kidney system disease is one of the complications that threaten patients with diabetes. So, in the study of Jadawji et al. and in 31 articles T2DM patients, published from 1950 to 2018 in South Asia with a sample size of 153827 patients, the prevalence of microalbuminuria in the South Asian group was reported in comparison to that among European patients. According to the findings, this rate was equal to 1.14 ((CI) 0.99, 1.32; P = 0.065) (29). On the other hand, in the study of Rosolowsky et al., the incidence rate of ESRD as one of the complications was reported to be 5.8/100 person-years (30), which indicates the presence of chronic kidney complications in patients with T1DM.

According to the findings, the overall prevalence of DN among T1DM patients in Iran was equal to 10% (confidence interval (CI) = 26.1-3.4). Various studies have been conducted on the prevalence of DN in the group of patients with T2DM. For instance, in a meta-analysis conducted by Zhang et al., the prevalence of DN in 30 articles published between 1991 and 2017 in China with a sample size of 46 up to 31,574 patients was 21.8% ((CI): 18.5-25.4%). In another meta-analysis by Wagnew et al., the prevalence of DN in 27 articles published between 1997 and 2017 with a sample size of 6552 was 35.3 (95% CI 27.46-43.14) (32). The prevalence rates reported in the mentioned meta-analyses on T2DM patients (31, 32) have been higher than that of our results; and the causes of this difference can be attributed

to the difference in the age range of the patients, which may have been effective in this field.

The meta-analysis performed by Piccoli et al. revealed that the prevalence of DN in the group of patients with T1DM is one of the chronic complications of this disease (33). Raile et al. (2007) investigated 27,805 patients in Germany, reporting that 26,605 of them had normal nephropathy (34). In the study of Andersen et al. in Denmark among 1303 patients, the prevalence of DN was 531 (41%) (35), which is consistent with the results of the present study manifesting the considerable prevalence of nephropathy in T1DM patients.

5- CONCLUSION

Considering the high prevalence of diabetic nephropathy in patients with T1DM, it is suggested that the necessary preventive measures be taken to reduce the complications of diabetes in these patients.

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